NAVFAC Atlantic Biological Resource Services

Contract: N62470-08-D-1008; Task Order: WE40

Final January 2015

Integrated Natural Resources Management Plan, Center for Security Forces Detachment Kittery Survival, Evasion, Resistance, and Escape Facility (SERE East)

Prepared for:
The U.S. Department of the Navy
Naval Facilities Engineering Command Mid-Atlantic

Prepared by:
Tetra Tech, Inc.

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NAVFAC Naval Facilities Engineering Command

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INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN

CENTER FOR SECURITY FORCES DETACHMENT KITTERY

SURVIVAL, EVASION, RESISTANCE, AND ESCAPE FACILITY (SERE EAST)

Approving Officials:

William Greene — 9/24/15
Installation Commanding Officer — Date

Field Supervisor — 08.12.2015
United States Fish and Wildlife Service — Date
for Regional Director

8/14/15
Maine Department of Inland Fisheries and Wildlife — Date

6-2-15
Naval Facilities Engineering Command, — Date
Regional Natural Resources Manager

05-28-15
Natural Resources Manager, — Date
Public Works Department -- Maine

INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN

Center for Security Forces Detachment Kittery

Survival, Evasion, Resistance, and Escape Facility (SERE East)

Date of Annual Review/Update	Name and Title of Reviewer(s)
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

5th Year Review

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

PLAN UPDATES

This Integrated Natural Resources Management Plan (INRMP) covers a five-year period. INRMPs should contain the most up-to-date natural resources information, and updates and revisions may be necessary in order to maintain a proactive management plan. Natural resource managers are encouraged to use geographic information systems as the basis of their INRMP and to incorporate the guidance and recommendations contained in "Conserving Biodiversity on Military Lands: A Guide for Natural Resources Managers" (United States Department of the Navy 2014 and Benton et al. 2008).

In accordance with the Sikes Act Improvement Act (SAIA) of 1997 and the Navy Environmental Readiness Program (United States Department of the Navy 2014), installations are required to perform an informal annual review of their INRMP to ensure that INRMP information is current and to evaluate the effectiveness of their INRMP The annual INRMP review must be completed in cooperation with the appropriate U.S. Fish and Wildlife Service (USFWS) and state fish and wildlife agency field-level offices. Measure of the success of the INRMP and identification of any issues associated with implementation of the INRMP will result from collaboration with cooperating partners (Navy 2006).

The annual INRMP review must be completed in cooperation with the appropriate USFWS and state fish and wildlife agency field-level offices. The measure of success of the INRMP and identification of any issues associated with implementation of the INRMP will result from collaboration with cooperating partners (Navy 2006).

Installations are not required to revise their INRMP within a specified time interval; however, a formal review of the INRMP is required every five years in coordination with USFWS and state partners (Navy 2006). If USFWS and state partners are in agreement, the completed annual review forms may be used in lieu of a formal review. Minor revisions to the INRMP should be completed annually to reduce the need for a more costly and time consuming revision following the formal five-year review. Annual reviews should be fully documented each year to provide each installation with the option to utilize the annual review documentation to fulfill the formal review requirement whenever possible. If results of the formal review determine that the existing INRMP is effective, the INRMP need not be revised. Any revisions to the authorities and guidance documents driving plan update requirements would be implemented as appropriate during the annual review or update periods.

The formal review satisfies a number of additional requirements. These include verification that all environmental compliance projects have been budgeted for and implemented on schedule, all required environmental positions are filled with trained staff or are in the process of being filled, all projects and activities identified for the coming year are included in the INRMP, all required coordination has been conducted, and all significant changes to the installation's mission requirements or its natural resources have been identified. Significant changes to the installation's mission or natural resources should be reviewed to determine if an INRMP revision is needed. Activities that may require an INRMP revision include, but are not limited to:

- a change in mission requirements or intensity of land use;
- a significant change in natural resources baseline conditions;

- a determination that the old INRMP was proven to be inadequate, was not able to be implemented, or that projects were ineffective in meeting natural resources management goals as evidenced from monitoring results;
- a change in natural resources management goals;
- the expiration of the previous INRMP's planning horizon; or
- the implementation of base realignment and closure actions.

Any of these activities should be brought to the attention of the USFWS and state partners during the review process.

The form included in this section should be used to document changes to the INRMP that will improve natural resources management. Annual updates will provide information that will be incorporated into the five-year review and potential revisions. Each entry in this section should reference the plan section and page number being updated to facilitate quick cross-referencing. INRMP modifications that are necessary are usually covered by the Environmental Assessment (EA) prepared for the INRMP. INRMP modifications should, however, be reviewed to compare the original action documented in the existing INRMP to the proposed modifications to determine if modifications to the INRMP are significant. If INRMP modifications are deemed not to be significant, updated actions will be covered by the original National Environmental Protection Act (NEPA) documentation. Proposed INRMP updates that are deemed to be significant will require additional NEPA documentation, usually at the EA level.

DATE	SECTION/PAGE	COMMENT	REVIEWER

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EXECUTIVE SUMMARY

This Integrated Natural Resources Management Plan (INRMP) has been prepared and will be implemented in accordance with the Sikes Act Improvement Act (SAIA) of 1997 and the United States Department of the Navy (Navy) Environmental Readiness Program Manual (Navy Office of the Chief of Naval Operations Manual 5090.1 [OPNAV M-5090.1) (United States Department of the Navy 2014). Section 101(a)(1)(B) of the SAIA requires the Secretary of all military departments to "prepare and implement an INRMP for each military installation in the United States" for those installations that contain habitat that is suitable for conservation and management of natural ecosystems. This INRMP has been prepared for the Center for Security Forces Detachment Kittery Survival, Evasion, Resistance, and Escape Facility in Redington, Maine (SERE East, SERE School, or Installation), in accordance with the following authorities, which were current at the time the INRMP was prepared. Revisions to the following authorities and guidance documents would replace the older version, and any necessary changes to the INRMP would be documented during the annual review or incorporated into the INRMP at the time it is updated.

- Department of Defense (DoD) Instruction 4715.03, Natural Resources Conservation Program (18 March 2011);
- OPNAV M-5090.1, Environmental Readiness Program Manual (10 January 2014);
- SAIA of 1997 (16 United States Code §670a et seq.);
- Naval Facilities Engineering Command (NAVFAC) Natural Resources Management Procedural Manual (P-73, Chapter 2: Integrated Natural Resources Management Plans) (07 December 2005);
- Endangered Species Act of 1973 (16 United States Code §1531 et seq.); and
- Navy INRMP Guidance (10 April 2006).

In addition to these authorities, natural resources managers are encouraged to use geographic information systems as the basis of their INRMP and to incorporate the guidance and recommendations provided in "Conserving Biodiversity on Military Lands: A Guide for Natural Resources Managers" (United States Department of the Navy 2014 and Benton et al. 2008).

The INRMP addresses future requirements and identifies projects to be implemented over the five-year duration of the plan. The INRMP will be reviewed annually in coordination with the U.S. Fish and Wildlife Service (USFWS) and the Maine Department of Inland Fisheries and Wildlife (MDIFW). The purpose of the annual reviews are to ensure that information contained within the plan is current, implementation and maintenance of conservation measures are on schedule, and funding for conservation and maintenance activities are included in the annual budget. The review also serves the following purposes: to identify any natural resources positions that need to be or are in the process of being filled; to ensure all necessary coordination has taken place; to ensure upcoming projects and activities for the coming year are identified and included in the INRMP; and to confirm that the INRMP contains any significant changes to the installation's military mission requirements or its natural resources. The annual review provides

an opportunity to incorporate changes in accepted environmental conservation practices and scientific advances associated with evaluation and implementation of natural resources management. If necessary, the annual review will consist of an update to the INRMP that includes an updated project list, documentation of significant changes to natural ecosystems, and updates to information contained in the INRMP appendices. However, the plan will be formally reviewed no less than every five years, per the requirements of Section 101(b)(2) of the SAIA. Forms to document periodic reviews are included at the beginning of this document, immediately following the Approving Officers signature page. Plan Update forms will be used to compile proposed updates throughout the course of each year and will serve to provide an outline for revisions to be incorporated during the formal five-year review.

The INRMP is organized into the following sections:

- **Section 1 – Introduction**. This section includes a discussion of the INRMP purpose and authorities applicable to the plan, the goals of the INRMP, a brief overview of the history and military mission of the SERE School, and a brief overview of natural resources management at the Installation.
- **Section 2 – Existing Conditions**. This section describes the existing physical and natural conditions of the SERE School. A general site description is included in this section along with information on, but not limited to, climate; geology, topography, and soils; water resources including wetlands and groundwater; flora and fauna including rare, threatened, endangered, and special concern species; significant wildlife habitat; regional land use and conservation lands; cultural resources; forest resources; and outdoor recreation.
- **Section 3 – Natural Resources Management Programmatic Objectives and Recommendations**. Natural resources management at the SERE School has been divided into four programmatic objectives: (1) land management, (2) fish and wildlife management, (3) forest management, and (4) outdoor recreation management. This section provides an overview of each of the programmatic objectives that has been established for the SERE School, discusses relevant natural resources management issues, and provides specific recommendations and projects that address these issues and that will assist in meeting the established programmatic objectives.
- **Section 4 – SERE School Natural Resources Programmatic Objective Management Areas**. This section provides a description of the four programmatic objective management areas and describes how the programmatic objectives have been applied to INRMP projects proposed for the Installation.
- **Section 5 – INRMP Implementation.** This section outlines the means for implementing this INRMP including guidelines on supporting the sustainability of the military mission and the natural environment, natural resources consultation requirements, achieving no net loss, National Environmental Protection Act (NEPA) compliance, project development and classification, funding sources, commitment (by the SERE School Commanding Officer for pursuing funding and execution of compliance-related projects), and use of cooperative agreements.

- **Section 6 – Management Recommendations Summary**. A summary of funding-dependent management recommendations for the SERE School are provided in this section. Recommendations have been grouped according to the Environmental Readiness Levels (ERLs) described in Section 5 as projects that are a compliance requirement, a Navy proactive involvement project, a Navy or DoD policy requirement project, or a Navy environmental stewardship project.
- **Section 7 – References**. This section includes a list of all references used in the development of the INRMP (references cited within the appendices are listed at the end of the appropriate appendix). A list of internet resources that can be accessed by the natural resource manager to obtain useful information also is provided in this section.
- **Appendix A – SERE School Environmental Assessment**. Contains a copy of the Environmental Assessment (EA) prepared for the INRMP as part of the NEPA compliance process.
- **Appendix B – Agency Correspondence**. Includes copies of agency correspondence for this INRMP.
- **Appendix C – Applicable Regulations and Public Laws.** Contains a list of regulations and public laws that are relevant to this INRMP.
- **Appendix D – Internet Resources.** Contains a list of useful natural resources internet resources.
- **Appendix E** – **SERE School Biological Surveys.** Contains copies of biological surveys and assessments that have been recently completed.
- **Appendix F – Natural Communities and Wildlife Factsheets.** Contains fact sheets for rare, threatened, and endangered natural communities and wildlife that occur or have the potential to occur at the SERE School.
- **Appendix G** – **SERE School Flora and Fauna Lists.** Contains tables for the flora and fauna (mammals, birds, herpetofauna, fish, and invertebrates) that have been documented at the SERE School. This appendix also includes a table of rare, threatened, endangered, or special concern species that are known to or have the potential to occur at the SERE School.
- **Appendix H** – **National Bald Eagle Management Guidelines.** Contains a copy of the National Bald Eagle (*Haliaeetus leucocephalus*) Management Guidelines (USFWS 2007).
- **Appendix I** – **SERE School Wildland Fire Management Plan.** Contains a copy of the 2014 Wildland Fire Management Plan for the SERE School.
- **Appendix J** – **SERE School Natural Resources Project Implementation Schedule.** Contains the summary table for all funding-dependent natural resources projects recommended for the five-year INRMP plan period, and includes the proposed implementation schedule, prime legal driver/initiative, class, Navy ERL, cost estimate, and potential funding sources for each natural resources project.

- **Appendix K – Department of Defense INRMP Template Crosswalk Table.** Contains a table that compares the SERE School INRMP outline with DoD INRMP Template requirements.
- **Appendix** L - White-nose Syndrome Conservation and Recovery Working Group. 2015. Acceptable Management Practices for Bat Control Activities in Structures - A Guide for Nuisance Wildlife Control Operators. U.S. Fish and Wildlife Service, Hadley, MA.

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LIST OF ACRONYMS AND ABBREVIATIONS

M-5090.1	The Office of the Chief of Naval Operations Environmental Readiness Program Manual 5090.1
%	percent
§	Section (of legal code)
°C	degrees Celsius
°F	degrees Fahrenheit
ac	acre(s)
APHIS	Animal and Plant Health Inspection Service
AT	Appalachian Trail
BCC	United States Fish and Wildlife Service Birds of Conservation Concern
BCR	Bird Conservation Region
Berger	Louis Berger & Associates, Inc.
BGEPA	Bald and Golden Eagle Protection Act
BMP	best management practice
CFR	Code of Federal Regulations
cm	centimeter(s)
CRM	Cultural Resources Manager
CWA	Clean Water Act
DoD	United States Department of Defense
DoDI	United States Department of Defense Instruction
DPS	Distinct Population Segment
EA	Environmental Assessment
EAP	Encroachment Action Plan
EO	Executive Order
ERL	Environmental Readiness Level
ESA	Endangered Species Act
ESCP	erosion and sediment control plan
FEMA	Federal Emergency Management Agency
FR	Federal Register
FY	fiscal year
ft	feet/foot
GIS	Geographic Information System
GPS	global positioning systems

GRC	GeoReadiness Center
ha	hectare(s)
HEBS	high elevation bird survey
IBP	Institute for Bird Populations
in	inch(es)
INRMP	Integrated Natural Resources Management Plan
Installation	Survival, Evasion, Resistance, and Escape School
IPM	integrated pest management
IPMP	Integrated Pest Management Plan
km	kilometer(s)
km^2	square kilometer(s)
LCC	Landscape Conservation Cooperative
LUPC	Land Use Planning Commission
m	meter(s)
mi	mile(s)
mi^2	square mile(s)
MAG	Maine Atlas and Gazetteer
MAPS	Monitoring Avian Productivity and Survivorship
MBTA	Migratory Bird Treaty Act
MDACF	Maine Department of Agriculture, Conservation, and Forestry
MDEP	Maine Department of Environmental Protection
MDIFW	Maine Department of Inland Fisheries and Wildlife
MHPC	Maine Historic Preservation Commission
MNAP	Maine Natural Areas Program
MOU	Memorandum of Understanding
MPB	Multi-Purpose and Public Works Area
MRSA	Maine Revised Statues Annotated
msl	mean sea level
NASB	Naval Air Station Brunswick
NAVFAC	Naval Facilities Engineering Command
Navy	United States Department of Navy
NCTC	National Conservation Training Center
n.d.	no date
NEPA	National Environmental Policy Act
NGO	non-governmental organization

NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NPS	National Park Service
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
NRM	Natural Resources Manager
NRP	Natural Resources Program
NRPA	Natural Resources Protection Act
NWI	National Wetland Inventory
NWP	Nationwide Permit
OIC	Officer in Charge
O&MN	Operations and Maintenance
OPNAV	Naval Operations
PARC	Partners in Amphibian and Reptile Conservation
PIF	Partners in Flight
PWD-ME	Public Works Department – Maine
REPI	Readiness and Environmental Protection Initiative
Saddleback	Saddleback Mountain Ski Area
SAIA	Sikes Act Improvement Act of 1997
SERE	Survival, Evasion, Resistance, Escape
SGCN	species of greatest conservation need
Sikes Act	Sikes Act Improvement Act of 1997
SPCC Plan	Spill Prevention Control and Countermeasure Plan
SWPPP	stormwater pollution prevention plan
TNC	The Nature Conservancy
TPL	Trust for Public Land
U.S.	United States of America
USACE	United States Army Corps of Engineers
USC	United States Code
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WMA	wildlife management area

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1.0 INTRODUCTION

Section 101(a)(1)(B) of the Sikes Act Improvement Act (SAIA or Sikes Act) (16 United States Code [USC] §670 et seq.) requires that each Military Department prepare and implement an Integrated Natural Resources Management Plan (INRMP) for installations that contain significant natural resources, unless the Secretary of Defense determines that the absence of significant natural resources on a particular installation makes preparation of such a plan inappropriate. Accordingly, this INRMP addresses natural resources management on those lands associated with the Center for Security Forces Detachment Kittery Survival, Evasion, Resistance, and Escape Facility (SERE East, hereafter referred to as the SERE School or Installation), located in western Maine, that are:

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

The SERE School is a DoD installation located in Redington Township, Franklin County, Maine (Figure 1-1). The Installation's primary mission is to provide advanced survival training support for future aircraft carrier pilots. The SERE School Program includes the following activities: scheduling and conducting SERE School classes including survival classes, providing liaison with other DoD activities concerning ongoing and proposed SERE School training, and conducting training for SERE School instructors. The SERE School property is strategically located to meet operational and training requirements of the Navy.

1.1 PURPOSE AND AUTHORITY

The primary purpose of this INRMP is to guide the SERE School natural resources management program for the five-year plan period in accordance with the following regulations and guidance documents:

- SAIA;
- Department of Defense Instruction (DoDI) 4715.03, Natural Resources Conservation Program (18 March 2011);
- The Navy Office of the Chief of Naval Operations Manual 5090.1 (OPNAV M-5090.1, Environmental Readiness Program Manual) (10 January 2014);
- Endangered Species Act (ESA) of 1973 (16 USC §1531 et seq.);
- Naval Facilities Engineering Command (NAVFAC) Natural Resources Management Procedural Manual (P-73, Chapter 2: Integrated Natural Resources Management Plans dated 7 December 2005); and

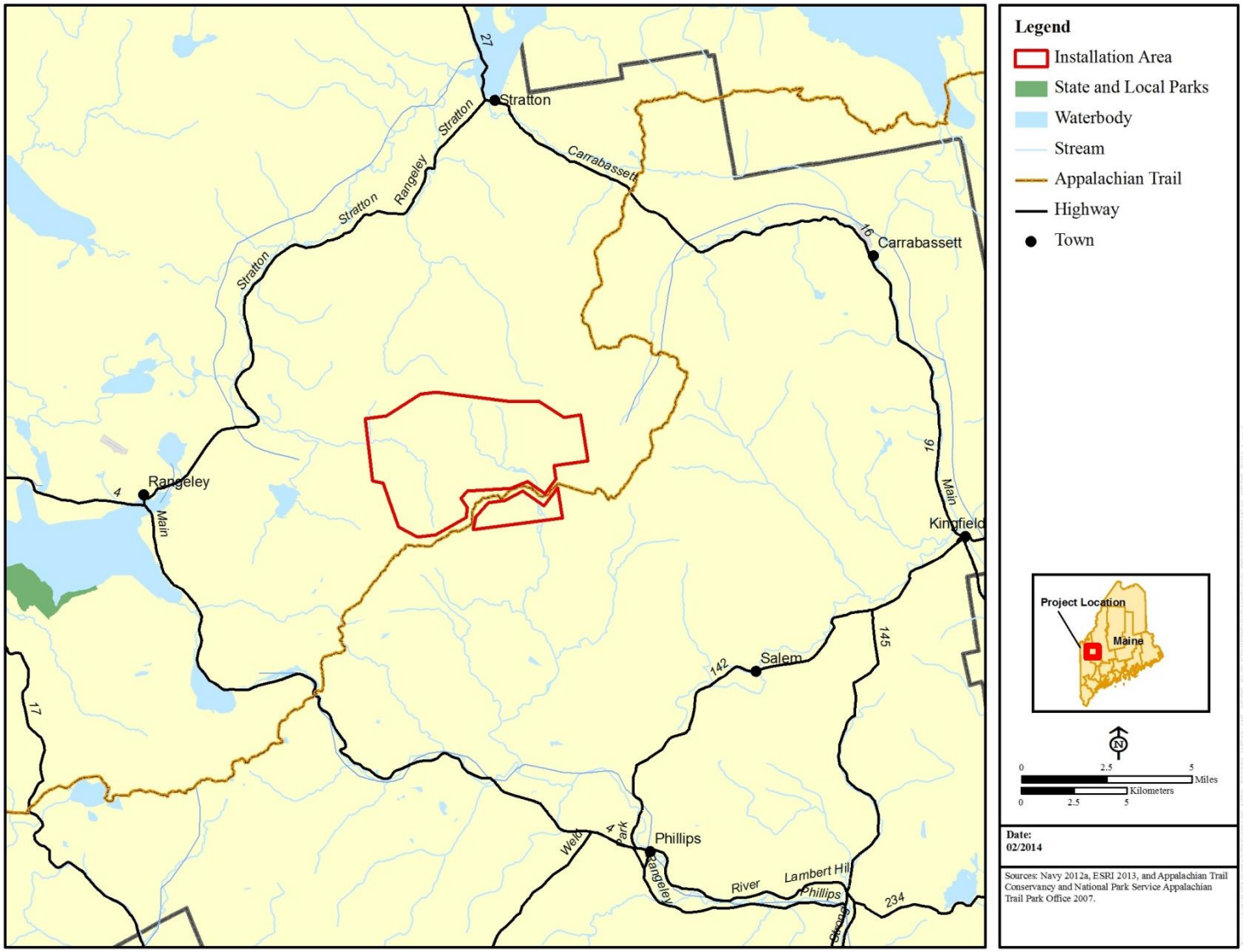

Figure 1-1. Regional Location of the SERE School, Redington, Maine.

- Navy INRMP Guidance (10 April 2006).

To facilitate the DoD's Natural Resources Program (NRP), the secretary of each military department is directed to prepare and implement an INRMP for each military installation under the jurisdiction of the Secretary. The INRMP must be prepared in cooperation with the Secretary of the Interior, acting through the Director of the United States Fish and Wildlife Service (USFWS), and the head of the appropriate state fish and wildlife agencies for the state in which the military installation is located. The Sikes Act acknowledges that the principal use of military installations is to ensure the preparedness of the Armed Forces. In accordance with the Sikes Act, the INRMP shall, to the extent appropriate and applicable, provide for the following:

- implementation of an ecosystem-based program that provides for conservation and rehabilitation of natural resources consistent with the military mission;
- integration and coordination of all natural resources management activities;
- provision for sustainable multipurpose uses of the natural resources;
- provision for public access for use of natural resources subject to safety and military security considerations; and
- enforcement of applicable natural resources laws (including regulations).

The Sikes Act also requires that the INRMP be submitted for public review and comment before final acceptance. In order to fulfill this requirement and comply with the National Environmental Policy Act (NEPA), appropriate documentation (an Environmental Assessment [EA]) has been prepared for implementation of the INRMP update; the EA is presented in Appendix A *SERE School Environmental Assessment*.

DoDI 4715.03 and OPNAV M-5090.1 state that the INRMP must incorporate the principles of ecosystems management as the basis for natural resources management on Navy lands. In accordance with this policy, the Navy will strive to maintain healthy, contiguous ecosystems on its own lands; where ecosystem boundaries extend onto adjoining lands, the Navy will strive to work cooperatively with neighboring landowners to manage these ecosystems.

At a minimum, the management and conditions of the SERE School will be reviewed annually to assure that the actions and precautions identified in the plan are carried out and that the desired anticipated effect is accomplished. Based on the results of monitoring, revisions to the plan may be necessary. These could include changes in work plans, accounting for mission or environmental changes, and modifications to management approaches. If the changes depart significantly from the original plan, coordination with the USFWS and the Maine Department of Inland Fisheries and Wildlife (MDIFW) is required.

1.2 GOALS AND OBJECTIVES

This INRMP is a long-term planning document that guides implementation of the NRP to help ensure consistency with the Installation's military mission while protecting and enhancing natural resources, to the extent practicable. In accordance with the SAIA and the Navy

Environmental Readiness Program Manual (OPNAV M-5090.1), this plan must provide for the following, consistent with military operations at the Installation:

- management of fish and wildlife, land, and forest resources;
- identification of fish- and wildlife-oriented recreational use activities and areas;
- enhancement or modification of fish and wildlife habitat;
- protection, enhancement, and restoration of wetlands where necessary for support of fish, wildlife, or plants;
- integration of, and consistency among, the various activities conducted under the INRMP;
- establishment of specific natural resources management goals, programmatic objectives, and timeframes for proposed actions;
- sustainable use by the public of natural resources to the extent that such use is consistent with the needs of fish and wildlife management and subject to Installation safety and security requirements;
- enforcement of natural resources laws and regulations;
- no net loss in the capability of military lands to support the military mission of the Installation; and
- regular review and update of this INRMP and its effects annually, and formal review no less often than every five years.

It is important to note that the SERE School INRMP is a living document and must be flexible in accommodating the unique mission and remote location of the Installation.

The fundamental goal of natural resources management on this Installation is to achieve optimum, sustainable long-term use of the land base for military training purposes while protecting the natural and cultural resources that exist. Over the next five-year period, a passive management-based approach to managing natural resources shall be implemented. Inventorying and monitoring are key elements to this approach and will help the Navy move towards an ecosystem approach to land management at the SERE School. The passive management approach can be characterized as "watch over and protect while developing an intimate knowledge of the ecosystem." The ultimate long-term goal is to achieve integrated ecosystems management of the Installation natural resources.

To prevent land degradation and environmental hazards it is important to create awareness among land users and identify land stewardship practices that support INRMP goals and objectives. An integral part of the natural resources management program is to provide environmental awareness and education to Installation personnel and to the public.

1.3 RESPONSIBILITIES

The NRP at the SERE School is encompassed within a region-wide Navy NRP that is overseen by the Public Works Department Maine (PWD-ME) Natural Resources Manager (NRM) based at Portsmouth Naval Shipyard, Kittery, Maine, under the direction of the Portsmouth Naval Shipyard Commanding Officer. Onsite, day-to-day facility management is handled by the NAVFAC PWD-ME site supervisor located at the SERE School. The PWD-ME NRM ensures compliance with applicable local, state, and federal regulations regarding management and protection of natural resources. The PWD-ME NRM and the NAVFAC PWD-ME site supervisor also promote environmental awareness to staff and recreational users of the SERE School. The SERE School NRP is broadly responsible for wetlands protection and mitigation, water quality protection, grounds maintenance, forest management, fish and wildlife management, threatened and endangered species management, migratory bird management, outdoor recreation management, pest management, and cultural resources management. Each of these areas of responsibility must be managed to balance potential conflicts among different interest and the operational mission of the SERE School. The concept of integrated management of natural resources both justifies and requires that internal and external stakeholders contribute to the management of natural resources.

1.3.1 Installation Stakeholders

The PWD-ME NRM is directly involved in implementation of this INRMP while ensuring successful accomplishment of the SERE School mission. The PWD-ME NRM is responsible for ensuring that SERE School staff complies with the laws and requirements associated with the management of natural resources, and that funding and staffing are sufficient to accomplish the projects and programmatic objectives outlined in this INRMP. Additional requirements of the SERE School facility stakeholders include performing annual reviews and revisions of the INRMP. Day to day implementation of the INRMP is the responsibility of the NAVFAC PWD-ME NRM.

1.3.2 External Stakeholders

In accordance with Executive Order (EO) 13352 (26 August 2004), *Facilitation of Cooperative Conservation*, SERE School natural resources staff are required to promote cooperative conservation with an emphasis on collaborating natural resources activities among federal, state, local, and tribal governments, non-governmental organizations (NGOs), and private citizens. The SAIA requires that this INRMP be prepared in cooperation with, and reflect mutual agreement of, the USFWS and MDIFW. This requirement affords them signatory authority as external stakeholders and approving officials of this INRMP. Cooperation and coordination with these agencies is an integral part of the Navy's NRP. The U.S. Army Corp of Engineers (USACE) has jurisdiction over waters of the U.S. and requires permits for projects that will impact surface waters or wetlands within their jurisdiction.

A list of agency, Navy, and external stakeholders are identified in Table 1-2. Adjacent landowners are identified with an asterisk.

Table 1-1. Stakeholders of Natural Resources at the SERE School.

Federal, State, and Local Agencies	
United States (U.S.) Fish and Wildlife Service	USDA Animal and Plant Health Inspection Service Wildlife Services
U.S. Department of Agriculture (USDA) Natural Resources Conservation Service	U.S. Army Corps of Engineers
U.S. Geological Survey	U.S. Forest Service
U.S. Environmental Protection Agency	Maine Department of Inland Fisheries and Wildlife
Maine Department of Agriculture, Conservation and Forestry	Maine Historic Preservation Commission
Franklin County	Redington Township
U.S. Department of the Navy	
Public Works Department-Maine	Navy Personnel
Commanding Officer	Officer in Charge
Naval Facilities Engineering Command Mid-Atlantic	Center for Security Forces Detachment Kittery Survival, Evasion, Resistance, and Escape Facility Command
Non-Governmental Organizations and Individuals	
National Park Service*	Audubon Society
The Dallas Company*	Military Retirees
Franklin Timberlands, Inc.*	Dependents of Navy Personnel
Mead Oxford Corporation*	The Nature Conservancy of Maine
Saddleback Maine	Institute for Bird Populations
Trout Unlimited	The Wilderness Society

* Adjacent landowner

1.3.3 Agency Coordination

As required by the Sikes Act this document has been prepared in cooperation with the USFWS and MDIFW. These agencies serve as advisors to the NRM regarding implementing potential natural resources projects and SERE School projects that may impact natural resources, and are the signatory agencies for this INRMP. Agency mutual agreement letters and agency correspondence received as part of this INRMP update are provided in Appendix B *Agency Correspondence*.

Significant cooperative efforts with the USFWS on this INRMP include management of wetlands, plants, and wildlife, including protected species and migratory birds under their jurisdiction. The USFWS shall notify the Navy of any federally listed threatened or endangered plants or wildlife species that have been identified as occurring at the Installation, and will provide technical information and assistance to ensure protection and conservation of these species (Fish and Wildlife Coordination Act, 16 USC §661-666c). The USFWS also can provide

technical assistance on implementing a fish stocking program at the SERE School should such a program be identified for the Installation.

MDIFW also serves as an advisor to the NRM and primarily provides information on management of game species and state listed rare, threatened, and endangered species. The MDIFW occasionally issues permits on an as needed basis for the taking of wildlife in and out of established harvesting seasons as part of the SERE School official survival training course. SERE School instructors must comply with the terms of the MDIFW permits. MDIFW also can provide technical assistance and recommendations to the INRMP.

U.S. Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS) Wildlife Services may be required for technical assistance and the control of nuisance wildlife.

The Maine Historic Preservation Commission (MHPC) is consulted regarding potential effects to known cultural and historical resources from Installation activities and proposed projects.

1.4 SERE School Location, History, and Military Mission

1.4.1 Location

The SERE School sits in the Carrabassett Valley just south of Bigelow Preserve, approximately 110 miles (mi) (177 kilometers [km]) north of Portland, Maine and 70 mi (11 km) northwest of Augusta, Maine (Figure 1-1). Situated on the Rangeley Mountain Range, the entire Installation is located within Redington Township, an unorganized township in Franklin County, Maine. The SERE School is located approximately 7 mi (12 km) east of the Town of Rangeley, the nearest town.

Several large timber companies as well as the National Park Service own and manage lands that abut the SERE School.

1.4.2 History

Redington Township, which was basically unsettled until the Philips and Rangeley Railroad was built through the township in 1891, is considered one of the more frontier-like townships within Franklin County. Redington has never been organized as either a plantation or a town.

Other than hunting, fishing and trapping, lumbering was probably one of the first economic activities that occurred in Redington Township beginning around 1890 after construction of the Philips & Rangeley Railroad. The railway ceased operation in 1935 when it went out of business (Louis Berger & Associates, Inc. [Berger] 1996).

In 1956 the Arctic Survival School was established at the former Naval Air Station Brunswick (NASB) in Brunswick, Maine to provide a "realistic and concentrated course for personnel of units due for a tour in the far north." In the 1960s the SERE School was established at NASB, formed out of the previously established Arctic Survival Training School. With the establishment of the SERE School the Navy expanded the mission of the older survival training program, eventually training not only air crewmen but also other military personnel whose duties

subjected them to a high risk of capture. Training included cold weather survival, evasion from capture, resistance to interrogation and exploitation, and escape from confinement.

In 1961 the Navy leased approximately 3,800 acres (ac) (1,538 hectares [ha]) from the Georgia Pacific Corporation at the present location of the Installation in Redington Township, Maine to conduct the SERE School training. Over the next 25 years, the Navy continued to lease the land from Georgia Pacific Corporation, gradually increasing the Installation acreage to more than 5,000 ac (2,023 ha) for the continued purpose of SERE School training.

In 1986 the Navy purchased the existing site of the Installation, totaling 12,466 ac (5,045 ha) (Military Construction Project P-132) from Georgia Pacific Corporation for the purposes of increased control over the property. This land purchase included 16 mi (26 km) of access road and right-of-way from Route 16 to the SERE School property. The Navy gave deeded access to all boundary owners on this right-of-way. Acquisition provided the Navy with control to make necessary improvements and conduct maintenance activities that were neither feasible nor practical when leasing the land. By adding what was considered to be a sufficient buffer between training areas and the surrounding land use, the purchase also provided sufficient acreage to conduct training activities with minimal disturbance and encroachment problems.

In 2005 the federal government initiated its most recent round of military base closures under the Base Realignment and Closure process. The DoD and Congress have used this process five times over the past two decades to reduce and realign the nation's military installations. In August 2005 the Base Realignment and Closure Commission voted to close NASB and relocate the Navy squadrons currently based there to Jacksonville, Florida. The runways at NASB were permanently closed in January 2010 with full closure and removal of all personnel on 31 May 2011 (Portland Press Herald 2011). Management responsibilities for the SERE School were transferred from NASB to PWD-ME in May 2011.

1.4.3 Military Mission

The SERE School's primary mission is to provide training in a remote natural environment that is conducive to teaching military personnel survival, rescue, evasion, and resistance skills. The SERE School provides year-round training, emphasizing the basic skills necessary for long-term survival; evasion of capture by hostile forces; resistance to interrogation, indoctrination and exploitation; and escape when captured and held by the enemy.

Navy pilots and other flight personnel are the typical military personnel that receive training at this facility. Basic SERE School training is conducted approximately 23 times per year, with courses typically lasting 12 days including about 7 days of field instruction. Each course trains up to a maximum of 62 students by an even greater number of instructors. Training activities that historically occurred at the SERE School, but which have been discontinued, include cold weather survival training, Explosive Ordnance and Demolition Mobile Unit exercises, and 10-day Advanced Evasion Exercises. The Installation also was historically used as a Tomahawk Cruise Missile testing, training, and recovery site for non-explosive simulation or testing.

The SERE School mission activities are not expected to change over the next 10 years, with the exception of potential increases in the demand and need for this type of training opportunity, which would likely result in an increased number of classes offered throughout the year.

Because of the nature of the mission, it is essential that all activities in support of this INRMP are coordinated with the Naval Education and Training Command, specifically the Center for Security Forces.

1.5 Overview of Natural Resources Management

Navy policy on natural resources management, as summarized from OPNAV M-5090.1, is to manage natural resources to support and be consistent with the installation mission, while protecting and enhancing those resources for multiple use, sustainable yield, and biological integrity. Land use practices and decisions must be based on scientifically sound conservation procedures and techniques and must use scientific methods and an ecosystems management approach. DoDI 4715.03 also requires that INRMPs incorporate the guidance for ecosystems management for natural resources under the stewardship and control of DoD. The goals of this strategy are to maintain and improve the sustainability and biological diversity of terrestrial and aquatic ecosystems while supporting sustainable economies, human use, and an environment that supports recreational use. The basic guidelines for ecosystems management are to:

- preserve the function and integrity of natural ecosystems;
- integrate human, social, and economic interests with environmental considerations;
- involve all interested parties (stakeholders) in identifying management goals; and
- adapt to changing conditions and requirements.

An ecosystems management approach encourages management decisions to be made on the community or ecosystem level rather than at a single species level. Maintaining or improving the quality, integrity, and connectivity of the ecosystem benefits both natural communities and individual species. In areas such as the SERE School, where much of the land has been retained in its natural condition, efforts to maintain, enhance, and restore natural ecosystems may be the most appropriate management strategy.

Management goals and objectives must be identified and assessed on a periodic basis to maintain the function and integrity of the ecosystems at the SERE School. However, as unknown factors arise and change occurs, management goals and prescriptions must be adapted. Adaptive management is an iterative cycle of planning, monitoring, evaluating, and adjusting management. Periodic reviews of management goals and practices provide the opportunity to incorporate new science and information as well as assess the performance of management actions. Prescribed actions will be considered experimental and subject to change if the expected results are not achieved. For the purposes of natural resources management, four (4) programmatic objectives have been identified for the SERE School: (1) land management, (2) fish and wildlife management, (3) forest management, and (4) outdoor recreation management. The following natural resources management areas under each of the programmatic objectives have been identified as potentially relevant to the SERE School.

1. Land Management
    a. Water Resources Management, including watersheds, floodplains, surface waters, groundwater, wetlands, and riparian areas
    b. Vegetation Management
    c. Invasive Plant Species Management
    d. Wildland Fire Management
    e. Rare Communities and Significant Wildlife Habitat Management
    f. Hazardous Waste Management
    g. Regional Conservation Lands
    h. Leases
    i. Cultural Resources Protection
    j. Rare, Threatened and Endangered Plant Species Management
    k. Environmental and Natural Resources Training
    l. Geographic Information System (GIS) Management, Data Integration, Access, and Reporting

2. Fish and Wildlife Management
    a. General Fish and Wildlife Management
    b. Management of Aquatic Species (fish and wildlife) and Their Habitats Management of Terrestrial Species and Their Habitats
    c. Management of Rare, Threatened, Endangered and Special Concern Species and Their Habitats
    d. Migratory Bird Management
    e. Invasive and Nuisance Wildlife Species Management
    f. Partnerships and Outreach
    g. Conservation Law Enforcement
    h. Environmental and Natural Resources Training
    i. GIS Management, Data Integration, Access, and Reporting

3. Forest Management
    a. General Forest Management
    b. Environmental and Natural Resources Training
    c. GIS Management, Data Integration, Access, and Reporting

4. Outdoor Recreation Management
    a. Public Access
    b. Outdoor Recreation Management
    c. Education and Outreach
    d. Environmental and Natural Resources Training
    e. GIS Management, Data Integration, Access, and Reporting

1.6 OPPORTUNITIES AND CONSTRAINTS

The natural resources and environment of the SERE School property fulfill all necessary aspects of the military mission. Active management of the environment is limited to the developed areas, such as the Multi-purpose Building (MPB) area, Alpha Camp, and the historic Redington settlement site located south of Redington Pond. Maintenance of Installation roads is continuous and requires sand and gravel that historically has been supplied by several sources on the property.

Natural resources management issues and requirements pose the following constraints to the SERE School's military mission and to further development of the facility (Figure 1-2):

- conservation and encouragement of protected flora and fauna species habitat;
- preservation of Atlantic salmon (*Salmo salar*) habitat;
- preservation of inland waterfowl/wading bird habitat and shoreland zones;
- limitation on new construction in wetlands, floodplains, and riparian buffer areas;
- maintenance of wildlife and edible tubers and plant parts necessary for conducting survival techniques training;
- maintenance of an adequate supply of drinking water for support of survival techniques training; and
- forest and wildland fire management.

The remaining areas of the SERE School outside of these constraints represent opportunity areas where mission activities would not be restricted by natural resources management issues. If expansion of the facility is necessary, these activities should be focused within developed areas. If development activities are necessary outside of the developed portion of the Installation, these should be conducted in a manner that minimizes changes to the landscape or natural resources. Furthermore, there are some possible opportunities for the Navy to leverage undeveloped habitat outside of the Installation boundaries in support of the military mission via encroachment partnering (Section 1.7 *Encroachment and Adjacent Land Use*).

1.6.1 Effects of the Military Mission on Natural Resources

Natural resources are an integral part of the SERE School training mission. In general, the effects of military operations on natural resources are minimal. Training is conducted year round, and generally there are no restrictions on where training can occur. The field portion of the training exercises consists of military personnel living off of natural resources for three days or less, and traveling across the property on foot using methods to avoid capture during mock evasion scenarios. In actual wartime scenarios, survival demands that personnel leave zero trace of their presence and location. As a result, there is very little evidence of the survival and evasion activities at the training facility. Even at drop-off and pick-up points, there is minimal indication that a large number of trainees have been involved with exercises at these locations. The trainees spread out during training exercises to avoid damaging ground vegetation and minimize the risk

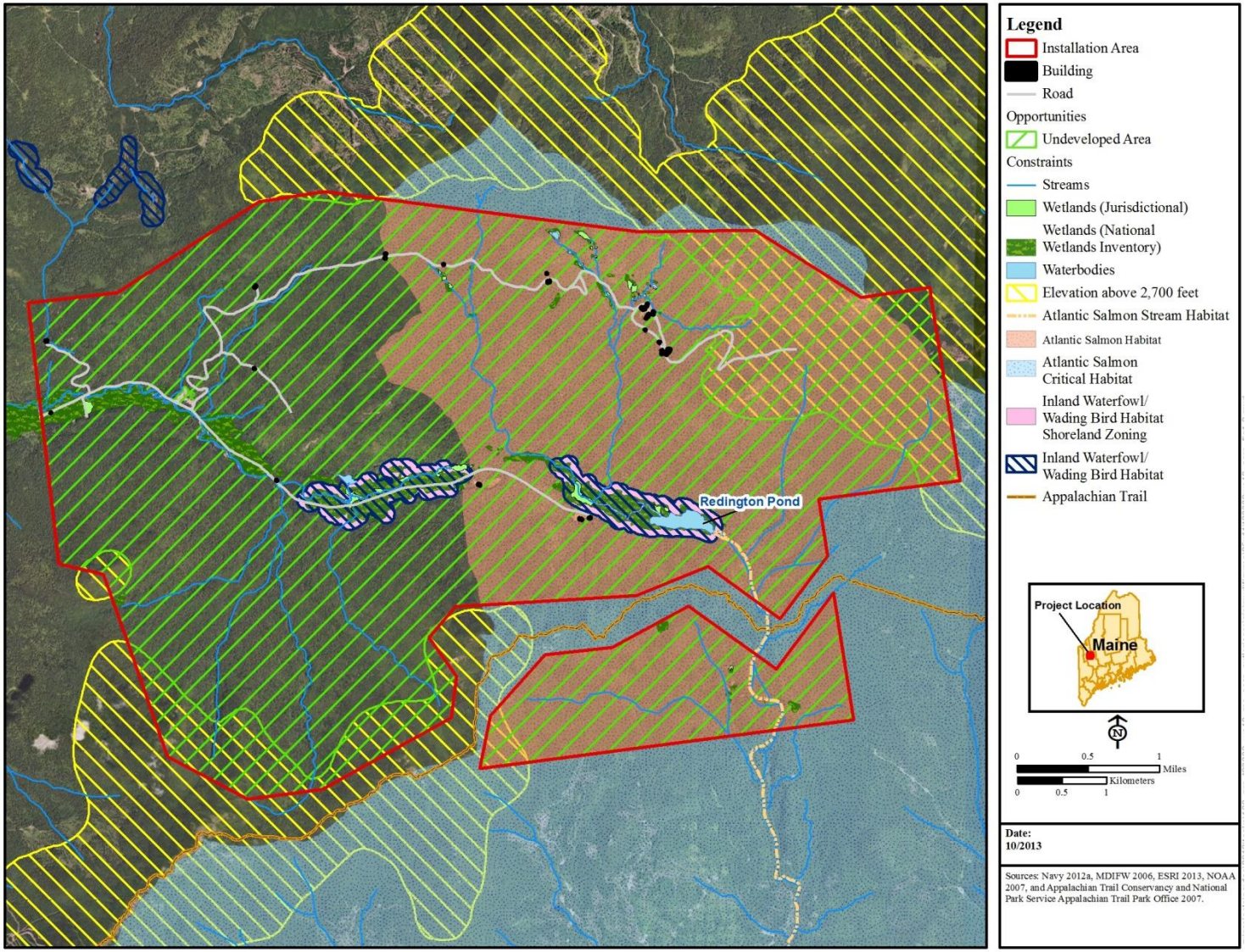

Figure 1-2. Opportunities and Constraints of the SERE School, Redington, Maine.

of detection. Litter is nonexistent. During the evasion and survival portions of the training, human excrement is individually buried far from water sources. Animals and vegetation utilized as food can become scarce as multiple training scenarios are conducted, so locations of heavy use are rotated to avoid over-utilizing the natural resources present. Although roads, parking areas, and buildings can displace forests and wildlife, expansion of the facility (when needed) and operation and maintenance of existing facilities are conducted to minimize impacts on natural resources. Erosion control measures are implemented during ground disturbing activities as necessary. Salt is applied to road surfaces during winter months, as necessary, to maintain safety and to minimize roadside impacts from salt. No loss of vegetation has been observed as result of salting the roads. During active periods, fumes from the diesel and gas operated machinery have a minor and short-lived effect on the air quality.

1.6.2 Plant and Animal Harvesting

In the past, the survival component of SERE School training required that trainees live off plant and animal material for several days. SERE School trainees could harvest wildlife within and outside of established hunting seasons for training purposes as long as a take permit was received from MDIFW. Currently the training mission does not require active harvest of native mammals, birds, fish, small herpetofauna, or invertebrates for training purposes. If it is determined that a wildlife take permit is required to support future mission requirements, the NRM will coordinate receipt and renewal of a take permit with MDIFW. If a permit is obtained, only those harvest methods listed on the permit will be utilized to take wildlife species, and under no circumstances are trainees allowed to intentionally take rare, threatened, or endangered wildlife species. The installation NRM is responsible for educating SERE School instructors on the identification and protection of rare, threatened and endangered flora and fauna and all other natural resource regulatory requirements.

Trainees are instructed on how to construct snares to capture small mammals such as rabbits and rodents, and to catch fish with a makeshift hook and line. Although instruction of these skills is an important component of the overall training mission, the current mission does not include active trapping or harvest of wildlife. Trainees are taught the steps for building and setting traps, and demonstrations are provided on how they work; however, these traps are dismantled at the end of the training session.

A variety and abundance of edible tubers and plant parts are utilized for the survival techniques portion of the training. A list of the most common types of plants is provided in Sections 2.3.8 (Natural Communities and Vegetation) and 3.1.2 (Vegetation Management, as well as Appendices F and G.

1.6.3 Physical Conditions and Resources Needed for the Military Mission

Survival training requires remote, natural conditions as described previously in this section. Evasion training requires variable terrain and landforms including mountainous areas, dense forests, flat open land, and areas containing surface waters. Both survival and evasion training require a remote location isolated from typical daily activities associated with modern living in order to provide the most realistic scenario for the trainees. To achieve this, trainees must be visually and acoustically isolated from offsite activities.

The resistance and escape components of SERE School training are conducted within the developed areas of the facility. An adequate supply of drinking water is required, as well as housing and wastewater facilities.

1.7 Encroachment and Adjacent Land Use

The DoD has established an Encroachment Management Program, which identifies, quantifies, mitigates, and prevents potential encroachment challenges to an installation or range. According to OPNAV Instruction 11010.40 an Encroachment Action Plan (EAP) is a tool, developed for the Installation Commanding Officer, Regional Commander, and Mission Component Commands, to use and respond to encroachment challenges, and to implement preventative or corrective actions identified as appropriate. The 2013 Portsmouth Naval Shipyard Encroachment Action Plan will be implemented in coordination with this INRMP. The existing EAP identifies encroachment concerns and provides mitigation strategies for the SERE School in Addendum D. The EAP establishes the military influence area, a geographic area surrounding the Installation that is of shared interest for the Navy and community stakeholders, as encompassing a 5-mi (8-km) geographic radius. The military influence area includes lands that hold significant development potential, as well as the Town of Rangeley and large tracts of undeveloped land adjacent to the Installation. Within this area, the top three encroachment challenges to the SERE School include security, urban development, and protection of rare, threatened and endangered species and their habitat. As a component of the EAP, the Navy is tracking and pursuing conservation opportunities on parcels surrounding the SERE School (Navy 2013a). See Section 3.1.7 *Regional Conservation Lands* for a discussion of ongoing and future conservation efforts.

Another tool under the Encroachment Management Program is Encroachment Partnering, which was authorized under 10 USC §2684a (*Agreements to Limit Encroachments and other Constraints on Military Training, Testing and Operations*). This authorizes military services to enter into cost-sharing partnerships with states, their political subdivisions, and/or conservation-minded NGOs to acquire lands from willing sellers. This serves to limit development or use of the acquired property, or to preserve habitat that supports military readiness requirements. Undeveloped habitat areas that border the SERE School present ideal opportunities for the Navy to establish buffers to separate the Installation from encroaching development. Appropriate signage at the SERE School–Appalachian Trail (AT) corridor boundary is a key component of limiting encroachment at the Installation.

The DoD Readiness and Environmental Protection Initiative (REPI) supports cost-sharing partnerships authorized by Congress (10 USC §2684a) between the military services, private conservation groups, and state and local governments to protect military testing and training capabilities and conserve land (DoD Sustainable Ranges Initiative n.d.). The REPI relies on information and results contained in the EAP, and enable the military to work with willing partners who help provide cost-sharing land conservation solutions to limit incompatible development and protect valuable open spaces and habitat around key test and training areas. REPI provides funding for the military to work with state and local governments, NGOs, and willing land owners to help prevent encroachment. Successful projects have resulted in the expansion of easements and the preservation of land around DoD installations (DoD 2012). The National Park Service (which manages the AT) and large timber companies (which are common

throughout the region) are the two most regionally important landowners that abut the SERE School property. Although not located directly adjacent to the SERE School, the Saddleback Mountain Ski Area (Saddleback) is an important neighbor located approximately 3 mi (5 km) southwest of the Installation. Saddleback is currently undergoing a 10-year expansion of lifts, trails, vacation homes, and other facilities, slated for completion in 2017 (AlpineZone.com 2007). This expansion of the ski area is described in an EA prepared for the expansion project, which documents that the project would result in no impact to the SERE School. Saddleback attracts many people to the high mountains year round, but primarily during the winter. Sights and sounds of ski operations are not evident from the most heavily used portions of the SERE School, nor are the military training operations evident from the ski area.

1.8 PUBLIC ACCESS

In accordance with the SAIA, an INRMP shall, to the extent appropriate and applicable, provide for public access to an installation for use of natural resources, including outdoor recreation subject to safety, military security considerations, and the military mission. Additionally, public access for the purposes of use of the natural resources and/or outdoor recreation should not result in degradation of installation natural resources. In addition to traditional outdoor recreation activities such as hiking, wildlife watching, fishing, and hunting, outdoor recreation activities can include educational programs that foster a sense of responsible stewardship among military personnel and the general public who are authorized access to an installation for these recreational purposes.

The military mission at the SERE School dictates that use of the property be exclusive to the military; thus public access is completely prohibited. The classified nature of the training demands a high degree of isolation from the public as well as confidentiality for national security purposes. Inadvertent contact between the public and trainees and other military personnel during training scenarios would not only jeopardize the effectiveness of the training, but would risk the safety of both the public and the people engaged in the training exercises.

Trespassing is an ongoing concern at the SERE School, especially given the adjoining AT corridor that traverses the property. Trespassers are dealt with on a case-by-case basis. Civilian hikers who have strayed from the AT are occasionally encountered on SERE School property. Another concern is encroachment of other activities such as logging. Consequently, the clear demarcation and maintenance of the SERE School boundary is a management priority.

1.9 PARTNERSHIPS AND OUTREACH

Due to the nature of the military mission and the location of the Installation, partnering opportunities with other organizations is limited. New partnerships may be established as more active management of SERE School natural resources takes place. However, partnering would only occur if it was determined that the partnership would not impact or conflict with the military mission.

For the purpose of improving natural resources management, a Memorandum of Agreement (MOU) was established between The Nature Conservancy (TNC) and DoD in June 1995, under

which TNC may on occasion be asked to assist with gathering natural resources information (DoD and TNC 1995). The Institute for Bird Populations (IBP) has historically conducted closely supervised Monitoring Avian Productivity and Survivorship (MAPS) mist-netting at two (2) locations on the facility during spring migration and nesting periods; however, this activity has not occurred since 2008. The purpose of the IBP MAPS program is to provide population, reproduction, and migration information on migratory and songbird species in the Northeast. The Navy will evaluate opportunities for collaborating with IBP to conduct additional MAPS surveys in the future. Other groups such as Vermont Center for EcoStudies (formerly Vermont Institute of Natural Science), Trout Unlimited, Maine and National Audubon Society chapters, and the Wilderness Society also have expressed interest in the resources at the SERE School. Boy Scouts and other civic groups may be allowed to conduct recreational and educational activities on a restricted basis and as authorized by the Navy.

As discussed in Section 3.1.7 *Regional Conservation Lands*, the Navy is pursuing conservation partnerships with the Trust for Public Land (TPL) and other state agencies on parcels surrounding the SERE School to minimize encroachment issues and conflicts with adjacent land use.

1.10 INRMP INTEGRATION WITH OTHER PLANS

In addition to this INRMP, there are several other plans that address specific issues of natural resources management at the SERE School. These plans and recently completed surveys are listed below and are described, where applicable, in this document:

- Draft Cultural Resources Survey (Berger 1996)
- Naval Installations Maine Consolidated Integrated Pest Management Plan (IPMP) (2012)
- SERE School Spill, Prevention, Countermeasures, and Control (SPCC) Plan (25 September 2012)
- Portsmouth Naval Shipyard EAP (2013)
- Streambank Assessment (2013; Appendix E)
- High Elevation Bird Survey (HEBS) (2013; Appendix E)
- Baseline Fish Survey and Habitat Assessment (2013; Appendix E)
- Bat acoustic survey (completed in 2014; Appendix E)
- Fall and spring raptor migration survey (completed in 2014; Appendix E)
- Winter bird/mammal resident survey (completed in 2014; Appendix E)
- Breeding bird survey (completed in 2014; Appendix E)
- Wildland Fire Management Plan (completed in 2014; Appendix I)

This INRMP also provides recommendations for completion of the following natural resources surveys and plans during the INRMP plan period (Appendix J *SERE School Natural Resources Project Implementation Schedule*):

- planning level wetlands and vernal pool surveys;
- assessment of potential riparian buffer restoration or enhancement areas;
- an erosion control plan;
- water quality baseline inventory;
- climate change vulnerability assessment;
- natural community type survey;
- edible plant survey;
- annual invasive species surveys;
- rare plant survey;
- baseline wildlife surveys;
- deer population survey and assessment of potential to establish a deer hunting program;
- assessment of potential to establish a catch and release fishing program;
- invasive and nuisance wildlife monitoring;
- rare, threatened, endangered, and special concern wildlife and invertebrate species surveys;
- Atlantic salmon habitat protection program;
- golden eagle (*Aquila chrysaetos*) monitoring;
- survey and monitoring of rusty blackbird (*Euphagus carolinus*);
- update of the 1998 basic characterization of forest types;
- development of forest management plan; and
- development of an environmental awareness program.

As plans are updated or new survey work is completed, copies will be included in Appendix E *SERE School Biological Surveys* and these plans and survey data will be integrated with the management recommendations provided in this INRMP.

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2.0 EXISTING CONDITIONS

The SERE School encompasses two parcels totaling 12,466 ac (5,045 ha) that are separated by the AT corridor, which traverses the southeastern corner of the property (Figure 2-1). The main parcel, north of the AT corridor, is 11,320 ac [4,581 ha] and the southern parcel is 1,146 ac [464 ha] (Table 2-1). All SERE School developed areas and facilities are located in the main parcel including the MPB, two Static Camps, the Redington Village Site, as well as several scattered small buildings and shelters along the roadsides. This INRMP covers natural resources management of both parcels, however it will not contain a detailed discussion of the facilities or the developed areas of the SERE School.

Table 2-1. Acreage of the SERE School.

Parcel	Size (acres)
Main	11,320
Southern	1,146
Total	**12,466**

2.1 SITE DETAILS

Facilities at the SERE School property are located in several developed areas (Figure 2-1). One area consists of the MPB, which at approximately 2 ac (0.8 ha) in size is the largest developed area on the property. It includes barracks, operations and maintenance buildings, administrative buildings, supply and storage, and other base support buildings. A new hostage resistance training classroom has been constructed on a 1-ac (0.4-ha) parcel near the main compound. Support buildings consist of a generator building and a water treatment facility. A fire tank booster pump station, leach field, helipad and access and service roads also are components of the Public Works area.

A resistance-training laboratory is located in the same general vicinity and is slightly larger than 1 ac (0.4 ha) in size. This is an imitation prisoner of war camp and is the student-training compound used in resistance and escape training scenarios.

Static Camp Alpha, located north of the Main Gate, includes several structures and a camping area and serves as the winter orientation center for SERE School students upon arrival at the Installation. A second Static Camp, X-ray, is located just west of Redington Village and consists of a new classroom facility and outhouse-latrine. It serves as a summer orientation center. There are also several isolated and scattered small buildings such as the gatehouse and a few small shelters on the roadsides. Commercial electrical power (with generator back-up) is provided to the main compound, and diesel-powered generators provide electricity to Alpha and X-ray training facilities.

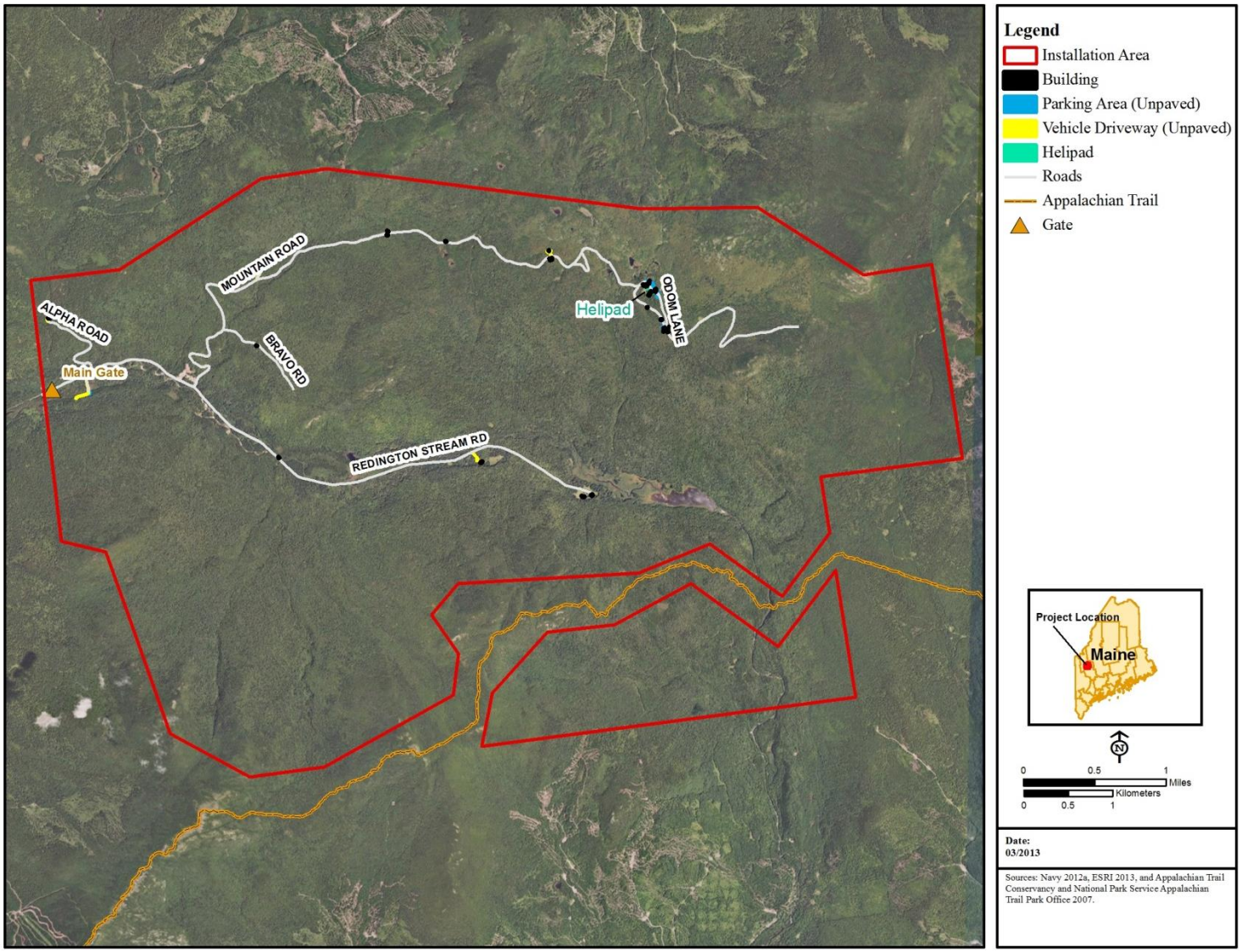

Figure 2-1. Site Details of the SERE School, Redington, Maine.

The old abandoned Redington Village Site contains some development and is utilized for training. One of the structures has been modified to provide temporary accommodations for instructors and students.

Most recently, six shacks (approximately 30 ft [9 m] by 60 ft [18 m]) were constructed within the Oscar Road training area, which is located within the northwest portion of the main parcel on approximately 1 ac (0.4 ha). This project resulted in approximately 0.5 ac (0.2 ha) of land clearing. Construction of a new two-bay troop transport garage adjacent to the MPB facility also was recently completed. Other projects that have been completed over the past fiscal year include replacement of miscellaneous culverts on Mountain Road, and road grading and drainage repair throughout the facility.

The southern parcel contains no developed areas and consists entirely of forested land.

2.2 Regional Transportation System

The Installation is accessed via Route 16 north from Rangeley and Dallas Road. The Navy owns a right-of-way over Dallas Road, which is a public access road from Route 16 to the SERE School property itself. There is an iron swing gate with an accompanying guard shack near the property boundary that is manned during active periods.

Approximately 23 mi (37 km) of gravel road exist throughout the property. These roads have been well-maintained and are in good condition. Existing sources of sand and gravel for road maintenance and winter sanding is obtained from both onsite (Moose Pit near Building 624) and offsite (two gravel pits owned by Georgia Pacific located off of Dallas Road) sources.

A helipad is located in the center of the MPB. This helipad formerly functioned as a Visual Flight Rules helipad that could be accessed from any direction, and was predominately used for emergency and medical purposes.

Abandoned roads and created footpaths are scattered throughout the Installation. Three trails are used extensively for recreation and mission purposes. An old abandoned railroad grade that once accessed the Redington logging camp is now a trail that provides access to the abandoned camp from the southeast along Orbeton Stream. The Blue Line Trail provides access to Redington Falls from the MPB as well as the Village Road. The third trail provides access from the MPB to ledges located in the northern portion of the property. None of these trails are open to the public. The AT is a unit of the National Park System and is managed under a unique partnership between the public and private sectors that includes, among others, the National Park Service (NPS), the USDA Forest Service (USFS), an array of state agencies, the Appalachian Trail Conservancy, and local trail-maintaining clubs (Appalachian Trail Conservancy 2013).

2.2.1 Projected Changes in Facilities

There are no major construction or mission related development projects currently programmed over the plan period. However, the DoD Missile Defense Agency is considering the SERE School, along with three other military installations, as a potential location to site a missile defense facility. In accordance with the NEPA, an Environmental Impact Statement (EIS) will be

prepared to provide a comprehensive analysis of the anticipated impacts associated with each of the siting alternatives. In the event that the Installation is selected as the site the for the proposed DoD Missile Defense Agency facility, the INRMP would need to be incorporated into the planning and design process to ensure that the goals and objectives of the INRMP are considered and compliance requirements are achieved. In addition, the INRMP would be updated accordingly to reflect any changes in the military mission or use of the Installation.

The INRMP and all other project needs are subject to change with mission requirements. Implementation of projects at the Installation will be conducted in accordance with applicable environmental laws and regulations. All projects are reviewed via the NAVFAC PWD-ME Environmental Checklist process for environmental compliance requirements. A copy of the applicable environmental checklist can be obtained from the Installation NRM.

2.3 LAND RESOURCES

2.3.1 Physiographic Location

The SERE School is located in the Adirondack–New England Mixed Forest–Coniferous Forest–Alpine Meadow Province of the Mountains Division, within the Humid Temperate Domain Ecoregion of the United States (Bailey 1995). This transitional province grades between boreal forest and broadleaf deciduous forest, and is a mixture of deciduous and coniferous forest types. Within this region vertical zonation is present with hardwoods (sugar maple [*Acer saccharum*], yellow birch [*Betula allegheniensis*], and beech [*Fagus* sp.]) occupying the valleys, mixed forests of spruce-fir and hardwoods on low mountain slopes, and nearly pure stands of balsam fir (*Abies balsamea*) and red spruce (*Picea rubens*) at the top. Individuals within the highest zone display evidence of the harsh weather effects that occur at high elevations (i.e., krummholz) (Bailey 1995). These ecosystems are common in the sparsely populated western mountains of Maine where large industrial timberland corporations historically owned the majority of the land and regularly harvested trees in support of the pulp and paper industry. With the exception of other smaller federal and state parcels in the western mountains, the SERE School provides one of the largest forested blocks that have not been harvested since 1961.

View from HEBS in northeast corner of main parcel

Source: I. Trefry

2.3.2 Natural Disturbance Regimes

The natural disturbance regime for the mountains of western Maine includes fire, insects, wind, snow/ice, and water movement. These are important determinants of ecosystem structure and function, and provide for a naturally occurring diversity of species. The most common disturbances in the area are large blow downs resulting from hurricanes or other severe wind events, as well as smaller area singletree phenomena. Insect and disease disturbances have resulted from gypsy moth (*Lymantria dispar*), spruce budworm (*Choristoneura fumiferana*), spruce beetle (*Dendroctonus rufipennis*), and severe beech bark disease. Higher elevation forests are often characterized by an even-aged wind throw disturbance phenomenon known as fir-waves. In general, wind disturbance is relatively high at this site and results in fir waves in the upper slopes of these mountains (Maine Nature Conservancy 1998). Also, spruce (*Picea* spp.) decline at higher elevations is related to severe winter injury and soil cation depletion (acidic soils).

Although forest fires in the Rangeley area are rare, the northeastern portion of the SERE School property contains a large area that burned in 1962. Firebreaks have been established in certain portions of the property to protect the developed area and provide an escape route for SERE School personnel. These firebreaks shall be maintained in accordance with the SERE School Wildland Fire Management Plan (Appendix I). Section 3.1.4 *Wildland Fire Management* provides details associated with wildland fire management at the SERE School.

In upland regions, forests dominated by intolerant trembling aspen (*Populus tremuloides*) and birch (*Betula* spp.) alternate with forests dominated by spruce and fir (*Abies* sp.). Browsing by moose (*Alces alces*) over a period of 20–40 years can convert an aspen stand into one dominated by conifers. As stands of conifers mature, they become increasingly favorable habitat for spruce budworm and other insects. Eventually, outbreaks occur, portions of the system are converted back into early successional aspen, and the combined upland system undergoes stable, long-period oscillations.

As the upland regions undergo these oscillations, the valley bottoms alternate between flooded plains and moist meadows. American beavers (*Castor canadensis*) maintain the flooded state by cutting streamside aspen for food and by damming the streams to create ponds. When the supply of aspen is insufficient, beavers abandon their dams, the dams' break, and the ponds are soon replaced by meadows. This relatively rapid change, a consequence of a decreasing supply of aspen, may be thought of as a loss of stability. The upland and lowland cycles tend to entrain each other because of the interaction between beavers and aspen. Fires also play a role in synchronizing cycles over large spatial areas, because conifers killed by the spruce budworm provide an abundance of fuel (Ludwig et al. 1997).

2.3.3 Climate

The regional climate is characterized by cold winters and warm summers. Because maritime air masses have year-round access to the eastern seaboard, precipitation is evenly distributed throughout the year. Severe winter conditions often are experienced within the Northern Climatological Division of Maine. Winter temperatures are typically between 20 and 25 degrees Fahrenheit (°F) (-6 degrees Celsius [°C]), though extreme low temperatures are not uncommon

(NOAA National Climatic Data Center 2012). Summers are generally mild with air temperatures typically in the low 50s °F (10 °C) minimum, and maximum temperatures in the mid- to upper-80s °F (30 °C). Hot days, where the temperature reaches 90 °F (32 °C), are infrequent. The warmest month of the year is July with an average maximum temperature of 76 °F (24 °C), and January is typically the coldest month of the year with an average minimum temperature of 1 °F (-17 °C). Temperature variations between night and day tend to be moderate during the summer with an average daily temperature difference of 21 °F (12 °C), and moderate during winter with an average daily temperature difference of 19 °F (11 °C) (NOAA National Climatic Data Center 2012).

The average annual precipitation recorded at the Rangeley Station is 43.2 inches (in) (109.7 centimeters [cm]), with rainfall fairly evenly distributed throughout the year. The wettest month of the year is June with an average rainfall of 4.6 in (11.7 cm) (NOAA National Climatic Data Center 2012). Winter precipitation in the form of snow averages approximately 117 in (297 cm) per season, usually stretching from late October through April. The prevailing low temperatures and densely wooded terrain typically prevent rapid melting.

Wind is primarily out of the southwest during the summer, and north and west in the winter. The sun shines approximately 45 percent (%) of the time over much of northern Maine and fog is frequent in the spring, summer, and fall (Navy 2007).

2.3.3.1 Regional Climate Change

DoDI 4715.03 requires the Navy to consider climate change in the development of INRMPs to help mitigate impacts on military installations. Impacts that must be considered include shifts in species' ranges and distributions, changes in phenology, rising sea levels, and variations in ecological processes such as drought, fire, and flood (DoD 2011).

Since 1970, the northeastern U.S. has experienced a 0.45 °F (0.25 °C) average temperature increase per decade, and the surface temperature of Maine's coastal waters has increased almost 2.0 °F (1.1 °C). According to *Maine's Climate Future Report* (Jacobson et al. 2009), the rate of warming in Maine has been increasing over the past century. All three of Maine's National Weather Service climate divisions are warmer than they were 30 years ago. This trend is parallel to the overall trend of global temperature increase since 1850. These changes have affected growing conditions in the state and have caused the horticultural plant hardiness zones for Maine to shift by one zone to the north. Additional impacts include a significant change to the hydrologic cycle; data reveal a trend towards wetter conditions over the time span from 1950 to 2007 in the state's three climate divisions (Jacobson et al. 2009).

2.3.3.2 Future Climate Change Projections

The University of Maine's Climate Change Institute includes several predictions of future climate change in its *Maine's Climate Future Report* (Jacobson et al. 2009). The Climate Change Institute used several ocean-atmospheric models based on an assumption of an intermediate level of greenhouse gas emissions used by the Intergovernmental Panel on Climate Change in its Fourth Assessment (Intergovernmental Panel on Climate Change 2007). The models show a strong trend in Maine towards warmer and generally wetter conditions in climate divisions for

seasons throughout the 21st century, with the exception of summer precipitation. Projected temperature and precipitation increases are greatest in the north and least along the coast. These warming trends imply a significant shift in the regional hydrology, from a snowmelt-dominated regime to one that shows significant runoff during the winter. This will likely have an adverse impact on the management of water supplies and flood mitigation. Uncertainties exist with all predictive models, and slight changes in seasonality of precipitation and increases in evaporation and plant transpiration that are likely to accompany warming complicate predictions of the net change in water balance across the state (Jacobson et al. 2009).

2.3.4 Land Use

Current land uses at the SERE School include military training, roadways, and recreational. The SERE School training, which is the primary purpose of the School, is conducted over much of the property. The areas of concentrated use are limited to the MPB, Static Camps, the Resistance Training Laboratory, the old Redington Village area, and the roadsides. All of these areas contribute to the training provided by the SERE School. Specifically, these facilities provide for the bivouacking of personnel, drop-off and pick-up zones, classroom training, and various other purposes.

Although activities on the remaining undeveloped portions of the property can be characterized as dispersed and light, the survival and evasion components of the training are heavily dependent on these areas and their natural resources. The landscape and sustainability of the natural resources are critical to the delivery of the mission. An adequate buffer is necessary to ensure that the mission is secure.

Redington Village

Source: I. Trefry

In addition to training, casual recreational uses of the SERE School property are permitted for the SERE School instructors during non-training periods (written approval is required from the Officer in Charge [OIC]; see Section 2.6 *Outdoor Recreation Resources*.

2.3.5 Regional Land Use

Currently, there is no regional land use plan or study that is being developed or conducted specifically for Franklin County. Development regulations in all of the unincorporated territories in Maine, including Redington Township and the other unincorporated townships and plantations in the Rangeley Lakes region, are developed, administered, and enforced directly by the Maine Land Use Planning Commission (LUPC, formerly the Maine Land Use Regulation Commission). Recent efforts to improve the effectiveness of managing land use in the unorganized and de-organized areas of Maine have focused in part on the need for more locally guided and proactive planning for these areas. The 2010 Comprehensive Land Use Plan prepared

by the Maine LUPC identifies this type of planning, referred to as "prospective zoning," as a priority for implementation. In addition, a directive to initiate prospective zoning is included in recent Maine legislation (Legislative Document 1798) and includes the requirement to report back to the Legislature on progress in January 2013 (Maine Land Use Regulation Commission 2013). To date, the LUPC has undertaken prospective zoning in the Rangeley Lakes region through development of the Prospective Zoning Plan for the Rangeley Region. The goal of the Prospective Zoning Plan for the Rangeley Region is to identify appropriate locations for development, promote land uses that reinforce the special character of the region over the long term and that remain consistent with the Comprehensive Land Use Plan (Maine Land Use Regulation Commission 2000).

The AT corridor that bisects the SERE School is owned and managed by the NPS. The trail crosses the Saddleback Range, which includes the peaks of Saddleback, the Horn, and Saddleback Junior. This area represents one of the most dramatic high-elevation hiking opportunities on the entire 2,160-mi (3,476-km) AT. The portion of the AT located adjacent to the SERE School is predominately used in the late spring, summer, and early fall. It is most closely accessed from the Saddleback Ski Area located approximately 2 mi (3 km) southwest of the SERE School perimeter. A trailhead that provides access to the AT is located on State Highway 16/27 south of Stratton, Maine. Trail hikers also can access the trail from several unimproved roads that traverse the region.

2.3.6 Geology, Topography, and Soil

2.3.6.1 Geological Formations

The SERE School is located in the Western Mountains Biophysical Region, which extends from Boundary Bald Mountain along the Maine-Quebec border to the Mahoosuc Range in southwestern Maine. The region is characterized by a mountainous landscape that is highly dissected by small, steep-sided streams. Elevations range from 1,000 to 2,000 ft (305 to 610 m). Bedrock in this region is extremely complex, composed of pelites and sandstones, with intrusions of various aged plutons (McMahon 1990).

The mountains in the region are underlain by granite and metamorphic rocks, and are thinly covered by glacial till. Metamorphosed sedimentary rock, penetrated in some places by igneous rock, is the bedrock component of the area's geology. The Saddleback Range contains some extraordinary natural features including glacially polished, exposed bedrock and unusual glacial erratics, and an extensive area above the tree line. Much of Franklin County is composed of pegmatite granites and gemstones. Feldspar and mica were previously mined in areas nearby. Semiprecious stones such as tourmaline, beryl, amethyst, and garnet also are available in this area.

2.3.6.2 Topography

The terrain of the SERE School is rugged, ranging from 1,440 ft (438 m) to 3,760 ft (1,146 m) above mean sea level (msl) (Figure 2-2). The mountain slopes typically have gradients of 15–30%. They range from occasional, nearly level benches to steep, almost vertical rock faces. Elevations of the Carrabassett Valley floor range from 1,475 feet (ft) (450 meters [m]) above msl

near the southern Installation boundary at the easterly end of the valley, to 1,595 ft (486 m) above msl at the western boundary of the Installation. In longitudinal profile, however, the valley floor climbs to a crest elevation of 1,674 ft (510 m) above msl within the Navy property. This crest, located about 0.75 mi (1.21 km) west of Redington Village, is a drainage divide. Areas to the east drain into Orbeton Stream, whereas those to the west drain into Redington Stream (Section 2.3.7.1 *Watersheds and Floodplains* provides additional watershed information).

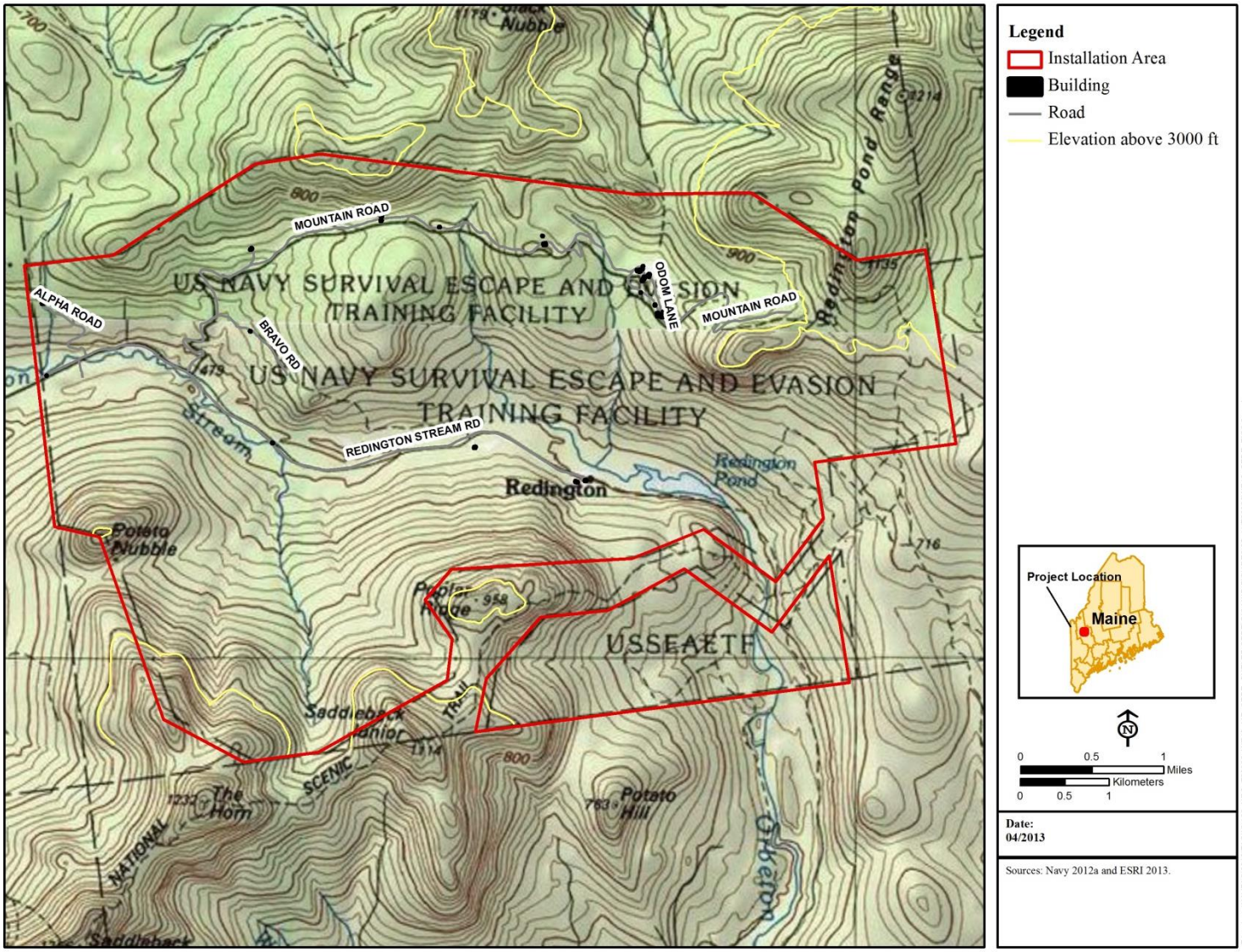

Figure 2-2. Topography of the SERE School, Redington, Maine.

The northern boundary of the property follows ridges and heights of land including an unnamed peak in the northeast corner of the property, which at 3,760 ft (1,146 m) has the highest elevation at the SERE School. The southern boundary of the property also follows ridges and peaks of land. The AT, which divides the Installation into two parcels, follows the mountain ridge connecting the Horn (4,023 ft [1,226 m]), Saddleback Junior (3,640 ft [1,110 m]), and Poplar Ridge (436 ft [133 m]). The southern 1,164-ac (471-ha) SERE School parcel contains a predominately south-southeasterly aspect sloping into Orbeton Stream. Elevations within the main SERE School parcel range from 1,595 ft (486 m) to 3,760 ft (1,146 m) above msl. Elevations within the southern SERE School parcel range from 1,440 ft (438 m) to 3,130 ft (954 m) above msl.

2.3.6.3 Soils

The SERE School is located in the Western Mountains Biophysical Region, which is characterized by various soils at distinct elevations throughout the region. At elevations greater than 2,500 ft (762 m) soils are cold, acidic, and generally well-drained. Thin, freely drained, organic soils also are common at high elevations. At middle and lower elevations soils are typically deep, somewhat poorly drained Telos, Monarda and Colonel coarse loamy soils. Ice-contact glaciofluvial deposits and stream alluvium fill many of the valleys in this region and soils derived from these deposits tend to be well- to excessively-drained gravels, sands, and sandy loams (McMahon 1990).

The soils on SERE School lands were classified and mapped in 1988 by the USDA Soil Conservation Service, now the USDA NRCS. This soil survey can be used to adjust land uses to account for soil limitations and the potential natural resources associated with soil types and the environment. It also can be used to avoid soil-related failures in land uses. Twenty-four (24) different soil types are associated with the SERE School (Figure 2-3 and Table 2-2). Some of these have severe limitations in terms of development potential, and Figure 2-3 should be referenced during the planning process for any new development at the Installation.

The primary soil type present at the SERE School is the Marlow-Dixfield association, moderately steep, very stony, which comprises approximately 18.3% (2,278.3 ac [922.0 ha]) of the soil types present (Table 2-2). These soil components are located on upland ridges with slopes of 15–25%. The Marlow component is derived from granite and/or coarse-loamy lodgment till from mica schist and is moderately well-drained. The Dixfield component is derived from coarse-loamy lodgment till from mica schist and is well drained. These soils do not meet the hydric soil criteria (USDA NRCS 2009a). This soil type is located throughout the Installation and occurs in both the main and southern parcels (Figure 2-3).

The Ricker-Saddleback association, very steep is the second most common soil type, comprising 10.8% (1,346.0 ac [544.7 ha]) of Installation soils. The Ricker component is associated with mountains on uplands with slopes of 15–80%, and is derived from coarse-loamy supraglacial melt-out till from mica schist. The Saddleback component is associated with mountains on uplands with 15–60% slopes, and is derived from coarse-loamy supraglacial meltout till. These soils are well-drained and do not meet hydric criteria (USDA NRCS 2009a). The Ricker-Saddleback association soils are located throughout the main parcel and in the western portion of the southern parcel (Figure 2-3).

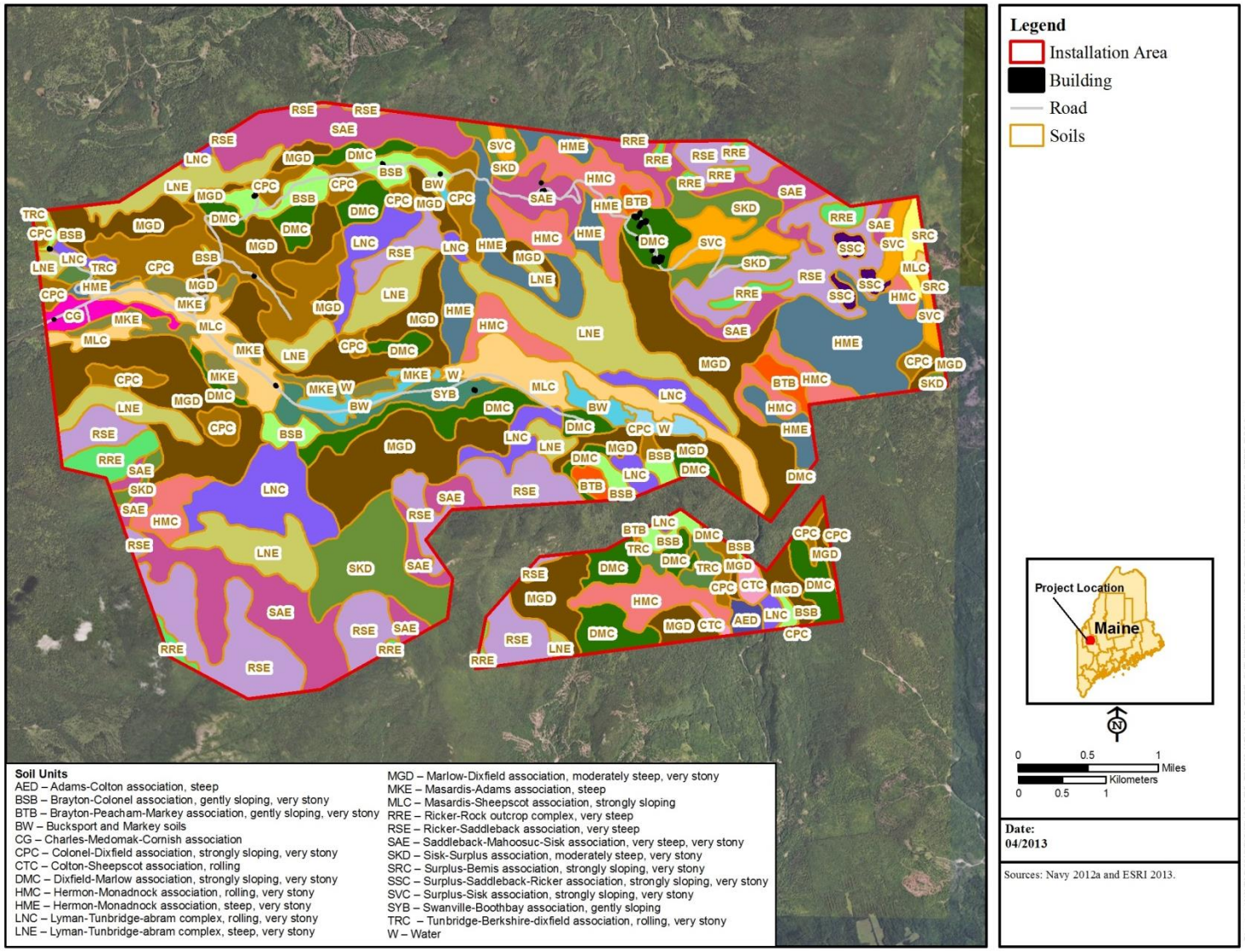

Figure 2-3. Soils of the SERE School, Redington, Maine.

Table 2-2. Soil Types of the SERE School.

Map Unit Symbol	Soil Series	Drainage Class	Area (Acres)	Percent Total
MGD[1]	Marlow-Dixfield association, moderately steep, very stony	Moderately well to well drained	2,277.5	18.3
RSE	Ricker-Saddleback association, very steep	Well drained	1,345.4	10.8
SAE	Saddleback-Mahoosuc-Sisk association, very steep, very stony	Well to somewhat excessively drained	1,219.7	9.8
LNE	Lyman-Tunbridge-Abram complex, steep, very stony	Well to excessively drained	1,043.1	8.3
DMC	Dixfield-Marlow association, strongly sloping, very stony	Moderately well to well drained	831.9	6.7
CPC	Colonel-Dixfield association, strongly sloping, very stony	Somewhat poorly to moderately well drained	807.2	6.5
HME	Hermon-Monadnock association, steep, very stony	Well to somewhat excessively drained	788.2	6.3
HMC	Hermon-Monadnock association, rolling, very stony	Well to somewhat excessively drained	705.0	5.7
LNC	Lyman-Tunbridge-Abram complex, rolling, very stony	Well to excessively drained	634.5	5.1
SKD	Sisk-Surplus association, moderately steep, very stony	Moderately well to well drained	559.2	4.5
MLC[2]	Masardis-Sheepscot association, strongly sloping	Moderately well to somewhat excessively drained	511.5	4.1
BSB	Brayton[3]-Colonel association, gently sloping, very stony	Somewhat poorly drained to poorly drained	319.1	2.6
SVC	Surplus-Sisk association, strongly sloping, very stony	Moderately well to well drained	217.4	1.7
RRE	Ricker-Rock outcrop complex, very steep	Well drained	212.0	1.7
MKE	Masardis-Adams association, steep	Somewhat excessively drained	211.1	1.7
SYB	Swanville[3]-Boothbay association, gently sloping	Somewhat poorly to poorly drained	134.4	1.1
BW	Bucksport and Markey soils[4]	Very poorly drained	120.3	1.0
BTB	Brayton-Peacham-Markey association, gently sloping, very stony[4]	Very poorly to poorly drained	103.0	0.8
TRC	Tunbridge-Berkshire-Dixfield association, rolling, very stony	Somewhat poorly to poorly drained	88.7	0.7
CG	Charles[3]-Medomak[3]-Cornish association	Very poorly to poorly drained	77.7	0.6
SSC	Surplus-Saddleback-Ricker association, strongly sloping, very stony	Moderately well to well drained	54.0	0.4
CTC	Colton-Sheepscot association,	Moderately well to	50.7	0.4

Map Unit Symbol	Soil Series	Drainage Class	Area (Acres)	Percent Total
	rolling	excessively drained		
W	Water	NA	50.6	0.4
SRC	Surplus-Bemis[3] association, strongly sloping, very stony	Poorly to moderately well drained	46.1	0.4
AED	Adams-Colton association, steep	Excessively to somewhat excessively drained	32.4	0.3
		Totals	**12,440.8[5]**	**100.0**

[1] Prime farmland soil

[2] Farmland soils of statewide importance

[3] Soil component meets hydric criteria

[4] Soil type meets hydric criteria

[5] Total soils acreages differ from the approved acreage provided by Navy Real Estate (Table 2-1) due to rounding errors and discrepancies between the Navy Real Estate data and acreage calculations using a GIS.

Sources: USDA NRCS 2009a and 2009b

The Saddleback-Mahoosuc-Sisk association, very steep, very stony is the third most common soil type, comprising 9.8% (1,220.2 ac [993.8 ha]) of Installation soils. The Saddleback and Sisk components are associated with mountains on uplands with slopes of 15–60%. These soils are well-drained and do not meet hydric criteria. The Mahoosuc component is associated with mountains on uplands with slopes of 15–80%. This soil is somewhat excessively drained and does not meet hydric criteria (USDA NRCS 2009a). This soil type is located in the northern and southern portions of the main parcel (Figure 2-3).

The remaining 21 soil types each comprise less than 9.0% of the Installation acreage, ranging from 0.3% to 8.4% in coverage. Surface waters and wetlands cover 0.4% of the Installation.

One soil type associated with the SERE School, Marlow-Dixfield association, moderately steep, very stony, is considered prime farmland soil. Prime farmland, as defined by the USDA NRCS, is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops, and is available for these uses (USDA NRCS 2012). Because the supply of high quality farmland is in limited supply in the U.S., prime farmland is identified to ensure that a long-term supply of food and fiber is available. In general, soils that meet prime farmland criteria have sufficient water supply from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, acceptable salt and sodium content, and have low rock content (7 Code of Federal Regulations [CFR] §657, Prime and Unique Farmlands). This soil type is the most prevalent soil on the Installation, and comprises approximately 2,278.3 ac (922.0 ha) of the SERE School (Table 2-2 and Figure 2-3).

Another soil type of the SERE School, Masardis-Sheepscot association, strongly sloping, is considered farmland of statewide importance. Farmland of statewide importance, as defined by the USDA NRCS, is land that is of statewide importance for the production of food, feed, fiber, forage, and oilseed crops. Criteria for this classification are determined by the appropriate state agencies but generally include farmland soils that are nearly classified as prime farmland soils

and that economically produce high yields of crops when treated and managed according to acceptable farming methods (USDA NRCS 2012). This soil type comprises approximately 4.1% (511.6 ac [207.0 ha]) of Installation soils and is located throughout the central portion of the main parcel, as well as a small area located along the eastern perimeter of the main parcel (Table 2-2 and Figure 2-3).

A streambank erosion survey conducted in June 2013 identified 10 stream segments with existing or potential erosion and sedimentation problem areas (Figure 2-4) (Navy 2013b). Eight streambank erosion areas were identified along Redington Stream, and erosion areas were identified on Mountain Road near Tumbledown Brook and near an unnamed tributary crossing.

2.3.7 Water Resources

Water resources of the SERE School described in this section include watersheds, floodplains, groundwater, surface water, wetlands, and riparian areas (Figure 2-4).

The military operation currently needs a maximum of 1,800 gallons (6,814 liters) per week to support all domestic uses during training periods. Historically, the SERE School obtained its water for drinking and fire protection purposes from a small reservoir on Tumbledown Brook approximately 300 ft (91 m) upstream of the MPB. Downstream from the holding reservoir, Tumbledown Brook flanks the southeast side of the Public Works area. In 2011, the SERE School installed a water well and pump with sufficient capacity to replace the surface water supply.

2.3.7.1 Watersheds and Floodplains

The SERE School is located entirely within the headwaters of the Kennebec Watershed, which drains a total area of 5,870 square mi (mi^2) (15,203 square km [km^2]) (Maine Rivers n.d.). The basin drains southward into Merrymeeting Bay, which is linked to the Gulf of Maine and Atlantic Ocean via the Lower Kennebec River (Merrymeeting Bay and the lower Kennebec River are identified collectively as the Kennebec Estuary). The Kennebec River discharges an average of 5,893 million gallons/day (22,307 million liters/day) (Maine Rivers 2012).

Floodplains are defined as low and relatively flat areas adjoining inland and coastal waters, and include flood-prone areas of offshore islands. The Federal Emergency Management Agency (FEMA) defines these areas as being subject to a 1% or greater chance of flooding in any given year. Floodplain data are not available for the Installation; however, floodplain areas are likely associated with Redington and Orbeton streams and Redington Pond.

2.3.7.2 Surface Water

The SERE School has several ponds, perennial and intermittent streams, and numerous wetland areas (Figure 2-4). The largest pond, Redington Pond (approximately 8-ac [3-ha]), is human-made. The pond was created by an earth and boulder dam built on a wooden cribwork foundation on Orbeton Stream in the early 1900s. It was constructed to flood the low-lying stream and create a pond to store logs sluiced down from the surrounding slopes (Navy 2007). Historically this pond also provided excellent trout habitat; however, the dam has not been maintained and over the years

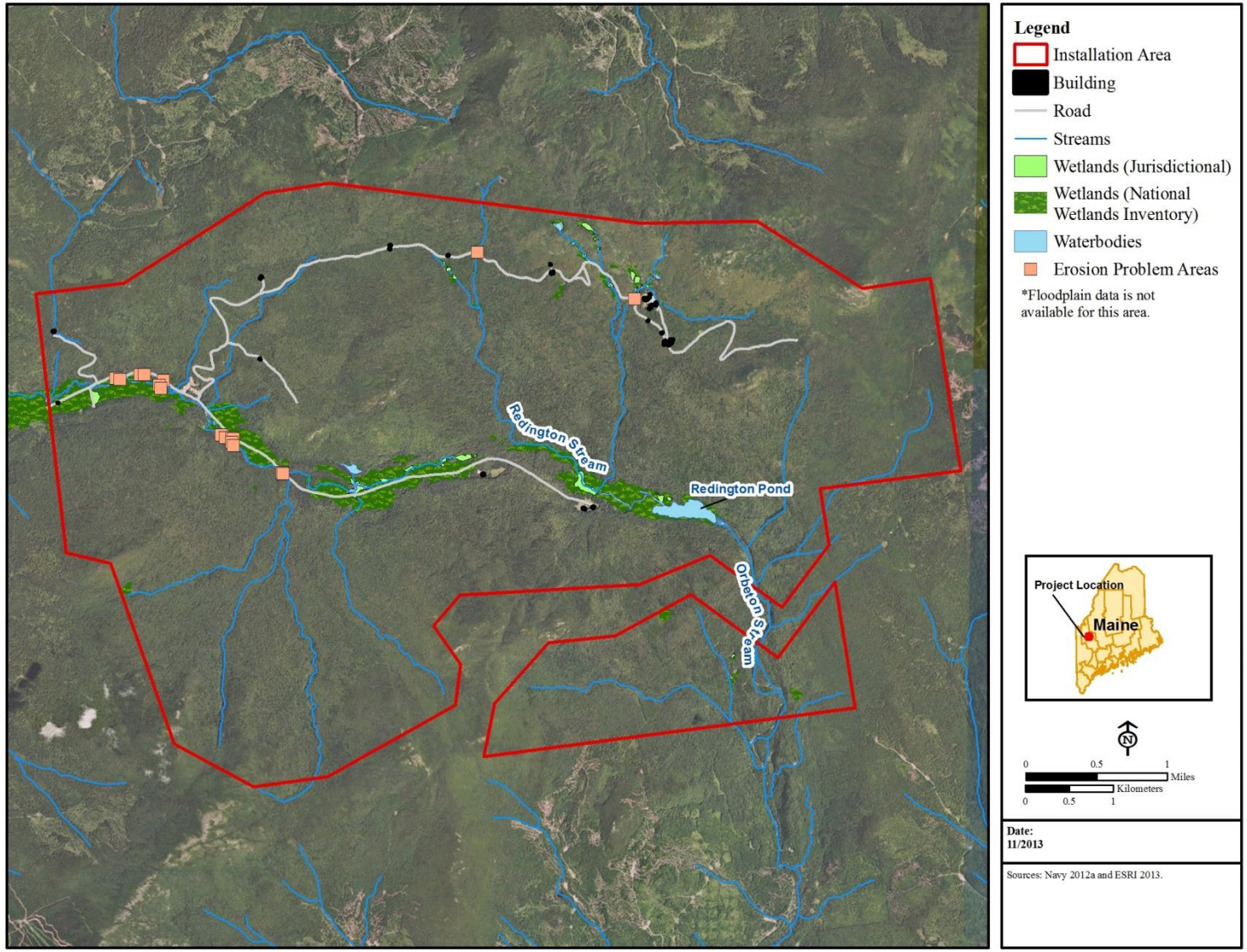

Figure 2-4. Water Resources of the SERE School, Redington, Maine.

the timber and rock-cribbing dam has deteriorated from its original height to its existing height of approximately 8 ft (2 m), causing the water level and pond size to decrease significantly.

Redington Pond

Source: I. Trefry

The pond is most likely at the maximum water level that will be achieved unless the dam is restored, as overtime it will slowly be overcome by wetland vegetation and will transition to freshwater marsh habitat. Numerous old stumps are already visible throughout the shallow waters of the pond (Navy 2012). In addition to Redington Pond, numerous small beaver impoundments exist throughout the property, and other small ponds have developed in glacial depressions along the valley floor. The two major streams draining the property are Redington and Orbeton streams. These two streams bisect the SERE School property nearly in half in an east-west dissection, divided by a crest (1,674 ft [510 m] elevation) located about 0.75 mi (1.20 km) west of Redington Village (Navy 2007). Areas to the east of this crest drain into Orbeton Stream, whereas those to the west drain into Redington Stream.

Orbeton Stream originates near the property's center within a scrub-shrub and forested wetland, then meanders east through a scrub-shrub and emergent wetland along the valley floor until it reaches Redington Pond. Orbeton Stream continues south from Redington Pond to its confluence with the Sandy River and eventually into the Kennebec River. The section of Orbeton Stream west of Redington Pond, is characterized by sluggish flow and somewhat turbid waters. Numerous small or remnant beaver dams have been observed in this reach. Orbeton Stream continues from the southeast corner of Redington Pond in an easterly then southerly direction where it flows to the southeast border of the SERE School main parcel, across the AT right-of-way, and continues across the southern parcel of the Installation. This section of Orbeton Stream has predominantly clear waters, a sandy substrate, and boulders and cobbles scattered along the banks. Redington Stream flows in a west-northwesterly direction from near the center of the property, paralleling Redington Stream Road. Redington Stream is a tributary of the South Branch of the Dead River and generally flows in a west-northwesterly direction from near the center of the property. The South Branch of the Dead River flows into Flagstaff Lake and eventually into the Kennebec River (Navy 2007).

Tumbledown Brook
Source: J. Sweitzer

Tumbledown Brook, which flows south from numerous natural ponds and wetlands in the headwaters located in the north-central portion of the property, is a perennial stream characteristic of the other streams that flow down the densely forested sides of the SERE School valley. A section that flows southwest into Tumbledown Brook between Mountain Road and the small pond north of the road (and potentially further to the north) that was marked on U.S. Geological Survey (USGS) topographic maps as an intermittent tributary is actually a stream with a perennial flow regime, at minimum. This tributary roughly originates at the northern boundary of the SERE School and maintains a high rate of flow and low meander with clear and cool water as a result of the steep topography and densely forested banks.

Further south, a series of scenic falls or cascades are spread over approximately the lower third of Tumbledown Brook. Redington Falls is a spectacular series of cascades and small waterfalls that gradually drop over 300 ft (91 m) in elevation. At its southern terminus just below the falls, Tumbledown Brook flows into Orbeton Stream west of Redington Pond. This portion of Tumbledown Brook is characterized by lower velocity, as the topography eases at the bottom of the valley. The substrate is primarily cobble and sand, and the water remains clear as it converges with Orbeton Stream. The intersection of Tumbledown Brook and Orbeton Stream corresponds to the historical western extent of Redington Pond as seen on USGS maps of the area (the western edge of the pond has receded substantially and is currently located more than 1,300 ft [400 m] east of the two streams' convergence) (Navy 2012).

Redington Falls
Source: I. Trefry

A fish survey completed at the SERE School in June 2013 included an assessment of the water quality of streams surveyed. Based on the survey results and habitat, geographic location, and water quality characteristics, the aquatic resource habitat and water quality of the streams at the SERE School are considered suboptimal to optimal. See Section 2.4.4 *Fish* for additional results of the fish survey. Fish survey locations are identified in Figure 2-5.

2.3.7.3 Groundwater

The availability of groundwater varies according to the nature of the underlying geology. Water stored in winter snowpacks provides much of the annual recharge of groundwater. Groundwater is used as the primary public water supply throughout the region. Historically the SERE School used water diverted from Tumbledown Brook for drinking water, domestic uses, and fire protection purposes. In 2011, a water well with a sufficient sized pump and distribution system was installed, which replaced this surface water supply. The Installation still has access to the Tumbledown Brook surface water supply for use in emergencies, such as water needed for control of wildland fires.

The water quality of an aquifer can be affected by the amount of surface area that is exposed to rock, the chemistry of the water moving into the aquifer from other aquifers, and the introduction or induced movement of contaminants. The concentration of dissolved solids in groundwater generally increases with depth, with some aquifers containing saltwater or brine within their deepest sections. Crystalline aquifers consist of almost insoluble igneous and metamorphic rock that is characterized by shallow fracture systems that store and transmit water. This shallow fracture system allows only minimal dissolution of rocks due to the rapid water movement along short flow paths.

2.3.7.4 Wetlands

A review of existing wetland data—USFWS National Wetland Inventory (NWI) and cursory data collected during the 2012 general walkover survey of the Installation—has identified a total of 676.4 ac (273.7 ha) of wetlands. Of these, 646.1 ac (261.5 ha) are NWI wetlands and 30.3 ac (12.3 ha) are for delineated wetlands; however, a jurisdictional determination for these delineated wetlands has not been obtained from USACE (Table 2-3 and Figure 2-4). Navy data available for the delineated wetlands did not identify wetland types or codes.

Table 2-3. Wetland Types of the SERE School.

Wetland Type	Code	Acres
Freshwater Forested/Shrub Wetland	PFO4Ba	584.0
Freshwater Emergent Wetland	PEM1E	42.2
Freshwater Pond	PUBF	17.3
Lake	L1UBHh	30.0
Riverine	R2USA	3.0
	Total	**676.4**

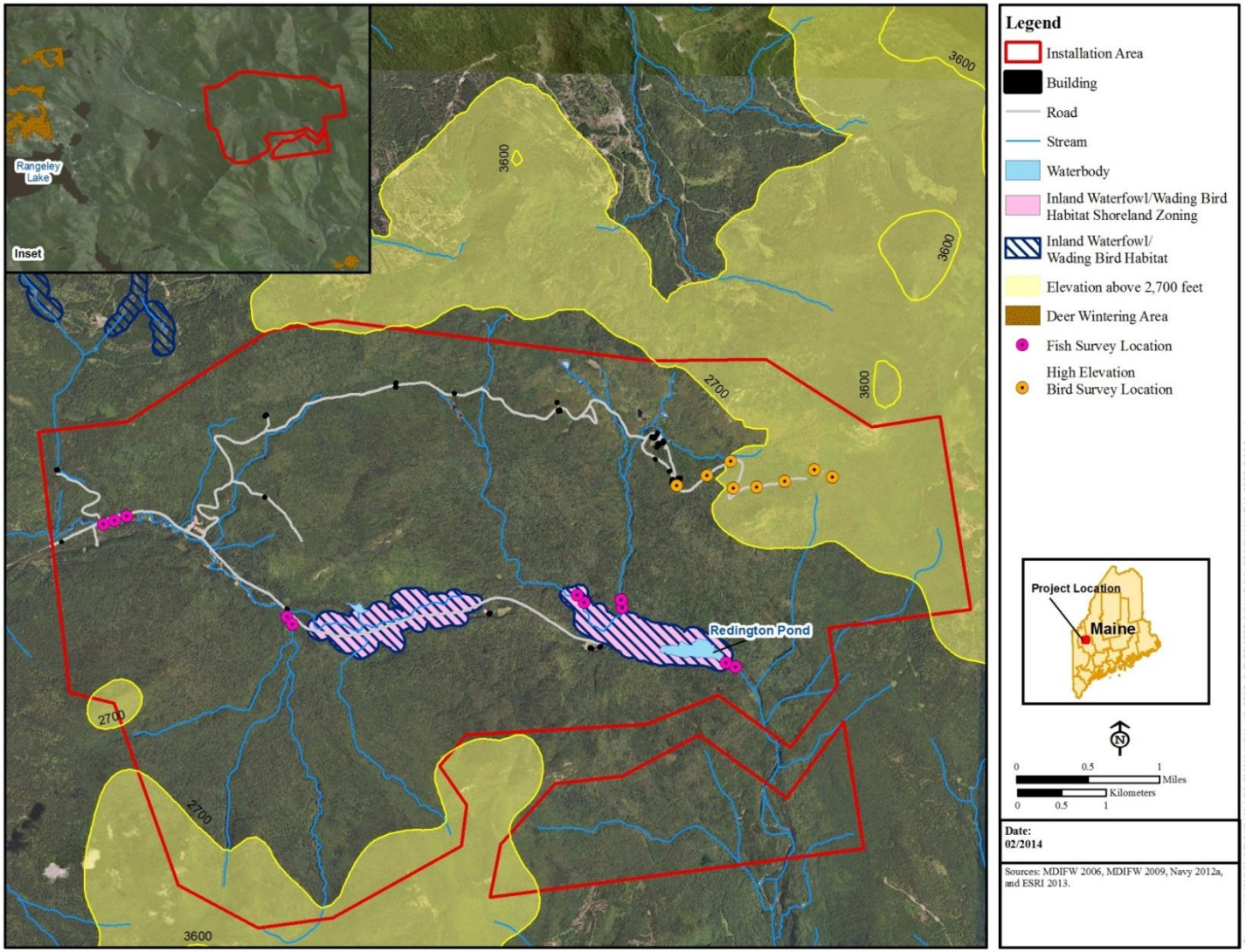

Figure 2-5. Rare Communities, Significant Wildlife Habitat, and Biological Survey Locations of the SERE School, Redington, Maine.

Wetlands occur throughout the SERE School property but are particularly abundant in the low-lying areas along Redington and Orbeton streams. Wetlands identified by biologists during the August 2012 general walkover field survey of the main parcel (Navy 2012b) were classified using the USFWS system for the *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al. 1979). All of the wetlands observed during the survey were palustrine scrub-shrub, palustrine emergent, palustrine forested, palustrine unconsolidated bottom wetlands, or a combination thereof. Wetlands classified as palustrine emergent were most often observed in association with wetlands dominated by woody vegetation. These occur as pockets within palustrine scrub-shrub or palustrine forested wetlands, or as linear features fringing shrub communities. Common species observed within palustrine emergent wetlands included bluejoint (*Calamagrostis canadensis*), sedges (*Carex* spp.), woolgrass (*Scirpus cyperinus*), rushes (*Juncus* spp.), spotted joe pye weed (*Eutrochium maculatum*), harlequin blueflag (*Iris versicolor*), spiraea (*Spiraea* spp.), blackberry (*Rubus* sp.), and ferns such as cinnamon fern (*Osmunda cinnamomea*) and royal fern (*O. regalis*) (Navy 2012b). These wetlands are classified as having hydroperiods that are seasonally flooded/saturated or semipermanently flooded.

In addition to these larger wetlands, pockets of small palustrine emergent wetlands not included on USFWS NWI maps were observed throughout the property, often in association with intermittent or perennial drainages. Similar palustrine emergent wetlands also were observed in disturbed areas such as old forest roads where runoff is concentrated allowing for the development of hydrophytic vegetation (Navy 2012b).

Palustrine scrub-shrub wetlands were perhaps the most frequently observed wetland type during the 2012 survey. These shrub-dominated wetlands occur as relatively small wetlands that form at the headwaters of the ridge-side drainages, and they also compose the extensive wetlands associated with the headwaters to Orbeton Stream and nearly all the riparian wetlands that occur along the valley floor. Virtually all of the palustrine scrub-shrub wetlands observed were dominated by gray alder (*Alnus incana*). Other species present included tamarack (*Larix laricina*), blackberry, meadowsweet (*Spiraea* sp.), bluejoint, goldenrods (*Solidago* spp.), spotted joe pye weed, and various graminoids species. The seasonal pattern of water levels within shrub wetlands include seasonally saturated, seasonally flooded, and semipermanently flooded (Navy 2012b).

Wetland

Source: I. Trefry

The most extensive palustrine forested wetlands were observed in association with the wetland complexes occurring along the valley floor. These wetland communities include needle-leaved

and broad-leaved trees; common species observed included black spruce (*Picea mariana*), red maple (*Acer rubrum*), eastern white cedar (also known as arborvitae) (*Thuja occidentalis*), balsam fir, catberry (*Nemopanthus mucronata*), gray alder, and cinnamon fern (Navy 2012b).

The remaining palustrine wetlands observed during the walkover survey were palustrine unconsolidated bottom wetlands. These non-vegetated or sparsely vegetated wetlands are primarily ponds with organic substrates. Many of these wetlands contained submerged aquatic plant species and well-developed rooted, floating aquatic plant communities dominated by pondweeds (Navy 2012b). Additional patches of wetlands occur along the road and small streams located in the main parcel of the Installation, as well as sparingly in the southern parcel.

2.3.7.5 Riparian Areas

Riparian habitat is characterized as the land and vegetated zone that forms the interface between terrestrial and aquatic ecosystems (USDA NRCS 1996). Typically, these areas are associated with the banks and margins of streams and rivers; however, this term has expanded in recent years to include areas located adjacent to all waterbodies including lakes, ponds, and wetlands. Riparian habitat at the SERE School is present along streams and other waterbodies and includes riparian areas that contain wetland habitat.

Redington Stream erosion
Source: J. Sweitzer

Riparian habitat was assessed during the stream survey of the SERE School conducted in June 2013. Scores for riparian vegetative zone width for streams surveyed were 16 (Orbeton Stream), 18 (Redington Stream and Middle Tributary), and 20 (Tumbledown Brook and Inlet to Redington Pond). These scores represent the optimal category for this parameter (scores between 16 and 20) as outlined in the a modified version of the methodology set forth in the U.S. Environmental Protection Agency (USEPA) Rapid Bioassessment Protocol (Appendix A-1, *Habitat Assessment Field Data Sheets for High and Low Gradient Streams*) (Barbour et al. 1999). A "score" is assigned so that relative comparisons can be made with other reaches within the same stream and other streams.

A streambank assessment conducted within focused stream areas of the SERE School in June 2013 identified 10 areas with existing erosion issues along Redington Stream (Navy 2013b). These are described in the Streambank Assessment in Appendix E *SERE School Biological Surveys*, and management recommendations for addressing erosion issues are provided in Section 3.1.1.3 *Water Quality Management*.

2.3.8 Natural Communities and Vegetation

The USEPA has divided the continental U.S. into 104 Level III ecoregions based on a general similarity in ecosystems and in the type, quality, and quantity of environmental resources within a specific region. This hierarchical system was designed to support the development and implementation of ecosystem management strategies across federal and state agencies and NGOs that are responsible for different types of resources within the same geographical areas. The SERE School is located in the Upper Montane/Alpine Zone and White Mountains/Blue Mountains Level III ecoregions (Griffith et al. 2009). The Upper Montane/Alpine Zone ecoregion is characterized by glaciated rock peaks, high mountains with steep slopes and ridges, and high gradient headwater streams with boulders, cobbles, and bedrock substrates. Typical vegetation includes spruce-fir forests of red spruce, balsam fir, paper birch (also known as white birch or heartleaf birch) (*Betula papyrifera*), and yellow birch, with mountain ash (*Sorbus americana*), mountain holly (*Ilex montana*), and creeping snowberry (*Gaultheria hispidula*) at lower elevations. Natural communities and species common at higher elevations include subalpine forests, krummholz, and heath/krummholz communities, stunted balsam fir, black spruce, paper birch, Labrador tea (*Ledum* sp.), sheep laurel (*Kalmia angustifolia*), black crowberry (*Empetrum nigrum*), and rhodora (*Rhododendron canadense*). Also observed are alpine areas with low mat-forming shrubs, sedges, rushes, grasses, mosses, and lichens, including diapensia (*Diapensia* sp.), Bigelow's sedge (*Carex bigelowii*), highland rush (*Juncus trifidus*), Lapland rosebay (*Rhododendron lapponicum*), shrubby fivefingers (*Sibbaldiopsis tridentate*), and bog blueberry (*Vaccinium uliginosum*). The White Mountains/Blue Mountains ecoregion is characterized by low to moderately high glaciated mountains, steep slopes, narrow valleys, few to no lakes, and high gradient streams with bedrock-, boulder-, and cobble-filled bottoms. Typical vegetation includes northern hardwood forests of sugar maple, American beech (*Fagus grandifolia*), and yellow birch, as well as hemlock-beech-red oak-white pine and hemlock forests with eastern hemlock (*Tsuga canadensis*), red spruce, red oak (*Quercus rubra*), and red maple at lower elevations. At higher elevations, there is some subalpine balsam fir-birch forest (Griffith et al. 2009).

An inventory of natural community types on the SERE School property conducted in the summer of 1999 revealed that approximately 97% of the land is forested (Navy 2007). The remaining acreage (approximately 370 ac [150 ha]) was mapped as non-forested open area predominantly consisting of edge meadow, swamps, bogs and aquatic ecosystems, alpine zones, and relatively little developed area (Navy 2007). This inventory also proved useful in generally understanding the composition of the understory, which provides many of the edible plants that are a key component of survival training exercises. SERE School personnel have expressed concern over an observed decline of these species in areas adjacent to the static camp and other areas where survival training is conducted (Navy 2007). No formal inventory of the edible plants in these areas has been conducted to date; however, the following is a list of the most common plants that are used as survival foods at the Installation:

- mountainsorrel (*Oxyria* sp.),
- fiddlehead or ostrich fern (*Matteuccia struthiopteris*),
- wild berries including bunchberry dogwood (*Cornus canadensis*),

- trillium (*Trillium* sp.),
- yarrow (*Achillea* spp.),
- pokeweed (*Phytolacca* sp.),
- common dandelion (*Taraxacum* sp.),
- reindeer moss (*Cladina* sp.),
- bluebead (*Clintonia* spp.),
- Indian cucumber (*Medeola virginiana*),
- spruce (*Picea* spp.) (needles and bark),
- birch (*Betula* spp.) (buds and bark), and
- sap from a variety of hardwoods.

Saddleback Range contains different arctic-alpine species, including several rare plants and animals, and some of the finest examples of krummholz habitat found anywhere in New England. Krummholz communities are characterized by a dense, strongly coniferous shrub growth-form, stunted due to the harsh conditions (Gawler and Cutko 2010).

The Maine Natural Areas Program (MNAP) has developed a classification system for Maine's natural community types that includes 98 distinct community types (Gawler and Cutko 2010). The vegetation types described in this section were determined to occur at the SERE School using a combination of desktop research, interviews with local and regional experts, and the general walkover field survey conducted in August 2012, during which more than 80 plants were identified (Navy 2012b and Appendix E *SERE School Biological Surveys*). More than 130 plant species have been observed at the SERE School (Appendix G *SERE School Flora and Fauna*, Table G-1). The natural community types described below are divided into those that occur in uplands and those that occur in wetlands and generally follow the MNAP classification system. MNAP also determines and assigns State rarity rankings to Maine's rare species and ecosystems (Table 2-4); these rankings are presented below alongside the descriptions of the natural community types that occur at the SERE School.

Table 2-4. Maine Natural Areas Program State Rarity Rankings.

Rarity Ranking	Description
S1	Critically imperiled in Maine because of extreme rarity (five [5] or fewer occurrences or very few remaining individuals or acres) or because some aspect of its biology makes it especially vulnerable to extirpation from the State of Maine.
S2	Imperiled in Maine because of rarity (6–20 occurrences or few remaining individuals or acres) or because of other factors making it vulnerable to further decline.
S3	Rare in Maine (20–100 occurrences).
S4	Apparently secure in Maine.
S5	Demonstrably secure in Maine.

Rarity Ranking	Description
SH	Known historically from the state, not verified in the past 20 years.
SX	Apparently extirpated from the state, loss of last known occurrence has been documented.
SU	Under consideration for assigning rarity status; more information needed on threats or distribution.
S#?	Current occurrence data suggests assigned rank, but lack of survey effort along with amount of potential habitat create uncertainty (e.g. S3?).

Source: MDACF 2013a

The ecosystems represented on the SERE School property, as described in *Natural Landscapes of Maine: A Guide to Natural Communities and Ecosystems* (Gawler and Cutko 2010), include:

- Spruce−Northern Hardwoods (S5),
- Montane Spruce–Fir Forest (S5),
- Subalpine Fir Forest (S3),
- Spruce–Fir Krummholz (S4),
- Spruce–Fir Wet Flat (S4),
- Alder Thicket (S5), and
- Sedge–Heath Fen (S4).

Factsheets available from Gawler and Cutko (2010) are provided in Appendix F *Natural Communities and Wildlife Factsheets* for each of the ecosystems represented on the SERE School property.

2.3.8.1 Upland Natural Communities

Spruce–Northern Hardwoods (S5)

This community type is abundant throughout the property, generally at elevations less than 2,000 ft (600 m) above msl. It is characterized by red spruce growing amongst hardwood species. At the SERE School common hardwood species observed in the canopy and sub-canopy include yellow and paper birch, red and sugar maple, and balsam fir. Shrub species include striped maple (*Acer pensylvanicum*) and regeneration of various canopy species. Common herbaceous plants observed include wood sorrel (*Oxalis* sp.), bunchberry dogwood, whorled wood aster (*Oclemena acuminata*), bluebead (*Clintonia borealis*), threeleaf goldthread (*Coptis trifolia*), starflower (*Trientalis borealis*), and wild sarsaparilla (*Aralia nudicaulis*).

Montane Spruce−Fir Forest (S5)

The Montane Spruce–Fir Forest communities are dominated by red spruce with lesser amounts of balsam fir, yellow birch, and American mountain ash. Northern white cedar (*Thuja occidentalis*) was observed in the riparian areas along several perennial streams including Tumbledown Brook. Other frequently observed species within these communities include

catberry, bunchberry, and wild sarsaparilla. A number of wetland plant species were observed in disturbed areas such as along old logging roads where runoff concentrates. Hydrophytic vegetation includes water horehound (*Lycopus americanus*), New England aster (*Symphyotrichum novae-angliae*), bladder sedge (*Carex intumescens*), and various rushes (*Juncus* spp.).

Subalpine Fir Forest (S3)

These communities are similar to Montane Spruce–Fir communities but generally occur at the SERE School at elevations greater than 2,700 ft [820 m] above msl where balsam fir is the dominant canopy species with red spruce present at lesser densities. Observations found paper birch and American mountain ash abundant in canopy openings created by fire and wind, and pin cherry also was present in disturbed areas. Common shrub and herbaceous species observed within these communities include hobblebush (*Viburnum lantanoides*) and withe rod (*V. nudum* var. *cassinoides*).

Spruce–Fir Krummholz (S3)

This coniferous community occurs on the ridge top near the northwest corner of the SERE School. This area is underlain by an abundance of talus, and dominant species include paper birch, balsam fir, and lowbush blueberry (*Vaccinium angustifolium*). Various bryoid species also are present. The highest-elevation portion of this community type appeared to be transitioning into krummholz, a community that is generally restricted to alpine habitats above 2,700 ft (820 m) above msl. In these transitional areas, the fir and birch were shorter in stature and some flagging (no or limited branch growth on windward side of tree) was observed.

2.3.8.2 Wetland Natural Communities

Spruce–Fir Wet Flat (S4)

This community occurs in poorly drained areas with little or no slope. Common canopy species observed within these lush communities include red maple, balsam fir, and paper birch. Understory species observed include gray birch (*Betula populifolia*) and northern wild raisin (*Viburnum cassinoides*), and herbaceous species include bunchberry dogwood, Canada mayflower (*Maianthemum canadense*), lady fern (*Athyrium filix-femina*), cinnamon fern, and hobblebush. A carpet of moss was present throughout.

Alder Thicket (S5)

This community, which was dominated by speckled alder, was observed at the headwaters and at parts along the upper reaches of Orbeton Stream. The herbaceous layer was well-developed in places; common species observed within this stratum included bluejoint, spotted joe pye weed, and meadowsweet.

Sedge–Heath Fen (S4)

This wetland community occurs as a pocket along the northern and western edge of Redington Pond. This open peatland community is dominated by sedges and other graminoids such as cottongrass (*Eriophorum* sp.), as well as dwarf shrubs such as bog cranberry (*Vaccinium*

microcarpus) and sheep laurel. Other herbaceous species include pitcher plant (*Sarracenia purpurea*) and sundew (*Drosera* sp.).

2.3.9 Noxious Weeds and Invasive Plants

Introduced plant species are nonindigenous species that do not naturally occur within the region and have either accidentally or purposefully become established. Although not all introduced species become invasive, many introduced species that become established outside of their native area are not subject to normal predation pressures, and will spread, oftentimes forcing out or replacing native species. Invasive species are those that persist, proliferate, and cause economic or environmental harm (Ecological Society of America 2004).

The Maine Department of Agriculture, Conservation, and Forestry (MDACF) has identified 19 species that are currently considered invasive in Maine. None of these plant species have been documented at the SERE School; however, a survey to specifically identify nuisance and invasive plant species has not been conducted at the Installation. MDACF also lists plant species that are potentially or probably invasive in Maine, as well as those that are highly likely to be invasive but have not been documented in Maine (MDACF 2010). None of the plant species identified in the walkover survey are included in these three categories (Navy 2012b).

The USDA lists 11 species that are state-listed noxious weeds (invasive aquatic plants) in Maine (USDA 2013a) as defined by the Maine Revised Statues Act (Chapter 722, §410-N, 20 October 2003). Only four of these plant species also are listed by MDACF. Of the 11 species that are listed by the USDA, none of these plant species have been identified at the SERE School (Navy 2012b).

Eight of the plants identified during the walkover survey are considered introduced or invasive according to the USDA PLANTS database (Navy 2012b and USDA 2013b). These include shame plant (*Mimosa pudica*), rabbitfoot clover (*Trifolium arvense*), red clover (*T. pratense*), white clover (*T. repens*), brittlestem hempnettle (*Galeopsis tetrahit*), Columbine meadow-rue (*Thalictrum aquilegifolium*), red fescue (*Festuca rubra*), and American red raspberry (*Rubus idaeus*). Although several nonindigenous species were observed along the gravel roadways during the July and August 2012 site visits—likely introduced via the use of erosion control seed mixes—none are considered to be invasive (Navy 2012b).

Although not observed during the walkover survey, purple loosestrife (*Lythrum salicaria*) is another invasive species that is present at the SERE School. A focused invasive species survey of the Installation is needed to determine if additional invasive plant species are present. Appendix G *SERE School Flora and Fauna*, Table G-1 identifies the plant species observed at the SERE School that are considered invasive or introduced.

2.3.10 Rare Communities and Significant Wildlife Habitat

For this INRMP, special concern communities and habitat include rare community types identified by MNAP and significant wildlife habitat defined by MDIFW. MNAP rankings are described in Table 2-4; however, only the top three classifications (S1, S2, and S3) are used to rank natural communities. No exemplary natural communities have been discovered on the

SERE School property, and therefore none of the natural communities described for the SERE School in Section 2.3.8 *Natural Communities and Vegetation* are classified as S1, S2, or S3 communities. However, alpine and subalpine communities do occur at the higher elevations and krummholz forest has been identified along Poplar Ridge (Navy 2007).

MDIFW has identified several types of significant wildlife habitat including high and moderate value waterfowl and wading bird habitat, shorebird feeding and staging areas, significant vernal pools, and deer wintering areas. High and moderate value inland waterfowl and wading bird habitat, and inland waterfowl and wading bird habitat shoreland zoning have been identified at the SERE School (Figure 2-5). High and moderate value inland waterfowl and wading bird habitat includes inland habitat areas, which are described as "inland wetland complexes having a 250-ft (76-m) wide zone surrounding the wetland complex, that through a combination of dominant wetland type, wetland diversity, wetland size, wetland type interspersion, and percent open water meets MDIFW guidelines, or is an inland wetland complex that has documented outstanding use by waterfowl or wading birds," as described in Chapter 335 of the Natural Resources Protection Act (NRPA). Inland waterfowl and wading bird habitat occurs along Redington Stream Road in the center of the main parcel of the SERE School property and in the vicinity of Redington Pond (MDIFW n.d. a).

The shoreland zone comprises all land areas within 250 ft (76 m), horizontal distance, of the:

- normal high-water line of any great pond or river;
- upland edge of a coastal wetland, including all areas affected by tidal action;
- upland edge of defined freshwater wetlands; and
- all land areas within 75 ft (23 m), horizontal distance, of the normal high-water line of certain streams (Maine Department of Environmental Protection [MDEP] n.d.).

Inland waterfowl and wading bird habitat shoreland zoning occurs along Redington Stream Road in the center of the main parcel of the SERE School property and in the vicinity of Redington Pond (MDIFW n.d. a).

Vernal pool habitat has been identified in several areas at SERE; however, a focused survey for the presence of significant vernal pools has not been conducted. Several vernal pools were observed along Redington Stream Road during the August 2012 general walkover field survey (Navy 2012b) and during the amphibian and reptile surveys completed by the Navy in 2013 (Appenix E, Enclosure 6). Due to their proximity to the road, it is possible that the vernal pool features are historic borrow pits created during construction of the narrow gauge railroad that is now Redington Stream Road. Despite the fact that vernal pools of such origin often serve as viable habitat for vernal pool species, they are not regulated as are similar features of "natural" origin in Maine. Regardless, it is likely that many other vernal pools occur within the SERE School property.

2.3.11 Rare, Threatened and Endangered Plants

The TNC conducted a field survey on the SERE School for rare, threatened, and endangered species as well as exemplary natural community types during the summers of 1987 and 1988.

Results of the survey are documented in a report prepared by the Natural Heritage Program of the Maine Chapter of TNC (Navy 2007). The 1988 inventory was focused within suitable habitats at the SERE School as identified from aerial photographs of the Installation and verified via ground reconnaissance. Habitats verified through ground reconnaissance as potential habitat for rare, threatened, and endangered species were then surveyed. At the time of the survey, no federal or state listed threatened and endangered plant species were identified.

The general walkover field survey conducted in August 2012 documented flora at the Installation but did not specifically target any rare, threatened, and endangered plants. Small whorled pogonia (*Isotria medeoloides*) is the only rare plant species identified with the potential to occur at the SERE School (Appendix G *SERE School Flora and Fauna,* Table G-5). Small whorled pogonia is a federally threatened species (59 Federal Register [FR] 50852-50857). This small plant is a member of the orchid family, which has been documented in 17 eastern states in the U.S. and in Ontario, Canada. Populations are typically small (1–20 stems) (USFWS 2008a). In 2007, 18 extant populations and 10 historic, extirpated, or unknown populations were identified in Maine; however, this species has not been documented in Franklin County (USFWS 2013a). In June 2015 Ecology & Environment, Inc., completed a small whorled pogonia habitat model for the SERE MDA Project utilizing the U.S. Fish and Wildlife Service (USFWS). 2001. Small Whorled Pogonia Habitat Model. Results of this modeling effort indicate that the site contains many areas with suitable slopes and vegetation, but none of the study area contains suitable soil conditions. Therefore, it is highly unlikely that small whorled pogonia occurs at the installation. Primary threats to the orchid are habitat loss and degradation, and collection for commercial or personal use (USFWS 2013b). A USFWS factsheet on small whorled pogonia is provided in Appendix F *Natural Communities and Wildlife Factsheets.*

2.3.12 Cultural Resources

Existing conditions of SERE School cultural resources is based on a Phase IA Cultural Resources Survey conducted by Berger in 1996. The survey included an assessment of prehistoric and historic archaeological sensitivity and historic architectural resources (Figure 2-6). A brief discussion of cultural resources associated with the SERE School follows.

2.3.12.1 Archaeological Resources

No previously identified prehistoric archaeological sites have been documented within the SERE School property or the general area. However, when the 1996 Berger survey was performed limited archaeological research had been conducted in the mountains of western Maine. Consequently, there was minimal specific site location information on which to base the prehistoric resources sensitivity modeling. As such, the prehistoric archaeological sensitivity assessment of the SERE School was based on broad generalizations and assumptions concerning prehistoric use of the region and on a Phase IA reconnaissance survey of the property. Three types of landscape features were identified as having the potential to contain prehistoric archaeological resources: level benches positioned on mountain slopes, valley floors adjacent to water bodies and wetlands, and potential portage areas located adjacent to waterways which would have been navigable by canoe during prehistoric periods (Figure 2-6). Generally areas of moderate to high sensitivity occur in the vicinity of key topographic features, such as well-drained, level to gently sloping, slightly elevated terrain near wetlands and streams. Most such

terrain occurs on the northern side of the valley. The sensitivity of such topographic features is judged to be highest when they are situated within approximately 328 ft (100 m) of a stream or wetland (Navy 2007). Although areas of moderate and high sensitivity were identified during the pedestrian reconnaissance, overall the Berger prehistoric sensitivity model determined the likelihood for prehistoric archaeological resources on the valley floor within the SERE School property are low.

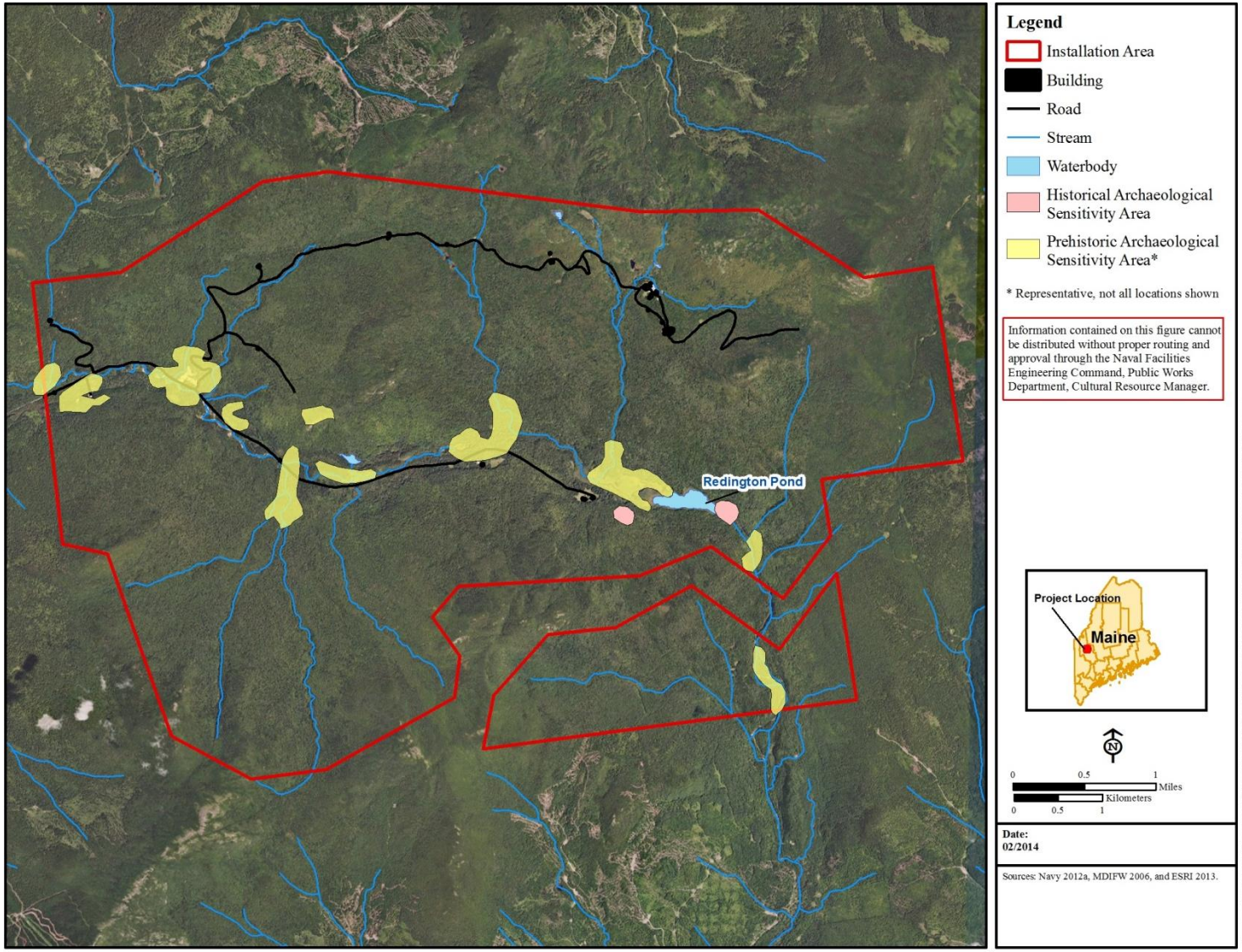

Figure 2-6. Cultural Resources of the SERE School, Redington, Maine.

Two areas of historic archaeological sensitivity were identified during the Phase IA pedestrian reconnaissance: structural foundations and archaeological deposits around Redington Village, and the structural remains of a dam located on the east end of Redington Pond (Figure 2-6). The Redington Village area includes probable subsurface structural remains as well as five standing wood buildings, several dumps with late nineteenth- and early twentieth-century debris, foundations, depressions, and the remains of a small dam which may have supplied drinking water for the village. The second sensitive area is the remains of a larger dam located on the eastern end of Redington Pond, which probably dates to circa 1880–1900. The dam was constructed to flood the low-lying stream banks and create a pond, which was used as a storage area for logs sluiced down from the surrounding slopes. The dam purportedly raised the pond to a level of 21 ft (6 m) (Berger 1996). The dam itself created an excellent recreational trout fishery, which was used by the general public for decades.

Additional consultation with the MHPC, which serves as the State Historic Preservation Office in Maine, would be required to determine if the resources at Redington Village or the dam at Redington Pond are considered significant and eligible for listing in the National Register of Historic Places. Additional historical and archaeological investigations, such as a Phase IB survey, may be required in order to assess the current National Register of Historic Places (NRHP) eligibility status of these resources.

2.3.12.2 Architectural Resources

Prior to the 1996 Berger survey no formal identification or evaluation of historic architectural resources within the SERE School had been previously undertaken. Due to the classified nature of both Cold War and present-day activities at the SERE School, information pertinent to a full evaluation of post-1960 architectural resources within the boundaries was not available for the Berger survey.

Redington Village

Source: I. Trefry

The SERE School does not contain architectural resources of exceptional importance with respect to the Navy's involvement in the Cold War, and thus does not meet National Register criteria governing resources which have achieved significance within the past 50 years (NRHP consideration G). The Berger survey determined that architectural resources associated with the SERE School Resistance Training Laboratory may prove to meet National Register Criteria once they have reached the age of 50 years. The Resistance Training Laboratory underwent substantial alterations in the late twentieth century. A re-evaluation of these resources would be required to determine their current status and eligibility for listing in the NRHP.

Aboveground structures in the Redington Pond Village area were determined by Berger to be ineligible for the NRHP. The integrity of the individual structure's materials and workmanship has degraded due to lack of maintenance. Additionally, the lack of visible reminders of railroad and logging activities which the village centered around has resulted in a loss of integrity and association with historic events.

Most such terrain occurs on the northern side of the valley. The sensitivity of these topographic features is judged to be highest when they are situated within approximately 328 ft (100 m) of a stream or wetland (Navy 2007).

2.3.13 Regional Conservation Lands

The MNAP has designated approximately 84,000 ac (33,994 ha) of ecological reserves on 16 public land units managed by the Division of Parks and Public Lands under MDACF. The purpose of the ecological reserves is to maintain one or more natural community type(s) or native ecosystem type(s) in a natural condition, to contribute to the protection of Maine's biological diversity, to provide a benchmark against which biological and environmental change may be measured, to provide research and long-term environmental monitoring and education opportunities, and to protect sufficient habitat for those species whose habitat needs are unlikely to be met on lands managed for other purposes (MDACF 2010).

Several ecological reserves are located within 40 mi (80 km) of the SERE School. Mount Abraham Ecological Reserve (4,033 ac [1,632 ha]) is located 5 mi (8 km) southeast of the SERE School. Seven rare plants and eight exemplary natural communities have been documented at Mount Abraham Ecological Reserve including Spruce – Fir Krummholz (see Section 2.3.8 *Natural Communities and Vegetation*). No rare, threatened, or endangered animals have been documented within this reserve (MDACF n.d. a).

Bigelow Preserve Ecological Reserve (10,540 ac [4,265 ha]) is located 11 mi (18 km) northeast of the SERE School. Eleven (11) rare plants and eight exemplary natural communities have been documented at Bigelow Preserve Ecological Reserve including Subalpine Fir Forest (see Section 2.3.8 *Natural Communities and Vegetation*). No rare, threatened, or endangered animals have been documented within this reserve (MDACF n.d. b).

Mahoosucs Unit Ecological Reserve (9,993 ac [4,044 ha]) is located 40 mi (64 km) southwest of the SERE School. Three rare plants and five exemplary natural communities have been documented at Mahoosucs Unit Ecological Reserve including Spruce–Northern Hardwoods Forest and Subalpine Fir Forest (see Section 2.3.8 *Natural Communities and Vegetation*). No rare, threatened, or endangered animals have been documented within this reserve (MDACF n.d. c).

Several state parks and reserved land units are located within approximately 50 mi (80 km) of the SERE School. In Maine these include Rangeley Lake State Park (869 ac [352 ha]), Grafton Notch State Park (3,000 ac [1,214 ha]), Bald Mount Blue State Park (8,000 ac [3,238 ha]), Chain of Ponds (1,100 ac [445 ha]), Dead River Public Reserved Land (4,771 ac [1,931 ha]), Mountain Public Reserved Land (1,873 ac [758 ha]), Richardson Public Reserved Land (22,000 ac [8,903 ha]), and Four Ponds Public Reserved Land (6,000 ac [2,428 ha]) (Maine Division of Parks

Public Lands 2009). Also in the vicinity is Umbagog Lake State Park (1,350 ac [546 ha]) in New Hampshire (New Hampshire Division of Parks and Recreation n.d.). These state parks and preserves offer recreational opportunities and provide important habitat for hundreds of wildlife species.

Lastly, several wildlife management areas (WMAs) also are located within 50 mi (80 km) of the SERE School including Stump Ponds WMA (40 ac [16 ha]), Fahi Pond WMA (277 ac [112 ha]), Mercer Bog WMA (317 ac [150 ha]), Chesterville WMA (1,340 ac [542 ha]), and Black Brook Flowage WMA (750 ac [304 ha]). WMAs are owned or leased by MDIFW for the purposes of wildlife management and provide recreational opportunities such as canoeing, fur trapping, fishing, hunting, and wildlife watching (MDIFW 2010a).

2.4 Fish and Wildlife Resources

Through field reconnaissance and literature review it is known that a wide array of wildlife species inhabit the mountains of western Maine throughout all or part of the year. To date 22 mammal, 55 bird, 14 herpetofauna, five fish, and six invertebrate species have been documented at the Installation. Fish and wildlife surveys completed in 2013 and 2014 (HEBS and winter resident survey – see Section 2.4.2 *Birds* and Section 2.4.1 *Mammals*; and a fish survey and habitat assessment – see Section 2.4.4 *Fish*; see Appendix E *SERE School Biological Surveys*), and recently completed (2014) wildlife surveys (winter mammal track counts, bat acoustic monitoring, spring and fall raptor migration surveys, and breeding bird surveys) provided additional baseline fish and wildlife data for the Installation (Appendix G *SERE School Flora and Fauna*). Results and reports for these surveys are included in Appendix E *SERE School Biological Surveys*, and the fauna tables in Appendix G *SERE School Flora and Fauna* have been updated to denote any new fish or wildlife observations.

Bull moose (*Alces alces*)
Source: I. Trefry

Wildlife species associated with the SERE School use a variety of habitat types and age classes of vegetation to meet their needs. In forested habitats, approximately 70% of the species use mature and over mature habitats, whereas 66% use early successional habitats for all or part of their life cycle. Upland openings also are highly valuable habitats and include areas such as cultivated fields, pastures, and orchards. Clear-cuts provide a shrubby-type opening, which is expected to move through successive stages of growth and development over time (Navy 2007).

The SERE School contains scattered beech trees, which provide hard mast (beechnuts) and soft mast (buds) forage for American black bear (*Ursus americanus*), grouse (Family Tetraonidae),

wild turkey (*Meleagris gallopavo*), white-tailed deer (*Odocoileus virginianus*), and other animals. Beech trees capable of producing mast are found in many stands within the property. Impoundments created by beaver exist in numerous locations. The various wetland types associated with the Installation provide habitat for species such as toads and frogs (Order Anura) and salamanders (Order Caudata).

The diversity of fish and wildlife on the SERE School is complementary to the military mission, particularly the survival training, as various species are used as food by trainees.

2.4.1 Mammals

During severe winter conditions that are common for New England white-tailed deer use dense softwood stands (often hemlock) as over-wintering habitat (deer yards) and browse nearby hardwood and softwoods adjacent to or within the concentrated softwood stands. Deer wintering areas identified by MDIFW and the Maine Office of GIS are located approximately 8 mi (13 km) south and 10 mi (16 km) east of the Installation (Maine Department of Administration and Financial Services 2011) (Figure 2-5), including areas north, west, and south of Rangeley Lake and areas within Dallas Plantation. According to MDIFW the deer wintering area located within Dallas Plantation is associated with Redington Stream, and likely extends within the boundaries of the Installation (Trefry 2014) (this data is not available from MDIFW, and is not shown on Figure 2-5). White-tailed deer and moose do occupy, use, and travel through the entire property at various times of the year.

Some mammal species that have been observed during site surveys or through casual observation or sign (e.g., scat, markings) include moose, white-tailed deer, eastern coyote (*Canis latrans*), American black bear, American beaver, porcupine (*Erethizon dorsatum*), deer mouse (*Peromyscus maniculatus*), and red squirrel (*Tamiasciurus hudsonicus*) (Navy 2012b) (Appendix G *SERE School Flora and Fauna*, Table G-2). Moderate levels of existing moose and deer use, such as fecal pellets, browsing pressure, bark scarred trees and scattered game trails, have been observed throughout the property (Navy 2007). An over-winter ecoregional Canada lynx (*Lynx canadensis*) track survey conducted at the SERE School in February and March 2005 identified bobcat (*Lynx rufus*) and fisher (*Martes pennanti*) tracks (Starr and Seyfried 2005). Winter resident surveys conducted on 06, 19 and 20 February 2014 documented winter utilization of the Installation by bobcat, snowshoe hare (*Lepus americanus*), long-tailed weasel (*Mustela frenata*), short-tailed weasel (*M. erminea*), American marten (*Martes americana*), North American river otter (*Lontra canadensis*), meadow vole (*Microtus pennsylvanicus*), and five bird species (see Section 2.4.2 *Birds*). Rare, threatened, endangered, or special status mammal species known or with the potential to occur at the SERE School are listed in Appendix G *SERE School Flora and Fauna*, Table G-5 and discussed in Section 2.4.7 *Rare, Threatened and Endangered Fish and Wildlife Species*.

Mammal surveys recently completed in 2014 include an acoustic monitoring survey of bat species and a mist-netting survey for bat species. These surveys provide baseline information for bat species utilization of the Installation. Review of available acoustic bat survey data has determined the presence of *Myotis* spp. (see Section 2.4.7 *Rare, Threatened and Endangered Fish and Wildlife Species* for additional bat acoustic survey information). Results and reports for

these surveys are included in Appendix E *SERE School Biological Surveys*, and the fauna tables in Appendix G *SERE School Flora and Fauna* have been updated to denote any new mammal observations.

2.4.2 Birds

Bird species observed at the SERE School include many that are considered interior/forest dwelling songbird species. In addition, many of the bird species on the SERE School lands are classified as neotropical migrants (birds that breed in North America then migrate to Central or South America for the non-breeding season), which require a diversity of habitats including spruce-fir, as well as early successional habitat (0–9 years old) for part of their life cycles. Although there is a scarcity of habitats that contain early successional age classes (approximately 15 ac [6 ha]), adjacent landowners provide an abundance of this habitat as a result of the ongoing forestry practices that are common throughout the region. SERE School lands provide a mosaic of habitats including upper elevation spruce-fir forest, a riparian corridor, as well as a unique Spruce–Fir Krummholz zone (stunted dense trees that are exposed to wind and weather at upper elevations) that provides habitat for a variety of bird species (i.e. Bicknell's thrush [*Catharus bicknelli*]). The Spruce–Fir Krummholz zone in particular extends along most of the upper elevations of the SERE School where it abuts National Park Service land on the south side of the property.

Birds that occur at the SERE School are listed in Appendix G *SERE School Flora and Fauna*, Table G-3. Rare, threatened, endangered, or special status bird species known or with the potential to occur at the SERE School are listed in Appendix G, Table G-5 and discussed in Section 2.4.7 *Rare, Threatened and Endangered Fish and Wildlife Species*. Since the Installation does not maintain MBTA take permits as part of the training mission, birds are not used as survival foods during training sessions.

Common garter snake (*Thamnophis sirtalis*)
Source: J. Sweitzer

The HEBS conducted in June 2013 (Figure 2-5) identified 25 unique bird species during two days of surveys, including 14 new bird species observations (Navy 2013c). The survey documented Bicknell's thrush at elevations greater than 2,700 ft (823 m) (more information on Bicknell's thrush is provided in Section 2.4.7 *Rare, Threatened and Endangered Fish and Wildlife Species*). Migrating raptor surveys were completed at the SERE School in the fall of 2013 and spring of 2014), and a breeding bird survey was completed in May 2014. Some of the bird species observed during the spring and fall raptor migration surveys include bald eagle (*Haliaeetus leucocephalus*), broad-winged hawk (*Buteo platypterus*), red-tailed hawk (*B. jamaicensis*), rough-legged hawk (*B. lagopus*), Cooper's hawk (*Accipiter cooperii*), sharp-shinned hawk (*A. striatus*), and turkey vulture (*Cathartes aura*). Any additional and incidental bird sightings also will be documented

during these surveys. In addition, a winter resident survey was completed in February of 2014 documented wildlife that utilize the Installation during the winter months, including birds. Bird species observed during the 2014 winter survey include ruffed grouse (*Bonasa umbellus*), black-capped chickadee (*Poecile atricapillus*), red-breasted nuthatch (*Sitta canadensis*), American robin (*Turdus migratorius*), and common raven (*Corvus corax*). Results and reports for these surveys are included in Appendix E *SERE School Biological Surveys*, and the fauna tables in Appendix G *SERE School Flora and Fauna* have been updated to denote new bird species observations.

2.4.3 Herpetofauna

The DoD Partners in Amphibian and Reptile Conservation (PARC) provides leadership, guidance, and support for the conservation and management of herpetofauna on military lands. DoD PARC is currently updating herpetofauna species lists for the approximately 80 Navy installations that have INRMPs (NAVFAC Mid-Atlantic 2013) including the SERE School. DoD PARC surveys of the SERE School have identified green frog (*Lithobates clamitans*), pickerel frog (*L. palustris*), eastern red-backed salamander (*Plethodon cinereus*), and painted turtle (*Chrysemys picta*) (NAVFAC Mid-Atlantic 2013). Other survey or casual observations include common garter snake (*Thamnophis sirtalis*), northern two-lined salamander (*Eurycea bislineata*), northern dusky salamander (*Desmognathus fuscus*), American toad (*Anaxyrus americanus*), mink frog (*Lithobates septentrionalis*), wood frog (*L. sylvaticus*), and spring peeper (*Pseudacris crucifer*) (Navy 2012b). Herpetofauna known to occur at the SERE School are listed in Appendix E (Enclosure 6) and Appendix G *SERE School Flora and Fauna*, Table G-4. Rare, threatened, endangered, or special status herpetofauna species known or with the potential to occur at the SERE School are listed in Appendix G, Table G-5 and discussed in Section 2.4.7 *Rare, Threatened and Endangered Fish and Wildlife Species*.

2.4.4 Fish

Trout and other coldwater fish species utilize the variety of ponds and streams at the SERE School. Generally, fish reproduction takes place in the second or higher order streams where sufficient flow and spawning gravel are present. For optimum production, coldwater fish require cool, continuous flowing water, unimpeded migration upstream and downstream, clean gravel for spawning and egg incubation, and clear water during the growing season. The quality of first order streams is critical to the quality of downstream habitats. Streams are therefore products of their watersheds and the terrestrial environment associated with the riparian zone.

Slimy sculpin (*Cottus cognatus*)

Source: J. Sweitzer

A fish survey was conducted at the SERE School in June 2013 and included sampling within a representative sample of perennial aquatic systems with the potential to support fish. A variety of sampling techniques, including rod and reel and electrofishing, were used to establish the baseline fish inventory for the Installation. Fish identified in the survey are considered typical of the ponds, streams, and small brooks in the western mountains of Maine. A total of 252 fishes representing five species were collected from all survey locations. All individuals were positively identified to species in the field. No deformities, lesions, or abnormalities were observed in any of the specimens collected.

Brook trout (*Salvelinus fontinalis*)
Source: I. Trefry

Fish samples collected at Redington Stream and the Middle Tributary were dominated by slimy sculpin (*Cottus cognatus*), which represented more than 80% of the species composition at each site. Brook trout (*Salvelinus fontinalis*) were the only species collected at the other three sites (Orbeton Stream, Tumbledown Brook, and the Inlet to Redington Pond). Interestingly, Tumble Down Brook supported a strong fish population consisting exclusively of brook trout. This stream, comprised mostly of cascades and pools, was the highest gradient stream sampled and there was little to no competition from other species (Navy 2013d). Four survey team members surveyed Redington Pond using a rods and reels method for approximately 2 hours and did not capture any fish. This was most likely due to the unfavorable rain conditions at the time of sampling (Navy 2013d). Students commonly catch brook trout from suitable surface waters during survival training.

Based on habitat, geographic location, and water quality characteristics, the aquatic resource habitat and water quality of SERE School streams are considered suboptimal to optimal. The June 2013 survey results were consistent with this classification. Specifically, all streams were dominated by species requiring high water quality such as brook trout and slimy sculpin.

Dogwood leaf beetle (*Calligrapha* sp.)
Source: J. Sweitzer

Fish known to occur at the SERE School are listed in Appendix G *SERE School Flora and Fauna*, Table G-4. Rare, threatened, endangered, or special status fish species known or with the potential to occur at the SERE School are listed in Appendix G, Table G-5 and discussed in Section 2.4.7 *Rare, Threatened and Endangered Fish and Wildlife Species*.

2.4.5 Invertebrates

A focused invertebrate survey has not been conducted at the SERE School. Invertebrates observed during site surveys and visits include mourning cloak (*Nymphalis antiopa*), dogwood leaf beetle (*Calligrapha* sp.), and caddisfly (Family Limnephilidae) (Appendix G *SERE School Flora and Fauna*, Table G-4). Based on the available wetland habitat, water resources, and the diversity of natural communities present at the SERE School, many more invertebrate species are likely to occur. A baseline invertebrate survey of aquatic and terrestrial habitats is needed to develop the invertebrate inventory for the SERE School.

2.4.6 Invasive and Nuisance Wildlife Species

Invasive wildlife are defined as species of native and non-native animals that may move into or are introduced to an area and disturb the habitat of a similar native species or a non-similar species that depends upon the territory or food source claimed by the invasive species. Nuisance wildlife, which may be either native or non-native species, also can cause inconvenience, annoyance, or irritation to the general human population or damage to property. The level of inconvenience or annoyance can range from relatively minor, such as reducing the aesthetic qualities of an area, to causing actual physical or economic damage to buildings, landscaped areas, and other structures. Nuisance wildlife also may act as a vector for human disease.

With some exceptions, species that may become a nuisance at the SERE School usually do not create a major threat to human health or cause extensive damage to buildings or landscaping. The impact these species exert is usually on the aesthetic quality of life. However, control of the nuisance wildlife such as beavers, bats, bears, and moose at the SERE School is an important component of natural resources management. Maine Revised Statute Title 12, Chapter 921 (*Wildlife Causing Damage or Nuisance*) identifies requirements for dealing with specific nuisance wildlife species including bear, beaver, birds, coyote, deer, dogs (*C. lupus familiarius*), muskrat (*Ondatra zibethicus*), and raccoon. The White-nose Syndrome Conservation and Recovery Working Groups, "Acceptable Management Practices for Bat Control Activities in Structures - A Guide for Nuisance Wildlife Control Operators" prepared by the. U.S. Fish and Wildlife Service shall be followed when dealing with bats in structures. A copy of this manual can be found in Appendix L.

At the SERE School moose and beaver are the most common nuisance wildlife species. Moose frequently are observed in the Installation garage that serves as the salt storage area. Moose cows with young are potentially dangerous, as the cow may charge to protect her young or if she feels trapped. Numerous beaver impoundments have been observed in a section of Orbeton Stream west of Redington Pond along Village Road, in one location along Mountain Road, as well as throughout the Installation. The resulting ponds and flooding that may result from beaver dam activities can impact roads and endanger motorists.

2.4.6.1 Zoonosis Prevention

The Maine Department of Health and Human Services Division of Infectious Disease monitors zoonosis, which are diseases communicable from animals to humans under natural conditions. Factors such as environmental changes, human and animal demography, pathogen changes, and

changes in farming practice can lead to the emergence of zoonotic diseases. Social and cultural factors such as food habits and religious beliefs also play a role in the emergence of zoonotic diseases. The primary zoonotic diseases of concern in the state of Maine include rabies, brucellosis, Q fever, hantavirus pulmonary syndrome, leptospirosis, psittacosis, trichinosis, and tularemia (Maine Division of Infectious Disease 2013a).

Rabies and Lyme disease are the primary zoonotic diseases of concern at the SERE School. Rabies is a disease caused by a virus that affects the brain and spinal cord and can result in death if left untreated. Rabies in animals is common in most parts of the U.S. including Maine. It is spread when an infected animal bites or scratches a person or animal, or if a rabid animal's saliva or neural tissue comes in contact with a person or animal's mouth, nose or eyes, or enters a cut in the skin. The most commonly infected animals in Maine are skunks (Family Mephitidae), raccoons (*Procyon lotor*), bats, and foxes. Healthcare providers are required to report human and animal rabies infestations to the Maine Center for Disease Control and Prevention immediately by telephone upon recognition or strong suspicion of the disease. Education about avoiding contact with wild animals and pet vaccination are two important components of rabies prevention in addition to a human pre-exposure vaccination, which is available to persons in high-risk groups (Maine Division of Infectious Disease 2013b).

Details on the zoonotic diseases of concern in Maine can be obtained from the Maine Department of Health and Human Services website: *http://www.maine.gov/dhhs/mecdc/infectious-disease/epi/zoonotic/*

Lyme disease is a tick-borne illness that can result in various dermatologic, rheumatologic, neurologic, and cardiac symptoms. Lyme disease is caused by *Borrelia burgorferi*, which is carried by infected deer ticks. The Maine Center for Disease Control and Prevention investigates all reports of positive laboratory tests or clinical diagnoses of erythema migrans, a skin lesion that occurs as the first clinical sign of the disease. The incidence rate of Lyme disease in Franklin County was 29.3 reported cases per 100,000 people from 2006 to 2011 (Maine Division of Infectious Disease 2013c). Limiting exposure to ticks is the best prevention method for avoiding tick-born disease infection. Persons who are exposed to tick-infested habitats should promptly conduct careful inspection and removal of crawling or attached ticks as it may take 24–48 hours of attachment before microorganisms are transmitted from the tick to the host (Maine Division of Infectious Disease 2013c).

2.4.7 Rare, Threatened and Endangered Fish and Wildlife Species

One federally listed species, the northern long-eared bat (*Myotis septentrionalis*), is known to occur at the Installation (Table 2-5; see mammal discussion that follows). Bicknell's thrush also has been observed at the SERE School, and this species is currently under federal review for listing. The black-crowned night heron (*Nycticorax nycticorax*) is the only state listed species that is known to occur at the Installation.

In addition to the wildlife observations included in Table 2-5, the Installation contains habitat that could support 18 other state and federally threatened or endangered species, based on known or potential occurrences of these species within the region, as described in the following sections and as listed in Table 2-5. In addition to the federal and state listed species identified in Table 2-5, Appendix G *SERE School Flora and Fauna*, Table G-5 also includes a complete list of

USFWS BCC species and Maine special concern species that are known or have the potential to occur at the Installation.

Table 2-5. Federal and State Threatened and Endangered Fish and Wildlife Species Known to or Having the Potential to Occur at the SERE School.

Common Name	Scientific Name	Status[1]	Occurrence[2]
Mammals			
Eastern cougar	*Felis concolor couguar*	Extinct	Extinct
Silver haired bat	*Lasionycteris noctivagans*	SC	O
Eastern red bat	*Lasiurus borealis*	SC	P
Hoary bat	*Lasiurus cinereus*	SC	P
Canada lynx	*Lynx canadensis*	FT, SC	P
Little brown bat	*Myotis lucifugus*	SC	O
Northern long-eared bat	*Myotis septentrionalis*	FT, SC	O
Tri-colored bat	*Perimyotis subflavus*	SC	O
New England cottontail	*Sylvilagus transitionalis*	SE	P
Northern bog lemming	*Synaptomys borealis*	ST	P
Birds			
Grasshopper sparrow	*Ammodramus savannarum*	SE	P
American pipit	*Anthus rubescens*	SE	P (migration)
Golden eagle	*Aquila chrysaetos*	SE	P
Short-eared owl	*Asio flammeus*	ST	P (migration)
Upland sandpiper	*Bartramia longicauda*	ST, BCC	P (migration)
Black tern	*Chlidonias niger*	SE	P
Bicknell's thrush	*Catharus bicknelli*	UR, BCC, SC	O
Sedge wren	*Cistothorus platensis*	SE	P
Yellow-billed cuckoo	*Coccyzus americanus*	PT, SC	P
Peregrine falcon	*Falco peregrinus*	SE (breeding), BCC	P
Harlequin duck	*Histrionicus histrionicus*	ST	P
Least bittern	*Ixobrychus exilis*	SE, BCC	P
Black-crowned night heron	*Nycticorax nycticorax*	ST	O
Least tern	*Sterna antillarum*	SE	P
Herpetofauna			
Wood turtle	*Glyptemys insculpta*	UR, SC	P
Northern spring salamander	*Gyrinophilus porphyriticus porphyriticus*	SC	P
Fish			
Atlantic salmon	*Salmo salar*	FE	P
Invertebrates			
Roaring Brook mayfly	*Epeorus frisoni*	SE	P
Ringed boghaunter	*Williamsonia lintneri*	ST	P
Early hairstreak	*Erora laeta*	SC	P
Quebec emerald	*Somatochlora brevicincta*	SC	P

[1] Status:
BCC: United States Fish and Wildlife Service Bird of Conservation Concern
FT: Federally Threatened
PE: Proposed Federal Endangered
PT: Proposed Federal Threatened
SC: Maine Species of Special Concern
SE: Maine Endangered
ST: Maine Threatened
UR: under federal review for listing
[2] Occurrence: O – occurs; P = potential to occur
Sources: MDIFW 2011a, Navy 2013a, USFWS 2011a, and USFWS 2013c

MDIFW's Endangered Species Program identifies 147 species as species of special concern (MDIFW 2011a) and Maine's Comprehensive Wildlife Conservation Strategy (MDIFW 2005) includes 213 species as Species of Greatest Conservation Need; however there is some overlap between these two lists. Both of these lists include species such as marine mammals and migratory birds for which potential habitat does not exist at the SERE School.

Maine's State and Federal Endangered and Threatened Species List is available for download at: *http://www.maine.gov/ifw/wildlife/endangered/listed_species_me.htm*.

Maine's Endangered Species Program maintains a list of Species of Special Concern, last updated in March 2011 and available for download at: *http://www.maine.gov/ifw/wildlife/endangered/specialconcern.htm*.

Maine's Comprehensive Wildlife Conservation Strategy (2005) includes a list of Species of Greatest Conservation Need, available for download at: *http://www.maine.gov/ifw/wildlife/conservation/action_plan.html#species*

Mammals

One federally listed mammal species, the northern long-eared bat, has been identified at the Installation and habitat is present that could support the federaly threatened Canada lynxUSFWS listed the Canada lynx as a federally threatened species in 2000 (65 FR 16053-16086), and this species also is a Maine species of special concern. An elusive cat, Canada lynx is easily recognizable by its long legs, large well-furred paws, long tufts on the ears, and a short black-tipped tail. The Canada lynx's range in North America is closely associated with the distribution of North American boreal forest with coniferous and mixed coniferous/hardwood forests, especially those areas that receive deep snow and have high-density populations of snowshoe hares (*Lepus americanus*), the principal prey of Canada lynx (USFWS 2013d). The USFWS designated Critical Habitat for Canada lynx in 2006; however this designation did not include any areas in Maine (50 CFR Part 17, 9 November 2006). In 2009, the USFWS issued revised Critical Habitat for Canada lynx to include portions of Aroostook, Franklin, Penobscot, Piscataquis, and Somerset counties, Maine (74 FR 8616-8702). The SERE School is not located within designated Critical Habitat for this species, but Critical Habitat for Canada lynx is located approximately 35 mi (56 km) north of the Installation. On 26 September 2013, the USFWS

issued a proposed rule to revise designated Critical Habitat within the contiguous U.S. Distinct Population Segment (DPS) of the Canada lynx (78 FR 187). This new Critical Habitat revision was undertaken to address two court orders resulting from litigation over the 2009 Critical Habitat revision. To ensure that all Canada lynx populations located within the contiguous U.S. are provided protection under the ESA, the USFWS also has proposed to revise the definition of the Canada lynx DPS as part of the proposed rule. This proposed ruling would designate only Critical Habitat that was occupied at the time of the species' listing in 2000; therefore, only the state of Maine is included in the proposed revision. An informational meeting was held on Monday, 04 November 2013, in Millinocket, Maine, and the proposed rule opened a 60-day public comment period, which closed on 26 December 2013.

United States Fish and Wildlife Service's proposed rule to revise designated Critical Habitat for Canada lynx is available for download at: *http://www.gpo.gov/fdsys/pkg/FR-2013-09-26/pdf/2013-23189.pdf*

The MDIFW conducted an over-winter ecoregional Canada lynx track survey at the SERE School in February and March 2005 (Starr and Seyfried 2005). No tracks or sign for Canada lynx were observed. The winter resident surveys completed in February 2014 and February 2015 documented observations and signs of winter mammal use of the Installation, and although isolated areas with high levels of snowshoe hare activity were observed, the survey did not document observations or sign of Canada lynx. Although there is no documented evidence of Canada lynx on the Installation, there have been records of this cat species in neighboring townships.

The northern long-eared bat (also known as northern myotis and eastern long-eared bat) (78 FR 191) was listed as "threatened" with a 4(d) rule in April 2015 and has been confirmed as present at the Installation. Confirmation is based on a review of bat acoustic data collected in 2013 and 2014. The *Myotis* spp. data collected identified presence of northern long-eared bat. Bat species identified during the bat acoustic surveys are included in Appendix G *SERE School Flora and Fauna*, and copies of the finalized bat acoustic survey reports are included in Appendix E *SERE School Biological Surveys*. Mist net surveys conducted in July 2015 did not result in the capture of northern long-eared bats. A total of 9, net nights were completed in areas where bat presence was documented during the 2013 and 2014 acoustic surveys. One big brown bat (*Eptesicus fuscus*) was caught over the course of the survey. A report documenting survey efforts and results is forthcoming.

The forested and riparian habitats of the Installation provide foraging and roosting habitat for the eastern small-footed bat (*Myotis leibii*), northern long-eared bat, little brown bat (*Myotis lucifugus*), hoary bat (*Lasiurus cinereus*), silver haired bat (*Lasionycteris noctivagans*), eastern red bat (*Lasiurus borealis*), big brown bat (*Eptesicus fuscus*), and tri-colored bat (*Perimyotis subflavus*) (formerly known as eastern pipistrelle). The Installation is within the documented range of the eastern small-footed and northern long-eared bats (76 FR 38095-38106). Although the USFWS has not initiated formal reviews for listing for all of these bat species, there is a high potential for these species to become listed during the plan period for this INRMP due to regional impacts from white nose syndrome and other factors. Several bat species that have the

potential to occur at the Installation also are considered species of special concern in Maine (Appendix G *SERE School Flora and Fauna*, Table G-5). Bat acoustic data collected in 2013 indicates that northern long-eared, little brown, tri-colored, and silver haired bats are present at the Installation. Based on bat acoustic data collected, other bat species with the potential to occur include hoary bat, eastern red bat, and big brown bat.

In May 2011 white nose syndrome was identified in bat populations located at two sites in Oxford County approximately 45 mi (72 km) southwest of the SERE School (MDIFW 2011b). White nose syndrome is a white fungus (*Geomyces destructans*) that can infect bat populations and may completely or significantly reduce bat populations residing in caves during their hibernation period. Some of the bat species described in this document hibernate in mines or caves and are therefore susceptible to white nose syndrome (MDIFW n.d. c). Due to concerns about high susceptibility to white nose syndrome, the USFWS is proactively collecting information on little brown bat, big brown bat, and tri-colored bat to determine if, in addition to existing threats, the disease may be increasing the extinction risk of certain bat species (USFWS 2011b).

More information on the spread of white nose syndrome in Maine can be found at: *http://www.maine.gov/ifw/wildlife/disease/white_nose_syndrome.htm*.

More information on the national spread of white nose syndrome can be found at: *http://www.nwhc.usgs.gov/disease_information/white-nose_syndrome/index.jsp.*

More information on DoD actions related to white nose syndrome can be found at: *http://www.denix.osd.mil/nr/upload/FACTSHEET_DWNS-and-DoD-Readiness-_2_.pdf*.

The USFWS initiated a 90-day review on 29 July 2011 to determine if federal listing of eastern small-footed bat is warranted. On 02 October 2013 the USFWS released their 12-month finding on a petition to list eastern small-footed bat and to designate critical habitat for this species (78 FR 191). This finding determined that listing the eastern small-footed bat under the ESA was not warranted at this time. Summer roosts of the eastern small-footed bat typically are within talus (a slope of accumulated rock debris) areas associated with rocky ridge-tops, but they also are known to roost on buildings and bridges and behind loose bark on trees. Overwintering hibernacula of eastern small-footed bats includes caves and abandoned mines. Eastern small-footed bats are nocturnal foragers, foraging primarily over streams, ponds, or other waterbodies that have high concentrations of nocturnal insects. They are considered generalist feeders, feeding primarily on soft-bodied prey that they capture during flight or that they glean from surfaces (USFWS 2013e).

The USFWS initiated a 90-day review on 29 July 2011 to determine if federal listing of northern long-eared bat was warranted. On 02 October 2013 the USFWS released their 12-month finding on a petition to list northern long-eared bat and to designate critical habitat for this species (78 FR 191). This finding determined that listing the northern long-eared bat under the ESA was warranted, and the USFWS is proposing to list this species as endangered throughout its range. The finding indicated that designation of critical habitat could not be determined. On 06 January 2014 the USFWS published their Interim Conference and Planning Guidance that addresses immediate information needs for Section 7 consultations and conservation planning for this species, should it be officially listed as endangered (USFWS 2014). The USFWS comment

period for the proposed listing of northern long-eared bat has been extended twice since the October 2013 USFWS 12-month finding was released and the most recent comment period ended on 18 December 2014. Comments received by the USFWS been considered by USFWS before their ruling to list this species is established. A listing determination of "Threatened" for the northern long-eared bat was completed in April 2015.

Preferred summer roosts of the northern long-eared bat are generally associated with old-growth forests composed of trees 100 years old or older, and this species is dependent on intact interior forest habitats that have a low edge-to-interior ratio (76 FR 38095-38106). Relevant late-successional forest features include a high percentage of old trees, uneven forest structure, single and multiple tree-fall gaps, standing snags, and woody debris. This species appears to favor small cracks or crevices in cave ceilings for hibernation. Northern long-eared bats are opportunistic insectivores, obtaining prey both in flight and by gleaning from surfaces. Prey includes small insects, such as moths, flies, leafhoppers, and beetles. Forested hillsides and ridges are their preferred foraging habitat, with the presence of mature forest stands thought to play an important role in their foraging behavior. Foraging occurs at dusk over small ponds and forest clearings under the forest canopy, or along streams (USFWS 2011c).

The USFWS has not initiated a formal review for the potential listing of little brown bat. Little brown bats also are opportunistic in their selection of roost sites, and are known to quickly exploit new roost sites once identified. Winter hibernacula are typically within caves or mines located 180–620 mi (290–998 km) from summer roosts. Little brown bats forage in flight on insects, often feeding over open water or along the margin of waterbodies and forest habitat. Juveniles tend to forage in clearings or open areas, whereas adults are known to regularly forage in more cluttered environments as well as open areas. Little brown bat reproductive females form maternity colonies in barns, attics, tree cavities, and other places that remain dark throughout the day (Kunz and Reichard 2011). Females tend to have high roost fidelity, returning to their natal roosts each year. Acoustic monitoring conducted in 2013 identified presence of *Myotis* spp. at the Installation, including the confirmed presence of little brown bat.

The USFWS has not initiated a formal review for the potential listing of hoary bat, silver haired bat, eastern red bat, big brown bat, and tri-colored bat; however these species are listed as species of special concern under MDIFW's Endangered Species Program (MDIFW 2011a). The hoary bat prefers deciduous and coniferous forests and woodlands, including areas altered by humans. Roost sites are usually in tree foliage 10–16 ft (3–5 m) above ground with dense foliage above and open flying room below, often at the edge of a clearing and commonly in hedgerow trees. Hoary bats are rarely found in caves. The hoary bat range includes most of North America, from Canada south through Mexico to Guatemala (NatureServe 2012).

Potential habitat for the silver haired bat includes primarily forested areas adjacent to lakes, ponds, or streams, including areas that have been altered by humans. Roost and nursery sites are in tree foliage, cavities, or under loose bark, and occasionally in buildings. Similar to the hoary bat, the silver haired bat is rarely found in caves. This species' range extends from southeastern Alaska and much of western Canada south of the Northwest Territories, south to central California, northern Mexico, and east through Georgia (Nature Serve 2012b).

Eastern red bat is found in forested areas, wooded hedgerows, and areas with large shade trees. Roosts are located in tree foliage 5–20 ft (2–6 m) above ground. The species' range includes the central and eastern U.S. and adjacent southern Canada and northeastern Mexico (NatureServe 2012).

Preferred habitat for the big brown bat includes various wooded and semi-open habitats, although the species is much more dominant in regions dominated by deciduous forest than in coniferous forest areas. Roosts are found in buildings, hollow trees, rock crevices, tunnels, and cliff swallow nests. Species range extends from southern Canada south to northern Colombia, northwestern Venezuela, and northern Brazil (Nature Serve 2012d).

Tri-colored bats prefer partly open country with large trees and woodland edges and are rarely found in deep woods or open fields. Roosts occur primarily in tree foliage and occasionally in buildings. Hibernation sites are usually in caves or mines with high humidity. Species range extends from Nova Scotia, southern Quebec, Michigan, and Minnesota south to Honduras, Texas, and the Gulf Coast (NatureServe 2012).

Habitat that could potentially support yellow nosed vole (*Microtus chrotorrhinus*) also occurs at the SERE School. Previous INRMPs provided for management of yellow nosed vole; however, this species is no longer identified as a state species of special concern. It inhabits exposed, moss-covered bedrock ledges with blocky talus littering the immediate down-slope area, which is often wet or damp from seeps and groundwater. Sphagnum moss (*Sphagnum platyphyllum*) is present to varying degrees and forest cover varies from 50% to 90% depending on the cover type. This habitat is relatively common at the SERE School, and this vole species is likely to occur.

Factsheets for Canada lynx and eastern small-footed, northern long-eared, little brown, hoary, silver haired, eastern red, big brown, and tri-colored bats are provided in Appendix F *Natural Communities and Wildlife Factsheets*.

Birds

According to the USFWS Birds of Conservation Concern (BCC) (USFWS 2008b), the SERE School is located in the U.S. portion of Bird Conservation Region (BCR) 14, Atlantic Northern Forests (see Section 3.2.3.4 [*Migratory Bird Management*] for more information on the USFWS BCC designations). Of the 91 bird species that have been identified on the Installation, seven species (Canada warbler [*Cardellina canadensis*], Bicknell's thrush, olive-sided flycatcher [*Contopus cooperi*], rusty blackbird, peregrine falcon [*Falco peregrinus*], bald eagle (breeding population), and bay-breasted warbler [*Setophaga castanea*]) are listed as BCC species for BCR 14 (Appendix G).

No federally listed bird species are known to occur at the SERE School; however, Bicknell's thrush, identified in the 2013 HEBS, is currently under review to determine if federal ESA listing is warranted (77 FR 48934–48947). In addition to their BCC status as noted above, Bicknell's thrush also is a species of special concern in Maine (MDIFW 2011a). This medium-sized thrush has a plain gray face with light streaks but no eye-ring. The tail is chestnut-colored, contrasting with wings and back, and the upper parts of the bird are brownish gray. Bicknell's thrush is only

recently considered a separate species from the gray-cheeked thrush (*Catharus minimus*) and has one of the most restricted breeding and wintering ranges of any North American bird (Cornell Lab of Ornithology n.d. a). Bicknell's thrush is adapted to naturally disturbed habitats, preferring to select patches of regenerating forest caused by "fir waves," windthrow, ice and snow damage, fire, and insect outbreaks, as well as chronically disturbed, stunted altitudinal and coastal conifer forest. Bicknell's thrush has recently been discovered in areas disturbed by timber harvesting, ski trail and road construction, and other human activities. Due to the remoteness of their breeding habitats and a lack of survey data, it is difficult to assess trends in their population. Evidence of local declines and loss of "traditional" breeding habitats may indicate either a shift in habitat use or increasing populations, but more likely reflects the species' opportunistic use of disturbed habitats. Extensive loss and degradation of primary forest habitats that Bicknell's thrush prefers in winter may pose the greatest threat to the species' long-term survival. Based on survey results, the Spruce–Fir Krummholz habitat of the Installation supports Bicknell's thrush, and this species is most likely to be found at elevations of around 2,700 ft (823 m) or above. A factsheet for Bicknell's thrush is provided in Appendix F *Natural Communities and Wildlife Factsheets*.

Habitat is present at the SERE School that could potentially support bald eagle, a Maine species of special concern and USFWS BCC species (breeding population only), as well as golden eagle, a state endangered species. The bald eagle was removed from the federal list of threatened and endangered wildlife on 07 July 2007 (72 FR 37346-37372), and at that time the USFWS established National Bald Eagle Management Guidelines (72 FR 31156-31157) that include protective measures outlined in the Bald and Golden Eagle Protection Act (BGEPA). Although no nests or observations of eagle activity were found during the 1988 TNC survey, potential habitat occurs on the SERE School property along the cliffs. Bald and golden eagles are protected by the BGEPA (16 USC §668–668c), the MBTA, and the Lacey Act (16 USC §3371-3378). These laws prohibit the possession, use, and sale of eagle feathers and parts as well as several other activities that could impact this species. The BGEPA also prohibits the taking, possession, and transportation of eagles and their parts, nests, and eggs for scientific, educational, and depredation control purposes. Under the Lacey Act it is unlawful to import, export, sell, acquire, or purchase fish, wildlife, or plants that are taken, possessed, transported, or sold in violation of federal or state laws.

The golden eagle is considered one of the rarest breeding birds extant in the northeastern U.S. Golden eagles have historically been found throughout the northern hemisphere with a small breeding population in Maine, Labrador, and Quebec. Golden eagles often nest on cliffs in mountains but tree-nesting prevails in forested regions. Sightings in Maine have typically been associated with mountainous areas in the western and northwestern portions of the state, with both cliff- and tree-nesting documented (MDIFW 2010b). Factsheets for bald and golden eagles are provided in Appendix F *Natural Communities and Wildlife Factsheets*.

Two state listed bird species, black-crowned night heron and peregrine falcon, have been identified at the SERE School. During the stream survey conducted in June 2013 a black-crowned night heron was observed

Black-crowned night heron (*Nycticorax nycticorax*)
Source: J. Sweitzer

within an alder thicket and wetland habitat located along Redington Stream Road. Black-crowned night heron is a Maine threatened species. A factsheet for this species is included in Appendix F *Natural Communities and Wildlife Factsheets*. A peregrine falcon was observed during raptor migration surveys conducted in the spring of 2014 (Appendix E).

In addition to Bicknell's thrush, 12 other bird species that are of special concern in Maine have been identified at the Installation. Two Maine species of special concern that were observed during the HEBS include white-throated sparrow (*Zonotrichia albicollis*), which had previously been observed at the Installation, and black-and-white warbler (*Mniotilta varia*) a new species identified for the Installation. Factsheets for these species are provided in Appendix F *Natural Communities and Wildlife Factsheets*. Additional Maine species of special concern observed during the walkover survey include least flycatcher (*Empidonax minimus*), American redstart (*Setophaga ruticilla*), and tree swallow (*Tachycineta bicolor*). Other bird species of concern observed during raptor migration, bat acoustic, breeding bird surveys conducted at the Installation in 2013 and 2014 include Canada warbler, veery (*Catharus fuscescens*), olive-sided flycatcher, chestnut-sided warbler (*Dendroica pensylvanica*), yellow warbler (*D. petechia*), rusty blackbird, and bald eagle.

The Spruce–Fir Wet Flat habitat of the Installation provides habitat for rusty blackbird, a USFWS BCC species and Maine species of special concern. Two observations of the species occurred in June and August of 2012. A presence-absence survey undertaken in June documented a breeding pair of rusty blackbirds with fledglings (Navy 2012c). The August general walkover survey also documented the presence of the species (Navy 2012b and Appendix E *SERE School Biological Surveys*). The medium-sized blackbird has a slightly decurved slender bill and a medium-length tail. Rusty blackbirds prefer wet habitats, including flooded woods, swamps, marshes, and the edges of ponds, which provide the necessary foraging areas that the species requires in winter and during migration. During the breeding season, rusty blackbirds can be found in bogs, beaver ponds, and wet woods in boreal forests. The rusty blackbird breeds across northern North America, from Alaska to eastern Canada, farther north than other blackbird species. It winters in flocks in the southeastern and midwestern U.S. During the breeding season, the male is black with a slight green-blue sheen, whereas the female is gray. During the non-breeding season, both the male and female's upper body feathers are lined in rust and both have pale eyebrows and yellow eyes. The bills, legs, and feet are black (Cornell Lab of Ornithology n.d. b). A factsheet for rusty blackbird is provided in Appendix F *Natural Communities and Wildlife Factsheets*.

Herpetofauna

No federal or state threatened or endangered herpetofauna are known or have the potential to occur at the SERE School. However, four species of special concern under MDIFW's Endangered Species Program (MDIFW 2011a) have the potential to occur, including blue-spotted salamander (*Ambystoma laterale*) (diploid populations only), northern spring salamander (*Gyrinophilus porphyriticus porphyriticus*), northern leopard frog (*Lithobates pipiens*), and wood turtle (*Glyptemys insculpta*) (Appendix G *SERE School Flora and Fauna*, Table G-5).

Fish

Atlantic salmon is an anadromous fish with a relatively complex life history; it typically spends 2–3 years in rivers and other freshwater habitats (for spawning and juvenile rearing), then migrates to the ocean where it also spends 2–3 years extensively feeding, and then returns to its natal river to spawn and restart the cycle. Suitable spawning habitat consists of gravel or rubble in areas of moving water. Atlantic salmon were once native to almost every river north of the Hudson River; remnant wild populations are presently known in only 11 rivers and the 2006 status review (71 FR 55431) for the species reported an estimated extinction risk of 19% to 75% within the next 100 years for the Gulf of Maine DPS (NOAA National Marine Fisheries Service [NMFS] 2006). A factsheet for Atlantic salmon is provided in Appendix F *Natural Communities and Wildlife Factsheets*.

The Gulf of Maine DPS of Atlantic salmon was listed as endangered on 17 November 2000 (65 FR 69459-69483). The DPS includes all naturally reproducing remnant populations of Atlantic salmon from the Kennebec River downstream of the former Edwards Dam site, northward to the mouth of the St. Croix River. DPS salmon taken for hatchery rearing for broodstock purposes and any captive progeny from these salmon also are included as part of the DPS. These hatchery-held fish, however, do not count toward a delisting or reclassification goal as this goal refers to the status of naturally-spawned salmon in the wild.

At the time of listing, there were at least eight rivers in the geographic range of the DPS known to still support wild Atlantic salmon populations (Dennys, East Machias, Machias, Pleasant, Narraguagus, Ducktrap and Sheepscot rivers, and Cove Brook). In addition to these eight rivers, there are at least 14 small coastal rivers within the historic range of the DPS from which wild salmon populations have been extirpated.

The Gulf of Maine DPS has declined to critically low levels. Adult returns, juvenile abundance estimates, and survival have continued to decline since the listing. In 2004, total adult returns to the eight rivers still supporting wild Atlantic salmon populations within the DPS were estimated to range from 60 to 113 individuals. No adults were documented in three of the eight rivers. Declining smolt production also has been documented in recent years, despite fry stocking. For example, from 1996 through 1999, annual smolt production in the Narraguagus River was estimated to average about 3,000 fish. Smolt production declined significantly in 2000 and for the past three years has averaged only about 1,500 fish per year. Overwinter survival in the Narraguagus River since 1997 has averaged about 12%, approximately half of the survival rate of previous years and significantly less than the 30% previously accepted for the region (NOAA NMFS and USFWS 2005).

When the USFWS initiated a court-ordered effort to designate critical habitat for all federally listed species, the DoD became concerned that the designation of critical habitat on military lands would add an excessive amount of burden (through administrative compliance and consultation requirements) on military installations, with limited benefit afforded to listed species (Benton et al. 2008). In defense, the DoD argued that it was currently providing extensive protection to listed species through the formal consultation process with the USFWS and via conservation measures specified in installation INRMPs. To address this, the Defense Authorization Act for fiscal year 2004 (Public Law 107-314, 02 December 2002) granted the

USFWS specific authority to exempt DoD lands from the designation of critical habitat provided that a comprehensive and approved INRMP was in effect; the INRMP specifically addressed the conservation of species under consideration; and the INRMP was implemented. Although Critical Habitat for the Atlantic salmon Gulf of Maine DPS (Figure 2-7) was designated in 2009 (74 FR 29300-29341), this INRMP provides for the protection of Atlantic salmon and therefore exempts the Installation from Critical Habitat designation and related requirements.

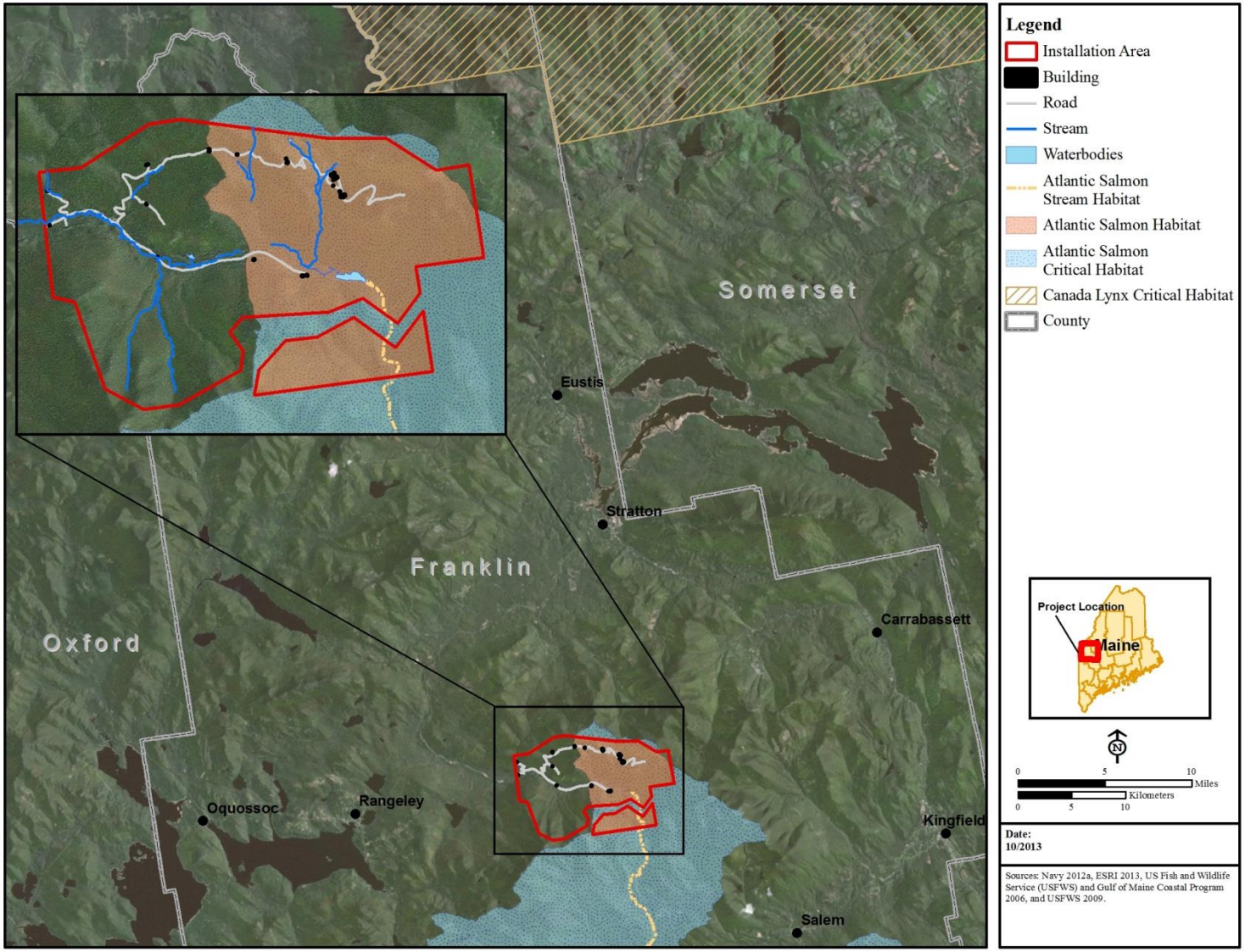

Figure 2-7. Atlantic Salmon Habitat at and in the Vicinity of the SERE School Region, Redington, Maine.

Atlantic salmon have not been documented at the SERE School; however, there is currently an ongoing effort to restore the Atlantic salmon population in Sandy River, located approximately 5 mi (9 km) south of the Installation, through an annual egg planting effort which began in 2009 (Fleming 2012). A baseline fish survey and habitat assessment of the SERE School conducted in 2013 did not identify the presence of Atlantic salmon at the SERE School, and there is a low potential for this species to occur due to migration barriers and the documented known range of wild populations.

Shortnose sturgeon (*Acipenser brevirostrum*) is a federal endangered species that has been documented in southern Maine rivers and estuaries. It is highly unlikely that this species would be encountered at the SERE School due to migration obstructions and population decline (NOAA Northeast Fisheries Science Center 2013).

The Gulf of Maine DPS of Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) was federally listed as threatened in February 2012 (77 FR 5914-5982), and this species has been documented in the Kennebec River watershed (Navy 2013a). Although the SERE School is located in the Kennebec River watershed, there is little potential for Atlantic sturgeon to occur at the Installation due limited suitable habitat and historical population declines. NOAA estimates that fewer than 300 individuals are spawning in Maine each year (NOAA Northeast Fisheries Science Center 2013).

Both blueback herring (*Alosa aestivalis*) and alewife (*A. pseudoharengus*) are candidate species for federal listing, and are often collectively referred to and managed as a single species, the river herring. Both species are anadromous and are able to migrate long distances within freshwater environments. It is very unlikely that blueback herring or alewife would be encountered on the SERE School due to the lack of deep, swift moving waters necessary for spawning (USGS 2012).

American eel (*Anguilla rostrata*) is a species of special concern in Maine due to population decline and habitat loss and restrictions. This species is encountered in a wide range of freshwater and marine habitats and was encountered during the spring 2015 electrofishing surveys in Orbeton stream just below the outlet of Redington Pond..

Invertebrates

A focused survey for rare, threatened, and endangered invertebrates has not been conducted at the SERE School. Rare invertebrate species that have the potential to occur include Roaring Brook mayfly (*Epeorus frisoni*), a globally rare and Maine endangered species; the state threatened ringed boghaunter (*Williamsonia lintneri*); early hairstreak (*Erora laeta*), a butterfly species that is a state species of special concern, and Quebec emerald (*Somatochlora brevicincta*), a dragonfly species that is a state species of special concern.

Roaring Brook mayfly historically was only known to occur at Roaring Brook in Baxter State Park, Maine (Swartz et al. 2004), first discovered on Mount Katahdin in 1939 (MDIFW n.d. b). Until recently the only known specimen was of a single male imago (adult) collected from the Roaring Brooks area by T. H. Frison in 1939 (Burian et al. 2004). MDIFW surveys of streams within central and western Maine since 2003 have identified 14 sites where Roaring Brook

mayflies occur (MDIFW n.d. b). Life history information collected thus far for this rare species (in Maine, New Hampshire, and Vermont) indicates this species is restricted to cold, undisturbed, high-elevation streams of the northern Appalachian Mountain Range. Information received from MDIFW indicates there is a strong potential for Roaring Brook mayfly to occur at the SERE School due to the presence of suitable stream habitat (Trefry, personal communication 2014).

Ringed boghaunter is a dragonfly species that has the potential to occur within the Sedge–Heath Fen habitat of the Installation. Early hairstreak is a butterfly species that could occur in the Spruce–Northern Hardwood Forest habitat. Quebec emerald is a dragonfly species that could occur in the Sedge–Heath Fen habitat (Navy 2012b). Based on a review of habitat requirements and occurrence data for dragonfly, damselfly, moth, butterfly, and other invertebrates species that are considered species of special concern in Maine, many have the potential to occur. A focused invertebrate survey should be conducted at the SERE School to develop a baseline inventory of invertebrate species, including identification of habitats that would support pollinators.

2.5 FOREST RESOURCES

The University of Maine conducted a forest inventory of the Installation in 1990 that included forest cover types and stocking levels in preparation for the development of a Forest Resource Management Plan (Braun et al. 1992). Although the majority of the SERE School property is composed of shade tolerant habitat types, nearly 4,000 ac (1,619 ha) contain shade intolerant, early successional species such as pin cherry (*Prunus pensylvanica*), aspen, and paper birch (Navy 2007). An inventory of natural community types at the SERE School conducted in 1999 characterized approximately 97% of the land (12,199 ac [4,937 ha] as forested (Figure 2-8) (Navy 2007). Table 2-6 provides a summary of the major forest cover types and associated habitat units identified at the SERE School.

Table 2-6. Habitat Types.

Major Habitat Unit	Society of American Foresters Cover Type Codes	Acres
Paper birch – red spruce – balsam fir	35	5,262
Red spruce – balsam fir	33	2,556
Paper birch	18	1,817
Aspen	16	1,304
Pin cherry	17	639
Red maple	108	621
	Total Forested Acreage	**12,199**

Sources: Braun et al. 1992 and United States Forest Service no date

Adjoining lands, primarily owned and managed for timber harvesting, can be expected to be logged on a rotational basis, providing early successional forest along the common boundaries and throughout the region. Throughout the western mountains of Maine there are few large blocks of land such as the SERE School where timber resources are not managed intensively.

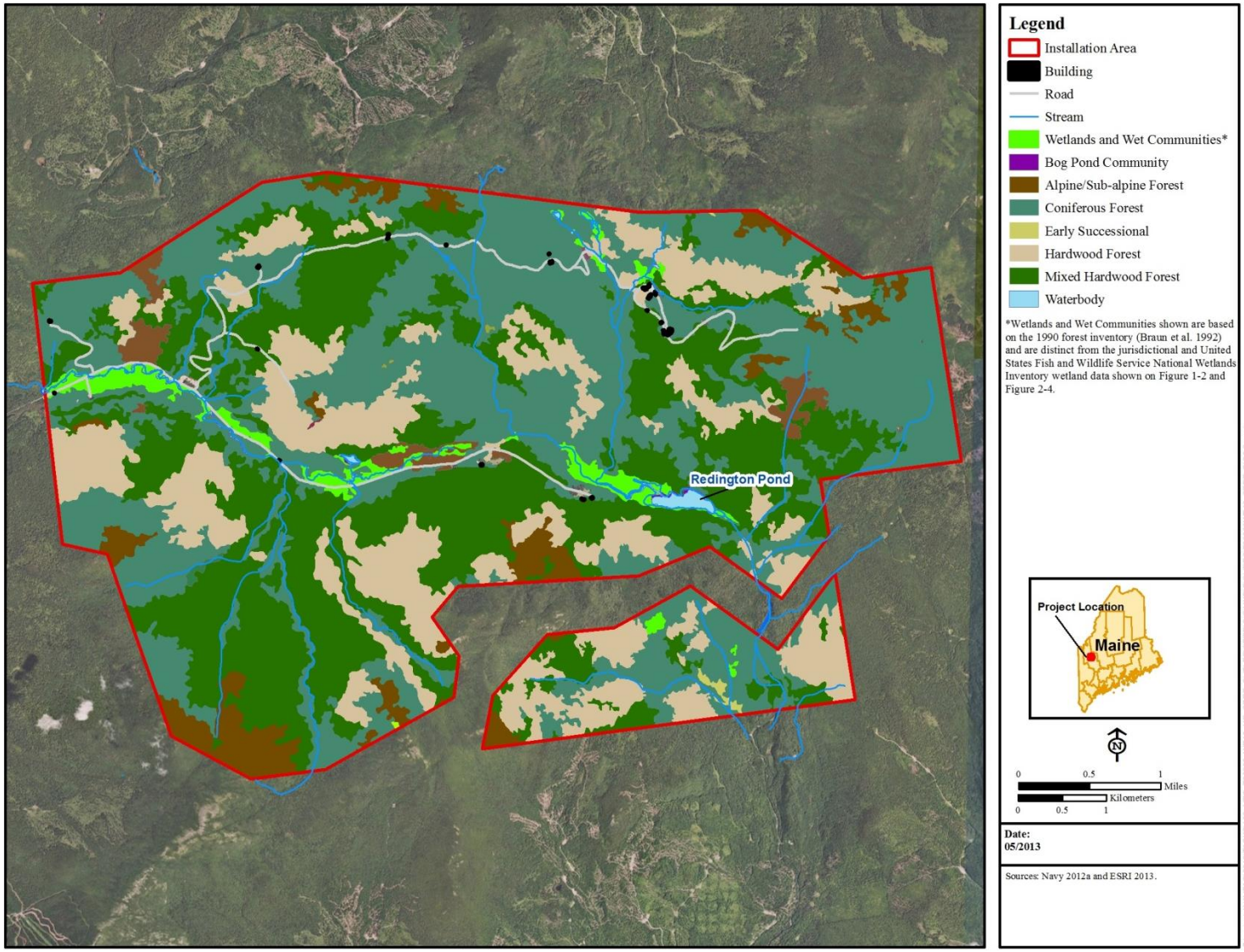

Figure 2-8. Forest Community Types of the SERE School, Redington, Maine.

2.1 OUTDOOR RECREATION RESOURCES

Due to the military mission at the SERE School there are currently limited opportunities for outdoor recreation. Development of a fishing and/or hunting program for military personnel is being considered. Results of the fish survey conducted at the SERE School in 2013 indicate that there are sufficient fish populations to support a recreational fishery program at the Installation.

INRMP projects proposed include conducting general mammal and deer population surveys to determine if deer populations at the SERE School would support development of a hunting program. In addition to training, casual recreational use of the property is permitted for SERE School instructors during non-training periods with written approval required from the OIC.

To prevent land degradation and environmental hazards, it is important to create awareness among land users about how to practice good land stewardship. An integral part of the natural resources management program is to provide environmental awareness and education to the Installation's community. The SERE School is proposing development of an environmental awareness program that will be designed to educate military instructors and support staff to better understand and appreciate the natural resources at the Installation, and to provide information for protection and management of these resources for the future. Through structured educational experiences and activities, users of the SERE School property will have the opportunity to become knowledgeable about the natural resources present at the Installation, the INRMP, and the relationship of the military mission to these resources.

As discussed in Section 2.3.13 *Regional Conservation Lands*, numerous opportunities for outdoor recreation are available in the region including the Rangeley Lakes region, the AT corridor, and nearby state parks and WMAs. Recreational opportunities at state parks and WMAs include activities such as hiking, camping, bird-watching, hunting, canoeing, horseback riding, and wildlife viewing. During the winter months, the region provides opportunities for snowmobiling, snowshoeing, skiing, sledding, and other winter activities.

3.0 NATURAL RESOURCES MANAGEMENT PROGRAMMATIC OBJECTIVES AND RECOMMENDATIONS

This section provides detailed information on the primary natural resources management programmatic objectives identified for the SERE School. Specific projects and recommendations have been developed that will assist the School in meeting the established programmatic objectives. Recommendations are bulleted differently in the following sections depending on whether the project is dependent on funding or if it is a recommendation that will not require a specific funding mechanism to complete. All projects requiring funding are summarized in Section 6.0 *Management Recommendation Summary* and Appendix J *SERE School Natural Resources Project Implementation Schedule*. Projects listed in Appendix J include a cross-reference to the programmatic objectives with which they are associated, as follows:

- land management
- fish and wildlife management
- forest management
- outdoor recreation management

☞ Indicates projects that require a funding mechanism to complete. Funding dependent projects may be associated with more than one programmatic objective.

❖ Indicates management recommendations that can be carried out passively, without the need to seek out specific funding to complete.

Implementation of this INRMP will benefit the operational mission of the SERE School, whereas a lack of active management of natural resources may result in a negative impact to the operational mission. No negative impacts to the mission are expected to occur from implementation of the programmatic objectives and recommendations described in this section.

3.1 LAND MANAGEMENT

OPNAV M-5090.1 (Navy 2014) defines land and watershed management as actions associated with coordinating land use and water management decisions to protect water resources, including water development projects, wetlands, floodplain management, soil conservation, environmentally and economically beneficial landscaping, non-point source pollution, pesticide use, ecological reserves or conservation areas, agriculture, forest management, and wildland fire management. Forest management at the SERE School is discussion in Section 3.3.

Land management at the SERE School includes:

- water resources management including watersheds, floodplains, surface waters, groundwater, wetlands, and riparian areas;
- water quality management (Clean Water Act [CWA] compliance, point and nonpoint source water pollution, sedimentation, and erosion control);
- vegetation management;

- invasive plant species management;
- wildland fire management;
- rare communities and significant wildlife habitat;
- hazardous waste management;
- regional conservation lands;
- leases;
- cultural resources protection;
- rare, threatened, and endangered plant species management;
- environmental and natural resources training; and
- GIS management, data integration, access, and reporting.

Land Management Programmatic Objectives

The following programmatic objectives have been established for land management at the SERE School.

- manage, maintain, and enhance land areas with natural resource value, and maintain ecological functions;
- manage training areas to reduce impacts to natural resources from implementation of the military mission;
- improve and enhance water quality by reducing nonpoint sources of pollution;
- preserve, protect, and enhance water resources (e.g., wetlands, vernal pools, surface water, groundwater);
- manage wetlands and riparian areas to protect soil and water resources and to provide wildlife habitat;
- maintain and enhance native vegetation including dense forest cover and the diversity of naturally occurring edible plants used in survival training;
- control and monitor invasive species; and
- provide adequate special management or protection of rare, threatened, endangered and special concern plant species, and rare communities and significant wildlife habitat.

3.1.1 Water Resources Management

Water resources are an important part of natural ecosystems due to the diverse biological and ecological functions they support and hydrologic functions they perform, such as improving water quality, groundwater recharge, pollutions treatment, nutrient cycling, provision of wildlife habitat and niches for flora and fauna, stormwater storage, and erosion protection (Benton et al. 2008). To protect these important resources many federal, state, and local laws have been enacted to regulate actions that may impact them including, but not limited to, the CWA;

Maine's NRPA and Site Location of Development Act; EO 11988, *Floodplain Management*; Maine Mandatory Shoreland Zoning (Maine Revised Statutes Annotated [MRSA] Title 38, Chapter 3, Subchapter 1, Article 2-B); EO 12962, *Recreational Fisheries*, BGEPA, and Magnuson–Stevens Fisheries Conservation and Management Act. The following sections describe these regulations and provide management recommendations that address the specific set of water resources management issues that occur at the SERE School.

Management of SERE School water resources will provide benefits to the Kennebec River Watershed and wetlands, surface waters, and riparian areas of the Installation. Management of these resources as described in this section also will provide an indirect benefit to Atlantic salmon, which has the potential to occur at the Installation and in the Kennebec River Watershed.

3.1.1.1 Watersheds and Floodplain Management

The Navy recognizes the importance of conservation of water resources. The SERE School is located entirely within the headwaters of the Kennebec River Watershed, which eventually drains into the Gulf of Maine and Atlantic Ocean. The land area of the SERE School is characterized by several ponds, perennial and intermittent streams, numerous freshwater wetlands, and vernal pools. In an effort to protect water quality at the SERE School and within surrounding areas, natural resources staff must identify erosion sites, including shoreline stabilization projects, that might affect water quality within the watershed. The staff also must review erosion and sedimentation control plans (ESCPs) for construction sites and provide oversight to ensure all best management practices (BMPs) are being enforced. The management of Kennebec River Watershed areas at the SERE School is subject to federal and state regulations, as applicable and discussed further below.

Floodplains receive additional protection through EO 11988, *Floodplain Management*, which directs federal agencies to reduce the risk of flood loss by not building in floodplains and to restore and preserve the natural and beneficial values served by floodplains.

At the state level, the Maine Floodplain Management Program works with communities and construction professionals to reduce the risk of flooding. The program works with other state agencies, such as MDEP and the MDACF in reviewing development projects for consistency with Maine's NRPA and Site Location of Development Act to ensure that development that is subject to state review is designed and developed to reduce future flood damages (MDACF 2013b). FEMA floodplain mapping data are not available for the Installation area; however, 100-year and/or 500-year floodplains are likely located within the valley on either side of Redington Stream and Redington Pond.

The Mandatory Shoreland Zoning Act (38 MRSA §345) requires municipalities to adopt, administer, and enforce local ordinances that regulate land use and any development activities in the shoreland zone (MDEP n.d.). Mandatory Shoreland Zoning requirements for development activities proposed within the shoreland zone are described in MRSA Title 38, Chapter 3, Subchapter 1, Article 2-B. The shoreland zone is defined as areas within 250 ft (76 m) of the normal high-water line of any great pond, river, or saltwater body; within 250 ft (76 m) of the upland edge of a coastal wetland; within 250-ft (76-m) of the upland edge of a freshwater wetland (except as otherwise provided in Section 438-A, Subsection 2 of the regulation); or

within 75 ft (23 m) of the high-water line of a stream. The purposes of the Mandatory Shoreland Zoning requirements are to:

- maintain safe and healthful conditions;
- prevent and control water pollution;
- protect fish spawning grounds, aquatic life, bird and other wildlife habitat;
- protect buildings and lands from flooding and accelerated erosion;
- protect archaeological and historic resources;
- protect commercial fishing and maritime industries;
- protect freshwater and coastal wetlands;
- control building sites, placement of structures, and land uses;
- conserve shore cover and visual, as well as actual, points of access to inland and coastal waters;
- conserve natural beauty and open space; and
- anticipate and respond to the impacts of development in shoreland areas (MRSA Title 38, Chapter 3, Subchapter 1, Article 2-B, Section 435).

The Navy is not required to comply with Maine's Mandatory Shoreland Zoning requirements; however, the Navy will evaluate relevant actions to remain consistent with the intent of the regulations to the maximum extent practicable.

- ❖ Any dredge or fill activities planned for areas subject to CWA requirements may require a USACE permit and also may be subject to NEPA review and documentation before any ground-disturbing activities are undertaken within the shoreland zone.

3.1.1.2 Surface Waters, Groundwater, Wetlands, and Riparian Areas Management

All activities on the SERE School will be conducted in a fashion that protects the natural water levels. The highest potential use of water exists in the watersheds of the developed areas (MPB and the Alpha and X-ray static camps) where the water is used for human consumption. In these areas, water quality will be protected (as described in Section 3.1.1.3 *Water Quality Management*) so that the water is suitable for domestic use when adequately treated. A new water well was constructed in 2011, which provides the primary source of domestic water at the Installation, replacing surface water previously used. Water sources will not be pumped dry.

Stream manipulation to accommodate public works facilities shall not be allowed without first coordinating with the PWD-ME Office. Changing the course of a stream or waterbody is a direct violation of the CWA.

As directed by the CWA, the DoD is responsible for identifying and locating jurisdictional waters of the United States, including wetlands that have the potential to be impacted by activities associated with the military mission.

☞ **Project 1:** Conduct a delineation of all surface waters at the SERE School, to include wetlands and streams at a minimum.

The development of roads, installation of new culverts, and grading or fill activities are examples of activities that have the potential to impact wetlands and waters of the United States, and a permit may be required before implementing these activities in accordance with Section 404 of the CWA. Certain actions that have minimal adverse impact on wetlands and other water resources may qualify for a Nationwide Permit (NWP). The NWP Program was designed to streamline the Section 404 permitting process and includes 'maintenance activities' conducted in waters of the United States such as repairing, rehabilitating, or replacing existing structures, as well as removing accumulated fill or debris from within or around existing structures. Activities associated with aquatic habitat restoration, establishment, or enhancement also may qualify for streamlined authorization under a NWP.

Wetlands that have been mapped for the SERE School and identified in this document are provided for planning purposes and include a combination of delineated and NWI wetland data. A jurisdictional determination has not been received for the delineated wetlands on the property. Protection and management of these wetlands must be addressed according to state and federal regulations.

Impacts to wetlands and other surface waters by planned future projects at the SERE School are to be avoided to the extent practicable. A formal jurisdictional wetland and water resources delineation (and receipt of a jurisdictional determination from the USACE) will be needed to verify resource boundaries before undertaking activities that disturb regulated wetlands or waterbodies, and a CWA Section 404 permit may be required. If wetland impacts are unavoidable and a permit is required to authorize the activity, appropriate impact minimization and mitigation will be required and will be determined through consultation with the appropriate federal and state agencies (USACE, USFWS, and MDEP). Additionally, Section 404 may require restoration of wetlands damaged by project activities, and although in-kind replacement of wetlands is the preferred mitigation strategy, other types of mitigation that may be applied include conservation easements, mitigation banking, and other mitigation as dictated by the federal and state agencies involved in the permitting and consultation process.

❖ To properly manage wetland resources at the SERE School, wetlands must be considered during the earliest stages of planning. Wetlands and riparian areas will be avoided during future construction of structures and other facilities, including roads. New roads will be located outside riparian areas, whenever possible. Any stream crossings will be designed to minimize the area disturbed, and unimproved stream crossings are prohibited.

Maintaining well-vegetated riparian buffers are an important part of a healthy environment. These vegetated areas along streams and other waterbodies provide benefits to humans and wildlife. Riparian buffer functions include maintaining habitat for fish and wildlife, nutrient cycling, streambank stability, natural stream flow, and water quality (Muhlberg and Moore 1998). Conserving and restoring riparian buffers minimizes erosion and subsequent loss of streambank habitat. Both the MPB and the Alpha Static Camps are located adjacent to streams, and past uses have had negative impacts on the streams and the riparian zone at these locations.

A restoration plan will be prepared by the PWD-ME and implemented to restore these areas to near natural conditions and to protect areas from future negative impacts.

❖ Avoid and minimize impacts to vegetated buffer areas along streams and other waterbodies during disturbance activities.

☞ **Project 2:** Conduct an assessment of potential riparian buffer restoration or enhancement areas. Where riparian restoration or enhancement opportunities exist, such as at the MPB Area and Alpha Static Camp sites, along roads, and along Redington Stream, use bioengineering techniques to stabilize compromised streambanks and plant using native species.

At a minimum, the wetlands management program at the SERE School should include the following protocol:

- The proponent of any SERE School activity that would potentially impact wetlands should contact the NRM for an assessment of project plans and potential alternatives.
- The findings of the wetland inventory should be referenced and incorporated in all NEPA documentation.
- Jurisdictional wetlands are off limits to all activities except those receiving prior approval from the NRM.
- Rehabilitation of structures and facilities in riparian areas will be designed to maintain or enhance the beneficial value of the riparian area.
- Military mission activities will be conducted in a way that protects water quality, water temperature, bank and channel stability, floodplain functioning, vegetation, and the sediment trapping abilities of the riparian ecosystem.

Refer to Figure 2-4 for a map of SERE School water resources.

3.1.1.3 Water Quality Management

An important water quality management issue at the SERE School is erosion and sediment control. Erosion can be a particular problem in developed areas, at construction sites, along roadways, and wherever pavement, buildings, compacted soil, or lack of vegetation allows water to flow freely and wash away accumulated debris. Erosion occurs in areas where bare ground is exposed to wind or moving water (runoff), and loose soil particles are detached and transported, and may be deposited downstream. Sediments clog fish gills, smother aquatic life, and destroy habitat needed by underwater plants. Runoff containing eroded sediments also carries nutrients, such as nitrogen and phosphorus, into ponds promoting algal blooms, and also may transport toxic chemicals.

To protect water quality at the SERE School and within surrounding areas, existing and potential erosion problem areas must be identified so that appropriate measures, including sedimentation control and shoreline stabilization projects, can be implemented. SERE School environmental staff also must ESCPs for ground-disturbing activities and provide oversight to ensure BMPs are being applied properly and consistently.

Redington Stream erosion
Source: J. Sweitzer

Redington Stream has historically meandered across the valley bottom and continues to change course today. Streambanks erode and at times jeopardize roads located within the valley. There are several problematic areas located at bends along Redington Stream where the stream is washing out streambanks. Road washouts occur periodically during storm events and may result in plugged or partially blocked culverts during the spring season. Erosion problems have been remedied at the low water crossings of Redington Stream through the installation of large culverts under the roadway in several locations. Streambank stabilization may be necessary to protect the Redington Stream Road; however, stabilization of eroding streambanks is required only where continued erosion will jeopardize the road. The methods used to stabilize the streambanks will be conducted in accordance with Maine's BMPs.

The streambank assessment conducted at the SERE School in June 2013 identified 10 stream segments with existing or potential erosion and sedimentation problem areas (Navy 2013b). Problem areas were defined as having active erosion or sedimentation issues, whereas potential problem areas were defined as those that, while not exhibiting active erosion, have the potential to result in erosion damage to infrastructure or environmentally sensitive resources. Streambank stabilization and erosion remedial actions should be focused within identified problem areas along Redington Stream, near Tumbledown Brook at Mountain Road, near the unnamed tributary crossing (Figure 2-4), and at new erosion/sedimentation areas identified during the plan period. Additional details and estimated costs associated with erosion control and streambank stabilization recommendations are provided in the *Streambank Assessment Technical Memorandum* in Appendix E *SERE School Biological Surveys*. Restoration activities include grading, stabilization with riprap stone, and re-seeding of unvegetated areas (Navy 2013b). Recommendations are based on numerous factors including existing natural conditions, existing streambank stabilization and restoration methods employed, low cost, ease of installation, maintenance requirements, and most importantly, effectiveness based on conditions.

Recreation trails are subject to erosion if not maintained properly. Trails such as the Blue Line Trail to Redington Falls require that on steep grades water be diverted off the trail via installation of water bars and other means. The water management structures should be maintained twice

annually, usually in the spring and fall. It also is important to check the trails after heavy rainfall events and in the spring after the snowpack has melted.

- ☞ **Project 3**: Conduct annual erosion surveys to identify soil erosion problem areas. These surveys should focus on the identification of areas of erosion along roadways, trails and footpaths, and areas of ground disturbance adjacent to and along edges of wetlands and surface waters; inspection of previously identified problem areas; and inspection of recently constructed erosion and sedimentation remediation areas.

- ☞ **Project 4:** Develop and implement erosion remedial and preventive measures to protect water quality and ensure shoreline stabilization, based on annual survey results (Project 3) and previous streambank assessments.

Soils information provided in Section 2.3.6.3 *Soils* should be referenced when making management decisions at the Installation. All ground-disturbing projects conducted at the SERE School will be covered by a stormwater pollution prevention plan (SWPPP) and/or ESCP as needed. These plans will identify measures to reduce pollution into receiving waters from stormwater runoff from the project site, in accordance with state regulations such as Maine Erosion and Sedimentation Control Law (38 MRSA 420-C). At a minimum, an ESCP must be submitted for review and approval to the Environmental Office. The plan shall incorporate BMPs because the implementation of BMPs is a sound and proven means of controlling erosion. Guidance for developing project-specific SWPPPs and ESCPs can be found in the Maine Erosion and Sediment Control BMPs manual and the Maine Forest Service's "Best Management Practices: Field Handbook" (see text box for access information for these documents). These references should be consulted on a project-by-project basis to obtain recommendations based on project type, location, soil disturbance, restoration requirements, and protection of natural resources within and adjacent to the project site. Some frequently used BMPs include those designed to protect water resources, soil stabilization techniques, control of stormwater runoff, and restoration of disturbed areas.

The Maine Department of Environmental Protection's *Erosion and Sediment Control BMPs Manual* (2003) is available to download at: *http://www.maine.gov/dep/land/erosion/escbmps/*.

The Maine Forest Service's *Best Management Practices Use and Effectiveness* (2010) is available for download at: *http://www.maine.gov/doc/mfs/pubs.htm#bmp_rpt_05_to_09.*

The NRM will review all proposed plans to ensure they comply with Maine's Erosion and Sedimentation Law. Soil erosion will be monitored at construction and demolition sites, roads and trails, and on a periodic basis by conducting spot inspections after large storm events. Bare soils are easily eroded. Erosion is not continuous, but can be catastrophic during major storms.

- ☞ **Project 5:** Prepare and implement an erosion control plan for all earth-disturbing activities. The plan will incorporate the results of annual erosion surveys (Project 3) and previously completed streambank assessments, and will include erosion remedial and preventive measures to protect water quality and ensure streambank stabilization. The plan will include training materials for SERE School personnel including

recommendations for conducting trail maintenance and BMPs to use during construction and ground-disturbing activities.

The following BMPs shall be applied to all activities at the SERE School:

- construction and management activities such as leach fields, landfills, fuel storage, or mining activities will employ the best available technology to protect groundwater quality;
- roadside ditches and brooks will be free of trash, slash or fill;
- shade-producing vegetation will be left on streambanks since elimination of shade creates an increase in water temperature from the heat of the sun and alters in-stream habitats;
- natural fallen logs shall be left in streams unless impacts to public works facilities occur as a result; and
- gravel will not be removed from stream or streambanks under any circumstances.

☞ **Project 6:** A water quality baseline inventory, to include inventory of surface waters that may support Atlantic salmon, shall be designed and implemented for the SERE School in accordance with existing Navy water quality monitoring protocols. Specific protocols for the SERE School shall be established to assure that water quality does not drop below natural levels and is maintained to provide quality habitat for Atlantic salmon.

Beaver dams also may affect water drainage, impede water flow, and affect water quality. As discussed in Section 2.4.6 *Invasive and Nuisance Wildlife Species*, beavers inhabit locations throughout the SERE School, and the resulting ponds (or flooded marsh areas) can have negative impacts on nearby roads. Routine monitoring of nuisance wildlife, as described in Section 3.2.4 *Invasive and Nuisance Wildlife Species Management*, should be conducted at the SERE School to determine if nuisance wildlife removal or relocation actions are necessary to protect natural resources and human health and safety. The Navy also will coordinate with MDIFW to develop a plan/strategy that outlines methods to address beaver issues that may be impacting Installation infrastructure.

3.1.2 Vegetation Management

Baseline vegetation data are integral in the management of vegetation at the SERE School. The objective for inventorying and monitoring flora at the SERE School is to ensure long-term mission accomplishment and ecosystem sustainability. It also assists the Navy in moving to an ecosystem management approach to managing the natural resources at the SERE School.

Inventory and monitoring procedures involve:

- creating and maintaining systems to store and analyze information about the natural resources; and

- regularly monitoring 1) those resources that are important indicators of overall ecosystem integrity, 2) the capability of lands to support the military mission, and 3) the status of imperiled species or communities.

Inventories have been taken of the natural community and forest cover types. These inventories function as baselines against which change in conditions can be monitored and evaluated, and a re-inventory of these resources should be conducted on a 10-year basis. Natural communities should be categorized according to the classification system developed by MNAP, which includes 98 distinct community types (Gawler and Cutko 2010), and should be verified with data from Beginning with Habitat and other local and regional wildlife data resources.

Beginning with Habitat **provides maps and accompanying information about important habitat features (riparian habitats, high value animal habitats, and large habitat blocks) as well as additional information and tools to implement habitat conservation in local land use planning efforts.** ***Beginning with Habitat*** **maps are available at: *http://www.beginningwithhabitat.org/*.**

☞ **Project 7:** Conduct a natural community type survey of the SERE School to ground-truth available GIS data of the vegetative community types present, and to collect additional natural community type data based on current scientific information.

SERE School personnel have expressed concern over an observed decline of the edible plants, including mountainsorrel, fiddlehead (or ostrich fern), wild berries such as bunchberry dogwood, trillium, yarrow, pokeweed, common dandelions, bluebead, and Indian cucumber. This is most notable and most problematic in areas adjacent to the static camps and other areas where the survival training is conducted, as trainees depend on these plants for food during SERE School training.

☞ **Project 8:** Conduct a survey to establish a baseline inventory of edible plants at the Installation, especially in training areas. Conduct follow-up surveys at least every five years of known edible plant areas to identify positive and negative trends associated with these resources.

The biological diversity of the SERE School and the viability and abundance of the species will be allowed to change as succession and natural disturbances dictate. Adjacent lands, particularly those owned by large timber companies, are expected to provide sufficient early successional forest conditions at the landscape level.

3.1.3 Noxious Weeds and Invasive Plants Management

Invasive species management encompasses the control of insect pests, invasive plant species, and noxious weeds through treatment and prevention measures. Invasive species management can be implemented first by adopting an integrated pest management (IPM) strategy that will aid in invasive species control by changing routine practices or making habitat and structural alterations. The integration of IPM strategies should reduce the use of and need for application of chemical controls; however, chemical controls may be required if problems persist despite the use of IPM methods. If chemical controls are necessary, they should be applied carefully to kill only targeted pests, with minimum use of the least toxic product available. The application of

herbicide to control invasive species must be done in accordance with state and federal regulations.

The SERE School acknowledges its responsibilities as listed in the White House Memorandum on Environmentally and Economically Beneficial Practices on Federal Landscaped Grounds (Office of the President, 26 April 1994). The memorandum's requirements include:

- using regionally native plants for landscaping;
- using construction practices that minimize adverse effects on the natural habitat; and
- implementing water-efficient practices.

The Naval Installations Maine Consolidated Integrated Pest Management Plan (IPMP) (NAVFAC Atlantic 2012) provides a comprehensive planning and operational tool that establishes the strategy and methods for conducting a safe, cost-effective, and environmentally sound pest control program for Navy installations located in northern Maine through implementation of IPM practices. The plan stresses an IPM approach to pest management and includes limited pesticide and herbicide treatment of materials, self-help programs for installation personnel, information notices on pest management practices, habitat modification, and mechanical controls for pest removal. The PWD-ME Pest Management Coordinator is responsible for implementation of the IPMP and handles the majority of complaints regarding pest control or nuisance wildlife at the SERE School. Pest management is performed by contract personnel through a contract issued by the Facilities Engineering and Acquisition Division. The contracting officer at Portsmouth Naval Shipyard is responsible for preparing contracts to support the pest control mission. Contract personnel must meet state certification requirements and adhere to state and federal laws and regulations. The objectives of the pest management program are prevention of pest-related health and safety issues that affect the mission; protection of government property, material, and aesthetics; and reduction in use of and dependence on pesticides. The IPMP includes specific management instructions for general household and nuisance pests, grounds maintenance, invasive and non-indigenous species, aquatic weeds, structural pest, stored product pests, health related pests, rodents, birds, and feral cats (NAVFAC Atlantic 2012). Weed control at the SERE School is conducted in accordance with the Naval Installations Maine Consolidated IPMP (NAVFAC Atlantic 2012). Additionally, a Memorandum of Agreement was established in 1990 between the DoD and USDA for *Conduct of Forest Insect and Disease Suppression on Lands Administered by the U.S. Department of Defense* (USDA and DoD 1990). This Memorandum of Agreement allows the DoD to task the USFS to survey the SERE School and fund suppression projects, as appropriate.

Incidental observations have identified several invasive species at the SERE School; however, since a focused invasive species survey has not been conducted, additional invasive plant species also are likely to be present. Plants observed at the SERE School that are considered invasive or introduced species are identified in Appendix G *SERE School Flora and Fauna*, Table G-1.

☞ **Project 9:** Conduct annual site surveys to proactively identify new occurrences of invasive species and to monitor restoration sites for growth. An annual survey of the SERE School waterbodies also should be conducted to evaluate the presence of invasive aquatic species, such as Eurasian milfoil and hydrilla. If these or other invasive aquatic

species are identified, coordinate with MDEP to determine if actions to remove these species are necessary.

☞ **Project 10:** Develop a plan to remove and restore areas infested with invasive plant species, including terrestrial and aquatic species identified in Project 9. For small stands it is preferred that all aboveground biomass as well as the underground rhizome by which they spread be manually removed. If manual removal is not feasible, stands should be treated with an approved herbicide such as glyphosate.

3.1.4 Wildland Fire Management

A fire instruction for the SERE School is currently being developed and will be the fire directive for the SERE School. Preparation of the SERE School Wildland Fire Management Plan has been competed (Appedix I) and includes guidelines for preventing and combating fires at the Installation including brush and forest fires, fire preparedness and prevention, establishing fire breaks, restoration, and emergency protocols for responding to wildland fires. The Installation compound is located at the end of Mountain Road, and therefore there is only one way to enter and exit the property by vehicle. This region of Maine rarely experiences extreme fire danger where risk of catastrophic wildfire could endanger the personnel at the Installation. The SERE School Wildland Fire Management Plan identifies emergency escape routes and proper agency contact information and protocols in case of a fire. In the event of a wildland fire, the primary focus is to get personnel off the property as quickly and safely as possible and to notify the appropriate agencies.

The lack of active forest management or timber harvesting at the SERE School since 1961 has resulted in dense forest habitats with a high density fuel load. To adequately determine the wildland fire danger and forest management practices that should be implemented at the SERE School, a forest characterization and forest management plan will be completed.

☞ **Project 11:** Upon completion of the updated forest characterization assessment (see Project 34), a forest management plan will be developed in coordination with the Maine Forest Service to include management of dense forest conditions (including salvage of downed trees and debris for firewood, timber sales, and reducing the risk of wildland fire), identification of areas containing abundant edible plants, and management of forest resources in response to natural disturbances. During their review of this INRMP, the USFWS Umbagog NWR also expressed interest in providing guidance and recommendations to the Navy for development and implementation of the forest management plan.

In the event that timber harvesting is proposed, this forest management plan will serve as a foundation for conducting a comprehensive forest inventory to determine what types of timber harvest practices should be applied to ensure sustainable use and continued ecological value of forested habitat.

Prescribed burning is not currently used in the management of vegetation, wildlife habitat, or for fuels reduction at the SERE School.

Firewood for heating and campfires is recovered from dead or downed trees generally within a short distance of the roads. This serves the purpose of reducing fuel loads along the roads and increasing the fire break capabilities of the roads.

3.1.5 Rare Communities and Significant Wildlife Habitat Management

Wetland habitats, including significant vernal pools, are considered significant wildlife habitat by MDEP due to their importance as amphibian breeding areas. The unconsolidated bottom wetlands of are associated primarily with pond habitats having organic substrates, as well as smaller areas embedded in scrub-shrub wetlands. These wetlands are considered ecologically important for birds, aquatic invertebrates, several mammals, amphibians and vascular plant species diversity. Riparian buffers also provide important habitat for fish and wildlife. The following recommendations are designed to address gaps in baseline information on significant wildlife habitat and other natural resources present at the SERE School:

- ☞ **Project 12:** Conduct a comprehensive vernal pool survey of the SERE School using MDIFW protocols. Survey should include identification of all potential vernal pools using a combination of desktop review and site visits to ground-truth and survey each potential vernal pool. Survey should be conducted during the appropriate survey window as determined by MDIFW to record evidence of use by breeding, obligate vernal pool species. Recording unique features of the pools, photographic documentation, and GIS mapping of each pool also should be conducted.

Several special interest areas exist at the SERE School including high elevation zones, Redington Falls, and Redington Pond (Figure 2-5; Redington Falls is not depicted on this figure to reduce the potential for trespassing). High elevation alpine areas receive special protection status in the state of Maine. Areas above 2700-ft (823-m) in elevation are considered special protection management areas by the LUPC (12 MRSA, Chapter 206-A). In accordance with these standards, high elevation areas should not be used for training or development activities. Core training activities typically do not occur in high elevation areas; however, passive travel (such as associated with evasion scenarios) in alpine areas may occur in support of the Installation's training objectives. All mission activities planned for high elevation areas shall be coordinated with the Installation NRM prior to initiating the activity, although occasionally recreation pursuits are allowed without NRM coordination. Trails in the alpine and sub-alpine areas shall be routinely maintained by trail users to discourage users from hiking off trail.

Redington Falls is listed in the Maine Atlas and Gazetteer (MAG) as a "scenic waterfall." However, the Gazetteer does not state that the falls are located on U.S. Navy property. MAG management agreed to drop Redington Falls from its listing in the Atlas beginning in 2008; however the 2013 MAG publication had the falls location included on the regional map for the Installation. Periodic review and coordination with MAG management is required to ensure that the location of Redington Falls is removed from subsequent publications. This is necessary to prevent civilian intervention in the military training mission and to protect public safety. Review and maintenance of signage installed along the Installation boundary should be performed at regular intervals to reduce the potential for people attempting accessing to this area. The falls will be unmanaged and left to natural processes. Changes in stream channel location should be anticipated in the long term, and the trail that provides access to the falls may have to be re-routed in this event. Trail conditions at Redington Falls and the nearby property boundary

adjacent to the AT should be monitored to ensure that proper signage is in place to prevent civilian trespassing and to maintain the military mission.

Other management measures that will be implemented to protect significant wildlife habitat at the SERE School includes maintaining a natural buffer around Redington Pond to protect the high and moderate value inland waterfowl and wading bird habitat and shoreland zoning (Figure 2-5). Since the Redington Pond dam will continue to deteriorate, causing the pond to revert to wetland marsh and vegetative conditions, this will affect fish populations within this waterbody. A research opportunity exists to study the natural restoration of this area to its former ecological condition. An analysis of changes in the Redington Pond shoreline area and vegetation monitoring adjacent to the pond are scheduled to be completed in 2015.

- ❖ Maintain a natural buffer around Redington Pond.

3.1.6 Hazardous Waste Management

The potential for a hazardous material spill at the SERE School is mostly limited to four specific areas: MPB, Alpha and X-ray static camps, and the training compound. The SERE School has a total aboveground storage tank capacity of 11,425 gallons (43,248 liters) of oil. No underground storage tanks are present. The aboveground storage tanks are not located in vehicular traffic areas and are protected against accidental damage from vehicles (Aerostar Environmental Services, Inc. 2012). All aboveground storage tanks have secondary containment with secondarily contained piping, and spill kits are provided at each storage tank site.

In the event of a spill, all procedures outlined in the SPCC Plan for the SERE School would be followed. The SPCC Plan was revised in June 2012 and establishes specific procedures for responding to the release, minimizing the effects, and removing hazardous spill materials. Appropriate contact persons and procedures also are included in the SPCC Plan in the event of a spill. If necessary, a natural resources damage assessment would be performed in accordance with the Oil Pollution Act of 1990 (33 USC 2701–2761) under the control of the Commander Navy Region Mid-Atlantic.

All personnel are trained in the handling and disposal of hazardous materials as required by OPNAV Instruction 5100.28 (Hazardous Material User's Guide).

3.1.7 Regional Conservation Lands

Regional conservation lands surrounding the SERE School include the AT and other ecological reserves as described in Section 2.3.13 *Regional Conservation Lands*.

As discussed in Section 1.7 *Encroachment and Adjacent Land Use*, an EAP document has been prepared that quantifies potential encroachment challenges for the Installation, and provides recommended mitigation strategies. As a component of the EAP, the Navy is tracking and pursuing conservation opportunities on parcels adjacent to the SERE School. TPL is pursuing funding for acquisition of five additional tracts in the region (that are part of the proposed Redington and Dallas Plantation projects) and has approached the Navy for assistance in acquiring two of these tracts that are adjacent to the SERE School. The Navy has applied for $1,000,000 in fiscal year (FY) 2013 REPI funds to acquire multiple conservation easements on approximately 12,514 ac (5,064 ha) of property located adjacent to the SERE School. TPL will

raise the remaining $1,000,000 needed for the acquisition. The Navy plans to execute a multi-year encroachment partnering agreement with TPL and will apply for additional REPI funds to acquire additional conservation easements on properties around the Installation between FY 2014 and FY 2018. Acquiring conservation easements on adjacent parcels would prevent incompatible development and preserve existing wilderness across most of Redington Township. The proposed easement terms would include specific measures for wildlife habitat and sustainable forest management, and would prohibit timber harvesting above 2,700 ft (823 m), subdivision, or development of any kind (Navy 2013a).

In addition to the parcel acquisitions associated with the EAP, the Maine Department of Conservation obtained funding from the USFS Legacy Program in 2012 to acquire the Crocker Mountain and Orbeton Stream properties, both in Franklin County. The grant application was supported by TPL, the Rangeley Lakes Heritage Trust, and the Maine AT Land Trust. The 12,046-acre Crocker Mountain Unit located in western Maine, includes three of Maine's highest mountains, and was permanently protected in 2013 as Public Reserved Lands, and will be managed by MDACF (High Peaks Alliance 2013).

Conservation of these and other properties surrounding the SERE School would support the Installation's efforts to prevent incompatible land use and preserve the existing wilderness in Redington Township that is essential to the military mission.

3.1.8 Leases

Nestle Company maintains a lease agreement with the SERE School for access to their Poland Springs pumping station, located outside the SERE School gate. Aside from routine coordination required to maintain this lease, no special management is associated with this lease.

3.1.9 Cultural Resources Protection

Locating and determining the significance of cultural resources relative to Section 106 and Section 110 of the National Historic Preservation Act (NHPA) is considered the responsibility of federal agencies. The regulations and procedures in 36 CFR 800, which implements Section 106 and Section 110 of the NHPA, require federal agencies to consider the effects of their undertakings on cultural resources listed in, eligible for, or potentially eligible for inclusion in the NRHP. Under Section 110, federal agencies are required to identify and protect all cultural resources within their landholdings that are eligible for inclusion in the NRHP. Under Section 106 federal agencies with jurisdiction over a proposed undertaking must consider the undertaking's effect on NRHP-listed, eligible, or potentially eligible cultural resources. Sections 106 and 110 of the NHPA outline the historic preservation responsibilities and processes that federal agencies must conduct for every undertaking. Prior to approval of the proposed action, the regulations require that the State Historic Preservation Office and the National Advisory Council on Historic Preservation be afforded the opportunity to comment.

Cultural resources within the Installation boundary are managed by the PWD-ME Cultural Resources Manager (CRM). The CRM is responsible for routine cultural resources compliance functions at the various installations in PWD-ME's area of responsibility, including the SERE School. The CRM inventories, evaluates, and protects historic buildings, structures, districts and other cultural resources in accordance with Sections 106 and 110 of the NHPA and Navy policy.

Coordination with the CRM is essential on natural resources projects to ensure timely interagency consultation and compliance with Section 106 of NHPA whenever a Navy-funded, -licensed, -permitted or -assisted undertaking may affect historic properties. In accordance with 36 CFR 800 of the NHPA, the CRM will coordinate with the MHPC to ensure that the appropriate steps are taken to protect cultural resources, ensure compliance with relevant federal and state regulations, and determine if additional cultural resources studies are required.

- ❖ For all ground-disturbing activities, including those related to natural resources management, cultural resource issues must be taken into consideration.

The Naval Air Station Brunswick Cultural Resources Survey Report (draft) (Berger 1996) recommends that the Navy follow consultation procedures as set forth in 36 CFR 800 (Protection of Historic Properties) concerning the possible effects of future land-related undertakings at the SERE School, and that the material in the survey be used as the basis for initial consultation between the Navy and MHPC in regards to cultural resources. A database should be established to track new information on cultural resource studies at the Installation and on substantial new ground disturbances to ensure that future surveys and evaluations employ the most accurate and up-to-date information (Berger 1996).

To prevent activities from affecting significant cultural resources, Installation and natural resources projects that involve ground-disturbing activities must be processed through the CRM. Earth-disturbing activities or removal of structures in areas where eligibility of sites for the NRHP has not been determined require coordination and consultation that is prescribed in Sections 106 and 110 of the NHPA. For management purposes, sites deemed eligible or potentially eligible for the NRHP are treated in exactly the same manner as sites that are listed in the NRHP. Concessions may need to be made to protect these sites.

Conversely, regarding excavations of archeological sites that may adversely affect natural resources, any activity will be evaluated, as needed, via the NEPA process for such impacts. Adverse effects will be mitigated through avoidance, minimization, or compensatory mitigation.

3.1.10 Rare, Threatened, Endangered, and Special Concern Plant Species Management

No listed plant species have been identified at the SERE School. Since the last target survey for listed plant species occurred in 1988, an updated rare, threatened, endangered, and special concern plant species survey should be conducted to reflect current conditions and ESA listings. Should any additional species or potential habitat be identified, the Installation will cooperate with the USFWS to identify protective measures that will ensure conservation and protection of rare plant species and habitats. Military mission and grounds maintenance activities will be conducted in a manner that will avoid disturbance and/or loss of rare, threatened, endangered plant, and special concern species, and sensitive habitats at the SERE School.

A list of rare, threatened and endangered plants with potential habitat in Maine is provided at *https://plants.usda.gov/java/threat*. This list is a compilation of the USFWS Endangered Species Program list (2006) and the MNAP list (1999). Proactive management of these species and the habitat that supports them is important to prevent these species from being listed under the ESA.

A baseline inventory of rare, threatened, endangered, and special concern plant species at the SERE School will provide valuable information for Installation natural resources personnel. Awareness of the locations of rare plant populations and habitats will allow SERE School trainees and instructors to avoid harvesting these plants and disturbing sensitive habitats during training exercises.

☞ **Project 13:** Conduct a plant survey and habitat assessment within the appropriate season for rare, threatened, endangered, or special concern plant species with the potential to occur at the Installation.

3.1.11 Partnerships and Outreach

Partnerships that address and promote regional collaboration with other installations, federal and state agencies, NGOs, and universities can provide valuable resources in the management of natural resources.

As discussed in Section 3.1.7 *Regional Conservation Lands*, the Navy is pursuing conservation partnerships and opportunities on parcels surrounding the SERE School to prevent incompatible land use. The Navy is currently partnering with TPL in an effort to acquire a 9,984-ac (4,040-ha) tract to prevent incompatible development and preserve the existing wilderness in Redington Township.

Climate change impacts to military installations and their missions is a DoD concern, and they have recognized that regional partnerships are the most appropriate means to conduct climate change vulnerability and impact assessments. All DoD components shall, in a regionally consistent manner to the extent practicable and using the best science available:

- utilize existing tools to assess the potential impacts of climate change to natural resources on DoD installations;
- identify significant natural resources that are likely to remain on DoD lands or that may in the future occur on DoD lands; and
- take steps to implement adaptive management to ensure the long-term sustainability of those resources, when not in conflict with mission objectives.

Assessing the impacts of climate change is best approached by identifying an environmental baseline for the future that considers the differences in landscape form and function caused by climate change and other stressors on the landscape (CNIC 2012).

The SERE School is located in the North Atlantic Landscape Conservation Cooperative (LCC). The cooperative, established as part of the U.S. Department of the Interior's Climate Change Response Strategy, is designed to provide a partnership in which the private, state, tribal, and federal conservation community can work together to address increasing land use pressures and widespread resource threats and uncertainties amplified by a rapidly changing climate (North Atlantic LCC n.d.). The SERE School should partner with the North Atlantic LCC to implement projects and studies related to climate change and natural resources management to the extent practicable and consistent with the Installation mission. An example of a relevant project that is

currently being pursued by the North Atlantic LCC is a partnership with NatureServe that involves species assessments for foundational and representative species and species of high regional concern, including Atlantic salmon and migratory birds that have the potential to occur at the Installation (North Atlantic LCC 2013).

The following INRMP projects will facilitate partnerships and outreach activities that will contribute to land management activities at the SERE School.

- **Project 14:** Establish partnerships with state and federal agencies, NGOs, and/or universities to promote the conservation and study of natural resources at the SERE School. Potential partners include the North Atlantic LCC, National and Maine Audubon Society chapters, IBP, TNC, The Wilderness Society, and the Vermont Center for EcoStudies.

- **Project 15:** Conduct a climate change vulnerability assessment in partnership with other DoD installations, federal and state agencies, NGOs, and/or universities. The assessment should focus on future climate change projections and the impacts of altered species' distribution patterns and variations in ecological processes such as drought, fire, and flood for Navy installations located in Maine.

3.1.12 Environmental and Natural Resources Training

Environmental staff should participate in periodic training courses and workshops to remain current on issues and laws as they relate to natural resources management at military installations. Other environmental and natural resources training activities should be undertaken, as needed, to ensure that environmental staff are prepared to handle any land management issues that may occur. See Section 3.4.3 *Education and Outreach* for additional information on the environmental awareness program at the Installation.

All personnel are trained in the handling and disposal of hazardous materials as per OPNAV Instruction 5100.28 (Hazardous Material User's Guide).

- **Project 16:** Develop an environmental awareness program focused on educating and training SERE School and PWD-ME personnel on protection of natural resources topics including implementation of BMPs for erosion control and trail maintenance, wetland protection, management of nuisance wildlife, and protection of rare, threatened, endangered, and special concern plant and wildlife species known to occur.

- **Project 17:** Provide periodic training for SERE School personnel and PWD-ME environmental staff regarding implementation of erosion and sediment control measures and use of effective BMPs. MDEP provides annual erosion and sediment control courses.

- **Project 18:** Provide training for environmental and grounds maintenance staff for identification of wetlands, and to avoid impacts to key vegetation species and wetland habitats identified in this INRMP for conservation and protection.

- **Project 19:** Provide professional training for PWD-ME environmental staff to include Field Techniques for Invasive Plant Management, Conservation Biology (both courses offered at the USFWS National Conservation Training Center [NCTC]), and Pest

Applicator Certification Training (offered by the Armed Forces Pest Management Board).

Table 3-1 provides the contact information for potential training opportunities.

Table 3-1 Natural Resources Training Opportunities.

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

NGOs
Wetland Training Institute, Inc. P. O. Box 31 Glennwood, NM 88039 Tel and Fax: 877-792-6482 Website: http://www.wetlandtraining.com/
The Shipley Group P. O. Box 908 Farmington, UT 84025 Tel: 888-270-2157 Website: http://www/shipleygroup.com
Universities
Duke University Nicholas School of the Environment and Earth Sciences Continuing Education Program Box 90328 Durham, NC 27708-0328 Tel: 919-613-8082 Fax: 919-684-8741 Website: http://www.env.duke.edu/cee/execed.html
University of Wisconsin-Madison Gaylor Nelson Institute for Environmental Studies Science Hall, 550 North Park Street Madison, WI 53706-1491 Tel: 608-263-1796 Website: http://www.ies.wisc.edu/

3.1.13 GIS Management, Data Integration, Access, and Reporting

GIS is an integral part of natural resources and environmental protection and planning. This powerful management tool provides NRMs with a comprehensive database that includes a spatial component. Information such as aerial photographs, survey and monitoring data, and various other natural resources information are all tied to a geographical coordinate system. Availability of this information enhances the SERE School's ability to effectively coordinate and ensure that current and planned mission activities do not adversely impact watersheds, wetlands, floodplains, natural landscapes, soils, forests, vegetation and wildlife, prime and unique farmland, and other natural resources that must be protected, conserved, and managed using an ecosystem approach. Additionally, efficient and effective land use planning supports readiness and sustainability, while protecting and enhancing the natural resources for multiple use, sustained yield, and biological integrity.

In accordance with OPNAV M-5090.1, NRMs are encouraged to use GIS as the basis of their INRMP, and thus all data layers with a spatial component are provided in a GIS-compatible format. To make use of this real-time technology and the benefits it offers, NRMs must receive training on this integrated system to fully implement a proactive natural resources management program that supports the mission and ecosystem integrity. Adequate training in data collection using GPS technology is another essential aspect of building and maintaining an up-to-date GIS that meets natural resources planning needs.

☞ **Project 20:** Work with the NAVFAC Mid-Atlantic GeoReadiness Center (GRC) to develop a GIS system for storing SERE School natural resources data.

☞ **Project 21:** Provide training to environmental staff to maintain the SERE School GIS database.

The Commander Navy Region Mid-Atlantic GRC is the single, authoritative source and distribution point for all geospatial information within the area of responsibility of the Navy Mid-Atlantic Region and is managed by the NAVFAC Mid-Atlantic GIS Division. The GRC houses the most current geospatial information (including aerial photography) for the entire Navy Mid-Atlantic Region and provides access to the comprehensive dataset and analysis tools to regional and DoD decision-makers/managers, sponsored contractors, and other sponsored individuals via a secure government Internet site.

Examples of baseline environmental data layers that were used to create INRMP figures include:

- property boundaries, roads, and buildings;
- soils;
- topography;
- water resources;
- rare communities and significant wildlife habitat;
- significant wildlife habitat;
- cultural resources;
- critical habitat; and
- forest stands.

The map figures presented in this INRMP were developed using existing digital data files provided by the Navy, from photographic interpretation and field reconnaissance of aerial photography, collected during field surveys, and from other GIS databases available to the public. An ESRI map service was used, which includes i-cubed Nationwide Prime high-resolution (approximately 3 ft [1 m] or greater) imagery for the contiguous U.S. The i-cubed Nationwide Prime service is a seamless, color mosaic of various commercial and government imagery sources, including Aerials Express 0.3–0.6 meter resolution imagery for metropolitan areas and the best available USDA National Agriculture Imagery Program imagery and enhanced versions of USGS Digital Ortho Quarter Quad imagery for other areas. The imagery is projected to Universal Transverse Mercator, Zone 19 North, World Geodetic System of 1984. All GIS data created or modified for use in this INRMP will be submitted to NAVFAC Atlantic, PWD-ME, and the Installation upon completion of this project.

3.2 FISH AND WILDLIFE MANAGEMENT

OPNAV M-5090.1 (Navy 2014) defines fish and wildlife management as those actions designed to preserve, enhance, and regulate indigenous wildlife (e.g., fish, birds, mammals, and all other classes of wild animals) and their habitats, including conservation of protected species and non-game species, and management and harvest of game species. Where applicable, management of bird/wildlife aircraft strike hazard reduction also should be coordinated with installation natural resources programs to ensure consistency with INRMP goals. .

Fish and wildlife management at the SERE School includes management of:

- aquatic species fish and wildlife species and their habitats;
- terrestrial wildlife species;
- rare, threatened, endangered, and special concern species (i.e., birds protected by the MBTA or the BGEPA) and their habitats including Atlantic salmon, Bicknell's thrush, and rusty blackbird;
- migratory bird management;
- invasive and nuisance wildlife;
- partnership development with federal, state and local agencies, and NGOs to establish wildlife monitoring and protection programs;
- conservation law enforcement;
- environmental and natural resources training; and
- GIS management, data integration, access, and reporting.

Fish and Wildlife Programmatic Objectives

The following programmatic objectives have been established for fish and wildlife management at the SERE School.

- protect, conserve, and promote native terrestrial and aquatic fauna;
- promote conservation of rare, threatened, endangered, and special concern species and their habitats known to occur at the SERE School through monitoring, surveys, and habitat protection and restoration;
- prevent and control invasive species and nuisance wildlife; and
- develop partnerships with federal, state, and local agencies and NGOs to implement wildlife monitoring and protection programs.

3.2.1 General Fish and Wildlife Management

The Sikes Act provides for cooperation by the DoD with the USFWS and state wildlife agencies in planning, development, and maintenance of fish and wildlife resources on military installations and requires the cooperative development and implementation of an INRMP on installations with sufficient resources. The MBTA, BGEPA, ESA, Lacey Act, and Magnuson–Stevens Fisheries Conservation and Management Act are other statutes that relate to fish and

wildlife management. The SERE School is located in a rural, undeveloped area of Maine, and has a significant amount of undeveloped acreage and aquatic habitat. Therefore, the SERE School offers ample opportunities for fish and wildlife management. Special fish and wildlife management measures also must include protection for rare, threatened, endangered, or special concern wildlife species.

In 2001 and 2002, Congress established the Wildlife Conservation and Restoration Program and State Wildlife Grant Program. These programs were developed to provide financial assistance to state and tribal fish and wildlife entities for the conservation of a multitude of wildlife species, including threatened and endangered species. Prior to these programs, there was little financial assistance available to states for conservation efforts targeting non-game wildlife species. In order to be eligible for federal grants and to adhere to the requirements for participating in the State Wildlife Grant program, each state was required to develop and submit for approval a statewide wildlife action plan or similar plan by October 2005. The purpose of these plans is to summarize the abundance and distribution of each state's wildlife resources and to identify species of greatest conservation need (SGCN), threats to SGCN, and key habitats throughout the state. In addition, the plans include conservation actions designed to address threats to SGCN. To meet the statewide wildlife action plan requirement, Maine developed a Comprehensive Wildlife Conservation Strategy in 2005, which provides a broad strategy for coordinating conservation efforts for Maine wildlife. In addition, the Comprehensive Wildlife Conservation Strategy fosters coordination among conservation partners for prioritizing individual and collaborative conservation efforts (MDIFW 2005).

This INRMP supports various activities and strategies described in the Comprehensive Wildlife Conservation Strategy including protecting essential habitat for rare, threatened, endangered, and special concern species such as Atlantic salmon, Canada lynx, and waterfowl; regular inventorying of flora and fauna species; limiting the use of chemical pesticides and fertilizers; preventing erosion and sedimentation; and pursuing regional conservation partnerships.

Information on Maine's Comprehensive Wildlife Conservation Strategy can be found at: *http://www.maine.gov/ifw/wildlife/groups_programs/comprehensive_strategy/table_contents.htm*.

Several recently completed surveys for mammals (including bats), birds, herpetofauna, and fish provide baseline data for the fish and wildlife associated with the Installation and fauna use of Installation habitats. Completion of an invertebrate survey also is planned for the INRMP plan period. The USFWS and MDIFW are consulted on survey protocols as needed. The objective for inventorying and monitoring fauna at the SERE School is to assure long-term mission accomplishment and ecosystem sustainability, and to assist the Navy in moving towards an ecosystem management approach to managing the natural resources at the SERE School.

☞ **Project 22:** Conduct baseline surveys to assess the presence of mammals and invertebrates at the SERE School. Survey methods should yield a comprehensive species list and representative data for the diversity and relative abundance of the mammal and invertebrate species occurring at the SERE School.

☞ **Project 23:** Conduct a deer population survey to determine if populations would support development of a hunting program at the SERE School.

☞ **Project 24:** Using the results of the baseline mammal survey (Project 22) and deer population survey (Project 23), work with the SERE School Command to determine if a hunting program can be developed for the SERE School.

The DoD PARC program is voluntary, proactive, and non-regulatory. DoD PARC focuses on habitat and species management inventory, research, and monitoring, as well as education, outreach, and training. To date, Navy installations within the NAVFAC Field Engineering Command Washington, Mid-Atlantic, Mid-West, and Northwest areas of responsibility have been surveyed for herpetofauna as part of this program. Once all the updated species lists are completed, they will be entered into a database that will be stored on the Navy Environmental Portal (https://eprdev.dandp.com/eprwebnet/Logon.aspx). The database will serve to fill numerous needs in the community. Many of the installations lack an accurate and up-to-date list of herpetofauna species found therein. With data calls, INRMP updates, and other relevant planning documents needed to support Navy projects and missions, it is essential that the most accurate species occurrence data be available on which to base natural resources management decisions.

3.2.2 Fisheries and Aquatic Species Management

A fish and habitat survey conducted at the SERE School in 2013 determined that the Installation contains a healthy and adequate fish population that would support development of a catch and release fishing program. If approved by the SERE School OIC, the NRM will develop a fishing instruction for SERE School personnel that includes MDIFW fishing regulations and catch and release size limits. Section 3.4.2 *Outdoor Recreation Management* provides additional information on development of a fishing program for the SERE School.

The following INRMP projects will provide benefit to the fisheries and aquatic resources of the Installation.

☞ **Project 6:** A water quality baseline inventory, to include inventory of surface waters that may support Atlantic salmon, shall be designed and implemented for the SERE School in accordance with existing Navy water quality monitoring protocols. Specific protocols for the SERE School shall be established to assure that water quality does not drop below natural levels and is maintained to provide quality habitat for Atlantic salmon.

☞ **Project 12:** Conduct a comprehensive vernal pool survey of the SERE School using MDIFW protocols. Survey should include identification of all potential vernal pools using a combination of desktop review and site visits to ground-truth and survey each potential vernal pool. Survey should be conducted during the appropriate survey window as determined by MDIFW to record evidence of use by breeding, obligate vernal pool species. Recording unique features of the pools, photographic documentation, and GIS mapping of each pool also should be conducted.

☞ **Project 25:** Work with the SERE School OIC to develop a fishing instruction for the SERE School to include restrictions, MDIFW fishing regulations, and catch and size limits.

In addition to these projects, identification and remediation of active erosion areas as described in Section 3.1.1.3 *Water Quality Management* will improve water quality and habitat for aquatic fish and wildlife.

3.2.3 Rare, Threatened, Endangered, and Special Concern Fish and Wildlife Species Management

3.2.3.1 Endangered Species Act of 1973

The primary regulatory protection for threatened and endangered species on federal lands is the ESA of 1973 (16 USC §1531 et seq.). The federal ESA is intended to serve as a mechanism for conservation of ecosystems upon which threatened and endangered species depend, as well as provide programs for species conservation that reduces their potential for becoming extinct. The ESA is administered by the USFWS (terrestrial and freshwater wildlife) and NMFS (marine species). Section 7 of the ESA requires all federal agencies, in consultation with USFWS or NMFS, to use their authority to further the purpose of the ESA and to ensure that their actions are not likely to jeopardize the continued existence of listed species as a result of destruction or adverse modification of critical habitat.

When the USFWS initiated a court-ordered effort to designate critical habitat for all federally listed species, the DoD became concerned that the designation of critical habitat on military lands would add an excessive amount of burden (through administrative compliance and consultation requirements) on military installations, with limited benefit afforded to listed species (Benton et al. 2008). In defense, the DoD argued that it was currently providing extensive protection to listed species through the formal consultation process with the USFWS and via conservation measures specified in installation INRMPs. To address this, the Defense Authorization Act for fiscal year 2004[1] granted the USFWS specific authority to exempt DoD lands from the designation of critical habitat, provided a comprehensive and approved INRMP was in effect, the INRMP specifically addressed the conservation of species under consideration, and the INRMP was implemented. Specifically, Section 4(a)(3)(B)(i) of the ESA (16 USC §1533(a)(B)(i)) states:

> "The Secretary shall not designate as critical habitat any lands or other geographical areas owned or controlled by the Department of Defense, or designated for its use, that are subject to an integrated natural resources management plan prepared under Section 101 of the Sikes Act (16 USC §670 et

[1] National Defense Authorization Act (2004), Section 318, see http://www.dod.mil/dodgc/olc/docs/2004NDAA.pdf.

> seq.), if the Secretary determines in writing that such plan provides a benefit to the species for which critical habitat is proposed for designation."

On 12 May 2014 a new federal rule (50 CFR §424.12(h)) was proposed by USFWS and NMFS (79 FR 27066), which would allow USFWS and NMFS to consider certain factors when determining whether a military installation's approved INRMP provides sufficient benefit to warrant exemption under Public Law 107-314, 02. INRMP factors include: (1) the extent of area and features present; (2) the type and frequency of use of the area by the species; (3) the relevant elements of the INRMP in terms of management objectives, activities covered, and best management practices, and the certainty that relevant elements will be implemented; and (4) the degree to which the relevant elements of the INRMP will protect the habitat from the types of effects that would be addressed through destruction-or-adverse modification analysis. This proposed ruling was still under review as of January 2015.

3.2.3.2 Maine Endangered Species Act

The Maine ESA was passed by the Maine Legislature in 1975, and the Commissioner of the MDIFW is designated with the authority to oversee its implementation. Currently, 33 species of fish and wildlife are listed as endangered or threatened under the Maine ESA; plants are not covered. Although the federal ESA considers species status as part of a national or range-wide perspective, Maine's ESA protects only those species that are vulnerable to disappearing within Maine to ensure that native species native to Maine continue to survive. Progress of Maine's ESA Program is reported annually in the Wildlife Division Research and Management Report prepared by MDIFW. This annual report will be referenced to obtain the most up-to-date information for species listed under Maine's ESA.

The MDIFW's Wildlife Division Research and Management Report is available online at: *http://www.maine.gov/ifw/wildlife/surveys_reports/research_management/index.htm*.

In addition to state listings of endangered and threatened species, MDIFW also maintains a list of species of special concern in the state. Maine species of special concern are any species of fish or wildlife that does not meet the criteria of an endangered or threatened species, but is particularly vulnerable and could easily become listed as endangered or threatened, or become extirpated due to restricted distribution, low or declining numbers, specialized habitat needs or limits, or other factors (MDIFW 2011a). Special concern species are established by policy, not by regulation, and are identified for planning and informational purposes, as they are not legally protected by the Maine ESA. MDIFW reviews and revises the list of special concern species at the beginning of each calendar year, as appropriate and based on criteria in the Maine Endangered and Threatened Species Listing Handbook (MDIFW 2009).

3.2.3.3 Species Protected by Federal and Maine Endangered Species Acts

One federally listed mammal species (northern long-eared bat) has been identified at the SERE School. Northern long-eared was listed as threatened under the federal ESA in April 2015. Bicknell's thrush also is known to occur at the Installation, and this species is currently under federal review to determine if federal ESA listing is warranted. Both of these species are considered species of special concern in Maine. Other Maine special concern species have been

observed at the Installation (see Appendix G *SERE School Flora and Fauna*, Table G-5); however, as discussed in Section 3.2.3.2 *Maine Endangered Species Act* Maine special concern are identified for planning and informational purposes, and are not legally protected by the Maine ESA. Black-crowned night heron, a Maine threatened species, is the only state listed species that has been observed at the Installation.

To adequately assess the status of rare, threatened, endangered, and special concern species at the Installation, focused surveys for species with the potential to occur within the appropriate season(s) is recommended. In the event additional federal and/or state listed species are identified at the SERE School, the Installation will cooperate with the USFWS and/or MDIFW to develop management strategies that would avoid, to the extent practicable, disturbance conflicts, habitat deterioration, and loss of habitat. If wildlife species that have the potential to occur at the Installation are added to the federal and/or state list of threatened or endangered species, an inventory to identify the presence and condition of the species and suitable habitats at the Installation would be required to determine presence or likelihood of occurrence at the SERE School.

- ☞ **Project 26:** Conduct periodic surveys during the appropriate season for rare, threatened, endangered, and special concern mammal species known or with the potential to occur at the Installation.
- ☞ **Project 27:** Conduct periodic surveys during the appropriate season for rare, threatened, endangered, and special concern bird species known or with the potential to occur at the Installation.
- ☞ **Project 28:** Conduct periodic surveys during the appropriate season for rare, threatened, endangered, and special concern invertebrate species known or with the potential to occur at the Installation. Survey should include terrestrial and aquatic invertebrate species and habitats that support these species, and identification of habitat that directly supports pollinators.

The USFWS failed to include Maine on its list of Critical Habitat for Canada lynx in 2006 (50 CFR Part 17); however, in 2009 the USFWS issued revised Critical Habitat designations for the Canada lynx to include portions of Aroostook, Franklin, Penobscot, Piscataquis, and Somerset counties, Maine (74 FR 8616-8702). The SERE School is not located within the federally-designated Critical Habitat for this species. No observations of Canada lynx activity have been made at the SERE School; however, potential lynx habitat and its primary prey, the snowshoe hare, exist at the Installation. The MDIFW conducted an over-winter ecoregional lynx track survey on SERE School lands in 2005 and no tracks were observed. Winter surveys conducted in February 2014 and 2015 also did not document winter usage of the Installation by Canada lynx. Although there is no documented evidence of Canada lynx on the SERE School property, there have been records of the species in neighboring townships and it is conceivable that this animal could occur at the Installation. The proposed development of a forest management plan (Project 11) should provide additional data necessary to improve ecosystem management of this species, including potential habitat improvements.

Recent correspondence with USFWS and a fish survey of the SERE School indicate that Atlantic salmon is unlikely to occur due to potential barriers located downstream from the Installation, as well as the low potential for existing populations to expand their range to the SERE School. Although it is unlikely that Atlantic salmon will occur at the SERE School, operational activities have the potential to affect potential Atlantic salmon habitat located at and downstream of the Installation. Currently no wild populations of Atlantic salmon occur in the Kennebec River Watershed; however, there is an ongoing effort to restore the Atlantic salmon population within the Sandy River, which is located approximately 5 mi (9 km) south of the Installation, through an annual egg planting effort that was initiated in 2009 (Fleming 2012).

The SERE School property has been excluded from the Atlantic salmon Critical Habitat designation, as this INRMP provides adequate management for Atlantic salmon as required by Section 4(a)(3)(B)(i) of the ESA (16 USC §1533(a)(B)(i)). Because the SERE School is located adjacent to designated Critical Habitat for Atlantic salmon, INRMP activities that protect and improve water quality will contribute to protection of potential Atlantic salmon habitat. Measures to prevent erosion and sedimentation into waterbodies, and wetland protection efforts described in Section 3.1.1 *Water Resource Management* will provide an indirect benefit to Atlantic salmon and designated Critical Habitat located downstream of or immediately adjacent to the Installation. The water quality protection measures and BMPs (such as erosion and sediment control, wetland protection, monitoring of nonpoint source pollution, and protection of watersheds from hazardous materials) also will indirectly benefit Atlantic salmon.

- ☞ **Project 29:** Work with the MDIFW to develop and implement an Atlantic salmon habitat protection program.

- ☞ **Project 30:** The Navy will work with USFWS and the MDIFW to determine whether the Redington Pond dam should be removed to improve on and offsite habitat conditions for native fish species, including Atlantic salmon.

In addition to these projects, identification and remediation of active erosion areas as described in Section 3.1.1.3 *Water Quality Management* will improve water quality and habitat for Atlantic salmon.

Potential habitat for the eastern small-footed bat, northern long-eared bat, and little brown bat exists at the SERE School. Bat acoustic data collected in 2013 and 2014 indicates the presence of northern long-eared bat, little brown bat, tri-colored bat, and silver haired bat. Other bat species with the potential to occur include hoary bat, eastern red bat, and big brown bat. As discussed in Section 2.4.7 *Rare, Threatened and Endangered Fish and Wildlife Species*, USFWS listed the northern long-eared bat as threatened under the federal ESA in April 2015. Acoustic data collected as part of recently completed bat monitoring surveys conducted in 2013 and 2014 will be used to further refine identification of *Myotis* spp. and other bat species that occur at the Installation. Mist net surveys conducted in July 2015 did not result in captures of Northern long-eared bats. Additional survey work is required to effectively document NLEB presence and use of installation habitats.

Additional surveys recently completed in 2014 include winter track counts, spring and fall raptor migration, breeding bird, and bat acoustic and mist-netting surveys, will provide needed baseline data for wildlife that utilize the Installation. Data collected during these surveys are included in Appendix G *SERE School Flora and Fauna* as relevant, and a copy of finalized survey reports are included in Appendix E *SERE School Biological Surveys*.

Although golden eagle has not been observed at the Installation, cliff habitat that would support this species is located at the SERE School. Continued monitoring and habitat protection is recommended for this state endangered species (Navy 2007). BGEPA standards should be followed if golden eagles are observed utilizing or nesting on the Installation. Migrating raptor surveys recently completed in the fall of 2013 and the spring of 2014 documented raptor migratory patterns at the Installation. Bird data collected during these surveys are included in Appendix G *SERE School Flora and Fauna* as relevant, and a copy of the finalized survey reports is included in Appendix E *SERE School Biological Surveys*.

☞ **Project 31:** Conduct periodic golden eagle monitoring within suitable habitat at the SERE School. If golden eagle nest locations are identified, GPS information for nest locations will be will be shared with the cooperating natural resource agencies (i.e. USFWS, MDIFW) as appropriate.

The yellow nose vole was formerly managed for; however, this species is no longer identified with any special status ranking federally or in the State of Maine. The species is an interesting and unique component of Maine's mammal fauna, inhabiting exposed, moss-covered bedrock ledges with blocky talus littering the immediate down-slope area. These areas are often wet or damp from seeps and ground water. Although the species is not listed under the federal or state ESAs, management of rare, threatened, endangered, and special concern species and their habitats will indirectly benefit this species.

3.2.3.4 Migratory Bird Management

Migratory birds are a large, diverse group of birds that utilize breeding grounds in the United States and Canada and overwinter in southern North America, Central and South America, the West Indies, and the Caribbean. The MBTA is the primary legislation in the United States established to conserve migratory birds. The MBTA prohibits the taking, killing, or possessing of migratory birds, their eggs, parts, and nests unless permitted by regulation. Nonnative species such as house sparrow, European starling, rock pigeon (*Columba livia*), and mute swan (*Cygnus olor*) are not protected by the MBTA.

The Final Rule on Take of Migratory Birds by the Armed Forces (50 CFR Part 21) allows for the incidental take of migratory birds by DoD during military readiness activities, provided a permit authorizing such activities has been received. Military readiness activities include all training and operations of the Armed Forces that relate to combat, and the adequate and realistic testing of military equipment, vehicles, weapons, and sensors for proper operation and suitability for combat use. Military readiness does not include the routine operation of installation support functions, such as administrative offices, military exchanges, commissaries, water treatment facilities, storage facilities, schools, housing, motor pools, laundries, Morale, Welfare, and Recreation activities, shops, mess halls; the operation of industrial activities; or the construction

or demolition of facilities listed above (72 FR 8931). To address the unintentional take of migratory birds as a result of activities necessary to support the military mission an MOU was adopted between the DoD and the USFWS, as required by EO 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds*, on 31 July 2006 (Benton et al. 2008). This MOU allows the military to obtain permits for the "unintentional take" of a migratory bird if it is in support of a military readiness operation (Benton et al. 2008). The procedures contain significant safeguards to ensure that the taking of birds is minimized when the new rule is used and that conservation measures are employed to compensate for the losses that may occur.

As part of the 1988 amendment to the Fish and Wildlife Conservation Act (16 USC §2901-2911) the USFWS is required to identify species, subspecies, and populations of all nongame migratory birds that, without additional conservation actions, are likely to become candidates for listing under the ESA of 1973. The goal envisioned by the USFWS in identifying BCC species for each established BCR is to stimulate the implementation of coordinated, proactive management and conservation actions among federal, state, tribal, and private partners to prevent these species from being listed under the ESA. Additionally, the BCR lists are intended to assist federal land-managing agencies and their partners in their efforts to abide by the bird conservation principles embodied in the MBTA and EO 13186 (USFWS 2008b).

Specific wildlife surveys that will provide benefit to migratory birds include surveys for migrating raptors (completed in 2014), breeding bird (2014), and golden eagle monitoring (planned) as described in Section 3.2.3.3 *Species Protected by Federal and Maine Endangered Species Acts*. Avian data collected during these surveys is included in Appendix G *SERE School Flora and Fauna*, Table G-3, and copies of the survey reports are included in Appendix E *SERE School Biological Surveys*.

Installation high elevation area
Source: I. Trefry

HEBS results for the SERE School identified Bicknell's thrush at elevations of around 2,700 ft (823 m) or above. Based on HEBS data collected at the SERE School and survey results from surrounding Mountain Birdwatch survey routes, SERE School activities conducted below an elevation of 2,700 ft (823 m) in support of the military mission would not be expected to impact Bicknell's thrush (Navy 2013c).

Rusty blackbird, a species of special concern in Maine (MDIFW 2011a), is considered one of North America's most rapidly declining species (Cornell Lab of Ornithology n.d. b). The population has plummeted by an estimated 85–99% over the past 40 years and scientists have been unable to determine the cause.

☞ **Project 32:** Establish a partnership with the Maine and National Audubon Society chapters to conduct surveys and monitoring of rusty blackbird populations at the SERE School.

The American woodcock is a medium-sized shorebird with short and bluntly rounded wings and a long bill. The coloring is a brown and black concealing pattern and is dimorphic for the species (similar for males and females). American woodcock are one of the few shorebirds that are regularly hunted for sport. The management objective of the USFWS with regards to the American woodcock is to increase populations of the species to levels consistent with the demands of consumptive and non-consumptive uses. Both short-term (2011–2012) and long-term (1968–2012) trends have been identified in American woodcock populations in Maine and other parts of the northeast and midwestern U.S. The American woodcock prefers forested habitats with openings and shrubby areas, open woodlands, and moist overgrown fields from southern Canada to the Gulf Coast (Cooper and Rau 2012). The USFWS developed a management plan for the species in 2008 that includes several recommendations, such as forest management to ensure that early succession habitat is maintained for the protection of the species. Although the American woodcock has not been observed at the SERE School, potential habitat for the species exists at the Installation. The slow drainage of Redington Pond is causing the pond to slowly be overcome by wetland vegetation and will cause the pond to transition to freshwater marsh habitat overtime. Therefore management measures, such as habitat conservation and migratory bird monitoring, should be taken to benefit this and other migratory bird species that use or could use the Installation (USFWS 2008b). An analysis of historical changes in the outline of Redington Pond, based on available aerial imagery, vegetation monitoring, and establishment of a water level gauge at Redington Pond is scheduled to be completed in 2015.

3.2.4 Invasive and Nuisance Wildlife Species Management

Beaver dam

Source: S. Watts

The Naval Installations Maine Consolidated IPMP (NAVFAC Atlantic 2012) provides a comprehensive planning and operational tool that establishes the strategy and methods for conducting a safe, cost-effective, and environmentally sound pest control program for Northern Maine Installations through IPM. The plan stresses an IPM approach to pest management and includes limited pesticide and herbicide treatment of materials, self-help programs for installation personnel, information notices on pest management practices, habitat modification, and mechanical controls for pest removal. The PWD-ME Pest Management Coordinator is responsible for implementation of the IPMP and handles the majority of complaints regarding pest control or nuisance wildlife at the SERE School. Pest management is performed by contract personnel through a contract issued by the Facilities Engineering and Acquisition Division. The contracting officer at Portsmouth Naval Shipyard is responsible for preparing contracts to support the pest control mission. Contract personnel must meet state certification requirements and adhere to state and federal laws and regulations. The objectives of the pest management program are the prevention of pest-related health and safety

issues that affect the mission; the protection of government property, material, and aesthetics; and the reduction in the use of and dependence on pesticides. The IPMP includes specific management instructions for general household and nuisance pests, grounds maintenance, invasive and non-indigenous species, aquatic weeds, structural pest, stored product pests, health related pests, rodents, birds, and feral cats (NAVFAC Atlantic 2012).

Moose crossing road near Installation
Source: I. Trefry

Nuisance wildlife can be a problem at the SERE School, particularly beaver, bats, moose, and bear, which are found throughout the property. As discussed in Section 2.4.6, *Invasive and Nuisance Wildlife Species* beavers inhabit locations throughout the SERE School and the resulting ponds can have negative impacts on nearby roads. Beaver dams also may affect water drainage, impede water flow, and affect water quality. The Navy will coordinate with MDIFW to develop a plan/strategy that outlines methods to address beaver issues that may be impacting Installation infrastructure. Corrective actions are to be undertaken and beaver populations should be managed where their activity interferes with public works facilities (e.g., roads and culverts) or compromises water resources. Although a hunting program does not currently exist at the SERE School, beaver trapping is allowed as required for management purposes. All beaver control work shall occur in conjunction with the MDIFW. If possible, nuisance beaver shall be relocated to a different watershed. Moose is another nuisance wildlife species and health and safety concern, as they are attracted to the interior of a salt storage shed located at the SERE School. Deer and moose crossing roads also pose a safety hazard for drivers of vehicles travelling on Installation and regional roadways.

- ☞ Routine monitoring of nuisance wildlife identified at the SERE School should be conducted to determine if nuisance wildlife removal or relocation actions are necessary to protect natural resources and/or human health and safety. The White-nose Syndrome Conservation and Recovery Working Groups, "Acceptable Management Practices for Bat Control Activities in Structures - A Guide for Nuisance Wildlife Control Operators" prepared by the. U.S. Fish and Wildlife Service shall be followed when dealing with bats in structures. A copy of this manual can be found in Appendix L.**Project 33:** Conduct biannual monitoring, or more frequently as needed, of invasive and nuisance wildlife including beavers, bats, moose, and bear to determine whether wildlife removal, relocation, or other remedial actions are necessary to protect natural resources and/or human health and safety.

- ❖ If any injured or disoriented deer, moose, or other stray animal is observed at the Installation, the MDIFW Regional Fish and Wildlife Office should be immediately contacted for assistance. The Regional Fish and Wildlife Office for the SERE School region is located in Strong, Maine (Region D). Fisheries issues should be directed to (207) 778-3322 and wildlife issues directed to (207) 778-3324.

3.2.5 Partnerships and Outreach

Partnerships that address and promote regional collaboration with other installations, federal and state agencies, NGOs, and universities can provide valuable resources in the management of natural resources.

Potential climate change impacts to fish and wildlife of the region include changes in precipitation, temperatures, and significant aquatic events such as intense rain, spring flooding, and droughts. Climate change will likely lead to significant changes in Maine's overall assemblage of plants and animals, as indicated by altered species distribution, migration patterns, and breeding behaviors (Jacobson et al. 2009). The importance of partnerships in addressing climate change impacts is discussed in Section 3.1.11 *Partnerships and Outreach*. The following INRMP projects will facilitate partnerships and outreach activities that will contribute to fish and wildlife management activities at the SERE School.

- ☞ **Project 14:** Establish partnerships with state and federal agencies, NGOs, and/or universities to promote the conservation and study of natural resources at the SERE School. Potential partners include the North Atlantic LCC, National and Maine Audubon Society chapters, IBP, TNC, The Wilderness Society, and the Vermont Center for EcoStudies.
- ☞ **Project 15:** Conduct a climate change vulnerability assessment in partnership with other DoD installations, federal and state agencies, NGOs, and/or universities. The assessment should focus on future climate change projections, the impacts of altered species' distribution patterns, and variations in ecological processes such as drought, fire, and flood for Navy installations located in Maine.

The North Atlantic LCC represents a partnership among various federal agencies working to address regional threats to natural resources and cultural heritage. Several key management challenges identified include fish and wildlife response to climate change, habitat fragmentation, protection of migratory fish and waterfowl, water availability for humans and ecosystems, water quality, and wildlife disease. For more information*: http://www.northatlanticlcc.org/*

A Climate Change Vulnerability Index for Northeast species is being developed by NatureServe and State Heritage Programs, which will enable resource managers to rapidly assess species' vulnerability to climate change. For more information:
http://www.northatlanticlcc.org/projects/completing-northeast-regional-vulnerability-assessment-incorporating-the-natureserve-climate-change-vulnerability-index

In addition to the DoD PARC program described in Section 3.2.1 *General Fish and Wildlife Management*, the Navy is one of the major participants in DoD Partners in Flight (PIF). PIF functions to direct resources for the conservation of land birds and their habitats through cooperative efforts in the areas of monitoring, research, management, and education. One of the prime focus areas of PIF in the northeast is the conservation of high elevation birds. Bicknell's thrush, a high elevation bird, and USFWS BCC species and Maine special concern species, has been placed on PIF's U.S.–Canada watch list for birds that are most vulnerable at a continental scale within these two countries. This is due to a combination of small and declining populations, limited distributions, and high threats throughout their ranges (Panjabi et al. 2012). The

Installation contains several areas that support Bicknell's thrush and other high elevation birds. Allowing partners to conduct limited research will further the SERE School's efforts to determine the conservation status of high elevation birds and other bird species in the Northeast, such as rusty blackbird, and to collect important data that can be used towards improving management for these species.

3.2.6 Conservation Law Enforcement

The Sikes Act requires that natural resources law enforcement be provided on military lands (Benton et al. 2008). The DoD has developed a very general law enforcement policy in DoDI 4715.03; however, comprehensive DoD law enforcement policy is lacking and each branch of the military has historically addressed the subject individually on an installation-by-installation basis. This has included a variety of law enforcement options including employment of civilian game wardens, military police, or combinations of civilian game wardens and military police. Currently the DoD does not have a standard for law enforcement training, firearms, or civilian job descriptions. Although the U.S. Marine Corps has developed a standard law enforcement policy, and the USAF is making strides to develop a similar program, a standard DoD policy on natural resources law enforcement has yet to be developed.

Public access at the SERE School is restricted to military personnel and authorized guests. The SERE School does not employ or warrant employment of security or law enforcement staff, If law enforcement assistance is needed for domestic issues, the local police department located in Rangeley, Maine will be contacted. The objective of the law enforcement program on the Installation is to ensure that compliance with the INRMP and applicable laws is achieved relative to:

- public trespassing and encroachment;
- recreational use; and
- regulatory compliance for construction and associated development activities.

Trespassing is a concern at the SERE School as well as encroachment from logging activity. It is imperative that the boundary of the SERE School be clearly marked and maintained. At a minimum, the Navy Real Estate Office should blaze (paint) the boundary line and install signage ("U.S. Navy Property – No Trespassing") to deter trespassing at the Installation. Once installed, the Navy Real Estate Office should conduct routine maintenance inspections of the boundary signs.

Hunting and fishing programs are not currently in place at the SERE School; however development of these programs is being considered. If these programs are authorized and implemented participants would be required to adhere to state and federal hunting and fishing regulations, as well as Navy policy and instruction.

Compliance with applicable environmental laws and regulations is required for all construction and associated activities. Because of the remoteness of the site, the NRM must rely on SERE School personnel, both civilian and military, and contract inspectors to ensure that these laws are being complied with.

Any known violations of Navy policy or local, state, or federal law will be reported to the Environmental Office immediately for action.

3.2.7 Environmental and Natural Resources Training

Training of environmental staff also is applicable to fish and wildlife management at the SERE School. Training of environmental staff is described under the Land Management Programmatic Objective in Section 3.1.12 *Environmental and Natural Resources Training* and includes conservation biology training that is applicable to fish and wildlife management. Other environmental and natural resources training activities should be undertaken, as needed, to ensure that environmental staff are prepared to handle any fish and wildlife management issues that may occur.

- ☞ **Project 16:** Develop an environmental awareness program focused on educating and training SERE School and PWD-ME personnel on protection of natural resources topics including implementing BMPs for erosion control and trail maintenance, wetland protection, management of nuisance wildlife, and protection of rare, threatened, endangered, and special concern plant and wildlife species known to occur.
- ☞ **Project 19:** Provide professional training for PWD-ME environmental staff to include Field Techniques for Invasive Plant Management, Conservation Biology (both courses offered at the USFWS NCTC), and Pest Applicator Certification Training (offered by the Armed Forces Pest Management Board).

3.2.8 GIS Management, Data Integration, Access, and Reporting

GIS management and data integration, access, and reporting also are applicable to fish and wildlife management at the SERE School. GIS management is described under the Land Management Programmatic Objective in Section 3.1.13 *GIS Management, Data Integration, Access, and Reporting*.

- ☞ **Project 20:** Work with the NAVFAC Mid-Atlantic GeoReadiness Center to develop a GIS system for storing SERE School natural resources data.
- ☞ **Project 21:** Provide training to environmental staff to maintain the SERE School GIS database.

3.3 FOREST MANAGEMENT

OPNAV M-5090.1 (Navy 2014) defines forest management as those actions designed for the production and sale of forest products and for maintaining the health and vigor of forest ecosystems. Actions include timber management, forest administration, timber sales, reforestation, afforestation, timber stand improvement, timber access road construction and maintenance, forest protection, and other directly related functions.

The overall goal of forest management at the Installation is to allow for natural forest succession and mature forest growth. There are no plans for conducting forest thinning, stand improvement, or active fire management at the Installation; however, the INRMP in no way limits the ability of

SERE School Command's or the NRP's ability to utilize forest management techniques to implement or improve mission requirements or meet NRP goals.

Forest management at the SERE School for this plan period includes:

- general forest management including mature tree stands protection, impact avoidance for tree species that provide important forage for birds and other wildlife, forest characterization and management, monitoring for forest pests and disease;
- environmental and natural resources training;
- and GIS management, data integration, access, and reporting.

Forest Management Programmatic Objectives

The following programmatic objectives have been established for forest management at the SERE School.

- protect and promote sustainable management of forest resources;
- manage forest habitats to promote use by trainees and a diverse range of wildlife species, including protection of trees that include edible parts, mature tree stands and snags, and protection of tree species that provide suitable nesting, roosting, and foraging habitat for wildlife;
- manage forest habitats to maintain wildlife travel corridors, streamside protection, and aesthetic buffer zones;
- maintain forest habitats to enhance plant community diversity;
- maintain forest habitats to ensure consistency with an ecosystem approach to forest management;
- manage forest habitats to reduce risk of wildfire in consideration of the military mission and safety of Navy personnel in accordance with the SERE School Wildland Fire Management Plan; and
- monitor forest resources for pests and disease.

3.3.1 General Forest Management

The primary objective of forest management at the SERE School is to sustain dense forest conditions and adequate supplies of naturally occurring survival foods. Currently insect and disease damage to forest resources are not a problem. Management of forest resources will be provided through updates of the Installation forest data and development of a forest management plan. An MOU between the DoD and USFS Health Protection (USDA and DoD 1990) allows the DoD to task the USFS to survey the SERE School and fund suppression projects as appropriate.

The USDA Forest Service Forest Health Protection's mission is to protect and improve the health of America's rural, wildland, and urban forests. The Forest Health Protection provides technical assistance on forest health-related matters, particularly those related to disturbance agents such as native and non-native insects, pathogens, and invasive plants. More information on the Forest Health Protection can be found at: *http://www.fs.fed.us/foresthealth/*.

- **Project 11:** Upon completion of the updated forest characterization assessment (see Project 34), a forest management plan will be developed in coordination with the Maine Forest Service to include management of dense forest conditions (including salvage of downed trees and debris for firewood, timber sales, and reducing the risk of wildland fire), identification of areas containing abundant edible plants, and management of forest resources in response to natural disturbances. During their review of this INRMP, the USFWS Umbagog NWR also expressed interest in providing guidance and recommendations to the Navy for development and implementation of the forest management plan.

- **Project 34:** Conduct an update of the 1998 basic characterization for SERE School forest types. The updated forestry survey should include delineation of each stand type, which is an easily defined area of the forest containing the same species mixture with similar heights, ages, diameters, densities, soils, health, or other unifying characteristics (MDACF, Maine Forest Service 2012). Data collected during the field assessment should include dominant and common tree species, sizes, age class, absolute density, soils, topography, key habitat features, and any other distinctive features.

Successional forest habitat

Source: I. Trefry

There are no current plans for active timber harvesting at the SERE School. The current forest conditions effectively support the mission requirements of the SERE School. The dense forest cover is important in the delivery of evasion scenarios, and the current vegetation provides adequate habitat that enables students to live off plants and animal life. Active forest management on the property is presently limited to the Forest Management Programmatic Objectives described above in Section 3.3 (Forest Management).

Although this forest system, unaltered by human intervention in the recent past, undergoes large alterations, sometimes very quickly, it can be thought of as resilient, maintaining its character

over many centuries. Conditions at any given site may change abruptly, but the system is usually a mosaic of patches at differing stages of the cycle (Ludwig et al. 1997).

When considered as a whole, the forest system maintains considerable diversity. These natural disturbances and successional changes are expected to be fully compatible with the military mission. As described above, a forest management plan will be developed to monitor the health of the forest and stability of ecosystems over time (Project 11). The monitoring program will involve a semiannual inventory of forest conditions for signs of pest and/or disease outbreaks and other issues. The plan also should provide additional data for improving ecosystem management at the Installation, including improving habitat for Canada lynx. Work will be conducted by contractors or in-house by the NRM.

Dead and downed trees are available as firewood along the roads of the SERE School. Removal of this material serves the purpose of providing heat and fuel, as well as improving the fire break capacity of the roads and increasing safety through the reduction of hazardous trees.

The USDA Eastern Forest Environmental Threat Assessment Center provides images, distribution maps, contact information, and brief and detailed descriptions about specific forest threats in the eastern U.S. The Forest Threat Summary Viewer is available at: *http://forestthreats.org/threatsummary.*

3.3.2 Partnerships and Outreach

Partnerships that address and promote regional collaboration with other installations, federal and state agencies, NGOs, and universities can provide valuable resources in the management of natural resources.

Potential climate change impacts to forest resources of the region include shifting geography for individual tree species, changes in overall wood availability, and changes in the timing of forest operations (Jacobson et al. 2009). The importance of partnerships in addressing climate change impacts is discussed in Section 3.1.11 *Partnerships and Outreach*. The following INRMP projects will facilitate partnerships and outreach activities that will contribute to forest management activities at the SERE School.

- **Project 14:** Establish partnerships with state and federal agencies, NGOs, and/or universities to promote the conservation and study of natural resources at the SERE School. Potential partners include the North Atlantic LCC, National and Maine Audubon Society chapters, IBP, TNC, The Wilderness Society, and the Vermont Center for EcoStudies.
- **Project 15:** Conduct a climate change vulnerability assessment in partnership with other DoD installations, federal and state agencies, NGOs, and/or universities. The assessment should focus on future climate change projections, the impacts of altered species' distribution patterns, and variations in ecological processes such as drought, fire, and flood for Navy installations located in Maine.

3.3.3 Environmental and Natural Resources Training

Training of environmental staff, described under the Land Management Programmatic Objective in Section 3.1.12 *Environmental and Natural Resources Training*, also is applicable to forest management at the SERE School. Other environmental and natural resources training activities should be undertaken, as needed, to ensure that environmental staff are prepared to handle any forest management issues that may occur.

- ☞ **Project 16:** Develop an environmental awareness program focused on educating and training SERE School and PWD-ME personnel on protection of natural resources topics including implementing BMPs for erosion control and trail maintenance, wetland protection, management of nuisance wildlife, and protection of rare, threatened, endangered, and special concern plant and wildlife species known to occur.
- ☞ **Project 17:** Provide periodic training for SERE School personnel and PWD-ME environmental staff regarding implementation of erosion and sediment control measures and use of effective BMPs. MDEP provides annual erosion and sediment control courses.
- ☞ **Project 19:** Provide professional training for PWD-ME environmental staff to include Field Techniques for Invasive Plant Management, Conservation Biology (both courses offered at the USFWS NCTC), and Pest Applicator Certification Training (offered by the Armed Forces Pest Management Board).

3.3.4 GIS Management, Data Integration, Access, and Reporting

GIS management and data integration, access, and reporting also are applicable to forest management at the SERE School. GIS management is described under the Land Management Programmatic Objective in Section 3.1.13 *GIS Management, Data Integration, Access, and Reporting*.

- ☞ **Project 20:** Work with the NAVFAC Mid-Atlantic GeoReadiness Center to develop a GIS system for storing SERE School natural resources data.
- ☞ **Project 21:** Provide training to environmental staff to maintain the SERE School GIS database.

3.4 Outdoor Recreation Management

OPNAV M-5090.1 (Navy 2014) requires INRMPs to address the appropriate level of public access for natural resources-based recreational opportunities consistent with installation security, military mission, and sustainable natural resources objectives. Installations are encouraged to develop their own programs and cooperate with federal, state, and private organizations to provide recreation opportunities for authorized military personnel and their guests.

Outdoor recreation management at the SERE School includes:

- public access;
- management of outdoor recreation opportunities for authorized DoD personnel and their guests, including evaluating the potential to implement a fishing and/or hunting program;

- education and outreach;
- environmental and natural resources training; and
- GIS management, data integration, access, and reporting.

Outdoor Recreation Management Programmatic Objectives

The following programmatic objectives have been established for outdoor recreation management at the SERE School.

- provide and promote outdoor recreation opportunities, including evaluation of development of hunting and fishing programs, as long as these do not conflict with the military mission or natural resources conservation;
- evaluate additional opportunities for natural resources-related outdoor recreation;
- promote educational awareness of Installation natural resources, including rare, threatened, endangered, and special concern species that are known to occur, and the importance of the Navy's natural resources stewardship efforts; and
- establish communication and/or partnerships with the AT Conservancy and National Park Service to ensure that the boundary between the AT and the SERE School is well-marked to reduce the risk of trespassing on Navy property by civilians using the AT.

3.4.1 Public Access

For the most part, access to the SERE School is limited to the military. Successful accomplishment of the military training is highly dependent upon a natural setting uninterrupted by the sights and sounds of humanity. Training occurs 23 weeks out of the year so there is limited opportunity for recreational pursuits. The safety of students and staff as well as the public are assured by the maintenance of the SERE School boundary and the prevention of trespassers from entering the property. Eliminating Redington Falls from the scenic waterfalls list published by the MAG will reduce the number of trespassers at the SERE School. In regards to the proximity of the AT in general and the risk of trespassing by non-Navy personnel, a permanent communication link should be established between the AT Conservancy, National Park Service, and the NRM.

Guest access to the Installation is limited to immediate family members and active and retired military personnel. Government liability extends only to military personnel; guests are not covered. On occasion, depending on the SERE School training schedule, civic groups such as the Boy Scouts shall be allowed access Redington Village for camping. This shall be on an extremely limited basis and at the complete discretion of the SERE School OIC.

3.4.2 Outdoor Recreation Management

The entire Installation is available for camping by authorized personnel during non-training periods with several exceptions. No camping is allowed in the alpine zone, in wetlands, and within 100 ft (30 m) of waterbodies including streams. These restrictions will keep site hardening out of these sensitive areas. Snowshoeing and cross-country skiing are allowed

throughout the Installation outside of training periods with the approval of the SERE School OIC. Additionally, there are ample opportunities for wildlife watching at the SERE School.

Snowmobiles, all-terrain vehicles, and motorcycles are allowed at the SERE School by permit only. In accordance with EO 11644, *Use of Off-Road Vehicles on the Public Lands*, use of off-road vehicles is restricted to roads and trails designated for their use to ensure the protection of resources on public lands. This also promotes the safety of all users of those lands and minimizes conflicts among the various uses of those lands. Development of trails in potential lynx habitat will be discouraged. User-defined trails are not allowed.

Trail users shall be instructed to clear out water bars of leaves and debris and asked to perform light trail maintenance activities while using the trails at the SERE School. Successful erosion control on recreation trails ensures the continued use of the trails. To ensure that trails are maintained safely, environmental training shall be provided by NRM (refer to Section 3.1.12 *Environmental and Natural Resources Training*).

- ☞ **Project 5:** Prepare and implement an erosion control plan for all earth-disturbing activities. The plan will incorporate the results of annual erosion surveys (Project 3) and previously completed streambank assessments, and will include erosion remedial and preventive measures to protect water quality and ensure streambank stabilization. The plan will include training materials for SERE School personnel including recommendations for conducting trail maintenance and BMPs to use during construction and ground-disturbing activities.

- ☞ **Project 16:** Develop an environmental awareness program focused on educating and training SERE School and PWD-ME personnel on protection of natural resources topics including implementing BMPs for erosion control and trail maintenance, wetland protection, management of nuisance wildlife, and protection of rare, threatened, endangered, and special concern plant and wildlife species known to occur.

- ☞ **Project 17:** Provide periodic training for SERE School personnel and PWD-ME environmental staff regarding implementation of erosion and sediment control measures and use of effective BMPs. MDEP provides annual erosion and sediment control courses.

Development of hunting and fishing programs for the SERE School are currently being considered. If it is determined that hunting and/or fishing activities would negatively impact the integrity of the military mission at the SERE School, these will not be developed and would not be considered further. A deer population survey is necessary to determine if present deer populations at the SERE School could support the development of a hunting program; however, this will occur only if the SERE School OIC determines that the program would not conflict with the military mission.

EO 12962, *Recreational Fisheries,* encourages the development and enhancement of recreational fisheries by federal agencies. At one time Redington Pond was considered to have an exceptional trout fishery. People traveled from all over the region to fish this pond. However, the dam that once maintained this waterbody collapsed and the pond is slowly draining. The pond is most likely at the maximum water level that will be achieved unless the dam is restored. Over time this pond will slowly be overcome by wetland vegetation and succeed into a freshwater marsh.

For now, a healthy fish population has been observed in the pond and other streams on the property. There is no transplant or stocking program at the SERE School.

Results of the 2013 fish survey determined that fish populations at the SERE School could support development of a catch and release program. Development of the fishing or hunting programs will require approval by the SERE School OIC.

- ☞ **Project 23:** Conduct a deer population survey to determine if populations would support development of a hunting program at the SERE School.

- ☞ **Project 24:** Using the results of the baseline mammal survey (Project 22) and deer population survey (Project 23) work with the SERE School Command to determine if a hunting program can be developed for the SERE School.

- ☞ **Project 25:** Work with the SERE School OIC to develop a fishing instruction for the SERE School to include restrictions, MDIFW fishing regulations, and catch and size limits.

3.4.3 Education and Outreach

Due to the nature of the military mission, there will be no official public conservation education program at the SERE School.

Development of an environmental awareness program at the SERE School will educate military instructors and support staff to better understand and appreciate the natural resources at the Installation, and to help them understand how to protect and manage these resources for the future. Through structured educational experiences and activities the users of the SERE School property will become knowledgeable about the natural resources present, the INRMP, and their relationship with these resources. The objective of the environmental awareness program is to enable those that use the SERE School to realize how natural resources and ecosystems affect each other and how those resources can be used wisely without endangering other resources or overall ecosystem health. The purpose is to equip users to make their own intelligent, informed resource decisions.

- ☞ **Project 16:** Develop an environmental awareness program focused on educating and training SERE School and PWD-ME personnel on protection of natural resources topics including implementing BMPs for erosion control and trail maintenance, wetland protection, management of nuisance wildlife, and protection of rare, threatened, endangered, and special concern plant and wildlife species known to occur.

The NRM will provide copies of the INRMP to the OIC and other responsible military personnel. Follow-up discussions on the activities and restrictions proposed in the INRMP will be conducted with SERE School instructors and support personnel to ensure their understanding of the plan and awareness of environmental protection and resource management needs. They in turn will provide relevant information to students during their training at the Installation.

3.4.4 Environmental and Natural Resources Training

Training of environmental staff also is applicable to outdoor recreation management at the SERE School. Training of environmental staff is described under the Land Management Programmatic Objective in Section 3.1.12 *Environmental and Natural Resources Training*. Other environmental and natural resources training activities should be undertaken, as needed, to ensure that environmental staff are prepared to handle any outdoor recreation management issues that may occur.

The NRM and other environmental staff from PWD-ME are responsible for providing information to Installation users about how to improve their understanding of the impacts of their mission, mission training, and other activities on the environment.

3.4.5 GIS Management, Data Integration, Access, and Reporting

GIS management and data integration, access, and reporting also are applicable to outdoor recreation management at the SERE School. GIS management is described under the Land Management Programmatic Objective in Section 3.1.13 *GIS Management, Data Integration, Access, and Reporting*.

- ☞ **Project 20:** Work with the NAVFAC Mid-Atlantic GeoReadiness Center to develop a GIS system for storing SERE School natural resources data.
- ☞ **Project 21:** Provide training to environmental staff to maintain the SERE School GIS database.

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4.0 SERE SCHOOL NATURAL RESOURCES PROGRAMMATIC OBJECTIVE MANAGEMENT AREAS

To facilitate effective management of the natural resources of the SERE School, natural resources management has been divided into the four programmatic objective management areas described in Section 3.0 *Natural Resources Management Programmatic Objectives*. Figure 4-1 identifies areas of the SERE School where the programmatic objectives are focused, and Table 4-1 indicates the projects associated with each management area. Primary management activities are identified and discussed for each programmatic objective, and general management recommendations are made to address each objective. Details of the project recommendations are provided in Section 3.0 *Natural Resources Management Programmatic Objectives* and Appendix J *SERE School Natural Resources Project Implementation Schedule*. A brief description of the extent of each programmatic objective management area is provided below.

- **Land Management Areas** of the SERE School are focused along existing roadways, within developed areas, cultural resources areas, wetlands, Redington Stream and Pond, and along the stream that drains Redington Pond (Figure 4-1). With the exception of the cultural resources areas, a 250-ft (76-m) buffer is included along each side of the roadways, around developed areas, and along streams. The inclusion of Orbeton Stream within the focused land management area is associated with management actions that will improve water quality, as this stream represents habitat most suitable for Atlantic salmon should their population expand to include the SERE School.
- **Fish and Wildlife Management Areas** encompass more than half of the Installation area, including the entire southern parcel (Figure 4-1). This management area includes all potential Atlantic salmon habitat, all areas at or above 2,700 ft (823 m) in elevation, and other significant wildlife habitat including MDIFW Inland Waterfowl and Wading Bird habitat and associated shoreland zones. The salt storage shed located near the intersection of Mountain Road and Redington Stream Road also is included in the fish and wildlife management area since nuisance wildlife issues are associated with this area of the Installation.
- **Forest Management Areas** cover all of the Installation, including the entire southern parcel (Figure 4-1).
- **Outdoor Recreation Management Areas** cover a large portion of the Installation, with the exception of the area located between Mountain Road and Redington Stream Road (Figure 4-1).

Although not tied specifically to a particular management area of the Installation, GIS management, data integration, access, and reporting are applicable to each of the four programmatic objectives described in the ensuing sections. Specifically this includes working with the NAVFAC GeoReadiness Center to develop a GIS database for the Installation (Project 20) and training of environmental staff to maintain this GIS database (Project 21). Additionally, partnership projects (Projects 14, 15, and 32) are identified as relevant for each of the management areas described in this section.

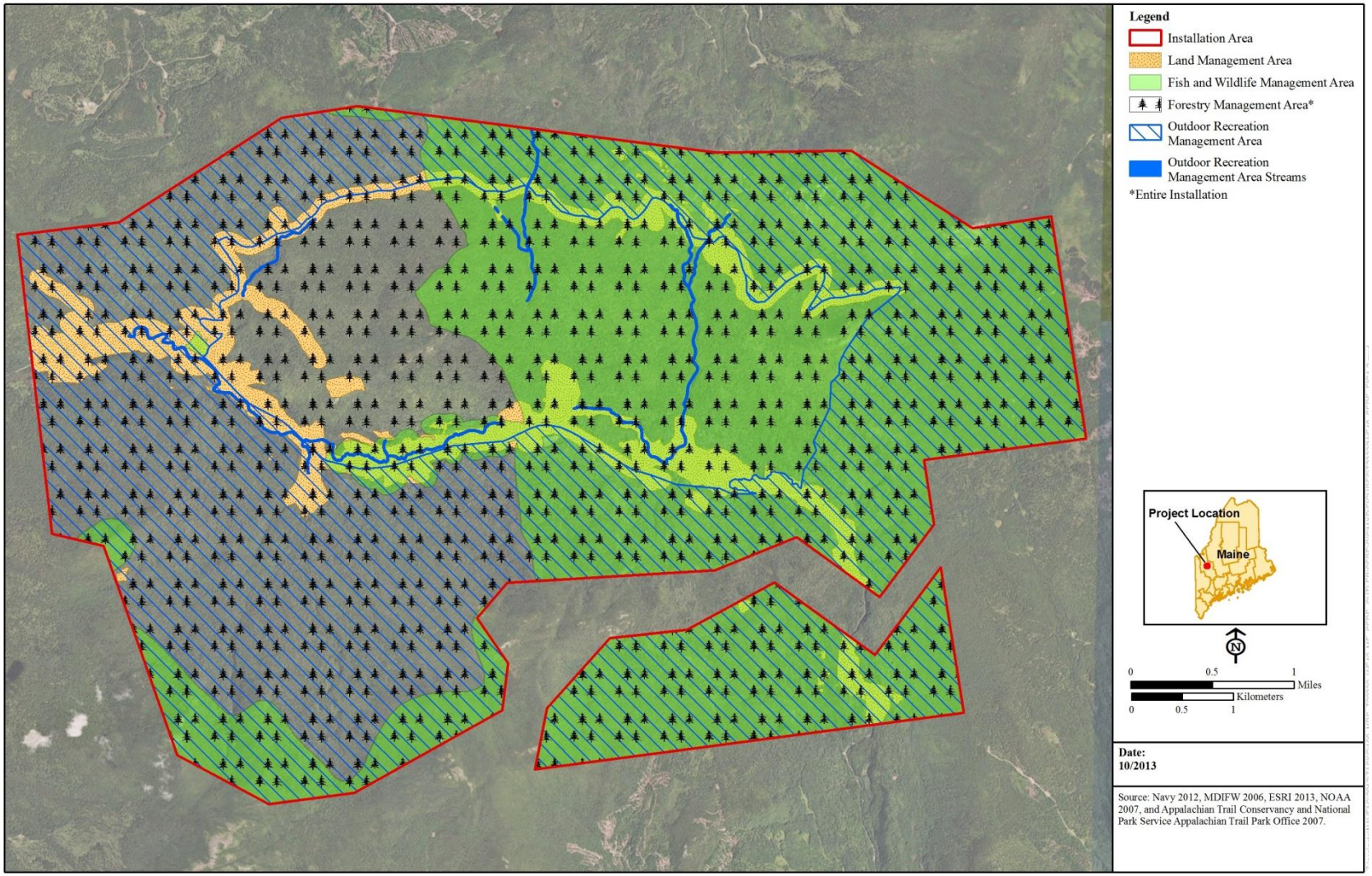

Figure 4-1. Management Areas of the SERE School, Redington, Maine.

Table 4-1. Integration of Natural Resources Programmatic Objective Management Areas and INRMP Projects.

Project #	Management Areas														
	Land									Fish and Wildlife			Forest	Outdoor Recreation	
	Water Resources	Vegetation	Noxious Weeds and Invasive Plants	Wildland Fire	Rare Communities and Significant Wildlife Habitat	Hazardous Waste	Regional Conservation Lands	Cultural Resources	Rare, Threatened, Endangered, and Special Concern Plant Species	General Fish and Wildlife	Rare, Threatened, Endangered, and Special Concern Wildlife Species	Invasive and Nuisance Wildlife	General Forest	General Outdoor Recreation	Public Access
1 – delineation of all surface waters	✓		✓		✓			✓		✓	✓	✓		✓	
2 – assessment of potential riparian buffer restoration or enhancement areas	✓	✓	✓		✓					✓	✓		✓		
3 – annual erosion surveys	✓						✓	✓	✓	✓	✓	✓	✓		
4 – erosion remedial and preventative measures	✓						✓	✓	✓	✓	✓		✓		
5 – erosion control plan	✓						✓	✓	✓	✓	✓		✓		
6 – water quality baseline inventory	✓						✓			✓	✓				
7 – natural community type survey		✓	✓	✓	✓				✓	✓	✓		✓		
8 – baseline inventory of edible plants		✓	✓		✓				✓				✓		
9 – annual invasive plant species survey	✓	✓	✓		✓		✓		✓	✓	✓		✓		
10 – invasive plant species plan	✓	✓	✓		✓		✓		✓	✓	✓		✓		

Project #	Management Areas														
	Land									Fish and Wildlife			Forest	Outdoor Recreation	
	Water Resources	Vegetation	Noxious Weeds and Invasive Plants	Wildland Fire	Rare Communities and Significant Wildlife Habitat	Hazardous Waste	Regional Conservation Lands	Cultural Resources	Rare, Threatened, Endangered, and Special Concern Plant Species	General Fish and Wildlife	Rare, Threatened, Endangered, and Special Concern Wildlife Species	Invasive and Nuisance Wildlife	General Forest	General Outdoor Recreation	Public Access
11 – forest management plan		✓	✓	✓	✓		✓		✓	✓	✓		✓		
12 – vernal pool survey	✓				✓					✓	✓				
13 - rare, threatened, endangered or special concern plant species survey		✓	✓		✓				✓						
14 – establish partnerships		✓	✓	✓	✓		✓		✓	✓	✓		✓		✓
15 – climate change vulnerability assessment	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓		
16 – environmental awareness program	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
17 – training for erosion and sediment control and use of effective best management practices	✓				✓	✓	✓	✓		✓	✓	✓	✓		

Project #	Management Areas														
	Land									Fish and Wildlife			Forest	Outdoor Recreation	
	Water Resources	Vegetation	Noxious Weeds and Invasive Plants	Wildland Fire	Rare Communities and Significant Wildlife Habitat	Hazardous Waste	Regional Conservation Lands	Cultural Resources	Rare, Threatened, Endangered, and Special Concern Plant Species	General Fish and Wildlife	Rare, Threatened, Endangered, and Special Concern Wildlife Species	Invasive and Nuisance Wildlife	General Forest	General Outdoor Recreation	Public Access
18 – training for identification of wetlands, and for avoiding impacts to key vegetation species and wetland habitats	✓	✓			✓	✓			✓	✓	✓		✓		
19 – training for Field Techniques for Invasive Plant Management, Conservation Biology, and Pest Applicator Certification	✓	✓	✓		✓		✓		✓	✓	✓		✓		
20 – develop geographic information system for storing natural resources data	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	
21 – training to maintain geographic information system database	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	
22 – baseline mammal and invertebrate surveys							✓			✓	✓			✓	
23 – deer population survey							✓			✓				✓	

Project #	Management Areas														
	Land									Fish and Wildlife			Forest	Outdoor Recreation	
	Water Resources	Vegetation	Noxious Weeds and Invasive Plants	Wildland Fire	Rare Communities and Significant Wildlife Habitat	Hazardous Waste	Regional Conservation Lands	Cultural Resources	Rare, Threatened, Endangered, and Special Concern Plant Species	General Fish and Wildlife	Rare, Threatened, Endangered, and Special Concern Wildlife Species	Invasive and Nuisance Wildlife	General Forest	General Outdoor Recreation	Public Access
24 – determine if a hunting program can be developed							✓			✓				✓	
25 – develop a fishing instruction										✓				✓	
26 - rare, threatened, endangered or special concern mammal species survey							✓			✓	✓				
27 - rare, threatened, endangered or special concern bird species survey							✓			✓	✓				
28 - rare, threatened, endangered or special concern invertebrate species survey							✓			✓	✓				
29 – Atlantic salmon habitat protection program	✓	✓			✓	✓	✓			✓	✓				
30 – determine if Redington Pond dam should be removed							✓			✓	✓				

Project #	Management Areas															
	Land									Fish and Wildlife			Forest	Outdoor Recreation	
	Water Resources	Vegetation	Noxious Weeds and Invasive Plants	Wildland Fire	Rare Communities and Significant Wildlife Habitat	Hazardous Waste	Regional Conservation Lands	Cultural Resources	Rare, Threatened, Endangered, and Special Concern Plant Species	General Fish and Wildlife	Rare, Threatened, Endangered, and Special Concern Wildlife Species	Invasive and Nuisance Wildlife	General Forest	General Outdoor Recreation	Public Access
31 – golden eagle (*Aquila chrysaetos*) monitoring							✓			✓	✓				
32 – partner with Audubon Society to conduct surveys and monitoring of rusty blackbird (*Euphagus carolinus*)							✓			✓	✓				
33 – monitoring of invasive and nuisance wildlife	✓				✓			✓		✓	✓	✓			
34 – update basic forest characterization		✓	✓	✓	✓		✓		✓	✓	✓		✓		

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4.1 LAND MANAGEMENT AREAS

Land management includes protection of land and water resources that will assist the Installation in meeting the Land Management Programmatic Objectives outlined in Section 3.1 *Land Management*. The Installation will continue to implement land management practices that have been occurring at the SERE School associated with meeting the operational mission, complying with federal and state regulatory and permitting requirements, and implementing INRMP recommendations as funding allows. This includes proactively managing land areas with natural resources to enhance or improve land resources, water resources and water quality, native vegetation, and rare communities and significant wildlife habitat including habitats that support rare, threatened, endangered, or special status species. These management activities also provide for wildland fire management and integrated protection of cultural resources. Refer to Table 4-1 for a list of projects associated with each land management area discussed below.

4.1.1 Water Resources Management

Water resources management includes a variety of funding-dependent projects and passive or non-funding dependent recommendations and requirements. The wetlands and surface water resources that are located throughout the Installation will be managed to protect water quality and aquatic habitats. Specific wetland and water quality management recommendations are provided in Section 3.1.1 *Water Resources Management*. Of the 34 funding-dependent projects identified in this INRMP (Appendix J *SERE School Natural Resources Project Implementation Schedule*), 15 of the proactive management activities described in this INRMP will assist in protecting water quality of surface and groundwater of the Installation (Projects 1–6, 9, 10, 12, 16–19, 29, and 33).

In addition to funding-dependent projects that are associated with water resources management, additional non-funding dependent management actions will be required to comply with state and federal laws and regulations intended to protect water quality. Any proposed ground-disturbing activities that may impact waters of the U.S. or wetlands will require a formal jurisdictional wetland determination to be conducted in the potential impact area, verification by USACE, and receipt of applicable USACE CWA permits. This includes any dredge or fill activities or other activities conducted within the shoreland zone. All present and future ground-disturbing activities at the Installation will incorporate appropriate erosion and sediment controls to reduce nonpoint source pollution, and these activities will comply with Maine's Erosion and Sedimentation Law.

NEPA documentation also may be required for certain ground-disturbing projects. Wetlands and other surface waters must be considered during the earliest stages of the planning process to ensure proper management and protection of water resources. Wetlands and riparian areas will be avoided during future construction of structures and other facilities including roads. New roads will be located outside riparian areas whenever possible. Any stream crossings will be designed to minimize the area disturbed, and unimproved stream crossings are prohibited. Additionally impacts to vegetation buffers will be avoided or minimized along streams and other waterbodies during ground-disturbing. A natural buffer should be maintained around Redington Pond to protect its water quality. The application of fertilizers, herbicides, and pesticides on the Installation should be avoided, to the extent practicable, to protect water quality.

Floodplain management involves proper planning for development projects that are located within floodplains or shoreland zones. MDEP is responsible for issuing Maine Pollutant Discharge Elimination System permits for stormwater discharges, including General or Individual permits. General Permits include construction, small municipal separate storm sewer systems (MS4), and multi-sector permits. Of these, a construction permit is most applicable to potential activities conducted at the SERE School. The General Permit – Construction Activity authorizes point source discharge of stormwater associated with construction and construction support activities to waters of the state other than groundwater, provided that the discharge meets the requirements of the general permit and applicable provisions of Maine's waste discharge and water classification statute and rules (MDEP 2006). Individual Permits are issued by MDEP for wastewater discharges, including those from municipal and industrial sources. None of the ongoing, proposed, or future activities conducted at the SERE School would be expected to require the need for an Individual Permit.

Information on Maine General Permit – Construction Activities is available from Maine Department of Environmental Protection at:
http://www.maine.gov/dep/land/stormwater/2006mcgp.pdf

Management of water resources will meet the following Land Management Programmatic Objectives:

- manage, maintain, and enhance land areas with natural resource value, and maintain ecological functions;
- manage training areas to reduce impacts to natural resources from implementation of the military mission;
- improve and enhance water quality by reducing nonpoint sources of pollution;
- preserve, protect, and enhance water resources (e.g., wetlands, vernal pools, surface water, groundwater);
- manage wetlands and riparian areas to protect soil and water resources and to provide wildlife habitat;
- control and monitor invasive species; and
- provide adequate special management or protection of rare, threatened, endangered, and special concern plant species, and rare communities and significant wildlife habitat.

Management actions associated with protection of water resources and associated upland habitats also will benefit fish and wildlife and outdoor recreation resources, as these habitats support a diverse assemblage of fish and wildlife species and are an important component of ecosystem function.

4.1.2 Vegetation Management

Vegetation management includes a variety of funding-dependent projects and non-funding dependent management actions. The flora and natural communities associated with the Installation will be managed to support the military mission, conserve biological diversity, and provide habitat for native wildlife including rare, threatened, endangered, and special status species known or with the potential to occur. Specific vegetation management recommendations are provided in Section 3.1.2 *Vegetation Management*. Of the 34 funding-dependent projects identified in this INRMP (Appendix J *SERE School Natural Resources Project Implementation Schedule*), 14 of the proactive management activities described in this INRMP will assist in conservation of natural communities and vegetative resources of the Installation (Projects 2, 7–11, 13–16, 18, 19, 29, and 34).

The use of regionally native plant species and beneficial landscaping practices will assist in maintaining and enhancing the health and integrity of natural vegetative communities at the SERE School. Although the SERE School is not expected to have a substantial requirement to conduct supplemental plantings of native trees and shrubs in maintained open areas and around buildings, restoration of disturbed areas should utilize native plants species and seed mixes. This practice, when consistently used with current and planned land uses, will help maintain the Installation's natural habitat diversity.

Impacts to vegetated buffer areas, including riparian buffers along streams and other waterbodies, will be avoided or minimized. Riparian buffers provide benefit by maintaining habitat for fish and wildlife and providing nutrient cycling, streambank stability, natural stream flow, and protection of water quality (Muhlberg and Moore 1998). Conserving and restoring riparian buffers minimizes erosion and subsequent loss of streambank habitat. Identification of riparian restoration and enhancement opportunities should include identification of bioengineering techniques and native plantings to stabilize compromised streambanks. The application of fertilizers, herbicides, and pesticides should be avoided to the extent practicable.

To better understand the natural community types being managed, a survey of natural community types (including rare communities and significant wildlife habitat) and a survey of edible plants should be conducted. Development of a comprehensive plant list for the SERE School also will provide important information on the diversity of plant species that are present, which directly supports military mission requirements. Vegetation should be left intact and allowed to expand naturally to provide the most benefit to wildlife, including food and refuge.

Management of vegetation resources will meet the following Land Management Programmatic Objectives:

- manage, maintain, and enhance land areas with natural resource value, and maintain ecological functions;
- manage training areas to reduce impacts to natural resources from implementation of the military mission;
- manage wetlands and riparian areas to protect soil and water resources and to provide wildlife habitat;

- maintain and enhance native vegetation including dense forest cover and the diversity of naturally occurring edible plants used in survival training;
- control and monitor invasive species; and
- provide adequate special management or protection of rare, threatened, endangered and special concern plant species, and rare communities and significant wildlife habitat.

Management actions associated with protection of vegetation resources also will benefit fish and wildlife, and outdoor recreation resources, as these habitats support a diverse assemblage of wildlife species; and are an important component of ecosystem function.

4.1.3 Noxious Weeds and Invasive Plants Management

Invasive plant species management includes a variety of funding-dependent projects. Annual monitoring and control of invasive plant species associated with the Installation, including invasive aquatic plant species, will support the military mission, conserve biological diversity, and maintain quality habitat for native fish and wildlife including rare, threatened, endangered, and special status species known or with the potential to occur. Annual invasive surveys will include monitoring for noxious weeds, but these are not currently a problem at the Installation. Specific invasive species management recommendations are provided in Section 3.1.3 *Noxious Weeds and Invasive Plants Management*. Of the 34 funding-dependent projects identified in this INRMP (Appendix J *SERE School Natural Resources Project Implementation Schedule*), 11 of the proactive management activities described in this INRMP will assist in the control and management of invasive plant species and noxious weeds, and promote conservation of natural communities on the Installation (Projects 2, 7, 9–11, 13–16, 19, and 34).

Management of invasive plant species and noxious weeds will meet the following Land Management Programmatic Objectives:

- manage, maintain, and enhance land areas with natural resource value, and maintain ecological functions;
- manage training areas to reduce impacts to natural resources from implementation of the military mission;
- preserve, protect, and enhance water resources (e.g., wetlands, vernal pools, surface water, groundwater);
- manage wetlands and riparian areas to protect soil and water resources, and to provide wildlife habitat;
- maintain and enhance native vegetation including dense forest cover and the diversity of naturally occurring edible plants used in survival training;
- control and monitor invasive species; and
- provide adequate special management or protection of rare, threatened, endangered and special concern plant species, and rare communities and significant wildlife habitat.

Management actions associated with control of noxious weeds and invasive plant species also will benefit fish and wildlife and outdoor recreation resources, as control of these plants will

ensure terrestrial and aquatic habitats are maintained to support a diverse assemblage of fish and wildlife species.

4.1.4 Wildland Fire Management

Wildland fire management is integrated with INRMP management recommendations but will be largely conducted in accordance with the Wildland Fire Management Plan that is currently under development for the SERE School. Several fund-dependent INRMP projects will contribute to wildland fire management including those associated with monitoring and conservation of forest resources. Wildland fire management recommendations will support the military mission, conserve biological diversity, and maintain quality habitat for native wildlife including rare, threatened, endangered, and special status species known or with the potential to occur. Specific wildland fire management recommendations are provided in Section 3.1.4 *Wildland Fire Management*. Of the 34 funding-dependent projects identified in this INRMP (Appendix J *SERE School Natural Resources Project Implementation Schedule*), six of the proactive management activities described in this INRMP will contribute to wildland fire management, and promote conservation of forest resources on the Installation (Projects 7, 11, 14–16, and 34).

Wildland fire management will meet the following Land Management Programmatic Objectives:

- manage, maintain, and enhance land areas with natural resource value, and maintain ecological functions;
- manage training areas to reduce impacts to natural resources from implementation of the military mission;
- maintain and enhance native vegetation including dense forest cover and the diversity of naturally occurring edible plants used in survival training; and
- provide adequate special management or protection of rare, threatened, endangered and special concern plant species, and rare communities and significant wildlife habitat.

Wildland fire management actions also will benefit wildlife, forest, and outdoor recreation resources, as the management of forest resources to minimize the risk of wildland fire will ensure habitats are maintained to support a diverse assemblage of wildlife species. Wildland fire management also will provide for protection of Navy resources (structural facilities) and ensure the health and safety of military personnel working or training at the Installation.

4.1.5 Rare Communities and Significant Wildlife Habitat Management

Rare communities and significant wildlife habitat management includes a variety of funding-dependent projects. Establishing baseline information on the rare communities and significant wildlife habitat of the Installation will provide important information for support of the military mission, maintain biological diversity, and maintain quality habitat for native fish and wildlife including rare, threatened, endangered, and special status species known or with the potential to occur. Specific management recommendations for rare communities and significant wildlife habitat are provided in Section 3.1.5 *Rare Communities and Significant Wildlife Habitat Management*. Of the 34 funding-dependent projects identified in this INRMP (Appendix J *SERE School Natural Resources Project Implementation Schedule*), 13 of the proactive management activities described in this INRMP will contribute to the conservation and protection of rare

communities and significant wildlife habitat of the Installation (Projects 7, 9–12, 13–16, 18, 19, 29 and 34).

Management of rare communities and significant wildlife habitat will meet the following Land Management Programmatic Objectives:

- manage, maintain, and enhance land areas with natural resource value, and maintain ecological functions;
- manage training areas to reduce impacts to natural resources from implementation of the military mission;
- preserve, protect, and enhance water resources (e.g., wetlands, vernal pools, surface water, groundwater);
- manage wetlands and riparian areas to protect soil and water resources and to provide wildlife habitat;
- maintain and enhance native vegetation including dense forest cover and the diversity of naturally occurring edible plants used in survival training;
- control and monitor invasive species; and
- provide adequate special management or protection of rare, threatened, endangered and special concern plant species, and rare communities and significant wildlife habitat.

Management actions associated with protection of rare communities and significant wildlife habitat will benefit fish and wildlife, forest, and outdoor recreation resources, as these habitats support a diverse assemblage of fish and wildlife species including rare, threatened, endangered, and special concern species known or with the potential to occur.

4.1.6 Hazardous Waste Management

Hazardous waste management at the SERE School is conducted in accordance with the SPCC as described in Section 3.1.6 *Hazardous Waste Management*. No specific hazardous waste management actions are provided in this INRMP; however, management of hazardous waste is important for protection of natural resources at the Installation. Of the 34 funding-dependent projects identified in this INRMP (Appendix J *SERE School Natural Resources Project Implementation Schedule*), four of the management activities described in this INRMP will contribute to hazardous waste management (Projects 16–19).

Hazardous waste management will meet the following Land Management Programmatic Objectives:

- manage, maintain, and enhance land areas with natural resource value, and maintain ecological functions;
- manage training areas to reduce impacts to natural resources from implementation of the military mission;
- improve and enhance water quality by reducing nonpoint sources of pollution;

- preserve, protect, and enhance water resources (e.g., wetlands, vernal pools, surface water, groundwater);
- manage wetlands and riparian areas to protect soil and water resources and to provide wildlife habitat;
- maintain and enhance native vegetation including dense forest cover and the diversity of naturally occurring edible plants used in survival training; and
- provide adequate special management or protection of rare, threatened, endangered and special concern plant species, and rare communities and significant wildlife habitat.

Management actions associated with hazardous waste also will benefit fish and wildlife, forest, and outdoor recreation resources, as the protection of these resources from hazardous waste impacts is an important component of natural resources management at the Installation.

4.1.7 Regional Conservation Lands

INRMP management actions will provide an indirect benefit to regional conservation lands by ensuring natural communities are left intact or improved to provide the most benefit to flora and fauna. Additionally, collection of baseline flora and fauna data including information on rare, threatened, endangered, or special concern species can be shared with local and state agencies, universities and NGOs to supplement regional database information. No specific management actions are provided in this INRMP for protection of regional conservation lands; however, implementation of the Installation Encroachment Action Plan will support the military mission and contribute to protection of regional conservation lands as described in Section 3.1.7 *Regional Conservation Lands*. Of the 34 funding-dependent projects identified in this INRMP (Appendix J *SERE School Natural Resources Project Implementation Schedule*), 26 of the management activities described in this INRMP will contribute to protection of regional conservation lands (Projects 3–6, 9–11, 13–17, 19, and 22–34).

The integrated natural resources management actions described in this INRMP for land, fish and wildlife, forest, and outdoor recreation resources will provide an indirect benefit to regional conservation lands.

4.1.8 Leases

Management of leases at the SERE School, as described in Section 3.1.8 *Leases*, is not associated with natural resources management. No specific lease management actions are provided in this INRMP.

4.1.9 Cultural Resources Management

The PWD-ME Cultural Resources Manager is presently responsible for coordinating with the State Historic Preservation Office on all development activities that may affect the historic and cultural resources of the SERE School, in accordance with 36 CFR 800 of the NHPA, to ensure that no significant cultural resources are affected. Although natural resources management at the Installation will take cultural resources into consideration for any INRMP action that may impact these resources, no specific cultural resources management actions are provided as these resources will be managed by the Cultural Resources Manager in accordance with federal and

state regulations. Management recommendations for cultural resources are provided in Section 3.1.9 *Cultural Resources Protection*. Of the 34 funding-dependent projects identified in this INRMP (Appendix J *SERE School Natural Resources Project Implementation Schedule*), six of the management activities described in this INRMP will provide for integrated management of cultural resources at the SERE School (Projects 3–5 and 15–17).

Integrated management of cultural resources will not directly meet any of the Land Management Programmatic Objectives, and does not overlap with management of fish and wildlife, forest, or outdoor recreation resources.

4.1.10 Rare, Threatened, Endangered and Special Concern Plant Species Management

Rare, threatened, endangered, and special concern plant species management includes a variety of funding-dependent projects. Collection of baseline data for rare, threatened, endangered, and special concern plant species of the SERE School is needed to develop the proper management strategies for protection of these resources. Specific rare, threatened, endangered, and special concern plant species management recommendations are provided in Section 3.1.10 *Rare, Threatened, Endangered, and Special Concern Plant Species Management*. Of the 34 funding-dependent projects identified in this INRMP (Appendix J *SERE School Natural Resources Project Implementation Schedule*), 15 of the proactive management activities described in this INRMP will assist in protecting of rare, threatened, endangered, and special concern plant species on the Installation (Projects 3–5, 7–11, 13–16, 18, 19 and 34).

Management of rare, threatened, endangered, and special concern plant species will meet the following Land Management Programmatic Objectives:

- manage, maintain, and enhance land areas with natural resource value, and maintain ecological functions;
- manage training areas to reduce impacts to natural resources from implementation of the military mission;
- maintain and enhance native vegetation including dense forest cover and the diversity of naturally occurring edible plants used in survival training;
- control and monitor invasive species; and
- provide adequate special management or protection of rare, threatened, endangered and special concern plant species, and rare communities and significant wildlife habitat.

Management actions associated with protection of rare, threatened, endangered, and special concern plant are required as part of federal and state ESAs and will prevent impacts to the military mission.

4.2 Fish and Wildlife Management Areas

Fish and wildlife management includes protection and conservation of native fauna including rare, threatened, endangered, and special concern species known to occur at the Installation. Fish and wildlife management actions described in this INRMP will assist the Installation in meeting

the Fish and Wildlife Management Programmatic Objectives outlined in Section 3.2 *Fish and Wildlife Management*. The Installation will continue to implement fish and wildlife management practices that have been occurring at the SERE School associated with meeting the operational mission, complying with federal and state regulatory and permitting requirements, and implementing INRMP recommendations as funding allows. This includes proactively managing fish and wildlife resources to enhance or improve populations and habitats that support these species. Refer to Table 4-1 for a list of projects associated with each fish and wildlife management area discussed below.

4.2.1 General Fish and Wildlife Management

General fish and wildlife management includes a variety of funding-dependent projects and non-funding dependent management actions. Baseline information on the fauna of the Installation is needed to development proper management strategies for protection of these resources. Specific fish and wildlife management recommendations are provided in Section 3.2.1 *General Fish and Wildlife Management* and Section 3.2.2 *Fisheries and Aquatic Species Management*. Of the 34 funding-dependent projects identified in this INRMP (Appendix J *SERE School Natural Resources Project Implementation Schedule*), 32 of the proactive management activities described in this INRMP will assist in providing protection and conservation of fish and wildlife species of the Installation (Projects 1–7, 9–12, 14–34).

Management of rare, threatened, endangered, and special status fish and wildlife resources will meet all of the Fish and Wildlife Management Programmatic Objectives:

- protect, conserve, and promote native terrestrial and aquatic fauna;
- promote conservation of rare, threatened, endangered, and special concern species and their habitats known to occur at the SERE School through monitoring, surveys, and habitat protection and restoration;
- prevent and control invasive species and nuisance wildlife; and
- develop partnerships with federal, state, and local agencies and NGOs to implement wildlife monitoring and protection programs.

Forest and vegetated communities provide important habitat for many types of wildlife, and where feasible these habitats should be allowed to expand naturally to provide food sources and habitat for wildlife. Forest species, such as the peregrine falcon and white-tailed deer, will benefit from development of a forest management plan. Impacts to vegetated buffer areas, including riparian buffers along streams and other waterbodies, should be avoided and minimized to maintain habitat for fish and wildlife and protect water quality through streambank stability. Completion of a comprehensive vernal pool survey will assist in identification of significant vernal pools that provide important breeding habitat for obligate vernal pool species, including herpetofauna that are known or have the potential to occur at the SERE School.

Development of partnerships with IBP, the Vermont Center for Ecostudies, and Maine and National Audubon Society chapters will promote conservation and monitoring of the birds that occur at the SERE School. The forested habitat of the SERE School provides an excellent place to partner with IBP to establish MAPS stations, as much of the forested habitat at the SERE School is undisturbed with little to no level of human activity and would provide valuable

information on utilization of forest habitats by neotropical migrants. Establishment and monitoring of MAPS would need to be coordinated and approved by the SERE School Command.

Management actions associated with protection and conservation of fish and wildlife resources also will benefit rare, threatened, endangered, and special concern fish and wildlife species known to occur at the Installation (see Section 4.2.2 *Rare, Threatened, Endangered, and Special Concern Fish and Wildlife Species Management*). In addition, fish and wildlife management actions will be benefit Installation land resources through habitat restoration and conservation measures, as well as outdoor recreation resources through an assessment of the potential to implement a hunting program and develop a fishing program.

4.2.2 Rare, Threatened, Endangered, and Special Concern Fish and Wildlife Species Management

Management of rare, threatened, endangered, and special concern fish and wildlife resources includes a variety of funding-dependent projects and non-funding dependent management actions. Baseline information on the rare, threatened, endangered, and special concern fish and wildlife resources of the Installation is needed to development proper management strategies for protection of these resources. Specific rare, threatened, endangered, and special concern fish and wildlife management recommendations are provided in Section 3.2.3 *Rare, Threatened, Endangered, and Special Concern Fish and Wildlife Species Management*. Of the 34 funding-dependent projects identified in this INRMP (Appendix J *SERE School Natural Resources Project Implementation Schedule*), 31 of the proactive management activities described in this INRMP will assist in providing protection and conservation of rare, threatened, endangered, and special concern fish and wildlife species of the Installation (Projects 1–12, 13–22, 26–34).

Management of rare, threatened, endangered, and special status fish and wildlife resources will meet all of the Fish and Wildlife Management Programmatic Objectives:

- protect, conserve, and promote native terrestrial and aquatic fauna;
- promote conservation of rare, threatened, endangered, and special concern species and their habitats known to occur at the SERE School through monitoring, surveys, and habitat protection and restoration;
- prevent and control invasive species and nuisance wildlife; and
- develop partnerships with federal, state, and local agencies and NGOs to implement wildlife monitoring and protection programs.

Development of partnerships with IBP, the Vermont Center for Ecostudies, the MDIFW, and Maine and National Audubon Society chapters will promote conservation and monitoring of rare, threatened, endangered, and special concern fish and wildlife species that occur at the SERE School. Partnering with IBP to establish MAPS at the Installation, if approved, would provide additional information on migratory birds that utilize Installation habitats, including the contribution of data to the long-term avian productivity and survivorship database maintained by IBP. A partnership with the Maine and National Audubon Society chapters will provide important information on Installation use by rusty blackbird.

Working with the MDIFW to develop and implement an Atlantic salmon habitat protection program and to assess the potential to remove Redington Pond dam to improve Atlantic salmon access to the Installation will provide direct benefit to Atlantic salmon. Per the Defense Authorization Act for fiscal year 2004 management actions are described in this INRMP that will directly and indirectly benefit fish and wildlife species, including rare, threatened, endangered, and special status species, which exempt the SERE School from the final Critical Habitat Rule for the GOM-DPS of Atlantic salmon. Activities that will protect wetlands and water quality and improve riparian habitats will directly benefit Atlantic salmon within the watershed, including hatchery-raised populations that could potentially occur at the Installation. Conservation and restoration of vegetation and development of a forest management plan may provide an indirect benefit to Canada lynx by attracting its prey to reside and forage in these habitats.

Impacts to vegetated buffer areas, including riparian buffers along streams and other waterbodies, should be avoided and minimized to maintain habitat for fish and wildlife and protect water quality through streambank stability. Completion of a comprehensive vernal pool survey will assist in identification of significant vernal pools that provide important breeding habitat for obligate vernal pool species, including rare, threatened, endangered, or special status herpetofauna species that are known or have the potential to occur at the SERE School.

Management actions associated with protection and conservation of rare, threatened, endangered, and special concern fish and wildlife species also will benefit Installation land resources through habitat restoration and conservation measures.

4.2.3 Invasive and Nuisance Wildlife Management

Invasive and nuisance wildlife management includes one funding-dependent project to conduct routine monitoring of nuisance wildlife to determine if removal or relocation actions are necessary to protect natural resources and human health and safety (Project 33). The primary nuisance wildlife at the Installation are beaver and moose. Collection of additional information on the mammal populations of the Installation will be used to develop proper management strategies for invasive and nuisance wildlife. Specific management recommendations for invasive and nuisance wildlife are provided in Section 3.2.4 *Invasive and Nuisance Wildlife Species Management*.

Management of invasive and nuisance wildlife will meet the following Fish and Wildlife Management Programmatic Objective:

- Prevent and control invasive species and nuisance wildlife.

Management of invasive and nuisance wildlife also will benefit Navy personnel, facilities, and land resources by improving health and safety, protection of roadways and facilities from flooding, and protection of water quality by preventing erosion and sedimentation into waterbodies.

4.3 FOREST MANAGEMENT AREAS

Forest management includes protection of forest resources and will assist the Installation in meeting the Forest Management Programmatic Objectives outlined in Section 3.3 *Forest Management*. The Installation will continue to implement forest management practices that have been occurring at the SERE School associated with meeting the operational mission, complying with federal and state regulatory and permitting requirements, and implementing INRMP recommendations as funding allows. This includes proactively managing forested areas to meet mission requirements, to enhance or improve wildlife habitat, and to reduce the risk of wildland fire.

4.3.1 General Forest Management

General forest management includes two funding-dependent projects and other non-funding dependent management actions that will directly benefit forest resources. An update to the 1998 forestry characterization assessment is needed (Project 34) and will be used to develop and implement a forest management plan (Project 11) for the Installation. General forest management recommendations are provided in Section 3.3.1 *General Forest Management*. Of the 34 funding-dependent projects identified in this INRMP (Appendix J *SERE School Natural Resources Project Implementation Schedule*), 13 of the proactive management activities described in this INRMP will provide an indirect benefit to forest resources (Projects 2–5, 7–10, 15–19).

Management of forest resources will meet all of the Forest Management Programmatic Objectives:

- protect and promote sustainable management of forest resources;
- manage forest habitats to promote use by trainees and a diverse range of wildlife species, including protection of trees that include edible parts, mature tree stands and snags, and protection of tree species that provide suitable nesting and foraging habitat for wildlife;
- manage forest habitats to maintain wildlife travel corridors, streamside protection, and aesthetic buffer zones;
- maintain forest habitats to enhance plant community diversity;
- maintain forest habitats to ensure consistency with an ecosystem approach to forest management;
- manage forest habitats to reduce risk of wildfire in consideration of the military mission and safety of Navy personnel in accordance with the SERE School Wildland Fire Management Plan; and
- monitor forest resources for pests and disease.

Forest habitat should be retained in its natural condition, to the extent practicable, to afford the greatest value to wildlife and to maintain the pristine natural environment and aesthetic value that supports the military mission of the SERE School. The mature hardwood and coniferous habitat provides shelter to wildlife during severe winter weather, and as mature trees die, snags will become available for wildlife and will create small forest openings that promote

regeneration and provide nesting habitat for migratory birds including eagles and other raptors. Forest dwelling wildlife species, including rare, threatened, endangered, and special concern species, will benefit from development of a forest management plan. Results of the deer population survey and appropriate deer habitat management recommendations should be incorporated into the forest management plan. Impacts to vegetated buffer areas, including riparian buffers along streams and other waterbodies, should be avoided and minimized to maintain habitat for fish and wildlife and protect water quality through streambank stability. Completion of a climate change vulnerability assessment for the Installation will provide information on expected impacts to forest resources from climate change. As described in Section 4.2.1 *General Fish and Wildlife Management* and Section 4.2.2 *Rare, Threatened, Endangered, and Special Concern Fish and Wildlife Species Management*, a partnership with IBP to establish MAPS stations within the forested habitat will be implemented if approved by the SERE School Command.

Management actions associated with protection and conservation of forest resources also will benefit fish and wildlife including rare, threatened, endangered, and special concern species known to occur at the Installation. In addition, development of a forest management plan will benefit Installation land resources through identification of habitat restoration and conservation measures.

4.4 Outdoor Recreation Management Areas

Outdoor recreation management includes natural resources actions designed to provide recreation opportunities that are sustainable, within the military mission, within established carrying capacities, and consistent with the natural resources upon which they are based. The outdoor recreation management actions described in this INRMP will assist the Installation in meeting the Outdoor Recreation Management Programmatic Objectives outlined in Section 3.4 *Outdoor Recreation Management*. The Installation will continue to provide limited outdoor recreation opportunities to authorized personnel during non-training periods, and additional outdoor recreation actions identified in this INRMP will be implemented as funding allows. Public access to the Installation, which also is covered under outdoor recreation management, is prohibited due to mission requirements except as authorized by the SERE School Command. This includes proactively managing forested areas to meet mission requirements, enhance or improve wildlife habitat, and to reduce the risk of wildland fire. Refer to Table 4-1 for a list of projects associated with each general outdoor recreation management area discussed below.

4.4.1 General Outdoor Recreation Management

General outdoor recreation management includes five funding-dependent projects that will directly benefit outdoor recreation opportunities, and one non-funding dependent project. Outdoor recreation opportunities at the Installation are not expected to expand substantially from current conditions due to military mission requirements and the limited availability of non-training periods during which time these activities would be authorized. Outdoor recreation management recommendations are provided in Section 3.4 *Outdoor Recreation Management*. Of the 34 funding-dependent projects identified in this INRMP (Appendix J *SERE School Natural Resources Project Implementation Schedule*), five of the proactive management activities

described in this INRMP will provide a direct benefit to outdoor recreation resources (Projects 16, 22–25).

Management of outdoor recreation resources will meet the following Outdoor Recreation Management Programmatic Objectives:

- provide and promote outdoor recreation opportunities, including evaluation of development of hunting and fishing programs, as long as these do not conflict with the military mission or natural resources conservation;
- evaluate additional opportunities for natural resources-related outdoor recreation; and
- promote educational awareness of Installation natural resources, including rare, threatened, endangered, and special concern species that are known to occur, and the importance of the Navy's natural resources stewardship efforts.

In consideration of military mission requirements, development and implementation of hunting and/or fishing programs at the SERE School will need to be discussed with and approved by the SERE School Command.

Outdoor recreation management actions would not provide additional direct or indirect benefits to land, fish and wildlife, or forest resources of the Installation.

4.4.2 Public Access

Public access to the Installation, as it is related to natural resources management and the provision of outdoor recreational opportunities, is restricted to military personnel and their authorized guests. Public access in this context includes one funding-dependent project and one non-funding dependent management action. Public access is described in Section 3.4.1 *Public Access*.

Proactive management activities that will provide a direct benefit to management of public access to the Installation includes establishing communication and/or a partnership with the AT Conservancy and National Park Service to identify additional measures that could be implemented to deter AT users from trespassing on the Installation. The installation and GPS recording of "U.S. Navy Property – No Trespassing" signs along the official survey boundary should be completed by the Navy Real Estate office. Once installed, this signage should be periodically monitored and maintained by the Navy Real Estate Office.

Management of public access to the Installation will meet the following Outdoor Recreation Management Programmatic Objective:

- establish communication and/or partnerships with the AT Conservancy and National Park Service to ensure that the boundary between the AT and the SERE School is well-marked to reduce the risk of trespassing on Navy property by civilians using the AT.

Management of public access to the Installation would provide an indirect benefit to land, fish and wildlife, and forest resources of the Installation by reducing the number of unauthorized personnel (foot traffic) at the Installation and reducing the potential for impacts to these resources from trespassers.

5.0 INRMP IMPLEMENTATION

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

1. Funding is secured for completion of all Environmental Readiness Level (ERL) 4 projects, as described in Section 5.5 *Project Development and Classification*.
2. Installation is staffed with a sufficient number of professionally trained environmental staff needed to perform the tasks required by the INRMP.
3. Annual coordination with all cooperating offices is performed.
4. Specific INRMP action accomplishments that are undertaken are documented each year.

The following sections provide an overview of the role that implementation of this INRMP would play in supporting sustainability of the military mission and the natural environment, meeting natural resources consultation requirements, achieving no net loss of the military mission, attaining NEPA compliance, understanding project development and classification, identifying funding sources, establishing commitment, and endorsing the use of cooperative agreements. The project table in Appendix J *SERE School Natural Resources Project Implementation Schedule* provides information for the implementation schedule, prime legal driver and initiative, class, Navy assessment level, cost estimate, and funding source for each of the projects proposed in this INRMP. Section 6.0 *Management Recommendation Summary* summarizes the INRMP projects according to the ERLs described in Section 5.5 *Project Development and Classification*.

5.1 SUPPORTING SUSTAINABILITY OF THE MILITARY MISSION AND THE NATURAL ENVIRONMENT

5.1.1 Integration of the Military Mission and Land Use

The Navy has taken a proactive approach towards integrating the military mission with concepts of sustainable land use by recognizing that efficient and effective land use planning supports military readiness and sustainability, while protecting and enhancing the natural resources for multiple use, sustained yield, and biological integrity. Development and human use are inherently limited on military lands that are kept in their natural condition to support the military mission, often resulting in lands that have extremely high ecological value. These areas may include large tracts of undisturbed habitats and diverse flora communities that are often used as retreat areas, migration stopover points, or foraging areas for threatened and endangered, and special concern fauna species. Recognizing that military mission requirements have the highest priority, Navy understands the role INRMPs play in identifying potential conflicts between a facility's mission and natural resources, and identifying actions necessary to maintain the availability of mission-essential properties and acreage. An INRMP balances the management of natural resources unique to the installation with the military mission requirements and other land use activities affecting an installation's natural resources (DoD and USFWS 2002). The SERE School understands the importance of integrating the military mission and land use to meet the

mission of military training and readiness while managing the valuable natural resources to ensure long-term environmental sustainability.

The military mission is not anticipated to change over the next 10 years. However, it is possible for the training demands to increase. The number of students participating in the program may increase over time; however, effects predicted from increased numbers of trainees are expected to be minimal.

5.1.2 Impacts to the Military Mission

The use and management of lands that support military training and readiness, and the decision-making associated with such land use, directly affect the sustainability of the ecosystem. Specific components of integrated natural resources management at the Installation include consideration of land, fish and wildlife, forest, and outdoor recreation resources. To protect and maintain natural resources while ensuring the continuation of the military mission, the SERE School has implemented an ecosystem management approach for environmental stewardship of the installation natural resources. The management strategy maximizes land use that supports military training while minimizing impacts to natural resources.

The major environmental constraints on the military mission and development at the SERE School, as described in Section 1.6 *Opportunities and Constraints* and shown on Figure 1-2, are:

- conservation and encouragement of protected flora and fauna species habitat;
- preservation of Atlantic salmon habitat located on the Installation;
- preservation of inland waterfowl/wading bird habitat and shoreland zones;
- limitation on new construction in wetlands, floodplains, and riparian buffer areas;
- maintenance of wildlife, and edible tubers and plant parts necessary for conducting survival techniques training; and
- maintenance of an adequate supply of drinking water for support of survival techniques training.

The landscape and sustainability of the natural resources are critical to implementation of the military mission. An adequate encroachment buffer is necessary to ensure that the mission is secure, and lands are preserved for potential future mission growth and maintenance of continuing mission critical activities. Implementation of this INRMP is not expected to impact the military mission, as management measures for conservation and protection of the natural resources of the SERE School as described in this INRMP are expected to improve the Navy's ability in implementing the military mission.

5.1.3 Relationship of Range Complex Management Plan or Other Operation Area Plans

The SERE School does not currently have a range management plan in place that would need to be coordinated with natural resources management of the Installation. The SERE School has the following plans in place that will be integrated with natural resources management of the Installation:

- Draft Cultural Resources Survey (1996)
- Naval Installations Maine Consolidated IPMP (2012)
- SERE School SPCC Plan (25 September 2012)
- Portsmouth Naval Shipyard Encroachment Action Plan (2013)
- Streambank Assessment (2013; Appendix E)
- High Elevation Bird Survey (HEBS) (2013; Appendix E)
- Baseline Fish Survey and Habitat Assessment (2013; Appendix E)
- Bat acoustic survey (completed in 2014; Appendix E)
- Fall and spring raptor migration survey (completed in 2014; Appendix E)
- Wildland Fire Management Plan (completed in 2014; Appendix I)
- Winter bird/mammal resident survey (completed in 2014; Appendix E)
- Breeding bird survey (completed in 2014; Appendix E)

As other biological surveys, data, plans, and reports are finalized, these will be included in this INRMP in Appendix E *SERE School Biological Surveys*, and integrated with the management actions described in this document.

5.2 NATURAL RESOURCES CONSULTATION REQUIREMENTS

Section 7 of the ESA requires federal agencies to formally consult with USFWS (terrestrial fish and wildlife) or NOAA NMFS (marine fish or fisheries) when any proposed activity authorized, carried out, or conducted by that agency may significantly affect a listed species or designated critical habitat. As a result of consultation, USFWS or NOAA NMFS would issue a biological opinion, which includes actions that the federal agency must complete in order to conduct the proposed activity. If critical habitat is designated on federal property and adequate protection and management of the critical habitat has been included in the installation INRMP, the ESA allows USFWS to preclude this habitat from the biological opinion. However, in order for the critical habitat to be excluded, the qualifying INRMP must address the maintenance and improvement of the primary constituent elements important to the species, and must manage for the long-term conservation of the species. For minor or less than significant impacts to ESA-listed species or designated critical habitat, informal consultation with USFWS and NOAA NMFS may be appropriate.

The 2004 Defense Authorization Act granted the USFWS specific authority to exempt DoD lands from the designation of critical habitat provided a comprehensive and approved INRMP was in effect; the INRMP specifically addressed the conservation of species under consideration; and the INRMP was implemented. Although Critical Habitat for the Atlantic salmon Gulf of Maine DPS (Figure 2-7) was designated in 2009 (74 FR 29300-29341), this INRMP provides for the protection of Atlantic salmon and therefore exempts the Installation from Critical Habitat designation and related requirements.

Habitat for Atlantic salmon is located at the SERE School (see Figure 2-7); however, the likelihood for Atlantic salmon to occur at the Installation is low based on migration barriers and the known range of existing wild populations. Designated Critical Habitat for Canada lynx is located approximately 33 mi (53 km) north of the SERE School (Figure 2-7). Section 7 consultation (formal or informal) will likely be required for any INRMP activities that have the potential to impact Atlantic salmon habitat located on the Installation.

No federally listed threatened or endangered species are known to occur at the SERE School (Appendix G *SERE School Flora and Fauna*, Table G-5). The northern long-eared bat is proposed for listing as endangered and has been confirmed as present at the Installation. Bicknell's thrush also is present, and this species is currently under review for listing under the federal ESA. Both of these species are Maine special concern species. One state threatened species, black-crowned night heron, is known to occur, and several other species identified as Maine special concern species also are present (Appendix G, Table G-5). Appendix G, Table G-5 identifies federal and state listed species known and with the potential to occur based on known ranges and habitats that are present at the Installation.

No exemplary natural communities have been discovered on the SERE School site; however, the Installation contains rare communities and significant wildlife habitat. Alpine and sub-alpine communities occur at the higher elevations of the Installation. Additionally, Krummholz Forest has been identified along Poplar Ridge (Navy 2007). Krummholz communities are characterized by thin soils and stunted coniferous tree growth and are regarded as unique by the MNAP. High and moderate inland waterfowl and wading bird habitat is present at the SERE School, and are considered significant wildlife habitat as designated by MDIFW and defined in the Maine NRPA. Two areas of inland waterfowl and wading bird habitat occur along Redington Stream Road of the main parcel, in association with area streams and Redington Pond (Figure 2-5).

A 1988 field survey conducted by the TNC did not identify any federal or state listed threatened and endangered plant species at the Installation; however, this survey is outdated. During this survey, potential habitat for the federally threatened Canada lynx and state endangered golden eagle was identified. Habitat that would support yellow nosed vole, a state species of special concern at the time of the survey, also was identified at the SERE School; however this species no longer listed as a species of special concern in Maine. A survey for Canada lynx was conducted over a two-day period in February and March 2005, with negative results (lynx was not detected) (Starr and Seyfried 2005). Observation or sign of Canada lynx also was not observed during the winter mammal survey conducted at the Installation in February 2014.

5.3 ACHIEVING NO NET LOSS

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

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

5.4 NEPA COMPLIANCE

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

Decisions that affect future land or resource use that are associated with an INRMP require NEPA analysis. The NRM should refer to Secretary of the Navy Instruction 5090.6A and OPNAV M-5090.1 for basic guidance on the preparation of NEPA documents. CEQ's "Regulations for Implementing NEPA" and "NEPA's Forty Most Asked Questions" provide further information.[2] The INRMP and associated NEPA documentation should be prepared as individual documents to ensure that the viability, integrity, and intent of each are maintained. The intent of the INRMP is to outline projects that would fulfill Navy compliance and

[2] CEQ's "Regulations for Implementing NEPA" is available at: http://ceq.hss.doe.gov/nepa/regs/ceq/toc_ceq.htm, and "NEPA's Forty Most Asked Questions" is available at: http://ceq.hss.doe.gov/nepa/regs/40/40p3.htm.

stewardship obligations, whereas the intent of the NEPA documentation is to analyze the impacts of the programmatic objectives outlined within the INRMP. Although each of these are prepared as separate documents, they should be prepared simultaneously, as it is important for installation natural resource managers to coordinate the two documents at the earliest possible stage to ensure that decisions reflect current environmental values, and avoid potential conflicts.

Preparation of the NEPA documentation should be completed early to accommodate Navy decision-makers. If a comment period or public notice is required for NEPA process, public notice and comment periods should be coordinated and integrated with the INRMP. A finding of no significant impact (FONSI) must be achieved before an INRMP may be approved. If a FONSI is not achievable, the NEPA process must proceed to an EIS. One of the first steps in the NEPA process is to define the proposed action and explain its purpose and need. The proposed action is to develop and implement an INRMP that integrates natural resources management with the installation's military use in a manner that ensures military readiness and provides for sustainable multipurpose uses and conservation of natural resources (Navy 2006). The purpose and need for the INRMP is to meet statutory requirements imposed by the SAIA as well as the requirements of various DoD, Navy, and Navy Instructions. The Purpose and Need section can be further clarified with a brief discussion of the required plan elements (as outlined in the SAIA) applicable to the installation.

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

The No Action/Status Quo alternative should always be included as an alternative to implementation of the INRMP. The No Action/Status Quo alternative describes impacts that

would occur if the installation did not implement the INRMP, and the installation continued to operate without a plan or the existing plan if one is in place. The No Action/Status Quo alternative serves as a baseline to which all other alternatives are compared. Each alternative should describe the general geographical extent applicable to each of the programmatic objectives. Each of the reasonable alternatives may only represent variable intensities of one or more of the programmatic objectives; however, differences in funding levels for each alternative would not constitute a valid range of alternatives. For example, it is not acceptable for all required compliance projects to represent an alternative. A brief summary of all alternatives considered for the INRMP should be included to provide the review agencies and the local community the range of management scenarios that were analyzed.

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

As part of the INRMP update conducted in 2013–2014, an EA was prepared to satisfy NEPA and Navy requirements. The final EA prepared for this INRMP, which was prepared upon completion of the environmental review and public comment process, is included in Appendix A of this INRMP and replaces the original EA prepared for the SERE School INRMP.

5.5 PROJECT DEVELOPMENT AND CLASSIFICATION

This INRMP is a public document that requires the mutual agreement of the SERE School, USFWS, and MDIFW. It is crucial therefore, that these entities reach a common understanding as to which projects are most likely to be funded through the sources identified in Section 5.6 *Funding Sources*. An annual strategy must be adopted for INRMP funding that addresses the Installation's legal requirements..

The Navy funding classification of recurring and non-recurring projects consists of the following four ERLs, in accordance with OPNAV M-5090.1 (Navy 2014). The following descriptions of each ERL are presented in decreasing order of priority, with ERL 4 representing the absolute minimum requirement to achieve compliance and projects/actions having the highest funding priority as must fund compliance projects, and ERL 1 representing investments in environmental leadership and general proactive environmental stewardship.

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

- Environmental Readiness Level 3 (ERL 3) – ERL 3 is for requirements derived from DoD and Navy policies, or proactive initiatives that could enable future compliance or result in positive return on Navy investments. They also could support critical readiness activities by decreasing encumbrances of statutory compliance requirements. These efforts are not mandated by law or other federal, state, or local requirements, but would minimize current or future impacts (including costs) to the Navy mission.
- Environmental Readiness Level 2 (ERL 2) – ERL 2 is for requirements derived from pending federal, state, or local requirements, laws, regulations, or EOs that could enable future compliance, but result in less certain returns on investments and uncertain benefits to the Navy mission. These project efforts are not mandated by existing law or other federal, state, or local requirements. Funding requirements should be based on best available scientific, or commercial data; or on pending federal, state, or local regulations under development (where publication is scheduled) using model state regulations or permit standards, if available.
- Environmental Readiness Level 1 (ERL 1) – ERL 1 is for investments in environmental leadership and general proactive environmental stewardship.

All INRMP projects must be entered into the EPR-web system and receive approval up the chain of command prior to soliciting any signatures on the INRMP. The Chief of Naval Operations Environmental Readiness Division is the final authority for designating the appropriate ERL for a given INRMP project.

5.6 FUNDING SOURCES

Once INRMP projects have been validated, and entered into EPR-web, ERL 4 and 3 projects are typically programmed in for funding. ERL 2 and 1 projects are not usually funded through the EPR-web system, and alternate sources of funding should be sought for these projects. EPR-web project entries should include clear justification of funds being requested so that: (1) natural resource funds are distributed wisely, and (2) funding levels are not threatened by the use of funds in ways that are inconsistent with funding program rules (Navy 2006). The primary sources for funding Navy natural resource projects are:

- Operations and Maintenance, Navy (O&MN) Environmental Funds
- Legacy Resource Management Program (Legacy Program) Funds
- Forestry Revenues
- Agricultural Outleasing
- Fish and Wildlife Fees
- Recycling Funds
- Strategic Environmental Research and Development Program (SERDP) Funds
- Other Non-DoD Funds

5.6.1 O&MN Environmental Funds

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

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

O&MN Environmental Funds are expected to be the primary source of funding for the SERE School INRMP Environmental Compliance projects.

5.6.2 The Legacy Resource Management Program

The Legacy Program was part of a special Congressional mandated initiative for funding military conservation projects. Although the Legacy Program was originally funded from 1991 to 1996 only, funds for new projects have continued to be available through this program (Navy 2006). Legacy Program funds can be used for a variety of conservation projects, such as regional ecosystem management initiatives, habitat preservation efforts, archaeological investigations, invasive species control, monitoring and predicting migratory patterns of birds and animals, and National partnerships and initiatives, such as National Public Lands Day. More information on requirements for Legacy Program applications can be found at: http://www.dodlegacy.org/.

Requests for Legacy funds should consider the following:

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

Legacy Program funds should be considered as a potential funding source for the SERE School INRMP projects.

5.6.3 Forestry Revenues

Forestry Revenues originate from the sale of forest products on Navy lands, and can be used to fund forestry and potentially other natural resources management programs. Forestry revenues are given preference for funding the Annual Navy Forestry Funds and the DoD Forestry Reserve Account. Annual Navy Forestry Funds are used to support commercial forestry operations at

installations. Forestry revenues are first used to reimburse commercial forestry expenses, then, as directed by DoD Financial Management Regulation 7000.14-R Volume 11A, 40% of net proceeds for the fiscal year for the installation are distributed to the state in which the installation resides. The state usually uses these funds to support road systems and schools. Once the commercial forestry expenses are reimbursed, and proceeds are distributed among the state counties, any remaining amount is transferred to a holding account known as the DoD Forestry Reserve Account.

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

1) Be specifically included in an approved management plan, such as an INRMP; and

2) Provide for at least one of the following:
   a. fish and wildlife habitat improvements or modifications;
   b. range rehabilitation where necessary for support of wildlife;
   c. control of off-road vehicle traffic;
   d. specific habitat improvement projects and related activities; or
   e. adequate protection for species of fish, wildlife, and plants considered threatened or endangered.

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

5.6.4 Agricultural Outleasing

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

5.6.5 Fish and Wildlife Fees

Fish and Wildlife fees are primarily collected as part of installation hunting, fishing or trapping programs. These fees are deposited and used in accordance with the Sikes Act and DoD financial management regulations. The Sikes Act specifies that user fees collected for hunting, fishing or trapping shall be used only on the installation where they are collected, and be used exclusively for fish and wildlife conservation and management at the installation where collected. Unless the SERE School implements a hunting or fishing program for the Installation, the Installation is not expected to receive funds from Fish and Wildlife Fees that can be used to support natural resource management projects.

5.6.6 Recycling Funds

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

5.6.7 Strategic Environmental Research and Development Program (SERDP) Funds

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

5.6.8 Non-DoD Funds

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

5.7 COMMITMENT

This INRMP will require formal adoption by the SERE School Commanding Officer to ensure commitment for pursuing funding, and to execute all ERL 4 projects, subject to the availability of funding. Funding of ERL 4 projects should be pursued within the specific timeframes

identified in Appendix J *SERE School Natural Resources Project Implementation Schedule* of this INRMP.

5.8 USE OF COOPERATIVE AGREEMENTS AND PARTNERSHIPS

A cooperative agreement is used to acquire goods or services, or stimulate an activity that will be implemented for the public good. Section 103a of the Sikes Act (16 USC §670c-1) provides the authority to enter into cooperative agreements with state and local governments, NGOs, and individuals to provide for the maintenance and improvement of natural resources on, or to benefit natural and historic research on, DoD installations. In addition to a standard cooperative agreement, examples of other agreements include MOUs and Cooperative Assistance Agreements. Funds appropriated for multiyear agreements during a fiscal year may be obligated to cover the cost of goods and services provided under a cooperative agreement entered into or through an agency agreement during any 18-month period beginning in that fiscal year, without regard to whether the agreement crosses fiscal years (31 USC §1535, Money and Finance – The Budget Process – Agency Agreements). Cooperative agreements entered into are subject to the availability of funds.

EO 13352, *Facilitation of Cooperative Conservation* (26 August 2004) directs that the Secretaries of the Interior, Agriculture, Commerce, and Defense and the Administrator of the EPA shall, to the extent permitted by law and subject to the availability of appropriations and in coordination with each other as appropriate:

- carry out the programs, projects, and activities of the agency that they respectively head that implement laws relating to the environment and natural resources in a manner that facilitates cooperative conservation;
- take appropriate account of and respects the interests of persons with ownership or other legally recognized interests in land and other natural resources;
- properly accommodate local participation in federal decision making; and
- provide that the programs, projects, and activities are consistent with protecting public health and safety.

The Navy expects to receive cooperative agreements from USFWS and MDIFW as part of their review of this INRMP. These will be provided in Appendix B *Agency Correspondence* upon receipt. Cooperative agreements with local or regional fish and wildlife agencies, conservation organizations, and education organizations have been initiated in the past and will continue to be supported. These agencies include, but are not limited to USDA NRCS, MHPC, IBP, Trout Unlimited, TNC, Maine and National Audubon Societies, the Vermont Center for EcoStudies, and The Wilderness Society.

6.0 MANAGEMENT RECOMMENDATION SUMMARY

This section presents a summary of the management recommendations that are described in Section 3.0 *Natural Resources Management Programmatic Objectives* and summarized for each management unit of SERE School in Section 4.0 *SERE School Natural Resources Programmatic Objectives Management Areas*. For prioritization and budgeting purposes, each action or project recommended in this INRMP is listed in the project table provided in Appendix J *SERE School Natural Resources Project Implementation Schedule*. The prime legal drivers, Navy assessment level (described in the Navy Chief of Naval Operations Environmental Requirements Guidebook), cost estimate, potential funding source, and schedule for each action or project is identified in Table J-1 in Appendix J. Natural resources program administration and day-to-day program activities are not included in the table. Policy guidance provided in DoDI 4715.03 states that each military service will be responsible for obtaining funding for natural resources projects. The prioritized natural resources summarized in this section and Appendix J utilize the program hierarchy and project classification described in Section 5.5 *Project Development and Classification*.

Conserving Biodiversity on Military Lands: A Guide for Natural Resources Managers (Benton et al. 2008) provides background information for natural resource managers, as well as examples and tools to aid in the development of ecosystem-based biodiversity conservation strategies in the context of the military mission and preparation of INRMPs. This guide is a useful source of assistance and guidance and should be consulted for additional information when implementing any of the following management recommendations. The nature of the military mission supports conservation and management of natural resources while still meeting training requirements. Management strategies should be reviewed and updated periodically as opportunities are identified to improve management practices, promote stewardship, and contribute to the military mission through biodiversity conservation.

6.1 SERE SCHOOL MANAGEMENT RECOMMENDATIONS

Each of the INRMP management recommendations are classified as one of four ERLs, as listed below in descending order of priority:

- Level 4: Environmental compliance requirement
- Level 3: Navy proactive involvement
- Level 2: Navy or DoD policy requirement
- Level 1: Navy environmental stewardship

Refer to Section 5.5 *Project Development and Classification* for a description of the ERL associated with each INRMP project.

6.1.1 Environmental Readiness Level 4: Environmental Compliance

There are no ERL 4 INRMP projects proposed for the five-year plan period.

6.1.2 Environmental Readiness Level 3: Navy Proactive Involvement

Water Resources Management

- **Project 1:** Conduct a delineation of all surface waters at the Installation, to include wetlands and streams at a minimum.

- **Project 3:** Conduct annual erosion surveys to identify soil erosion problem areas. These surveys should focus on the identification of areas of erosion along roadways, trails and footpaths, and areas of ground disturbance adjacent to and along edges of wetlands and surface waters; inspection of previously identified problem areas; and inspection of recently constructed erosion and sedimentation remediation areas.

- **Project 4:** Develop and implement erosion remedial and preventive measures to protect water quality and ensure shoreline stabilization, based on annual survey results (Project 3) and previous streambank assessments.

Water Resources Management and Outdoor Recreation Management

- **Project 5:** Prepare and implement an erosion control plan for all earth-disturbing activities. The plan will incorporate the results of annual erosion surveys (Project 3) and previously completed streambank assessments, and will include erosion remedial and preventive measures to protect water quality and ensure streambank stabilization. The plan will include training materials for SERE School personnel including recommendations for conducting trail maintenance and BMPs to use during construction and ground-disturbing activities.

Water Resources Management, and Fisheries and Aquatic Species Management

- **Project 6:** A water quality baseline inventory, to include inventory of surface waters that may support Atlantic salmon, shall be designed and implemented for the SERE School in accordance with existing Navy water quality monitoring protocols. Specific protocols for the SERE School shall be established to assure that water quality does not drop below natural levels and water quality is maintained to provide quality habitat for Atlantic salmon.

Vegetation Management

- **Project 7:** Conduct a natural community type survey of the SERE School to ground-truth available GIS data of the vegetative community types present, and to collect additional natural community type data based on current scientific information.

- **Project 8:** Conduct a survey to establish a baseline inventory of edible plants at the Installation, especially in training areas. Conduct follow-up surveys at least every five years of known edible plant areas to identify positive and negative trends associated with these resources.

Rare Communities and Significant Wildlife Habitat Management, and Fisheries and Aquatic Species Management

- **Project 12:** Conduct a comprehensive vernal pool survey of the SERE School using MDIFW protocols. Survey should include identification of all potential vernal pools using a combination of desktop review and site visits to ground-truth and survey each potential vernal pool. Survey should be conducted during the appropriate survey window as determined by MDIFW to record evidence of use by breeding, obligate vernal pool species. Recording unique features of the pools, photographic documentation, and GIS mapping of each pool also should be conducted.

Rare, Threatened, Endangered, and Special Concern Plant Species Management

- **Project 13:** Conduct a plant survey and habitat assessment within the appropriate season for rare, threatened, endangered, or special concern plant species with the potential to occur at the Installation.

Species Protected by Federal and Maine Endangered Species Acts

- **Project 26:** Conduct periodic surveys during the appropriate season for rare, threatened, endangered, and special concern mammal species known or with the potential to occur at the Installation.

- **Project 27:** Conduct periodic surveys during the appropriate season for rare, threatened, endangered, and special concern bird species known or with the potential to occur at the Installation.

- **Project 28:** Conduct periodic surveys during the appropriate season for rare, threatened, endangered, and special concern invertebrate species known or with the potential to occur at the Installation. Survey should include terrestrial and aquatic invertebrate species and habitats that support these species, and identification of habitat that directly supports pollinators.

- **Project 29:** Work with the MDIFW to develop and implement an Atlantic salmon habitat protection program.

- **Project 30:** The Navy will work with USFWS and the MDIFW to determine whether Redington Pond dam should be removed to improve on and offsite habitat conditions for native fish species, including Atlantic salmon.

- **Project 31:** Conduct periodic golden eagle monitoring within suitable habitat at the SERE School. If golden eagle nest locations are identified, GPS information for these sites will be will be shared with the cooperating natural resource agencies (i.e. USFWS, MDIFW) as appropriate.

Migratory Bird Management

- **Project 32:** Establish a partnership with Maine and National Audubon Society chapters to conduct surveys and monitoring of rusty blackbird populations at the SERE School.

6.1.3 Environmental Readiness Level 2: Navy or DoD Policy Requirement

Water Resources Management

- **Project 2:** Conduct an assessment of potential riparian buffer restoration or enhancement areas. Where riparian restoration or enhancement opportunities exist, such as at the Alpha and Multi-Purpose Building sites, along roads, and along Redington Stream, use bioengineering techniques to stabilize compromised streambanks and plant using native species.

Noxious Weeds and Invasive Plants Management

- **Project 9:** Conduct annual site surveys to proactively identify new occurrences of invasive species and to monitor restoration sites for growth. An annual survey of the SERE School waterbodies also should be conducted to evaluate the presence of invasive aquatic species, such as Eurasian milfoil and hydrilla. If these or other invasive aquatic species are identified, coordinate with MDEP to determine if actions to remove these species are necessary.

- **Project 10:** Develop a plan to remove and restore areas infested with invasive plant species, including terrestrial and aquatic species identified in Project 9. For small stands it is preferred that all aboveground biomass as well as the underground rhizome by which they spread be manually removed. If manual removal is not feasible, stands should be treated with an approved herbicide such as glyphosate.

Partnerships and Outreach

- **Project 15:** Conduct a climate change vulnerability assessment in partnership with other DoD installations, federal and state agencies, non-governmental organizations, and/or universities. The assessment should focus on future climate change projections, impacts of altered species' distribution patterns, and variations in ecological processes such as drought, fire, and flood for Navy installations located in Maine.

Environmental and Natural Resources Training, Outdoor Recreation Management, and Education and Outreach

- **Project 16:** Develop an environmental awareness program focused on educating and training SERE School and PWD-ME personnel on protection of natural resources topics including implementing BMPs for erosion control and trail maintenance, wetland protection, management of nuisance wildlife, and protection of rare, threatened, endangered, and special concern plant and wildlife species known to occur.

Environmental and Natural Resources Training and Outdoor Recreation Management

- **Project 17:** Provide periodic training for SERE School personnel and PWD–ME environmental staff regarding implementation of erosion and sediment control measures and use of effective BMPs. MDEP provides annual erosion and sediment control courses.

Environmental and Natural Resources Training

- **Project 18:** Provide training for environmental and grounds maintenance staff for identification of wetlands, and for avoiding impacts to key vegetation species and wetland habitats identified for conservation and protection.

- **Project 19:** Provide professional training for PWD-ME environmental staff to include Field Techniques for Invasive Plant Management, Conservation Biology (both courses offered at the USFWS NCTC), and Pest Applicator Certification Training (offered by the Armed Forces Pest Management Board).

- **Project 21:** Provide training to environmental staff to maintain the SERE School GIS database.

Geographic Information Systems (GIS) Management, Data Integration, Access and Reporting

- **Project 20:** Work with the Naval Facilities Engineering Command Mid-Atlantic GeoReadiness Center to develop a GIS system for storing SERE School natural resources data.

General Fish and Wildlife Management

- **Project 22:** Conduct baseline surveys to assess the presence of mammals and invertebrates at the SERE School. Survey methods should yield a comprehensive species list and representative data for the diversity and relative abundance of mammals and invertebrates occurring at the SERE School.

Invasive and Nuisance Wildlife Management

Project 33: Conduct biannual monitoring, or more frequently as needed, of invasive and nuisance wildlife including beavers, bats, moose, and bear to determine whether wildlife removal, relocation, or other remedial actions are necessary to protect natural resources and/or human health and safety. The Navy shall coordinate with MDIFW and other applicable agencies to develop a plan/strategy outlining methods to address nuisance wildlife issues that may be impacting Installation infrastructure and mission requirements. The White-nose Syndrome Conservation and Recovery Working Groups, "Acceptable Management Practices for Bat Control Activities in Structures - A Guide for Nuisance Wildlife Control Operators" prepared by the. U.S. Fish and Wildlife Service shall be followed when dealing with bats in structures. A copy of this manual can be found in Appendix L.

General Forest Management

- **Project 34:** Conduct an update of the 1998 basic characterization for SERE School forest types. The updated forestry survey should include delineation of each stand type, which is an easily defined area of the forest containing the same species mixture with similar heights, ages, diameters, densities, soils, health, or other unifying characteristics (MDACF, Maine Forest Service 2012). Data collected during the field assessment should

include dominant and common tree species, sizes, age class, absolute density, soils, topography, key habitat features, and any other distinctive features.

6.1.4 Environmental Readiness Level 1: Navy Environmental Stewardship

Wildland Fire Management and General Forest Management

- **Project 11:** Upon completion of the updated forest characterization assessment (see Project 34), a forest management plan will be developed in coordination with the Maine Forest Service to include management of dense forest conditions (including salvage of downed trees and debris for firewood, timber sales, and reducing the risk of wildland fire), identification of areas containing abundant edible plants, and management of forest resources in response to natural disturbances. During their review of this INRMP, the USFWS Umbagog NWR also expressed interest in providing guidance and recommendations to the Navy for development and implementation of the forest management plan.

Partnerships and Outreach

- **Project 14:** Establish partnerships with state and federal agencies, NGOs, and/or universities to promote the conservation and study of natural resources at the SERE School. Potential partners include the North Atlantic LCC, National and Maine Audubon Society chapters, IBP, TNC, The Wilderness Society, and the Vermont Center for EcoStudies.

General Fish and Wildlife Management and Outdoor Recreation Management

- **Project 23:** Conduct a deer population survey to determine if populations would support development of a hunting program at the SERE School.

- **Project 24:** Using the results of the baseline mammal survey (Project 22) and the deer population survey (Project 23), work with the SERE School Command to determine if a hunting program can be developed for the SERE School.

Fisheries and Aquatic Species Management and Outdoor Recreation Management

- **Project 25:** Work with the SERE School OIC to develop a fishing instruction for the SERE School to include restrictions, MDIFW fishing regulations, and catch and size limits.

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APPENDIX A

SERE School Environmental Assessment

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An electronic copy of the SERE School INRMP is on the CD located inside the front cover of the hard copy of this document.

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APPENDIX B

Agency Correspondence

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Umbagog NWR
2756 Dam Road
P.O. Box 240
Errol, NH 03579-0240
(603) 482-3415

19 June 2014

Department of the Navy
Portsmouth Naval Shipyard
Building 59, 3rd floor
Portsmouth NH 03904

Attention: Ian W. Trefry

Dear Mr. Trefry:

The U.S. Fish and Wildlife Service, Umbagog National Wildlife Refuge has reviewed the Integrated Natural Resources Management Plan, Center for Security Forces Detachment Kittery Survival, Evasion, Resistance, and Escape Facility (SERE East) document. Our review does not constitute a review by the U.S. Fish and Wildlife Service Maine Field Office and their comments will be provided in a separate letter.

We appreciate the opportunity to review this document as it relates to our planning in the geographic area. The U.S. Fish and Wildlife Service has been studying the High Peaks region of Maine for its potential to conserve land for a National Wildlife Refuge. Umbagog National Wildlife Refuge has the lead in this study. While specific parcels of land have not yet been identified for inclusion in a refuge proposal, the SERE East property would abut or be in close proximity to many key parcels being studied at this time. The High Peaks region of Maine is of high conservation value due to the percentage of high elevation habitat along with the adjoining topography that creates a gradient of elevation and habitat types important to many species of fish and wildlife including species of conservation concern and endangered species. The habitat and elevational gradients also provide for resiliency to climate change that will remain regionally important to wildlife in the face of global warming.

The SERE East facility is unique in this regionally important landscape in the condition of its forests. No forest management has occurred on the property since the 1960s making the forests on this property a rare mature forest in an intensely harvested industrial forest landscape. As you stated in section 2.5, "Throughout the western mountains of Maine, there are few large blocks of land such as the SERE School where timber resource is not managed intensively." We commend the Navy for their policy on natural resource management which bases land management on an ecosystem approach and identifies that "In areas such as the SERE School, where much of the land has been

retained in its natural condition, efforts to maintain, enhance, and restore natural ecosystems may be the most appropriate strategy." (Section 1.5) The SERE East property represents a unique opportunity to manage for old growth forest conditions that could be realized in the near future. This property is truly unique in that regard.

Section 3.3 provided more detail on forest management, but it is not exactly clear how the forest will be managed. Forest management seems to desire mature tree stand protection and avoiding impact to trees that provide important forage for birds and other wildlife. Also, it appears that maintaining forest habitats to ensure consistency with an ecosystem approach to forest management. In section 3.3.1 it is stated that, "There will be no active timber management at the SERE School." And "Active management of vegetation on the property is not presently necessary to meet the mission and natural resource objectives." Other sections of the document however, voice concern about the potential wildfire risk of a dense forest and the need to reduce that risk through management and maintain/ improve fire breaks. The development of a forest management plan in coordination with the Maine Forest Service and the option to manage these forests is clearly stated and keeping the management option open will give you the ability to use timber harvest to meet biological, ecological, and mission goals. As stated in the INRMP, natural disturbance is typically single tree and small group disturbances. Single tree and small group selection harvesting could improve wildlife habitat, increase structural diversity and forest complexity, and potentially increase edible plants if designed carefully. Completing Project 34 will help to understand the forest resource. Umbagog NWR has been using single tree and small group selection to increase forest complexity, we would be happy to share what we have learned and how we came to that decision with you as you consider Project 11 – developing a Forest Management Plan.

The importance of the low lying areas and wetlands is also well stated in regard to wetlands, waterfowl, wading birds, rusty black bird, Atlantic salmon, and wintering white-tailed deer. These are important resources in the Maine High Peaks region and we are happy to see that they are recognized.

Again, thank you for the opportunity to review the INRMP. Please let us know if we can assist you with planning or management in any way.

Sincerely,

Paul F Casey

Paul F. Casey, Refuge Manager

Rivard, Linda

From: Trefry, Ian W CIV NAVFAC MIDLANT, PWD Maine <ian.trefry@navy.mil>
Sent: Tuesday, December 02, 2014 9:00 AM
To: Rivard, Linda
Subject: FW: Wildlife comments INRMP -- Sere School Redington Twp.
Signed By: ian.trefry@navy.mil

-----Original Message-----
From: Cordes, Robert [mailto:Robert.Cordes@maine.gov]
Sent: Thursday, November 13, 2014 12:51 PM
To: Perry, John
Cc: Trefry, Ian W CIV NAVFAC MIDLANT, PWD Maine
Subject: Wildlife comments INRMP -- Sere School Redington Twp.

John,

Here are my comments for the INRMP for the NAVY SERE installation in Redington Twp.

General comments:

This plan is very thorough and addresses the wildlife species/habitats. Surveys for RTE species/habitats have either been completed or are pending completion.

Specific comments:

Page 1-13, Section 1.6.2 -1st Para. : What are the typical species taken? This may require a permit - particularly for herps. There would a chance that wood turtles, spring salamaders, etc.. exist at the facility and we would want to limit take of those species.

Page 2-39, Table 2-5: Eastern Cougar - should be listed as extinct after recent USFWS determination, and thus no potential for occurring.

Page 3-9, Para 4, Beaver lodges: I would change language to "Beaver dams also may affect", and I would offer that MDIFW would like to work with the Navy to develop a plan/strategy for addressing issues with beavers and the installation infrastructure.

I would add a fact sheet for the following species:

Roaring Brook Mayfly

Northern Bog Lemming

Rock (yellow-nose) vole

Thanks,

Bob

Robert C. Cordes

Asst. Regional Wildlife Biologist

MDIFW Region D

689 Farmington Rd.

Strong, ME 04983

207-778-3324 ext. 24

APPENDIX C

Applicable Regulations and Public Laws

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Acronyms and Abbreviations

Army	United States Department of the Army
CFR	Code of Federal Regulations
DoD	United States Department of Defense
DoDI	United States Department of Defense Instruction
EO	Executive Order
EPA	United States Environmental Protection Agency
ESA	Endangered Species Act
FR	Federal Register
INST	Instructions
INRMP	Integrated Natural Resources Management Plan
MBTA	Migratory Bird Treaty Act
MRSA	Maine Revised Statutes Annotated
NAVFAC	Naval Facilities Engineering Command
Navy	United States Department of the Navy
NEPA	National Environmental Policy Act
NGO	non-governmental organization
OPNAV	Chief of Naval Operations
PL	Public Law
SAIA	Sikes Act Improvement Act
SECNAV	Secretary of the Navy
U.S.	United States
USACE	United States Army Corps of Engineers
USC	United States Code
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service

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NUMBER	TITLE	DESCRIPTION
Federal		
7 Code of Federal Regulations (CFR) 657	Prime and Unique Farmlands	Authorizes the United States (U.S.) Department of Agricultural (USDA) Natural Resources Conservation Services to maintain an inventory of the prime farmland and unique farmlands in the U.S.
32 CFR 190	Natural Resources Management Program	Provides U.S. Department of Defense (DoD) policy on natural resources management.
32 CFR 229	Protection of Archaeological Resources: Uniform Regulations	Establishes uniform definitions, standards, and procedures for all federal land managers in providing protection for archaeological resources located on public lands and Indian lands of the U.S.
32 CFR 650	Historic Preservation	Provides guidance and procedures for protecting, preserving, restoring, and rehabilitating all sites, structures, and objects of historical, architectural, archaeological, or cultural significance located on U.S. Department of the Army (Army)-controlled property.
36 CFR 60	National Register of Historic Places	Authorizes the Secretary of the Interior to expand and maintain a National Register of districts, sites, buildings, structures, and objects significant in American history, architecture, archaeology, engineering and culture.
36 CFR 63	Determination of Eligibility for Inclusion in the National Register of Historic Places	Establishes the process for the determination of eligibility for inclusion in the National Register of Historic Places.
36 CFR 65	National Historic Landmarks Program	Establishes the National Historic Landmarks Program whose purpose is to identify and designate National Historic Landmarks and encourage the long range preservation of nationally significant properties that illustrate or commemorate the history and prehistory of the U.S.
36 CFR 67	Historic Preservation Certifications	Authorizes the issuance of certifications of historic district statutes and of state and local historic districts, certifications of significance, and certifications of rehabilitation in connection with certain tax incentives involving historic preservation.
36 CFR 68	Secretary of the Interior's Standards for the Treatment of Historic Properties	Provides advice on how to protect a wide range of historic properties.

NUMBER	TITLE	DESCRIPTION
36 CFR 78	Waiver of Federal Agency Responsibilities Under Section 110 of the National Historic Preservation Act	Authorizes the Secretary of the Interior to promulgate regulations under which requirements in Section 110 may be waived in whole or in part in the event of a major natural disaster or an imminent threat to the national security.
36 CFR 79	Curation of Federally Owned and Administered Archaeological Collections	Provides minimum standards for the long-term management and care of archaeological collections.
36 CFR 800	Protection of Historic and Cultural Properties (Public Law [PL] 89–665)	Requires that federal agency heads undertake planning and actions as necessary to minimize harm to any National Historic Landmark that may be directly and adversely affected by an undertaking.
43 CFR 3	Preservation of American Antiquities	Provides for jurisdiction over ruins, archaeological sites, historic and prehistoric monuments and structures, objects of antiquity, historic landmarks, and other objects of historic and scientific interest to the Secretaries of USDA, Army, and the U.S. Department of the Interior as appropriate.
50 CFR 17	Endangered and Threatened Wildlife and Plants	Prescribes policies for the conservation and restoration of endangered and threatened wildlife and plants.
50 CFR 21	Migratory Bird Permits; Take of Migratory Birds by the Armed Forces (PL 107–314)	Allows for the incidental take of migratory birds by DoD during military readiness activities, provided a permit authorizing such activities has been received.
Executive Orders (EOs) 11514 and 11991	Protection and Enhancement of Environmental Quality	Directs issuance of instructions and guidelines relative to preparation of Environmental Impact Statement.
EO 11593	Protection and Enhancement of the Cultural Environment	Directs federal agencies to inventory their cultural resources and establishes policies and procedures to ensure the protection, restoration, and maintenance of federally owned sites, structures, and objects of historical, architectural, or archaeological significance.
EO 11644	Use of Off-Road Vehicles on the Public Lands	Promotes the safety of all users of public lands by establishing guidelines for the use of off-road vehicles on public lands.
EO 11987	Exotic Organisms	Requires federal agencies to restrict the introduction of exotic species into the natural ecosystems on lands and water owned or leased by the U.S.
EO 11988	Floodplain Management	Requires federal agencies to evaluate effects of action they have taken on floodplains.

NUMBER	TITLE	DESCRIPTION
EOs 11989 and 12608	Off-Road Vehicles on Public Lands	Restricts the use of off-road vehicles (including all vehicles used in hunting and other outdoor activities when off paved surfaces) away from paved roads or other designated hard surfaces.
EO 11990	Protection of Wetlands	Requires government agencies, in carrying out agency actions and programs affecting land use, to provide leadership and take action to minimize the destruction, loss, or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands
EO 12088	Federal Compliance with Pollution Control Standards	Ensures that all necessary actions are taken to prevent, control, and abate environmental pollution with respect to federal facilities and activities under control of the Agency.
EO 12962	Recreational Fisheries	Requires federal agencies to improve the quantity, function, sustainable productivity, and distribution of U.S. aquatic resources for increased recreational fishing opportunities.
EO 13007	Indian Sacred Sites	Requires federal agencies to manage federal lands to accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners and to avoid adversely affecting the physical integrity of such sacred sites.
EO 13061	Federal Support of Community Efforts Along American Heritage Rivers	Establishes the American Heritage Rivers initiative to promote the resource and environmental protection, economic revitalization, and historic and cultural preservation of Americans Heritage Rivers.
EO 13112	Invasive Species	Requires executive agencies to restrict the introduction of exotic organisms into natural ecosystems
EO 13148	Greening the Government through Leadership in Environmental Management	Mandates that environmental management considerations must be a fundamental and integral component of federal government policies, operations, planning, and management and that sustainable management is pursued through the implementation of cost-effective, environmentally sound landscaping practices and programs to reduce adverse impacts to the natural environment.
EO 13186	Responsibilities of Federal Agencies to Protect Migratory Birds	Imposes substantive obligations on the U.S. for the conservation of migratory birds and their habitats.

NUMBER	TITLE	DESCRIPTION
EO 13352	Facilitation of Cooperative Conservation	Requires that the Secretaries of the Interior, Agriculture, Commerce, and Defense and the Administrator of the U.S. Environmental protection Agency (EPA) shall carry out the programs, projects, and activities of the agency in a manner that facilities cooperative conservation.
EO 13433	Facilitation of Hunting Heritage and Wildlife Conservation	Directs federal agencies to facilitate the expansion and enhancement of hunting opportunities and the management of game species and their habitat.
59 Federal Register (FR) 50852–50857	Endangered and Threatened Species; Final Rule to Reclassify the Plant *Isotria medeoloides* (Small Whorled Pogonia) from Threatened to Endangered	Issues determination that small whorled pogonia warrants reclassification from endangered to threatened based on fulfillment of reclassification criteria as stated in the Small Whorled Pogonia Recovery Plan (1992).
60 FR 40837	President's Executive Memorandum on Environmentally and Economically Beneficial Landscape Practices on Federal Landscaped Grounds	Provides guidance developed by the interagency workgroup under the direction of the Federal Environmental Executive to assist federal agencies in the implementation of environmentally and economically beneficial landscape practices, and requires implementing landscaping practices that are intended to benefit the environment and generate long-term cost savings.
65 FR 16053–16086	Determination of Threatened Status for the Contiguous U.S. Distinct Population Segment of the Canada Lynx and Related Rule; Final Rule	Assigns the status of federally threatened species to the U.S. Distinct Population Segment of the Canada lynx which occurs in portions of Colorado, Idaho, Maine, Michigan, Minnesota, Montana, New Hampshire, New York, Oregon, Utah, Vermont, Washington, and Wisconsin.
65 FR 69459–69483	Endangered and Threatened Species; Final Endangered Status for a Distinct Population Segment of Anadromous Atlantic Salmon (*Salmo salar*)in the Gulf of Maine	Issues determination of endangered status pursuant to the Federal Endangered Species Act (ESA) for the Gulf of Maine distinct population segment of Atlantic salmon.
70 FR 12710–12716	Final List of Bird Species to Which the Migratory Bird Treaty Act (MBTA) Does Not Apply	Provides a list of bird species to which the MBTA does not apply.
71 FR 168	Memorandum of Understanding Between DoD and U.S Fish and Wildlife Service (USFWS) to Promote the Conservation of Migratory Birds	Outlines a collaborative approach to promote the conservation of migratory bird populations, identifies specific activities where cooperation between the parties will contribute substantially to the conservation of migratory birds and their habitats.

NUMBER	TITLE	DESCRIPTION
71 FR 55431	Endangered and Threatened Species: Notice of Availability of the Status Review for Atlantic Salmon in the U.S.	Issues study completed by biologists from the Maine Atlantic Salmon Commission, Penobscot Indian Nation, National Marine Fisheries Services, and USFWS on status of Atlantic salmon in the U.S.
72 FR 31156–31157	National Bald Eagle Management Guidelines	Advises the public of the availability of the National Bald Eagle Management Guidelines which provide guidance to land managers, landowners, and others as to how to avoid disturbing bald eagles.
72 FR 37346–37372	Removing the Bald Eagle in the Lower 48 States from the List of Endangered and Threatened Wildlife	Announces the removal of the bald eagle from the federal list of endangered and threatened wildlife based on a thorough review of all available information which indicates that the threats to this species have been eliminated or reduced to the point that the species has recovered and no longer meets the definition of threatened or endangered under the ESA.
74 FR 8616–8702	Revised Designation of Critical Habitat for the Contiguous United States Distinct Population Segment of the Canada Lynx	Designates revised critical habitat for the Canada lynx, including critical habitat located in Aroostook, Franklin, Penobscot, Piscataquis, and Somerset countries, Maine.
74 FR 29300–29341	Designation of Critical Habitat for Atlantic Salmon (*Salmo salar*) Gulf of Maine Distinct Population Segment; Final Rule	Designates critical habitat for the Atlantic salmon Gulf of Maine distinct population segment in 45 specific areas.
76 FR 38095–38106	90-Day Finding on a Petition To List the Eastern Small-Footed Bat and the Northern Long-Eared Bat as Threatened or Endangered	Announces the results of a 90-day finding on a petition to list the eastern small-footed bat and northern long-eared bat as endangered or threatened under the ESA. Petition presents substantial scientific or commercial information that the listing of these species may be warranted. Initiates a review to determine if the listing of these species is warranted.
77 FR 5914–5982	Endangered and Threatened Wildlife and Plants; Final Listing Determinations for Two Distinct Population Segments of Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) in the Southeast	Issues a final determination to list the Carolina and South Atlantic distinct population segments of Atlantic sturgeon as endangered under the ESA.

NUMBER	TITLE	DESCRIPTION
77 FR 48934–48947	Endangered and Threatened Wildlife and Plants; 90-Day Finding on a Petition To List the Bicknell's Thrush (*Catharus bicknelli*) as Endangered or Threatened	Announce the results of a 90-day finding on a petition to list Bicknell's thrush as threatened or endangered under the ESA. Petition presents substantial scientific or commercial information indicating that listing this species may be warranted. Initiatives a review to determine if the listing of these species is warranted.
78 FR 191	Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition To List the Eastern Small-Footed Bat and the Northern Long-Eared Bat as Endangered or Threatened Species; Listing the Northern Long-Eared Bat as an Endangered Species; Proposed Rule	Announces the results of a 12-month finding on a petition to list the eastern small-footed bat and the northern long-eared bat as endangered or threatened under the ESA and to designate critical habitat. Listing of eastern small-footed bat is not warranted but listing of the northern long-eared bat is. Proposes to list the northern long-eared bat as endangered throughout its range.
PL 93–452	Conservation and Rehabilitation Program on Military and Public Lands	Authorizes conservation and rehabilitation programs on Military and Public Lands owned by Department of Energy, Bureau of Land Management, and U.S. Forest Service.
PL 107–77	Appropriations Act of 2002	Authorizes appropriations for the Departments of Commerce, Justice, and State, the Judiciary, and related agencies for the fiscal year ending 30 September 2002.
7 United States Code (USC) Section (§)136	Federal Insecticide, Fungicide and Rodenticide Act (PL 80–104)	Governs the use and application of pesticides in natural resources management plans.
7 USC §4201, *et seq.*	Farmland Protection Policy Act (PL 97–98)	Requires that federal programs be compatible with state, local, and private efforts to protect farmland.
7 USC §7701 *et seq.*	Plant Protection Act of 2000 (PL 106–224)	Prohibits importing, exporting, or moving in interstate commerce an unauthorized plant pest. Prohibits the unauthorized mailing, and knowing delivery by a mail carrier, of plant pests.
10 USC §2665	Sale of Certain Interests in Lands; Logs	The sale of forest products is authorized to finance the cost of managing forest resources for commercial production.
10 USC §2667	Armed Forces, Leases; non-excess property of military departments and Defense Agencies	Provides general requirements for leasing certain lands that will promote national defense or be in the public interest.
10 USC §2671	Military Reservations and Facilities: Hunting, Fishing, and Trapping (PL 85–337)	Provides that hunting, fishing, and trapping on military lands will be in accordance with state laws.

NUMBER	TITLE	DESCRIPTION
10 USC §2684a	Agreements to Limit Encroachments and other Constraints on Military Training, Testing and Operations	Establishes DoD Encroachment Patterning program and authorizes military services to enter into cost-sharing partnerships with states, their political subdivisions, and/or conservation minded non-governmental organizations (NGOs) to acquire lands from willing sellers.
16 USC §431–433	Antiquities Act of 1906, as amended	Assigns penalties for damage, destruction, etc. of antiquities and authorizes the President of the U.S. is authorized to declare by public proclamation historic landmarks, historic and prehistoric structures, and other objects of historic or scientific interest that are situated upon the lands owned or controlled by the U.S. Government.
16 USC §461	Historic Sites Act of 1935 (PL 74–292)	Declares national policy to identify and preserve nationally significant historic sites, buildings, objects, and antiquities and authorizes the National Historic Landmarks program.
16 USC §469–469c–2	Archaeological and Historic Preservation Act, as amended (PL 86–523)	Provides for the preservation of historical and archaeological data which might otherwise be lost or destroyed as a result of any alteration of the terrain caused as a result of any federal construction project or federally licensed activity or program.
16 USC §470	National Historic Preservation Act of 1966 (PL 102–575)	Establishes a program for the preservation of additional historic properties throughout the U.S.
16 USC §470aa–mm	Archaeological Resources Protection Act of 1979, as amended	Provides for the protection of archaeological resources and sites which are on public lands and Indian lands and fosters cooperation and exchange of information between governmental authorities, the professional archaeological community, and private individuals.
16 USC §528	Multiple-Use Sustained-Yield Act of 1960 (PL 86–517)	Directs that national forests be managed under the principles of multiple use and to produce a sustained yield of products and services.
16 USC §590a *et seq.*	Soil Conservation and Domestic Allotment Act, as amended (PL 74–46)	Provides for application of soil conservation practices on federal lands.

NUMBER	TITLE	DESCRIPTION
16 USC §661–666c	Fish and Wildlife Coordination Act	Authorizes the Secretaries of Agriculture and Commerce to provide assistance to and cooperate with federal and state agencies to protect, rear, stock, and increase the supply of game and fur-bearing animals, as well as to study the effects of domestic sewage, trade wastes, and other polluting substances on wildlife.
16 USC §668–668c	Bald and Golden Eagle Protection Act of 1940, as amended (PL 86–70)	Prohibits the taking (harassment, sale, or transportation) of bald or golden eagles, alive or dead, whole or in part and their nest and/or eggs.
16 USC §670 *et seq.*	Sikes Act Improvement Act (SAIA) of 1997 (passed as an amendment to the Sikes Act of 1960) (PL 105–85)	Each integrated natural resources management plan (INRMP) prepared under this Act should provide for the sustainable use by the public of natural resources, to the extent that the use is not inconsistent with the needs of fish and wildlife resources. The Secretary of the Interior, in consultation with state fish and wildlife agencies, must submit a report annually on the amounts expended by Interior and state fish and wildlife agencies on activities conducted pursuant to INRMPs to respective Congressional committees with oversight responsibilities.
16 USC §703–712	MBTA, as amended (PL 65–186)	Prohibits taking or harming a migratory bird, its eggs, nest, or young without the appropriate permit.
16 USC §757a–757g	Anadromous Fish Conservation Act (PL 89–304)	Authorizes the Secretaries of the Interior and Commerce to enter into cooperative agreements with the States and other non-federal interests for conservation, development, and enhancement of anadromous fish.
16 USC §1001 *et seq.*	Watershed Protection and Flood Prevention Act	Authorizes the Secretary of Agriculture to cooperate with states and other public agencies in works for flood prevention and soil conservation, as well as the conservation, development, utilization, and disposal of water.
16 USC §1271–1287	Wild and Scenic Rivers Act, as amended (PL 90–542)	Required identification and protection of any river or stream that qualifies under the Act.

NUMBER	TITLE	DESCRIPTION
16 USC §1531 *et seq.*	ESA of 1973, as amended (PL 93–205)	Provides for the identification and protection of threatened and endangered species of fish, wildlife, and plants and their critical habitats. Requires federal agencies to ensure that no agency action is likely to jeopardize the continued existence of an endangered or threatened species. Requires biological assessments of any agency action when an endangered or threatened species may be present in the area(s) affected by the action.
16 USC §1600	Resources Planning Act, as amended (PL 93–378)	Requires a complete national assessment or inventory of all forest, rangeland resources, and public needs every ten years, along with a plan to meet those needs.
16 USC §1801 *et seq.*	Magnuson–Stevens Fisheries Conservation and Management Act	Establishes policies for the sustainable management of fishery resources and the protection of essential fish habitats.
16 USC §2001	Soil and Water Resources Conservation Act of 1977	Provides for the collection and analysis of resource data and appraisal of the status, conditions, and trends of soil and water resources.
16 USC §2901 *et seq.*	Fish and Wildlife Conservation Act (Nongame Act) of 1980, as amended	Encourages the development of conservation plans for nongame fish and wildlife of ecological, educational, aesthetic, cultural, recreational, economic or scientific value.
16 USC §3371–3378	Lacey Act	Establishes civil and criminal penalties for mistreatment of plants and wildlife.
16 USC §3901–3932	Emergency Wetlands Resources Act	Promotes the conservation of wetlands in order to maintain the public benefits they provide, and to fulfill international obligations contained in various migratory bird treaties and conventions.
16 USC §4321	National Invasive Species Act (PL 104–332)	Prescribes policies to prevent the introduction and spread of non-indigenous species into U.S. waters
16 USC §4401	North American Wetlands Conservation	Encourages partnerships among federal agencies and others to protect, restore, enhance, and manage wetlands and other habitats for migratory birds, fish, and wildlife.
25 USC §3001	Native American Graves Protection and Repatriation Act (PL 101–601)	Provides for the protection of Native American graves and requires federal agencies and institutions to return Native American cultural items to lineal descendants and culturally affiliated Indian tribes and Native Hawaiian organizations.

NUMBER	TITLE	DESCRIPTION
31 USC §1535	Money and Finance – The Budget Process – Agency Agreements	Provides policy on how an agency or major organizational unit within an agency may place an order with a major organization within the same agency or another agency for goods or services
33 USC §401 *et seq.*	Rivers and Harbors Act	Requires authorization from the U.S. Army Corps of Engineers (USACE) for the construction of any structure in or over any navigable waters of the U.S. and the excavation/dredging or deposition of material in these waters or any obstruction or alteration in navigable water.
33 USC §1251 *et seq.*	Federal Water Pollution Control Act (Clean Water Act) of 1972, as amended (PL 92–500)	Section 303 requires States to identify waters that do not or are not expected to meet applicable water quality standards with technology-based controls alone and to develop programs to achieve the State standards. Section 319 requires federal agencies to comply with State nonpoint source pollution abatement guidelines. Section 401 prohibits point source discharge of pollutants into navigable waters, unless an appropriate permit is first obtained. Section 402 controls direct discharges into navigable waters and covers National Pollutant Discharge Elimination System permits, issued by either EPA or an authorized state/tribe, with industry-specific, technology-based and water-quality-based limits and pollutant monitoring and reporting requirements. Section 404 prohibits discharge of dredged or fill material into navigable waters of the U.S., including wetlands, without first obtaining a permit from the USACE.
33 USC §2701–2761	Oil Pollution Act of 1990	Creates a comprehensive prevention, response, liability, and compensation regime to deal with vessel- and facility-caused oil pollution to U.S. navigable waters.
42 USC §300f *et seq.*	Safe Drinking Water Act, as amended (PL 93–523)	Protects the quality of drinking water in the U.S. whether from above ground or underground sources
42 USC §1962d	Water Resources Planning Act of 1965, as amended	Provides for the optimum development of the Nation's natural resources through the planning of water and related resources.

NUMBER	TITLE	DESCRIPTION
42 USC §1996	American Indian Religious Freedom Act of 1978, as amended (PL 95–341)	Provides for the protection and preservation of traditional religions of Native Americans including but not limited to access to sites, use and possession of sacred objects, and the freedom to worship through ceremonials and traditional rites.
42 USC §2000bb–2000bb4	Religious Freedom Restoration Act of 1993 (PL 103–141)	Prevents laws that substantially burden a person's free exercise of their religion.
42 USC §4231	Intergovernmental Coordination Act of 1968 (PL 90–577)	Requires any federal agency which administers any program requiring a State plan as a condition of assistance to give the governor of the state an opportunity to comment on the relationship of such state plant to any comprehensive or other state plan or program.
42 USC §4321 *et seq.*	National Environmental Policy Act (NEPA) of 1969, as amended (PL 91–190)	Establishes a national policy to preserve important natural aspects of our national heritage and enhance the quality of renewable resources.
42 USC §7401	Clean Air Act, as amended	Provides for the protection and enhancement of the quality of the Nation's air resources through research and technical and financial assistance to state and local governments.
42 USC §9601 *et seq.*	Comprehensive, Environmental Response, Compensation and Liability Act, as amended (PL 96–510)	Authorizes Natural Resource Trustees to recover damages for injury to, destruction of, or loss of natural resources resulting from the release of a hazardous substance.
43 USC §1241 *et seq.*	Carlson-Foley Act of 1968 (PL 90–583)	Provides for the control of noxious plants on land under control or jurisdiction of the federal government.
43 USC §1701	Federal Land Policy and Management Act of 1976 (PL 94–579)	Establish public land policy and guidelines for the management, protection, development, and enhancement of public lands.
DoD		
DoD Directive 4715.1	Environmental Security	Establishes policy for environmental security within the DoD and establishes the Defense Environmental Security Council, the Environment, Safety, and Occupational Health Policy Board, and the Armed Forces Pest Management Board.
DoD Financial Management Regulation 7000.14R	Volume 11A – Reimbursable Operations, Policy, and Procedures	Provides general reimbursement procedures for when DoD Components perform work or sell property within the DoD, to other U.S. government agencies and to private parties.
DoD Instruction (DoDI) 4700.2	Secretary of Defense Awards for Natural Resources and Environmental Management	Prescribes policies and procedures for an integrated program for multiple-use management for natural resources on property under DoD control.

NUMBER	TITLE	DESCRIPTION
DoDI 4700.4	Natural Resources Management Program	Prescribes policies and procedures for an integrated program for multiple-use management of natural resources on DoD property.
DoDI 4715.03	Natural Resources Conservation Program	Implements policy, assigns responsibilities, and prescribes procedures for the integrated management of natural and cultural resources on property under DoD control
DoDI 4715.16	Cultural Resources Management	Establishes DoD policy and assigns responsibilities under the authority of DoD Directive 5134.01 and in accordance with DoD Directive 4715.1E to comply with applicable federal statutory and regulatory EOs, and Presidential memorandums for the integrated management of cultural resources on DoD-managed lands
DoDI 6055.6	DoD Fire and Emergency Services Program	Establishes a comprehensive Fire and Emergency Services Program and prescribes policies to prevent and minimize loss of DoD lives and damage to property and the environment.
DoDI 7310.5	Accounting for Production and Sale of Forest Products	Provides policy, procedures, and assigns responsibilities for DoD reimbursement and for a State's entitlement to a share in the net proceeds derived from forest products sold from military installations or facilities.
DoD Technical Guide No. 37	Armed Forces Pest Management Board, Integrated Management of Stray Animals on Military Installations	Provides additional guidance for installations in addressing feral cat control issues.
U.S. Department of the Navy (Navy)		
5090, Ser N456M/1U595 820	Chief of Naval Operations Policy Letter Preventing Feral Cat and Dog Populations on Navy Property	States that installations must adopt proactive pet management procedures that prevent the establishment of free-roaming cat and dog populations. Additionally, installations must ensure the humane capture and removal of feral cats and dogs, and efforts should be made to find homes for adoptable animals.
Naval Facilities Engineering Command (NAVFAC) Instructions (INST) 6250.3F	Performance and Reporting of Pest Control Operations in the Naval Shore Establishment	Provides policy for how pesticide use should be reported with detailed information about the preparation and use of the Pest Management Report.
NAVFAC INST 7110	Funds Management for Fish and Wildlife and Game Conservation and Rehabilitation	Budgets and estimates preparation for fish and wildlife, game conservation and rehabilitation.

NUMBER	TITLE	DESCRIPTION
NAVFAC P-73	Real Estate Operations and Natural Resources Management Procedural Manual, Volumes I and II	Addresses all Chief of Naval Operations natural resources program requirements, guidelines, and standards.
Chief of Naval Operations Instruction (OPNAVINST) 5090.1D	Environmental Readiness Program Manual	Establishes policy and assigns responsibilities for the Navy Natural Resources Program, and directs major claimants and intermediate commands to ensure that subordinate commands support natural resources programs on installations under their control.
OPNAVINST 5100.28	Hazardous Material User's Guide	Provides Navy guidance with general safety and environmental information for hazardous materials commonly found on ships.
OPNAVINST 11010.40	Encroachment Management Program	Establishes several mechanisms under the Encroachment Partnering program, including the Encroachment Action Plan, which identifies, quantifies, mitigates, and prevents potential encroachment challenges to an installation or range.
Secretary of the Navy (SECNAV) INST 5090.6A	Environmental Planning for Department of the Navy Actions	Provides comprehensive program of environmental planning and stewardship in support of the readiness of the U.S. naval forces.
SECNAVINST 6240.6E	Environmental Protection and Natural Resources Management Program	Assigns responsibility to the Chief of Naval Operations and the Commandant of the Marine Corps for the development and implementation of natural resources programs on all land and water areas under the jurisdiction of the Department of the Navy.
Maine		
12 Maine Resources Statutes Annotated (MRSA), Part 2, Chapter 201A, Subchapter 1, §544	Natural Areas Program	Establishes the Natural Areas Program within the Department of Agriculture, Conservation, and Forestry and assigns a mandate to conduct an ongoing, statewide inventory of the state's natural areas, including rare plants, animals, natural communities, and ecosystems.
12 MRSA, Part 2, Chapter 206-A	Land Use Regulation	Establishes principles of sound planning, zoning, and development to the townships of Maine to preserve public health, safety, and general welfare, to support Maine's natural-resource based economy, and to encourage appropriate land use.
12 MRSA, Part 9, Subpart 1, Chapter 605, Subchapter 5	Atlantic Salmon License	Requires a permit for the fishing of Atlantic salmon from any state waters. Establishes restrictions in method of fishing, season, and catch limits.

NUMBER	TITLE	DESCRIPTION
12 MRSA, Part 13, Chapter 925, Subchapter 3	Maine ESA	Provides Maine Department of Inland Fisheries and Wildlife a mandate to conserve all of the species of fish and wildlife found in Maine, as well as the ecosystems upon which they depend.
38 MRSA, Chapter 3, Subchapter 1, Article 2, §419C	Prevention of the Spread of Invasive Aquatic Plants	Prohibits the possession, importation, cultivation, transportation, or distribution of any invasive aquatic plant or parts of any invasive aquatic plant.
38 MRSA, Chapter 3, Subchapter 1, Article 2, §420C	Erosion and Sedimentation Control	Establishes procedures for erosion control measures which should be sued to prevent unreasonable erosion of soil or sediment beyond the project site or into a protected natural resource.
38 MRSA, Chapter 3, Subchapter 1, Article 2-B	Mandatory Shoreland Zoning Act	Requires municipalities to adopt, administer, and enforce local ordinances that regulate land use activities in the shoreland zone.
38 MRSA, Chapter 3, Subchapter 1, Article 5A	Natural Resources Protection Act	Establishes the need to facilitate research, develop management programs, and establish environmental standards that will prevent the degradation of an encourage the enhancement of the state's rivers and streams, great ponds, fragile mountain areas, freshwater wetlands, significant wildlife habitat, coastal wetlands, and coastal sand dune systems that are resources of state significance.
38 MRSA, Chapter 3, Subchapter 1, Article 6	Site Location of Development	Requires review of developments that may have a substantial effect upon the environment, including development such as projects occupying more than 20 acres, metallic mineral and advanced exploration projects, large structures and subdivisions, and oil terminal facilities.
38 MRSA, Chapter 20B, §1871–1872	Invasive Aquatic Plants and Nuisance Species Control	Establishes the Interagency Task Force on Invasive Aquatic Plants and Nuisance Species and provides an action plan to protect Maine's inland waters from the spread of invasive aquatic plants and nuisance species.
Other		
Not applicable (N/A)	Clean Water Action Plan	A presidential initiative to restore and protect America's waters by reducing nonpoint pollution, emphasizing collaborative strategies around watersheds, increasing wetlands, protecting coastal waters, providing incentives for protection of forest and grassland buffers, and promoting community-based planning.

NUMBER	TITLE	DESCRIPTION
N/A	Guidance for Implementation of Federal Wildland Fire Management Policy	Provides for consistent implementation of the 1995/2001 Federal Fire Policy, as directed by the Wildland Fire Leadership Council. This guidance also calls for increased dialogue and collaboration between federal agencies and tribal, local, and state agencies as plans are updated and implemented to manage wildfires in order to accomplish resource and protection objectives
N/A	Forest Service Directive System, Forest Service Manual and Handbooks	Codifies the agency's policy, practice, and procedures. The system serves as the primary basis for the internal management and control of all programs and the primary source of administrative direction to Forest Service employees.
N/A	Cooperative Agreement between the Department of Defense and the Nature Conservancy	Facilitates the implementation of the DoD Legacy Resource Management Program and the use of both agencies' resources to provide effective and efficient protection and management of biodiversity within the context of the DoD's environmental security and military missions.
N/A	Memorandum of Agreement between the U.S. Forest Service and DoD for the Conduct of Forest Insect and Disease Suppression on Lands Administered by the DoD	Establishes guiding principles for cooperation between U.S. Forest Service and DoD in support of field operations to prevent and suppress damaging forest insect and disease outbreaks whenever it is determined to be necessary.

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APPENDIX D

Internet Resources

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Federal

- Center for Disease Control (http://www.cdc.gov/)
- The Federal Register (http://www.gpo.gov/fdsys/browse/collection.action?collectionCode=FR)
- National Aeronautics and Space Administration (NASA) Global Climate Change (http://climate.nasa.gov/)
- National Interagency Fire Center (http://www.nifc.gov/)
- National Military Fish and Wildlife Association (http://www.nmfwa.net/)
- National Park Service (http://www.nps.gov/index.htm)
- United States Environmental Protection Agency (USEPA), Climate Change (http://www.epa.gov/climatechange/)
- USEPA, Environmental Dataset Gateway (https://edg.epa.gov/metadata/catalog/main/home.page)
- USEPA, Ground Water and Drinking Water (http://water.epa.gov/drink/)
- USEPA, Riparian Zone and Stream Restoration (http://www.epa.gov/ada/eco/riparian.html)
- USEPA, Water Quality Standards for Surface Waters (http://water.epa.gov/scitech/swguidance/standards)
- USEPA, Watersheds (http://water.epa.gov/type/watersheds/index.cfm)
- United States Army Corps of Engineers (USACE), Professional Development Support Center (http://pdsc.usace.army.mil/)
- USACE, Regulatory Division (http://www.usace.army.mil/Missions/CivilWorks/RegulatoryProgramandPermits.aspx)
- United States (U.S.) Government Printing Office, Code of Federal Regulations (http://www.gpo.gov/fdsys/browse/collectionCfr.action?collectionCode=CFR)
- U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service Wildlife Services (http://www.aphis.usda.gov/about_aphis/programs_offices/wildlife_services/)
- USDA Animal and Plant Health Inspection Service, National Wildlife Disease Program (http://www.aphis.usda.gov/wildlife_damage/nwdp/index.shtml)
- USDA, Forest Cover Types (https://esi.sc.egov.usda.gov/html/fscover.htm)
- USDA, Forest Health Protection (http://www.fs.fed.us/foresthealth/)
- USDA, Forest Inventory and Analysis National Program (http://www.fia.fs.fed.us/library/maps/)
- USDA, Forest Threat Summary Viewer (http://forestthreats.org/threatsummary)
- USDA, National Conservation Practice Standards (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/technical/?cid=nrcsdev11_001020)
- USDA National Resources Conservation Service (NRCS), Geospatial Data Gateway (http://datagateway.nrcs.usda.gov/)
- USDA NRCS, Maine (http://www.nrcs.usda.gov/wps/portal/nrcs/site/me/home/)

- USDA NRCS, Migratory Bird Habitat Initiative (http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/programs/farmbill/initiatives/?cid=steldevb1027669)
- USDA NRCS, Plants Database (http://plants.usda.gov/java)
- U.S. Department of the Interior Bureau of Land Management, Habitat Restoration (http://recovery.doi.gov/press/bureaus/bureau-of-land-management/bureau-of-land-management-habitat-restoration/)
- U.S. Forest Service (USFS) (http://www.fs.fed.us)
- USFS, Fire Effects Information System (http://www.fs.fed.us/database/feis/)
- USFS, Fire and Aviation Management (http://www.fs.fed.us/fire/safety/index.html)
- U.S. Fish and Wildlife Service (USFWS), A System for Mapping Riparian Areas in the Western United States (www.fws.gov/wetlands/Documents/A-System-for-Mapping-Riparian-Areas-In-The-Western-United-States-2009.pdf)
- USFWS, Birds of Conservation Concern (http://www.fws.gov/migratorybirds/NewReportsPublications/SpecialTopics/BCC2008/BCC2008.pdf)
- USFWS, Critical Habitat Portal (http://criticalhabitat.fws.gov/crithab/)
- USFWS, Endangered Species Program (http://www.fws.gov/endangered/laws-policies/index.html)
- USFWS, Migratory Bird Program (http://www.fws.gov/migratorybirds/)
- USFWS, National Conservation Training Center (http://nctc.fws.gov/)
- USFWS, National GIS Datasets (http://www.fws.gov/gis/data/national/index.html)
- USFWS, National Wetlands Inventory (http://www.fws.gov/wetlands/)
- USFWS, North Atlantic Landscape Conservation Cooperative (http://www.fws.gov/northeast/science/nalcc.html)
- USFWS, Office of Law Enforcement (http://www.fws.gov/le/)
- U.S. Geological Survey (USGS), National Wildlife Health Center (http://www.nwhc.usgs.gov/)
- USGS, National Wildlife Health Center, White-Nose Syndrome (http://www.nwhc.usgs.gov/disease_information/white-nose_syndrome/)
- USGS, Nonindigenous Aquatic Species (http://nas.er.usgs.gov/default.aspx)

State

- Maine Department of Agriculture, Conservation, and Forestry (MDACF) (http://www.maine.gov/dacf/)
- MDACF, Forests (http://www.maine.gov/dacf/forestry/index.html)
- MDACF, Maine Forest Service (http://www.maine.gov/dacf/mfs/index.shtml)
- MDACF, Maine Forest Service, Best Management Practices for Forestry: Protecting Maine's Water Quality (http://www.maine.gov/dacf/mfs/publications/handbooks_guides/bmp_manual.html)
- MDACF, Maine Natural Areas Program (http://www.maine.gov/dacf/mnap/index.html)
- MDACF, Maine Natural Areas Program, Beginning with Habitat (http://www.maine.gov/dacf/mnap/assistance/bwh.htm)
- MDACF, Rare Plants (http://www.maine.gov/dacf/mnap/features/rare_plants/index.htm)

- MDACF, State and Global Rarity Program (http://www.maine.gov/dacf/mnap/features/rank.htm)
- MDACF, State Parks and Public Lands (http://www.state.me.us/doc/parks/index.html)
- Maine Department of Environmental Protection (MDEP) (http://www.maine.gov/dep/)
- MDEP, Maine Erosion and Sediment Control Best Management Practices (http://www.maine.gov/dep/land/erosion/escbmps/)
- MDEP, Natural Resources Protection Act (http://www.maine.gov/dep/land/nrpa/)
- MDEP, Permits, Licenses, and Certifications (http://www.maine.gov/dep/permits/index.html)
- Maine Department of Inland Fisheries and Wildlife (MDIFW) (http://www.maine.gov/ifw/)
- MDIFW, Accessing Data (http://www.maine.gov/ifw/wildlife/environmental/mdifw/accessing.html)
- MDIFW, Fishing (http://www.maine.gov/ifw/fishing/index.htm)
- MDIFW, Hunting and Trapping in Maine (http://www.maine.gov/ifw/hunting_trapping/index.htm)
- MDIFW, Maine Endangered and Threatened Species Listing Handbook (http://www.maine.gov/ifw/pdfs/listingHandbook.pdf)
- MDIFW, Research and Management Report 2013 (http://www.maine.gov/ifw/wildlife/pdfs/2013%20R&M%20Report-FINAL_9-06-13.pdf)
- MDIFW, Species of Special Concern (http://www.maine.gov/ifw/wildlife/endangered/specialconcern.htm)
- MDIFW, State List of Endangered & Threatened Species (http://www.maine.gov/ifw/wildlife/endangered/listed_species_me.htm)
- MDIFW, Wildlife Action Plan (http://www.maine.gov/ifw/wildlife/reports/wap.html)
- MDIFW, White-Nose Syndrome (http://www.maine.gov/ifw/wildlife/disease/white_nose_syndrome.htm)
- Maine Department of Health and Human Services, Infectious Disease Epidemiology Program (http://www.maine.gov/dhhs/mecdc/infectious-disease/epi/zoonotic/)
- Maine Department of Marine Resources (http://www.maine.gov/dmr/index.htm)
- Maine Department of Marine Resources, Atlantic Salmon Recovery Framework (http://www.maine.gov/dmr/searunfish/salmonframework.shtml)
- Maine Office of GIS (http://www.maine.gov/megis/)

United States Department of Defense (DoD)

- Armed Forced Pest Management Board, Training and Certification (http://www.afpmb.org/pubs/courses/courses.htm)
- Conserving Biodiversity on Military Lands (http://www.dodbiodiversity.org/)
- DoD, Environment, Safety and Occupational Health Network and Information Exchange (http://www.denix.osd.mil/)
- DoD, Environment, Safety and Occupational Health Network and Information Exchange, Natural Resources (http://www.denix.osd.mil/nr/)

- DoD, Legacy Program (https://www.dodlegacy.org/legacy/index.aspx)DoD, National Defense Authorization Act for Fiscal Year 2012 (http://www.gpo.gov/fdsys/pkg/BILLS-112hr1540enr/pdf/BILLS-112hr1540enr.pdf)
- DoD, Natural Resource Programs & INRMP Implementation: Partnering Tools (http://www.dodworkshops.org/files/Training/SikesModules/Mod8_PartnerTools_FINAL_july09.pdf)
- DoD Natural Resources Conservation Compliance Program (http://www.dodnaturalresources.net/)
- DoD, Partners in Flight (http://www.dodpif.org/)

United States Department of the Navy (Navy)

- Naval Facilities Engineering Command (NAVFAC) (http://www.navfac.navy.mil/)
- NAVFAC GeoReadiness Center (http://proceedings.esri.com/library/userconf/eucom-africom10/papers/georeadiness-program.pdf)
- NAVFAC Mid-Atlantic (http://www.navfac.navy.mil/navfac_worldwide/atlantic/fecs/mid-atlantic.html)
- Navy, Civil Engineer Corps Officers School, Environmental Training Program (https://www.netc.navy.mil/centers/csfe/cecos/)
- Navy, Environmental Portal, Environmental Portal Logon (https://eprdev.dandp.com/eprwebnet/Logon.aspx)

Universities

- Cornell University Lab of Ornithology (http://www.birds.cornell.edu/Page.aspx?pid=1478)
- Duke University, Nicholas School of the Environment and Earth Sciences Continuing Education Program (http://www.nicholas.duke.edu/)
- University of Wisconsin-Madison, Gaylor Nelson Institute for Environmental Studies (http://www.iss.wisc.edu/)
- University of Maine Orono, College of Natural Sciences, Forestry, and Agriculture (http://nsfa.umaine.edu/)

NGOs

- The American Bird Conservancy (http://www.abcbirds.org/abcprograms/policy/cats/index.html)
- Appalachian Trail Conservancy (http://www.appalachiantrail.org)
- Bat Conservation International (http://www.batcon.org/)
- Center for Climate and Security (http://climateandsecurity.org/)
- Center for Plant Conservation (http://www.centerforplantconservation.org/)Feline Conservation Federation, Canada Lynx (http://www.felineconservation.org/feline_species/canada_lynx.htm)
- The Institute for Bird Populations (http://www.birdpop.org/)
- Landscape Conversation Cooperative (http://lccnetwork.org/)
- Maine Audubon (http://maineaudubon.org/)

- Maine Audubon, Bat Conservation (http://maineaudubon.org/wildlife-habitat/bat-conservation/)
- National Audubon Society (http://www.audubon.org/)
- National Wildlife Federation, Canada Lynx (http://www.nwf.org/wildlife/wildlife-library/mammals/canada-lynx.aspx)
- NatureServe (http://www.natureserve.org/aboutUs/index.jsp)
- North American Bird Conservation Initiative, United States. Bird Conservation Region #14 (http://www.nabci-us.org/bcr14.htm)
- North Atlantic Landscape Conservation Cooperative (http://www.northatlanticlcc.org/)
- North Atlantic Landscape Conservation Cooperative, Climate Change Vulnerability Index for Northeast Species (http://www.northatlanticlcc.org/projects/completing-northeast-regional-vulnerability-assessment-incorporating-the-natureserve-climate-change-vulnerability-index)
- North Atlantic Salmon Conservation Organization (http://www.nasco.int/)
- The Nature Conservancy (TNC) (http://www.nature.org)
- TNC, Maine Field Office (http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/maine/)
- TNC, Migratory Bird Program (http://my.nature.org/birds/)
- TNC, Protecting Native Plants and Animals (http://www.nature.org/ourinitiatives/habitats/forests/howwework/protecting-native-plants-and-animals-taking-on-the-invaders.xml)
- Sustainable Agriculture Network (http://www.sare.org/)
- Society of Wetland Scientists (http://www.sws.org/links.mgi)
- Society for Ecological Restoration (http://www.ser.org/)
- The Student Conservation Association (http://www.thesca.org/)
- The Vermont Center for Ecostudies (http://www.vtecostudies.org/)
- Wetland Training Institute, Inc. (http://www.wetlandtraining.com/)
- White-Nose Syndrome (http://whitenosesyndrome.org/)
- The Wilderness Society (http://wilderness.org/)

Other

- Council on Environmental Quality (CEQ), Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act (http://www.oregon.gov/ODOT/HWY/GEOENVIRONMENTAL/docs/e_guide/ceqregs-booklet.pdf)
- CEQ, Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations (http://energy.gov/sites/prod/files/G-CEQ-40Questions.pdf)
- Dow AgroSciences Products (http://www.dowagro.com/range/products/)
- Intellicast Weather (http://www.intellicast.com/)
- Intergovernmental Panel on Climate Change (http://www.ipcc.ch/)
- TerraServerUSA, Mapping Program Information (http://www.terraserver.com/)

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APPENDIX E

SERE School Biological Surveys

Enclosure 1 Streambank Assessment Technical Memorandum

Enclosure 2 General Walkover Field Survey Technical Memorandum

Enclosure 3 High Elevation Bird Survey Technical Memorandum

Enclosure 4 Baseline Fish Survey and Habitat Assessment Technical Memorandum

Enclosure 5 Winter Mammal, Breeding Bird, Raptor Migration, and Bat and Avian Acoustic Surveys

Enclosure 6 Baseline Survey for Amphibians and Reptiles at Three Navy Installations in Maine

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Enclosure 1

Streambank Assessment Technical Memorandum

January 2015

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NAVFAC Atlantic Biological Resource Services

Contract: N62470-08-D-1008; Task Order: WE45, Task 1

Streambank Assessment Technical Memorandum

Survival, Evasion, Resistance, & Escape (SERE) School Redington Township, Maine

FINAL – December 2013

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1 INTRODUCTION

As part of the U.S. Department of the Navy's (Navy) Integrated Natural Resource Management Plan (INRMP) the Navy is required to assess the status of natural resources on their lands and implement management strategies to protect those resources. One of the goals of the INRMP is to identify projects to be implemented over the five-year duration of the plan. As part of the project implementation process, Tetra Tech, Inc. (Tetra Tech) was contracted by Naval Facilities Engineering Command Atlantic (NAVFAC Atlantic) to conduct a streambank assessment (Project) at the U.S. Navy Survival, Evasion, Resistance, & Escape (SERE) School located in Redington Township, Franklin County, Maine (Figure 1 and Figure 2).

The purpose of the streambank assessment was to identify areas experiencing active erosion (problem areas) and areas that, if not stabilized, have the potential for erosion and/or sedimentation to occur (potential problem areas). For areas determined to be problem areas or potential problem areas, practicable options for stabilization and restoration were considered and are presented within this report.

Figure 1. Redington Stream, Streambank Assessment Locations, SERE School, Redington Township, Franklin County, Maine.

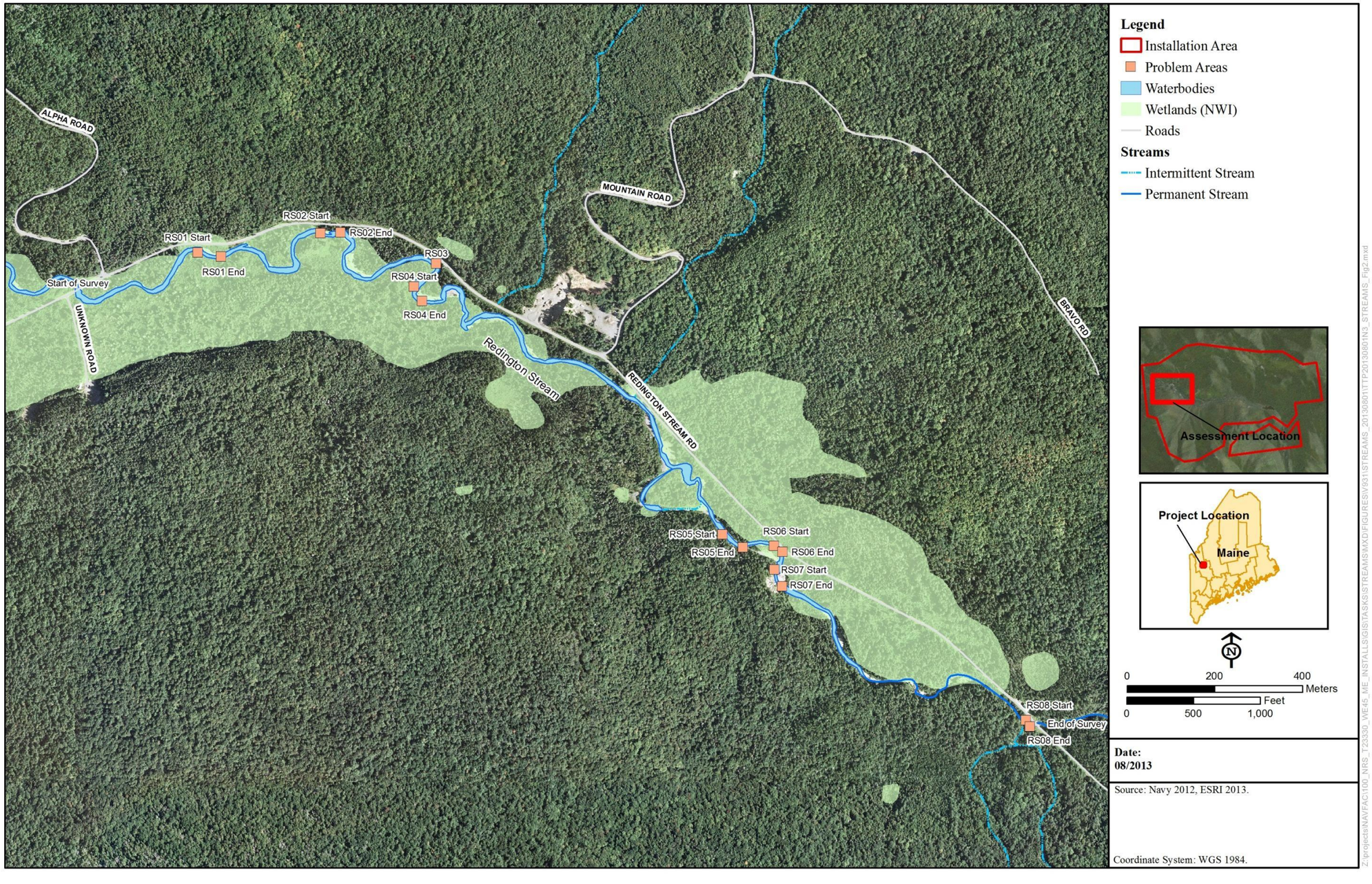
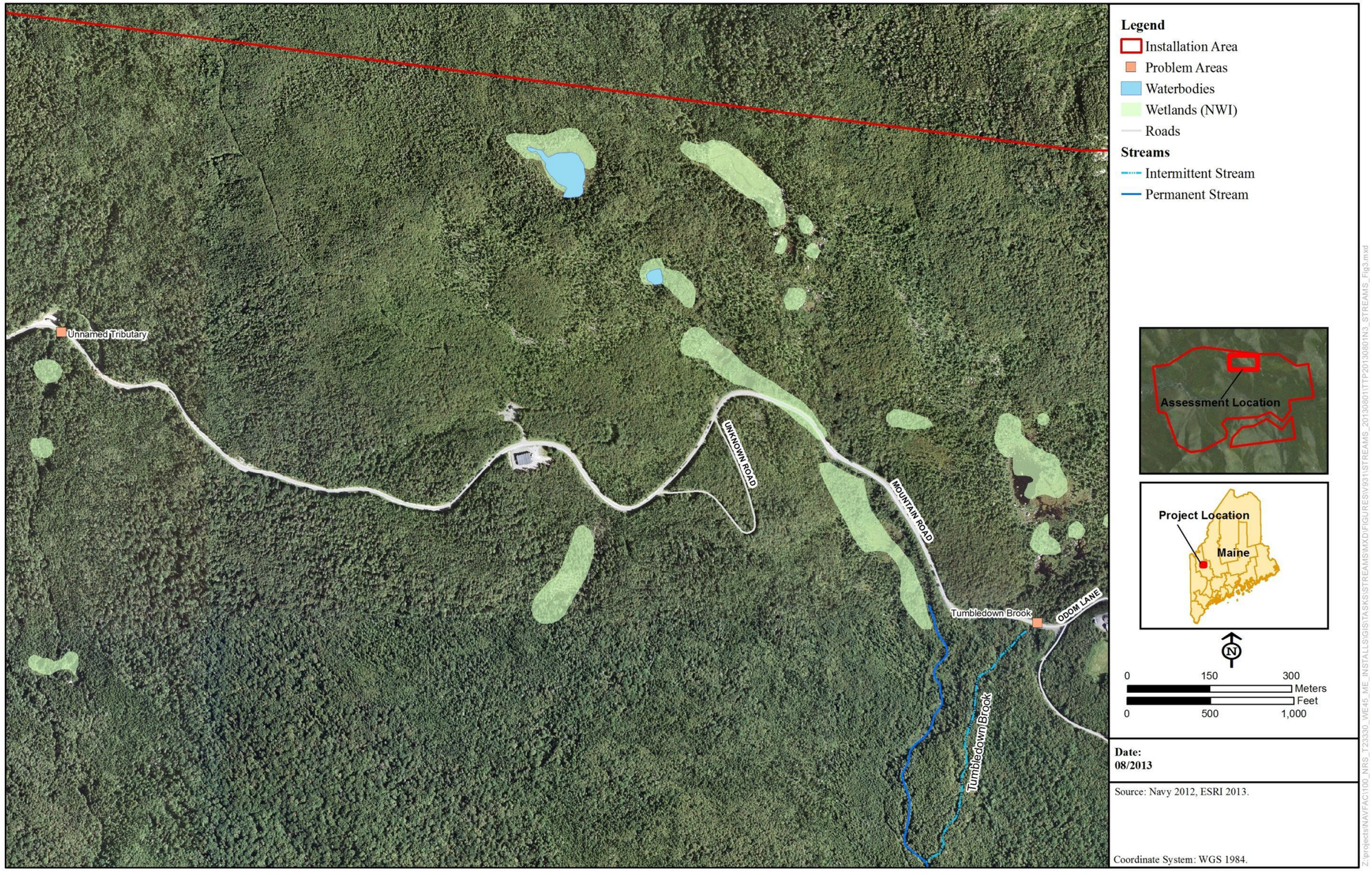


Figure 2. Tumbledown Brook and Unnamed Tributary, Streambank Assessment Locations, SERE School, Redington Township, Franklin County, Maine.



2 SURVEY METHODS

Prior to initiation of the field survey, a desktop review of aerial and topographic imagery was conducted for streams that Navy had identified as priority areas in order to identify areas of interest and site accessibility.

Physical characterization of streams included documentation of relevant stream parameters and conditions including stream type, stream origin, instream features, sediment type, and presence of aquatic vegetation. Erosion and sedimentation problem areas were characterized and described (i.e., substrate type, bank angles, channel widths, bank heights). Biologists looked for visual signs of turbidity and sedimentation, which were not observed at the time of the assessment. Streambank conditions were documented using visual assessment methods, digital photography, and mapping by means of global positioning system (GPS).

3 RESULTS

This section includes general descriptions of the streams and problem areas located within the Project area at the SERE School.

3.1 DESCRIPTION OF STREAMS

Based on consultation with Navy, three areas were identified as having erosion potential: the western end of Redington Stream, and two stream crossings along Mountain Road—Tumbledown Brook and an unnamed tributary.

In general, streams identified within the Project area are characterized as having constant flow with a low degree of channel alteration resulting from culverted crossings along Redington Stream Road and Mountain Road. At the time of the assessment the majority of the identified streams possessed moderate to high flow and high volume. Bank angles ranged from 5 to nearly 90 degrees, with some streams exhibiting undercut banks for at least a portion of the reach. Substrate generally consisted of sand, gravel, cobble, and boulder. Most streambanks were determined to be stable; however, a few areas had active erosion at the time of the assessment. Most of the erosion along Redington Stream was determined to be natural, caused by the natural meanders of the stream and exacerbated by high flow events. However several erosion areas were identified that should be repaired. Problem areas also were identified at road crossings along the Mountain Road and are discussed below.

3.2 PROBLEM AREAS

The 06 June 2013 streambank assessment identified ten stream segments as problem areas or potential problems areas. Problem areas were defined as having active erosion or sedimentation issues, whereas potential problem areas were defined as those that, while not exhibiting active erosion, have the potential for erosion that may result in damage to infrastructure or environmentally sensitive resources. The eight streambank erosion areas identified along Redington Stream are represented in Figure 1 and labeled as RS01 through RS08 (with the START and END of each problem area also identified). The Tumbledown Brook and Unnamed Tributary erosion areas are represented in Figure 2.

Redington Stream Erosion Area 01

Erosion Area 01 is on a southeast bank of Redington Stream as seen in Figure 1. Redington Stream is characterized as having moderate flow with sand, gravel, and cobble substrate. This section of Redington Stream had a water depth ranging from 6 to 12 inches, bank full width of 20–25 feet, and a bank full height of 6–12 inches. Numerous tributaries feed into Redington Stream, which drains into Redington Pond.

The eroding bank is approximately 200 feet long and is composed mostly of sand, gravel, and fines. Field biologists determined that this erosion area is of natural causes where the stream turns to the northeast. Lateral scouring is causing the bank to erode and deposit sand and gravel on the northern bank (see Appendix A, photos 6 and 7).

Redington Stream Erosion Area 02

Erosion Area 02 is also located on Redington Stream and is characterized as having moderate flow with gravel and cobble substrate. The water depth ranges from 10 to 24 inches, bank full width of 10–12 feet, and a bank full height of approximately 1–2 feet.

The eroding bank is a result of natural stream features that produce lateral scouring on the south bank of the stream. The steep bank angles undergo lateral scour, which has uprooted trees and caused the trees and vegetation to enter the stream (see Appendix A, photo 8).

Redington Stream Erosion Area 03

Erosion Area 03 is located along the southern side of Redington Stream Road on Redington Stream. Streambank erosion area 03 is characterized as having perennial flow with sand, gravel, and cobble substrate. Water depth ranges from 12 to 24 inches, bank full width of 30–35 feet, and a bank full height of 3 feet.

The bank angles are very steep (approximately 70°–75°) with a height of approximately 15 feet. The streambank is approximately 50 percent stable with vegetative cover and 50 percent eroding with bare ground. Roadway sediments are able to migrate from the road into the stream during rain events. At the time of the assessment active bank slumping and erosion was occurring in an area approximately 30–40 feet wide (see Appendix A, photos 9–11).

Redington Stream Erosion Area 04

Erosion Area 04 is located along Redington Stream where there is a bankfull height of 4–6 feet and a bankfull width of 20–25 feet. The water depth ranges from approximately 12 to 24 inches. The erosion was determined to be natural resulting from instream features and the natural bend of the stream. The steep bank angles undergo lateral scour and have resulted in undercut banks (see Appendix A, photo 12).

Redington Stream Erosion Area 05

Erosion Area 05 is located on Redington Stream and is characterized by moderate flows with sand, gravel, cobble, and boulder substrates. The bankfull width is approximately 25 feet with a depth of 6–18 inches. The erosion area is a steep bank (45°–60°) approximately 300 feet long located on the southern side of the stream. Streambank erosion area 05 is approximately 20 feet tall and is a result of natural stream meanders and instream features (see Appendix A, photos 13 and 14).

Redington Stream Erosion Area 06

Erosion Area 06 is located on the northern side of Redington Stream and is characterized by moderate flows with gravel, cobble, and boulder substrates. This area, which has been previously rip-rapped, is currently stable; however erosion has begun on the western edge of the rip-rap. The banks are approximately 45° and vegetation is loosened and slumping down as a result of high flows and lateral scour (see Appendix A, photos 15 and 16).

Redington Stream Erosion Area 07

Erosion Area 07 is located along the southern edge of Redington Stream. The stream substrate is a mix of boulder, cobble, gravel, and sand. The bank is a mix of sand and gravel and is approximately 50 feet high with a bank angle of approximately 45°. The erosion was determined to be a result of natural causes due to the natural bends of the stream and presence of unconsolidated sand and gravel in the bank (see Appendix A, photos 17 and 18).

Redington Stream Erosion Area 08

Erosion Area 08 located in Redington Stream where two tributaries converge with Redington Stream, adjacent to Charlie Cabin. This area is located on the northern side of the stream with a bankfull height of between 3 and 5 feet. The substrate is a mix of gravel, cobble, and sand. This erosion is not a result of natural features and is caused by unstable and unvegetated banks along the bridge. This area, which is almost directly downstream of the confluence of the two tributaries, receives periodic high flows and is therefore vulnerable to erosion and sedimentation (see Appendix A, photos 19–21).

Tumbledown Brook Erosion Area

This section of Tumbledown Brook is intersected by Mountain Road, as seen in Figure 2, and crossed by a metal culvert 4 feet in diameter and approximately 30 feet in length. The culvert is stabilized by boulders, and a small section of active erosion was occurring at the time of the assessment on the south side of Mountain Road (see Appendix A, photo 27). There was evidence of sediment migrating from the eroding travel lane over the culvert and into Tumbledown Brook. Sheet flows during rain events travel down Mountain Road and cause rill erosion on both the north and south sides of the travel lane (photos 24 and 26). These migrating sediments enter Tumbledown Brook through scour lines present on the topside of the culvert (photo 25). The boulders on the south side of Mountain Road have shifted over time and allowed for the road erosion and scour lines to originate. There are metal bank stabilization sheets that have been uplifted and transported downstream on the southern side of the road (photos 28 and 29).

Unnamed Tributary Erosion Area

This unnamed tributary is crossed by Mountain Road, as seen in Figure 2, and spanned by a 25-foot long timber culvert. Water moving down the travel lane has created sheet and rill erosion on both sides of the road (see Appendix A, photos 31–33). Scour lines that have formed along the top of the culvert allow for sediments to be transported from the roadway and into the stream and surrounding forest (photos 35 and 36).

4 DISCUSSION

Of the ten streambank erosion areas identified as problem areas or potential problem areas, recommendations for stabilization and/or restoration have been developed for three segments on Redington Stream (Figure 1) as well as the erosion areas at two stream crossings—Tumbledown Brook and the unnamed tributary—on Mountain Road (Figure 2). The following recommendations may be used as guidance for the implementation of streambank stabilization and restoration efforts. Rough cost estimates are provided for restoration planning purposes. Stabilization and restoration methods set forth in this document were recommended based on numerous factors including existing natural conditions, existing streambank stabilization and restoration methods employed, low cost, ease of installation, maintenance requirements, and most importantly, effectiveness based on conditions.

4.1 RECOMMENDATIONS FOR STABILIZATION AND RESTORATION OF STREAMBANKS

Redington Stream Erosion Area 03

Stabilization of Erosion Area 03 can be accomplished by shoring up the road edges with additional rip-rap in the area where scour lines begin and sediment first migrates from the road. Water should not be allowed to pool on the road, and any depressions should be filled in to divert water away from the slope. Once road edges are stabilized with rip-rap, the streambanks can be prepared for permanent vegetative stabilization cover. Care should be taken to minimize soil disturbance and prevent sediment from entering the waterway. The soil should be raked to provide an even surface for seeding and to allow the seeds to stay in place. Next, a suitable groundcover seed should be applied. Suitable seed mixes include a seed mix of creeping fescue, redtop, rye grass, and tall fescue. Alternative seed mixes also are outlined in the 2003 *Maine Erosion and Sediment Control Best Management Practices* (MDEP 2003[1]). Seeding should be performed at least 45 days prior to the first annual frost.

The area will need to be stabilized while the vegetation becomes established. This can be accomplished with an erosion control blanket. Erosion control blankets should be installed with overlapping edges and stapled into the ground (MDEP 2003).

Cost estimate for completion for Redington Stream Erosion Area 03: Based on an 800 square foot price for erosion control blankets that are approximately $120/roll. The anchoring staples for the erosion control blanket will cost approximately $45 and the seed will cost approximately $30 for a coverage of over 1,000 square feet. Tetra Tech estimates approximately 1–2 rolls will be necessary to stabilize the bank, totaling approximately $320 in materials.

[1] MDEP (Maine Department of Environmental Protection). 2003. Maine Erosion and Sediment Control BMPs. Bureau of Land and Water Quality, Maine Department of Environmental Protection. Augusta, ME. Retrieved from: http://www.maine.gov/dep/land/erosion/escbmps/

Redington Stream Erosion Area 06

The banks of Redington Stream should be stabilized through additional seeding and mulching in areas of exposed soil at the top of the bank. Additional rip-rap material should be extended downstream to newly eroded areas and streambanks.

Cost estimate for completion for Redington Stream Erosion Area 06: Groundcover seed will cost approximately $30 and one cubic yard of mulch costs approximately $15. Based on a cubic yard price for rip-rap/boulders of approximately $25/cubic yard, Tetra Tech estimates approximately 1–2 yards of rip-rap material will be necessary to stabilize the banks, totaling approximately $100 in materials.

Redington Stream Erosion Area 08

Erosion Area 08 should be stabilized with additional seeding and mulching on exposed soil areas at the top of the bank. Rip-rap is the most appropriate material to stabilize the banks because of the high water volumes and velocities present at this convergence. For bank stabilization, additional large rip-rap and boulder material should be placed on the slumping bank to slow water during high flows in the spring and during rain events. Any gaps in the boulders should be backfilled with smaller coarse crushed stone to prevent scouring around the larger boulders (MDEP 2003).

Cost estimate for completion for Redington Stream Erosion Area 08: Groundcover seed will cost approximately $30 and one cubic yard of mulch costs approximately $15. Based on a cubic yard price for rip-rap/boulders of approximately $25/cubic yard, Tetra Tech estimates approximately 3–4 yards of rip-rap material and 0.5 cubic yard of mulch will be necessary to stabilize the banks, totaling approximately $150 in materials.

Tumbledown Brook Erosion Area

Sheet flows traveling down Mountain Road during rain events should be diverted away from the north and south sides of the road and directed into well-vegetated upland areas. This can be accomplished through diversions such as timber logs, rock check dams, or rip-rap. The road slumping at the top of the culvert allows for water to travel over and around the culvert and into the stream. This area should be built up with coarse crushed stone and rip-rap to prevent water pooling here. The crushed stone will both stabilize the area and provide a filter strip as it travels down the road. The slope around the culvert should be stabilized with large boulders and course rip-rap. Any exposed soils should be seeded and covered with erosion control blankets.

Unnamed Tributary Erosion Area

This area was undergoing similar problems as witnessed at Tumbledown Brook Erosion Area. Water flows from Mountain Road should be diverted away from the stream crossing. Because sedimentation was occurring in upland areas, vegetative buffers or filter strips of coarse crushed stone should be installed at road edges. The road edge over the culvert should be built up to prevent water pooling and traveling over the top of the culvert. This can be accomplished with coarse crushed stone and gravel. The banks surrounding the wooden culvert appeared to be stable at the time of the assessment and do not require further stabilization. However, the banks

should be monitored periodically for erosion, and any exposed soils should be seeded and covered with erosion control blankets.

Cost estimate for completion for Tumbledown Brook Erosion Area and Unnamed Tributary Erosion Area: These two erosion areas are very similar in size and severity and will require similar restoration actions. Based on a cubic yard price for rip-rap/boulders of approximately $25/cubic yard and crushed stone of approximately $32/cubic yard, Tetra Tech estimates approximately 1–2 cubic yards of rip-rap material and 1 cubic yard of crushed stone will be necessary to stabilize the banks. Given that groundcover seed will cost approximately $30 and one cubic yard of mulch costs approximately $15, the cost of the stabilization at each area will total approximately $130 in materials.

4.2 POTENTIAL PERMITS THAT MAY BE REQUIRED

The potential permits that may be required prior to implementing erosion control measures, and a brief description of these permits, is provided below. In most cases, the language in this section is taken directly from the permits.

4.2.1 Maine Programmatic General Permit (PGP)

The U.S. Army Corps of Engineers (Corps), New England District, State General Permits vary by state. However, they all take advantage of strong state coastal and wetland protection laws, reduce duplication in review between the Corps and the state, and expedite the permit review process for the applicant.

Each State General Permit (GP) utilizes a tiered approach with categories linked to impact thresholds. These thresholds are listed in the individual permits and determine the level of review necessary from the federal perspective. For example, certain activities are non-reporting to the Corps once an applicant has obtained all required state and local approvals.

The GP covers activities in waters of the U.S. that have no more than minimal individual, secondary, and cumulative adverse effects on the aquatic environment in waters of the U.S. within the boundaries of and off the coast of the State of Maine.

In order for activities to qualify for this GP, they must meet the GP's terms and eligibility criteria, general conditions, and definition of categories outlined in the permit.

Under this GP, projects may qualify for the following:

- Category 1: Category 1 Notification Form required. (Submittal of the Category 1 Notification Form at Appendix B to the Corps is required.
- Category 2: Application required. (Submittal of an application to the Corps is required and written approval from the Corps must be received.

If your project is ineligible for Category 1, it may qualify for Category 2 or an Individual Permit and you must submit an application. The thresholds for Categories 1 and 2 are defined in the

Maine GP. This GP does not affect the Corps Individual Permit review process or activities exempt from Corps regulation.

Activities covered:

- work and structures that are located in, under or over any navigable water of the U.S.[2] that affect the course, location, condition, or capacity of such waters; or the excavating from or depositing of material in such waters. The Corps regulates this under Section 10 of the Rivers and Harbors Act of 1899).
- the discharge of dredged or fill material into waters of the U.S [3]. The Corps regulates this under Section 404 of the Clean Water Act (CWA).[4]
- the transportation of dredged material for the purpose of disposal in the ocean. The Corps regulates this under Section 103 of the Marine Protection, Research and Sanctuaries Act.

4.2.2 Natural Resources Protection ACT (NRPA)

The Maine Department of Environmental Protection (MDEP) Natural Resources Protection Act (NRPA) program regulates activities in, on, over or adjacent to natural resources such as lakes, wetlands, streams/rivers, fragile mountain areas, and sand dune systems. The program uses permit by rule (PBR) for certain classes of activity. Standards to be met focus on the possible impacts to the resources and to existing uses.

Protected natural resources are coastal sand dune systems, coastal wetlands, significant wildlife habitat, fragile mountain areas, freshwater wetlands, great ponds and rivers, streams or brooks. See 38 MRSA 480-B for statutory definitions.

The purpose section of NRPA provides, in part, that: "The Legislature finds and declares that the State's rivers and streams, great ponds, fragile mountain areas, freshwater wetlands, significant wildlife habitat, coastal wetlands and coastal sand dune systems are resources of state significance. These resources have great scenic beauty and unique characteristics, unsurpassed recreational, cultural, historical and environmental value of present and future benefit to the citizens of the State and that uses are causing the rapid degradation and, in some cases, the destruction of these critical resources, producing significant adverse economic and environmental impacts and threatening the health, safety and general welfare of the citizens of the State."

The law is focused on "protected natural resources." A permit is required when an "activity" will be:

---

[2] Defined at 33 CFR 329 and Appendix A, Page 4.

[3] Defined at 33 CFR 328.

[4] When there is a regulated discharge of dredged or fill material into waters of the U.S., the Corps will also consider secondary impacts, which are defined at Appendix A, Endnote/Definition 2 of the Maine PGP.

- located in, on or over any protected natural resource, or
- located adjacent to (A) a coastal wetland, great pond, river, stream or brook or significant wildlife habitat contained within a freshwater wetland, or (B) certain freshwater wetlands.

An "activity" is (A) dredging, bulldozing, removing or displacing soil, sand, vegetation or other materials; (B) draining or otherwise dewatering; (C) filling, including adding sand or other material to a sand dune; or (D) any construction, repair or alteration of any permanent structure.

4.2.3 Mandatory Shoreland Zoning Act

The MDEP Shoreland Zoning program is primarily administered through municipalities, and involves the regulation of activities in the shoreland zone. The Mandatory Shoreland Zoning Act (MSZA) requires municipalities to adopt, administer, and enforce local ordinances that regulate land use activities in the shoreland zone. The shoreland zone is comprised of all land areas within 250 feet, horizontal distance, of the:

- normal high-water line of any great pond or river;
- upland edge of a coastal wetland, including all areas affected by tidal action, and
- upland edge of defined freshwater wetlands; and
- all land areas within 75 feet, horizontal distance, of the normal high-water line of certain streams.

The purposes of the MSZA are as follows:

- to prevent and control water pollution;
- to protect fish spawning grounds, bird and wildlife habitat;
- to protect buildings and lands from flooding and accelerated erosion;
- to protect archeological and historic resources;
- to protect commercial fishing and maritime industries;
- to protect freshwater and coastal wetlands;
- to control building sites, placement of structures and land uses;
- to conserve shore cover, and visual as well as actual points of access to inland and coastal waters;
- to conserve natural beauty and open space; and
- to anticipate and respond to the impacts of development in shoreland areas.

Since, shoreland zoning regulations are administered and enforced by each municipality through municipal specific ordinances, the local code enforcement officer is typically the first point of contact for shoreland zoning questions. Shoreland Zoning Staff at the MDEP assist

municipalities with shoreland zoning related questions and issues, as well as provide technical assistance and training on the shoreland zoning rules.

4.2.4 Rivers and Harbors Act of 1899, Section 10 – Work in Navigable Waters

The Corps regulates activities that could obstruct or alter navigable waters of the U.S. under Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403). Section 10 prohibits the unauthorized obstruction or alteration of any navigable water of the U.S. This section provides that the construction of any structure in or over any navigable water of the U.S., or the accomplishment of any other work affecting the course, location, condition, or physical capacity of such waters is unlawful unless the work has been recommended by the Chief of Engineers and authorized by the Secretary of the Army. The Secretary's approval authority has since been delegated to the Chief of Engineers.

The purpose of Corps Section 10 permit is to protect those waters that are subject to the ebb and flow of the tide and/or are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce. It shall be unlawful to build or commence the building of any wharf, pier, dolphin, boom, weir, breakwater, bulkhead, jetty, or other structures in any port, roadstead, haven, harbor, canal, navigable river, or other water of the U.S., outside established harbor lines, or where no harbor lines have been established.

It shall not be lawful to excavate or fill, or in any manner to alter or modify the course, location, condition, or capacity of:

- any port,
- roadstead,
- haven
- harbor,
- canal,
- lake,
- harbor of refuge,
- or enclosure within the limits of any breakwater, or of the channel of any navigable water of the U.S.

The Corps authorizes activities by issuing individual and general permits. Individual permits include Standard Individual Permits and Letters of Permission, and general permits include Nationwide Permits and Regional General Permits. The Corps determines which type of permit is needed. A Department of the Army permit can include authorization under Section 10 and/or Section 404.

4.2.5 Clean Water Act, Section 404 – Discharge of Fill

Construction activity requiring excavation and/or discharge of dredged or fill material in waters of the U.S requires the Section 404 permit. The federal Clean Water Act (CWA) was written to protect and restore the quality of the surface waters of the U.S. To help in attaining this goal, filling, grading, mechanized land clearing, ditching, other excavation activity, and piling installation in waters of the U.S. require a Corps Section 404 Permit prior to the commencement of construction.

Section 404 Discharge of Fill in the CWA authorizes the Secretary of the Army, acting through the Chief of Engineers, to issue permits after notice and opportunity for public hearing, for the discharge of dredged or fill material into the waters of the U.S. at specified disposal sites. (See 33 CFR Part 323.) The regulatory definition of waters of the U.S is:

> (1) All waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide;
>
> (2) All interstate waters including interstate wetlands;
>
> (3) All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation or destruction of which could affect interstate or foreign commerce including any such waters:
>
> > (i) Which are or could be used by interstate or foreign travelers for recreational or other purposes; or
> >
> > (ii) From which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or
> >
> > (iii) Which are used or could be used for industrial purpose by industries in interstate commerce;
>
> (4) All impoundments of waters otherwise defined as waters of the United States under the definition;
>
> (5) Tributaries of waters identified in paragraphs (a) (1) through (4) of this section;
>
> (6) The territorial seas;
>
> (7) Wetlands adjacent to waters (other than waters that are themselves wetlands) identified in paragraphs (a) (1) through (6) of this section.
>
> (8) Waters of the United States do not include prior converted cropland. Notwithstanding the determination of an area's status as prior converted cropland by any other Federal agency, for the purposes of the Clean Water Act, the final authority regarding Clean Water Act jurisdiction remains with EPA. Waste treatment systems, including treatment ponds or lagoons designed to meet the requirements of CWA (other than cooling ponds as defined in 40 CFR 423.11(m) which also meet the criteria of this definition) are not waters of the United States.

Application for a permit/letter of permission for work regulated under Section 404 (CWA) and Section 10 (Rivers and Harbors Act) can be made by completing and submitting one application form. Information submitted with the application includes descriptions of the proposed project's purpose, reasons for the proposed discharge of dredged/fill material, type and amount of material being discharged (yds3), surface areas of wetlands/waters filled, and the names and addresses of adjacent property owners. Three types of illustrations must also be submitted with the application: vicinity map, plan view, or a typical cross section map. Several nationwide permits authorize work under both Section 404 and Section 10. However, not all nationwide permits grant approval under both Section 10 and Section 404. A letter of approval from the Corps may be required for work within navigable waters of the U.S. or dredging and filling within waters of the U.S. when this work is not covered under an existing regional/general Corps Permit.

4.2.6 Clean Water Act, Section 401 – Water Quality Certification

Section 401 of the CWA requires that an applicant for a federal license or permit provide a certification that any discharges from the facility will comply with the act, including water quality standard requirements. CWA Section 401 Water Quality Certification (WQC) provides states and authorized tribes with an effective tool to help protect water quality, by providing them an opportunity to address the aquatic resource impacts of federally issued permits and licenses. The MDEP has been designated by the Governor of the State as the certifying agency for issuance of Section 401 WQC for all activities in the state not subject to Land Use Planning Commission permitting and review.

Section 401 WQC Permits are required when an activity that may result in any discharge to a navigable water of the U.S. Applicants must supply the federal licensing authority with a certification from the State that any such discharge will comply with State water quality standards. The federal license or permit may not be issued until WQC has been issued or waived. MDEP may add conditions to the certification, and these must become conditions of the federal license. In order for a WQC to be required, the activity causing the discharge must be authorized by a permit or license issued by a federal agency. Federal licenses and permits most frequently subject to Section 401 WQC include, but are not limited to, Section 404 permits and Rivers and Harbors Act Section 10 permits, issued by the Corps.

APPENDIX A

Photographic Record

PHOTOGRAPHIC RECORD

Company: NAVFAC Atlantic
Project: SERE School Streambank Assessment

Photo No.: 1

Date: 06 June 2013

Photographer: J. Sweitzer

Comments:

Double steel arch culvert near gate on Redington Stream Road.

View facing northwest of double arch culverts and gabion baskets with natural stone at intersection of Redington Stream with Redington Stream Road.

Photo No.: 2

Date: 06 June 2013

Photographer: J. Sweitzer

Comments:

Redington Stream

Typical streambank consisting of gravel and sand sediments with good vegetative cover.

Photo No.: 3

Date: 06 June 2013

Photographer: J. Sweitzer

Comments:

Redington Stream

View of typical portion of Redington Stream. Streambed of gravel and cobble substrate.

PHOTOGRAPHIC RECORD

Company: NAVFAC Atlantic
Project: SERE School Streambank Assessment

Photo No.: 4

Date: 06 June 2013

Photographer: J. Sweitzer

Comments:

View of slimy sculpin (*Cottus cognatus*) on cobble substrate. Individuals were observed protecting nests throughout the reach.

Photo No.: 5

Date: 06 June 2013

Photographer: J. Sweitzer

Comments:

One of several northern two-lined salamanders (*Eurycea bislineata*) observed throughout Redington Stream.

Photo No.: 6

Date: 06 June 2013

Photographer: J. Sweitzer

Comments:

Redington Stream Erosion Area 01

View west of streambank erosion on south bank of Redington Stream. Bank composed of sand and fine sediment. Erosion is causing slumping of bank into the stream channel.

PHOTOGRAPHIC RECORD

Company: NAVFAC Atlantic
Project: SERE School Streambank Assessment

Photo No.: 7

Date: 06 June 2013

Photographer: J. Sweitzer

Comments:

Redington Stream Erosion Area 01 (Natural)

View east of streambank slumping along south bank of Redington Stream.

Photo No.: 8

Date: 06 June 2013

Photographer: J. Sweitzer

Comments:

Redington Stream Area 02 (Natural)

View east of streambank slumping along south bank of Redington Stream.

Photo No.: 9

Problem Area: Redington Stream Erosion Area 03

Date: 06 June 2013

Photographer: J. Sweitzer

Comments:

Redington Stream Erosion Area 03

View facing northeast of streambank and road bank slumping along north bank of Redington Stream. A small 30 to 40 feet section of Redington Road bank has slumped off into Redington Stream.

PHOTOGRAPHIC RECORD

Company: NAVFAC Atlantic
Project: SERE School Streambank Assessment

Photo No.: 10

Problem Area: Redington Stream Erosion Area 03

Date: 06 June 2013

Photographer: J. Sweitzer

Comments:

Redington Stream Erosion Area 03

Close-up of north bank showing slumping into Redington Stream.

Photo No.: 11

Problem Area: Redington Stream Erosion Area 03

Date: 06 June 2013

Photographer: J. Sweitzer

Comments:

Redington Stream Erosion Area 03

View facing north of slumping of road/streambank in vicinity of Redington Road.

Photo No.: 12

Date: 06 June 2013

Photographer: J. Sweitzer

Comments:

Redington Stream Erosion Area 04 (Natural)

View facing southeast of erosion on south bank of Redington Stream.

PHOTOGRAPHIC RECORD

Company: NAVFAC Atlantic
Project: SERE School Streambank Assessment

Photo No.: 13

Date: 06 June 2013

Photographer: J. Sweitzer

Comments:

Redington Stream Erosion Area 05 (Natural)

View facing southeast of erosion and slumping on south bank of Redington Stream.

Photo No.: 14

Date: 06 June 2013

Photographer: J. Sweitzer

Comments:

Redington Stream Erosion Area 05 (Natural)

View facing west of erosion and slumping on south bank of Redington Stream.

Photo No.: 15

Problem Area: Redington Stream Erosion Area 06

Date: 06 June 2013

Photographer: J. Sweitzer

Comments:

Redington Stream Erosion Area 06

View northwest of rip-rapped streambank on north side of Redington Stream and south side of Redington Stream Road.

PHOTOGRAPHIC RECORD

Company: NAVFAC Atlantic
Project: SERE School Streambank Assessment

Photo No.: 16

Problem Area: Redington Stream Erosion Area 06

Date: 06 June 2013

Photographer: J. Sweitzer

Comments:

Redington Stream Erosion Area 06

View northwest of rip-rapped streambank on north side of Redington Stream and south side of Redington Stream Road. New erosion has formed west of the rip-rapped streambank section.

Photo No.: 17

Date: 06 June 2013

Photographer: J. Sweitzer

Comments:

Redington Stream Erosion Area 07 (Natural)

View south of eroded bank on south side of Redington Stream.

Photo No.: 18

Date: 06 June 2013

Photographer: J. Sweitzer

Comments:

Redington Stream Erosion Area 07 (Natural)

View south of eroded bank on south side of Redington Stream.

PHOTOGRAPHIC RECORD

Company: NAVFAC Atlantic
Project: SERE School Streambank Assessment

Photo No.: 19

Problem Area: Redington Stream Erosion Area 08

Date: 06 June 2013

Photographer: J. Sweitzer

Comments:

Redington Stream Erosion Area 08

View north of eroding bank on north side of Redington Stream in vicinity of Charlie Cabin, immediately downstream of confluence with unnamed tributary.

Photo No.: 20

Date: 06 June 2013

Photographer: J. Sweitzer

Comments:

View upstream of confluence with unnamed tributary.

Photo No.: 21

Date: 06 June 2013

Photographer: J. Sweitzer

Comments:

End of streambank survey along Redington Stream. View north of Redington Stream Road bridge over unnamed tributary at confluence with Redington Stream.

PHOTOGRAPHIC RECORD

Company: NAVFAC Atlantic
Project: SERE School Streambank Assessment

Photo No.: 22

Date: 06 June 2013

Photographer: J. Sweitzer

Comments:

Tumbledown Brook

View northeast facing upstream on north side of Mountain Road.

Photo No.: 23

Problem Area: Tumbledown Brook

Date: 06 June 2013

Photographer: J. Sweitzer

Comments:

View facing southwest of double culvert and boulders on north side of Mountain Road.

Photo No.: 24

Problem Area: Tumbledown Brook

Date: 06 June 2013

Photographer: J. Sweitzer

Comments:

View facing east of Mountain Road in vicinity of Tumbledown Brook. Sheet flow turns into rill erosion and has led to some scouring and transport of sedimentation off north and south side of travel lane into Tumbledown Brook.

PHOTOGRAPHIC RECORD

Company: NAVFAC Atlantic
Project: SERE School Streambank Assessment

Photo No.: 25

Problem Area: Tumbledown Brook

Date: 06 June 2013

Photographer: J. Sweitzer

Comments:

Scouring of travel lane at Tumbledown Brook

View facing down to Brook on north side of Mountain Road travel lane. Transport of sediment into stream occurs during heavy rain events.

Photo No.: 26

Problem Area: Tumbledown Brook

Date: 06 June 2013

Photographer: J. Sweitzer

Comments:

View facing west of south side of Mountain Road travel lane. Signs of rill erosion present.

Photo No.: 27

Problem Area: Tumbledown Brook

Date: 06 June 2013

Photographer: J. Sweitzer

Comments:

View of road bank on south side of Mountain Road. Erosion of bank, and transportation of travel lane sand and gravel occurs during heavy rain events, causing minor sedimentation in stream.

PHOTOGRAPHIC RECORD

Company: NAVFAC Atlantic
Project: SERE School Streambank Assessment

Photo No.: 28

Problem Area: Tumbledown Brook

Date: 06 June 2013

Photographer: J. Sweitzer

Comments:

View of culverts and boulders on south bank of Mountain Road. Some boulders have shifted, causing minor erosion of the road bank.

Photo No.: 29

Problem Area: Tumbledown Brook

Date: 06 June 2013

Photographer: J. Sweitzer

Comments:

View facing southwest and downstream of Tumbledown Brook. Metal sheeting transported downstream from culverts.

Photo No.: 30

Problem Area: Unnamed Tributary

Date: 06 June 2013

Photographer: J. Sweitzer

Comments:

View southwest of a timber culvert under Mountain Road at the crossing of an unnamed tributary to Redington Stream.

PHOTOGRAPHIC RECORD

Company: NAVFAC Atlantic
Project: SERE School Streambank Assessment

Photo No.: 31

Problem Area: Unnamed Tributary

Date: 06 June 2013

Photographer: J. Sweitzer

Comments:

View southeast of rill erosion and scouring on north side of Mountain Road travel lane. Evidence of sediment transport into the unnamed tributary during heavy rain events.

Photo No.: 32

Problem Area: Unnamed Tributary

Date: 06 June 2013

Photographer: J. Sweitzer

Comments:

View facing southeast of minor scouring on south side of Mountain Road. Sedimentation of stream occurs during heavy rain events.

Photo No.: 33

Problem Area: Unnamed Tributary

Date: 06 June 2013

Photographer: J. Sweitzer

Comments:

View facing northeast on south side of Mountain Road. Scouring of road bed is noticeable on top of timber framed culvert.

PHOTOGRAPHIC RECORD

Company: NAVFAC Atlantic
Project: SERE School Streambank Assessment

Photo No.: 34

Problem Area: Unnamed Tributary

Date: 06 June 2013

Photographer: J. Sweitzer

Comments:

View of unnamed tributary facing southwest and downstream of Mountain Road. Water clear with no signs of turbidity caused by active erosion.

Photo No.: 35

Problem Area: Unnamed Tributary

Date: 06 June 2013

Photographer: J. Sweitzer

Comments:

View facing west on south side of Mountain Road. Scouring on road bed has led to sedimentation of uplands approximately 50 feet east of the unnamed tributary.

Photo No.: 36

Problem Area: Unnamed Tributary

Date: 06 June 2013

Photographer: J. Sweitzer

Comments:

Sedimentation in wooded upland in the vicinity of the unnamed tributary. This area should be monitored for transport of sediment into the stream.

Enclosure 2

General Walkover Field Survey Technical Memorandum

January 2015

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Task 1B SERE School, Redington, Maine
Contract No. N62470-08-D-1008
Task Order No. WE40

General Walkover Field Survey
Technical Memorandum

Date: 08 October 2012
Location: Survival, Evasion, Resistance & Escape (SERE) School

1.0 INTRODUCTION

Tetra Tech, Inc. (Tetra Tech) was contracted by the U.S. Department of the Navy (Navy), Naval Facilities Engineering Command Atlantic (NAVFAC Atlantic) to perform activities associated with the update of the 2007 SERE School Integrated Natural Resources Management Plan (INRMP) (Project). These activities were to include performing a General Walkover Field Survey (GWFS) of the SERE School as well as a High Elevation Bird Survey (HEBS). The purpose of the surveys is to acquire supplemental and updated natural resources information for inclusion in appropriate sections in the INRMP.

This Technical Memorandum provides a summary of the GWFS and findings. Specifically, the following sections contain an overview of the field methods used to complete the survey as well as a brief description of the survey results. Also included are field observations made during the onsite Project kick-off meeting in late July 2012. Attachment A contains a list of all species known to occur at the SERE School and Attachment B contains a photographic record of the GWFS.

2.0 SURVEY METHODS

A desktop review of aerial imagery was conducted prior to initiation of the field survey to identify survey areas, access points and restricted areas, terrain, and general habitat information.

The GWFS was conducted on 21–23 August 2012 by two Tetra Tech biologists, Sarah Watts and Lindsay Eiser, and Mr. Ian Trefry, the Naval Natural Resources Manager from Public Works Department–Maine. A combination of walkover and drive through surveys were conducted at the main parcel. The biologists familiarized themselves with the natural resources and physical features of the station.

Areas that were visited during the course of the site visit include the following:

1. Day 1: bluffs/overlook area east of the Bravo Road terminus, a potential location for a HEBS point in a krummholz community at the northeast corner of the main parcel.

2. Day 2: Redington Falls located in a perennial tributary to Orbeton Stream west of Redington Pond, and a meander survey of the alder thicket wetlands west of Redington Pond.
3. Day 3: Two perennial tributaries along Mountain Road and Orbeton Stream east of Redington Pond to points south of the southeast corner of the main parcel.

Throughout the course of the site visit, biologists recorded many species of plants, birds, mammals, invertebrates, reptiles, and amphibians (Attachment A). In addition, certain observations were further documented through point data locations collected using a Global Positioning System (GPS). Biologists also conducted a cursory assessment of the vegetation community types that occur at the installation, looked for disturbance resulting from military mission activities, and gathered ideas for potential projects that may be included in the INRMP update.

3.0 RESULTS

The following sections include descriptions of water resources including wetlands, as well as the vegetation communities and faunal species observed during the GWFS.

3.1 WATER RESOURCES

3.1.1 Surface Waters

Tumble Down Brook is a perennial stream that flows south from numerous natural ponds and wetlands in the headwaters, which are located in the north-central portion of the property. A section that was marked on U.S. Geological Survey (USGS) topographic maps as an intermittent tributary that flows southwest into Tumble Down Brook is actually a stream with a perennial flow regime, at minimum, between Mountain Road and the small pond north of the road, and potentially further to the north. This tributary roughly originates at the northern boundary of the SERE School and maintains a high rate of flow and low meander with clear and cool water as a result of the steep topography and densely forested banks. Tumble Down Brook is characteristic of the other streams that flow down the densely forested sides of the SERE School valley.

Further south, a series of falls or cascades that spread over approximately the lower third of Tumble Down Brook are referred to as Redington Falls. The falls were accessed via a trailhead located along Redington Stream Road. A fork in the trail approximately midway between Redington Stream Road and Mountain Road provides access to the upper reaches of Tumble Down Brook to the west, and a shorter route to Mountain Road via a log bridge over the brook to the east.

At its southern terminus, Tumble Down Brook flows into Orbeton Stream west of Redington Pond. This portion of Tumble Down Brook is characterized by lower velocity as the topography eases at the bottom of the valley. The substrate is primarily cobble and sand, and the water remains clear as it converges with Orbeton Stream.

Unlike Tumble Down Brook, the section of Orbeton Stream west of Redington Pond is characterized by sluggish flow and somewhat turbid waters. Numerous small or remnant beaver dams were observed in this reach. Orbeton Stream originates within a scrub-shrub and forested wetland, then meanders east through a scrub-shrub and emergent wetland along the valley floor until it reaches Redington Pond.

Orbeton Stream continues from the southeast corner of Redington Pond in an easterly then southerly direction. Orbeton Stream flows to the southeast border of the SERE School (main parcel), across the Appalachian Trail right-of-way, continuing across the south parcel of the Installation. Orbeton Stream has predominantly clear waters, a sandy substrate, and boulders and cobbles scattered along the banks.

The intersection of Tumble Down Brook and Redington Stream corresponds to the historical western extent of Redington Pond as seen on USGS maps of the area. The western edge of the pond is currently located more than 1,300 feet (400 meters) east of the convergence. The water level is lowering due to the deteriorating man-made earthen dam at its east end. Numerous old stumps are visible throughout the shallow waters of the pond.

3.1.2 Wetlands

Wetlands that occur at the SERE School are classified using the U.S. Fish and Wildlife Service (USFWS) system for the *Classification of Wetlands and Deepwater Habitats of the United States* (USFWS 1979). Wetlands occur throughout the property. All of the wetlands observed during the GWFS were palustrine scrub-shrub (PSS), palustrine emergent (PEM), palustrine forested (PFO), palustrine unconsolidated bottom (PUB) wetlands, or a combination thereof. A discussion of the wetland and upland vegetation communities is provided in Section 3.2.

Wetlands classified as PEM or wetlands containing predominantly emergent vegetation were observed most often in association with wetlands dominated by woody vegetation. These wetlands occur as pockets within PSS or PFO wetlands or as linear features fringing shrub. Common species observed within PEM wetlands include bluejoint (*Calamagrostis canadensis*), sedges (*Carex* spp.), woolgrass (*Scirpus cyperinus*), rushes (*Juncus* spp.), spotted Joe Pye weed (*Eupatoriadelphis maculatus*), blueflag iris (*Iris versicolor*), meadowsweet (*Spiraea* spp.), blackberry (*Rubus* sp.), and ferns such as cinnamon fern (*Osmunda cinnamomea*) and royal fern (*Osmunda regalis*). These wetlands are mapped as having hydroperiods that are seasonally flooded/saturated or semipermanently flooded (USFWS National Wetland Inventory [NWI] maps).

In addition to the larger wetlands that appear on the USFWS NWI maps, pockets of small PEM wetlands not included on NWI maps were observed throughout the Project area, often in association with intermittent or perennial drainages. Similar PEM wetlands also were observed in disturbed areas, such as old forest roads, where runoff is concentrated allowing for the development of hydrophytic vegetation.

PSS wetlands were perhaps the most frequently observed wetland type during the GWFS. These shrub-dominated wetlands occur as relatively small wetlands that form the headwaters for the

ridge-side drainages, as well as the extensive wetlands that are the headwaters to Orbeton Stream and nearly all the riparian wetlands that occur along the valley floor. Virtually all of the PSS wetlands observed were dominated by speckled alder (*Alnus incana*). Other species present included tamarack (*Larix laricina*), blackberry, meadowsweet, bluejoint, goldenrods (*Solidago* spp.), spotted Joe Pye weed, and various graminoids species. The seasonal pattern of water levels within shrub wetlands include seasonally saturated, seasonally flooded, and semipermanently flooded.

The most extensive PFO wetlands were observed in association with the wetland complexes occurring along the valley floor. These wetland communities include needle-leaved and broad-leaved trees; common species observed include black spruce (*Picea mariana*), red maple (*Acer rubrum*), eastern white cedar (*Thuja occidentalis*), balsam fir (*Abies balsamea*), catberry (*Nemopanthus mucronata*), speckled alder, and cinnamon fern.

The remaining palustrine wetlands observed during the GWFS were PUB wetlands. These non-vegetated or sparsely vegetated wetlands are primarily ponds with organic substrates. Many of these wetlands contained submerged aquatic plant species, as well as well-developed rooted floating aquatic plant communities dominated by pondweeds.

3.2 VEGETATION

The SERE School is located in the Adirondack−New England Mixed Forest−Coniferous Forest−Alpine Meadow Province of the Mountains Division, within the Humid Temperate Domain Ecoregion of the United States (Bailey 1995). This transitional province grades between boreal forest and broadleaf deciduous forest, and is a mixture of deciduous and coniferous forest types. Within this region vertical zonation is present with hardwoods (sugar maple, yellow birch, and beech) occupying the valleys, mixed forests of spruce-fir and hardwoods on low mountain slopes, and nearly pure stands of balsam fir and red spruce (*Picea rubens*) at the top. Individuals within the highest zone display evidence of the harsh weather effects that occur at high elevations (i.e., krummholz) (Bailey 1995).

The vegetation types described in this section were determined to occur at the SERE School using a combination of desktop research, interviews with local and regional experts, and the GWFS field survey. More than 80 plants were identified during the site visits (Attachment A).

3.2.1 Upland Natural Communities

Maine Natural Areas Program (MNAP) has developed a classification system for Maine's natural community types. This classification includes 98 distinct community types that are described in *Natural Landscapes of Maine* (Gawler and Cutko 2010). The descriptions of the natural community types that were observed at the SERE School main parcel during the GWFS generally follow the MNAP classification system:

Spruce – Northern Hardwoods (S5)[1]

This community type is abundant throughout the property, generally at elevations less than 2,000 feet (600 meters) above mean sea level (MSL). It is characterized by red spruce growing amongst hardwood species. At the SERE School, common hardwood species observed in the canopy and sub-canopy include yellow birch (*Betula allegheniensi*s), red maple, sugar maple (*Acer saccharum*), white birch (*B. paperifer*), and balsam fir. Shrub species include striped maple (*Acer pensylvanicum*) and regeneration of various canopy species. Common herbaceous plants observed include wood sorrel (*Oxalis* sp.), bunchberry (*Cornus canadensis*), whorled wood aster (*Oclemena acuminata*), bluebead lily (*clintonia borealis*), threeleaf goldthread (*Coptis trifolia*), starflower (*Trientalis borealis*), and wild sarsaparilla (*Aralia nudicaulis*).

Montane Spruce-Fir Forest (S5)

The Maritime Spruce–Fir Forest communities are dominated by red spruce with lesser amounts of balsam fir, yellow birch, and mountain ash (*Sorbus americana*). Northern white cedar (*Thuja occidentalis*) was observed in the riparian areas along several perennial streams including Tumble Down Brook. Other frequently observed species within these communities include catberry, bunchberry, and wild sarsaparilla. In disturbed areas, such as along old logging roads where runoff was concentrating, a number of wetland plant species were observed. Hydrophytic vegetation observed includes water horehound (*Lycopus americanus*), New England aster (*Symphyotrichum novae-angliae*), bladder sedge (*Carex intumescens*) and various rushes (*Juncus* sp.).

Subalpine Fir Forest (S3)

These communities are similar to Montane Spruce−Fir communities but generally occur at higher elevations (above 2,700 feet [820 meters]) at the SERE School, where balsam fir was the dominant canopy species with red spruce present at lesser densities. Heart-leaved birch (*Betula cordifolia*) and mountain ash were abundant in canopy openings created by fire and wind, and pin cherry (*Prunus pensylvanica*) was also present in disturbed areas. Common shrub and herbaceous species observed within these communities include hobblebush (*Viburnum lantanoides*) and wild raisin (*Viburnum cassinoides*).

[1] STATE RARITY RANKING (RANKS ARE DETERMINED BY THE MNAP):

S1 Critically imperiled in Maine because of extreme rarity (five or fewer occurrences or very few remaining individuals or acres) or because some aspect of its biology makes it especially vulnerable to extirpation from the State of Maine.

S2 Imperiled in Maine because of rarity (6−20 occurrences or few remaining individuals or acres) or because of other factors making it vulnerable to further decline.

S3 Rare in Maine (20−100 occurrences).

S4 Apparently secure in Maine.

S5 Demonstrably secure in Maine.

Spruce- Fir Krummholz (S4)

This coniferous community was observed on the ridge top near the HEBS area in the northwest corner of the SERE School. This area was underlain by an abundance of talus, and dominant species observed include heart-leaved birch, balsam fir, and lowbush blueberry (*Vaccinium angustifolium*). Various bryoid species were also present. The highest portion of this community type appeared to be transitioning into krummholz, a community that is generally restricted to alpine habitats above 2,700 feet (820 meters). In these transitional areas, the fir and birch were shorter in stature and some flagging was observed.

3.2.2 Wetland Natural Communities

Spruce – Fir Wet Flat (S4)

This community was observed in poorly drained areas with little or no slope. Common canopy species observed within these lush communities include red maple, balsam fir, and white birch. Understory species observed include gray birch (*Betula populifolia*) and wild raisin, and herbaceous species include bunchberry, Canada mayflower, lady fern (*Athyrium filix-femina*), cinnamon fern, and hobblebush. A carpet of moss was present throughout.

Alder Thicket (S5)

This community, which was dominated by speckled alder, was observed at the headwaters and at parts along the upper reaches of Orbeton Stream. The herbaceous layer was well-developed in places; common species observed within this stratum included bluejoint, spotted Joe Pye weed, and meadowsweet.

Sedge-Heath Fen (S4)

Although this community was not observed up close during the GWFS, it was visited during the onsite kick-off meeting conducted in late July. This wetland community occurs as a pocket along the northern and western edge of Redington Pond. This open peatland community is dominated by sedges and other graminoids such as cottongrass (*Eriophorum* sp.), as well as dwarf shrubs such as bog cranberry (*Vaccinium macrocarpon*) and sheep laurel (*Kalmia angustifolia*.), and other herbaceous species such as pitcher plants (*Sarracenia purpurea*) and sundew (*Drosera* sp.).

3.2.3 Invasive Species

Introduced plant species are nonindigenous species that do not naturally occur within the region and have either accidentally or purposefully become established. Not all introduced species become invasive. Although several nonindigenous species were observed along the gravel roadways—likely introduced via the use of erosion control seed mix—none of them are considered to be invasive.

3.3 WILDLIFE

Numerous species of wildlife were observed during both the kick-off meeting and the GWFS. Complete lists of observed species by group are provided in Attachment A.

3.3.1 Mammals

Species observed during the GWFS or site survey via direct observation or sign (e.g., scat, markings) include moose (*Alces alces*), porcupine (*Erethizon dorsatum*), American black bear (*Ursus americanus*), beaver (*Castor canadensis*), and red squirrel (*Tamiasciurus hudsonicus*).

3.3.2 Amphibians and Reptiles

Herpetofauna observed during site visits conducted include common garter snake (*Thamnophis sirtalis*), two-lined salamander (*Eurycea bislineata*), dusky salamander (*Desmognathus fuscus*), American toad (*Anaxyrus americanus*), mink frog (*Lithobates septentrionalis*), wood frog (*Lithobates sylvaticus*), and spring peeper (*Pseudocris crucifer*). Spring salamanders (*Gyrinophilus porphyriticus*) are a species of concern in the state of Maine. Although none were observed during the GFWS, the numerous perennial streams with cool, clear, fast-flowing water provide quality habitat for spring salamanders.

3.3.3 Birds

Bird species observed during the two site visits included many that are considered interior dwelling species. A list of birds is provided in Attachment A.

3.4 RARE COMMUNITIES AND SIGNIFICANT WILDLIFE HABITAT

Vernal pools are protected as Significant Wildlife Habitat under Chapter 335 of the Natural Resources Protection Act in the State of Maine. At least one potential vernal pool was observed along Redington Stream Road. This feature was dry at the time of the GWFS but the obvious depression was lined with tussock sedge (*Carex stricta*) and exhibited signs of seasonal inundation (presence of caddisfly larvae [Family Limnephilidae] and water lines on surrounding vegetation). Due to the proximity of the road, it is possible that the feature is an historic borrow pit created during construction of Redington Stream Road. Despite the fact that vernal pools of such origin often serve as viable habitat for vernal pool species, they are not regulated as are similar features of "natural" origin in Maine. Regardless, it is likely that many other vernal pools occur within the SERE School property.

3.5 THREATENED AND ENDANGERED SPECIES AND SPECIES OF SPECIAL CONCERN

Although no threatened, endangered, or species of concern were observed during the site visits, potentially suitable habitat for several of these species were observed. Habitat may be present for species including, but not limited to, bobcat (*Lynx rufus*) (Spruce-Fir Forest), Bicknell's thrush (*Catharus bicknelli*) (Spruce-Fir Krummholz), rusty blackbird (*Euphagus carolinus*) (Spruce-Fir Wet Flat) and invertebrates such as the early hairstreak (*Erora laeta*) (Spruce-Northern Hardwood Forest), Quebec emerald (*Somatochlora brevicincta*), and ringed boghaunter (*Williamsonia lintneri*) (Sedge-Heath Fen community).

4.0 REFERENCES

Bailey, R.G. 1995. Descriptions of the Ecoregions of the United States. Misc. Publication No. 1391 (rev.). United States Department of Agriculture, Forest Service, Washington D.C., 108 p.

Gawler, S.C. and A.R. Cutko. 2010. Natural Landscapes of Maine: A Guide to Natural Communities and Ecosystems. Maine Natural Areas Program, Maine Department of Conservation, Augusta, Maine.

U.S. Fish and Wildlife Service (USFWS). 1979. Classification of Wetlands and Deepwater Habitat of the United States. Biological Services Program FWS/OBS-79-31. Prepared by L.M. Cowardin, V. Carter, F.C. Golet, and E.T. LaRoe for U.S. Department of the Interior, Washington, D.C.

Attachment A

Species Lists

Vegetation Known to Occur at Survival, Evasion, Resistance, Escape (SERE) School, Redington, Maine		
Common Name	**Scientific Name**	**Associated Habitat**
American elm	*Ulmus americana*	Redington Pond Trail
American larch	*Larix laricina*	Redington Pond Trail
American water horehound	*Lycopus americanus*	Hike up to HEBS
Balsam fir	*Abies balsamea*	Redington Pond Trail, The Bluffs, Hike to HEBS, Blue Line Trail
Beaked hazel	*Corylus cornuta*	The Bluffs
Black spruce	*Picea mariana*	Headwater wetlands to Orbeton Stream
Black willow	*Salix nigra*	Redington Pond Trail
Blue bead lily	*Clintonia borealis*	The Bluffs
Blue flag iris	*Iris versicolor*	Redington Pond Trail
Blueberry	*Vaccinium corymbosum*	Redington Pond Trail
Bluejoint	*Calamagrostis canadensis*	Headwaters to Orbeton Stream
Bog cranberry	*Oxycoccus microcarpus*	Redington Pond Trail
Buttercup	*Ranunculus* sp.	Redington Pond Trail
Canada mayflower	*Maianthemum canadense*	The Bluffs, Blue Line Trail
Canada toadflax	*Nuttallanthus canadensis*	Hike to HEBS
Cinnamon fern	*Osmundastrum cinnamomeum*	Redington Pond Trail, Blue Line Trail
Common wood-sorrel	*Oxalis montana*	The Bluffs
Cottongrass	*Eriophorum angustifolium*	Redington Pond Trail
Eastern white ceder	*Thuja occidentalis*	Path to Blue Line Cabin and Waterfall
Fireweed	*Epilobium angustifolium*	Redington Pond Trail
Flat topped white aster	*Doellingeria umbellata*	Redington Pond Trail
Fringed sedge	*Carex crinita*	Hike up to HEBS
Golden thread	*Nemipterus virgatus*	The Bluffs
Goldenrod	*Solidago* sp.	Redington Pond Trail, The Bluffs, Hike to HEBS
Gray birch	*Betula populifolia*	Path to Blue Line Cabin and Waterfall
Great bladder sedge	*Carex intumescens*	Hike up to HEBS
Ground-cedar	*Lycopodium digitatum*	The Bluffs
Hay-scented fern	*Dennstaedtia punctilobula*	The Bluffs
Heart-leaved birch	*Betula cordifolia*	Hike to HEBS
Hemp nettle	*Galeopsis tetrahit*	Hike up to HEBS, Redington Pond Trail
Hobblebush	*Viburnum lantanoides*	Path to Blue Line Cabin and Waterfall
Horseweed	*Conyza canadensis*	Hike up to HEBS
Indian pipe	*Monotropa uniflora*	The Bluffs
Jewelweed	*Impatiens capensis*	Redington Pond Trail
Joe-pye weed	*Eupatorium purpureum*	Redington Pond Trail
Lady fern	*Athyrium filix-femina*	Redington Pond Trail, The Bluffs, Blue Line Trail
Laurel	*Kalmia* sp.	Redington Pond Trail
Meadow rue	*Thalictrum aquilegifolium*	Redington Pond Trail
Mountain ash	*Sorbus americana*	Hike up to HEBS
Mountain holly	*Nemopanthus mucronatus*	Hike up to HEBS
Mountain maple	*Acer spicatum*	Path to Blue Line Cabin and Waterfall
Netted chain fern	*Woodwardia areolata*	Redington Pond Trail
New england aster	*Symphyotrichum novae-angliae*	Hike up to HEBS
New york aster	*Symphyotrichum novi-belgii*	Hike up to HEBS
New york fern	*Thelypteris noveboracensis*	Redington Pond Trail
Painted trillium	*Trillium undulatum*	The Bluffs, Blue Line Trail
Paper birch	*Betula papyrifera*	Hike up to HEBS
Pearly everlasting	*Anaphalis margaritacea*	Redington Pond Trail, The Bluffs, Hike to HEBS
Peat moss	*Sphagnum platyphyllum*	Redington Pond Trail, Hike to HEBS
Pin cherry	*Prunus pensylvanica*	Hike up to HEBS
Princess pine	*Lycopodium obscurum*	The Bluffs
Purple trillium	*Trillium erectum*	The Bluffs, Blue Line Trail
Rabbit's foot clover	*Trifolium arvense*	The Bluffs
Red cedar	*Juniperus virginiana*	Redington Pond Trail
Red clover	*Trifolium pratense*	Redington Pond Trail
Red fescue	*Festuca rubra*	The Bluffs
Red maple	*Acer rubrum*	Redington Pond Trail, The Bluffs, Blue Line Trail
Red spruce	*Picea rubens*	Redington Pond Trail, The Bluffs, Blue Line Trail
Royal fern	*Osmunda regalis*	Headwater wetland to Orbeton Stream
Rush	*Juncus* sp.	Hike up to HEBS
Sedge	*Carex* sp.	Redington Pond Trail
Sensitive fern	*Mimosa pudica*	Redington Pond Trail
Solomon seal false	*Smilacina racemosa*	Redington Pond Trail
Speckled alder	*Alnus incana*	Redington Pond Trail
Spotted Joe Pye Weed	*Eupatoriadelphus maculatus*	Headwater wetland to Orbeton Stream
Starflower	*Trientalis borealis*	Hike up to HEBS
Steeplebush	*Spiraea tomentosa*	Redington Pond Trail
Strawberry	*Fragaris ananassa*	Redington Pond Trail
Striped maple	*Acer pensylvanicum*	Redington Pond Trail, The Bluffs, Blue Line Trail
Sugar maple	*Acer saccharum*	Redington Pond Trail, Blue Line Trail
Sun dew	*Drosera adelae*	Hike up to HEBS
Tall white aster	*Aster umbellatus*	The Bluffs, Hike to HEBS
Trembling aspen	*Populus tremuloides*	The Bluffs
Trout lilly	*Erythronium americanum*	The Bluffs
White birch	*Betula papyrifera*	The Bluffs, Blue Line Trail, Hike to HEBS
White clover	*Trifolium repens*	Redington Pond Trail
White meadowsweet	*Spiraea latifolia*	Redington Pond Trail, Hike to HEBS
Whorled aster	*Oclemena acuminata*	The Bluffs, Blue Line Trail
Wild raisin	*Viburnum cassinoides*	Redington Pond Trail
Wild sarsaparilla	*Aralia nudicaulis*	Redington Pond Trail, The Bluffs, Hike to HEBS
Wool grass	*Scirpus cyperinus*	Redington Pond Trail

Vegetation Known to Occur at Survival, Evasion, Resistance, Escape (SERE) School, Redington, Maine		
Common Name	**Scientific Name**	**Associated Habitat**
Yellow birch	*Betula alleghaniensis*	Redington Pond Trail, The Bluffs
Yellow clintonia	*Clintonia borealis*	The Bluffs
Blackberry	*Rubus* sp.	Redington Pond Trail
	Scirpus sp.	Redington Pond Trail

Birds Known to Occur at Survival, Evasion, Resistance, Escape (SERE) School, Redington, Maine		
Common Name	**Scientific Name**	**Associated Habitat**
American goldfinch	*Carduelis tristis*	open second-growth woodlands/roadsides
American kestrel	*Falco sparverius*	open field/grasslands
American redstart	*Setophaga ruticilla*	secondary growth deciduous forest
American robin	*Turdus migratorius*	open forest/shrub/grasslands
Belted kingfisher	*Ceryle alcyon*	coastal/waterbodies
Blackburnian warbler	*Dendroica fusca*	coniferous/mixed forest
Black-capped chickadee	*Poecile atricapillus*	mixed forest/edge habitat
Black-throated blue warbler	*Dendroica caerulescens*	
Black-throated green warbler	*Dendroica virens*	coniferous/mixed forest
Blue jay	*Cyanocitta cristata*	deciduous/coniferous/edge habitat
Broad-winged hawk	*Buteo platypterus*	deciduous/mixed forest
Canada goose	*Branta canadensis*	coastal/grasslands
Cape May warbler	*Dendroica tigrina*	coniferous forest
Common grackle	*Quiscalus quiscula*	open fields/grasslands/open forest/urban areas
Common raven	*Corvus corax*	coniferous/deciduous forest/grasslands
Common redpoll	*Carduelis flammea*	
Dark-eyed junco	*Junco hyemalis*	coniferous/mixed forest
Hairy woodpecker	*Picoides villosus*	Mature forest
Least flycatcher	*Empidonax minimus*	open woodlands
Northern flicker	*Colaptes auratus*	open woodland/edge habitat
Philidelphia vireo	*Vireo philadelphicus*	deciduous forest
Red-breasted nuthatch	*Sitta canadensis*	spruce-fir forest
Red-eyed vireo	*Vireo olivaceus*	deciduous/mixed forest
Red-tailed hawk	*Buteo jamaicensis*	open fields/grasslands/open forest
Ruffed-grouse	*Bonasa umbellus*	aspen woodlands/early succesional mixed deciduous
Rusty blackbird	*Euphagus carolinus*	wet forest/bogs
Swamp sparrow	*Melospiza georgiana*	weltands/tidal marshes/meadows
Tree swallow	*Tachycineta bicolor*	open areas/coastal
Unidentified duck species		
Warbling vireo	*Vireo gilvus*	deciduous forest/riparian
White-throated sparrow	*Zonotrichia albicollis*	coniferous/mixed forest
Yellow-rumped warbler	*Dendroica coronata*	

Habitat information taken from http://www.birds.cornell.edu/AllAboutBirds/BirdGuide/

Mammals Known to Occur at Survival, Evasion, Resistance, Escape (SERE) School, Redington, Maine

Order/Family	Family	Common Name	Scientific Name	Associated Habitat
Carnivora	Ursidae	American black bear	*Ursus americanus*	forests
Rodentia	Castoridae	American beaver	*Castor canadensis*	rivers and streams
Carnivora	Felidae	Bobcat	*Lynx rufus*	forest, forest edge
Carnivora	Canidae	Eastern coyote	*Canis latrans*	various
Rodentia	Muridae	Deer mouse	*Peromyscus maniculatus*	various
Artiodactyla	Cervidae	Moose	*Alces alces*	boreal and mixed deciduous forest
Rodentia	Erethizontidae	Porcupine	*Erethizon dorsatum*	forests, hillsides, rocky outcrops
Rodentia	Sciuridae	Red squirrel	*Tamiasciurus hudsonicus*	coniferous and deciduous forest

Reptiles and Amphibians Known to Occur at Survival, Evasion, Resistance, Escape (SERE) School, Redington, Maine

Common Name	Scientific Name	Associated Habitat
Amphibians		
American toad	*Bufo americanus*	various
Dusky salamander	*Desmognathus fuscus*	perennial streams
Mink frog	*Rana septentrionalis*	ponds, lakes, streams
Spring peeper	*Pseudacris crucifer*	vernal pools
Two-lined salamanders	*Eurycea bislineata*	perennial streams
Wood frog	*Rana sylvatica*	vernal pools
Reptiles		
Garter snake	*Thamnophis sirtalis*	upland forest

Fish Known to Occur at Survival, Evasion, Resistance, Escape (SERE) School, Redington, Maine		
Common Name	**Scientific Name**	**Associated Habitat**
Brook trout	*Salvelinus fontinalis*	Small streams and lakes

Invertebrates Known to Occur at Survival, Evasion, Resistance, Escape (SERE) School, Redington, Maine		
Common Name	**Scientific Name**	**Associated Habitat**
Butterflies		
Mourning cloak	*Nymphalis antiopa*	Northern Hardwood Forest
Caddisfly	Family Limnephilidae	Vernal Pool

Attachment B

Photographic Record

TETRA TECH, INC.

PHOTOGRAPHIC RECORD

Client: NAVFAC Atlantic
Project: SERE School General Walkover Field Survey
Document: Technical Memorandum

Photographer: S. Watts
Date: 8/21/12
Photo No.: 1

Comments:
Spruce – Northern Hardwoods Community

Photographer: I. Trefry
Date: 8/22/12
Photo No.: 2

Comments:
Montane Spruce- Fir Forest

TETRA TECH, INC.

PHOTOGRAPHIC RECORD

Client: NAVFAC Atlantic
Project: SERE School General Walkover Field Survey
Document: Technical Memorandum

Photographer: I. Trefry
Date: 8/21/12
Photo No.: 3

Comments:
Subalpine Fir Forest

Photographer: Watts
Date: 8/21/12
Photo No.: 4

Comments:
Transition into Spruce-Fir krummholz community.

TETRA TECH, INC.

PHOTOGRAPHIC RECORD

Client: NAVFAC Atlantic
Project: SERE School General Walkover Field Survey
Document: Technical Memorandum

Photographer: S. Watts
Date: 8/22/12
Photo No.: 5

Comments:
Alder Shrub Thicket

Photographer: I. Trefry
Date: 8/9/12
Photo No.: 6

Comments:
Sedge-Heath Fen

TETRA TECH, INC.

PHOTOGRAPHIC RECORD

Client: NAVFAC Atlantic
Project: SERE School General Walkover Field Survey
Document: Technical Memorandum

Photographer: S. Watts
Date: 8/21/12
Photo No.: 7

Comments:
View of valley from bluffs

Photographer: S. Watts
Date: 8/21/12
Photo No.: 8

Comments:
View from HEBS in northeast corner of main parcel

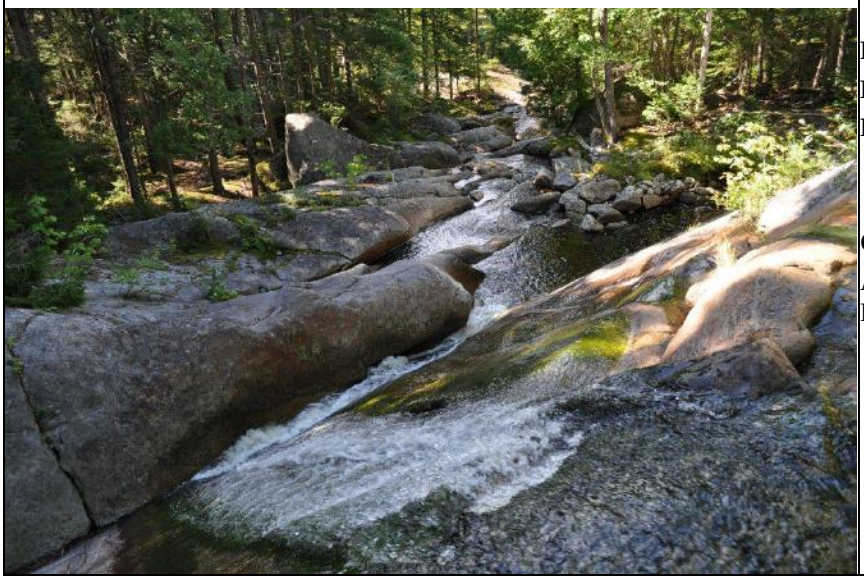
TETRA TECH, INC.

PHOTOGRAPHIC RECORD

Client: NAVFAC Atlantic
Project: SERE School General Walkover Field Survey
Document: Technical Memorandum

Photographer: S. Watts
Date: 8/22/12
Photo No.: 9

Comments:
Orbeton Stream west of Redington Pond



Photographer: I. Trefry
Date: 8/22/12
Photo No.: 10

Comments:
A section of cascades at Redington Fall

TETRA TECH, INC.

PHOTOGRAPHIC RECORD

Client: NAVFAC Atlantic
Project: SERE School General Walkover Field Survey
Document: Technical Memorandum

Photographer: I. Trefry
Date: 8/22/12
Photo No.: 11

Comments:
View of Redington Village and ridge along southern boundary

Photographer: S. Watts
Date: 8/21/12
Photo No.: 12

Comments:
Common garter snake (*Thamnophis sirtalis*)

TETRA TECH, INC.

PHOTOGRAPHIC RECORD

Client: NAVFAC Atlantic
Project: SERE School General Walkover Field Survey
Document: Technical Memorandum

Photographer: S. Watts
Date: 8/21/12
Photo No.: 13

Comments:
Mourning cloak butterfly (*Nymphalis antiopa antiopa*)

Photographer: S. Watts
Date: 8/23/12
Photo No.: 14

Comments:
Spring peeper *(Pseudacris crucifer)*

TETRA TECH, INC.

PHOTOGRAPHIC RECORD

Client: NAVFAC Atlantic
Project: SERE School General Walkover Field Survey
Document: Technical Memorandum

Photographer: I. Trefry
Date: 8/22/12
Photo No.: 15

Comments:
Brook trout (*Salvelinus fontinalis*) in Tumble Down Brook

Photographer: I. Trefry
Date: 8/22/12
Photo No.: 16

Comments:
Two-lined salamander (*Eurycea bislineata*) observed in an upper reach of Tumble Down Brook.

TETRA TECH, INC.

PHOTOGRAPHIC RECORD

Client: NAVFAC Atlantic
Project: SERE School General Walkover Field Survey
Document: Technical Memorandum

Photographer: I. Trefry
Date: 8/23/12
Photo No.: 17

Comments:
Wood frog
(*Lithobates sylvaticus*)

Photographer: Trefry
Date: 8/22/12
Photo No.: 18

Comments:
Porcupine
(*Erethizon dorsatum*)

TETRA TECH, INC.

PHOTOGRAPHIC RECORD

Client:	NAVFAC Atlantic
Project:	SERE School General Walkover Field Survey
Document:	Technical Memorandum

Photographer: S/ Watts
Date: 7/25/12
Photo No.: 19

Comments:
Panoramic photo from the west end of Redington Pond

Photographer: S. Watts
Date: 7/25/12
Photo No.: 20

Comments:
Panoramic photo from the overlook at the Bluffs

Enclosure 3

High Elevation Bird Survey Technical Memorandum

January 2015

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NAVFAC Atlantic Biological Resource Services

Contract: N62470-08-D-1008; Task Order: WE40, Task 2B

High Elevation Bird Survey Technical Memorandum
Survival, Evasion, Resistance, & Escape (SERE) School

FINAL
October 2013

Prepared by:
Tetra Tech, Inc.
2200 Wilson Blvd., Suite 400
Arlington, VA 22201

Table of Contents

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1 INTRODUCTION

Tetra Tech, Inc. (Tetra Tech) was contracted by the U.S. Department of the Navy (Navy), Naval Facilities Engineering Command Atlantic (NAVFAC Atlantic) to perform activities associated with the update of the 2007 SERE School Integrated Natural Resources Management Plan (INRMP) (Project). Under the current task order (WE40), these activities included performing a High Elevation Bird Survey (HEBS) at the SERE School. The purpose of the HEBS was to acquire presence/absence data for the Bicknell's thrush (*Catharus bicknelli*) and other forest dwelling bird species that occur at high elevation at the SERE School following protocols designed by the Vermont Center for Ecostudies. All technical data collected will be incorporated into the SERE School INRMP update.

This Technical Memorandum provides a summary of HEBS to document the presence/absence of Bicknell's thrush at the SERE School. Currently, the Bicknell's thrush is a candidate species for listing under the United States Fish and Wildlife Service (USFWS) Endangered Species Act. Should the species be listed as either endangered or threatened, the USFWS would likely develop a conservation plan and designation of critical habitat. Specifically, the following sections contain an overview of the field methods used to complete the survey as well as a brief description of the survey results. Appendix A contains a photographic record of the HEBS survey points. Appendix B contains information gathered by the Vermont Center for Ecostudies for Mountain Birdwatch 2013 from nearby survey routes.

2 SURVEY METHODS

The SERE School covers approximately 12,440 acres (5,034 hectares), and is located in Franklin County, Maine. The SERE School is part of the White Mountain/Blue Mountain Ecoregion (Griffith et al. 2009). Much of this ecoregion consists of elevations generally 1,000 feet (ft) (305 meters [m]) to over 3,000 ft (904 m), with inclusions of higher peaks occurring in the Upper Montane/Alpine Zone Ecoregion (Griffith et al. 2009). The mostly acidic upland soils include some high elevation spruce-fir, widespread northern hardwood-conifer forests, and at lowest elevations some transition hardwood-conifer forests occur (Griffith et al. 2009).

A desktop review of aerial imagery was conducted prior to initiation of the field survey to identify survey areas, access points and restricted areas, terrain, and general habitat information. Discussions with the SERE School Natural Resources Manager also were conducted to obtain site information with focal areas to concentrate on, which was used to develop the survey route for the HEBS. The survey was designed to evaluate habitat beginning near the SERE School compound and extending to the east up in elevation into the spruce/fir zone.

Surveys followed the protocol and standard operating procedures for Mountain Birdwatch – *Protocol and Standard Operating Procedures for Monitoring High-elevation Landbirds in the Northern Appalachian and Laurentian Regions* (Version 2.0; Hart and Lambert 2010). A total of 11 species will be considered target species for the survey including Bicknell's thrush, Swainson's thrush (*Carthurus ustulatus*), hermit thrush (*Carthurus guttatus*), white-throated sparrow (*Zonotrichia albicollis*), fox sparrow (*Passerella iliaca*), winter wren (*Troglodytes troglodytes*), blackpoll warbler (*Setophaga striata*), black-capped chickadee (*Poecile atricapillus*), boreal chickadee (*Poecile hudsonicus*), yellow-bellied flycatcher (*Empidonax flaviventris*), and red squirrel (*Sciurus vulgaris*).

Consistent with the Mountain Birdwatch protocol (Hart and Lambert 2010), a qualified Tetra Tech field biologist conducted four consecutive 5-minute counts at each of the eight survey locations (Figure 1), for a total sampling period of 20 minutes per point. The biologist conducted repeated simple counts for all target species (including Bicknell's thrush) during each 5-minute period. To increase the likelihood of detecting Bicknell's thrush, which is most vocal during the pre-dawn period, observers began the surveys 45 minutes before sunrise. To reduce the risk of counting the same individual twice, datasheets were used to map each individual and its observed or presumed movements. Additional information recorded at each survey point included date, time, weather, and habitat. Each survey point also was photographed facing two directions (Appendix A).

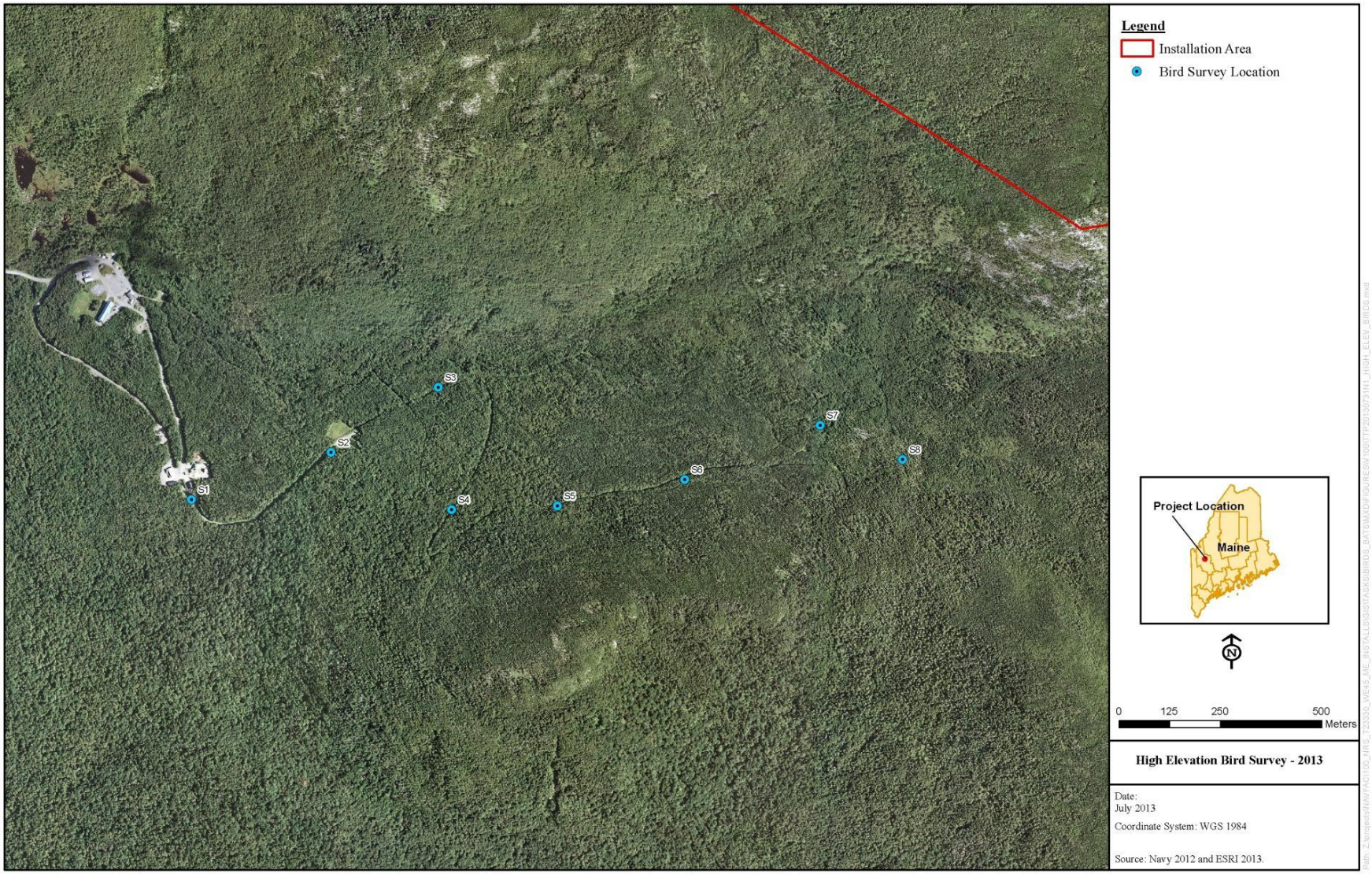

Figure 1. High Elevation Bird Survey Points at the SERE School, Redington Township, Franklin County, ME.

3 RESULTS

Surveys were conducted on 13 June and 26 June, 2013. One Bicknell's thrush was audibly detected on 13 June 2013 at Survey Point 8 by its song. An additional incidental observation of two Bicknell's thrush was detected on 12 June near Survey Point 4, as the birds were calling to each other. This incidental observation was during the initial reconnaissance and setup of the survey transect. No other Bicknell's thrush was detected. Survey Point 8 is approximately 3,112 ft (949 m) in elevation and Survey Point 4 is approximately 2,830 ft (863 m) in elevation. A total of 25 bird species were detected during the survey (Table 1).

Table 1. List of Bird Species Observed during High Elevation Bird Surveys at the SERE School, Redington Township, Franklin County, ME.

SERE School, Franklin County, Maine - High Elevation Bird Survey Species List	
13 and 26 June 2013	
American robin	*Turdus migratorius*
Bicknell's thrush	*Catharus bicknelli*
Black-and-white warbler	*Mniotilta varia*
Black-capped chickadee	*Poecile atricapillus*
Blackpoll warbler	*Setophaga striata*
Black-throated blue warbler	*Setophaga caerulescens*
Black-throated green warbler	*Setophaga virens*
Blue-headed vireo	*Vireo solitarius*
Brown creeper	*Certhia americana*
Canada goose	*Branta canadensis*
Cape May warbler	*Setophaga tigrina*
Dark-eyed junco	*Junco hyemalis*
Golden-crowned kinglet	*Regulus satrapa*
Hermit thrush	*Catharus guttatus*
Nashville warbler	*Oreothlypis ruficapilla*
Ovenbird	*Seiurus aurocapilla*
Red-breasted nuthatch	*Sitta canadensis*
Red-eyed vireo	*Vireo olivaceus*
Swainson's thrush	*Catharus ustulatus*
White-breasted nuthatch	*Sitta carolinensis*
White-throated sparrow	*Zonotrichia albicollis*
Winter wren	*Troglodytes hiemalis*
Yellow-bellied flycatcher	*Empidonax flaviventris*
Yellow-breasted sapsucker	*Sphyrapicus varius*
Yellow-rumped warbler	*Setophaga coronata*

4 DISCUSSION

The recent change of Bicknell's thrush from a subspecies of gray-cheeked thrush (*Catharus minimus*) to full species status has heightened interest and concern among birders, scientists, land-use planners, and conservationists (Rimmer et al. 2001, Rimmer and McFarland 2013). Bicknell's thrush is adapted to naturally disturbed habitats, preferring to select patches of regenerating forest caused by "fir waves", windthrow, ice and snow damage, fire, and insect outbreaks, as well as chronically disturbed, stunted altitudinal and coastal conifer forests (Rimmer et al. 2001). In addition to these natural successional habitats, Bicknell's thrush has recently been discovered in areas disturbed by timber harvesting, ski trail and road construction, and other human activities (Rimmer et al. 2001).

Due to the remoteness of their breeding habitats, Bicknell's thrush is virtually un-sampled by Breeding Bird Surveys, making it difficult to assess trends in their population (Rimmer and McFarland 2013). Evidence of local declines and extinctions in "traditional" breeding habitats may indicate either a shift in habitat use or increasing populations, but more likely reflects the species' opportunistic use of disturbed habitats (Rimmer et al. 2001). Extensive loss and degradation of the primary forest habitats that Bicknell's thrush prefer in winter may pose the greatest threat to the species' long-term survival, as the species is found only to winter in the wet broadleaf montane forests of a few Caribbean Islands (Cuba, Jamaica, Haiti, Dominican Republic, and Puerto Rico) (Rimmer and McFarland 2013 Rimmer et al. 2001).

Despite detailed studies such as the HEBS, few concrete data are available by which to assess the conservation status of Bicknell's thrush. However, based on the amount of potential breeding habitat identified from remote-sensing data, mean home range area, and dual assumptions of non-overlapping home ranges and saturated habitat, the estimated range-wide breeding population in North America is 25,000–50,000 individuals (Rimmer et al. 2001).

Additional data provided by the Vermont Center for Ecostudies' Mountain Bird Watch surveys for the Redington Southeast (~1.0 mile [1.6 kilometer] east of the SERE School), Caribou Pond West (~1.0 mile [1.6 kilometer] east of the SERE School), and Saddleback Junior (~3.0 [4.8 kilometer] miles southwest of the SERE School) areas have documented Bicknell's thrush at seven out of 15 points (46.6 percent) surveyed during the 2013 season (Appendix B).

Evidence of Bicknell's thrush at the SERE School indicates that habitat that supports this species does exist (species detected at two of eight survey points). However, survey results at the SERE School may indicate that there may be an elevation threshold of around 2,700 ft (823 m) or above where Bicknell's thrush is most likely to be found.

Based on survey results from the SERE School and surrounding Mountain Birdwatch survey routes, activities to support the SERE School military mission could occur up to this elevation gradient with little or no impact to the Bicknell's thrush expected. SERE School property with montane spruce/fir habitat and elevations greater than 2,700 ft (823 m) that were not surveyed in 2013 also are likely support Bicknell's thrush.

5 LITERATURE CITED

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Rimmer, C.C., K.P. McFarland, W.G. Ellison and J.E. Goetz. 2001. Bicknell's Thrush (*Catharus bicknelli*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/592doi:10.2173/bna.592.

APPENDIX A

Photo Log

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TETRA TECH, INC.

PHOTOGRAPHIC RECORD

Client: NAVFAC Atlantic
Project: SERE School High Elevation Bird Survey
Document: Technical Memorandum

Photographer: DWH
Date: 6/13/13
Photo No.: 1

Comments:
HEBS Point #1

Photographer: DWH
Date: 6/13/13
Photo No.: 2

Comments:
HEBS Point #1

TETRA TECH, INC.

PHOTOGRAPHIC RECORD

Client: NAVFAC Atlantic
Project: SERE School High Elevation Bird Survey
Document: Technical Memorandum

Photographer: DWH
Date: 6/13/13
Photo No.: 3

Comments:
HEBS Point #2

Photographer: DWH
Date: 6/13/13
Photo No.: 4

Comments:
HEBS Point #2

TETRA TECH, INC.

PHOTOGRAPHIC RECORD

Client: NAVFAC Atlantic
Project: SERE School High Elevation Bird Survey
Document: Technical Memorandum

Photographer: DWH
Date: 6/13/13
Photo No.: 5

Comments:
HEBS Point #3

Photographer: DWH
Date: 6/13/13
Photo No.: 6

Comments:
HEBS Point #3

TETRA TECH, INC.

PHOTOGRAPHIC RECORD

Client: NAVFAC Atlantic
Project: SERE School High Elevation Bird Survey
Document: Technical Memorandum

Photographer: DWH
Date: 6/13/13
Photo No.: 7

Comments:
HEBS Point #4

Photographer: DWH
Date: 6/13/13
Photo No.: 8

Comments:
HEBS Point #4

TETRA TECH, INC.

PHOTOGRAPHIC RECORD

Client: NAVFAC Atlantic
Project: SERE School High Elevation Bird Survey
Document: Technical Memorandum

Photographer: DWH
Date: 6/13/13
Photo No.: 9

Comments:
HEBS Point #5

Photographer: DWH
Date: 6/13/13
Photo No.: 10

Comments:
HEBS Point #5

TETRA TECH, INC.

PHOTOGRAPHIC RECORD

Client: NAVFAC Atlantic
Project: SERE School High Elevation Bird Survey
Document: Technical Memorandum

Photographer: DWH
Date: 6/13/13
Photo No.: 11

Comments:
HEBS Point #6

Photographer: DWH
Date: 6/13/13
Photo No.: 12

Comments:
HEBS Point #6

TETRA TECH, INC.

PHOTOGRAPHIC RECORD

Client: NAVFAC Atlantic
Project: SERE School High Elevation Bird Survey
Document: Technical Memorandum

Photographer: DWH
Date: 6/13/13
Photo No.: 13

Comments:
HEBS Point #7

Photographer: DWH
Date: 6/13/13
Photo No.: 14

Comments:
HEBS Point #7

TETRA TECH, INC.

PHOTOGRAPHIC RECORD

Client: NAVFAC Atlantic
Project: SERE School High Elevation Bird Survey
Document: Technical Memorandum

Photographer: DWH
Date: 6/13/13
Photo No.: 15

Comments:
HEBS Point #8

Photographer: DWH
Date: 6/13/13
Photo No.: 16

Comments:
HEBS Point #8

APPENDIX B

Vermont Center for Ecostudies

Mountain Birdwatch 2013 Survey Data

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Mountain Birdwatch 2013 Data
Redington Southeast, Caribou Pond West, Saddleback Junior

Prepared for Derek Hengstenberg, TetraTech

VERMONT CENTER FOR ECOSTUDIES

UNITING PEOPLE & SCIENCE FOR CONSERVATION

By Dr. Judith Scarl
Conservation Biologist and Mountain Birdwatch project director
Vermont Center for Ecostudies

TetraTech wildlife biologist Derek Hegstenberg requested presence/absence data for three Mountain Birdwatch 2.0 routes surveyed in 2013: 14 Redington Southeast (attachment 1), 110 Caribou Pond West (attachment 2), and 126 Saddleback Junior (attachment 3). TetraTech will compare this data with surveys conducted within the US Navy SERE School property in Maine.

Data from these three routes were collected by two volunteers and one Vermont Center for Ecostudies' staff member between 13 June and 23 June 2013. All data were collected according to the protocols detailed in the Mountain Birdwatch Protocol and Standard Operating Procedures (attachment 4), with the caveat that Mountain Birdwatch has expanded its suitable date range such that surveys between 1 June and 30 June are permitted. A trained intern or paid staff member checked each field data sheet to ensure that accurate collection methods were employed, and these individuals also checked the accuracy of data entered into an online database.

Surveys on each of these three routes were initiated between 0410 and 0450; observers surveyed each route in order, beginning with point 1. Surveys were not conducted in high winds or steady rain (see attachment 4). Bicknell's Thrush was detected at all three of these Mountain Birdwatch routes (see Table 1). Mountain Birdwatch points are meant to be largely independent, and Bicknell's Thrush was detected at 7 out of 15 points along these three routes.

Route	Point	Survey Date	BITH Detected
14	1	23-Jun-13	No
14	2	23-Jun-13	Yes
14	3	23-Jun-13	Yes
14	4	23-Jun-13	No
14	5	23-Jun-13	No
14	6	23-Jun-13	No
110	1	19-Jun-13	Yes
110	2	19-Jun-13	Yes
110	3	19-Jun-13	Yes
110	4	19-Jun-13	Data unavailable- confidential
126	1	13-Jun-13	Yes
126	2	13-Jun-13	Yes
126	3	13-Jun-13	No
126	4	13-Jun-13	No
126	5	13-Jun-13	No
126	6	13-Jun-13	No

Mountain Birdwatch 2.0

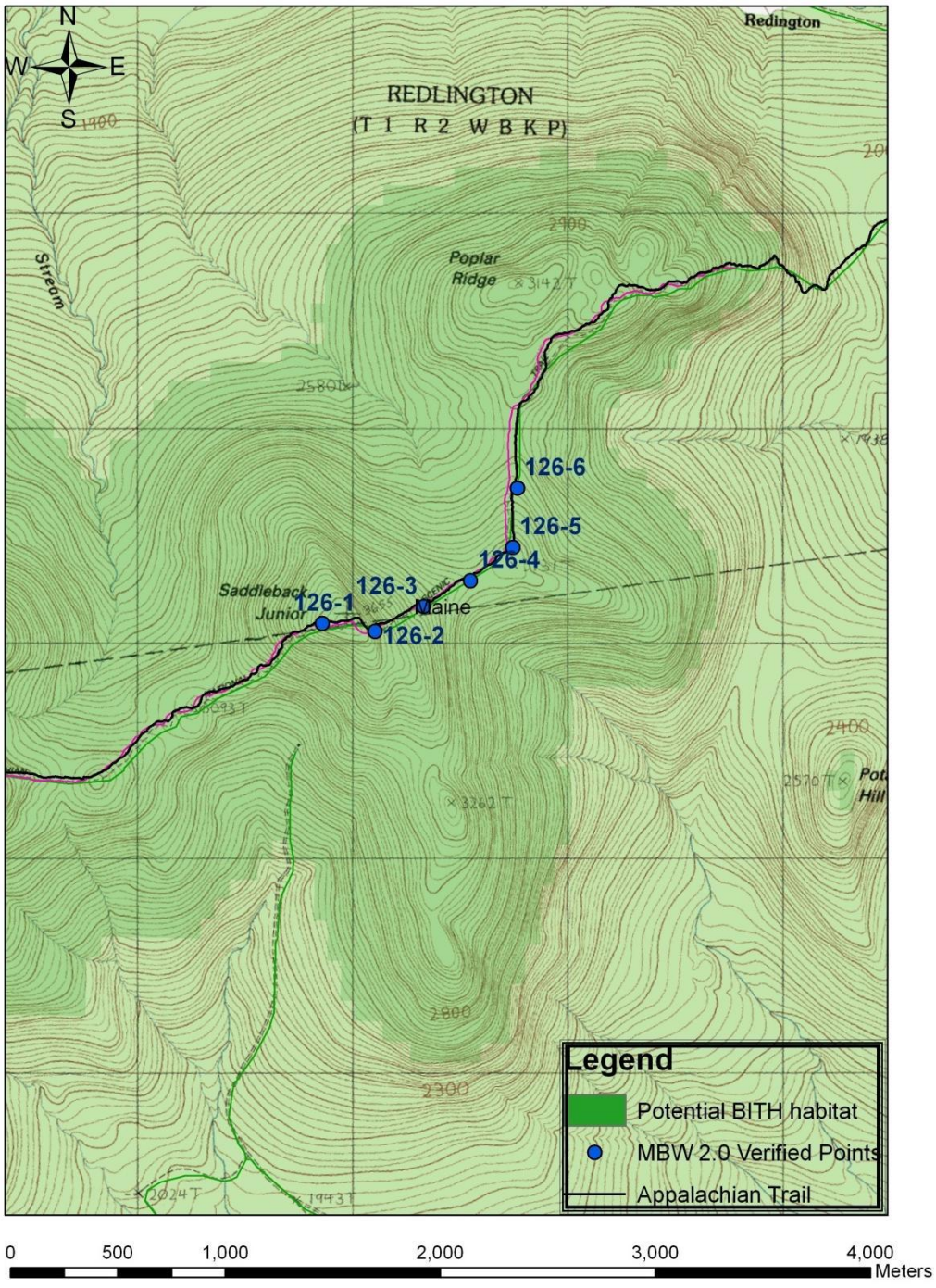
Route 126: Saddleback Junior, ME

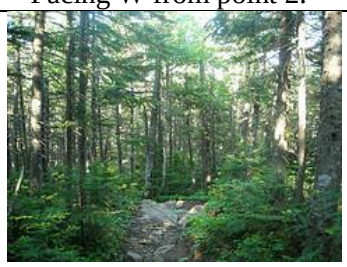
Hike Duration/Difficulty: 3 hours, strenuous.

Route/Trail Access: Off of highway 4 south, turn left on Dallas Hill Road, then right on Saddleback Mountain Road. Park at main lodge at ski area and acquire map from inside. Two mile hike up ski hill to trail that leads to AT. Head NE on AT to summit of Saddleback and then on to the summit of The Horn, and then onto the summit of Saddleback Jr. The points begin just before the summit and continue over it and down to the saddle. A shelter sits on Poplar Ridge about 900 meters beyond last point. Total mileage about 6.5 miles.

Revised 11/2012

126 Saddleback Junior



Pt #	Picture 1	Picture 2	GPS[1]	Description
1	 Facing E from point 1.	 Facing W from point 1.	**N** 44.95794 **W** 70.45932 **Elev(m)** 1080	8 meters east of point, a triangle rock standing on its end with a white blaze on it. Very near summit of Saddleback Jr.
2	 Facing E from point 2.	 Facing W from point 2.	**N** 44.95765 **W** 70.45619 **Elev(m)** 1093	On slope east of Saddleback Jr. summit. 5 meters up trail a white blaze on rock. Right @ point a blaze on a rock on north side of trail. Steep descent right after point heading east.
3	 Facing SW from point 3.	 Facing NE from point 3.	**N** 44.95871 **W** 70.45338 **Elev(m)** 1003	8 meters up (west) trail a white blaze on a fir. Rocky and rooty trail with mild slope.
4	 Facing E from point 4.	 Facing W from point 4.	**N** 44.95984 **W** 70.45063 **Elev(m)** 948	In flat, muddy spot, puncheon laid out over mud. East of puncheon, flat rocks. Lots of ground lichen.
5	 Facing S from point 5.	 Facing N from point 5.	**N** 44.96127 **W** 70.44818 **Elev(m)** 950	On SE side of trail a live snag (detopped) one foot diameter. On SW side of trail, a two trunked fir.
6	 Facing S from point 6.	 Facing NE from point 6.	**N** 44.96374 **W** 70.44798 **Elev(m)** 903	At bottom of rocky descent, just before water bar, heading NE on trail. Two paper birch on either side of trail, equal size. NE of point trail flattens out.

***Please survey this route in order, beginning with point 1.**

[1]Note that waypoint locations are provided in decimal degrees.

Visit www.flickr.com and search People for "Mountain Birdwatch" to view additional pictures of your route online.

Mountain Birdwatch 2.0

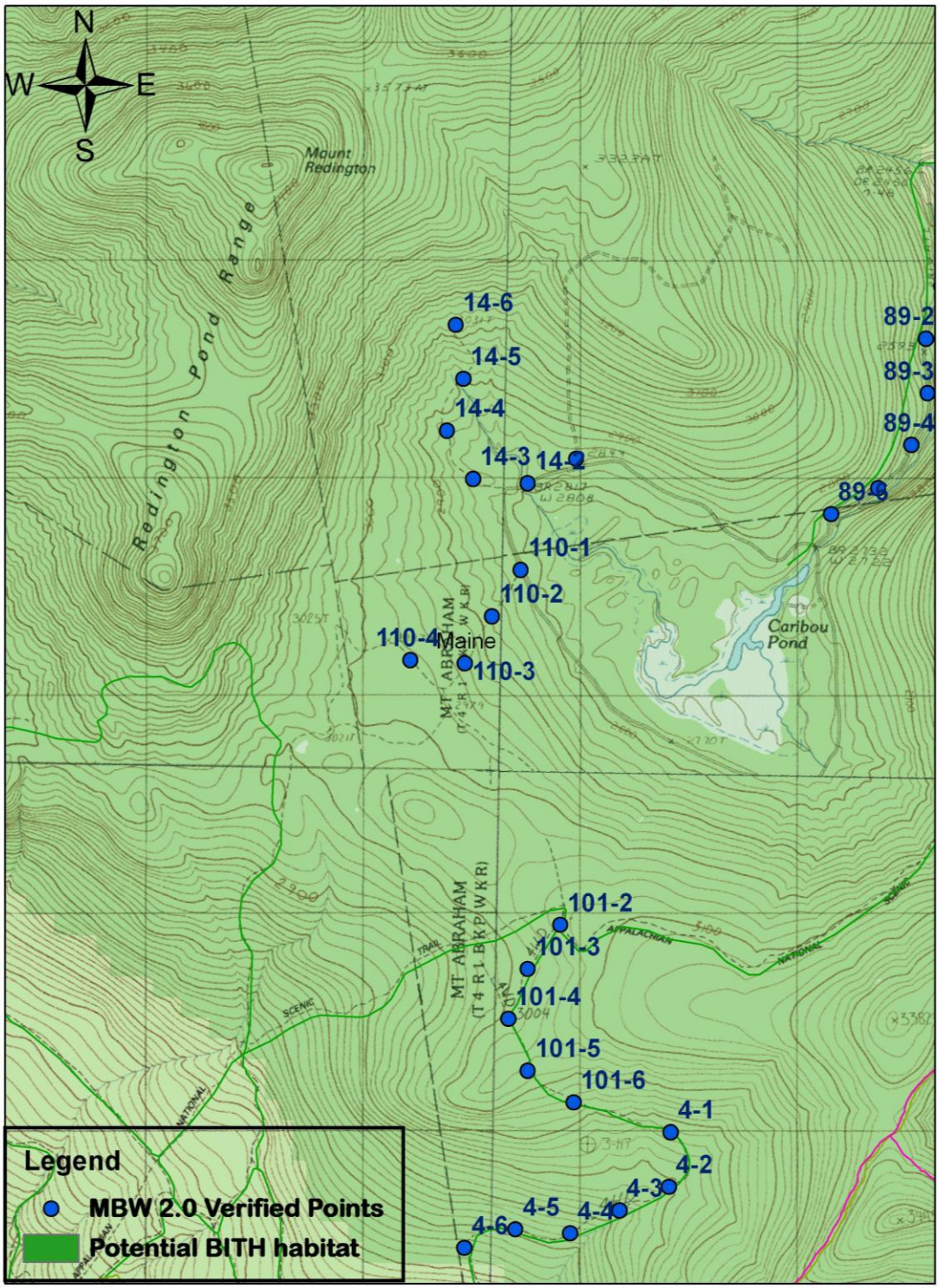
Route 110: Caribou Pond West, ME

Hike Duration/Difficulty: 1 to 1-1/2 hour hike.

Route/Trail Access: Off of 27 onto Caribou Pond Road. Drive as far as you can (~8.5 miles) and take right fork at Caribou Pond. Hike 45 minutes to points on road. Walking from Point 3 to Point 4 -- road junction described is quite overgrown. The secondary road to Point 4 is fine, but difficult to locate the turnoff without GPS. Just before the main road swings left, pass through an open, young fir grove toward the summit of Mt Redington which is now visible in the distance. Two major washouts on Caribou Pond Road necessitate parking and hiking earlier than indicated on current directions.

Revised 9/2012

110 Caribou Pond West



Pt #	Picture 1	Picture 2	GPS[1]	Description
1	 Point 1 facing North	 Point 1 facing West	**N** 45.00843 **W** 70.37341 **Elev(m)** 856	Point on road that runs north south. Less developed road intersecting and heading west. On east side of road a diamond shaped sign with an arrow pointing north.
2	 Point 2 facing West	 Point 2 facing East	**N** 45.00649 **W** 70.37505 **Elev(m)** 875	Small stream flowing in road. Road overgrown with lots of rocks. Just above point, a lone fir growing in middle of road.
3	 Point 3 facing South	 Point 3 facing West	**N** 45.00452 **W** 70.37659 **Elev(m)** 898	Overgrown road. 25 meters east of large clearing. A few large (diameter 8") birch tree snags at point.
4	 Point 4 facing West	 Point 4 facing East	**N** 45.00462 **W** 70.37978 **Elev(m)** 909	After a right turn off of the main road previously on, point on an overgrown road, very mucky, lots of moss. Redington Ridge to northwest.

***Please survey this route in order, beginning with point 1.**

[1]Please note that waypoint locations are provided in decimal degrees.

Visit www.flickr.com and search People for "Mountain Birdwatch" to view additional pictures of your route.

Mountain Birdwatch 2.0

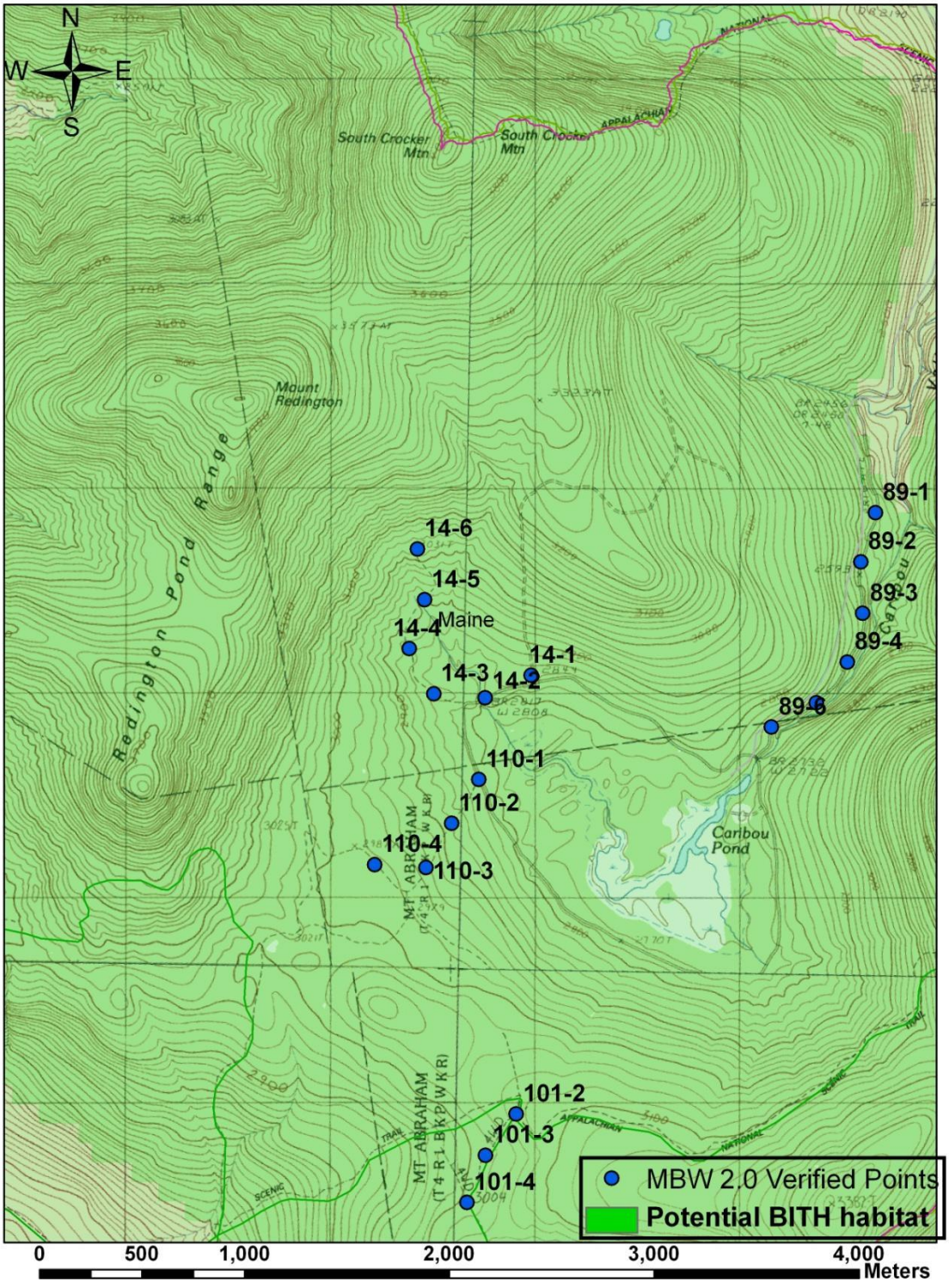
Route 14: Redington Southeast, ME

Hike Duration/Difficulty: 1 hour

Route/Trail Access: On highway 27 north, just past Sugarloaf main entrance, take left onto Caribou Valley Road. Stay on main dirt road, past AT intersection and drive as far as you can go (very rough road). When you've driven as far as you can and are walking, stay left at the intersection with the severely washed out road on the right. Continue walking on road until you come to a T, head right about <1 mile. 14-1 is at first intersection you will reach.

Revised7/2012

14 Redington Southeast



Pt #	Picture 1	Picture 2	GPS[1]	Description
1	 Direction uncertain – N?	 Direction uncertain – S?	**N** 45.01305 **W** 70.37027 **Elev(m)** 869	At first intersection past pond Y, take right and walk 20 meters to north. Overgrown road runs north south.
2	 Point 2 facing W?	 Point 2 facing E?	**N** 45.01202 **W** 70.37311 **Elev(m)** 856	At intersection continue straight on main road, 8 meters east of drainage that crosses road and 30 meters east of old wood bridge across stream. Road runs east-west.
3	 Direction uncertain – E?	 Direction uncertain – W?	**N** 45.01217 **W** 70.37629 **Elev(m)** 863	After bridge described at last point, there is another intersection, head right. 5 meters after circular flat rocky section, trail tails off into small foot path on old road.
4	 Direction uncertain – N?	 Direction uncertain – S?	**N** 45.01413 **W** 70.37788 **Elev(m)** 875	Site 5 meters north of large white pyramidal boulder on east side of trail, and 35 meters south of what looks like a small gravel clearing.
5	 Direction uncertain- E?	 Direction uncertain – S?	**N** 45.01631 **W** 70.37696 **Elev(m)** 880	90 meters NE of large, bald log landing. Road runs SW-NE. 20 meters NE of old rotted bridge over creek.
6	 Point 6 facing SW	 Point 6 facing NE	**N** 45.01852 **W** 70.37746 **Elev(m)** 916	The seeming end of trail/road. A large, circular rocky clearing. The trail comes into clearing from south. Two large birch snags to SW.

Please survey this route in order, beginning with point 1. Please note and report direction each picture faces for points 1-5.

[1]Please note that waypoint locations are provided in decimal degrees.

Visit www.flickr.com and search People for "Mountain Birdwatch" to view additional pictures of your route online.

Enclosure 4

Baseline Fish Survey and Habitat Assessment Technical Memorandum

January 2015

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NAVFAC Atlantic Biological Resource Services

Contract: N62470-08-D-1008; Task Order: WE45, Task 2

Baseline Fish Survey and Habitat Assessment Technical Memorandum

Survival, Evasion, Resistance, & Escape (SERE) School

FINAL – September 2013

Prepared by:
Tetra Tech, Inc.
2200 Wilson Blvd., Suite 400
Arlington, VA 22201

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1 INTRODUCTION

The purpose of this study is to characterize the fish community composition and assess instream and riparian habitats at the U.S. Navy Survival, Evasion, Resistance, & Escape (SERE) School located in Redington Township, Franklin County, Maine (Figure 1). The fish surveys and habitat assessments conducted on Redington Pond and in six stream reaches on 10–12 June 2013 will provide the SERE School with baseline data on the occurrence and distribution of freshwater fish assemblages, enabling future evaluations of changes within the fish community. This study will also help determine whether waterbodies present on SERE School property can support fish populations adequate to establish and maintain a catch-and-release fishing program. Finally, these data will be used to guide natural resources management and supplement natural resource assessments and regulatory documentation, including the update of the Integrated Natural Resource Management Plan (INRMP) currently underway.

The fish surveys and habitat assessments were conducted on Redington Pond and six stream reaches that were determined to be representative of perennial aquatic systems with the potential to provide high water quality habitat for fish species such as brook trout (*Salvelinus fontinalis*) and Atlantic salmon (*Salmo salar*). The SERE School also contains streams and waterbodies that would normally fall within designated Critical Atlantic Salmon Habitat (Figure 1) including Orbeton Stream and Redington Pond (see Figure 4), as well as Tumbledown Brook and an unnamed inlet to Redington Pond (see Figure 5). However, in accordance with section 4(a)(3)(B)(i) of the Endangered Species Act, the SERE School is precluded from designation as Critical Atlantic Salmon Habitat because it was determined, in writing and with the concurrence of state and federal agency representatives who reviewed the Integrated Natural Resources Management Plan (INRMP) for the Installation, that the SERE School INRMP provides benefit to Atlantic salmon. Therefore, the SERE School does not meet the definition of critical habitat (NMFS NOAA 2009). Furthermore, migration barriers found downstream generally prevent any migrating Atlantic salmon from accessing the streams located on SERE School property.

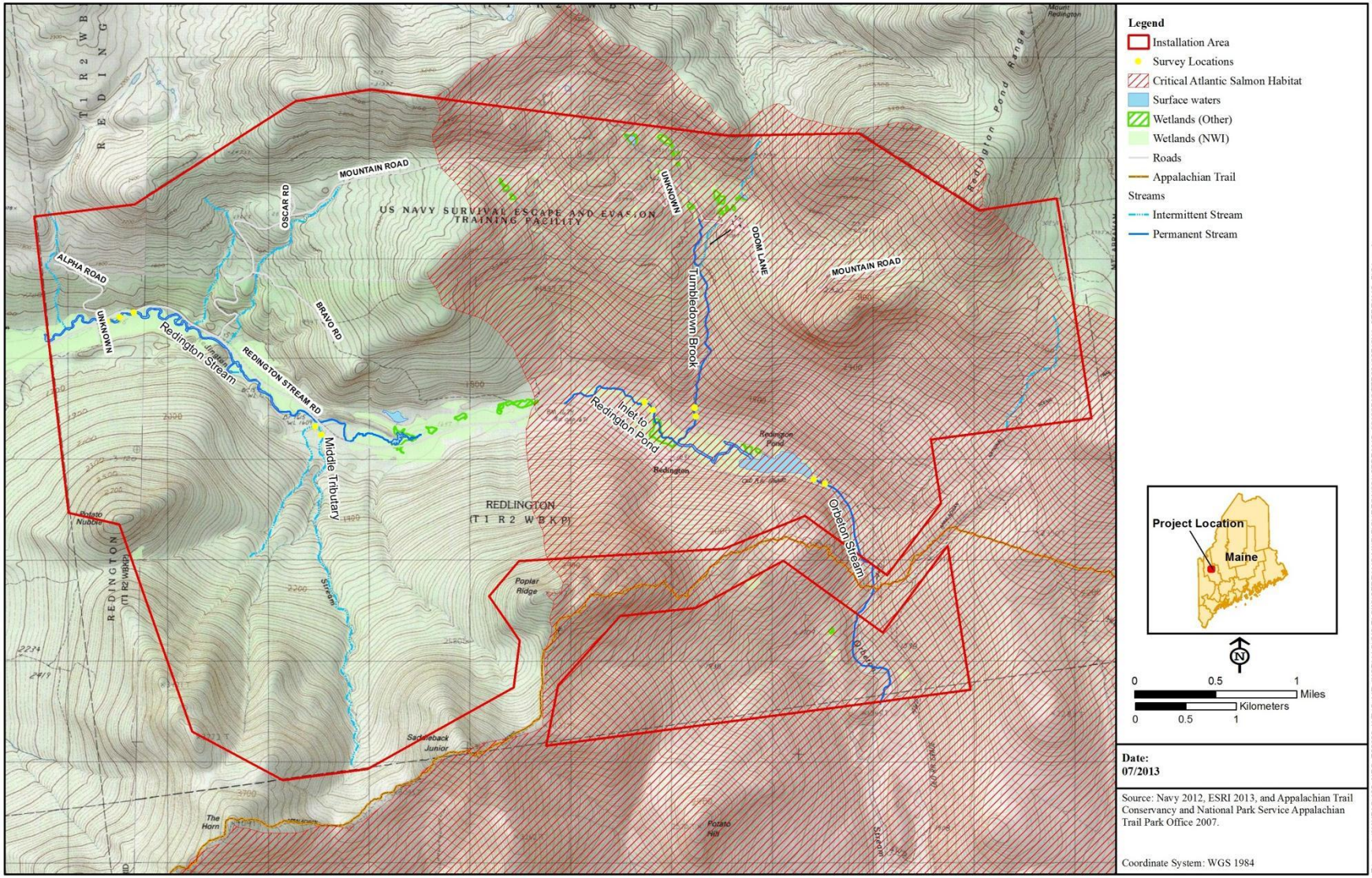

Figure 1. Site Location for SERE School in Redington Township, Franklin County, ME.

2 SURVEY METHODOLOGY

On 10–12 June 2013 Tetra Tech biologists conducted riparian and instream habitat assessments concurrent with backpack electrofishing surveys on six stream reaches using methodology modified from the U.S. Environmental Protection Agency's (EPA) *Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers* (Barbour et al. 1999). Fish sampling was also conducted in Redington Pond using rod and reel sampling methods. Tetra Tech staff and the SERE School Natural Resource Manager (NRM) determined that backpack electrofishing and seines would not be effective in sampling Redington Pond and instead used rods and reels, both from the shore and a boat, to survey the area. This method allowed the survey team to access a larger portion of Redington Pond, investigate the status of the current fishery, and evaluate future fishing programs. Copies of field data forms are included in Appendix A, a copy of the Scientific Collector's Permit is provided in Appendix B, EPA's RBP *Chapter 8 Fish Protocols* is provided in Appendix C, and a photo log is provided in Appendix D.

2.1 SITE SELECTION

To establish sampling sites for this study, Tetra Tech biologists performed a walkover of various streams and waterbodies sites during the stream bank assessment conducted on 6 June 2013. The goal of this site visit was to determine which of the possible sampling sites were most representative of installation conditions and suitable for fish surveys and habitat assessments. Based on the reconnaissance, Tetra Tech biologists determined that sections of Redington Stream, Redington Pond, Orbeton Stream, Tumbledown Brook, and two unnamed tributaries (called "Middle Tributary" and "Inlet to Redington Pond" in this report) were appropriate to sample for the purposes of this study, as shown in Figures 2 through 5.

2.2 FISH SURVEY PROTOCOLS

Tetra Tech biologists experienced in electrofishing and identification of freshwater fishes conducted fish surveys on 10–12 June 2013. The survey at Redington Pond utilized rod and reel sampling methods, while the surveys at all stream locations utilized backpack electrofishing methods in accordance with Chapter 8 of the RBP (Barbour et al. 1999) (see Appendix C). Survey methods are summarized below:

- A Scientific Collector's Permit was obtained from Maine Department of Inland Fisheries and Wildlife (Appendix B).
- Tetra Tech biologists surveyed 150 meter-long stream reaches. The downstream start point at each stream was marked with a GPS point. A tape measure was used to delineate the 150-meter reach length, which was measured by walking along the stream channel. During measurement, all meanders were followed so that a true linear distance was obtained. The upstream end of the reach was also marked with a pin flag and a GPS point. Water quality measurements (temperature, pH, specific conductance, salinity, dissolved oxygen, and percent oxygen saturation) were obtained at the start point of each stream reach.
- Tetra Tech fisheries biologists conducted the electrofishing survey, with SERE School field staff providing additional assistance with dipnetting/processing, as needed.

Figure 2. Map of Redington Stream with the downstream (START) and upstream (END) points of the surveyed Reach 1 (END-1) and Reach 2 (END -2).

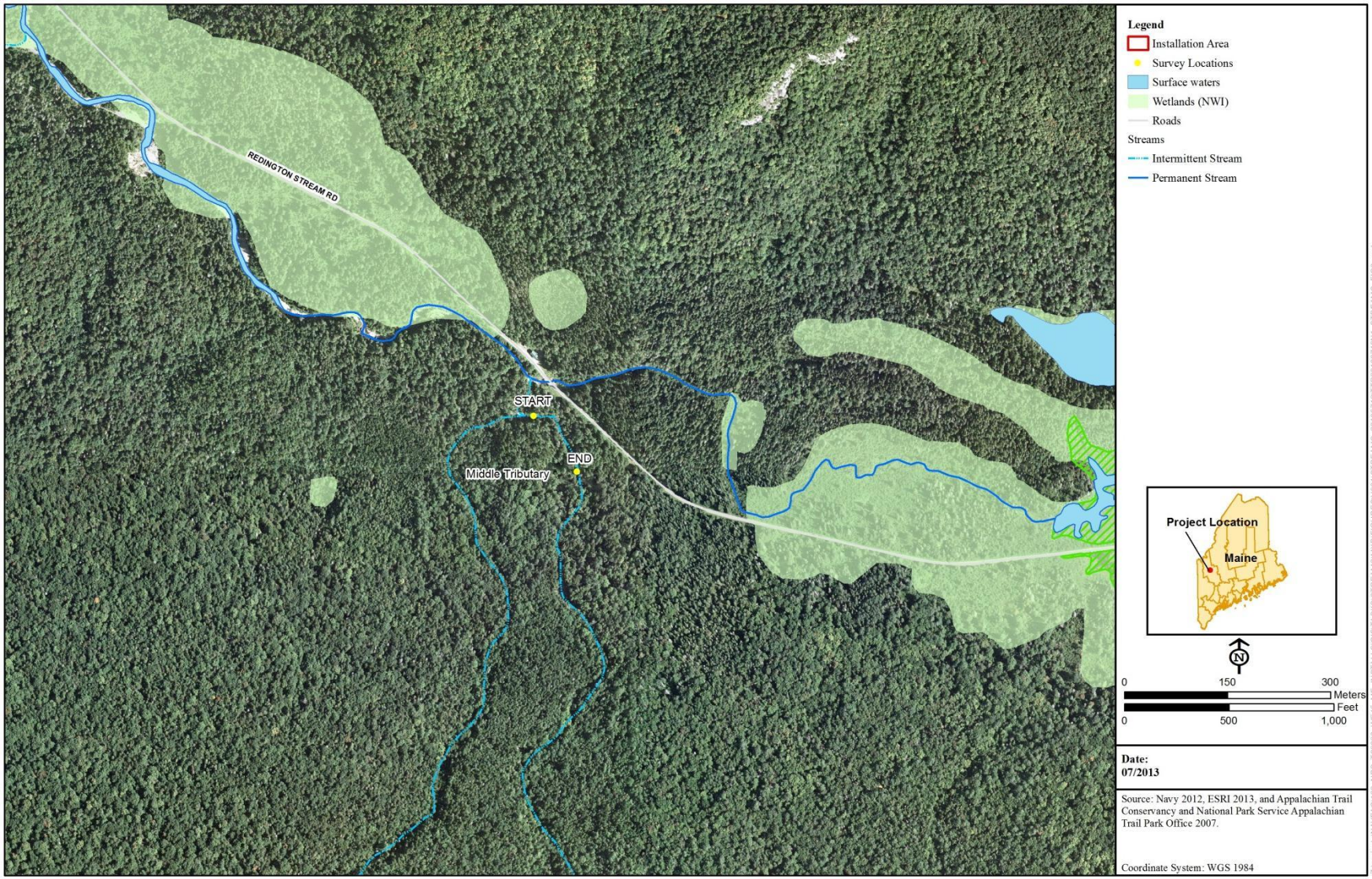

Figure 3. Map of Middle Tributary with the downstream (START) and upstream (END) points of the surveyed reach.

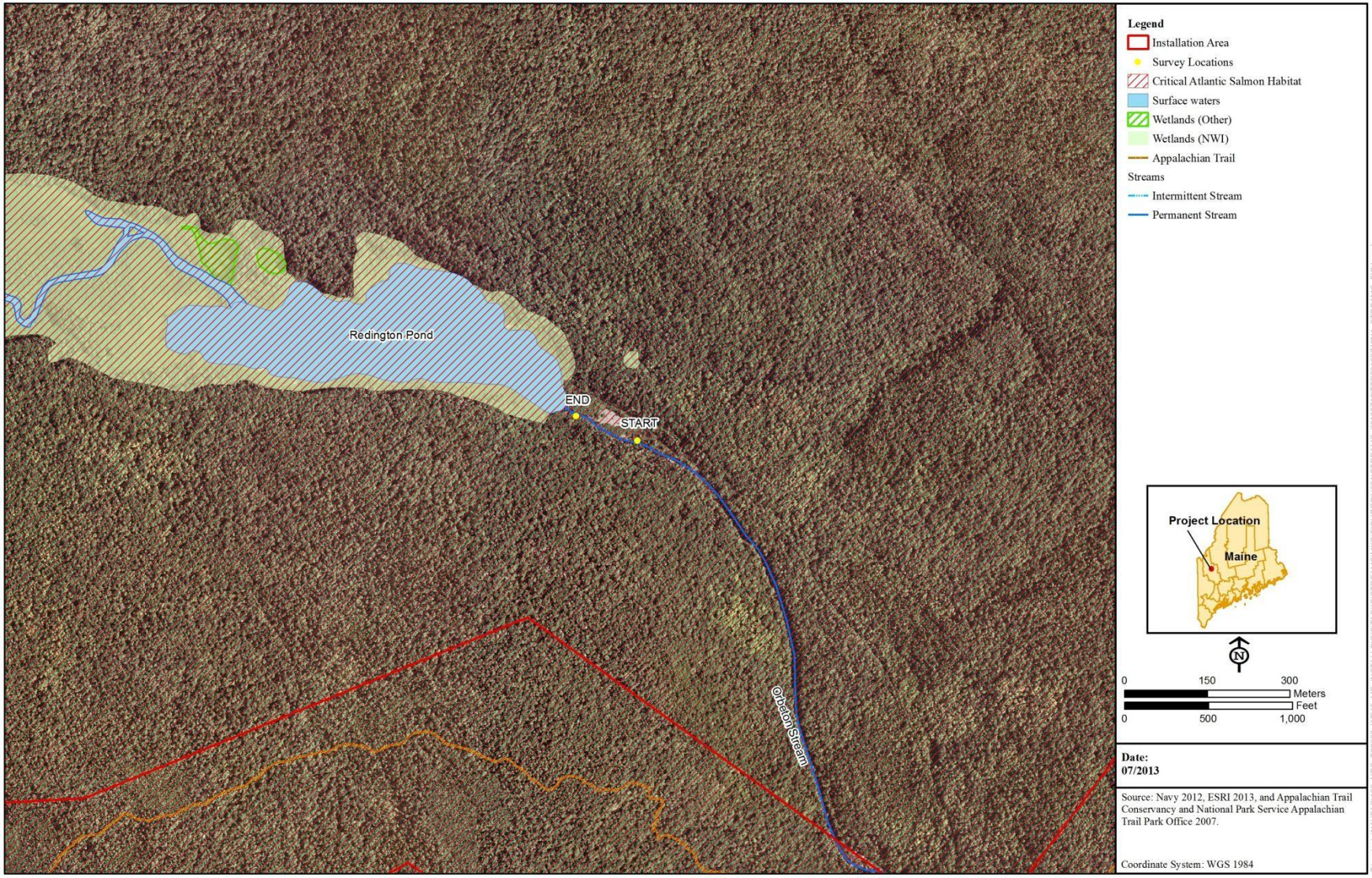

Figure 4. Map of Orbeton Stream with the downstream (START) and upstream (END) points of the surveyed reach.

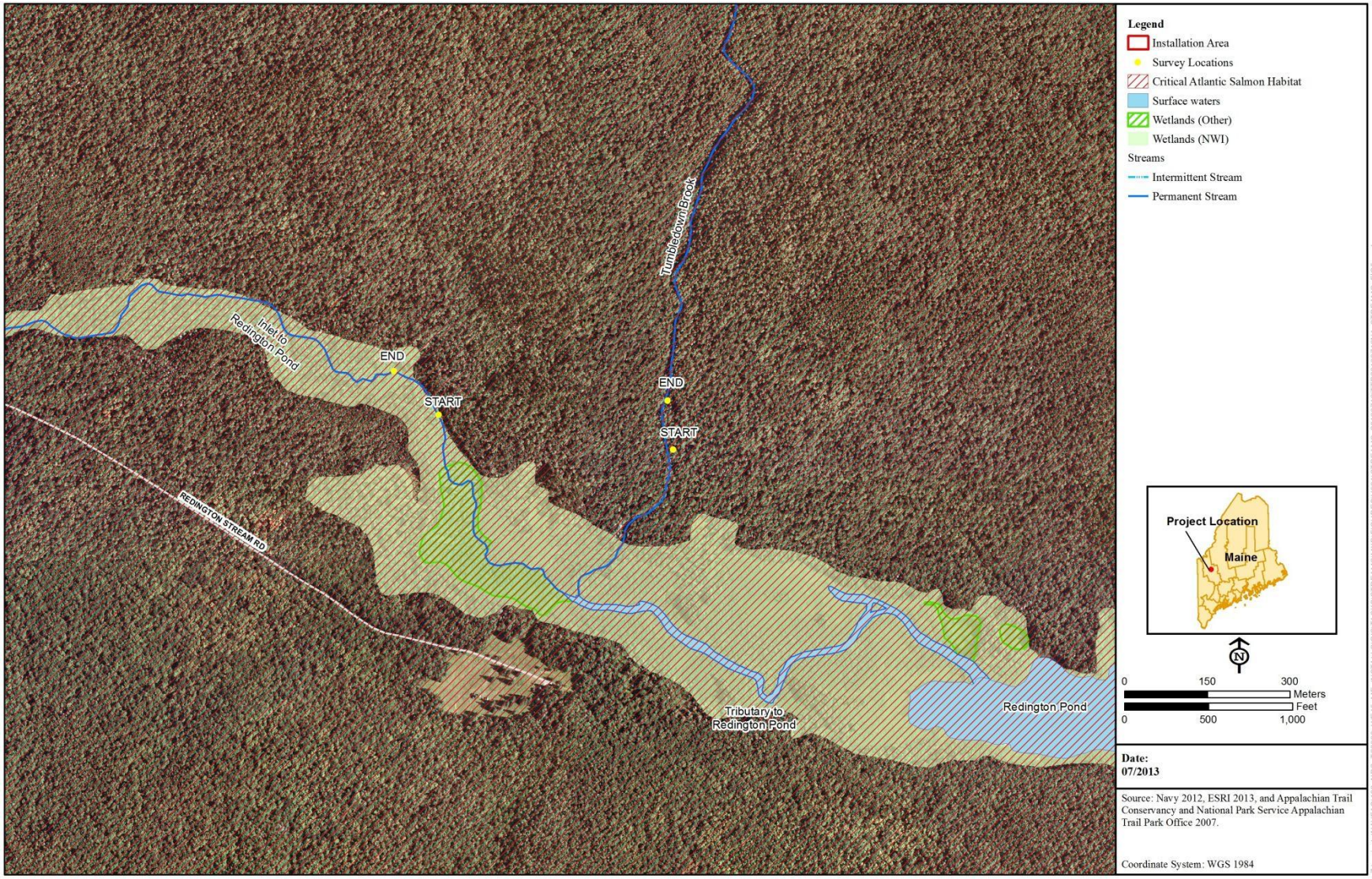

Figure 5. Map of the Inlet to Redington Pond and Tumbledown Brook with the downstream (START) and upstream (END) points of the surveyed reaches.

- Biologists wore chest waders and rubber lineman's gloves during the surveys.
- A Smith-Root LR-24 backpack electrofishing unit was used at all stream survey locations, with a fresh battery at the start of each location.
- The LR-24 was calibrated through the "auto-setup" function; then survey team members fine-tuned voltage, frequency, duty-cycle, and so forth as needed.
- One survey team member wore the electrofishing unit, held the anode, and held a dipnet (the cathode trailed behind in the water), while two more survey team members used a dipnet and held the collection bucket. All survey team members were responsible for locating and dipnetting stunned fish and placing them in the bucket for processing.
- After a safety briefing for the entire survey team, the timer was set to zero and the survey began at the start of each reach. The beginning (downstream end) of each reach was located at physical fish barriers, such as a natural riffle or log jam, as recommended by the RBP (Barbour et al. 2009).
- The fish survey continued upstream employing a bank-to-bank sweeping technique that covered all wadeable habitats within the reach.
- Collected fishes were held in a 5 gallon bucket with fresh ambient water changes, as needed.
- At the end of the reach, the fishes were processed, sorted, and identified to the species level. Processing involved recording the total number of individuals of each species. In addition, a representative subset of 30 individuals from each species were measured (total length [TL]) to the nearest millimeter (mm). Individuals smaller than 20 mm TL were not identified or included in the results.
- Fishes were also observed for any deformities, lesions, or abnormalities.
- Fishes were released back into the stream after all data were obtained.
- Rod and reel surveys were conducted in Redington Pond utilizing fly rods. Over the course of approximately 2 hours, Redington Pond was sampled by four biologists from both the eastern shoreline and a boat.

2.2.1 Electrofishing

The fish sampling methodology was modified from EPA's RBP, Chapter 8 (Appendix C). Field biologists used the fixed-distance sampling reach designation outlined in the RBP to collect a representative sample of the fish assemblage from the appropriate habitat composition. A fixed distance of 150 meters was used to obtain a representative sample of the habitats suitable to characterize the freshwater fish assemblage within the reach (further details described in U.S. EPA 2007). The 150-meter sampling reach length was employed at six locations to compare the fish populations downstream and upstream of potential migration barriers within SERE School streams.

2.3 VISUAL HABITAT ASSESSMENT PARAMETERS

A general site evaluation and assessment, including physical characterization, water quality assessment, and a visual assessment of instream and riparian habitat, was conducted for the six stream reaches surveyed for fish. Habitat assessment methods followed a modified version of the methodology set forth in Appendix A-1 (*Habitat Assessment Field Data Sheets for High and Low Gradient Streams*) of the RBP (Barbour et al. 1999). The following list is an example of parameters included in a Level I stream habitat assessment:

Physical Characterization:

- General Land Use
- Stream Origin and Type
- Riparian Vegetation Features
- Instream Parameters – Width, Depth, Flow, and Substrate

Water Quality:

- *In situ* measurements including water temperature, dissolved oxygen, pH, and conductivity collected upon arrival at each survey site.

Visual Based Observations (High Gradient Streams):

- Epifaunal Substrate/ Available Cover
- Substrate Embeddedness
- Velocity/Depth Combinations
- Sediment Deposition
- Channel Flow Status
- Channel Alteration
- Frequency of Riffles
- Bank Stability
- Bank Vegetative Protection
- Riparian Vegetative Zone Width

Visual Based Habitat Assessment (Low Gradient Streams):

- Inorganic/Organic Substrate
- Epifaunal Substrate/ Available Cover
- Sediment Deposition
- Channel Flow Status

- Channel Alteration
- Channel Sinuosity
- Bank Stability
- Bank Vegetative Protection
- Riparian Vegetative Zone Width

The following definitions for each of the habitat assessment parameters from the RBP (Barbour et al. 1999) are provided below. A "score" is assigned to each of these categories for each surveyed reach so that relative comparisons can be made with other reaches within the same stream and other streams. A reach is typically delineated by physical breaks in the habitat such as gradient, riparian vegetation, channelization, potential migration barriers (bridges, culverts, dams), or other notable features.

1. *Epifaunal Substrate/Available Cover* – Evaluates the diversity and quantity of natural structures in the stream available for inhabitants to use as refuge, feeding, and spawning sites. These features include cobble (riffles), boulders, undercut banks, and fallen trees; and a diverse mixture and of these structures increases recovery potential following disturbances. A wide range of particle sizes in riffles and runs often provide the highest quality habitat for certain fish and macroinvertebrates, and submerged woody debris are some of the most productive features for macroinvertebrates.

2. *Embeddedness* – Measures the percentage to which rocks and snags are surrounded or sunken into the stream bottom. Resulting from sediment mobilization and deposition, the usable surface for macroinvertebrates and fish decreases as embeddedness increases.

3. *Velocity Depth Regime* – Habitat diversity is directly related to the patterns of velocity and depth. Typically, streams with the highest quality habitat will have all four patterns present: slow-deep, slow-shallow, fast-deep, and fast-shallow. Streams with the most stable habitat will have an abundance of each pattern.

4. *Sediment Deposition* – Measures the sediment accumulation in pools and the resulting changes to the stream bottom. Heavy sedimentation is a characteristic of a dynamic and unstable aquatic environment that is uninhabitable for many organisms.

5. *Channel Flow Status* – Measures the extent to which a channel is filled with water. Changes in channel size will affect the channel flow status, and when water coverage decreases useable habitat becomes limited for many organisms. Channel flow status is important during abnormal or lowered flow conditions.

6. *Channel Alteration* – Evaluates large-scale changes to the stream channel shape. It is common to find straighten streams in urban and agricultural areas and to also divert streams for flood control and irrigation. Straightened streams have far less suitable habitat features for its inhabitants than natural sinuous streams. Such alteration

commonly results in streambed scouring, which often causes sedimentation downstream.

7. *Channel Sinuosity* – Evaluates the meandering or sinuosity of the stream. A high degree of sinuosity provides for diverse habitat and fauna. The absorption of energy by bends protects the stream from excessive erosion and flooding and provides refuge for benthic invertebrates and fish during storm events. Natural conditions in low-gradient streams are shifting channels and bends, and alteration is usually in the form of flow regulation, channelization, and diversion.

8. *Frequency of Riffles (or Bends)* – Riffles are a high-quality habitat for a wide variety of organisms and therefore increased abundance of riffles greatly increases the diversity of the aquatic community. Streams with higher sinuosity are better suited to handle large flow increases from storms by absorbing energy and lowering flows around bends.

9. *Bank Stability* – Measures whether the banks are eroded or have the potential to erode. Erosions characteristics include crumbling, unvegetated banks, and exposed tree roots and soil. Eroding banks allow soil and sediments to migrate into streams and change substrate composition.

10. *Vegetative Protection* – Measures the extent of vegetative protection on the stream bank and in the near-stream section of the riparian zone. Plant root systems on stream banks help to bind soil and reduce soil migration. Native plant canopies also provide shade over the streams, generally improving the habitat for fish and insects.

11. *Riparian Vegetative Zone Width* – Measures the width of the natural vegetation between the stream banks through the riparian zone. This vegetated zone provides a pollutant buffer from runoff, controls erosion, provides habitat and uptakes nutrients before they enter the stream. Narrow riparian zones often occur around residential and urban developments, golf courses, and agriculture fields.

Scores were assigned to 10 of the 11 habitat assessment parameters described above depending on whether the stream sampled was a high gradient or low gradient stream. High gradient streams were sampled for habitat assessment parameters 1–6 and 8–11; low gradient streams were sampled for habitat assessment parameters 1–7 and 9–11. By assigning a score to the 10 habitat parameters described above, a stream can be assessed and assigned a total score that reflects its condition. Scores ranging from 0 to 20 are assigned to each of the ten habitat parameters, with 0 being a "poor" score and 20 being an "optimal" score. After scoring all parameters, a final score can be determined. The final stream score can range from 0 to 200, with a score of 0 to 59 representing a "poor" condition, 60 to 112 representing a "marginal" condition, 113 to 165 representing a "suboptimal" condition, and 166 to 200 representing an "optimal" condition. This rapid "qualitative" approach was performed concurrent to the fish surveys and applied to five of the six stream reaches (although two reaches of Redington Stream were surveyed for fish, only Reach 1 was evaluated for habitat due to the similarity of the reaches).

3 RESULTS

3.1 FISH SURVEY DATA

A total of 252 fishes, representing five species, were collected from all survey locations. All individuals were positively identified to species in the field. No deformities, lesions, or abnormalities were observed in any of the specimens collected. Survey teams sampled 150 meter long reaches at each survey location. Fish sampling and processing at Redington Stream took approximately 46 minutes (Reach 1) and 35 minutes (Reach 2) of actual "trigger" time (i.e., the time that the electrofishing unit was on and producing electrical current). The Middle Tributary was significantly narrower than Redington Stream and sampling and processing took approximately 29 minutes, whereas the Inlet to Redington Pond required approximately 33 minutes to complete. Survey teams spent the most time at Orbeton Stream, which required approximately 64 minutes of "trigger" time because the walking conditions were unstable and retrieving stunned fish was more difficult amongst the numerous boulders and cobble present. Tumbledown Brook, which was a series of cascades and pools, took the least amount of time to sample with only 16 minutes of "trigger" time.

Fish samples collected at Redington Stream Reach 1, Reach 2, and the Middle Tributary were dominated by slimy sculpin (*Cottus cognatus*), which represented more than 80 percent (%) of the species composition at each site. Brook trout (*Salvelinus fontinalis*) were the only species collected at the other three sites (Orbeton Stream, Tumbledown Brook, and the Inlet to Redington Pond). Interestingly, Tumble Down Brook supported a strong fish population consisting exclusively of brook trout. This stream, comprised mostly of cascades and pools, was the highest gradient stream sampled and there was little to no competition from other species.

The overall length distributions for most species were comparable among sites. The widest range of size/age classes were collected from Orbeton Stream (minimum fish length of 37 mm) and the Inlet to Redington Pond (minimum fish length of 28 mm).

Four survey team members surveyed Redington Pond using a rods and reels method for approximately 2 hours and did not capture any fish. This was most likely due to the unfavorable rain conditions at the time of sampling.

3.1.1 Redington Stream Reach 1 and 2

Redington Stream is a low gradient stream, and contains abundant natural meanders and remains unchannelized. The stream segment that was surveyed parallels Redington Stream Road (Figure 2). Surveying (Reach 1) began just upstream of the bridge on Redington Stream Road that spans the stream, and surveys concluded 300 meters upstream of the start point. This was the widest stream surveyed (3–6 meters wide) and was a mix of glides, riffles, and pools. For the most part, the banks were stable with little to no erosion, with the exception of two small portions that were close to Redington Stream Road (see Photo 3 in Appendix D). Fish survey results are displayed below in Table 1 and 2.

Table 1. Results of Stream Electrofishing Surveys Conducted in Redington Stream Reach 1, June 2013 – SERE School, Redington Township, ME.

Common Name	Scientific Name	Minimum Length (mm)	Maximum Length (mm)	Average Length (mm)	Number of Individuals	% Comp.[1]
Brook trout	Salvelinus fontinalis	86	–	–	1	1.3
Blacknose dace	*Rhinichthys atratulus*	61	62	61.5	2	2.6
Creek chub	*Semotilus atromaculatus*	64	75	69.5	2	2.6
Slimy sculpin	*Cottus cognatus*	32	93	58.5	70*	89.7
White sucker	*Catostomus commersoni*	47	162	93.7	3	3.8
				Total	78	100%

* Average length was calculated from a subsample of 30 individuals.

[1] Percent composition

Table 2. Results of Stream Electrofishing Surveys Conducted in Redington Stream Reach 2, June 2013 – SERE School, Redington Township, ME.

Common Name	Scientific Name	Minimum Length (mm)	Maximum Length (mm)	Average Length (mm)	Number of Individuals	% Comp.[1]
Brook trout	*Salvelinus fontinalis*	115	–	–	1	1.4
Slimy sculpin	*Cottus cognatus*	34	98	56.9	61*	83.6
White sucker	*Catostomus commersoni*	122	195	150.5	11	15.0
				Total	73	100%

* Average length was calculated from a subsample of 30 individuals.

[1] Percent composition

3.1.2 Middle Tributary

The Middle Tributary is a narrow (2 to 3 meters wide), high gradient tributary that feeds into Redington Stream, adjacent to Charlie Camp (Figure 3). Surveying began at the confluence of the streams and ended 150 meters upstream. This section of stream contained high water flows and was mostly straight with the exception of a few small bends. Numerous trees had fallen across the stream as seen in Photo 13 of Appendix D. The substrate was a mix of boulders and cobble, while the banks were stable. There was no evidence of non-point source pollution from erosion. Fish survey results are displayed below in Table 3.

Table 3. Results of Stream Electrofishing Surveys Conducted in the Middle Tributary, June 2013 – SERE School, Redington Township, ME.

Common Name	Scientific Name	Minimum Length (mm)	Maximum Length (mm)	Average Length (mm)	Number of Individuals	% Comp.[1]
Brook trout	*Salvelinus fontinalis*	85	128	104.3	3	17.6
Slimy sculpin	*Cottus cognatus*	30	80	63.7	14	82.4
				Total	17	100%

[1] Percent composition

3.1.3 Orbeton Stream

Orbeton Stream is a narrow, high gradient stream located within designated Critical Atlantic Salmon Habitat (Figure 4). Orbeton Stream is fed by Redington Pond and flows are limited by a small, unmaintained wooden dam. At the time of the survey, water velocity was high due to recent rain events. The fish surveys began 150 meters downstream from the outlet dam in Redington Pond and concluded at the dam. The surrounding landscape is forested and was historically used for logging before becoming Navy property. The banks are stable with abundant fish cover in the form of undercut banks, woody debris, and rock features. No submerged aquatic vegetation was present at the time of the survey. Fish survey results are presented below in Table 4.

Table 4. Results of Stream Electrofishing Surveys Conducted in Orbeton Stream, June 2013 – SERE School, Redington Township, ME.

Common Name	Scientific Name	Minimum Length (mm)	Maximum Length (mm)	Average Length (mm)	Number of Individuals	% Comp. [1]
Brook trout	*Salvelinus fontinalis*	**37**	**176**	**94.6**	**49***	**100**
				Total	**49**	**100%**

* Average length was calculated from a subsample of 30 individuals.

[1] Percent composition

3.1.4 Tumbledown Brook

Tumbledown Brook is an isolated high gradient stream that falls within the designated Critical Atlantic Salmon Habitat. It is very narrow (1 to 3 meters wide) and consists of cascades and pools of cool, clear water (Figure 5). The surrounding landscape is a forested alpine community with abundant cedar trees that create a thick canopy over the stream. Survey teams began the survey in a pool, which acted as a natural fish barrier, and continued approximately 150 meters upstream to the base of a large waterfall. Fish survey results are presented below in Table 5.

Table 5. Results of Stream Electrofishing Surveys Conducted in Tumbledown Brook, June 2013 – SERE School, Redington Township, ME.

Common Name	Scientific Name	Minimum Length (mm)	Maximum Length (mm)	Average Length (mm)	Number of Individuals	% Comp. [1]
Brook trout	*Salvelinus fontinalis*	**62**	**160**	**96.2**	**14**	**100**
				Total	**14**	**100%**

[1] Percent composition

3.1.5 Inlet to Redington Pond

The Inlet to Redington Pond is a high gradient stream, which falls within designated Critical Atlantic Salmon Habitat (Figure 5). The survey began approximately 50 meters downstream from where a training footpath crosses the stream and ended 150 meters upstream. The stream consisted of a series of riffles, glides, and pools. The banks were stable and unchannelized, and there was abundant woody debris on the upper half of the survey reach. The woody debris had

numerous chew markings suggesting that beaver activity was occurring in the area. The sediment was a mix of gravel, cobble, and boulders. Fish survey results are presented below in Table 6.

Table 6. Results of Stream Electrofishing Surveys Conducted in the Inlet to Redington Pond, June 2013 – SERE School, Redington Township, ME.

Common Name	Scientific Name	Minimum Length (mm)	Maximum Length (mm)	Average Length (mm)	Number of Individuals	% Comp. [1]
Brook trout	*Salvelinus fontinalis*	**28**	**115**	**65.1**	**21**	**100**
				Total	**21**	**100%**

[1] Percent composition

3.2 WATER QUALITY RESULTS

Water quality data were collected at each survey location. Overall, each survey site exhibited excellent water quality characteristics with cool temperatures, low turbidity, high dissolved oxygen content, and low conductivity. Water quality results are provided in Table 7.

Table 7. Water Quality Results in June 2013, for the SERE School Baseline Fish Survey and Habitat Assessment – Redington Township, ME.

Reach Name	Time	Dissolved Oxygen (mg/L)	Temp. (°C)	pH	Specific Conductance (µS/cm)
Redington Stream, Reach 1	13:20	12.27	13.30	6.93	21.0
Redington Stream, Reach 2	14:15	10.37	13.00	6.90	17.0
Middle Tributary	17:15	11.39	11.00	7.09	12.0
Orbeton Stream	09:30	10.15	13.70	6.78	17.0
Tumbledown Brook	13:15	10.95	10.82	7.25	13.0
Inlet to Redington Pond	14:30	10.93	9.73	7.22	10.0
Redington Pond	09:15	10.57	10.40	7.35	15.0

3.3 HABITAT SCORE RESULTS

In general, most of the stream reaches exhibited similar habitat compositions and contained a mix of riffles, pools, and glides. Tumbledown Brook, which was the highest gradient stream sampled, was a mix of cascades and pools. The total score for each reach indicates the condition of the habitat present within the reach. Redington Stream and Orbeton Stream were determined to be of suboptimal condition (i.e., total score ranging from 113 to 165). The remaining streams (Middle Tributary, Tumbledown Brook, and Inlet to Redington Pond) had slightly higher quality habitat and were determined to be in optimal condition.

Table 8. Habitat Assessment Parameter Results for the SERE School Habitat Assessment – Redington Township, ME.

Reach Name		Habitat Assessment Parameters										
	Epifaunal Substrate/ Available Cover	Embeddedness	Velocity/Depth Regime	Sediment Deposition	Channel Flow Status	Channel Alteration	Channel Sinuosity	Frequency of Riffles	Bank Stability	Vegetative Protection	Riparian Vegetative Zone Width	Total
	20	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**200**
Redington Stream	10	18	8	11	13	20	13	NA	19	16	18	**146**
Middle Tributary	19	20	15	20	19	20	NA	20	20	20	18	**191**
Orbeton Stream	13	19	15	18	16	15	NA	18	18	15	16	**163**
Tumbledown Brook	14	19	15	19	19	20	NA	17	20	20	20	**183**
Inlet to Redington Pond	16	16	13	16	17	20	NA	18	18	20	20	**174**

Note: NA = Not Applicable

4 CONCLUSIONS

Based on habitat, geographic location, and water quality characteristics, the aquatic resource habitat and water quality of the streams at the SERE School are considered suboptimal to optimal. The June 2013 electrofishing surveys yielded results that were consistent with this classification. Specifically, all streams were dominated by species requiring high water quality such as brook trout and slimy sculpin. Generally, electrofishing survey results were comparable among all of the stream survey sites; notable observations and exceptions are summarized below:

- species composition was similar.
- length distributions for most species were similar, with the exception of Orbeton Stream and Inlet to Redington Pond (the average length of brook trout was lower here, displaying a wider age class of this species).
- species richness was considerably low, with half the streams dominated by only two species: slimy sculpin and brook trout.
- the highest numbers of fish were caught in the two Redington Stream reaches.

Although the habitat characteristics are very similar at most streams on the SERE School property, habitat assessments revealed a few dissimilarities at Redington Stream that account for observed differences in species diversity between sampling sites. Redington Stream had the lowest habitat score (146), which may explain the presence of more tolerant species (creek chub [*Semotilus atromaculatus*], white sucker [*Catostomus commersoni*], and blacknose dace [*Rhinichthys atratulus*]). Specifically, Redington Stream's lower scores in availability of instream cover, sediment deposition, and frequency of riffles may account for the higher fish diversity. Another habitat parameter that may have contributed to the observed abundances of other fish species in Redington Stream is the filamentous algae observed covering more of the stream's substrates (Photo 4 in Appendix D), compared to only small amounts reported in the other four streams. Aquatic vegetation can be a food source for white suckers; thus the relative lack of aquatic vegetation in other streams may help to explain the absence of white sucker.

5 LITERATURE CITED

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NMFS NOAA (National Marine Fisheries Service, National Oceanic and Atmospheric Administration). 2009. Endangered and Threatened Species; Designation of Critical Habitat for Atlantic Salmon (*Salmo salar*) Gulf of Maine Distinct Population Segment. Federal Register. Vol. 74. No. 117, Friday, June 19, 2009, Rules and Regulations. Department of Commerce, NOAA. 50 CFR Part 226. Docket No. 0808061060-9170-02. RIN 0648-AW77. Final rule.

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APPENDIX A

Field Data Sheets

FISH SAMPLING FIELD DATA SHEET (FRONT)

@ Charlie Camp page ____ of ____

STREAM NAME Middle Trib	LOCATION SERE School
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
GEAR	INVESTIGATORS
FORM COMPLETED BY Deena Anderson/Brian Dresser	DATE 06/10/13 TIME _____ AM PM / REASON FOR SURVEY

SAMPLE COLLECTION	**How were the fish captured?** ☑ back pack ☐ tote barge ☐ other _____ **Block nets used?** ☐ YES ☑ NO **Sampling Duration** Start time _____ End time _____ Duration 1753 **Stream width (in meters)** Max _____ Mean _____
HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Riffles ____% ☐ Pools ____% ☐ Runs ____% ☐ Snags ____% ☐ Submerged Macrophytes ____% ☐ Other ( ) ____%
GENERAL COMMENTS	

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE) TL (total length)					ANOMALIES* D	E	F	L	M	S	T	Z
Brook Trout	3	128	100	85	0									
Slimy Sculpin, Mottled	14	30	48	72	72	60								
		60	65	70	70	65								
		80	69	64	67									

FISH SAMPLING FIELD DATA SHEET (BACK)

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

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

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME ORBITON - 1	LOCATION SERE SCHOOL	
STATION # _____ RIVERMILE _____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS DRESSER, GAUDET, ANDERSON		
FORM COMPLETED BY DRESSER	DATE 6/11 TIME 0930 AM PM	REASON FOR SURVEY

WEATHER CONDITIONS

Now		Past 24 hours
☐	storm (heavy rain)	☐
☒	rain (steady rain)	☐
☐	showers (intermittent)	☒
100 %	%cloud cover	☐ 50 %
☐	clear/sunny	☐

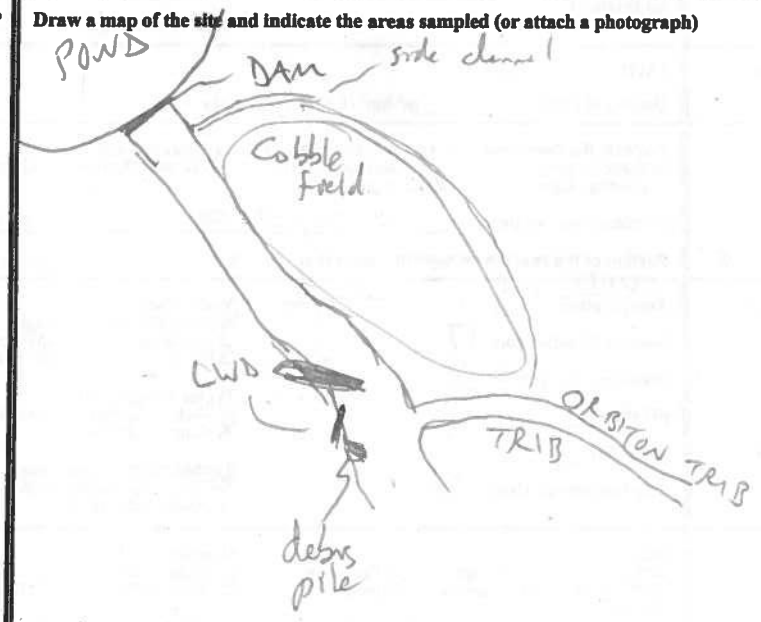
Has there been a heavy rain in the last 7 days? ☒ Yes ☐ No

Air Temperature ____ °C 58 °F

Other _____

SITE LOCATION/MAP

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



STREAM CHARACTERIZATION

Stream Subsystem
☒ Perennial ☐ Intermittent ☐ Tidal

Stream Type
☒ Coldwater ☐ Warmwater

Stream Origin
☐ Glacial
☐ Non-glacial montane
☒ Swamp and bog
☐ Spring-fed
☐ Mixture of origins
☐ Other _____
Impoundment

Catchment Area _____ km²

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

Predominant Surrounding Landuse
☒ Forest ☐ Commercial
☐ Field/Pasture ☐ Industrial
☐ Agricultural ☒ Other H
☐ Residential

Local Watershed NPS Pollution
☒ No evidence ☐ Some potential sources
☐ Obvious sources

Local Watershed Erosion
☐ None ☐ Moderate ☐ Heavy

W. Birch
Y Birch
M. Maple
S. Maple
R Maple
Spruce sp
Viburnum

RIPARIAN VEGETATION (18 meter buffer)

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

dominant species present _____

INSTREAM FEATURES

Estimated Reach Length 150 m
Estimated Stream Width _____ m
Sampling Reach Area _____ m²
Area in km² (m²x1000) _____ km²
Estimated Stream Depth _____ m
Surface Velocity (at thalweg) _____ m/sec

Canopy Cover
☐ Partly open ☐ Partly shaded ☐ Shaded

High Water Mark _____ m

Proportion of Reach Represented by Stream Morphology Types
☐ Riffle _____ % ☐ Run _____ %
☐ Pool _____ %

Channelized ☐ Yes ☐ No
Dam Present ☒ Yes ☐ No @ Upper end of Pond

LARGE WOODY DEBRIS

LWD _____ m²
Density of LWD _____ m²/km² (LWD/ reach area) 1

AQUATIC VEGETATION

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

dominant species present ~~[illegible]~~ covering 3 strands Filamentous green Algae

Portion of the reach with aquatic vegetation _____ %

WATER QUALITY

97.8% SAT
100.8%

Upper 13.7 °C Lower 5.8
Specific Conductance 17
Dissolved Oxygen 1
pH 6.78
Turbidity CL
WQ Instrument Used 6

Water Odors
☒ Normal/None ☐ Sewage
☐ Petroleum ☐ Chemical
☐ Fishy ☐ Other _____

Water Surface Oils
☐ Slick ☐ Sheen ☐ Globs ☐ Flecks
☒ None ☐ Other _____

Turbidity (if not measured)
☒ Clear ☐ Slightly turbid ☐ Turbid
☐ Opaque ☐ Stained ☐ Other _____

SEDIMENT/ SUBSTRATE

Odors
☐ Normal ☐ Sewage ☐ Petroleum
☐ Chemical ☐ Anaerobic ☒ None
☐ Other _____

Oils
☒ Absent ☐ Slight ☐ Moderate ☐ Profuse

Deposits
☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand
☐ Relict shells ☐ Other _____

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

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock		0%	Detritus	sticks, wood, coarse plant materials (CPOM)	<1%
Boulder	> 256 mm (10")	30%			
Cobble	64-256 mm (2.5"-10")	70%	Muck-Mud	black, very fine organic (FPOM)	0%
Gravel	2-64 mm (0.1"-2.5")	5%			
Sand	0.06-2mm (gritty)	<1%	Marl	grey, shell fragments	0%
Silt	0.004-0.06 mm	0%			
Clay	< 0.004 mm (slick)	0%			

FISH SAMPLING FIELD DATA SHEET (FRONT)

page ____ of ____

STREAM NAME ORBITON	LOCATION SERE School	
STATION # _____ RIVERMILE _____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
GEAR	INVESTIGATORS	
FORM COMPLETED BY Andersan / Dresser	DATE 06/11/13 TIME 10:00 AM PM	REASON FOR SURVEY

SAMPLE COLLECTION	**How were the fish captured?** ☑ back pack ☐ tote barge ☐ other _____ **Block nets used?** ☐ YES ☑ NO **Sampling Duration** Start time _____ End time _____ Duration 3812 **Stream width (in meters)** Max _____ Mean _____
HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Riffles ____% ☐ Pools ____% ☐ Runs ____% ☐ Snags ____% ☐ Submerged Macrophytes ____% ☐ Other ( ) ____%
GENERAL COMMENTS	

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES*							
							D	E	F	L	M	S	T	Z
Brook Trout	49	112	49		465	92								
		93	108		176	95								
		61	102	97	102									
		98	9.	4	92	43								
		50	125	98	47	82								
Brook Trout (cont'd)		43	105		122	1								

FISH SAMPLING FIELD DATA SHEET (BACK)

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

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

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GADIENT STREAMS (FRONT)

STREAM NAME ORBITON 1	LOCATION	
STATION # _____ RIVERMILE _____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		
FORM COMPLETED BY	DATE 6/11 TIME 0930 AM PM	EASON FOR SURVEY

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Categor			
	Optimal	Suboptimal	Iarginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40%ix of stable habitat;abitat availabily less than desirablsubstrate frequentl disturbed or removed	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, coble, and boulder paicles are 50-75% surrouded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of th 4 habitat regimes preent (if fast-shallow or ow-shallow are missing,core low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate depsition of new gravel, and or fine sediment on old and new bars; 30-50%of the bottom affectd; sediment deposits at obtructions, constrictions, nd bends; moderate depsition of pools prevalet.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 (18) 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 2575% of the available chanel, and/or riffle substrats are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 (16)	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIED DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream w normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffs relatively frequentratio of distance betwe riffles divided by width the stream <7:1 (genally 5 to 7); variety of bitat is key. In streams vere riffles are continuus, placement of boulers or other large, natui obstruction is imortant.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evience of erosion or bank ilure absent or minim; little potential for futre problems. <5% f bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% f the streambank surfces and immediate riparin zone covered by nativ vegetation, incling trees, understorjshrubs, or nonwoody macrophytes; vgetative disruption through grazing or mowng minimal or not vident; almost all plantallowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) ave not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score _____

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME ORBITON TRIB	LOCATION SERR SCHOOL	
STATION # _____ RIVERMILE _____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		
FORM COMPLETED BY	DATE 6/11 TIME 1020 AM PM	REASON FOR SURVEY

WEATHER CONDITIONS

Now		Past 24 hours
☐	storm (heavy rain)	☐
☒	rain (steady rain)	☐
☐	showers (intermittent)	☒
100 % ☐	%cloud cover	☐ 50 %
☐	clear/sunny	☐

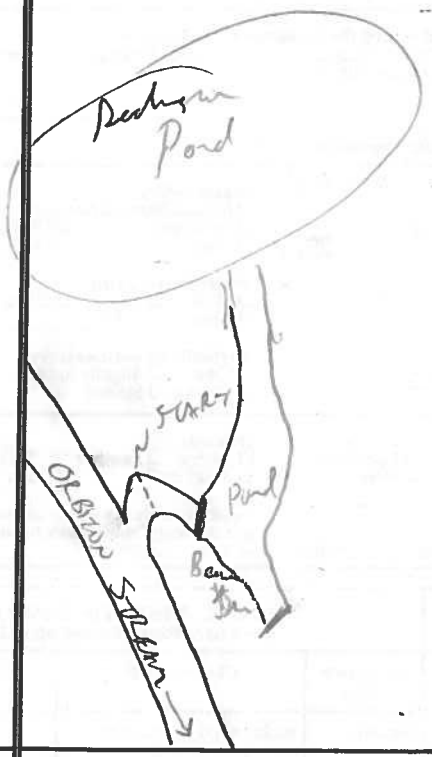
Has there been a heavy rain in the last 7 days? ☒ Yes ☐ No

Air Temperature ____ °C 55°

Other _____

SITE LOCATION/MAP

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



DID NOT SURVEY (Site closed / Beaver Pond)

STREAM CHARACTERIZATION

Stream Subsystem
☒ Perennial ☐ Intermittent ☐ Tidal

Stream Type
☒ Coldwater ☐ Warmwater

Stream Origin
☐ Glacial
☐ Non-glacial montane
☐ Swamp and bog
☐ Spring-fed
☐ Mixture of origins
☐ Other _____

Catchment Area _____ km²

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

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

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

Local Watershed Erosion
☐ None ☐ Moderate ☐ Heavy

RIPARIAN VEGETATION (18 meter buffer)

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

dominant species present _____

INSTREAM FEATURES

Estimated Reach Length _____m

Estimated Stream Width _____m

Sampling Reach Area _____m^2

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

Estimated Stream Depth _____m

Surface Velocity (at thalweg) _____m/sec

Canopy Cover
☐ Partly open ☐ Partly shaded ☐ Shaded

High Water Mark _____m

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

Channelized ☐ Yes ☐ No

Dam Present ☐ Yes ☐ No

LARGE WOODY DEBRIS

LWD _____m^2

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

AQUATIC VEGETATION

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

dominant species present _____

Portion of the reach with aquatic vegetation _____%

WATER QUALITY

98.7%

UPPER

Temperature_____° C 13.9

Specific Conductance_____ 17

Dissolved Oxygen _____ 10.21

pH _____ .3

Turbidity CLEAR

WQ Instrument Used YSI 6

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

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

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

SEDIMENT/ SUBSTRATE

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

Oils
☐ Absent ☐ Slight ☐ Moderate ☐ Profuse

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

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

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

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME REDINGTON STR.	LOCATION SERE SCHOOL	
STATION # _____ RIVERMILE _____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS GAUDET, ANDERSON, DRESSER		
FORM COMPLETED BY DRESSER	DATE 1320 TIME _____ AM PM	REASON FOR SURVEY

WEATHER CONDITIONS

CALM, CLEAR

Now		Past 24 hours
☐	storm (heavy rain)	☐
☐	rain (steady rain)	☐
☐	showers (intermittent)	☐
___% ☐	%cloud cover	☐ ___%
☒	clear/sunny	☒

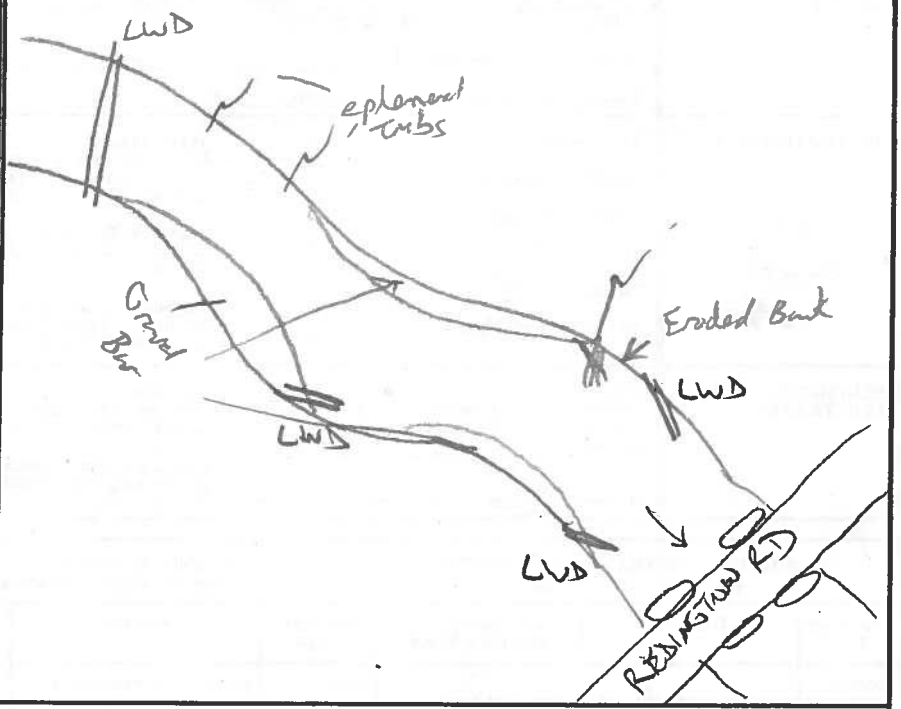
Has there been a heavy rain in the last 7 days? ☒ Yes ☐ No

Air Temperature ____ °C 70°F

Other _____

SITE LOCATION/MAP

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



STREAM CHARACTERIZATION

Stream Subsystem
☒ Perennial ☐ Intermittent ☐ Tidal

Stream Type
☒ Coldwater ☐ Warmwater

Stream Origin
☐ Glacial
☐ Non-glacial montane
☐ Swamp and bog
☐ Spring-fed
☐ Mixture of origins
☐ Other _____

Catchment Area _____ km²

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

Predominant Surrounding Landuse
☒ Forest ☐ Commercial ☐ Industrial ☐ Field/Pasture ☐ Agricultural ☐ Residential ☒ Other ROAD/GRAVEL IN RIPARIAN AREA

Local Watershed NPS Pollution
☒ No evidence ☐ Some potential sources ☐ Obvious sources

Local Watershed Erosion MINIMAL Bank
☒ None ☐ Moderate ☐ Heavy

RIPARIAN VEGETATION (18 meter buffer)

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

dominant species present _____

INSTREAM FEATURES

* Reach-1 = 150m
Reach-2 =

Estimated Reach Length _____ m
Estimated Stream Width 5-8 m
Sampling Reach Area 0 _____ m²
Area in km² (m²x1000) _____ km²
Estimated Stream Depth 0.3-0.8 m
Surface Velocity ~ 0.4 m/sec (at thalweg)

Canopy Cover mostly open
☒ Partly open ☐ Partly shaded ☐ Shaded
High Water Mark 0.8 m
Proportion of Reach Represented by Stream Morphology Types
☒ Riffle 40 % ☐ Run 50 % ☒ Pool 10 %
Channelized ☐ Yes ☒ No
Dam Present ☐ Yes ☒ No

LARGE WOODY DEBRIS

LWD 10 m² 6 pieces
Density of LWD _____ m²/km² (LWD/ reach area)

AQUATIC VEGETATION

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

dominant species present filamentous; scattered on cobbles

Portion of the reach with aquatic vegetation 5 %

WATER QUALITY DOWN

Temperature 13.3 °C
Specific Conductance 21 µS
Dissolved Oxygen 12.27
pH 6.93
Turbidity CLEAR
WQ Instrument Used YSI 556

100%+ DO SAT

UP
13.5
21
10.54
6.99
CLEAR

Water Odors
☒ Normal/None ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Fishy ☐ Other _____

Water Surface Oils NONE
☐ Slick ☐ Sheen ☐ Globs ☐ Flecks ☐ None ☐ Other _____

Turbidity (if not measured)
☒ Clear ☐ Slightly turbid ☐ Turbid ☐ Opaque ☐ Stained ☐ Other _____

SEDIMENT/ SUBSTRATE

Odors
☐ Normal ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Anaerobic ☒ None ☐ Other _____

Oils
☒ Absent ☐ Slight ☐ Moderate ☐ Profuse

Deposits
☐ Sludge ☐ Sawdust ☐ Paper fiber ☒ Sand ☐ Relict shells ☐ Other _____

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

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock		0%	Detritus	sticks, wood, coarse plant materials (CPOM)	5% Debris Dams Only
Boulder	> 256 mm (10")	5			
Cobble	64-256 mm (2.5"-10")	20	Muck-Mud	black, very fine organic (FPOM)	0%
Gravel	2-64 mm (0.1"-2.5")	40			
Sand	0.06-2mm (gritty)	25	Marl	grey, shell fragments	0%
Silt	0.004-0.06 mm	0			
Clay	< 0.004 mm (slick)	0			

gravel / cobble / sand
50 20 30

- few small side debris dams
- LWD = ++++ ++++

60/40
Riff/Glide
side pool = ++++

No overst

Alder
* Spruce
* Y. Birch
Viburnum
R. Maple

* Downed Riparian Canopy

End of reach 2 Water Qual

Temp 13.0°C
Sp.Cond. 17 µ
DO 10.37 (98.3
pH 6.90
CLEAR

Point Bars

30 ✓
60 ✓
90 ✓
120 ✓
150 ✓

30 ✓
60 ✓
90 ✓
120 ✓
150 ✓

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

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score _____

ONLY @ CONFLUENCE

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

STREAM NAME MIDDLE CR13	LOCATION	
STATION # _____ RIVERMILE _____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		
FORM COMPLETED BY DRESSER	DATE 6/10 TIME 1715 AM PM	REASON FOR SURVEY

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	(20) 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	(20) 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

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

Local Watershed NPS Pollution
☒ No evidence ☐ Some potential sources
☐ Obvious sources

Local Watershed Erosion
☐ None ☐ Moderate ☐ Heavy

RIPARIAN VEGETATION (18 meter buffer)

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

dominant species present _____

INSTREAM FEATURES

Estimated Reach Length _____ m
Estimated Stream Width 3-4 m
Sampling Reach Area _____ m²
Area in km² (m²x1000) _____ km²
Estimated Stream Depth 0.3-0. m
Surface Velocity 0.8 m/sec (at thalweg)

Canopy Cover
☐ Partly open ☐ Partly shaded ☒ Shaded

High Water Mark 1.0 m

Proportion of Reach Represented by Stream Morphology Types
☒ Riffle 99 % ☐ Run 0 %
☒ Pool 1 %

Channelized ☐ Yes ☒ No

Dam Present ☐ Yes ☒ No

30 ✓
30 ✓
90 ✓
20 ✓
50 ✓

LARGE WOODY DEBRIS

LWD 50 m²
Density of LWD _____ m²/km² (LWD/ reach area) ++++ ++++ |

AQUATIC VEGETATION

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

dominant species present NONE

Portion of the reach with aquatic vegetation 0 %

WATER QUALITY

100% +

Temperature 11.0 °C 1.0
Specific Conductance 12 12
Dissolved Oxygen 11.39 11.21
pH 7.09 707
Turbidity CLEAR
WQ Instrument Used YSI 556

Water Odors
☒ Normal/None ☐ Sewage
☐ Petroleum ☐ Chemical
☐ Fishy ☐ Other _____

Water Surface Oils
☐ Slick ☐ Sheen ☐ Globs ☐ Flecks
☒ None ☐ Other NONE

Turbidity (if not measured)
☒ Clear ☐ Slightly turbid ☐ Turbid
☐ Opaque ☐ Stained ☐ Other _____

SEDIMENT/ SUBSTRATE

Odors
☐ Normal ☐ Sewage ☐ Petroleum
☐ Chemical ☐ Anaerobic ☒ None
☐ Other _____

Oils
☒ Absent ☐ Slight ☐ Moderate ☐ Profuse

Deposits
☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand
☐ Relict shells ☐ Other NONE

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

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock		0%	Detritus	sticks, wood, coarse plant materials (CPOM)	N/A - 0%
Boulder	> 256 mm (10")	15%			
Cobble	64-256 mm (2.5"-10")	70%	Muck-Mud	black, very fine organic (FPOM)	N/A - 0%
Gravel	2-64 mm (0.1"-2.5")	10%			
Sand	0.06-2mm (gritty)	5	Marl	grey, shell fragments	N/A - 0%
Silt	0.004-0.06 mm	—			
Clay	< 0.004 mm (slick)	—			

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME MIDDLE TRIB	LOCATION SERE SCHOOL - CHARLIE CAMP	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		
FORM COMPLETED BY DRESSER	DATE 6/10 TIME 17:15 AM PM	REASON FOR SURVEY

WEATHER CONDITIONS

Now		Past 24 hours
☐	storm (heavy rain)	☐
☐	rain (steady rain)	☐
☐	showers (intermittent)	☐
100 %	%cloud cover	☐ ___%
☐	clear/sunny	☐

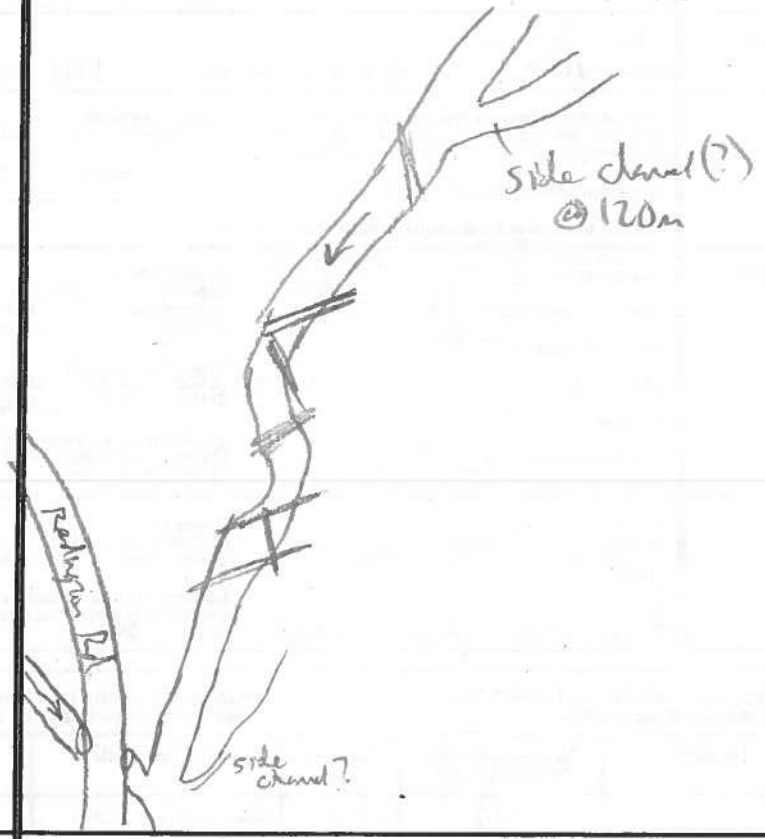
Has there been a heavy rain in the last 7 days? ☒ Yes ☐ No

Air Temperature____ °C 70F

Other_____

SITE LOCATION/MAP

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



STREAM CHARACTERIZATION

Stream Subsystem ?
☒ Perennial ☐ Intermittent ☐ Tidal

Stream Type
☒ Coldwater ☐ Warmwater

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

Catchment Area_____km²

FISH SAMPLING FIELD DATA SHEET (BACK)

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

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

FISH SAMPLING FIELD DATA SHEET (FRONT)

page ____ of ____

STREAM NAME INLET to R.P.	LOCATION
STATION # ______ RIVERMILE ______	STREAM CLASS
LAT ______ LONG ______	RIVER BASIN
STORET #	AGENCY
GEAR	INVESTIGATORS
FORM COMPLETED BY	DATE 6/11 TIME 1500 AM PM / REASON FOR SURVEY

SAMPLE COLLECTION	**How were the fish captured?** ☒ back pack ☐ tote barge ☐ other ______ **Block nets used?** ☐ YES ☒ NO **Sampling Duration** Start time ______ End time ______ Duration 1997 **Stream width (in meters)** Max ______ Mean ______
HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Riffles ___% ☐ Pools ___% ☐ Runs ___% ☐ Snags ___% ☐ Submerged Macrophytes ___% ☐ Other ( ) ___%
GENERAL COMMENTS	

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES* D	E	F	L	M	S	T	Z
BROOK TROUT	21	114	85	67	65	74								
		115	101	84	33	70								
		90	38	32	65	91								
		61	38	42	28	36								
		39												

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

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	(20) 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE	20 19 (18) 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 (9)	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 (9)	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank (10) 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank (10) 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank (10) 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank (10) 9	8 7 6	5 4 3	2 1 0

Total Score _____

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

STREAM NAME Inlet to Reservoir	LOCATION	
STATION # _____ RIVERMILE _____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		
FORM COMPLETED BY	DATE 6/11/13 TIME _____ AM PM	REASON FOR SURVEY

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 (16)	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	20 19 18 17 (16)	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 (16)	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 (17) 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

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

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

Local Watershed Erosion
☒ None ☐ Moderate ☐ Heavy

RIPARIAN VEGETATION (18 meter buffer)

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

dominant species present _____

INSTREAM FEATURES

Estimated Reach Length 150 m
Estimated Stream Width 3 m
Sampling Reach Area _____ m^2
Area in km^2 (m^2x1000) _____ km^2
Estimated Stream Depth .3 m
Surface Velocity (at thalweg) 1.10 m/sec

Canopy Cover
☐ Partly open ☑ Partly shaded ☐ Shaded

High Water Mark 1 m

Proportion of Reach Represented by Stream Morphology Types
☐ Riffle 2 % ☐ Run 7 %
☐ Pool 90 %

Channelized ☐ Yes ☒ No

Dam Present ☐ Yes ☒ No

LARGE WOODY DEBRIS

LWD 3 m^2
Density of LWD _____ m^2/km^2 **(LWD/ reach area)**

AQUATIC VEGETATION

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

dominant species present None

Portion of the reach with aquatic vegetation _____ %

WATER QUALITY

Temperature 9.73 °C
Specific Conductance 10
Dissolved Oxygen 96.9%
pH 7.22
Turbidity _____
WQ Instrument Used YSI

Water Odors
☒ Normal/None ☐ Sewage
☐ Petroleum ☐ Chemical
☐ Fishy ☐ Other _____

Water Surface Oils
☐ Slick ☐ Sheen ☐ Globs ☐ Flecks
☒ None ☐ Other _____

Turbidity (if not measured)
☒ Clear ☐ Slightly turbid ☐ Turbid
☐ Opaque ☐ Stained ☐ Other _____

SEDIMENT/ SUBSTRATE

Odors
☒ Normal ☐ Sewage ☐ Petroleum
☐ Chemical ☐ Anaerobic ☐ None
☐ Other _____

Oils
☒ Absent ☐ Slight ☐ Moderate ☐ Profuse

Deposits
☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand
☐ Relict shells ☐ Other _____

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

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	
Boulder	> 256 mm (10")				
Cobble	64-256 mm (2.5"-10")		Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1"-2.5")	5			
Sand	0.06-2mm (gritty)		Marl	grey, shell fragments	
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)				

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Inlet to Redington	LOCATION Sewe	
STATION # _____ RIVERMILE _____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS TC		
FORM COMPLETED BY TC	DATE 6/11 TIME 11 50 AM PM	REASON FOR SURVEY

WEATHER CONDITIONS

Now		Past 24 hours
☐	storm (heavy rain)	☐
☐	rain (steady rain)	☐
☑	showers (intermittent)	☑
___% ☐	%cloud cover	☐ ___%
☐	clear/sunny	☐

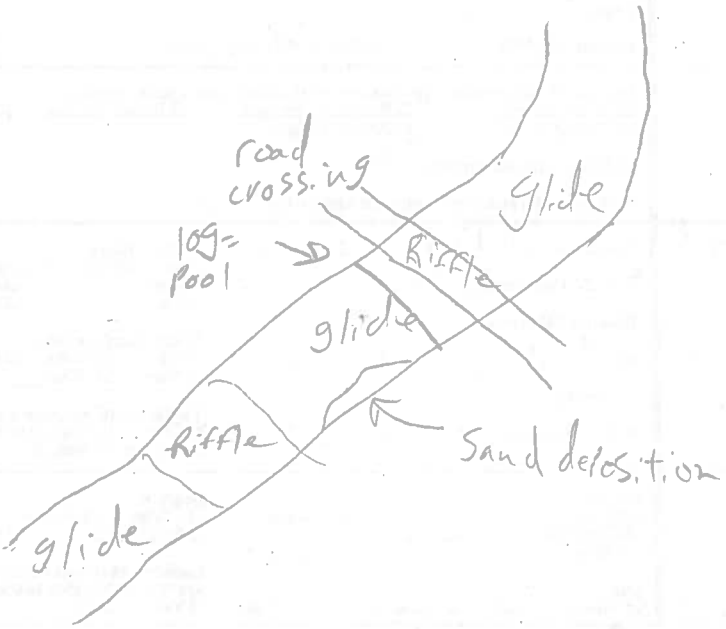
Has there been a heavy rain in the last 7 days? ☑ Yes ☐ No

Air Temperature 50 ° C

Other _____

SITE LOCATION/MAP

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



STREAM CHARACTERIZATION

Stream Subsystem
☑ Perennial ☐ Intermittent ☐ Tidal

Stream Type
☑ Coldwater ☐ Warmwater

Stream Origin
☐ Glacial
☑ Non-glacial montane
☐ Swamp and bog
☐ Spring-fed
☐ Mixture of origins
☐ Other _____

Catchment Area _____ km²

Probably Spawning here
- lots of gravel + small Brookies
- undercut banks

FISH SAMPLING FIELD DATA SHEET (BACK)

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

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

FISH SAMPLING FIELD DATA SHEET (FRONT)

page ____ of ____

STREAM NAME Tumble Down	LOCATION SERE School
STATION #________ RIVERMILE________	STREAM CLASS
LAT __________ LONG __________	RIVER BASIN
STORET #	AGENCY
GEAR	INVESTIGATORS
FORM COMPLETED BY Anderson/Dresser	DATE 06/11/13 TIME 14:00 AM (PM) — REASON FOR SURVEY

SAMPLE COLLECTION	**How were the fish captured?** ☒ back pack ☐ tote barge ☐ other ________ **Block nets used?** ☐ YES ☒ NO **Sampling Duration** Start time ________ End time ________ Duration 997 **Stream width (in meters)** Max________ Mean________
HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Riffles____% ☐ Pools____% ☐ Runs____% ☐ Snags____% ☐ Submerged Macrophytes____% ☐ Other ( )____%
GENERAL COMMENTS	

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES*							
							D	E	F	L	M	S	T	Z
Brook Trout	14	160	115	80	114	86								
		102	84	135	84	113								
		78	78	82	76									

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

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	(20) 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE	20 19 18 (17) 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank (10) 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank (10) 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank (10) 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank (10) 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank (10) 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank (10) 9	8 7 6	5 4 3	2 1 0

Total Score _____

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

STREAM NAME Tumble Down	LOCATION SPRE School
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS	
FORM COMPLETED BY Anderson / Grandet	DATE 06/11/13 TIME 13:15 AM (PM) — REASON FOR SURVEY

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 (14) 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

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

Local Watershed NPS Pollution
☒ No evidence ☐ Some potential sources
☐ Obvious sources

Local Watershed Erosion
☒ None ☐ Moderate ☐ Heavy

RIPARIAN VEGETATION (18 meter buffer)

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

dominant species present cedar, birch, beech

cedar birch beech

INSTREAM FEATURES

Estimated Reach Length 150 m
Estimated Stream Width 2.5 m
Sampling Reach Area _____ m^2
Area in km^2 (m^2x1000) _____ km^2
Estimated Stream Depth 0.5 m
Surface Velocity (at thalweg) 2 m/sec

Canopy Cover
☐ Partly open ☒ Partly shaded ☐ Shaded
High Water Mark 0.2 m
Proportion of Reach Represented by Stream Morphology Types
☐ Riffle ____% ☐ Run ____%
☒ Pool 40 % ☒ Cascade 60%
Channelized ☐ Yes ☒ No
Dam Present ☐ Yes ☒ No

LARGE WOODY DEBRIS

LWD 0 m^2 none
Density of LWD 0 m^2/km^2 (LWD/ reach area)

AQUATIC VEGETATION

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

dominant species present n al on

Portion of the reach with aquatic vegetation 1 %

WATER QUALITY

Temperature start 10.82 °C end
Specific Conductance 13 µS
Dissolved Oxygen 109.5/9 . %
pH 7.25
Turbidity Clea
WQ Instrument Used _____

Water Odors
☒ Normal/None ☐ Sewage
☐ Petroleum ☐ Chemical
☐ Fishy ☐ Other_____

Water Surface Oils
☐ Slick ☐ Sheen ☐ Globs ☐ Flecks
☒ None ☐ Other_____

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

SEDIMENT/ SUBSTRATE

Odors
☐ Normal ☐ Sewage ☐ Petroleum
☐ Chemical ☐ Anaerobic ☒ None
☐ Other_____

Oils
☒ Absent ☐ Slight ☐ Moderate ☐ Profuse

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

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

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock		50%	Detritus	sticks, wood, coarse plant materials (CPOM)	
Boulder	> 256 mm (10")	30%			
Cobble	64-256 mm (2.5"-10")	10%	Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1"-2.5")	10%			
Sand	0.06-2mm (gritty)	Ø	Marl	grey, shell fragments	
Silt	0.004-0.06 mm	Ø			
Clay	< 0.004 mm (slick)	Ø			

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Tumble Down	LOCATION SERE School
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS Dresser/Gaudet/Anderson	
FORM COMPLETED BY Anderson/Gaudet	DATE 06/11/13 TIME 15:15 AM (PM)
	REASON FOR SURVEY

WEATHER CONDITIONS

Now		Past 24 hours
☐	storm (heavy rain)	☐
☐	rain (steady rain)	☐
☒	showers (intermittent)	☒
100% ☒	%cloud cover	☒ 75%
☐	clear/sunny	☐

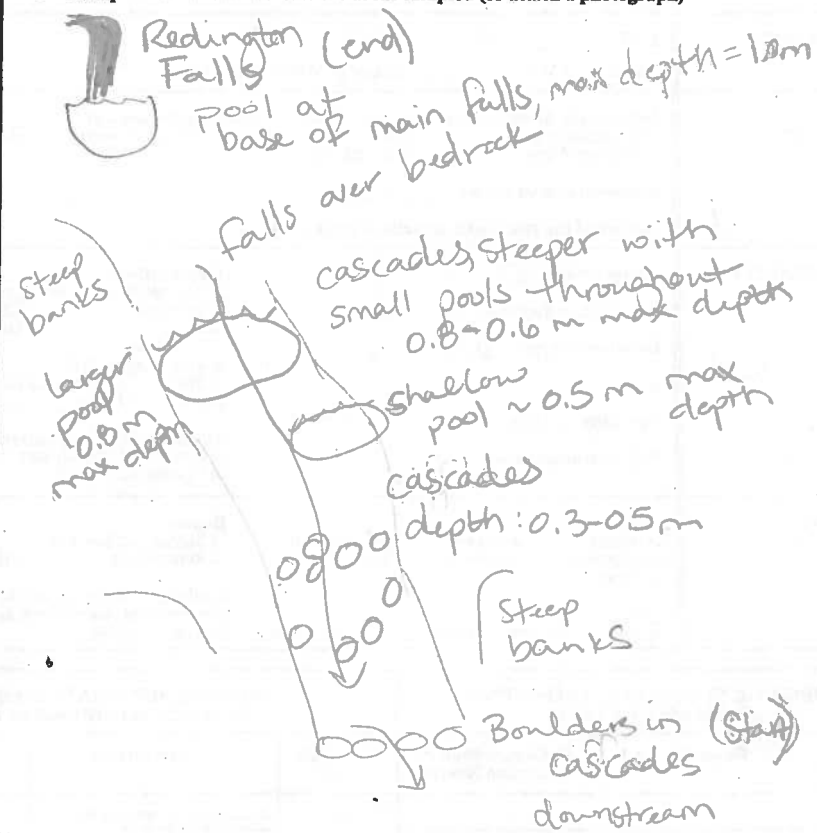
Has there been a heavy rain in the last 7 days? ☒ Yes ☐ No

Air Temperature 59 °C

Other _____

SITE LOCATION/MAP

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



STREAM CHARACTERIZATION

Stream Subsystem
☒ Perennial ☐ Intermittent ☐ Tidal

Stream Type
☒ Coldwater ☐ Warmwater

Stream Origin
☐ Glacial
☒ Non-glacial montane
☐ Swamp and bog
☐ Spring-fed
☐ Mixture of origins
☐ Other _____

Catchment Area _____ km²

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

STREAM NAME REDINGTON STR.	LOCATION	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		
FORM COMPLETED BY DRESSER	DATE 1320 TIME 6:10 AM PM	REASON FOR SURVEY

Parameters to be evaluated in sampling reach

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

150+

- very large debris dam @ 210m (fills space over scour)
- gravel bar + eroded bank w/ good overhang from debris dam @ 235

REDINGTON STR. 6/10

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

Parameters to be evaluated broader than sampling reach

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

Total Score _____

Reach #1

FISH SAMPLING FIELD DATA SHEET (FRONT)

page ____ of

STREAM NAME REDINGTON STR.	LOCATION SERE School, Rangeley, ME
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
GEAR	INVESTIGATORS
FORM COMPLETED BY Deena Anderson/Brian Dresser	DATE 6/10/13 TIME 13:15 AM (PM) — REASON FOR SURVEY

SAMPLE COLLECTION	**How were the fish captured?** ☑ back pack ☐ tote barge ☐ other _____ **Block nets used?** ☐ YES ☑ NO **Sampling Duration** Start time 13:15 End time 14:30 Duration 2813 **Stream width (in meters)** Max _____ Mean _____
HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Riffles ____% ☐ Pools ____% ☐ Runs ____% ☐ Snags ____% ☐ Submerged Macrophytes ____% ☐ Other ( ) ____%
GENERAL COMMENTS	

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE) TL (total length)					ANOMALIES* D	E	F	L	M	S	T	Z
White Sucker	3	162	72	47										
Brook Trout	1	86												
Sculpin [redacted]	70	74	54	93	85	60								
Slimy		82	47	81	32	50								
		53	56	42	91	81								
		66	55	41	54	66								
		39	45	34	62	49								
Sculpin (cont'd)		36	68	66	39	55								

FISH SAMPLING FIELD DATA SHEET (BACK)

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES*							
							D	E	F	L	M	S	T	Z
Black-nose Dace	2	62	61											
Creek Chub	2	75	64											

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

Reach #2

FISH SAMPLING FIELD DATA SHEET (FRONT)

page ____ of

STREAM NAME Redington Str.	LOCATION SERE School
STATION #_____ RIVERMILE_____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
GEAR	INVESTIGATORS
FORM COMPLETED BY Deena Anderson/Brian Dressa	DATE _____ TIME _____ AM PM / REASON FOR SURVEY

SAMPLE COLLECTION	**How were the fish captured?** ☑ back pack ☐ tote barge ☐ other 2114 **Block nets used?** ☐ YES ☑ NO **Sampling Duration** Start time _____ End time _____ Duration _____ **Stream width (in meters)** Max_____ Mean_____
HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Riffles____% ☐ Pools____% ☐ Runs____% ☐ Snags____% ☐ Submerged Macrophytes____% ☐ Other ( )____%
GENERAL COMMENTS	

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE) TL (total length)					ANOMALIES* D	E	F	L	M	S	T	Z
White Sucker	11	195	150	160	135*	150*								
		148	152	146	162	135								
		122												
Brook Trout	1	115												
Sculpin, [redacted]	61	92	98	76	54	57								
Slimy		34	68	55	35	53								
		70	96	42	50	62								
		78	56	45	45	55								
		78	40	32	47	47								
Sculpin (cont'd)		35	65	41	56	85								

*eggs expelled when measured

FISH SAMPLING FIELD DATA SHEET (BACK)

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

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

APPENDIX B

Scientific Collector's Permit

STATE OF MAINE
DEPARTMENT OF INLAND FISHERIES AND WILDIFE

PERMIT

Tetra Tech, Inc. 451 Presumpscot Street Portland, ME 04103	**Date** **Effective** 06/01/2013	**Expiration** 06/30/2013
	Renewable **Yes** ☐ **No** ☐	**Fee** N/A

Name of Principal Officer (If business) Sarah Watts – 879-9496	**Type of Permit** **SCIENTIFIC FISH COLLECTORS**

Location where authorized activity may be conducted
Orbeton Stream, Redington Pond and tributaries

Permittee must notify the Regional Fishery Biologist prior to conducting any type of fish collections. Trapnets and gillnets are not to be used without prior notification of the District Warden. This permit must be carried on the person of the permittee while exercising the privileges granted herein. It is non-transferable.

Condition of permit: Baseline fish inventory of perennial waters at Navy SERE School

Gear: Rod & Reel, electrofishing, seining, minnow traps.

Species and Numbers: all species will be captured and released

Disposition: returned to water alive

Subpermittees: Justin Sweitzer, Tyler Gaudet, Brian Dresser & Chris Wharton

All collection of specimens in Maine must have and follow a written disinfection and biosecurity plan. The plan should include policies and procedures for removal of aquatic plants, cleaning and disinfection of field equipment between collection sites, as well as reporting aquatic invasive fish species to the MDIFW.

Work on DPS salmon rivers should be cleared with the DMR, Sea Run Fisheries and Habitat. If you are working on a watershed where Atlantic Salmon are listed as endangered or threatened, you may need to acquire an additional permit from either National Marine Fishery Service 866-7322 or U.S. Fish & Wildlife, Old Town 827-5938.

When working on tribal lands please contact the appropriate tribal official.

Reporting requirements: Copies of any data forms or associated reports should be submitted to the Regional Biologist or to Fisheries in our Augusta Office

Signature of authorized agency representative	**Director of Fisheries**	**Date**
Michael E Brown		5/6/2013

APPENDIX C

EPA *Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers*

Chapter 8 Fish Protocols

8 FISH PROTOCOLS

Monitoring of the fish assemblage is an integral component of many water quality management programs, and its importance is reflected in the aquatic life use-support designations of many states. Narrative expressions such as “maintaining coldwater fisheries”, “fishable” or “fish propagation” are prevalent in state standards. Assessments of the fish assemblage must measure the overall structure and function of the ichthyofaunal community to adequately evaluate biological integrity and protect surface water resource quality. Fish bioassessment data quality and comparability are assured through the utilization of qualified fisheries professionals and consistent methods.

The Rapid Bioassessment Protocol (RBP) for fish presented in this document, is directly comparable to RBP V in Plafkin et al. (1989). The principal evaluation mechanism utilizes the technical framework of the Index of Biotic Integrity (IBI) — a fish assemblage assessment approach developed by Karr (1981). The IBI incorporates the zoogeographic, ecosystem, community and population aspects of the fish assemblage into a single ecologically-based index. Calculation and interpretation of the IBI involves a sequence of activities including: fish sample collection; data tabulation; and regional modification and calibration of metrics and expectation values. This concept has provided the overall multimetric index framework for rapid bioassessment in this document. A more detailed description of this approach for fish is presented in Karr et al. (1986) and Ohio EPA (1987). Regional modification and applications are described in Leonard and Orth (1986), Moyle et al. (1986), Hughes and Gammon (1987), Wade and Stalcup (1987), Miller et al. (1988), Steedman (1988), Simon (1991), Lyons (1992a), Simon and Lyons (1995), Lyons et al. (1996), and Simon (1999).

The RBP for fish involves careful, standardized field collection, species identification and enumeration, and analyses using aggregated biological attributes or quantification of the numbers (and in some cases biomass, see Section 8.3.3, Metric 13) of key species. The role of experienced fisheries scientists in the adaptation and application of the RBP and the taxonomic identification of fishes cannot be overemphasized. The fish RBP survey yields an objective discrete measure of the condition of the fish assemblage. Although the fish survey can usually be completed in the field by qualified fish biologists, difficult species identifications will require laboratory confirmation. Data provided by the fish RBP can serve to assess use attainment, develop biological criteria, prioritize sites for further evaluation, provide a reproducible impact assessment, and evaluate status and trends of the fish assemblage.

Fish collection procedures must focus on a multihabitat approach — sampling habitats in relative proportion to their local representation (as determined during site reconnaissance). Each sample reach should contain riffle, run and pool habitat, when available. Whenever possible, the reach should be sampled sufficiently upstream of any bridge or road crossing to minimize the hydrological effects on overall habitat quality. Wadeability and accessability may ultimately govern the exact placement of the sample reach. A habitat assessment is performed and physical/chemical parameters measured concurrently with fish sampling to document and characterize available habitat specifics within the sample reach (see Chapter 5: Habitat Assessment and Physicochemical Characterization).

8.1 FISH COLLECTION PROCEDURES: ELECTROFISHING

All fish sampling gear types are generally considered selective to some degree; however, electrofishing has proven to be the most comprehensive and effective *single* method for collecting stream fishes. Pulsed DC (direct current) electrofishing is the method of choice to obtain a representative sample of the fish assemblage at each sampling station. However, electrofishing in any form has been banned from certain salmonid spawning streams in the northwest. As with any fish sampling method, the proper scientific collection permit(s) must be obtained before commencement of any electrofishing activities. The accurate identification of each fish collected is essential, and species-level identification is required (including hybrids in some cases, see Section 8.3.3, Metric 11). Field identifications are acceptable; however, voucher specimens must be retained for laboratory verification, particularly if there is any doubt about the correct identity of the specimen (see Section 8.2). Because the collection methods used are not consistently effective for young-of-the-year fish and because their inclusion may seasonally skew bioassessment results, fish less than 20 millimeters total length will not be identified or included in standard samples.

ELECTROFISHING CONFIGURATION AND FIELD TEAM ORGANIZATION

All field team members must be trained in electrofishing safety precautions and unit operation procedures identified by the electrofishing unit manufacturer. Each team member must be insulated from the water and the electrodes; therefore, chest waders and rubber gloves are required. Electrode and dip net handles must be constructed of insulating materials (e.g., woods, fiberglass). Electrofishers/electrodes must be equipped with functional safety switches (as installed by virtually all electrofisher manufacturers). Field team members must not reach into the water unless the electrodes have been removed from the water or the electrofisher has been disengaged.

It is recommended that at least 2 fish collection team members be certified in CPR (cardiopulmonary resuscitation). *Many* options exist for electrofisher configuration and field team organization; however, procedures will always involve pulsed DC electrofishing and a minimum 2-person team for sampling streams and wadeable rivers. Examples include:

- Backpack electrofisher with 2 hand-held electrodes mounted on fiberglass poles, one positive (anode) and one negative (cathode). One crew member, identified as the electrofisher unit operator, carries the backpack unit and manipulates both the anode and cathode poles. The anode may be fitted with a net ring (and shallow net) to allow the unit operator to net specimens. The remaining 1 or 2 team members net fish with dip nets and are responsible for specimen transport and care in buckets or livewells.

- Backpack electrofisher with 1 hand-held anode pole and a trailing or floating cathode. The electrofisher unit operator manipulates the anode with one hand, and has a second hand free for use of a dip net. The remaining 1 or 2 team members also aid in the netting of specimens, and in addition are responsible for specimen transport in buckets or livewells.

- Tote barge (pramunit) electrofisher with 2 hand-held anode poles and a trailing/floating cathode (recommended for large streams and wadeable rivers). Two team members are each equipped with an anode pole and a dip net. Each is responsible for electrofishing and the netting of specimens. The remaining team member will follow, pushing or pulling the barge through the sample reach. A livewell is maintained within the barge and/or within the sampling reach but outside the area of electric current.

The safety of all personnel and the quality of the data is assured through the adequate education, training, and experience of all members of the fish collection team. At least 1 biologist with training and experience in electrofishing techniques and fish taxonomy *must* be involved in each sampling event. Laboratory analyses are conducted and/or supervised by a fisheries professional trained in fish taxonomy. Quality assurance and quality control must be a continuous process in fisheries monitoring and assessment, and must include all program aspects (i.e., field sampling, habitat measurement, laboratory processing, and data recording).

Tote barge (pram unit) Electrofishing

Backpack Electrofishing

FIELD EQUIPMENT/SUPPLIES NEEDED FOR FISH SAMPLING—ELECTROFISHING

- appropriate scientific collection permit(s)
- backpack or tote barge-mounted electrofisher
- dip nets
- block nets (i.e., seines)
- elbow-length insulated waterproof gloves
- chest waders (equipped with wading cleats, when necessary)
- polarized sunglasses
- buckets/livewells
- jars for voucher/reference specimens
- waterproof jar labels
- 10% buffered formalin (formaldehyde solution)
- measuring board (500 mm minimum, with 1 mm increments)[a]
- balance (gram scale)[b]
- tape measure (100 m minimum)
- fish Sampling Field Data Sheet[c]
- applicable topographic maps
- copies of field protocols
- pencils, clipboard
- first aid kit
- Global Positioning System (GPS) Unit

[a] Needed only if program/study requires length frequency information

[b] Needed only if total biomass and/or the Index of Well-Being are included in the assessment process (see Section 8.3.3, Metric 13).

[c] It is helpful to copy fieldsheets onto water-resistant paper for use in wet weather conditions.

8.1.1 Field Sampling Procedures

1. A representative stream reach (see Alternatives for Stream Reach Designation, next page) is selected and measured such that primary physical habitat characteristics of the stream are included within the reach (e.g., riffle, run and pool habitats, when available). The sample reach should be located away from the influences of major tributaries and

bridge/road crossings (e.g., sufficiently upstream to decrease influences on overall habitat quality). The exact location (i.e., latitude and longitude) of the downstream limit of the reach must be recorded on each field data sheet. (If a Global Positioning System unit is used to provide location information, the accuracy or design confidence of the unit should be noted.) A habitat assessment and physical/chemical characterization of water quality should be performed within the same sampling reach (see Chapter 5: Habitat Assessment and Physicochemical Characterization).

2. Collection via electrofishing begins at a shallow riffle, or other physical barrier at the downstream limit of the sample reach, and terminates at a similar barrier at the upstream end of the reach. In the absence of physical barriers, block nets should be set at the upstream and downstream ends of the reach prior to the initiation of any sampling activities.

ALTERNATIVES FOR STREAM REACH DESIGNATION

The collection of a representative sample of the fish assemblage is essential, and the appropriate sampling station length for obtaining that sample is best determined by conducting pilot studies (Lyons 1992b, Simonson et al. 1994, Simonson and Lyons 1995). Alternatives for the designation of stream sampling reaches include:

- **Fixed-distance designation**—A standard length of stream, e.g., a 150-200-meter reach (Ohio EPA 1987), 100-meter reach (Massachusetts DEP 1995) may be used to obtain a representative sample. Conceptually, this approach should provide a mixture of habitats in the reach and provide, at a minimum, duplicate physical and structural elements such as riffle/pool sequences.

- **Proportional-distance designation**— A standard number of stream channel "widths" may be used to measure the stream study reach, e.g., 40 times the stream width is defined by Environmental Monitoring & Assessment Program (EMAP) for sampling (Klemm and Lazorchak 1995). This approach allows variation in the length of the reach based on the size of the stream. Application of the proportional-distance approach in large streams or wadeable rivers may require the establishment of sampling program time and/or distance maxima (e.g., no more than 3 hours of electrofishing or 500-meter reach per sampling site, [Klemm et al. 1993]).

3. Fish collection procedures commence at the downstream barrier. A minimum 2-person fisheries crew proceeds to electrofish in an upstream direction using a side-to-side or bank-to-bank sweeping technique to maximize area coverage. All wadeable habitats within the reach are sampled via a single pass, which terminates at the upstream barrier. Fish are held in livewells (or buckets) for subsequent identification and enumeration.

4. Sampling efficiency is dependent, at least in part, on water clarity and the field team's ability to see and net the stunned fish. Therefore, each team member should wear polarized sunglasses, and sampling is conducted only during periods of optimal water clarity and flow.

5. All fish (greater than 20 millimeters total length) collected within the sample reach must be identified to species (or subspecies). Specimens that cannot be identified with certainty in the field are preserved in a 10% formalin solution and stored in labeled jars for subsequent laboratory identification (see Section 8.2). A representative voucher collection must be retained for unidentified specimens, very small specimens, new locality records, and/or a particular region. In addition to the unidentified specimen jar, a voucher collection of a

subsample of each species identified in the field should be preserved and labeled for subsequent laboratory verification, if necessary. Obviously, species of special concern (e.g., threatened, endangered) should be noted and released *immediately* on site. Labels should contain (at a minimum) location data (verbal description and coordinates), date, collectors' names, and sample identification code and/or station numbers for the particular sampling site. Young-of-the-year fish less than 20 millimeters (total length) are not identified or included in the sample, and are released on site. Specimens that can be identified in the field are counted, examined for external anomalies (i.e., deformities, eroded fins, lesions, and tumors), and recorded on field data sheets. An example of a "Fish Sampling Field Data Sheet" is provided in Appendix A-4, Form 1. Space is available for optional fish length and weight measurements, should a particular program/study require length frequency or biomass data. However, these data *are not required* for the standard multimetric assessment. Space is allotted on the field data sheets for the *optional* inclusion of measurements (nearest millimeter total length) and weights (nearest gram) for a subsample (to a maximum 25 specimens) of each species. Although fish length and weight measurements are optional, recording a range of lengths for species encountered may be a useful routine measure. Following the data recording phase of the procedure, specimens that have been identified and processed in the field are released on site to minimize mortality.

6. The data collection phase includes the completion of the top portion of the "Fish Sampling Field Data Sheet" (Appendix A-4, Form 1),

QUALITY CONTROL (QC) IN THE FIELD

1. Quality control must be a continuous process in fish bioassessment and should include all program aspects, from field collection and preservation to habitat assessment, sample processing, and data recording. Field validation should be conduced at selected sites and will involve the collection of a duplicate sample taken from an adjacent reach upstream of the initial sampling site. The adjacent reach should be similar to the initial site with respect to habitat and stressors. Sampling QC data should be evaluated following the first year of sampling in order to determine a level of acceptable variability and the appropriate duplication frequency.

2. Field identifications of fish *must* be conducted by qualified/trained fish taxonomists, familiar with local and regional ichthyofauna. Questionable records are prevented by: (a) requiring the presence of at least one experienced/trained fish taxonomist on every field effort, and (b) preserving selected specimens (e.g., Klemm and Lazorchak 1995 recommend a subsample of a maximum 25 voucher specimens of each species) and those that cannot by readily identified in the field for laboratory verification and/or examination by a second qualified fish taxonomist (see Section 8.2). Specimens must be properly preserved and labeled (refer to Section 8.1.1, number 5). When needed, chain-of-custody forms must be initiated following sample preservation, and must include the same information as the sample container labels.

3. All field equipment must be in good operating condition, and a plan for routine inspection, maintenance, and/or calibration must be developed to ensure consistency and quality of field data. Field data must be complete and legible, and should be entered on standardized field data forms and/or digital recorders. While in the field, the field team should possess sufficient copies of standardized field data forms and chains-of-custody for all anticipated sampling sites, as well as copies of all applicable Standard Operating Procedures (SOPs).

which duplicates selected information from the physical/chemical field sheet. Information regarding the sample collection procedures must also be recorded. This includes method of fish capture, start time, ending time, duration of sampling, maximum and mean stream widths. The percentage of each habitat type in the reach is estimated and documented on the data sheet. Comments should include sampling conditions, e.g., visibility, flow, difficult access to stream, or anything that may prove to be valuable information to consider for future sampling events or by personnel unfamiliar with the site.

8.2 LABORATORY IDENTIFICATION AND VERIFICATION

Fish records of questionable quality are prevented by preserving specimens (that cannot be readily identified in the field) for laboratory examination and/or a voucher collection for laboratory verification. Specimens must be properly preserved (e.g., 10% formalin for tissue fixing and 70% ethanol for long-term storage) and labeled (using museum-grade archival labels/paper, and formalin/alcohol-proof pen or pencil). Labels should contain (at a minimum) site location data (i.e., verbal description and site coordinates), collection date, collector's names, species identification (for fishes identified in the field), species totals, and sample identification code and/or station number. All samples received in the laboratory should be tracked using a sample log-in procedure (Appendix A-4, Form 2). Laboratory fisheries professionals *must* be capable of identifying fish to the lowest possible taxonomic level (i.e., species or subspecies) and should have access to suitable regional taxonomic references (see Section 8.4) to aid in the identification process. Laboratories that do not typically identify fish, or trained fisheries professionals that have difficulty identifying a particular specimen or group of fish, should contact a taxonomic specialist (i.e., a recognized authority for that particular taxonomic group). Taxonomic nomenclature *must* be kept consistent and current. Common and scientific names of fishes from the United States and Canada are listed in Robins et al. (1991).

QUALITY CONTROL (QC) FOR TAXONOMY

1. A representative voucher collection must be retained for unidentified specimens, small specimens, and new locality records. In addition, a second voucher jar should be retained for a subsample of each species identified in the field (e.g., Klemm and Lazorchak 1995 recommend a subsample of 25 voucher specimens of each species). The vouchers must be properly preserved, labeled, and stored in the laboratory for future reference (see Section 8.2).

2. Voucher collections should be verified by a second qualified fish taxonomist, i.e., a professional other than the taxonomist responsible for the original field identifications. The word "validated" and the name of the taxonomist that validated the identification should be added to each voucher label. Specimens sent from the laboratory to taxonomic specialists should be recorded in a "Taxonomy Validation Notebook" (see Chapter 7), noting the label information and date sent. Upon return of the specimens, the date received and findings should also be recorded in the notebook (and the voucher label), along with the name of the person who performed the validation.

3. Information on samples completed (through the identification/validation process) will be tracked in a "Sample Log" notebook, to track the progress of each sample (Appendix A-4, Form 2). Sample log entries will be updated as each step is completed (e.g., receipt, identification, validation, archive).

4. A library of taxonomic literature is essential for the aid and support of identification/verification activities, and must be maintained (and updated as needed) in the laboratory. A list of selected taxonomic references is provided in Section 8.4.

8.3 DESCRIPTION OF FISH METRICS

Through the IBI, Karr et al. (1986) provided a consistent theoretical framework for analyzing fish assemblage data. The IBI is an aggregation of 12 biological metrics that are based on the fish assemblage's taxonomic and trophic composition and the abundance and condition of fish. Such multiple-parameter indices are necessary for making objective evaluations of complex systems. The IBI was designed to evaluate the quality of small Midwestern warmwater streams but has been modified for use in many regions (e.g., eastern and western United States, Canada, France) and in different ecosystems (e.g., rivers, impoundments, lakes, and estuaries).

The metrics attempt to quantify a biologist's best professional judgment (BPJ) of the quality of the fish assemblage. The IBI utilizes professional judgment, but in a prescribed manner, and it includes quantitative standards for discriminating the condition of the fish assemblage (Figure 8-1). BPJ is involved in choosing both the most appropriate population or assemblage element that is representative of each metric and in setting the scoring criteria. This process can be easily and clearly modified, as opposed to judgments that occur after results are calculated. Each metric is scored against criteria based on expectations developed from appropriate regional reference sites. Metric values

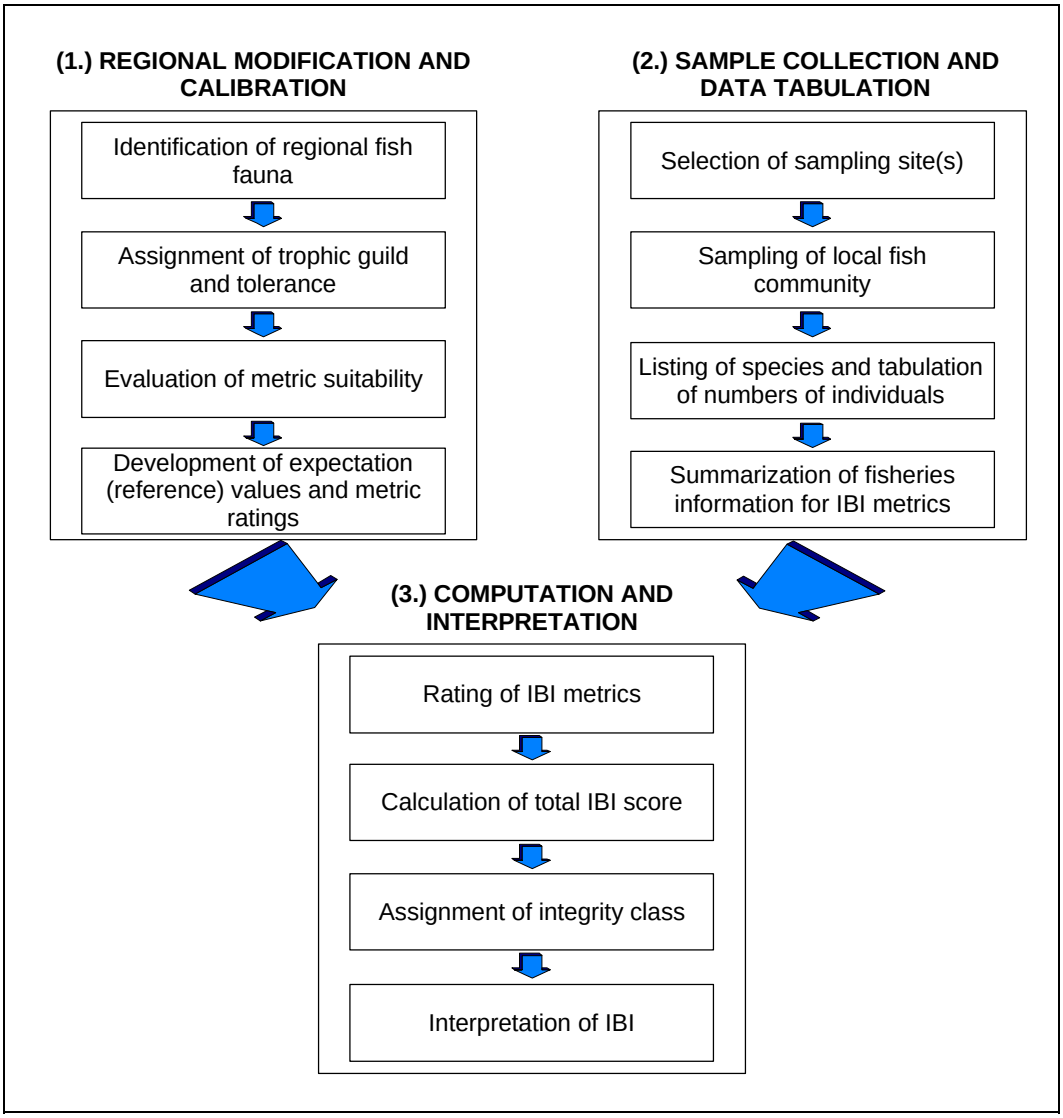


Figure 8-1. Sequence of activities involved in calculating and interpreting the Index of Biotic Integrity (adapted from Karr et al. 1986).

approximating, deviating slightly from, or deviating greatly from values occurring at the reference sites are scored as 5, 3, or 1, respectively. The scores of the 12 metrics are added for each station to give an IBI ranging from a maximum of 60 (excellent) to a minimum of 12 (very poor). Trophic and tolerance classifications of selected fish species are listed in Appendix C. Additional classifications can be derived from information in State and regional fish texts, by objectively assessing a large statewide database, or by contacting authors/originators of regional IBI programs or pilot studies. Use of the IBI by water resource agencies may result in further modifications. Many modifications have occurred (Miller et al. 1988) without changing the IBI's basic theoretical foundations.

The IBI serves as an integrated analysis because individual metrics may differ in their relative sensitivity to various levels of biological condition. A description and brief rationale for each of the 12 IBI metrics is outlined below. The original metrics described by Karr (1981) for Illinois streams are followed by substitutes used in or proposed for different geographic regions and stream sizes. Because of zoogeographic differences, different families or species are evaluated in different regions, with regional substitutes occupying the same general habitat or niche. The source for each substitute is footnoted below. Table 8-1 presents an overview of the IBI metric alternatives and their sources for various areas of the United States and Canada.

EXAMPLES OF SOURCES FOR METRIC ALTERNATIVES

Karr et al. (1986)
Leonard and Orth (1986)
Moyle et al. (1986)
Fausch and Schrader (1987)
Hughes and Gammon (1987)
Ohio EPA (1987)
Miller et al. (1988)
Steedman (1988)
Simon (1991)
Lyons (1992a)
Barbour et al. (1995)
Simon and Lyons (1995)
Hall et al. (1996)
Lyons et al. (1996)
Roth et al. (1997)
Simon (1999)

8.3.1 Species Richness and Composition Metrics

These metrics assess the species richness component of diversity and the health of resident taxonomic groupings and habitat guilds of fishes. Two of the metrics assess assemblage composition in terms of tolerant or intolerant species.

Metric 1. Total number of fish species Substitutes (Table 8-1): Total number of resident native fish species and salmonid age classes.

This number decreases with increased degradation; hybrids and introduced species are not included. In coldwater streams supporting few fish species, the age classes of the species found represent the suitability of the system for spawning and rearing. The number of species is strongly affected by stream size at most small warmwater stream sites, but not at large river sites (Karr et al. 1986, Ohio EPA 1987).

Metric 2. Number and identity of darter species Substitutes (Table 8-1): Number and identity of sculpin species, benthic insectivore species, salmonid juveniles (individuals); number of sculpins (individuals); percent round-bodied suckers, sculpin and darter species.

These species are sensitive to degradation resulting from siltation and benthic oxygen depletion because they feed and reproduce in benthic habitats (Kuehne and Barbour 1983, Ohio EPA 1987). Many smaller species live within the rubble interstices, are weak swimmers, and spend their entire lives in an area of 100-400 m^2 (Matthews 1986, Hill and Grossman 1987). Darters are appropriate in most

Mississippi Basin streams; sculpins and yearling trout occupy the same niche in western streams. Benthic insectivores and sculpins or darters are used in small Atlantic slope streams that have few sculpins or darters, and round-bodied suckers are suitable in large midwestern rivers.

Metric 3. Number and identity of sunfish species. Substitutes (Table 8-1): Number and identity of cyprinid species, water column species, salmonid species, headwater species, and sunfish and trout species.

Table 8-1. Fish IBI metrics used in various regions of North America.[a]

Alternative IBI Metrics	Midwestern United States	Central Appalachians	Sacramento-San Joaquin	Colorado Front Range	Western Oregon Ohio	Ohio Headwater Sites	Northeastern United States	Ontario	Central Corn Belt Plain	Wisconsin-Warmwater	Wisconsin-Coldwater	Maryland Coastal Plain	Maryland Non-Tidal
1. Total Number of Species	X	X	X	X				X		X		X	X
#native fish species					X	X	X		X		X		
# salmonid age classes[b]				X	X								
2. Number of Darter Species	X	X		X		X				X	X		
# sculpin species					X								
# benthic insectivore species								X					
# darter and sculpin species							X						
# darter, sculpin, and madtom species										X			
# salmonid juveniles (individuals)[b]			X		X			X					
% round-bodied suckers						X[c]							
# sculpins (individuals)			X										
# benthic species												X	X
3. Number of Sunfish Species	X			X		X				X	X		
# cyprinid species					X								
# water column species								X					
# sunfish and trout species									X				
# salmonid species			X							X			
# headwater species							X						
% headwater species							X			X			
4. Number of Sucker Species	X				X	X		X		X	X		
# adult trout species[b]			X		X								
# minnow species				X			X			X			
# sucker and catfish species									X				
5. Number of Intolerant Species	X			X	X	X		X			X	X	X	X
# sensitive species							X			X			
# amphibian species			X										
presence of brook trout									X				
% stenothermal cool and cold water species											X		
% of salmonid ind. as brook trout											X		
6. % Green Sunfish	X												
% common carp					X								
% white sucker				X				X					
% tolerant species						X	X			X	X	X	X	X
% creek chub		X											
% dace species									X				
% eastern mudminnow												X	

Table 8-1. Fish IBI metrics used in various regions of North America.[a]

Alternative IBI Metrics	Midwestern United States	Central Appalachians	Sacramento-San Joaquin	Colorado Front Range	Western Oregon Ohio	Ohio Headwater Sites	Northeastern United States	Ontario	Central Corn Belt Plain	Wisconsin-Warmwater	Wisconsin-Coldwater	Maryland Coastal Plain	Maryland Non-Tidal
7. % Omnivores	X			X		X	X	X	X	X	X		
% generalist feeders		X											
% generalists, omnivores, and invertivores													X
8. % Insectivorous Cyprinids	X											X	
% insectivores					X			X		X	X	X	X[e]
% specialized insectivores		X		X									
# juvenile trout			X										
% insectivorous species						X	X						
9. % Top Carnivores	X					X		X	X	X	X		
% catchable salmonids					X								
% catchable trout			X										
% pioneering species							X			X		X	
Density catchable wild trout			X										
10. Number of Individuals (or catch per effort)	X	X	X	X	X	X[d]	X[d]		X	X	X[d]	X	
Density of individuals								X					X
% abundance of dominant species												X	X
Biomass (per m^2)													X[f]
11. % Hybrids	X							X					
% introduced species				X	X								
% simple lithophills						X				X	X		X
# simple lithophills species							X						
% native species			X										
% native wild individuals			X										
% silt-intolerant spawners												X	
12. % Diseased Individuals (deformities, eroded fins, lesions, and tumors)	X	X		X	X	X	X	X	X	X	X	X	X

Note: X = metric used in region. Many of these variations are applicable elsewhere.

a Taken from Karr et al. (1986), Leonard and Orth (1986), Moyle et al. (1986), Fausch and Schrader (1987), Hughes and Gammon (1987), Ohio EPA (1987), Miller et al. (1988), Steedman (1988), Simon (1991), Lyons (1992a), Barbour et al. (1995), Simon and Lyons (1995), Hall et al. (1996), Lyons et al. (1996), Roth et al. (1997).

b Metric suggested by Moyle et al. (1986) or Hughes and Gammon (1987) as a provisional replacement metric in small western salmonid streams.

c Boat sampling methods only (i.e., larger streams/rivers).

d Excluding individuals of tolerant species.

e Non-coastal Plain streams only.

f Coastal Plain streams only.

These pool species decrease with increased degradation of pools and instream cover (Gammon et al. 1981, Angermeier 1987, Platts et al. 1983). Most of these fishes feed on drifting and surface invertebrates and are active swimmers. The sunfishes and salmonids are important sport species. The sunfish metric works for most Mississippi Basin streams, but where sunfish are absent or rare, other

groups are used. Cyprinid species are used in coolwater western streams; water column species occupy the same niche in northeastern streams; salmonids are suitable in coldwater streams; headwater species serve for midwestern headwater streams; and trout and sunfish species are used in southern Ontario streams. Karr et al. (1986) and Ohio EPA (1987) found the number of sunfish species to be dependent on stream size in small streams, but Ohio EPA (1987) found no relationship between stream size and sunfish species in medium to large streams, nor between stream size and headwater species in small streams.

Metric 4. Number and identity of sucker species. Substitutes (Table 8-1): Number of adult trout species, number of minnow species, and number of suckers and catfish.

These species are sensitive to physical and chemical habitat degradation and commonly comprise most of the fish biomass in streams. All but the minnows are longlived species and provide a multiyear integration of physicochemical conditions. Suckers are common in medium and large streams; minnows dominate small streams in the Mississippi Basin; and trout occupy the same niche in coldwater streams. The richness of these species is a function of stream size in small and medium sized streams, but not in large (e.g., non-wadeable) rivers.

Metric 5. Number and identity of intolerant species. Substitutes (Table 8-1): Number and identity of sensitive species, amphibian species, and presence of brook trout.

This metric distinguishes high and moderate quality sites using species that are intolerant of various chemical and physical perturbations. Intolerant species are typically the first species to disappear following a disturbance. Species classified as intolerant or sensitive should only represent the 5-10 percent most susceptible species, otherwise this becomes a less discriminating metric. Candidate species are determined by examining regional ichthyological books for species that were once widespread but have become restricted to only the highest quality streams. Ohio EPA (1987) uses number of sensitive species (which includes highly intolerant and moderately intolerant species) for headwater sites because highly intolerant species are generally not expected in such habitats. Moyle (1976) suggested using amphibians in northern California streams because of their sensitivity to silvicultural impacts. This also may be a promising metric in Appalachian streams which may naturally support few fish species. Steedman (1988) found that the presence of brook trout had the greatest correlation with IBI score in Ontario streams. The number of sensitive and intolerant species increases with stream size in small and medium sized streams but is unaffected by size of large (e.g., non-wadeable) rivers.

Metric 6. Proportion of individuals as green sunfish. Substitutes (Table 8-1): Proportion of individuals as common carp, white sucker, tolerant species, creek chub, and dace.

This metric is the reverse of Metric 5. It distinguishes low from moderate quality waters. These species show increased distribution or abundance despite the historical degradation of surface waters, and they shift from incidental to dominant in disturbed sites. Green sunfish are appropriate in small midwestern streams; creek chubs were suggested for central Appalachian streams; common carp were suitable for a coolwater Oregon river; white suckers were selected in the northeast and Colorado where green sunfish are rare to absent; and dace (*Rhinichthys* species) were used in southern Ontario. To avoid weighting the metric on a single species, Karr et al. (1986) and Ohio EPA (1987) suggest using a small number of highly tolerant species (e.g., alternative Metric 6— percent abundance of tolerant species).

8.3.2 Trophic Composition Metrics

These three metrics assess the quality of the energy base and trophic dynamics of the fish assemblage. Traditional process studies, such as community production and respiration, are time consuming to conduct and the results are equivocal; distinctly different situations can yield similar results. The trophic composition metrics offer a means to evaluate the shift toward more generalized foraging that typically occurs with increased degradation of the physicochemical habitat.

Metric 7. Proportion of individuals as omnivores. Substitutes (Table 8-1): Proportion of individuals as generalist feeders.

The percent of omnivores in the community increases as the physical and chemical habitat deteriorates. Omnivores are defined as species that consistently feed on substantial proportions of plant and animal material. Ohio EPA (1987) excludes sensitive filter feeding species such as paddlefish and lamprey ammocoetes and opportunistic feeders like channel catfish. In areas where few species fit the true definition of omnivore, the proportion of generalized feeders may be substituted (Leonard and Orth 1986).

Metric 8. Proportion of individuals as insectivorous cyprinids. Substitutes (Table 8-1): Proportion of individuals as insectivores, specialized insectivores, insectivorous species, and number of juvenile trout.

Invertivores, primarily insectivores, are the dominant trophic guild of most North American surface waters. As the invertebrate food source decreases in abundance and diversity due to habitat degradation (e.g., anthropogenic stressors), there is a shift from insectivorous to omnivorous fish species. Generalized insectivores and opportunistic species, such as blacknose dace and creek chub were excluded from this metric by Ohio EPA (1987). This metric evaluates the midrange of biological condition, i.e., low to moderate condition.

Metric 9. Proportion of individuals as top carnivores. Substitutes (Table 8-1): Proportion of individuals as catchable salmonids, catchable wild trout, and pioneering species.

The top carnivore metric discriminates between systems with high and moderate integrity. Top carnivores are species that feed, as adults, predominantly on fish, other vertebrates, or crayfish. Occasional piscivores, such as creek chub and channel catfish, are not included. In trout streams, where true piscivores are uncommon, the percent of large salmonids is substituted for percent piscivores. These species often represent popular sport fish such as bass, pike, walleye, and trout. Pioneering species are used by Ohio EPA (1987) in headwater streams typically lacking piscivores. Pioneering species predominate in unstable environments that have been affected by temporal desiccation or anthropogenic stressors, and are the first to reinvade sections of headwater streams following periods of desiccation.

8.3.3 Fish Abundance and Condition Metrics

The last 3 metrics indirectly evaluate population recruitment, mortality, condition, and abundance. Typically, these parameters vary continuously and are time consuming to estimate accurately. Instead of such detailed population attributes or estimates, general population parameters are evaluated. Indirect estimation is less variable and much more rapidly determined.

Metric 10. Number of individuals in sample. Substitutes (Table 8-1): Density of individuals.

This metric evaluates population abundance and varies with region and stream size for small streams. It is expressed as catch per unit effort, either by area, distance, or time sampled. Generally sites with lower integrity support fewer individuals, but in some nutrient poor regions, enrichment increases the number of individuals. Steedman (1988) addressed this situation by scoring catch per minute of sampling greater than 25 as a 3, and less than 4 as a 1. Unusually low numbers generally indicate toxicity, making this metric most useful at the low end of the biological integrity scale. Hughes and Gammon (1987) suggest that in larger streams, where sizes of fish may vary in orders of magnitude, total fish biomass may be an appropriate substitute or additional metric.

Metric 11. Proportion of individuals as hybrids. Substitutes (Table 8-1): Proportion of individuals as introduced species, simple lithophils, and number of simple lithophilic species.

This metric is an estimate of reproductive isolation or the suitability of the habitat for reproduction. Generally as environmental degradation increases the percent of hybrids and introduced species also increases, but the proportion of simple lithophils decreases. However, minnow hybrids are found in some high quality streams, hybrids are often absent from highly impacted sites, and hybridization is rare and difficult to detect. Thus, Ohio EPA (1987) substitutes simple lithophils for hybrids. Simple lithophils spawn where their eggs can develop in the interstices of sand, gravel, and cobble substrates without parental care. Hughes and Gammon (1987) and Miller et al. (1988) propose using percent introduced individuals. This metric is a direct measure of the loss of species segregation between midwestern and western fishes that existed before the introduction of midwestern species to western rivers.

THE INDEX OF WELL-BEING (IWB)

The Iwb (Gammon 1976, 1980, Hughes and Gammon 1987) incorporates two abundance and two diversity measures in an approximately equal fashion, thereby representing fish assemblage quality more realistically than a single diversity or abundance measure. The Iwb is calculated using the formula:

$$Iwb = 0.51nN + 0.5\ 1nB + \bar{H}_N + \bar{H}_B$$

where

- N = number of individuals caught per unit distance sampled
- B = biomass of individuals caught per unit distance
- $\bar{H}$ = Shannon diversity index, calculated as:

$$\bar{H} = -\Sigma \frac{n_i}{N}\ 1n\ (\frac{n_i}{N})$$

where

- n_i = relative number or weight of the ith species
- N = total number or weight of the sample

THE MODIFIED INDEX OF WELL-BEING (MIWB)

The MIwb (Ohio EPA 1987) retains the same formula as the Iwb; however, highly tolerant species, hybrids, and exotic species are eliminated from the abundance (i.e., number and biomass) components of the formula. This modification increases the sensitivity of the index to a wider array of environmental disturbances.

Metric 12. Proportion of individuals with disease, tumors, fin damage, and skeletal anomalies

This metric depicts the health and condition of individual fish. These conditions occur infrequently or are absent from minimally impacted reference sites but occur frequently below point sources and in

areas where toxic chemicals are concentrated. They are excellent measures of the subacute effects of chemical pollution and the aesthetic value of game and nongame fish.

Metric 13. Total fish biomass (optional).

Hughes and Gammon (1987) suggest that in larger (e.g., non-wadeable) rivers where sizes of fish may vary in orders of magnitude this additional metric may be appropriate. Gammon (1976, 1980) and Ohio EPA (1987) developed an Index of Well-Being (Iwb) and Modified Index of Well-Being (MIwb), respectively, based upon both fish abundance and biomass measures. The combination of diversity and biomass measures is a useful tool for assessing fish assemblages in larger rivers (Yoder and Rankin 1995b). Ohio EPA (1987) found that the additional collection of biomass data (i.e., in addition to abundance information needed for the IBI) required to calculate the MIwb does not represent a significant expenditure of time, providing that subsampling techniques are applied (see Field Sampling Procedures 8.1.1).

Because the IBI is an adaptable index, the choice of metrics and scoring criteria is best developed on a regional basis through use of available publications (Karr et al. 1986, Ohio EPA 1987, Miller et al. 1988, Steedman 1988; Simon 1991, Lyons 1992a, Simon and Lyons 1995, Hall et al. 1996, Lyons et al. 1996, Roth et al. 1997, Simon 1999). Several steps are common to all regions. The fish species must be listed and assigned to trophic and tolerance guilds. Scoring criteria are developed through use of high quality historical data and data from minimally-impaired regional reference sites. This has been done for much of the country, but continued refinements are expected as more ecological data become available for the fish community.

8.4 TAXONOMIC REFERENCES FOR FISH

The following references are provided as a list of taxonomic references currently being used around the United States for identification of fish. Any of these references cited in the text of this document will also be found in Chapter 11 (Literature Cited).

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APPENDIX D

Photo Log

PHOTOGRAPHIC RECORD

Company: SERE School, Redington Township, Maine
Project: SERE School Baseline Fish and Habitat Survey

Photo No.: 1

Date: June 10, 2013

Comments: Field crews preparing the electrofishing unit at Redington Stream

Photo No.: 2

Date: June 10, 2013

Comments: View of the start facing upstream at Redington Stream

PHOTOGRAPHIC RECORD

Company: SERE School, Redington Township, Maine
Project: SERE School Baseline Fish and Habitat Survey

Photo No.: 3

Date: June 10,2013

Comments: Eroded Bank in Redington Stream

Photo No.: 4

Date: June 10, 2013

Comments: Filamentous algae in Redington Stream

PHOTOGRAPHIC RECORD

Company: SERE School, Redington Township, Maine
Project: SERE School Baseline Fish and Habitat Survey

Photo No.: 5

Date: June, 10 2013

Comments: Common shiner captured in Redington Stream

Photo No.: 6

Date: June 10, 2013

Comments: Crew conducting electrofishing surveys in Redington Stream.

PHOTOGRAPHIC RECORD

Company: SERE School, Redington Township, Maine
Project: SERE School Baseline Fish and Habitat Survey

Photo No.: 7

Date: June 10, 2013

Comments: Slimy sculpin captured in Middle Tributary.

Photo No.: 8

Date: June 10, 2013

Comments: Biologists electrofish Middle Tributary

PHOTOGRAPHIC RECORD

Company: SERE School, Redington Township, Maine
Project: SERE School Baseline Fish and Habitat Survey

Photo No.: 9

Date: June 10, 2013

Comments: Large woody debris across Middle Tributary

Photo No.: 10

Date: June 10, 2013

Comments: View facing upstream at Middle Tributary

PHOTOGRAPHIC RECORD

Company: SERE School, Redington Township, Maine
Project: SERE School Baseline Fish and Habitat Survey

Photo No.: 11

Date: October 20, 2011

Comments: Brook trout captured in Orbeton Stream

Photo No.: 12

Date: June 11, 2013

Comments: Field crews enumerating and measuring fish at Orbeton Stream

PHOTOGRAPHIC RECORD

Company: SERE School, Redington Township, Maine
Project: SERE School Baseline Fish and Habitat Survey

Photo No.: 13

Date: June 11, 2013

Comments: Electrofishing in Orbeton Stream

Photo No.: 14

Date: June 11, 2013

Comments: View facing downstream at Orbeton Stream

PHOTOGRAPHIC RECORD

Company: SERE School, Redington Township, Maine
Project: SERE School Baseline Fish and Habitat Survey

Photo No.: 15

Date: June 11, 2013

Comments: View of the end facing upstream at Tumbledown Brook

Photo No.: 16

Date: June 11, 2013

Comments: View of the sampling bucket filled with brook trout and slimy sculpin

Enclosure 5

Winter Mammal, Breeding Bird, Raptor Migration, and Bat and Avian Acoustic Surveys

January 2015

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NAVFAC Atlantic Biological Resource Services

Contract: N62470-08-D-1008; Task Order: WE45, Task 5

Winter Mammal, Breeding Bird, Raptor Migration, and Bat and Avian Acoustic Surveys

Center for Security Forces Detachment Kittery Survival, Evasion, Resistance, and Escape Facility, Redington Township, Maine

FINAL – December 2014

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ACRONYMS AND ABBREVIATIONS

%	percent
°C	degrees Celsius
°F	degrees Fahrenheit
BBS	Breeding Bird Survey
BCC	Birds of Conservation Concern
DoD	Department of Defense
ESA	Endangered Species Act
ft	feet/foot
hr	hour
Hz	hertz
GPS	global positioning system
INRMP	Integrated Natural Resources Management Plan
Installation	Security Forces Detachment Kittery Survival, Evasion, Resistance, and Escape Facility
m	meter(s)
MDIFW	Maine Department of Inland Fisheries and Wildlife
Navy	United States Department of the Navy
NCDC	National Climatic Data Center
NLEB	northern long-eared bat
SERE East	Security Forces Detachment Kittery Survival, Evasion, Resistance, and Escape Facility
SERE School	Security Forces Detachment Kittery Survival, Evasion, Resistance, and Escape Facility
SM 2	Song Meter 2
U.S.	United States
USFWS	United States Fish and Wildlife Service

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1.0 INTRODUCTION

The United States Department of the Navy (Navy) Center for Security Forces Detachment Kittery Survival, Evasion, Resistance, and Escape Facility (SERE East, hereafter referred to as the SERE School or Installation) is located in Redington Township, Maine. The Installation's primary mission is to provide advanced survival training support for future aircraft carrier pilots and includes the following activities: scheduling and conducting SERE School classes including survival classes, providing liaison with other United States (U.S.) Department of Defense (DoD) activities concerning ongoing and proposed SERE School training, and conducting training for SERE School instructors. The SERE School property is strategically located to meet operational and training requirements of the Navy.

In support of established natural resources management goals and objectives that have been identified in the SERE School Integrated Natural Resources Management Plan (INRMP), the Navy is interested in establishing baseline mammal and avian information for the SERE School. This report summarizes the results of several surveys that have been completed in support of INRMP goals and objectives including winter mammal track counts, raptor migration surveys, and bat and avian acoustic surveys. Completion of these surveys directly supports the following SERE School INRMP Projects:

- **Project 22:** Conduct baseline surveys to assess the presence of mammals and invertebrates at the SERE School. Survey methods should yield a comprehensive species list and representative data for the diversity and relative abundance of mammals and invertebrates occurring at the SERE School.

- **Project 26:** Conduct periodic surveys during the appropriate season for rare, threatened, endangered, and special concern mammal species known or with the potential to occur at the Installation.

- **Project 27:** Conduct periodic surveys during the appropriate season for rare, threatened, endangered, and special concern bird species known or with the potential to occur at the Installation.

- **Project 31:** Conduct periodic golden eagle (*Aquila chrysaetos*) monitoring within suitable habitat at the SERE School. If golden eagle nest locations are identified, GPS information for these sites will be will be shared with the cooperating natural resource agencies (i.e., United States Fish and Wildlife Service [USFWS], Maine Department of Inland Fisheries and Wildlife [MDIFW]) as appropriate.

Winter mammal track count data collected for this task also indirectly supports the following SERE School INRMP Project:

- **Project 24:** Using the results of the baseline mammal survey (Project 22) and the deer population survey (Project 23), work with the SERE School Command to determine if a hunting program can be developed for the SERE School.

1.1 EXISTING SITE CONDITIONS FOR WILDLIFE

Wildlife habitats at the SERE School include a variety of aquatic and terrestrial habitats (Figure 1-1). A 1999 inventory of natural community types conducted on the SERE School property determined that approximately 97 percent (%) of the land is forested (Navy 2007). The remaining acreage (approximately 370 acres [150 hectares]) was mapped as non-forested open area predominantly consisting of edge meadow, swamps, bogs and aquatic ecosystems, alpine zones, and relatively little developed area.

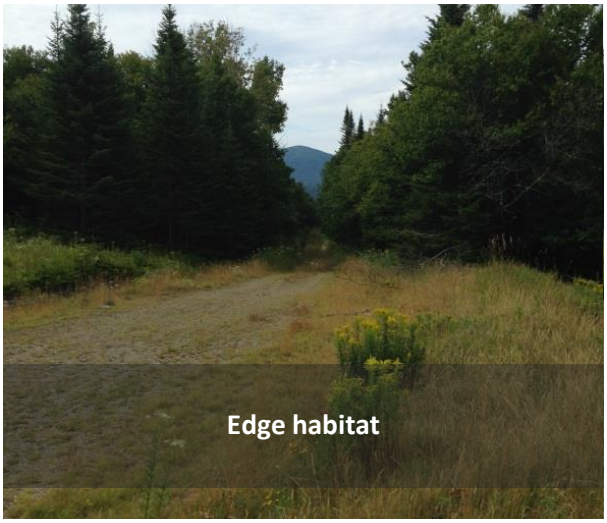


Figure 1-1. Variety of Habitats at the SERE School, Redington, Maine.

2.0 WINTER MAMMAL TRACK COUNTS

2.1 GOALS AND OBJECTIVES

The goal of the SERE School winter mammal track count surveys was to obtain baseline mammal data for species that utilize the Installation during the winter months, including the collection of data to aid in determining presence/absence of Canada lynx (*Lynx canadensis*), a federal threatened species under the 1973 Endangered Species Act (ESA). Objectives identified to support this goal included conducting winter track count surveys along four transects located throughout the property, and identification of mammals through footprints or tracks created as they travelled throughout the Installation.

2.2 METHODS

Winter track count surveys were conducted utilizing the survey methodology outlined in MDIFW's 2003–2007 Lynx Ecoregional Track Survey Protocol (MDIFW no date). A desktop review of topographic and aerial imagery for the SERE School was conducted prior to field surveys to identify potential transect locations based on accessibility and habitat type at the Installation. For the purpose of this study, we selected four survey transects with habitat and landscape characteristics preferred by Canada lynx and representative of the Installation. Transect placement was determined based on habitat discontinuities, habitat quality, and road access. When practicable, transects were sited perpendicular to major slopes to increase the likelihood of being crossed by lynx moving through the area. Transects were established using geographic information systems software and were uploaded to a global position system (GPS) unit prior to the initiation of field surveys. In total, established transects accounted for 10.1 miles (16.3 kilometers) of access road and adjacent habitats. The four transects selected included Redington Stream Road (Transect 1), Mountain Road Spur (Transect 2), Blue Line Trail (Transect 3), and Potato Nub Bluff (Transect 4) (Figure 2-1).

Days with optimal snow tracking conditions were targeted for each survey period, and survey conditions were considered optimal during the 24–48 hours following a recent snow or wind event (Figure 2-2). Surveys were conducted 24–72 hours after a snow/wind event if conditions provided clear definition of tracks. Surveys were conducted on foot with the use of skis and/or snowshoes, if necessary, to document animal tracks and sign following MDIFW methods.

Handheld GPS units were used to maintain a bearing and to document track intercepts. All tracks that occurred within 20 feet (ft) (6 meters [m]) of the center of each transect were counted, and tracks of all species encountered (target and non-target) were evaluated and identified to the lowest practicable taxonomic level (i.e., family, genus, species). Matrices collected and recorded for each track encountered included a track intercept waypoint, track length, track width, stride, straddle, sinking depth, and track quality. Additional information pertaining to gait, track pattern, presence/absence of nails, presence of urination, presence of scat, and age of track also were recorded. Additional notes were recorded in the comments portion of the data sheet. Information on snow quality and depth also was recorded to understand any effect snow conditions and depth may have on the number and conditions of tracks encountered. Photographs of representative tracks are available in Appendix A.

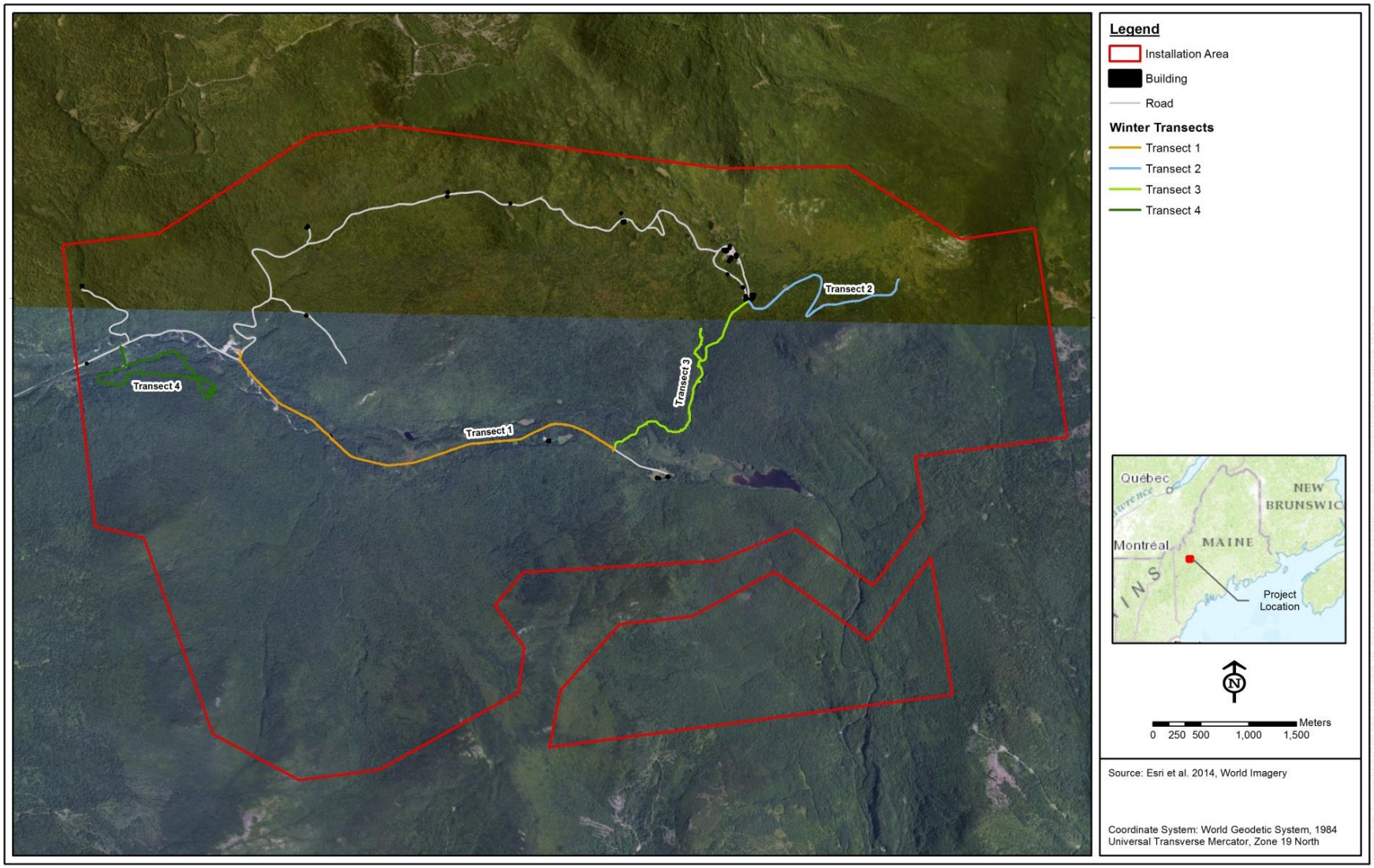


Figure 2-1. Winter Mammal Track Count Transect Locations, SERE School, Redington, Maine.

Figure 2-2. Winter Mammal Tracking Conditions, SERE School, Redington, Maine.

2.3 RESULTS

Two winter track survey events were conducted at the SERE School during February 2014. The first survey event was completed on 05 February and 06 February 2014, and the second survey was completed on 19 February and 20 February 2014. The selection of transects surveyed per tracking event was dependent on snow tracking quality, weather conditions, and access restrictions. As a result, the Redington Stream Road (Transect 1) and Mountain Road Spur (Transect 2) transects were covered during the first survey period, and the Redington Stream Road (Transect 1), Blue Line Trail (Transect 3), and Potato Nub Bluff (Transect 4) transects were covered during the second survey period. All transects were covered at least once.

On 05 February 2014 the Redington Stream Road transect tracking event was ended before reaching Redington Village and Redington Pond due to deteriorating conditions (i.e., accumulating snow). On 06 February 2014 the Redington Stream Road transect tracking event was ended after 0.5 hour of survey time due to the arrival of training personnel. Thus, the Redington Stream Road transect (Transect 1) was officially surveyed once and incidentally twice. Incidental tracks observed during these events were included in the survey results. The two survey periods resulted in a total of 13 hours and 50 minutes of survey time, covering approximately 14 miles (23 kilometers).

The tracks of 18 species were identified during the February 2014 winter track survey effort, including 13 mammalian species and 5 avian species (Table 2-1). Of the four transects surveyed, the Redington Stream Road (Transect 1) and Potato Nub Bluff (Transect 4) transects had the greatest diversity of wildlife tracks. Tracks most commonly observed include snowshoe hare (*Lepus americanus*), red squirrel (*Tamiasciurus hudsonicus*), black-capped chickadee (*Poecile atricapillus*), and mouse (*Peromyscus* sp.). Of the total number of tracks observed, snowshoe hare accounted for 50%, red squirrel accounted for 10%, and mouse species and black-capped chickadee each accounted for 7%. The remaining 26% was composed of the other 14 species.

Table 2-1. Winter Mammal Track Count Survey Results by Date, SERE School.

Common Name (Total Count)[1]	Scientific Name	Occurrence by Observation Date		Track Count by Transect (Survey Dates)			
		05 and 06 February 2014[1]	19 and 20 February 2014	Redington Stream Road (05, 06, and 19 February 2014)	Mountain Road Spur (06 February 2014)	Blue Line Trail (19 February 2014)	Potato Nub Bluff (20 February 2014)
American marten	*Martes americana*		X			2	6
American river otter	*Lontra canadensis*		X				1
American robin	*Turdus migratorius*		X	2			1
Black-capped chickadee	*Poecile atricapillus*		X	5		3	20
Bobcat	*Lynx rufus*		X				3
Common raven	*Corvus corax*		X				1
Coyote	*Canis latrans*	X		-[1]			
Long-tailed weasel	*Mustela frenata*	X	X	1	4	13	2
Meadow vole	*Microtus pennsylvanicus*	X	X	5		9	2
Moose	*Alces alces*	X[1]	X	3[1]	2	4	6
Mouse	*Peromyscus* spp.	X	X	8	6	4	7
Red squirrel	*Tamiasciurus hudsonicus*	X	X	9[1]		18	6
Red-breasted nuthatch	*Sitta canadensis*		X	1		1	4
Ruffed grouse	*Bonasa umbellus*	X		1	9		
Short-tailed weasel	*Mustela erminea*	X	X		2	3	1
Snowshoe hare	*Lepus americanus*	X	X	56[1]	15	64	35
Unknown mustelid species	*Mustela* sp.	X		-[1]			
White-tailed deer	*Odocoileus virginianus*	X		2[1]		2	

1 – Total counts for a portion of the results collected on 05 February 2014 were not recorded due to poor tracking conditions.

2.4 DISCUSSION

The presence of Canada lynx at the Installation was not detected during the 2014 winter mammal track surveys. However, of the 18 species identified, the highest abundance of track counts was attributed to snowshoe hare, a primary food source for Canada lynx. The majority of the Installation is forested, which provides adequate foraging and wintering habitat for snowshoe hare. Regenerating low-elevation spruce-fir forests, which are particularly good habitat for snowshoe hare, are patchily distributed throughout the Installation. Results of the winter track count surveys suggest that predator abundance at the Installation is not very high; there was only one occurrence of coyote tracks, and no fox or fisher tracks were observed.

The availability of the snowshoe hare as a prey species is one of several factors that can affect the presence and abundance of lynx in Maine. Survey results show that the Installation supports healthy populations of snowshoe hare; however, due to the low number of surveys (two) and survey effort (13 hours and 50 minutes of survey time), results cannot be used to determine if these populations are sufficient to support resident Canada lynx. Other factors, including habitat availability, hunting pressure, and predator abundance, also affect hare and lynx populations in Maine (Vashon et al. 2012).

The results of MDIFW's winter track surveys indicate a low potential for Canada lynx to occur in the immediate area of the Installation (Vashon et al. 2012). The absence of observations of Canada lynx during winter track surveys, in addition to available recent literature on Canada lynx home range, suggest that the Installation is not likely within the home range of resident Canada lynx, although vagrant lynx may use portions of the Installation and surrounding areas on occasion.

3.0 RAPTOR MIGRATION SURVEYS

3.1 GOALS AND OBJECTIVES

Raptor migration surveys were conducted during fall 2013 and spring 2014 to determine the spatio-temporal distribution and level of use by raptor species at the Installation, as well as to collect baseline information on eagle migration and raptor activity during the fall and spring migration periods.

Raptor Migration Survey Location

Source: D. Hengstenberg

3.2 METHODS

A standardized protocol based on HawkWatch recommended method was used to collect data on multiple aspects of each observed raptor's flight patterns (HMANA 2005). Data on seasonal timing, species, flight height, flight location, and flight type are presented and discussed. Additionally, Installation data were compared with an established raptor migration count in order to gain a greater regional perspective.

During observational surveys, the following data were recorded on standardized data sheets:

1) Species and number of birds within a 2,640-ft (800-m) radius;
2) Age and sex, when determination was possible;
3) Exact time of each observation in Eastern Daylight Time;
4) Weather data for each hour of observation including wind speed and direction, air temperature, percent cloud cover, precipitation, and visibility;
5) Flight direction, flight height, flight type, and flight location for each raptor observed (flight paths also were recorded on topographic maps of the Project area); and
6) Survey start and stop times, and total minutes of observation.

Tetra Tech biologists conducted standardized visual counts of migrating raptors from one primary location and one secondary location that provided views of the skies and surrounding areas (Figure 3-1). The primary observation point 1 was situated on a south face bluff with views to the west, southwest, south, and east, with an elevation of 2,100 ft (642 m). The secondary observation point 2 had limited views to the northeast and east and was located at an elevation of 2,575 ft (784 m). Sixteen (16) surveys were conducted from 09:00 to 15:00 hours Eastern Daylight Time within each recommended sampling window of early September to mid-December (eight surveys completed in fall 2013) and early March to mid-May (eight surveys completed in spring 2014). These time periods were targeted to sample the time of year when strong thermals develop and the majority of raptor migration activity occurs in Maine.

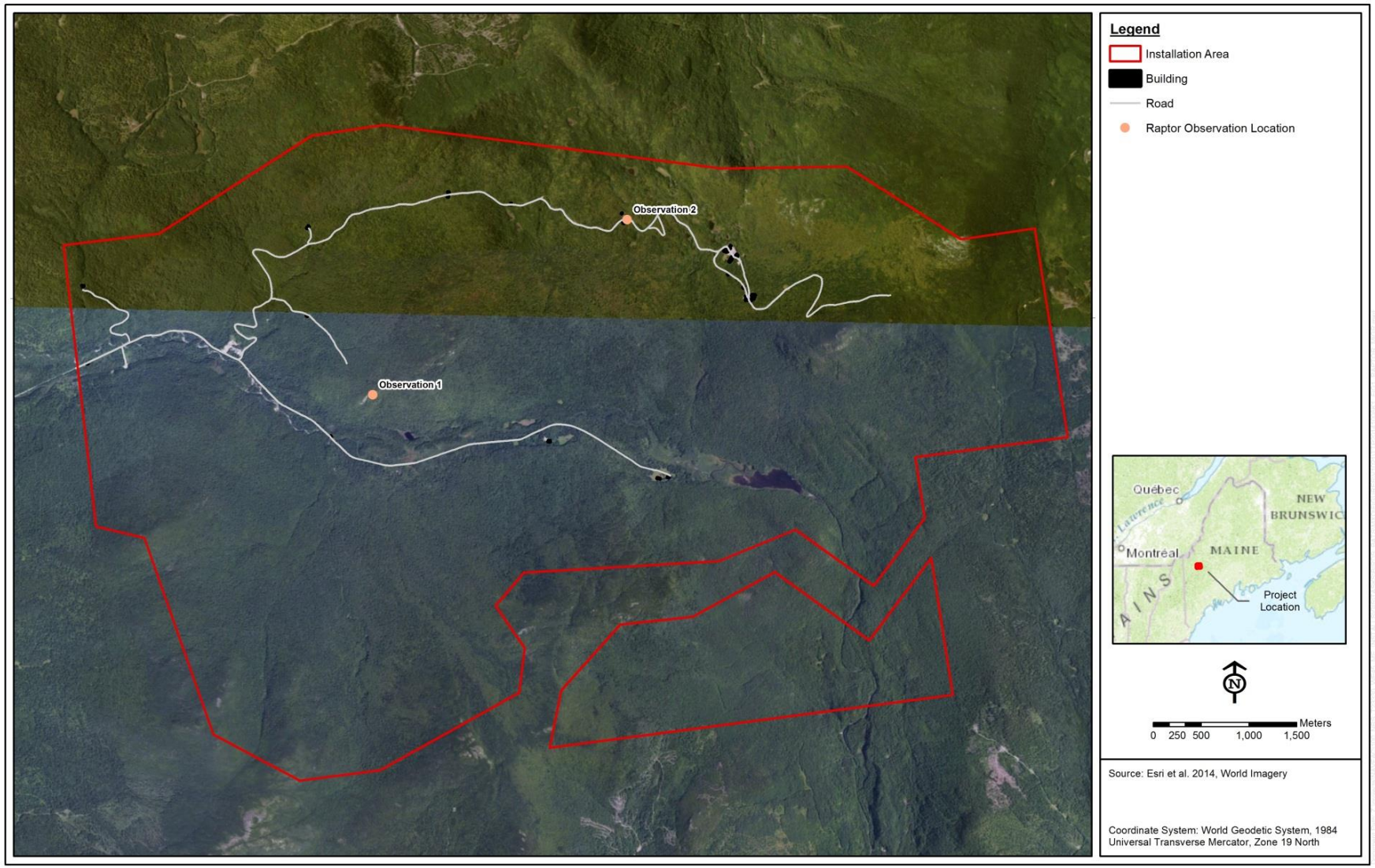


Figure 3-1. Raptor Migration Observation Locations, SERE School, Redington, Maine.

3.3 RESULTS

3.3.1 Raptor Migration Summary (Fall and Spring)

Raptor surveys were conducted by biologists in September, October, and November of 2013 (eight survey dates) and April and May 2014 (eight survey dates). Overall, 85.5 combined hours of raptor migration observations were collected in 2013 and 2014. In the fall 2013 migration period 31 raptors were observed during 43.75 hours of effort (0.71 birds/hour [hr]). In the spring 2014 migration period, approximately 51% more birds (n = 63) were encountered than in the fall during a similar survey effort (41.75 hours of observation; 1.51 birds/hr). A total of 7 species plus 3 unidentified raptors were recorded during the fall 2013 survey period, and a total of 11 species plus 5 unidentified raptors were encountered during spring 2014. The combined observation rate for both seasons was 1.11 birds/hr. Most birds were observed between the hours of 0900 and 1400 (Figure 3-2). No federally-listed threatened or endangered raptor species were observed during raptor migration surveys.

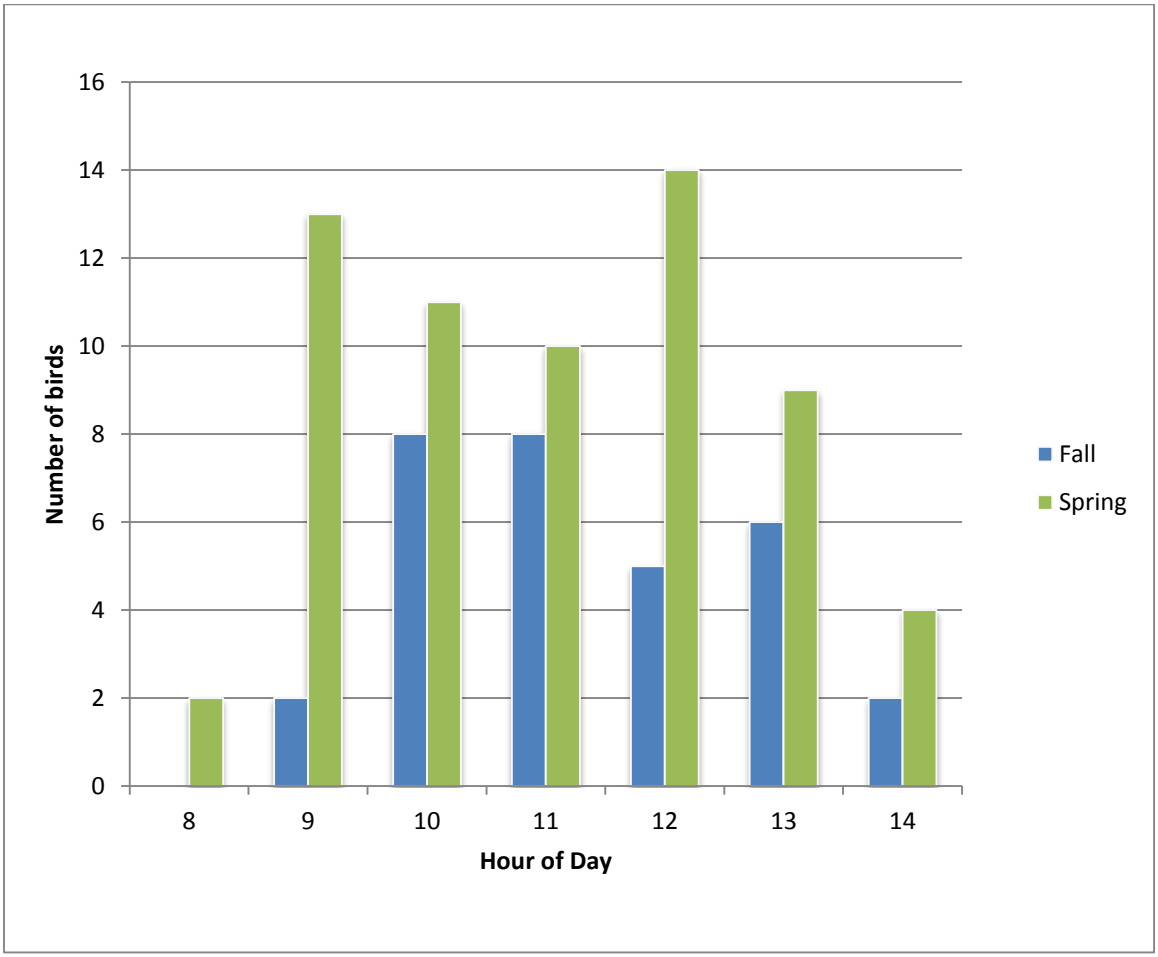


Figure 3-2. Hourly Breakdown of Raptor Migration SERE School, Redington, Maine.

3.3.2 Fall 2013

Total survey effort for the fall 2013 survey included 43.75 hours of direct, visual observation during eight days between 04 September 2013 and 21 November 2013. A total of 31 migrating raptors representing seven species, plus one unidentified raptor were recorded at varying heights above ground level and at different times of day (Tables 3-1 and 3-2). This produced an overall passage rate of 0.71 birds/hr. Daily count totals ranged from 0 to 7 birds. The highest raptor count (seven observations) was recorded on two dates: 05 September during northwest winds and temperatures reaching 66 degrees Fahrenheit (°F) (19 degrees Celsius [°C]), and on 25 September during northwest winds and temperatures reaching 50 °F and 10 °C. The lowest count (zero observations) occurred on 21 November 2013, a day with temperatures reaching only the low 30s and with upslope snow showers and winds out of the west.

Turkey vulture (*Cathartes aura* [n = 12]) and sharp-shinned hawk (*Accipiter striatus* [n = 8]) accounted for the majority of all observations (65%) during the fall 2013 surveys. Less frequently observed species include broad-winged hawk (*Buteo platypterus* [n = 3]) and Cooper's hawk (*Accipiter cooperii*) (n = 2), plus three unidentified raptors. A single bald eagle (*Haliaeetus leucocephalus*), red-tailed hawk (*Buteo jamaicensis*), and rough-legged hawk (*Buteo lagopus*) also were observed. Bald eagles are federally protected under the Bald and Golden Eagle Protection Act and are a species of concern in Maine. No federal- or state-listed ESA species were observed. There was some variation among species in the frequency of raptor observations, but generally observations spiked after the first hour of observation (09:00 to 10:00), then increased until 14:00, after which observations decreased (Figure 3-2). Weather during the fall 2013 survey season was generally clear, sunny, and dry with high pressure system movements. Prevailing winds were northwest for seven of the eight surveys. The magnitude of raptor migration at the SERE School during fall 2013 was about 10 times less than activity observed at Cadillac Mountain in Acadia National Park, Maine during the same period (Table 3-1).

Table 3-1. Raptor Migration Comparison of the Number of Raptors Observed, Fall 2013.

Fall 2013	SERE School	Cadillac Mountain, Acadia National Park
4-Sep	5	6
5-Sep	7	94
11-Sep	1	1
19-Sep	6	136
24-Sep	3	11
25-Sep	7	92
25-Oct	2	16
21-Nov	0	no count
Total	**31**	**356**

Table 3-2. Daily Summary of Migrating Raptors, Fall 2013, SERE School, Redington, Maine.

Common Name	Scientific Name	Total Observations by Date								Total
		04-Sep	05-Sep	11-Sep	19-Sep	24-Sep	25-Sep	25-Oct	21-Nov	
Bald eagle	*Haliaeetus leucocephalus*				1					**1**
Broad-winged hawk	*Buteo platypterus*		1				2			**3**
Cooper's hawk	*Accipiter cooperii*		1				1			**2**
Red-tailed hawk	*Buteo jamaicensis*							1		**1**
Rough-legged hawk	*Buteo lagopus*							1		**1**
Sharp-shinned hawk	*Accipiter striatus*		2	1	2	2	1			**8**
Turkey vulture	*Cathartes aura*	4	3		2	1	2			**12**
Unidentified raptor	-	1			1		1			**3**
Total		**5**	**7**	**1**	**6**	**3**	**7**	**2**	**0**	**31**
Survey Effort (hours)		**5.75**	**5.50**	**5.50**	**5.50**	**5.50**	**4.00**	**6.00**	**6.00**	**43.75**
Passage Rate		**0.87**	**1.27**	**0.18**	**1.09**	**0.55**	**1.75**	**0.33**	**0.00**	**0.71**

3.3.3 Spring 2014

The total survey effort for the spring 2014 survey included 41.75 hours of direct, visual observation over the course of eight days between 17 April 2014 and 14 May 2014. A total of 63 migrating raptors representing 11 species, plus five unidentified raptors, ranging from small falcon species to medium-sized hawks to eagles, were recorded at varying heights above ground level and at different times of day (Tables 3-3 and 3-4). This produced an overall observation rate of 1.51 birds/hr. Daily count totals ranged from 0 to 14 birds. The highest count of raptors (14 observations) was recorded 09 May 2014 with east southeast winds and moderate temperatures. The lowest count (zero observations) occurred on 14 May 2014, which was the last day of the spring survey effort, when winds were from the south.

Broad-winged hawk (n = 24), turkey vulture (n = 9), and sharp-shinned hawk (n = 8) accounted for the majority of all observations (65%). Less frequently observed species included red-tailed hawk (n = 5), Cooper's hawk (n = 4), and bald eagle (n = 3), as well as five unidentified raptors. A single American kestrel (*Falco sparverius*), merlin (*F. columbarius*), peregrine falcon (*F. peregrinus*), northern goshawk (*Accipiter gentilis*), and osprey (*Pandion haliaetus*) also were observed. Peregrine falcon is a state-listed endangered species. No federally-listed raptor species were observed during the spring raptor migration surveys conducted at the Installation.

There was some variation among species in the frequency of raptor observations, but generally observations spiked after the first hour of observation (09:00 to 10:00), then increased until 14:00, after which time observations decreased (Figure 3-2). Weather during the spring 2014 survey season was generally clear, sunny, and dry with high pressure system movements. Prevailing winds were south for five of the eight surveys. The magnitude of raptor migration at the SERE School during the spring was four times less than at Bradbury Mountain State Park, Maine during the same period (Table 3-3). Raptor migration surveys are not conducted at Cadillac Mountain in the spring so Bradbury Mountain State Park was chosen for the spring time comparison.

Table 3-3. Raptor Migration Comparison of the Number of Raptors Observed, Spring 2014.

Spring 2014	SERE School, Maine	Bradbury Mountain State Park, Maine
17-Apr	5	66
18-Apr	5	73
25-Apr	10	129
30-Apr	10	8
8-May	9	34
9-May	14	3
13-May	10	16
14-May	0	13
Total	**63**	**276**

Table 3-4. Daily Summary of Migrating Raptors, Spring 2014, SERE School, Redington, Maine.

Common Name	Scientific Name	Total Observations by Date								Total
		17-Apr	18-Apr	25-Apr	30-Apr	08-May	09-May	13-May	14-May	
American kestrel	*Falco sparverius*						1			**1**
Bald eagle	*Haliaeetus leucocephalus*	1		1			1			**3**
Broad-winged hawk	*Buteo platypterus*	1	1	1	9	3	5	4		**24**
Cooper's hawk	*Accipiter cooperii*			1			2	1		**4**
Merlin	*Falco columbarius*							1		**1**
Northern goshawk	*Accipiter gentilis*		1							**1**
Osprey	*Pandion haliaetus*				1					**1**
Peregrine falcon	*Falco peregrinus*			1						**1**
Red-tailed hawk	*Buteo jamaicensis*			2		3				**5**
Sharp-shinned hawk	*Accipiter striatus*	1	2	1		1	1	2		**8**
Turkey vulture	*Cathartes aura*	2	1	1		2	2	1		**9**
Unidentified raptor	-			2			2	1		**5**
Total		**5**	**5**	**10**	**10**	**9**	**14**	**10**	**0**	**63**
Survey Effort (hours)		**5.00**	**5.00**	**5.00**	**6.00**	**6.00**	**3.75**	**5.00**	**6.00**	**41.75**
Passage Rate		**1.00**	**1.00**	**2.00**	**1.67**	**1.50**	**3.73**	**2.00**	**0.00**	**1.51**

3.4 DISCUSSION

The most frequently observed species during the fall migration period were turkey vulture and sharp-shinned hawk, both of which typically use the type of habitats found at the Installation for hunting, breeding, and possibly nesting. Turkey vultures are not technically classified as raptors, but they are diurnal migrants and are ecologically similar to raptors in regard to flight patterns and migration routes. As a result, turkey vultures are routinely recorded during hawk counts nationwide. The sharp-shinned hawks typically were observed flying just above the canopy during their flights as they moved through the Installation. Broad-winged hawks and the red-tailed hawk were observed using updrafts and thermals to kite above the site and hunt for prey in the fields and wooded areas. One bald eagle was observed during the fall survey flying north to south high above the observation point. It should be noted that the primary raptor observation point used had limited views to the north, which can make observing fall migration challenging; as a result, most birds were spotted as they were moving away from the observer.

Eleven (11) species were observed during the spring period, with the broad-winged hawk being the most frequently observed species. Three bald eagles, including adults and sub-adults, were observed during surveys from mid-April to early May 2014.

Based on repeated observations of broad-winged hawks and red-tail hawks hunting and perching within the vicinity of the raptor observation point 1, it is likely both species are nesting on the Installation. The Installation provides both species adequate foraging and nesting habitat, and there was one observation of a broad-winged hawk carrying a black snake in its talons.

4.0 BAT AND AVIAN ACOUSTIC SURVEYS

The SERE school supports a diverse assemblage of bird and bat species, particularly during the spring and summer when the Installation experiences an influx of migratory species during the breeding season. Some of these avian and bat species have gained elevated conservation status by federal or state agencies, the DoD Partners in Flight program, or are classified as USFWS Birds of Conservation Concern (BCC). The number of different species included in these categories that occur on the Installation remains unclear and federal regulations mandate conservation actions for listed species.

As part of the 1988 amendment to the Fish and Wildlife Conservation Act (Public Law 100-653), the USFWS is required to identify species, subspecies, and populations of migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the 1973 ESA. According to the USFWS *Birds of Conservation Concern 2008* (USFWS 2008), the SERE school is located within the U.S. portion of the Atlantic Northern Forests region, also known as Bird Conservation Region 14. The goal envisioned by the USFWS in identifying BCC species is to stimulate the implementation of coordinated, proactive management and conservation actions among federal, state, tribal, and private partners to prevent these species from being listed under the ESA. Additionally, the BCC lists are intended to assist federal land-managing agencies and their partners in their efforts to abide by the bird conservation principles embodied in the Migratory Bird Treaty Act and Executive Order 13186 titled "Responsibilities of federal agencies to protect migratory birds" (USFWS 2008).

Expanding from traditional survey methods such as point counts and mist netting for avian and bat species, an emerging technique is the use of acoustic monitoring devices, which can be deployed to operate remotely. Typically this method involves deployment of a recording device that is programmed to record user selected time intervals for a specific duration of the survey period, followed by a review of the recordings to identify species. The DoD Partners in Flight program has recently recommended acoustic surveys to evaluate birds and bats at DoD installations (Bart et al. 2012).

New software programs have been developed that are capable of scanning audio recordings of birds and bats. Bat software programs such as Sonobat, Kaleidoscope, and BCID are commercially available and can perform auto-classification. Recent advancements in full spectrum recordings (i.e., ultrasonic recordings made at high sampling rates) produce call details such as amplitude and harmonic structure, which can improve accuracy of classification (Agranat 2012). Although automatic classification is a complex process and not without error, bat calls are relatively simplistic in structure when compared to the complexities found in avian vocalizations. Acoustic monitoring was first used to document flight calls during nocturnal migrations (Evans and Mellinger 1999). More recently, programs such as Hidden Markov Model Toolkit, Extensible Bioacoustics Tool, and Raven Pro, which display spectrograms of vocalizations, have been used to aid in identification of species like songbirds that have more complex vocalizations (Brandes 2008, Dawson and Efford 2009). Using full spectrum recordings, models have been developed on the same principles employed by bat auto-classification to identify species-specific avian vocalizations to assist and streamline the process of manual review (Venier et al. 2012, Rempel et al. 2013, Wildlife Acoustics 2013). Song Scope is a commercially available software package that allows users to create recognizer models for species-specific vocalizations. Due to the sheer

volume of avian species and inherent complexities associated with their vocalizations, no package has been developed that includes a recognizer library similar to analogous bat identification programs. Therefore, Song Scope is not a stand-alone identification package but a tool to locate potential vocalizations of target species and streamline review of large quantities of data.

4.1 GOALS AND OBJECTIVES

The objective of the bat and avian acoustic surveys was to identify baseline bat and avian species information for the Installation, with a focus on 1) identifying species of elevated conservation concern that have the potential to occur at the Installation, and 2) determining overall species richness and abundance using acoustic monitoring devices and vocalization recognition software. Identifying the occurrence of sensitive species will provide information to inform management decisions on the Installation and ensure that actions are in compliance with the Migratory Bird Treaty Act and state and federal ESAs.

4.2 METHODS

Standardized protocols have been established for passive acoustic surveys undertaken to evaluate bat species risk at wind energy facilities in Maine and elsewhere, and DoD has developed the Coordinated Bird Monitoring Program for conducting bird acoustic surveys (Bart et al. 2012). Tetra Tech followed these protocols for completion of the bat and avian acoustic surveys at the Installation.

Reviews of Installation habitat data and bat species life history characteristics and ranges also were conducted to identify the bat species most likely to occur. Specific survey methodologies were then developed that would adequately evaluate bat and avian species that occur at the SERE School over the course of one year. The surveys were designed so that they can be repeated for future bat and bird inventories. Table 4-1 provides a summary of the desktop analysis of bat species likely to occur at the Installation.

Table 4-1. Bat Species and the Likelihood of Occurrence, SERE School, Redington, Maine.

Likelihood of Occurrence	Reason for Likelihood	Common Name	Scientific Name	Protection Status	Habitat Association
High	Suitable habitat, species range overlaps within Project area, and known occurrences in adjacent counties to Project area.	Big brown bat	*Eptesicus fuscus*	–	Habitat generalist found in a variety of habitats, including agricultural croplands; associated with human habitation structures
High	Suitable habitat within Project area, species range overlaps with Project area, and known occurrences in adjacent counties to Project area.	Eastern red bat	*Lasiurus borealis*	Maine Species of Special Concern	Found in hardwood deciduous forests; Generally found in close association with riparian areas.
High	Suitable habitat within Project area, species range overlaps with Project area, and known occurrences near Project area	Hoary bat	*Lasiurus cinereus*	Maine Species of Special Concern	Forested upland habitats, including mixed northern hardwoods.
High	Suitable habitat within the Project area and species range overlaps with Project area.	Silver-haired bat	*Lasionycteris noctivagans*	Maine Species of Special Concern	Closely associated with conifer and mixed hardwood forests; Generally found in association with riparian areas.
High	Suitable habitat within the Project area and species range overlaps with Project area.	Eastern small-footed bat	*Myotis leibii*	Maine Species of Special Concern	Closely associated with conifer and mixed hardwood forests; Generally found in association with riparian areas, and rocky outcroppings or talus slopes.
High	Suitable habitat within the Project area and species range overlaps with Project area.	Little brown bat	*Myotis lucifugus*	Maine Species of Special Concern	Found in close proximity to a water source for foraging and in close proximity to manmade structures.
High	Suitable habitat within the Project area and species range overlaps with Project area.	Northern long-eared bat	*Myotis septentrionalis*	USFWS Proposed Endangered, Maine Species of Special Concern	Found in dense forest areas and forages in a variety of habitats. Closely associated with cave structures.
High	Suitable habitat within the Project area and species range overlaps with Project area.	Tricolored bat [formerly eastern pipistrelle]	*Perimyotis subflavus [*formerly *Pipistrellus subflavus]*	Maine Species of Special Concern	Found along edge habitats between agricultural croplands and native grassland

4.2.1 Passive Acoustic Monitoring

Acoustic monitoring was conducted during the fall of 2013 (01 September–31 October) and again during the spring and summer of 2014 (18 April–31 August) to provide activity information for a complete seasonal warm period for both birds (spring migration, breeding, fledging, fall migration) and bats (spring migration, parturition, volancy, and fall migration). Four bat and avian acoustic monitoring stations were established at our sites (Figure 4-1) within the installation in a variety of habitat types (Figure 4-2). Each of the detectors was visited monthly to ensure units were functioning properly and to download data.

Figure 4-1. Wildlife Acoustic Detectors, SERE School, Redington, Maine.

Sampling locations were chosen based on representative habitats and elevations within the Installation, areas with potential for high bat activity, and areas available for access under existing Installation security requirements and guidelines.

- **Site 1** was located adjacent to Redington Road in a riparian area dominated by alder, willow, spirea, and sedges (elevation 1,620 ft [500 m]). Redington Stream meanders past the station approximately 197 ft (60 m) to the east.

- **Site 2** was located at the northern edge of Redington Pond and flanked by willows and alder to the north and west and open water to the south and east (elevation 1,620 ft [494 m]).

- **Site 3** was located on the western edge of a beaver pond surrounded by predominantly mature spruce and fir (elevation 2,391 ft [729 m]).

- **Site 4** was located in a small, grassy clearing surrounding by mature birch, fir, and spruce (elevation 2,620 ft [798 m]).

Wildlife Acoustic Inc. Song Meter 2 (SM 2) passive acoustic monitoring detectors were used for monitoring both bat and avian species. Each detector was equipped with dual microphones—one devoted to bats and other to birds—to allow for simultaneous recording of each taxon. A customized recording program was developed for avian species that made recordings in 30-minute blocks; it began recording 30 minutes prior to sunrise for three hours, and then again in the evening for an additional three hours, ending 30 minutes after sunset for a total of six hours of recordings per detector per day. The customized bat recording was programmed to begin recording 45 minutes before sunset and stop recording 45 minutes after sunrise each day. The bat recording program fundamentally differs in that recordings are triggered by a series of calls identified as potential ultrasonic echolocation bat calls, and a recording is made of that single event—typically only several seconds long. In contrast, the avian recordings capture all potential vocalizations and ambient noise for the sampling window.

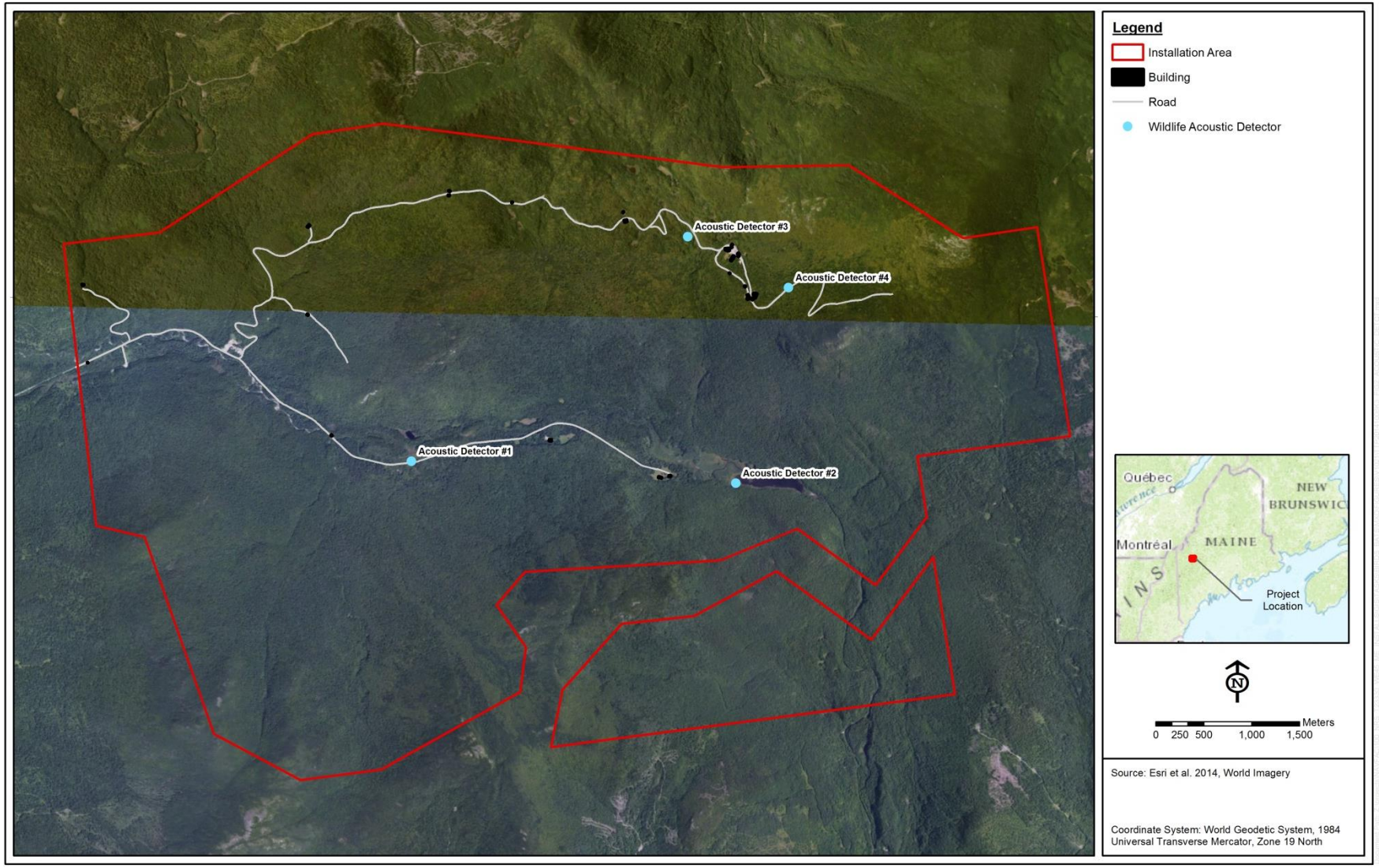


Figure 4-2. Wildlife Acoustic Detector Locations, SERE School, Redington, Maine.

All recordings were made using .wav file format; avian recordings used a sampling rate of 44,100 hertz (Hz) and bat recordings used a much higher sampling rate of 256 kilohertz. Each detector set-up consisted of a SM 2 acoustic detector affixed to a metal stake 3.3 ft (1.0 m) above ground and was powered by a 10–20-watt solar panel and 12-volt DC marine battery encased in waterproof housing. Two microphones—one to record bats and the second to record birds—with insulating foam were attached to the SM 2 on a pole extending from the stake to a height of 6.6 ft (2.0 m) to reduce ambient noise and avoid vegetation obstructing sound waves. Detector microphones were angled at 45 degrees above ground to facilitate recording of the airspace above and adjacent to the detector. The effective range of the microphone varies depending the physical sampling environment (amount and type of surrounding vegetation), atmospheric conditions (rain, relative humidity), ambient noise (waves, etc.), and wind. Depending on species' call frequencies and atmospheric conditions, most calls can be detected at distances greater than 98 ft (30 m) with a likely maximum of 328 ft (100 m) (Wildlife Acoustics 2013).

4.3 DATA ANALYSIS

4.3.1 Bats

Tetra Tech used Sonobat 3.2.0 NNE software (Sonobat, Inc.) to analyze all potential bat calls recorded during the survey period. Sonobat utilizes full spectrum ultrasonic recordings made at high sample rates (256 kilohertz). Using full spectrum data, spectrograms display detailed information such as frequency sweep harmonics and power distribution of signals within echolocation calls. These attributes provide details necessary to accurately classify calls to the species level—information not available with zero cross recordings. Prior to analysis, data were filtered using the "scrubber utility" to omit files with excessive noise or poor quality calls. The Sonobat classifier was set to a "discriminate probability threshold" of 0.9, an "acceptable quality" of 0.7, and an "acceptable quality for tally" of 0.1. Only call sequences with five or more pulses within 15 seconds were included in the analysis because these are more likely to provide sufficient information upon which to base a species-level classification. Shorter call sequences are less likely to exhibit the full suite of characteristics required to accurately classify a *Myotis* species or other type of call sequence.

To be thorough in our analysis and be in compliance with the methods for bat acoustic data analysis recommended by USFWS in the Indiana Bat Guidelines (USFWS 2014a), which is applicable to northern long-eared bat (NLEB) per the NLEB Guidance (USFWS 2014b), all potential bat calls recorded during the survey period were analyzed using Kaleidoscope 2.1.0 (Bats of North America; Wildlife Acoustics, Inc). The USFWS recommends that acoustic data be analyzed using a combination of any two approved candidate software programs. USFWS is currently working with other federal agencies to evaluate automated call classification software programs; therefore all software programs available for use at the time of this report are considered "candidate" programs. All data recorded at Sites 1–4 were processed using classifiers for species with potential for regional occurrence. Data were analyzed using Kaleidoscope to provide a comparison with Sonobat results and test the program's efficacy of accurately classifying *Myotis* calls—which have similar characteristics and typically are more difficult to identify at the species level. All calls classified as northern long-eared bat by Kaleidoscope were then viewed and manually vetted within Sonobat.

Bats are known to produce different echolocation calls depending on the micro-habitat conditions. Some call sequences can be difficult to classify due to the overlap in call pulse characteristics across species (Table 4-2). Species with calls less than 40 kilohertz, such as hoary bat (*Lasiurus cinereus*), emit calls that are distinct in slope, duration, characteristic frequency, and frequency range (i.e., parameterizations) and we have high confidence in Sonobat's ability to accurately classify these species. However, for other species, particularly those of the *Myotis* genus, it is difficult to accurately differentiate among species based on call sequence characteristics due to the similarities in call parameters. Nevertheless, it is often possible to make accurate classification inferences based on good quality calls of species that are typically more difficult to distinguish, such as little brown bat (*Myotis lucifugus*) and northern long-eared bat (*Myotis septentrionalis*). Call sequences of eastern red bat (*Lasiurus* borealis) also are often unique, but occasionally appear similar to *Myotis* species, especially if the recording is of poor quality.

Table 4-2. Bat Species/Species Group Classification Use for Analysis of Passive Acoustic Monitoring Data, SERE School, Redington, Maine.

Group	Character Frequencies	Species
Low Frequency	12 kHz–24 kHz	Hoary bat
Middle Frequency	24 kHz–38 kHz	Big brown bat Silver-haired bat
High Frequency (non-*Myotis* species)	44 kHz–45 kHz	Eastern red bat Tri-colored bat
High Frequency (*Myotis* species)	46 kHz–52 kHz	Little brown bat Eastern small-footed bat Northern long-eared bat

Following the automated classification of call sequences using Sonobat, we conducted a qualitative analysis of all probable *Myotis* species call sequences that were automatically classified, per the Indiana Bat Guidelines (USFWS 2014b). Each call that was classified as a *Myotis* species or eastern red bat by Sonobat, was visually (e.g., qualitatively, manually) compared to a call library for the suspected species. Automated classification coupled with manual review allows for relatively accurate identification of bat species (O'Farrell et al. 1999, O'Farrell and Gannon 1999). All high frequency call sequences also were qualitatively reviewed. Characteristic frequency (Fc), slope, maximum apparent frequency, and duration, among other metrics, were evaluated during the qualitative analysis (Szewczak 2011). The Indiana Bat Guidelines suggest the use of qualitative vetting of the recorded call sequences for the final classification to species level, and permit visual confirmation to overrule quantitative analysis results (USFWS 2014a). Results from automated classification and the qualitative analysis are presented in Section 4.4.2.

4.3.2 Birds

Song Scope

Avian acoustic data were collected in .wav file format. WAV files were then analyzed using Song Scope Version 4.3 software (Wildlife Acoustics Inc.), which identifies vocalizations of target species, greatly reducing time for manual review. Twelve (12) avian species were targeted for analysis because they are of elevated state or federal conservation status (USFWS 2008, MDIFW 2014) and are known to occur to occur on the Installation from previous studies (Navy 2007) or have a high likelihood of occurrence based on regional ebird records (Sullivan et al. 2009). Species-specific recognizers were trained using reference calls gathered from the Cornell Lab of Ornithology's Macaulay Library and additional species-specific files that were sent by request (Cornell University 2014) and built on very specific characteristics such as frequency range, song length, syllable length, syllable gap, dynamic range, and complexity. Song Scope provides a quantitative measure of recognizer effectiveness with cross training values and associated standard deviations based on model fit and these values were used to guide the model building process.

A unique recognizer is required for vocalizations with considerable variation. Therefore, we built recognizers for vocalization types that have the highest likelihood of detection by species. For most species, this meant that their prototypical song was used (regional recordings were selected from the Macaulay Library when available to account for variation in dialect). However, the black-backed woodpecker's (*Picoides arcticus*) "drum" and black-crowned night-heron's (*Nycticorax nycticorax*) "wok-call" were used because their song types are infrequent and non-distinct. Numerous unique recognizers were initially developed and tested for the 12 avian species of concern before initiating analysis with the final group with an average training score of 79.2% and +/- 3.2 standard deviation (Table 4-3). Field recordings were scanned with each recognizer that identified vocalizations containing similar characteristics, generating a summary of positive results or "hits." Results included true positives (correct detections), false positives (misclassifications), and false negatives. Parameter settings were dialed to include a manageable number of false positives and to avoid missing false negatives. Each hit was then manually reviewed visually on the spectrogram, and aurally to verify species identification.

From previous studies and initial tests, we found that processing time is a limiting factor with automated classification in Song Scope; a single 30-minute recording takes on average 1.25 minutes to process with a single recognizer. This seems like a manageable value but given the duration of the survey multiplied by the number of detectors and number of recognizers, it would take 1,881.6 hours or 78.4 straight days in processing time alone. To truncate the original sample size, a set of filters involving four steps was established for the acoustic dataset. In the first step, we screened out all days that received greater than 1 centimeter (0.39 inch) of precipitation (National Climatic Data Center [NCDC] 2014, as singing activity would naturally be lower on those days, and the ambient noise of rainfall on the microphone makes vocalization identification difficult. For spring and summer data we then we selected the first hour of daily recordings because vocalizations are typically highest during the dawn chorus (Alldredge et al. 2007). For fall data, the second hour of recordings were selected as vocalizations increase slightly following dawn once cooler temperatures begin to rise (Parrish, personal observation). Third, only species with a high likelihood of occurrence, detection, and unique vocalizations that could be reasonably identified in the Song Scope environment were included in analysis. Lastly, we ran the species recognizers

only at sites located in habitats where species had potential to occur. For example, recognizers for species associated with open water were not run at Site 4 because there is only forested habitat.

Data were processed in batches based on season and/or acoustic monitor location, which allows for spatially explicit results and reduced software processing errors (very large batch sizes caused the program to crash). Recordings made at a single site were scanned by one recognizer at a time to produce a summary of hits, which were then manually reviewed visually on a spectrogram, and aurally to confirm or reject positive species identification.

Table 4-3. Initial Song Scope Recognizer Parameters and Test Results for the 12 Species of Interest, SERE School, Redington, Maine.

Species	Type	Total Training	SD	Model Performance	Likelihood of Detection	Likelihood of Occurrence
American redstart	song	77.46	1.69	Good	High	Known
Black and white warbler	song	74.31	2.14	Excellent	High	Known
Black-backed woodpecker	drum	85.32	4.55	Good	High	Moderate
Black-crowned night-heron	wok call	81.69	6.60	Good	Low	Known
Bicknell's thrush	song	77.78	1.88	Adequate	Moderate	Known
Blackpoll warbler	song	83.50	2.95	Excellent	High	Known
Canada warbler	song	74.83	2.19	Poor	Moderate	Moderate
Fox sparrow	song	77.44	3.85	Adequate	Moderate	Low
Grasshopper sparrow	song	84.32	2.36	Adequate	Moderate	Low
Rusty blackbird	song	76.11	3.53	Poor	Moderate	Known
Sedge wren	song	79.37	2.07	Good	Low	Low
Wood thrush	song	77.99	4.75	Poor	High	High

Manual Review

Use of automated recognition software like Song Scope is used to reduce the amount of time typically required for manual review of acoustic recordings over a broad temporal scale by highlighting vocalizations with a high probability of being a target species. However, use of recognition software does not obviate the need for manual review. In order to determine overall species richness (i.e., the number of different species occurring within a given area) and abundance at the Installation, we manually reviewed a subsample of all recordings using an approach very similar to a traditional point-count survey. In addition, this review served as an efficacy test on recognizer performance by confirming a lack of detections for some of the targeted species.

We divided acoustic recordings made at the Installation into three seasons: spring (30 April–17 June), summer (30 June–20 August), and fall (05 September–24 October). During each season five 10-minute intervals were selected for a total of 15 repeated samples at each detector location. The following criteria were used for sample selection: (1) no rainfall was recorded on the sample day (NCDC 2014), (2) the first 10 minutes of the morning's second recording was used (i.e., start time is 10 minutes following sunrise), and (3) days were spaced at approximately two weeks apart

within each sample window. The 10-minute intervals were manually reviewed visually on the spectrogram, and aurally to determine the total number of species and individuals at each detector location by season. Totals were then used to calculate species' frequency of occurrence and diversity indices among detector sites.

4.4 RESULTS

The quantitative and qualitative (or manual) results of the acoustic survey are presented separately for the data analysis using Sonobat and the data analysis using Kaleidoscope. Both analyses used the same full spectrum dataset in the native .wav file format. Given the elevated concern for NLEB, we consider the qualitatively vetted Sonobat results the definitive results due to Sonobat's proven capacity to more accurately classify *Myotis* species (Chenger 2014). These classifications were then further divided into seasons (spring, summer, fall) to gauge activity levels during migratory and breeding/volancy periods. Also provided are activity rates (call sequences per detector-night), which are a normalized index of activity across detector locations regardless of sampling effort.

4.4.1 Survey Effort – Bats

During the 2013 and 2014 bat acoustic monitoring study a total of 784 detector nights were sampled over the course of 61 calendar nights between the nights of 01 September and 31 October 2013, and 135 calendar nights between the nights of 18 April and 31 July 2014.

4.4.2 Species Present – Bats

Quantitative Full-Spectrum Analysis

The results of the Sonobat software quantitative analysis program resulted in 2,093 bat call sequences on which the program was able reach consensus between the mean pulse classification and "by vote" classification algorithms. Of these, 148 (7.0%) call sequences were classified as *Myotis* species (Table 4-4). Only two of these call sequences were classified as northern long-eared bat (NLEB) and the remainder were little brown bat. All of the *Myotis* calls contained sufficient information on which to make an accurate classification to species level during the subsequent qualitative analysis. Other species identified by Sonobat included big brown bat (*Eptesicus fuscus*), eastern red bat (*Lasiurus borealis*), hoary bat, silver-haired bat (*Lasionycteris noctivagans*), and tri-colored bat (*Perimyotis subflavus*). The majority of calls identified by Sonobat were silver-haired bat (n = 775; 37.03%), followed closely by big brown bat (n = 644; 30.77%) and hoary bat (n = 469; 22.41%) (Table 4-4).

The results of the Kaleidoscope software quantitative analysis program identified 3,401 bat call sequences to the species level. Of the 3,401 total call sequences, 156 (7.07%) call sequences were classified as Myotis species (Table 4-5). The majority were classified as little brown bat followed by northern long-eared bat with 33 call sequences and eastern small footed bat with 11 call sequences. The remainder of species identified included big brown bat, eastern red bat, hoary bat, silver-haired bat, and tri-colored bat. The majority of calls identified by Sonobat were silver-haired bat (n = 1612; 47.39%), followed by hoary bat (n = 838; 24.64%) and big brown bat (n = 681; 20.02%) (Table 4-5).

Table 4-4. Quantitative 2013 and 2014 combined Sonobat Results, SERE School, Redington, Maine.

Species	Site 1	Site 2	Site 3	Site 4	Total
Big brown bat	590	33	12	9	644
Eastern red bat	15	10	9	6	40
Hoary bat	145	127	67	130	469
Silver-haired bat	595	134	27	19	775
Little brown bat	52	61	12	21	146
Northern long-eared bat	0	2	0	0	2
Tri-colored Bat	1	12	1	1	15
Total	**1,398**	**379**	**128**	**188**	**2,093**

Table 4-5. Quantitative 2013 and 2014 combined Kaleidoscope Results, SERE School, Redington, Maine.

Species	Site 1	Site 2	Site 3	Site 4	Total
Big brown bat	649	16	8	8	681
Eastern red bat	33	37	12	12	94
Hoary bat	502	191	7	138	838
Silver-haired bat	1,254	288	49	21	1,612
Eastern small-footed bat	3	6	1	1	11
Little brown bat	42	48	8	14	112
Northern long-eared bat	15	11	4	3	33
Tri-colored Bat	0	14	1	5	20
Total	**2,498**	**611**	**90**	**202**	**3,401**

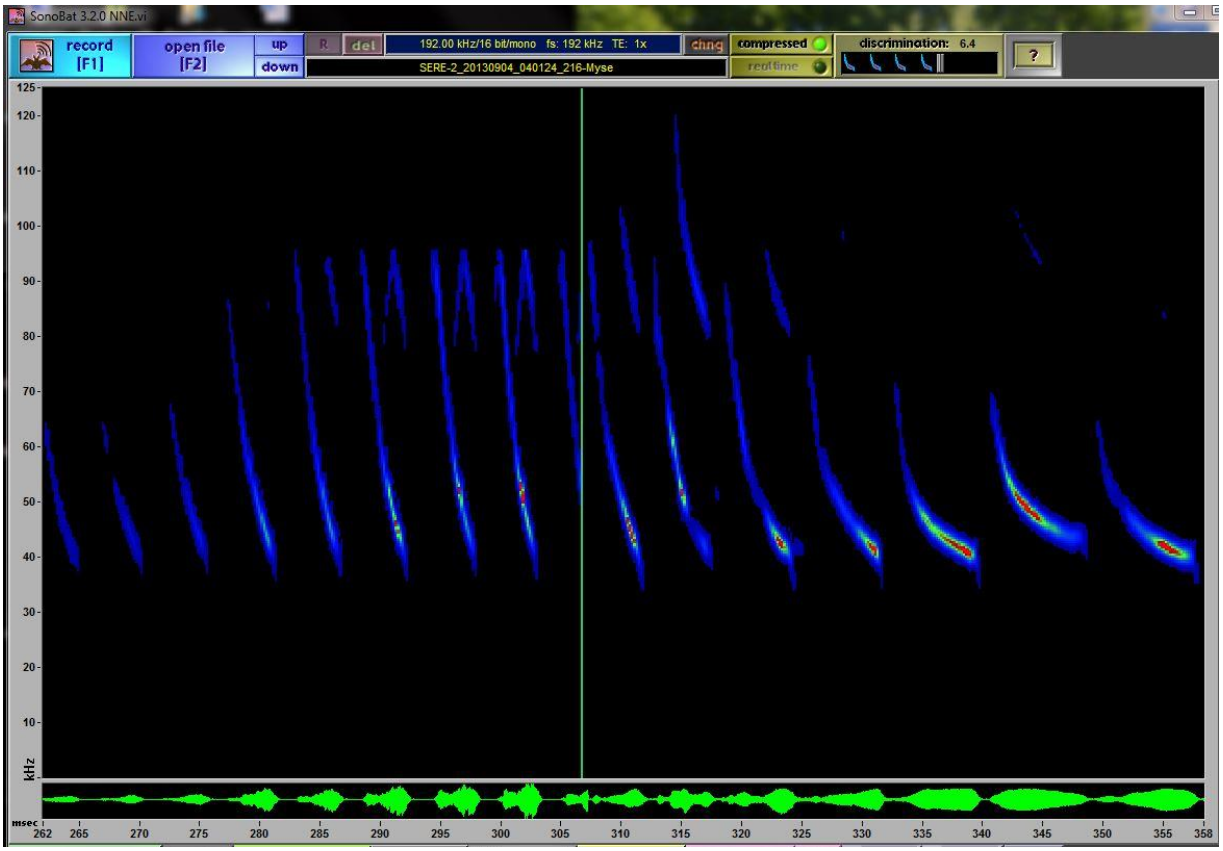
Qualitative Full-Spectrum Analysis

Following the Sonobat analysis, all call files identified as *Myotis*, eastern red bat, and tri-colored bat were manually reviewed in their native full-spectrum (.wav) format. The majority of the classifications were determined to be accurate with only minor modifications (Table 4-6). Four tri-colored bat calls were determined to be eastern red bat, and one tri-colored bat was determined to be little brown bat. Most notably, two call sequences classified as NLEB by Sonobat were determined to be little brown bat upon further review (Figure 4-2). This particular example was likely a "feeding buzz" created by a little brown bat near the microphone, hence the steep sweeps that resemble NLEB calls. When the entire event was reviewed for these two call sequences, there were abundant sweeps and harmonics that were registered at frequencies below those characteristic of NLEB.

All bat call sequences identified as NLEB were manually viewed in Sonobat to determine if Kaleidoscope classification was correct based on characteristics of call structure and using comparisons in the call reference library (Table 4-7). Only one of the 33 calls was within the frequency range and slope that is unique to NLEB but lacked adequate characteristics to positively identify it as NLEB and was classified as NLEB or little brown bat. The remainder of the calls belonged to little brown and big brown bats.

Table 4-6. Qualitatively Vetted Sonobat Results 2013 and 2014 combined, SERE School, Redington, Maine.

Species	Site 1	Site 2	Site 3	Site 4	Total	% Occurrence
Big brown bat	590	33	12	11	646	30.86%
Eastern red bat	15	13	9	7	44	2.10%
Hoary bat	145	127	67	130	469	22.41%
Silver-haired bat	595	134	27	19	775	37.03%
Little brown bat	52	63	12	22	149	7.12%
Tri-colored Bat	1	9	1	0	10	0.48%
Total	**1,398**	**379**	**128**	**189**	**2,093**	



The left pane is a portion of the call event identified as northern long –eared bat (NLEB) and the right pane is a compiled reference view of little brown bat calls.

Figure 4-3. Manual review of call sequence classified as NLEB by Sonobat.

Table 4-7. Qualitatively Vetted Kaleidoscope Results 2013 and 2014 combined, SERE School, Redington, Maine.

Species	Site 1	Site 2	Site 3	Site 4	Total	% Occurrence
Big brown bat	654	20	10	8	692	20.35%
Eastern red bat	38	37	12	12	99	2.91%
Hoary bat	502	191	7	138	838	24.64%
Silver-haired bat	1,255	288	49	21	1,613	47.43%
Eastern small-footed bat	3	6	1	1	11	0.32%
Little brown bat	46	55	10	16	127	3.73%
Northern long-eared bat or little brown bat	0	0	0	1	1	0.03%
Tri-colored Bat	0	14	1	5	20	0.59%
Total	**2,498**	**611**	**90**	**202**	**3,401**	

4.4.3 Call Rates and Temporal Distribution – Bats

Of the total 2,093 bat call events, relatively few calls were recorded during the spring (12.71%) and fall (7.26%) migratory periods (Tables 4-8 and 4-10). The vast majority of the calls (72.81%) were recorded in the summer period (Table 4-9). Activity rates (total number of call events/ detector nights) followed a similar trend with the highest overall rates found in the summer with rate of 5.01 calls per detector per night (Figure 4-3). Peak summer activity occurred on the nights of 12 and 13 August with a total of 112 and 118 bat calls recorded among detectors, respectively. Spikes in the number of calls also occurred on 15 May and 02 July with 56 and 65 calls, respectively. The total number of calls recorded and rates of activity varied widely by season and detector location. The highest rates of activity were recorded at Site 1 located adjacent to Redington Road and Stream, with an average of 14.78 call events per night.

Table 4-8. Qualitatively Vetted Sonobat Results Spring Period 2014 (4/18–6/15), SERE School, Redington, Maine.

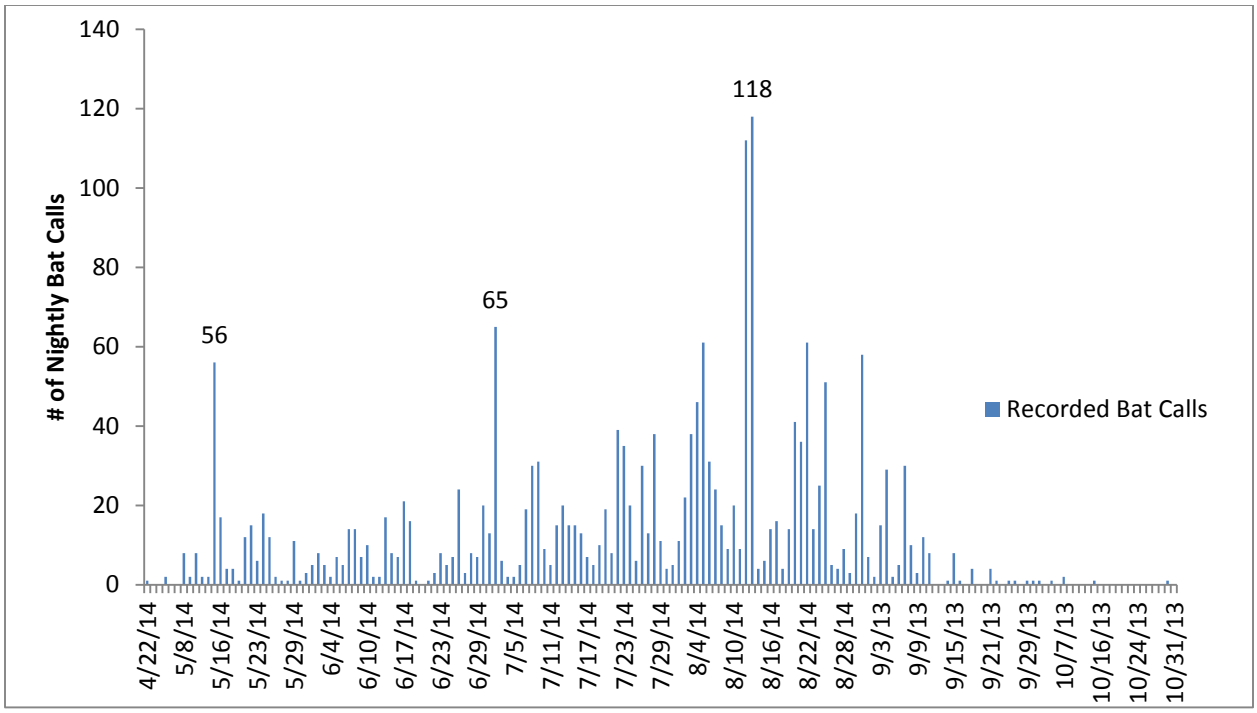
Species	Site 1	Site 2	Site 3	Site 4	Total
Big brown bat	0	0	0	2	2
Eastern red bat	0	0	0	1	1
Hoary bat	19	83	21	80	203
Silver-haired bat	3	16	5	6	30
Little brown bat	23	6	0	1	30
Total	**45**	**105**	**26**	**90**	**266**
Activity Rate	**0.76**	**1.78**	**0.44**	**1.53**	**1.13**

Table 4-9. Qualitatively Vetted Sonobat Results Summer Period 2014 (6/16–8/31), SERE School, Redington, Maine.

Species	Site 1	Site 2	Site 3	Site 4	Total
Big brown bat	522	29	12	7	570
Eastern red bat	11	9	6	5	31
Hoary bat	100	64	43	43	250
Silver-haired bat	452	106	10	6	574
Little brown bat	38	40	6	12	96
Tri-colored Bat	0	3	0	0	3
Total	**1,123**	**251**	**77**	**73**	**1,524**
Activity Rate	**14.78**	**3.30**	**1.01**	**0.96**	**5.01**

Table 4-10. Qualitatively Vetted Sonobat Results Fall Period 2014 (9/1–10/31), SERE School, Redington, Maine.

Species	Site 1	Site 2	Site 3	Site 4	Total
Big brown bat	15	3	0	1	19
Eastern red bat	2	4	2	2	10
Hoary bat	15	4	4	2	25
Silver-haired bat	51	8	7	1	67
Little brown bat	1	18	3	3	25
Tri-colored Bat	0	5	1	0	6
Total	**84**	**42**	**17**	**9**	**152**
Activity Rate	**1.38**	**0.69**	**0.28**	**0.15**	**0.62**



Note that 2013 data were included in line with 2014 data to provide trend of activity levels across a complete warm season.

Figure 4-4. Number of Bat Calls Cumulatively Recorded among Detectors at Sites 1–4 by Night for the Periods 18 April –31 August 2014 and 1 September – 31 October 2013, SERE School, Redington, Maine.

4.4.4 Song Scope – Birds

During the survey period, passive avian acoustic recordings were collected on 196 days at all four sites from 01 September to 31 October 2013 and 18 April to 31 August 2014. Over the course of the survey period, 23 days received greater than 1.0 centimeter (0.39 inch) of rain and were not included in analysis. A total of 1,384 field recordings (692 hours) from the four acoustic monitors were analyzed in Song Scope using recognizers for 12 species. At the rate of 1.25 minutes/file, the total processing time for each recognizer was 29 hours, or approximately 351 hours for all 12 recognizers (calculations based on analysis at all four detectors with 12 recognizers).

A total of 589 vocalizations were recognized as target species by Song Scope for 2013 fall data. The majority of these were for American redstart (*Setophaga ruticilla*) (n = 301), followed by rusty blackbird (*Euphagus carolinus*) (n = 108) and wood thrush (*Hylocichla mustelina*) (n = 85). All of the Song Scope hits were considered false positives after manual review. These three species have complex song types and are more prone to have similarities to other species. A range of species and vocalizations triggered hits for these species including black-capped chickadees (*Poecile atricapillus*), American robin (*Turdus migratorius*), yellow-bellied sap sucker (*Sphyrapicus varius*), and red-eyed vireo (*Vireo olivaceus*). Other species with more consistent vocalizations, such as black and white warbler (*Mniotilta varia*) (n = 25) and grasshopper sparrow (*Ammodramus savannarum*) (n = 10), consistently triggered the common black-capped chickadee "tseet" call (Foote et al. 2010) and buzzy insect noise, respectively.

Analysis of 2014 spring and summer data yielded a total of 3,761 hits classified by Song Scope as target species vocalizations (Table 4-11). Note that this does not include results for Canada warbler (*Cardellina canadensis*), rusty blackbird, or wood thrush. Due to these species' complex song types there was a preponderance of false positives. For example, analysis of data for Site 1 with the wood thrush recognizer triggered 7,105 hits. Review of a subsample of hits revealed only false positives. Similar results were observed for rusty blackbird and Canada warbler. High numbers of vocalizations were also recognized for other target species with relatively complex songs including the Bicknell's thrush (*Catherus bicknelli*) (n = 318), fox sparrow (*Passerella iliaca*) (n = 755), and sedge wren (*Cistothorus platensis*) (n = 842). All hits for these species were determined to be false positives during complete review. Hits for black-crown night-heron (*Nycticorax nycticorax*) vocalizations at Sites 1 and 2 were all false positives as well, the majority of which were attributed to American crow (*Corvus brachyrhynchos*) and common raven's (*Corvus corax*) ubiquitous demonstrative "caw" vocalization, which is strikingly similar to the black-crowned night-heron's "wok" call. Manual review of hits for American redstart (n = 642), black and white warbler (n = 13), and blackpoll warbler (*Setophaga striata*; n = 971) confirmed that Song Scope correctly classified vocalizations for these species 37%, 24%, and 100% of the time, respectively.

Table 4-11. Recognizer Results from fall (9/1–10/31) 2013 Song Scope Analysis, SERE School, Redington, Maine.

Species	Site 1		Site 2		Site 3		Site 4		Total	
	Hits	Positive id	Hits	Positive id	Hits	Positive id	Hits	Positive id	Hits	Positive id
American redstart	96	0	118	0	36	0	51	0	301	0
Black and white warbler	5	0	4	0	9	0	7	0	25	0
Black-backed woodpecker	0	0	0	0	0	0	0	0	0	0
Black-crowned night-heron	1	0	3	0	*	*	*	*	4	0
Bicknell's thrush	0	0	0	0	0	0	0	0	0	0
Blackpoll warbler	0	0	0	0	0	0	0	0	0	0
Canada warbler	6	0	16	0	7	0	3	0	32	0
Fox sparrow	0	0	1	0	0	0	0	0	1	0
Grasshopper sparrow	3	0	4	0	2	0	1	0	10	0
Rusty blackbird	44	0	25	0	4	0	35	0	108	0
Sedge wren	7	0	6	0	5	0	5	0	23	0
Wood thrush	39	0	29	0	5	0	12	0	85	0

Table 4-12. Recognizer Results from spring and summer (4/1–8/30) 2014 Song Scope Analysis, SERE School, Redington, Maine.

Species	Site 1		Site 2		Site 3		Site 4		Total	
	Hits	Positive id	Hits	Positive id	Hits	Positive id	Hits	Positive id	Hits	Positive id
American redstart	186	18	32	31	180	118	244	71	642	238
Black and white warbler	2	2	0	0	6	1	5	0	13	3
Black-backed woodpecker	0	0	0	0	0	0	0	0	0	0
Black-crowned night-heron	184	0	18	0	*	*	*	*	202	0
Bicknell's thrush	15	0	24	0	176	0	103	0	318	0
Blackpoll warbler	1	1	7	7	266	266	697	697	971	971
Canada warbler	3,166	NA	**	**	**	**	**	**	**	NA
Fox sparrow	301	0	152	0	94	0	208	0	755	0
Grasshopper sparrow	1	0	0	0	8	0	9	0	18	0
Rusty blackbird	2,884	NA	1,738	NA	**	**	**	**	**	NA
Sedge wren	299	0	543	0	-	-	-	-	842	0
Wood thrush	7,105	NA	-	-	-	-	-	-	-	-

* Recognizer was not run for that site due to lack of habitat

**Recognizer was not run due to large number of false positives observed at other sites

4.4.5 Manual Review – Birds

A total of 475 individual birds of 46 species were identified during manual review of the acoustic recording subsample at the Installation. Number of individual birds detected and diversity indices varied among locations with the highest number of birds detected at Site 2 (n = 154) and the greatest diversity found at Site 1 (richness = 34 species, Shannon Diversity Index = 3.27). Species dominance was greatest at the avian community located at Site 4 (Simpson Diversity Index = 2.79) (Table 4-13).

Table 4-13. Total Number of Species (Species Richness) Recorded During Manual Review of Acoustic Recording Subsample, SERE School, Redington, Maine.

	Site 1	Site 2	Site 3	Site 4
Species Richness	34	31	22	20
Simpson Diversity Index	0.95	0.94	0.92	0.97
Shannon Diversity Index	3.27	3.15	2.81	2.79
Total # of individuals	**135**	**154**	**91**	**95**

The most abundant species detected at the Installation were black-capped chickadee with 45 individuals recorded, followed by dark-eyed junco (*Junco hyemalis*) with 39 individuals, and white-throated sparrow (*Zonotrichia albicollis*) with 36 individuals. Several species closely associated with open water or riparian habitats, including the mallard duck (*Anas platyrhynchos*), common grackle (*Quiscalus quiscula*), and rusty blackbird, were detected at Sites 1 and 2, but the majority fall under the broad classification of woodland passerines (Table 4-14). The highest frequencies of occurrence were recorded for generalist species that could be found in a variety of habitat types with 20% of the species detected at each site.

Table 4-14. Total Individuals Detected by Species and Site during Manual Review of Acoustic Recording Subsample, SERE School, Redington, Maine.

	Site 1	Site 2	Site 3	Site 4	Total	Frequency of occurrence
Alder flycatcher	8	9	0	0	17	50%
American robin	6	8	2	10	26	100%
Black-capped chickadee	7	14	11	13	45	100%
Belted kingfisher	0	1	1	0	2	50%
Blue-headed vireo	0	6	1	3	10	75%
Blackbird sp.	0	1	1	0	2	50%
Blue jay	9	2	2	0	13	75%
Blackpoll warbler	0	0	9	10	19	50%
Boreal chickadee	0	0	0	1	1	25%
Brown creeper	2	0	0	0	2	25%

	Site 1	Site 2	Site 3	Site 4	Total	Frequency of occurrence
Black-throated blue warbler	0	1	1	0	2	50%
Black-throated green warbler	0	0	0	4	4	25%
Black and white warbler	0	3	0	0	3	25%
Cedar waxwing	2	0	0	2	4	50%
Chipping sparrow	5	3	0	0	8	50%
Common grackle	2	0	0	0	2	25%
Common yellow throat	7	9	2	1	19	100%
Chestnut-sided warbler	3	1	0	0	4	50%
Dark eyed junco	13	8	9	9	39	100%
Downy woodpecker	0	0	1	1	2	50%
Golden crowned kinglet	2	2	2	3	9	100%
Hermit thrush	2	0	0	0	2	25%
Least flycatcher	0	6	0	0	6	25%
Mallard duck	2	1	0	0	3	50%
Magnolia warbler	4	1	4	2	11	100%
Myrtle warbler	3	0	3	2	8	75%
Nashville warbler	1	0	0	0	1	25%
Northern flicker	0	1	0	0	1	25%
Northern parula	1	2	0	0	3	50%
Northern waterthrush	4	0	0	0	4	25%
Oven bird	2	4	0	0	6	50%
Pine warbler	3	0	0	0	3	25%
Pileated woodpecker	2	0	0	0	2	25%
Purple finch	2	0	0	2	4	50%
Red-breasted nut hatch	2	0	0	8	10	50%
Ruby-crowned kinglet	2	0	3	0	5	50%
Red-eyed vireo	3	3	4	3	13	100%
Rusty blackbird	0	4	0	0	4	25%
Song sparrow	1	4	0	0	5	50%
Swamp sparrow	1	15	2	0	18	75%
Swianson's thrush	4	7	7	7	25	100%
Veery	1	3	0	0	4	50%
Willow flycatcher	0	2	0	0	2	25%
Winter wren	8	3	6	7	24	100%
White-throated sparrow	11	9	13	3	36	100%
Yellow warbler	1	7	1	0	9	75%
Unknown chipping	9	14	6	4	33	100%

The majority of individuals (n = 235) were detected during the spring period (30 April–14 June) in the height of the breeding season with detections declining steadily in the summer (30 June–20 August; n = 165) and fall (05 September–24 October; n = 73) periods. The number of calls identified within the summer period can largely be attributed to those species known to vocalize more frequently outside of the breeding season and dawn chorus.

4.5 DISCUSSION

4.5.1 Bats

A total of seven bat species were positively identified during qualitative vetting of Sonobat and Kaleidoscope classifications, including two *Myotis* species—little brown bat and eastern small-footed bat. One call sequence was classified as a "*Myotis* species" because it lacked distinguishing characteristics to positively identify either as northern long-eared bat or little brown bat. Five species of the more commonly detected species (i.e., silver-haired bat, hoary bat, big brown bat, little brown bat, and eastern red bat) were present at all sites, although activity levels varied among species and location. The number of call sequences detected and activity rates were greater at lower elevations (Sites 1 and 2) than at upper elevations (Sites 3 and 4).

To address the challenge of differentiating calls among the *Myotis* genus, we used two classification software programs to reduce the number of false positive results with more conservative and conclusive filters (Sonobat) and broadened sample size to avoid false negatives with more course filters (Kaleidoscope). As a result, Kaleidoscope identified nearly 500 more call sequences than Sonobat including numerous NLEB calls. However, *Myotis* calls recorded and classified during Kaleidoscope quantitative analysis were not consistent with known reference calls or characteristics of NLEB calls. Subsequent qualitative analysis determined that the majority of sequences classified as NLEB by Kaleidoscope were either little brown bat or fragments of other *Myotis* calls. These determinations were based on the characteristics of the calls compared to known species calls in a reference library, as well as the temporal proximity to call sequences recorded during the same period and clearly attributable to little brown bat.

Qualitative vetting of acoustic calls is based on multiple characteristics of the call (i.e., slope, characteristics frequency, maximum and minimum frequencies, and overall shape of the call pulses) as well as when the call was recorded, and it is therefore typically a more accurate means of classification when coupled with currently available quantitative analysis software. The amount of clutter within a foraging environment can affect the echolocation call structure and accurate classification of NLEB is typically lower in an open environment as there is increased overlap with other species (Borders et al. 2004). The vast majority of calls incorrectly identified as NLEB during quantitative analysis in Kaleidoscope were based more on steepness, power, and structure in the call sweep, rather than frequency range. In general, consensus identifications made in Sonobat were more conservative and species identifications made in Kaleidoscope more liberal. For example, when reviewing the 33 calls identified as NLEB in Kaleidoscope, 11 of the call sequences were not classified in Sonobat even though the recordings were of good quality. If parameters in Sonobat were adjusted to include lower quality calls, and call series with fewer pulses, it is likely the results would be in greater agreement.

Silver-haired bats were the most frequently detected species and occurred across the Installation at all acoustic sites during the 2013 fall and 2014 spring and summer survey periods. Big brown and hoary bats were the second most common species, both of which occurred across all sites. Little brown bats, eastern red bats and tri-colored bats were all detected as well but do not constitute a large percentage of the bat communities near acoustic detector locations.

High numbers of silver-haired bats were recorded at Site 1, located in the center of the valley within a riparian area adjacent to Redington Stream. Silver-haired bats are a migratory, tree-roosting species and are one of the most common bats found in forested areas of America (Bat Conservation International 2014a). The mature stands of mixed forest that flank Redington Stream likely contain a large number of snags. This species relies on this precise forest composition to form maternity colonies and forage. At the northernmost extent of its range, the big brown bat also had high numbers of calls recorded at Site 1 along Redington Stream. Although big brown bats are considered generalist, the riparian forest mosaic and ample areas with open canopy and less forest clutter appear to be the preferential habitat within the Installation for this species. Like silver-haired bats, hoary bats are a migratory tree-roosting species but the numbers of their calls were more evenly distributed among detector locations on the Installation. Hoary bats accounted for 90% of the calls recorded during the spring period, indicating this species is likely migrating through the Installation. They also comprised 16% of the calls during the summer and were likely roosting within forest boarders found at all detector locations. Relatively few eastern red bats were detected across the seasons but likely occur in low numbers as residents during the summer months. Very few tri-colored bats were detected within the Installation suggesting they are not common summer residents but migrate through the area, which is on the northern fringe of their range (Bat Conservation International 2014b).

Myotis species were infrequently recorded during the survey period. Results of the Sonobat analysis helped differentiate between *Myotis* species calls with a higher degree of certainty than qualitative analysis alone, and we determined that all calls belonged to little brown bat, the majority of which were recorded at Sites 1 and 2 on the valley floor. Survey results indicate that *Myotis* species have low activity levels in the vicinity of the detectors. Based on known regional distributions it is likely that eastern small-footed bat and NLEB occur within the Installation; however, the 2013 and 2014 acoustic dataset did not contain conclusive call sequences indicative of the eastern small-footed bat or NLEB. In July 2011, USFWS was petitioned to list the NLEB and eastern small-footed bat as endangered or threatened, and to designate critical habitat under the ESA. On 02 October 2013, USFWS released the results of their 12-month finding on the 2011 petition (USFWS 2013). Based on USFWS' review for eastern small-footed bat, listing is not warranted at this time. Listing for NLEB was deemed warranted, and the species is now proposed for listing as federally endangered. In addition, USFWS indicated that critical habitat for NLEB was not determinable (USFWS 2013). The petition to list little brown bat is still in review. Although Sonobat identified two calls as NLEB, qualitative review revealed the entire call sequences shared more characteristics with little brown bat.

Habitat for the local bat community is found on the Installation from the late spring to late fall. This observation is supported by the pattern of peak calls during the passive acoustic monitoring periods in mid-summer. Resident *Myotis* species may be present year round in lower numbers and are likely to occur in forested edge habitat and/or use old buildings as a roost sites. Early detections in April prior to migratory periods further support year-round use of the Installation by *Myotis*

species. Greater numbers of calls and activity rates by migratory bat species during the summer season demonstrates that there were long-distance migratory tree-roosting bats spending the summer residency period at the Installation.

Activity rates declined rapidly following a small pulse on 07 September 2013, likely due to the early onset of cooler temperatures in the region and fact that this area of Maine is near the northernmost range extent for several species. Therefore the area does not receive a lasting flow of migrants from the north for an extended period, which is common elsewhere in lower latitudes. No marked increase of activity was recorded in early fall, which would be characteristic of large-scale migration events. This evidence suggests that a moderate level of migration occurs within the Installation. (Cryan and Veilleux 2007), further supporting the notion that this region represents the upper limits of species' ranges and may serve as an endpoint rather than a stopover location. Some activity within the survey period may be due to weather conditions, including mean nightly temperature and wind speed, which potentially contributed to the patterns of activity recorded by the acoustic detector sets. The increase in bat call sequences recorded in July may have resulted from (1) increased foraging activity near the detectors due to a rise in mean nightly temperatures (Racey and Swift 1985, O'Donnell 2000, Kusch et al. 2004), and (2) increases in food resource concentrations near the detectors.

Migratory tree bats appear to have the highest occurrence and use of habitats within the installation. Lower detection rates for *Myotis* species is likely attributed to the prevalence of white nose syndrome in the northeast and subsequent decline in *Myotis* populations (USFWS 2014b). A few call sequences were classified by Kaleidoscope as eastern small-footed bat and NLEB, however the majority of these calls did not contain characteristics that could be irrefutably attributed to these species when viewed manually. There is a high likelihood that these species do occur on the installation, though at very low numbers.

4.5.2 Birds

The 2013 and 2014 avian acoustic monitoring survey at the SERE school generated a rich archive documenting the presence of avian species that occur at the Installation. Four of the targeted 12 species of concern (Table 4-8) were identified from the data subsample using Song Scope auto classification, and a total of 46 species were identified during manual review. Of the 46 species identified during manual review, 28 were not previously documented on the Installation (Navy 2012).

Low detection of target species was likely due to a combination of biological, software, and sampling factors. Although incidental observations have been reported within the region for six of the 12 species targeted using automatic classification, these observations were made over a broad temporal scale and were not necessarily in the same habitats where acoustic monitors were deployed (Sullivan et al. 2009). For example, SERE school is on the fringe of the ranges of the black-crowned night heron, grasshopper sparrow, and sedge wren (Poole 2014). Bicknell's thrush may occupy areas less than 2,700 ft (823 m) in New Hampshire if preferential habitat is available (Parrish, unpublished data), but Site 4 (elevation 2,620 ft [799 m]) is below the putative elevation range for species to occupy within the region (Lambert et al. 2008, Frey et al. 2011). The probability of detection (i.e., the likelihood of making an observation if a species is present) can be greatly influenced by the number of recorded observations (Royle et al. 2005, Alldredge et al.

2007). The 12 species included in the analysis were assumed to have greater detectability given vocalization characteristics such as frequency and amplitude. However, vocalizations that were assumed to be recognizable by the software may be less identifiable due to vocal similarities among species, lack of training data, and interference from background noise. The Installation had numerous ambient noise sources, both natural and anthropogenic. Wind and rain were physical sources of noise but also common were biological sources such as amphibians and the occasional coyote chorus. There also were recording segments with vehicle traffic, human voices, and gunfire. Acoustic saturation of the recordings from loud background noise was encountered during the analysis process and may have prevented some vocalizations from being correctly identified. Mining local weather records to use only non-rain days improved sample quality considerably.

Song Scope

According to Wildlife Acoustics (2013), creating an effective Song Scope recognizer requires abundant, high quality training data and plenty of trial and error. We obtained song recordings from the Cornell Lab of Ornithology's Macaulay Library to use for training data. Experience gained from previous studies (Navy 2014) prompted us to increase the amount of training recording including regional call types for the focal species, which were specifically selected and requested from the Macaulay Library. Even though we included variation in song and dialect when annotating many species-specific vocalization examples to "train" a recognizer model, and despite the investment of ample trial and error in the development of each recognizer, there remain constraints on which species a model will perform well for.

The factor most limiting a recognizer model's performance is the complexity and vocal array (i.e., frequency [Hz], syllable size, cadence) of the species of interest. Our target species contained species from both ends of the spectrum, ranging from the succinct trills of the blackpoll warbler, grasshopper sparrow, and black and white warbler that are higher in frequency then the majority of avian vocalizations, to the complex and non-distinctive garbles and warbling of the rusty blackbird and Canada warbler that occur within the frequency range common to most avian vocalizations (i.e., 3,000–6,500 Hz). This last point is very important, and when viewing a spectrogram it is clear that overlap within this busy "air space" in the frequency spectrum is the primary cause for false positive classifications.

With this in consideration, it is of no surprise that models performed best for those species with a higher than average vocal frequency. The recognizer model for blackpoll warbler performed extraordinarily well, with an accuracy near 100% for all vocalizations automatically classified. Given that the blackpoll warbler is a species of increasing concern (MDIFW 2014, USFWS 2008), automatic classification for this species should be strongly considered as a monitoring tool. Nearly 99% of automatic classifications were made at Sites 3 and 4, which further supports model accuracy. That is because these are at higher elevations and habitats where blackpoll warblers occur, and multiple incidental observations of this species were made at these sites as well (Parrish, personal observation). Although American redstart does have a wide vocal array, the recognizer model for this species was trained using its most characteristic song type consisting of a simple four note song with a accented ending (e.g., "tsee, tsee, tsee, tsiee") (Sherry and Holmes 1997). After manual review of songs classified as American redstart by Song Scope, we determined that 37% of the classifications were correct, and the remainder were false positives. Meanwhile, recognizers for wood thrush, rusty blackbird, and Canada warbler generated a large number of

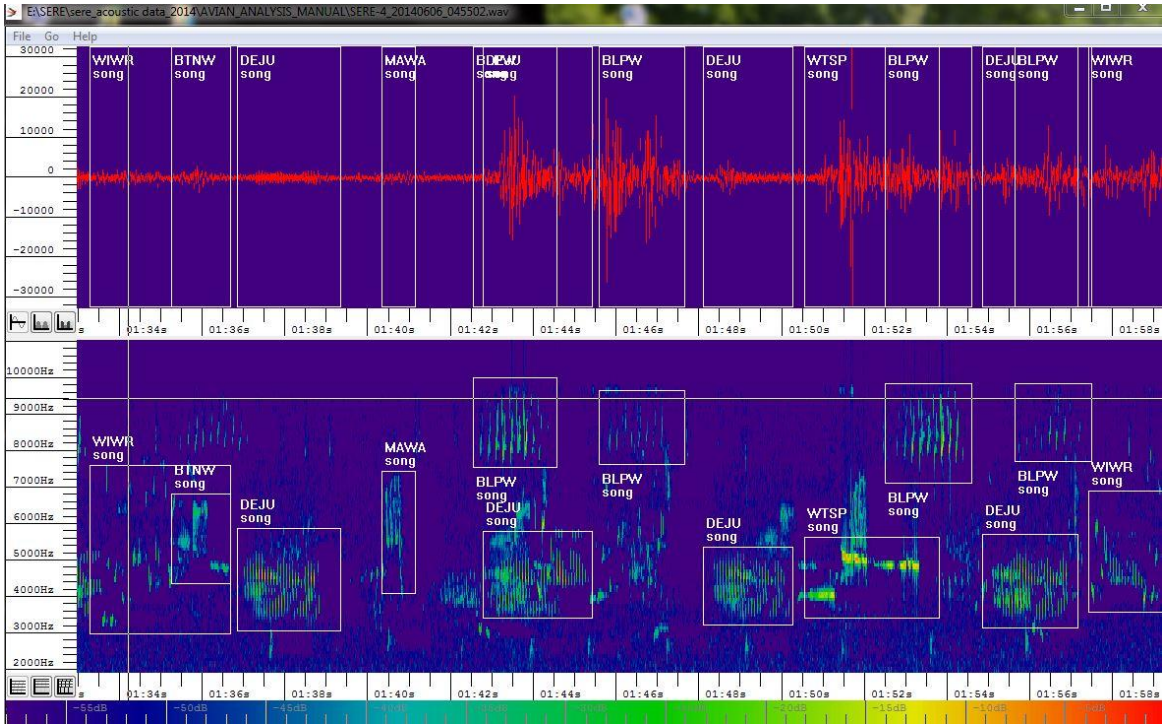
false positives that would have taken a considerable amount of time to manually review. Analysis of 2014 data using recognizers for these species was curtailed after realizing the volume of false positives generated. Review of subsampled results revealed true positives did occur for Canada warbler, yet the input required to review hits for these species for the entire year is beyond the scope of work for this Task Order, and ultimately defeats the purpose of auto-classification as a tool to reduce review time.

Researchers have demonstrated that customized species-specific recognizer models with capabilities superior to those of Song Scope also have inconsistencies and require manual review due to differences in regional dialects (Bueller, personal comm., Hockman, personal comm). Applications of auto-classification software still lack accuracy to be used broadly but can be effectively employed to identify species with amenable vocalizations.

Manual Review

During manual review of acoustic recordings, a total of 46 species were identified, two of which—blackpoll warbler and rusty blackbird—were species of concern targeted during auto-classification (Appendix B). Results of species richness from this subsample are similar when compared to the 64 species identified during the 2014 Breeding Bird Survey (BBS) (Section 5.0). Although prominent habitat types at the Installation were fairly represented by the four acoustic monitoring sites (e.g., lowland pond, riparian, higher elevation spruce-fir), the increase in the number of detections made at BBS points is likely because the complete range of habitats was sampled during BBS surveys (e.g., mid-elevation northern hardwood, transitional zone from northern hardwood to spruce-fir), and species with low aurally detectability were recorded (i.e., raptors and waterfowl). Four species were identified during the manual review of subsamples of acoustic recordings that were not detected during BBS surveys.

Manual review of subsampled recordings proved to be effective in obtaining baseline species richness and abundance at the Installation (Appendix B). Identifications of songs were made with strong confidence due to the ability to re-listen to song sequences and make direct comparisons with spectrograms of known vocalizations from the Macaulay Library. With practice and increased familiarity at visually recognizing species-specific songs on spectrogram, users can develop a search image and can quickly scan a recording to identify call types. This is most effective when there are fewer vocalizations such as during the fall period, and can reduce a 10-minute sample period to a few minutes because the recording can be quickly scanned to identify and only listen to those periods with vocalizations. For example, in a busy chorus we could identify six species at a glance within this 25-second recording (Figure 4-4).



Species identified include calls from: winter wren (WIWR), black-throated green warbler (BTNW), dark-eyed junco (DEJU), magnolia warbler (MAWA), blackpoll warbler (BLPW), and white-throated sparrow (WTSP).

Figure 4-5. Spectrogram Illustrating 25 Seconds of a Recording Made at Site 4.

A 10-minute sampling period was useful for the summer and fall data when vocalization frequencies are low because they allowed for the detection of more individuals. However, review time for a 10-minute sampling period during the height of the breeding season in the spring is greatly increased because of the volume of overlapping calls. Furthermore, manual review may be unnecessary in this case because so few individuals are missed (which is the problem in aural surveys) because we have the added benefit of visually seeing and replaying calls. Sampling at 5-minute intervals is recommended during the breeding season when singing frequencies are high.

Discerning call and chip notes is more difficult even with visual comparison. In these instances, we did not have the option to verify species identification in the field as in a typical point-count survey, and some chips and calls remained unidentified. Additionally, song frequency decreases markedly for most species following the breeding season (Wilson and Bart 1985).

Lower species richness and abundance in the summer and fall is likely influenced by lowered species detectability. Unless the aim is to target specific species during stopover migration in the fall, it may be a beneficial strategy to concentrate sampling during the peak of the breeding season from mid-May to July to ensure the detection of all species that occur. The greatest species diversity was documented at Site 1 in the bottom of the valley. Site 1 is located among willow and alder shrubs within a wetland complex adjacent to Redington Stream and Redington Road, a warbler nesting wonderland. Bordering this open canopy are mature aspen, maple, spruce and fir, creating a diverse plant community that characteristically supports a high number of avian species.

Sites 3 and 4 were located at higher elevations in forests dominated by spruce and fir; both had less species richness and were dominated by fewer species.

5.0 BREEDING BIRD SURVEYS

5.1 GOALS AND OBJECTIVES

Breeding bird surveys (BBS) were conducted at the Installation to determine baseline bird species occurrence and document relative abundance, spatio-temporal distribution, and species richness of breeding birds.

5.2 METHODS

Breeding bird point-count surveys were conducted during the 2014 breeding period using survey protocols established by the North American Breeding Bird Program and the DoD Coordinated Bird Monitoring Protocol (USGS 1998, Bart et. al 2012). Point counts were conducted along two transects, transect A and transect B, during late May and early June 2014. There were a total of 49 point-count locations, 29 along Transect A and 20 along Transect B (Figure 5-1), each of which was surveyed three times. The point-count locations were surveyed for 5 minutes apiece, resulting in 510 minutes of survey effort.

Transects were positioned to provide coverage of representative habitats present at the Installation including upland, wetland/swamp, stream corridors, and mixed hardwood and coniferous habitats. Points were spaced at least 500 ft (151 m) apart using a handheld GPS to reduce the potential for double counting. Point counts included a tally of all birds seen and heard within a 330-ft (100-m) radius of the point count location.

Surveys were conducted during optimal weather conditions with light winds and no precipitation. Surveys began around sunrise to correspond with the period when most birds are vocalizing, and all surveys ended before 11:10 am. Birds detected audibly or visually were recorded on a standardized data sheet. Each observed bird was identified to species. All birds seen or heard were counted during the finite 5-minute sampling period for each survey point. Habitat information for each survey was recorded and used to evaluate potential trends in spatial occurrence patterns. All point-count locations were recorded with a Garmin GPS and plotted.

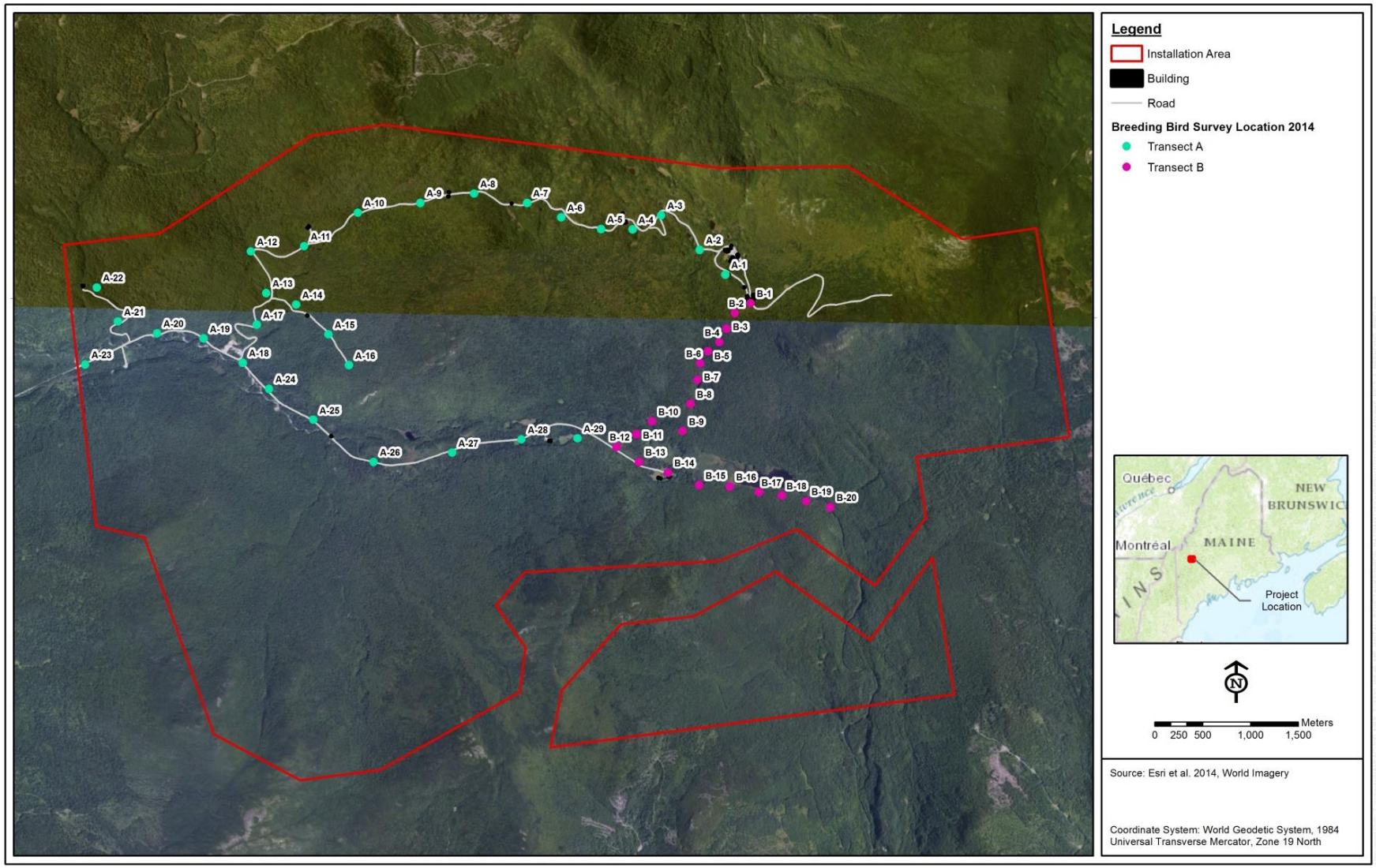


Figure 5-1. Breeding Bird Point Count Locations, SERE School, Redington, Maine.

5.3 RESULTS

A total of 963 birds representing 64 species were observed and recorded throughout the three days of surveys (Table 5-1 and Table 5-2). Species richness varied from 6 to 24 species per point for both transects (Table 5-3 and Table 5-4). B14 had the greatest species richness, and B6 and B7 had the lowest. The greatest number of birds observed (grand total) occurred at B13, and the fewest were detected at B7. Black-throated green warbler (*Setophaga virens*) and white-throated sparrow were the most abundant birds observed. In general, diversity was greater on transect A along Redington Road then at higher elevations (B-13–B-29) along the Blue Line Trail (Table 5-3 and 5-4). Points 5 and 6 along transect B exhibited high diversity as indicated by the Shannon Diversity Index (2.32 and 2.21, respectively). Points 17 and 18, also along transect B, exhibited the greatest species dominance as indicated by the Simpson Diversity Index (0.29 and 0.21, respectively).

The overall encounter rate for the survey ranged from 4.86 to 7.69 birds/5-minute count (Table 5-2). Fewer birds and fewer species were observed during the last survey in June.

Table 5-1. Summary of Number of Birds Counted, Species Diversity, and Relative Abundance for Breeding Bird Surveys by Date, SERE School, Redington, Maine.

Date	Number of Birds Counted	Species Diversity	Bird/5-Minute Point Count[1]
29 May 2014	377	48	7.69
05 June 2014	348	49	7.10
19 June 2014	238	41	4.86
Total	**963**	**64**	

[1]There were 29 point count locations on Transect A and 20 point count locations on Transect B, for a total of 49 point counts.

No endangered or threatened species were observed during the BBS. However, of the 64 species observed, 10 are listed as species of special concern by MDIFW (2014) (Table 5.2): American redstart, black-and-white warbler, Canada warbler, chestnut-sided warbler (*Setophaga pensylvanica*), least flycatcher (*Empidonax minimus*), olive-sided flycatcher (*Contopus cooperi*), tree swallow (*Tachycineta bicolor)*, veery (*Catharus fuscescens*), white-throated sparrow, and yellow warbler (*Setophaga petechia).*

Table 5-2. Summary of Species Counts, Frequency of Occurrence at Points, and Relative Abundance for Breeding Bird Surveys, SERE School, Redington, Maine.

Common Name	Maine Species of Special Concern	Survey Date			Total	Frequency of Occurrence	Bird/5-Minute Count
		29 May 2014	05 June 2014	19 June 2014			
Alder flycatcher		3	9	3	15	22.4%	0.10
American black duck		2	1		3	4.1%	0.02
American crow		2	1		3	6.1%	0.02
American redstart	*X*	16	11	12	39	34.7%	0.27
American robin		20	13	10	43	63.3%	0.29
Baltimore oriole		1			1	2.0%	0.01
Bay-breasted warbler				1	1	2.0%	0.01
Black-and-white warbler	*X*	10	5	3	18	32.7%	0.12
Black-capped chickadee		29	8	5	42	42.9%	0.29
Blackburnian warbler		1	1	2	4	8.2%	0.03
Blackpoll warbler		2			2	4.1%	0.01
Black-throated blue warbler		4	10	6	20	26.5%	0.14
Black-throated green warbler		36	30	19	85	81.6%	0.58
Blue-headed vireo		11	9	8	28	42.9%	0.19
Blue jay		3	5	1	9	16.3%	0.06
Broad-winged hawk		2			2	2.0%	0.01
Brown creeper				1	1	2.0%	0.01
Canada goose		1	1		2	4.1%	0.01
Canada warbler	*X*		5	1	6	12.2%	0.04
Cedar waxwing				1	1	2.0%	0.01
Chestnut-sided warbler	*X*	5	8	5	18	24.5%	0.12
Chipping sparrow		4	1	2	7	10.2%	0.05
Common raven			3	2	5	10.2%	0.03
Common yellowthroat		9	6	5	20	30.6%	0.14

Common Name	Maine Species of Special Concern	Survey Date			Total	Frequency of Occurrence	Bird/5-Minute Count
		29 May 2014	05 June 2014	19 June 2014			
Dark-eyed junco		16	8	5	29	42.9%	0.20
Downy woodpecker		2	2		4	8.2%	0.03
Eastern phoebe		1	1		2	4.1%	0.01
Great-crested flycatcher				1	1	2.0%	0.01
Golden-crowned warbler		3	8	5	16	20.4%	0.11
Gray catbird				1	1	2.0%	0.01
Hermit thrush		2	1	7	10	18.4%	0.07
Indigo bunting				1	1	2.0%	0.01
Least flycatcher	*X*	6	10	6	22	24.5%	0.15
Magnolia warbler		28	18	11	57	59.2%	0.39
Mourning warbler		1			1	2.0%	0.01
Nashville warbler			4	8	12	22.4%	0.08
Northern flicker		1	3	2	6	10.2%	0.04
Northern parula		11	15	9	35	46.9%	0.24
Northern waterthrush		2	3	4	9	10.2%	0.06
Olive-sided flycatcher	*X*		1		1	2.0%	0.01
Ovenbird		19	20	9	48	46.9%	0.33
Palm warbler		2	1		3	2.0%	0.02
Pileated woodpecker			2	1	3	6.1%	0.02
Purple finch			1		1	2.0%	0.01
Red-breasted grosbeak		1			1	2.0%	0.01
Red-breasted merganser		1			1	2.0%	0.01
Red-breasted nuthatch		14	13	2	29	42.9%	0.20
Ruby-crowned kinglet		1			1	2.0%	0.01
Red-eyed vireo		15	15	14	44	46.9%	0.30
Ruby-throated hummingbird			3		3	6.1%	0.02

Common Name	Maine Species of Special Concern	Survey Date			Total	Frequency of Occurrence	Bird/5-Minute Count
		29 May 2014	05 June 2014	19 June 2014			
Ruffed grouse		7			7	14.3%	0.05
Red-winged blackbird		1			1	2.0%	0.01
Song sparrow			2	1	3	6.1%	0.02
Swamp sparrow		4	1		5	10.2%	0.03
Swainson's thrush		9	23	13	45	57.1%	0.31
Tree swallow	*X*	1	2		3	6.1%	0.02
Veery	*X*	1	3	3	7	12.2%	0.05
Willow flycatcher		1			1	2.0%	0.01
Winter wren		20	19	17	56	63.3%	0.38
Woodpecker sp.			1		1	2.0%	0.01
White-throated sparrow	*X*	37	21	26	84	65.3%	0.57
Yellow-breasted sapsucker		2	3		5	8.2%	0.03
Yellow-rumped warbler		7	14	5	26	46.9%	0.18
Yellow warbler	*X*		3		3	4.1%	0.02
Total		**377**	**348**	**238**			**6.55**

Table 5-3. Transect A Abundance and Species Richness Results for Breeding Bird Surveys by Date, SERE School, Redington, Maine.

Point	Survey Date			Total	Species Richness	Simpson Diversity	Shannon Diversity
	29 May 2014	05 June 2014	19 June 2014				
A1	9	7	4	20	12	0.90	2.44
A2	7	10	3	20	12	0.88	2.14
A3	8	10	8	26	14	0.88	2.25
A4	8	4	7	19	10	0.87	2.15
A5	6	4		10	6	0.87	2.29
A6	4	5	1	10	7	0.83	1.96
A7	6	6	7	19	13	0.76	1.64
A8	5	5	5	15	11	0.78	1.77
A9	13	5	6	24	14	0.88	2.47
A10	3	5	3	11	8	0.89	2.56
A11	8	6	3	17	10	0.82	2.20
A12	6	5	2	13	9	0.81	2.09
A13	3	5	5	13	11	0.81	2.12
A14	5	7	4	16	8	0.68	1.62
A15	6	3	2	11	6	0.68	1.66
A16	5	3	5	13	7	0.87	2.63
A17	8	9	6	23	15	0.75	1.85
A18	10	9	8	27	17	0.81	2.30
A19	6	9	3	18	13	0.80	2.15
A20	10	7	3	20	12	0.78	2.07
A21	5	4	3	12	8	0.71	1.92
A22	7	2	4	13	9	0.57	1.40
A23	8	15	11	34	21	0.75	1.96
A24	8	7	5	20	10	0.66	1.65
A25	10	13	4	27	17	0.47	1.07
A26	15	10	3	28	15	0.46	1.10
A27	12	6	8	26	14	0.64	1.69
A28	8	5	6	19	14	0.56	1.45
A29	4	5	3	12	9	0.68	1.84

Table 5-4. Transect B Abundance and Species Richness Results for Breeding Bird Surveys by Date, SERE School, Redington, Maine.

Point	Survey Date			Total	Species Richness	Simpson Diversity	Shannon Diversity
	29 May 2014	05 June 2014	19 June 2014				
B1	8	9	6	23	10	0.66	1.63
B2	8	7	9	24	10	0.72	2.03
B3	6	4	6	16	9	0.67	1.88
B4	6	5	1	12	10	0.63	1.66
B5	6	5	5	16	11	0.77	2.32
B6	4	2	3	9	5	0.73	2.21
B7	1	5	0	6	5	0.60	1.67
B8	4	7	4	15	8	0.71	2.01
B9	5	3	3	11	7	0.63	1.88
B10	11	9	10	30	17	0.62	1.70
B11	9	8	8	25	17	0.53	1.37
B12	10	8	5	23	14	0.58	1.44
B13	7	21	12	40	23	0.50	1.35
B14	16	10	8	34	24	0.46	1.15
B15	9	8	5	22	16	0.38	0.99
B16	15	13	5	33	19	0.45	1.17
B17	12	9	4	25	22	0.29	0.69
B18	11	11	4	26	16	0.21	0.53
B19	9	6	4	19	12	0.41	1.02
B20	7	7	4	18	13	0.33	0.81

5.4 DISCUSSION

All bird species observed and recorded during the 2014 BBS are commonly found in the habitat types present on the Installation. The Installation provides the local breeding bird community with a variety of habitat types and can support species from Neotropical migrants to waterfowl. The 2014 BBS was not designed to capture the high elevation bird community but instead was focused on lower elevation habitats (below 2,300 ft [697 m]) on the Installation. The BBS survey did not document any federally or state threatened or endangered species but did record 10 species that are considered by MDIFW as species of special concern. The points where the greatest number of species were documented contained a variety of habitat types including forest, edge, and open meadow.

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APPENDIX A

PHOTOGRAPHIC LOG

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PHOTOGRAPHIC RECORD

Client: United States Department of the Navy
Project: SERE School Winter Mammal Track Counts, Raptor Migration, and Bat and Avian Acoustic Surveys

Photograph No.: 1
Date: 05 February 2014
Photographer: C. Parrish
Comments: Ruffed grouse (*Bonasa umbellus*) track in fresh powder along Redington Stream Road transect.

Photograph No.: 2
Date: 05 February 2014
Photographer: C. Parrish
Comments: Short-tailed weasel (*Mustela erminea*) tracks in fresh powder along Mountain Spur Road transect.

PHOTOGRAPHIC RECORD

Client: United States Department of the Navy
Project: SERE School Winter Mammal Track Counts, Raptor Migration, and Bat and Avian Acoustic Surveys

Photograph No.: 3
Date: 06 February 2014
Photographer: C. Parrish
Comments: Long-tailed weasel (*Mustela frenata*) tracks in fresh powder along Mountain Spur Road transect.

Photograph No.: 4
Date: 19 February 2014
Photographer: C. Parrish
Comments: Meadow vole (*Microtus pennsylvanicus*) track in fresh powder along Blue Trail transect.

PHOTOGRAPHIC RECORD

Client: United States Department of the Navy
Project: SERE School Winter Mammal Track Counts, Raptor Migration, and Bat and Avian Acoustic Surveys

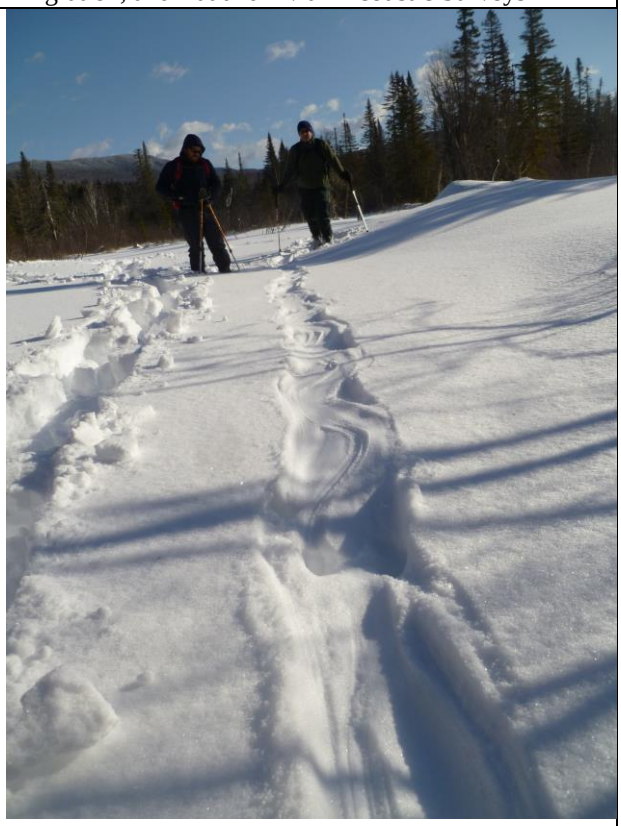
Photograph No.: 5
Date: 19 February 2014
Photographer: C. Parrish
Comments: American marten (*Martes americana*) tracks along Blue Line Trail transect.

Photograph No.: 6
Date: 19 February 2014
Photographer: C. Parrish
Comments: Female moose (*Alces alces*) with young along Blue Line Trail transect.

PHOTOGRAPHIC RECORD

Client: United States Department of the Navy

Project: SERE School Winter Mammal Track Counts, Raptor Migration, and Bat and Avian Acoustic Surveys



Photograph No.: 7, 8 and 9

Date: 20 February 2014

Photographer: C. Parrish

Comments: North American river otter (*Lontra canadensis*) tracks, tunnel, and slide along Potato Nub Bluff transect.

PHOTOGRAPHIC RECORD

Client: United States Department of the Navy
Project: SERE School Winter Mammal Track Counts, Raptor Migration, and Bat and Avian Acoustic Surveys

Photograph No.: 10, 11, 12, and 13
Date: 20 February 2014
Photographer: C. Parrish
Comments: Bobcat (*Lynx rufus*) tracks, front pad print, bed, and track measurement along Potato Nub Bluff transect.

PHOTOGRAPHIC RECORD

Client: United States Department of the Navy
Project: SERE School Winter Mammal Track Counts, Raptor Migration, and Bat and Avian Acoustic Surveys

Photograph No.: 14
Date: 20 February 2014
Photographer: C. Parrish
Comments: American marten tracks along Potato Nub Bluff transect.

APPENDIX B

RESULTS OF QUALITATIVE (MANUAL) ANALYSIS OF ACOUSTIC BAT DATA BY SEASON

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SERE School Avian Acoustic Survey Results for spring (30 April – 17 June 2014), summer (30 June – 20 August 2014), and fall (5 September – 24 October 2013)

	Site 1				Site 2				Site 3				Site 4		
Species	spring	summer	fall		spring	summer	fall		spring	summer	fall		spring	summer	fall
ALFL	3	5	0		5	4	0		0	0	0		0	0	0
AMRO	5	1	0		4	3	1		2	0	0		3	0	7
BCCH	2	0	5		5	6	3		5	6	0		3	2	8
BEKI	0	0	0		0	0	1		0	0	1		0	0	0
BHVI	0	0	0		2	2	2		1	0	0		1	2	0
BLBI_SP	0	0	0		0	0	1		0	0	1		0	0	0
BLJA	3	1	5		0	0	2		1	0	1		0	0	0
BLPW	0	0	0		0	0	0		7	2	0		5	4	1
BOCH	0	0	0		0	0	0		0	0	0		0	0	1
BRCR	2	0	0		0	0	0		0	0	0		0	0	0
BTBW	0	0	0		1	0	0		1	0	0		0	0	0
BTNW	0	0	0		0	0	0		0	0	0		3	1	0
BWWA	0	0	0		3	0	0		0	0	0		0	0	0
CEWA	0	0	2		0	0	0		0	0	0		0	0	2
CHSP	3	2	0		2	1	0		0	0	0		0	0	0
COGR	2	0	0		0	0	0		0	0	0		0	0	0
COYE	6	1	0		5	4	0		2	0	0		0	1	0
CSWA	1	2	0		0	1	0		0	0	0		0	0	0
DEJU	5	8	0		4	4	0		5	4	0		4	5	0
DOWO	0	0	0		0	0	0		0	0	1		0	0	1
GCKI	2	0	0		0	0	2		1	1	0		2	1	0
HETH	0	2	0		0	0	0		0	0	0		0	0	0
LEFL	0	0	0		6	0	0		0	0	0		0	0	0
MALD	2	0	0		1	0	0		0	0	0		0	0	0
MAWA	4	0	0		0	1	0		1	3	0		2	0	0
MYWA	2	1	0		0	0	0		3	0	0		2	0	0

Species	Site 1				Site 2				Site 3				Site 4		
	spring	summer	fall		spring	summer	fall		spring	summer	fall		spring	summer	fall
NAWA	1	0	0		0	0	0		0	0	0		0	0	0
NOFL	0	0	0		1	0	0		0	0	0		0	0	0
NOPA	1	0	0		1	1	0		0	0	0		0	0	0
NOWA	4	0	0		0	0	0		0	0	0		0	0	0
OVEN	0	2	0		1	3	0		0	0	0		0	0	0
PIWA	0	3	0		0	0	0		0	0	0		0	0	0
PIWO	0	1	1		0	0	0		0	0	0		0	0	0
PUFI	2	0	0		0	0	0		0	0	0		2	0	0
RBNH	1	0	1		0	0	0		0	0	0		2	1	5
RCKI	2	0	0		0	0	0		3	0	0		0	0	0
REVI	0	3	0		1	2	0		1	3	0		0	3	0
RUBL	0	0	0		2	2	0		0	0	0		0	0	0
SOSP	0	1	0		2	2	0		0	0	0		0	0	0
SWSP	1	0	0		8	6	1		2	0	0		0	0	0
SWTH	3	1	0		3	4	0		3	4	0		5	2	0
VEER	1	0	0		3	0	0		0	0	0		0	0	0
WIFL	0	0	0		1	1	0		0	0	0		0	0	0
WIWR	3	5	0		2	1	0		2	4	0		3	4	0
WTSP	7	4	0		6	3	0		8	5	0		2	1	0
YEWA	1	0	0		5	2	0		0	1	0		0	0	0
UNKCHIPPING	1	4	4		4	3	7		1	1	4		1	1	2
TOTAL	**69**	**43**	**14**	**0**	**74**	**53**	**13**	**0**	**48**	**33**	**4**	**0**	**39**	**27**	**25**

Enclosure 6

Baseline Survey for Amphibians and Reptiles at Three Navy Installations in Maine

January 2015

Final

Baseline Survey for Amphibians and Reptiles At Three Navy Installations in Maine

Northern Two-lined Salamander

June 2013

Prepared by:
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Naval Facilities Engineering Command

Introduction

This report summarizes a baseline field survey for reptiles and amphibians (herpetofauna) at three U.S. Navy installations in the State of Maine (Naval Computer and Telecommunications Area Master Station Atlantic Detachment Cutler [NCTAMSLANT DET Cutler]; Great Pond Outdoor Adventure Center [GPOAC]; and Survival, Evasion, Resistance, and Escape School Rangeley Maine [SERE School]). The survey was conducted by natural resource specialist Chris Petersen, Naval Facilities Engineering Command, Atlantic (NAVFAC LANT) and natural resource manager Ian Trefry, Naval Facilities Engineering Command Mid-Atlantic (NAVFAC MIDLANT). The survey was conducted from June 3-7, 2013.

The overall objective of the survey was to confirm the presence of reptiles and amphibians species potentially thought to be present on the three Navy installations. Data from the survey supplements information in the Integrated Natural Resource Management Plan (INRMP) and will be used for environmental planning, natural resource management, and conservation in support of the military missions of the installations. Prior to this survey, only cursory field observations and opportunistic field sightings were used to document the herpetofauna of these sites.

Prior to the field work, a list of potential species was compiled to establish field methodologies and field survey strategies based on species-specific habitat preferences. This list was created by gathering data from field guides, the National Amphibian Atlas (http://armi.usgs.gov/national_amphibian_atlas.php), and museum records (http://herpnet.org/portal.html). Based on this literature search, it was deemed possible that 25 species of herpetofauna could be present at the three sites.

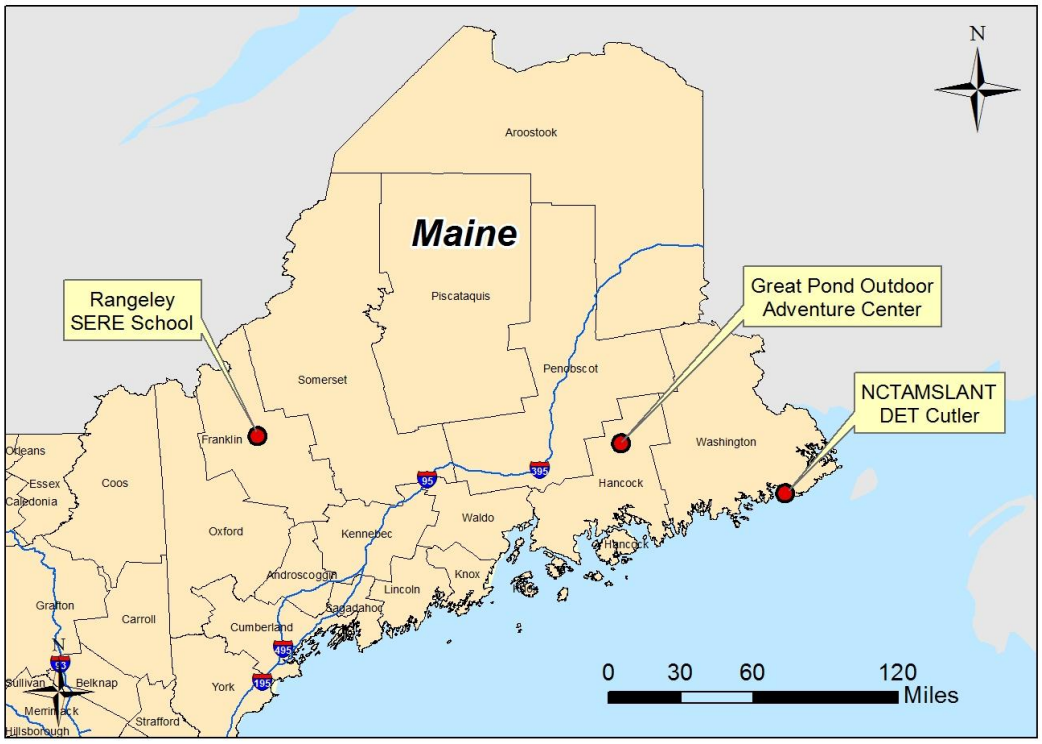
Project Locations and Habitats for Amphibians and Reptiles

Naval Computer and Telecommunications Area Master Station Atlantic Detachment Cutler

The NCTAMSLANT DET Cutler occupies 3,003 acres in the town of Cutler, Maine. The Town of Cutler is located in easternmost region of the State of Maine, in Washington County, approximately 30 miles southwest of the Canadian border and Campobello Island, New Brunswick, Canada (figure 1). The installation comprises two areas—the 2,896-acre very low frequency (VLF) area and the 107-acre high frequency (HF) area. The baseline herpetofauna survey was conducted only on the VLF area. Ponds, wetlands, and forested habitat of the VLF area provide habitat for amphibians and reptiles.

Several natural and manmade ponds, totaling approximately 34 acres, are located throughout the VLF area and provide habitat for amphibians. Several of the ponds of the VLF area are located adjacent to, or in proximity of, the VLF perimeter access road, and a large complex of natural ponds is located within the gravel pit area located at the

Figure 1. Survey site locations



northern end of the VLF area. Most of the ponds located within the VLF area are small, ranging in size from less than 0.1 acres to approximately 1.8 acres.

Based on National Wetland Inventory (NWI) maps and field verification, there are four primary wetland types located throughout the VLF area: palustrine scrub-shrub (PSS), palustrine emergent (PEM), palustrine forested (PFO), and palustrine unconsolidated bottom (PUB) wetlands (INRMP 2012). The most common wetland type in the VLF area is PEM wetland containing some scrub-shrub wetland (PEM/PSS). Common species within these wetlands include bluejoint (*Calamagrostis canadensis*), sedges (*Carex* spp.), woolgrass (*Scirpus cyperinus*), soft rush (*Juncus effusus*), cottongrass (*Eriophorum tenelum*), mannagrass (*Glyceria* spp.), flat-top goldentop (*Euthamia graminifolia*), and willows (*Salix* spp.). These wetlands comprise 897 acres of the VLF area, are dominated by persistent emergent vegetation, and are seasonally-to-permanently flooded.

The second most abundant wetland type within the VLF area is PSS wetland (724 acres). This scrub-shrub wetland is dominated by either broad-leaved or needle-leaved shrub species—or a combination thereof—that are adapted to a variety of wetland hydroperiods. Common species that occur within PSS wetlands on the installation include speckled alder (*Alnus incana* ssp. *rugosa*), willows, sweetgale (*Myrica gale*), bluejoint, rough goldenrod (*Solidago rugosa*), and flat-top white aster (*Doellingeria umbellata*).

Common species that occur within PFO wetlands on NCTAMSLANT DET Cutler include black spruce (*Picea mariana*), red maple (*Acer rubrum*), eastern larch (*Larix laricina*), balsam fir (*Abies balsamea*), catberry (*Nemopanthus mucronata*), speckled alder, and three-seeded sedge (*Carex trisperma*).

Great Pond Outdoor Adventure Center

The GPOAC is located in Hancock County, in central Maine, approximately 35 miles northeast of Bangor, and approximately 30 miles north of Ellsworth, Maine (figure 1). The GPOAC encompasses four parcels of land totaling approximately 397 acres, and is located adjacent to three bodies of water (Great Pond, King Pond, and Alligator Lake) in Hancock County, Maine. The baseline herpetofauna survey was conducted at Great Pond and King Pond parcels.


Collar Brook Stream

Wetlands on the site include PSS, PFO, streams, and vernal pools totaling approximately 14 acres (INRMP 2012). The largest of the wetlands is 11.6 acres and is located between the welcome center and the camping area on the shore of Great Pond. The second largest wetland is 2.1 acres and is located adjacent to the GPOAC access road and just to the north of Cabin 5.

Vegetation cover at the GPOAC is primarily forest with native grasses, shrubs, and some lawn areas maintained in the vicinity of the main buildings near the entrance to the Great Pond Welcome Center. The Great Pond parcel is predominantly Oak–Northern Hardwood with Hemlock Forest and Northern Hardwood Forest scattered throughout. Common tree species found in the Oak–Northern Hardwood communities are American beech (*Fagus grandifolia*), sugar maple (*Acers accharum*), red oak (*Quercus rubra*), eastern hemlock, white pine (*Pinus strobus*), yellow birch, and red spruce.

Survival, Evasion, Resistance, and Escape School

The SERE school is located approximately 110 miles north of Portland and 70 miles northwest of Maine's capital city of Augusta (figure 1). An inventory of the habitat of the installation revealed that approximately 97 percent of the SERE school property is forested (Conservation Mapping of the SERE School, 2000). The remaining 369 acres is

non-forested open area predominantly consisting of edge meadow, swamps, bogs and aquatic ecosystems, alpine zones, and a relatively small amount of developed area.

The ecosystems represented on the SERE school are described in "Natural Landscapes of Maine: A Classification of Ecosystems include:

- Spruce-Fir-Northern Hardwood Forest Ecosystem
- Stream, Stream Shore, Main Channel River, and Eutrophic Pond Ecosystems
- Basin Swamp and Domed Bog Ecosystems
- Alpine and Rock Outcrop Ecosystems

SERE School

The terrain of the SERE school is quite rugged. The mountain slopes typically have gradients of between 15 and 30 percent. They range from occasional, nearly level benches to steep, almost vertical rock faces (INRMP 2012).

Field Methodology

Visual encounter surveys were the primary technigue used by NAVFAC biologists to conduct the field work. This survey method involves searching selected wetland and upland habitats for amphibians and reptiles when the probability of encounter is high (appropriate microhabitat, weather, and time of day for the target species). This technique

was conducted during daylight hours by walking in selected habitats searching for animals within their microhabitats. Particular attention was taken to search under fallen logs, plywood boards, and other discarded materials since these items are known to provide cover habitat for herpetofauna.

A second technique using during this survey included driving roads at night looking for individuals crossing or resting on the roadway. This technique involved driving slowly on roads at night and carefully scanning the road in the headlights of the vehicle looking for active herpetofauna.

A third technique used during the survey was listening for breeding frogs and toads calling at night. This technique was helpful for identifying secretive species not observed during the day and for locating wetland habitats where these species are breeding.

Amphibians and reptiles encountered were captured by hand or net and identified to species. A digital photograph was recorded of each captured species and habitat where they were located prior to their release. The Global Positioning System (GPS) was used to record the location of the observed animals.

Results

Eighteen herpetofauna species (15 amphibians and 3 reptiles) were confirmed on the 3 Navy installations during the 5-day survey period (table 1). This represents 72 percent of the possible species that could have been observed on the installations. Six of the species had not been confirmed on the installations previously.

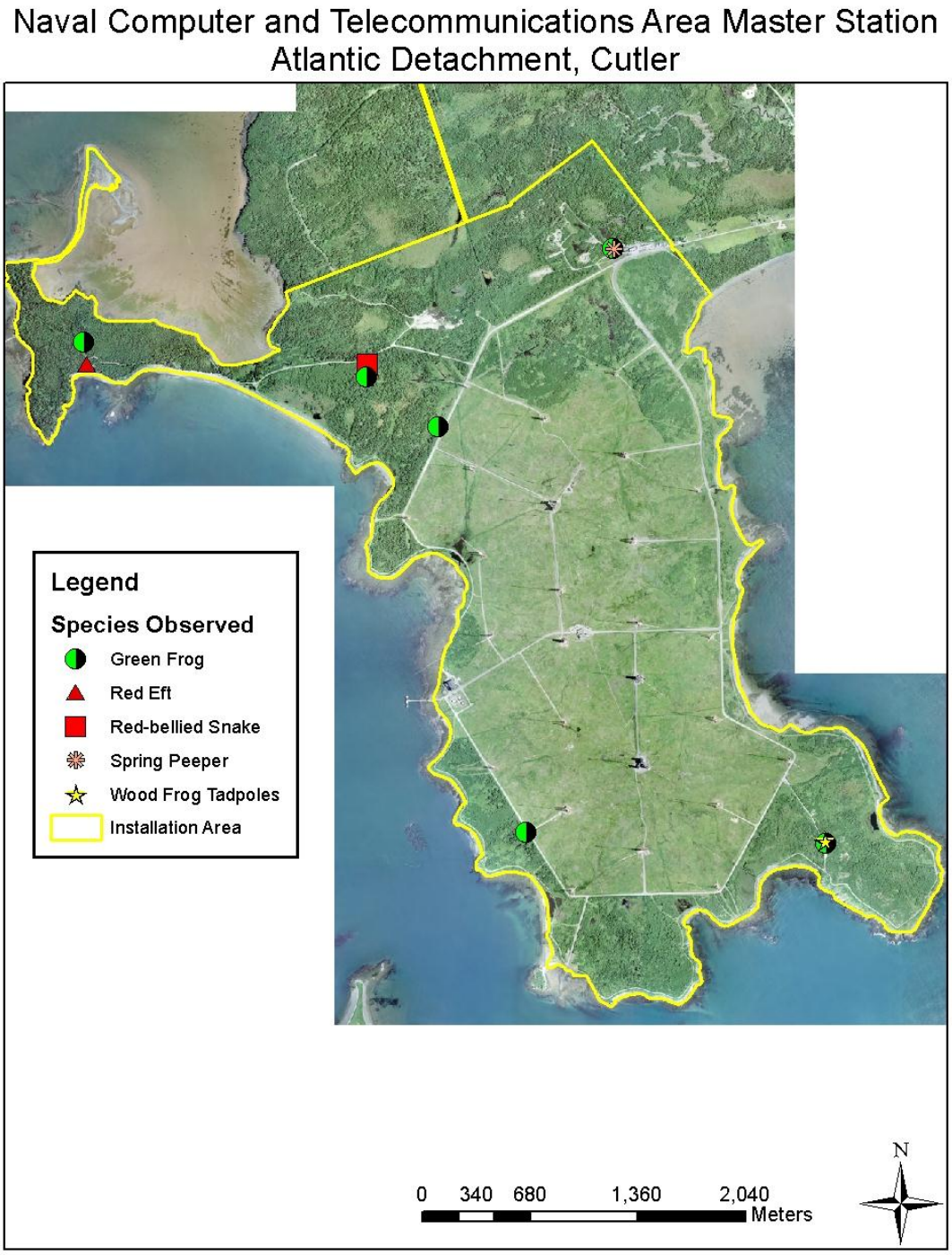
The daytime weather conditions during the Cutler survey (June 3, 2013) were overcast with occasional periods of rain and heavy fog. The air temperature was approximately 60 °F with occasional gusty winds. The weather conditions at Great Pond (June 4-5, 2013) were sunny to partly cloudy with a maximum daily temperature of approximately 65 °F. At the Rangeley SERE school (June 6-7, 2013), the weather conditions ranged from sunny to overcast with occasional light rain. Daytime temperatures were approximately in the high 60s °F.

Naval Computer and Telecommunications Area Master Station Atlantic Detachment Cutler

Four amphibian and one reptile species were encountered at Cutler during the survey (table 1). Amphibian species documented included the spring peeper (*Pseudacris crucifer*), northern green frog (*Lithobates clamitans melanota*), wood frog (*Lithobates sylvaticus*) tadpoles, and red-spotted newt (*Notophthalmus viridescens viridescens*; red eft stage). The frog species were located in PSS wetland habitats at several locations across the base (figure 2). The red eft was located under wood debris lying next to a log cabin. The only snake species documented was a northern red-belled snake (*Storeria occipitomaculata occipitomaculata*) discovered under a fallen branch located in an early

successional field. Neither the red-spotted newt nor the northern red-belled snake had been recorded on the installation previously.

Figure 2. Location of species encountered at NCTAMSA Det Cutler



Great Pond Outdoor Adventure Center

Thirteen species of amphibians and two species of reptiles were recorded at the GPOAC (table 1, figure 3). A chorus consisting of multiple frog species was observed the night of June 3rd in the PSS wetland located near Cabin 5. Spring peepers, gray treefrogs (*Hyla versicolor*), northern green frogs, and American bullfrogs (*Lithobates catesbeiana*) were recorded at this location. An eastern American toad (*Anaxyru americanus americanus*) was located on the main road while conducting nighttime vehicle surveys.


Gray Treefrog


Northern Dusky Salamander

In Collar Brook Stream, several northern dusky salamanders (*Desmognathus fuscus*) and northern two-lined salamanders (*Eurycea bislineata*) were captured under rocks on the edge of the stream on both sides of the road bridge. These two species were also located in a stream located on the north side of Great Pond.

Within the PSS wetland habitat located where Collar Brook Stream drains into the Great Pond, the following species were observed: common snapping turtle (*Chelydra serpentina serpentine*), pickerel frog (*Lithobates palustris*), green frog, American bullfrog, and a dusky salamander.

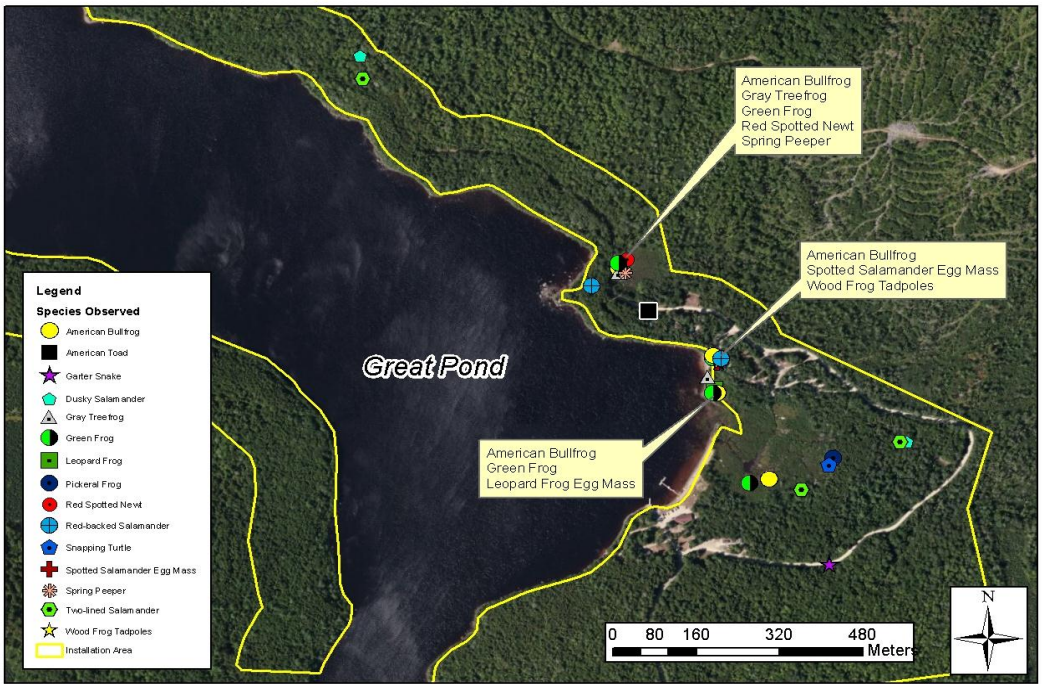
A vernal pool located in the campground contained spotted salamander (*Ambystoma maculatum*) egg masses and wood frog tadpoles. It is possible that some of the egg masses could have been from the blue spotted salamander (*Ambystoma maculatum*). A single eastern garter snake (*Thamnophis sirtalis sirtalis*) was captured crossing the gravel road leading to the cabins.

Several hours were spent surveying for amphibians and reptiles around King Pond on June 5, 2013. A stream leading into King Pond contained northern dusky salamanders and northern two-lined salamanders. Within several vernal pools on the edge of the pond,

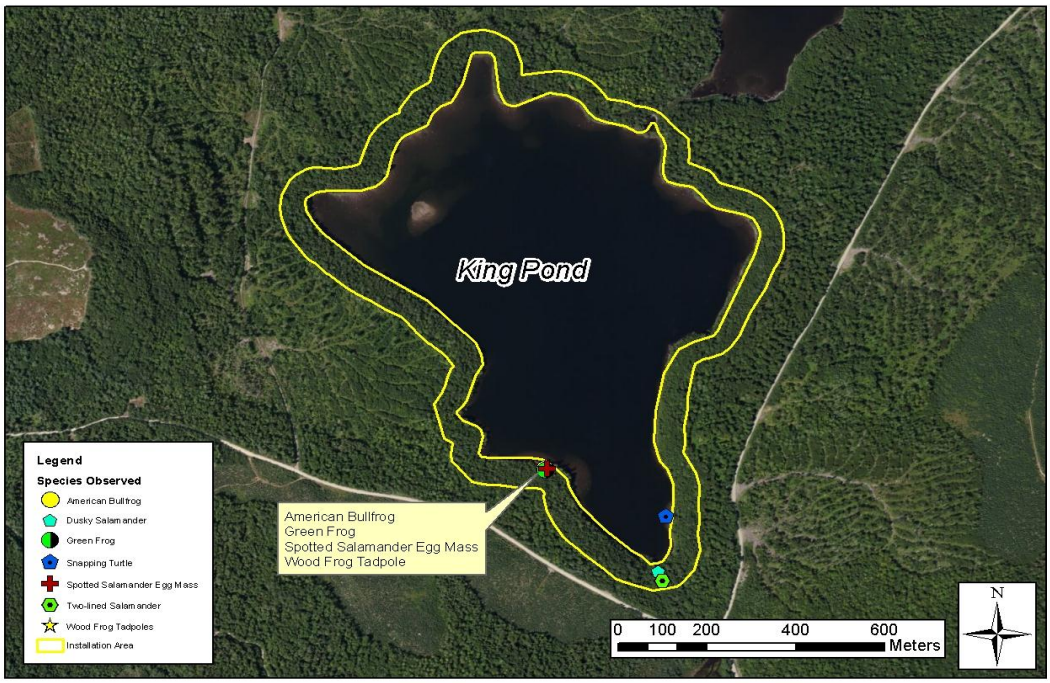
green frogs, bull frogs, wood frog tadpoles, and spotted salamander egg masses were seen. A common snapping turtle was observed basking on a rock in the pond.

Figures 3-4. Location of species encountered at GPOAC

Great Pond Outdoor Adventure Center



Great Pond Outdoor Adventure Center-King Pond



Of the species observed at GPOAC during the survey, both the northern dusky salamander and the northern two-lined salamander were new observations for the installation.

Survival, Evasion, Resistance, and Escape School

Eleven species of amphibians and one reptile species were recorded at the Rangeley SERE School (table 1, figure 4). Northern dusky salamanders and northern two-lined salamanders were common in many of the streams of the installation, including Tumbledown Brook. Within several vernal pools, amphibians such as northern green frogs, spotted salamander egg masses, and wood frog tadpoles were commonly observed. A red-spotted newt was observed in only one vernal pool, but is likely more widely distributed on the site.


Wood Frog

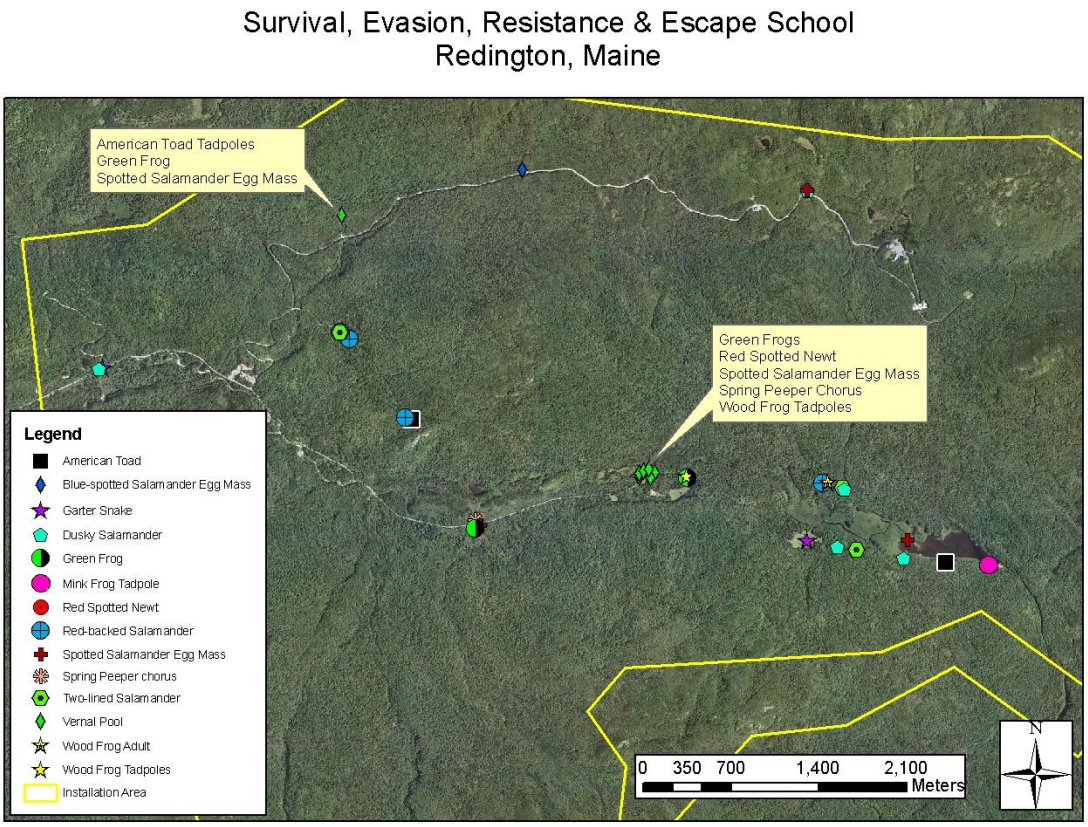
Other amphibian species confirmed included the eastern American toad, red-backed salamander (*Plethodon cinereus*), and a mink frog (*Lithobates septentrionalis*) tadpole. Some of the egg masses observed were believed to be from the blue spotted salamander. Pictures of the egg masses are being verified with a herpetologist of Maine. Spring peeper choruses were heard in three locations during a nighttime survey: Redington Pond, at a single vernal pool located north of the road to Redington Pond, and in a riparian wetland south of the bluff (figure 4).

The only reptile species recoded was the eastern garter snake. This species was seen at two locations on the installation; in the field located at the end of Redington Road and at the bridge on the main entrance road. A wood pile at the edge of the road near the bridge contained more than eight snakes.


Garter Snake

Of the species recorded at the Rangeley SERE school, the northern dusky and the red-spotted newt were new records for the installation.

Figures 5. Location of species encountered at SERE School



Discussion

This baseline field survey assisted with documenting the presence of herpetofauna species on the three Navy installations and provided some insight as to what species could likely be confirmed in future survey efforts based on available habitat. Appendix A lists the species and their presence (confirmed or potential) for the three Navy installations to date.

At NCTAMSLANT DET Cutler, 9 species have been confirmed and 15 species have the potential to be present on the installation. It is likely that the mink frog, red-backed salamander, and four-toed salamander (*Hemidactylium scutatum*) are present on the site based on suitable habitat. However, no suitable habitat was observed for the northern dusky salamander and northern two-lined salamander and they likely do not occur on the site. In addition, the American bullfrog, if present, would have likely been encountered on the site during this and other field investigations. Therefore I do not think it occurs on the site. The American bullfrog is considered invasive in Maine and its lack of presence is beneficial to the ecosystem.

Nineteen species of herpetofauna have been confirmed on the GPOAC and four species have the potential to be present: four-toed salamander, northern ringed-necked snake (*Diadophis punctatus edwardsii*), northern watersnake (*Nerodia sipedon sipedon*), and wood turtle (*Glyptemys insculpta*). Based on the habitat observed during the study, it is likely that these species occur on the installation. Particularly good habitat (moss covered hummocks) was observed for the four-toed salamander. Staff at the GPOAC reported seeing a three foot snake on the road this spring. Although not confirmed, this snake species was likely a northern watersnake, which is the only snake species that grows to this length in this area of Maine.

Thirteen species of herpetofauna have been confirmed on the SERE school and 12 additional species have the potential to be present. Due to the size of the installation (approximately 11,000 acres) and its diversity of habitats, many of these species likely occur. However, based on a discussion with the road crew at the facility, it is unlikely smooth green snakes (*Opheodrys vernalis*) are present. These snakes, when present in an area, are commonly seen and would likely have been observed by the staff. Additionally, it is unlikely that the American bullfrog is present on the site. Survey occurred when American bullfrogs should have been breeding, but were not heard or seen.

Table 1: Species confirmed on the three Navy installations during the baseline field survey June 3-7, 2013.

Scientific Name	Common Name	Cutler	Great Pond	SERE School
Anaxyru americanus americanus	Eastern American Toad		X	X
Hyla versicolor	Gray Treefrog		X	
Pseudacris crucifer	Spring Peeper	X	X	X
Lithobates catesbeiana	American Bullfrog		X	
Lithobates clamitans melanota	Northern Green Frog	X	X	X
Lithobates palustris	Pickerel Frog		X	
Lithobates pipiens	Northern Leopard Frog		X	
Lithobates septentrionalis	Mink Frog			X
Lithobates sylvatica (sylvaticus)	Wood Frog	X	X	X
Notophthalmus viridescens viridescens	Red-spotted Newt	X	X	X
Ambystoma laterale	Blue-spotted Salamander			X
Ambystoma maculatum	Spotted Salamander		X	X
Desmognathus fuscus	Northern Dusky Salamander		X	X
Eurycea bislineata	Northern Two-lined Salamander		X	X
Gyrinophilus porphyriticus	Spring Salamander			
Hemidactylium scutatum	Four-toed Salamander			
Plethodon cinereus	Eastern Red-backed Salamander		X	X
Diadophis punctatus edwardsii	Northern Ring-necked Snake			

Nerodia sipedon sipedon	Northern Watersnake			
Opheodrys vernalis	Smooth Green Snake			
Storeria occipitomaculata occipitomaculata	Northern Red-bellied Snake	X		
Thamnophis sirtalis sirtalis	Eastern Garter Snake		X	X
Chelydra serpentina serpentina	Common Snapping Turtle		X	
Chrysemys picta picta	Eastern Painted Turtle			
Glyptemys insculpta	Wood Turtle			

Appendix A

Great Pond Outdoor Adventure Center	Frog or Toad	*Bufo (Anaxyrus) americanus americanus*	Eastern American Toad	Confirmed	Tetra Tech 2007,2008, Trefry 2013
Great Pond Outdoor Adventure Center	Frog or Toad	*Hyla versicolor*	Gray Treefrog	Confirmed	Tetra Tech 2007,2008, Trefry 2013
Great Pond Outdoor Adventure Center	Frog or Toad	*Pseudacris crucifer*	Spring Peeper	Confirmed	Tetra Tech 2007,2008, Trefry 2013
Great Pond Outdoor Adventure Center	Frog or Toad	*Rana (Lithobates) catesbeiana*	American Bullfrog	Confirmed	Tetra Tech 2007,2008, Trefry 2013
Great Pond Outdoor Adventure Center	Frog or Toad	*Rana (Lithobates) clamitans melanota*	Northern Green Frog	Confirmed	Tetra Tech 2007,2008, Trefry 2013
Great Pond Outdoor Adventure Center	Frog or Toad	*Rana (Lithobates) palustris*	Pickerel Frog	Confirmed	Tetra Tech 2007,2008, Trefry 2013
Great Pond Outdoor Adventure Center	Frog or Toad	*Rana (Lithobates) pipiens*	Northern Leopard Frog	Confirmed	Tetra Tech 2007,2008, Trefry 2013
Great Pond Outdoor Adventure Center	Frog or Toad	*Rana (Lithobates) septentrionalis*	Mink Frog	Confirmed	Tetra Tech 2007,2008
Great Pond Outdoor Adventure Center	Frog or Toad	*Rana (Lithobates) sylvatica (sylvaticus)*	Wood Frog	Confirmed	Tetra Tech 2007,2008, Trefry 2013
Great Pond Outdoor Adventure Center	Newt	*Notophthalmus viridescens viridescens*	Red-spotted Newt	Confirmed	Tetra Tech 2007,2008, Trefry 2013
Great Pond Outdoor Adventure Center	Salamander	*Ambystoma laterale*	Blue-spotted Salamander	Potential	
Great Pond Outdoor Adventure Center	Salamander	*Ambystoma maculatum*	Spotted Salamander	Confirmed	Tetra Tech 2007,2008, Trefry 2013

Great Pond Outdoor Adventure Center	Salamander	*Desmognathus fuscus*	Northern Dusky Salamander	Confirmed	Trefry 2013
Great Pond Outdoor Adventure Center	Salamander	*Eurycea bislineata*	Northern Two-lined Salamander	Confirmed	Trefry 2013
Great Pond Outdoor Adventure Center	Salamander	*Hemidactylium scutatum*	Four-toed Salamander	Potential	
Great Pond Outdoor Adventure Center	Salamander	*Plethodon cinereus*	Eastern Red-backed Salamander	Confirmed	Tetra Tech 2007,2008, Petersen 2013
Great Pond Outdoor Adventure Center	Snake	*Diadophis punctatus edwardsii*	Northern Ring-necked Snake	Potential	
Great Pond Outdoor Adventure Center	Snake	*Nerodia sipedon sipedon*	Northern Watersnake	Potential	
Great Pond Outdoor Adventure Center	Snake	*Opheodrys vernalis*	Smooth Green Snake	Confirmed	Tetra Tech 2007,2008
Great Pond Outdoor Adventure Center	Snake	*Storeria occipitomaculata occipitomaculata*	Northern Red-bellied Snake	Confirmed	Tetra Tech 2007,2008
Great Pond Outdoor Adventure Center	Snake	*Thamnophis sirtalis sirtalis*	Eastern Garter Snake	Confirmed	Tetra Tech 2007,2008, Trefry 2013
Great Pond Outdoor Adventure Center	Turtle	*Chelydra serpentina serpentina*	Common Snapping Turtle	Confirmed	Tetra Tech 2007,2008, Trefry 2013

Great Pond Outdoor Adventure Center	Turtle	*Chrysemys picta picta*	Eastern Painted Turtle	Confirmed	Tetra Tech 2007,2008
Great Pond Outdoor Adventure Center	Turtle	*Glyptemys insculpta*	Wood Turtle	Potential	

NCTAMSLANT DET Cutler (HFS)	Frog or Toad	*Anaxyrus americanus americanus*	Eastern American Toad	Confirmed	INRMP 2012
NCTAMSLANT DET Cutler (HFS)	Frog or Toad	*Hyla versicolor*	Gray Treefrog	Potential	
NCTAMSLANT DET Cutler (HFS)	Frog or Toad	*Lithobates catesbeianus*	American Bullfrog	Potential	
NCTAMSLANT DET Cutler (HFS)	Frog or Toad	*Lithobates clamitans melanota*	Northern Green Frog	Confirmed	INRMP 2012
NCTAMSLANT DET Cutler (HFS)	Frog or Toad	*Lithobates palustris*	Pickerel Frog	Potential	
NCTAMSLANT DET Cutler (HFS)	Frog or Toad	*Pseudacris crucifer*	Spring Peeper	Confirmed	INRMP 2012
NCTAMSLANT DET Cutler (HFS)	Frog or Toad	*Rana (Lithobates) pipiens*	Northern Leopard Frog	Potential	
NCTAMSLANT DET Cutler (HFS)	Frog or Toad	*Rana (Lithobates) septentrionalis*	Mink Frog	Potential	
NCTAMSLANT DET Cutler (HFS)	Frog or Toad	*Rana (Lithobates) sylvatica (sylvaticus)*	Wood Frog	Confirmed	INRMP 2012
NCTAMSLANT DET Cutler (HFS)	Newt	*Notophthalmus viridescens viridescens*	Red-spotted Newt	Potential	
NCTAMSLANT DET Cutler (HFS)	Salamander	*Ambystoma laterale*	Blue-spotted Salamander	Potential	

NCTAMSLANT DET Cutler (HFS)	Salamander	*Ambystoma maculatum*	Spotted Salamander	Confirmed	INRMP 2012
NCTAMSLANT DET Cutler (HFS)	Salamander	*Desmognathus fuscus*	Northern Dusky Salamander	Potential	
NCTAMSLANT DET Cutler (HFS)	Salamander	*Eurycea bislineata*	Northern Two-lined Salamander	Potential	
NCTAMSLANT DET Cutler (HFS)	Salamander	*Hemidactylium scutatum*	Four-toed Salamander	Potential	
NCTAMSLANT DET Cutler (HFS)	Salamander	*Plethodon cinereus*	Eastern Red-backed Salamander	Potential	
NCTAMSLANT DET Cutler (HFS)	Snake	*Diadophis punctatus edwardsii*	Northern Ring-necked Snake	Potential	
NCTAMSLANT DET Cutler (HFS)	Snake	*Nerodia sipedon sipedon*	Northern Watersnake	Potential	
NCTAMSLANT DET Cutler (HFS)	Snake	*Opheodrys vernalis*	Smooth Green Snake	Potential	
NCTAMSLANT DET Cutler (HFS)	Snake	*Storeria occipitomaculata occipitomaculata*	Northern Red-bellied Snake	Potential	
NCTAMSLANT DET Cutler (HFS)	Snake	*Thamnophis sirtalis sirtalis*	Eastern Garter Snake	Confirmed	INRMP 2012
NCTAMSLANT DET Cutler (HFS)	Turtle	*Chelydra serpentina serpentina*	Common Snapping Turtle	Potential	

NCTAMSLANT DET Cutler (HFS)	Turtle	*Chrysemys picta picta*	Eastern Painted Turtle	Potential	
NCTAMSLANT DET Cutler (HFS)	Turtle	*Glyptemys insculpta*	Wood Turtle	Potential	
NCTAMSLANT DET Cutler (HFS)	Frog or Toad	*Anaxyrus americanus americanus*	Eastern American Toad	Confirmed	Petersen 2011, INRMP 2012
NCTAMSLANT DET Cutler (HFS)	Frog or Toad	*Hyla versicolor*	Gray Treefrog	Confirmed	INRMP 2012
NCTAMSLANT DET Cutler (HFS)	Frog or Toad	*Lithobates catesbeianus*	American Bullfrog	Potential	
NCTAMSLANT DET Cutler (HFS)	Frog or Toad	*Lithobates clamitans melanota*	Northern Green Frog	Confirmed	Trefry and Petersen 2013, INRMP 2012
NCTAMSLANT DET Cutler (HFS)	Frog or Toad	*Lithobates palustris*	Pickerel Frog	Potential	
NCTAMSLANT DET Cutler (HFS)	Frog or Toad	*Pseudacris crucifer*	Spring Peeper	Confirmed	Trefry and Petersen 2013, INRMP 2012
NCTAMSLANT DET Cutler (HFS)	Frog or Toad	*Rana (Lithobates) pipiens*	Northern Leopard Frog	Potential	
NCTAMSLANT DET Cutler (HFS)	Frog or Toad	*Rana (Lithobates) septentrionalis*	Mink Frog	Potential	
NCTAMSLANT DET Cutler (HFS)	Frog or Toad	*Rana (Lithobates) sylvatica (sylvaticus)*	Wood Frog	Confirmed	Trefry and Petersen 2013, INRMP 2012
NCTAMSLANT DET Cutler (HFS)	Newt	*Notophthalmus viridescens viridescens*	Red-spotted Newt	Confirmed	Trefry 2013(personal observation)
NCTAMSLANT DET Cutler (HFS)	Salamander	*Ambystoma laterale*	Blue-spotted Salamander	Potential	

NCTAMSLANT DET Cutler (HFS)	Salamander	*Ambystoma maculatum*	Spotted Salamander	Confirmed	INRMP 2012
NCTAMSLANT DET Cutler (HFS)	Salamander	*Desmognathus fuscus*	Northern Dusky Salamander	Potential	
NCTAMSLANT DET Cutler (HFS)	Salamander	*Eurycea bislineata*	Northern Two-lined Salamander	Potential	
NCTAMSLANT DET Cutler (HFS)	Salamander	*Hemidactylium scutatum*	Four-toed Salamander	Potential	
NCTAMSLANT DET Cutler (HFS)	Salamander	*Plethodon cinereus*	Eastern Red-backed Salamander	Potential	
NCTAMSLANT DET Cutler (HFS)	Snake	*Diadophis punctatus edwardsii*	Northern Ring-necked Snake	Potential	
NCTAMSLANT DET Cutler (HFS)	Snake	*Nerodia sipedon sipedon*	Northern Watersnake	Potential	
NCTAMSLANT DET Cutler (HFS)	Snake	*Opheodrys vernalis*	Smooth Green Snake	Potential	
NCTAMSLANT DET Cutler (HFS)	Snake	*Storeria occipitomaculata occipitomaculata*	Northern Red-bellied Snake	Confirmed	Trefry and Petersen 2013
NCTAMSLANT DET Cutler (HFS)	Snake	*Thamnophis sirtalis sirtalis*	Eastern Garter Snake	Confirmed	INRMP 2012
NCTAMSLANT DET Cutler (HFS)	Turtle	*Chelydra serpentina serpentina*	Common Snapping Turtle	Potential	

NCTAMSLANT DET Cutler (HFS)	Turtle	*Chrysemys picta picta*	Eastern Painted Turtle	Potential	
NCTAMSLANT DET Cutler (HFS)	Turtle	*Glyptemys insculpta*	Wood Turtle	Potential	

SERE School	Frog or Toad	*Bufo (Anaxyrus) americanus americanus*	Eastern American Toad	Confirmed	Trefry, 2013
SERE School	Frog or Toad	*Hyla versicolor*	Gray Treefrog	Potential	
SERE School	Frog or Toad	*Pseudacris crucifer*	Spring Peeper	Confirmed	Trefry and Petersen, 2013
SERE School	Frog or Toad	*Rana (Lithobates) catesbeiana*	American Bullfrog	Potential	
SERE School	Frog or Toad	*Rana (Lithobates) clamitans melanota*	Northern Green Frog	Confirmed	Trefry and Petersen, 2013
SERE School	Frog or Toad	*Rana (Lithobates) palustris*	Pickerel Frog	Confirmed	Trefry, 2012
SERE School	Frog or Toad	*Rana (Lithobates) pipiens*	Northern Leopard Frog	Potential	
SERE School	Frog or Toad	*Rana (Lithobates) septentrionalis*	Mink Frog	Confirmed	Trefry, 2013
SERE School	Frog or Toad	*Rana (Lithobates) sylvatica (sylvaticus)*	Wood Frog	Confirmed	Trefry and Petersen, 2013
SERE School	Newt	*Notophthalmus viridescens viridescens*	Red-spotted Newt	Confirmed	Trefry and Petersen, 2013
SERE School	Salamander	*Ambystoma laterale*	Blue-spotted Salamander	Potential	

SERE School	Salamander	*Ambystoma maculatum*	Spotted Salamander	Confirmed	Trefry and Petersen, 2013
SERE School	Salamander	*Desmognathus fuscus*	Northern Dusky Salamander	Confirmed	Trefry and Petersen, 2013
SERE School	Salamander	*Eurycea bislineata*	Northern Two-lined Salamander	Confirmed	Trefry and Petersen, 2013
SERE School	Salamander	*Gyrinophilus porphyriticus*	Spring Salamander	Potential	
SERE School	Salamander	*Hemidactylium scutatum*	Four-toed Salamander	Potential	
SERE School	Salamander	*Plethodon cinereus*	Eastern Red-backed Salamander	Confirmed	Trefry and Petersen, 2013
SERE School	Snake	*Diadophis punctatus edwardsii*	Northern Ring-necked Snake	Potential	
SERE School	Snake	*Lampropeltis triangulum triangulum*	Eastern Milksnake	Potential	
SERE School	Snake	*Opheodrys vernalis*	Smooth Green Snake	Potential	
SERE School	Snake	*Storeria occipitomaculata occipitomaculata*	Northern Red-bellied Snake	Potential	

SERE School	Snake	*Thamnophis sirtalis sirtalis*	Eastern Garter Snake	Confirmed	Trefry and Petersen, 2013
SERE School	Turtle	*Chelydra serpentina serpentina*	Common Snapping Turtle	Potential	
SERE School	Turtle	*Chrysemys picta picta*	Eastern Painted Turtle	Confirmed	Trefry, 2012
SERE School	Turtle	*Glyptemys insculpta*	Wood Turtle	Potential	

APPENDIX F

Natural Communities and Wildlife Factsheets

Enclosure 1 Spruce–Northern Hardwoods Forest
Enclosure 2 Montane Spruce–Fir Forest
Enclosure 3 Subalpine Fir Forest
Enclosure 4 Spruce Fir Krummholz
Enclosure 5 Spruce–Fir Wet Flat
Enclosure 6 Alder Thicket
Enclosure 7 Sedge–Heath Fen
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Enclosure 11 Northern long-eared bat
Enclosure 12 Little brown bat
Enclosure 13 Hoary bat
Enclosure 14 Silver haired bat
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Enclosure 16 Big brown bat
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Enclosure 19 Golden eagle
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Enclosure 28 Northern bog lemming

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Spruce - Northern Hardwoods Forest

Spruce - Northern Hardwoods Forest

State Rank S5

Community Description

This mixed forest type is characterized by red spruce and yellow birch, or less often another hardwood (sugar maple, red maple, or beech). Scattered large supercanopy white pine trees are occasional. Balsam fir and paper birch are common, typically as smaller trees, and hemlock may be an associate at some sites. The sapling/shrub layer may be fairly well developed (20-40% cover), with striped maple and saplings of canopy species; shrub species vary among sites. The herb layer ranges from sparse to dense but is usually >15% cover, divided between forbs, ferns, and regenerating trees, with dwarf shrubs virtually absent. The bryoid layer is patchy and locally well developed, with bryophytes far more abundant than lichens. As is typical in mesic forests in Maine, three-lobed bazzania is a frequent bryophyte.

Soil and Site Characteristics

These forests occur on cooler microsites from near sea level to 2200'. They are usually on hillslopes, ranging from lower to upper slopes and from gentle to steep (up to 50%). The soils are typically well drained, sometimes somewhat excessively drained, sandy to loamy in texture, with pH 5.0-5.4.

Balsam Fir

Diagnostics

Sites are distinguished by a mixture of red spruce and northern hardwoods (most often yellow birch) in the canopy; conifer and deciduous components exceed 25% cover each.

Similar Types

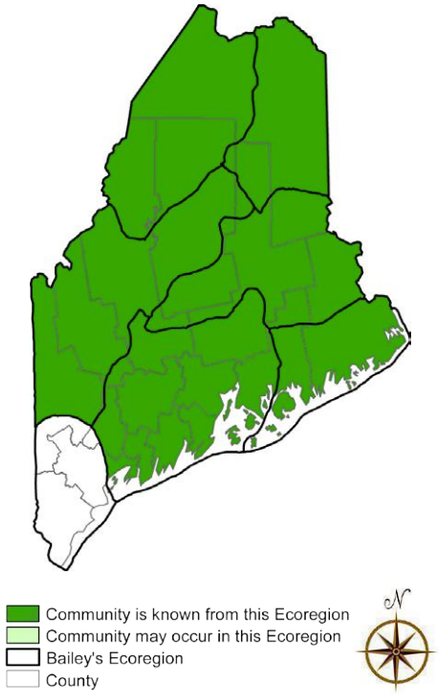
Beech - Birch - Maple Forests are more strongly deciduous. Spruce - fir forest types can be similar but have <25% cover of northern hardwood species. Both of these types can be contiguous with this type and may intergrade with it.

Conservation, Wildlife, and Management Considerations

Nearly all forests of this type have been harvested in the past, and at many sites the spruce has been selectively removed. As a result, the canopies of such sites are more often indicative of Beech - Birch - Maple Forests, with spruce and fir more common in the understory than in the canopy. Sites with relatively little human disturbance are rare but are moderately well represented on conservation lands.

This type provides nesting habitat for a large number of passerine bird species, including sharp-shinned hawk, Cape May warbler, black-throated blue warbler, black-throated green warbler, Blackburnian warbler, scarlet tanager, spruce grouse, Swainson's thrush, northern parula, and ovenbird. The globally uncommon early hairstreak butterfly uses beech as its larval host plant.

Location Map



Three-lobed Bazzania

Distribution

Most characteristic of the New England - Adirondack Province, and extending westward from Maine; found to a lesser extent in the Laurentian Mixed Forest Province.

Landscape Pattern: Matrix. This type is intended to represent forests that are truly 'mixed' at a stand scale, rather than large blocks containing a mosaic of distinct conifer and hardwood stands. For the latter example, the 'Spruce – Northern Hardwood Forest Ecosysystem' is a more appropriate mapping unit.

Characteristic Plants

These plants are frequently found in this community type. Those with an asterisk are often diagnostic of this community.

Canopy
Balsam fir
Red spruce*
White pine*
Yellow birch*

Sapling/shrub
American beech
Balsam fir*
Hobblebush*
Mountain maple*
Red maple
Red spruce*
Striped maple*
Yellow birch

Herb
Northern wood-sorrel
Spinulose wood fern*
Starflower

Bryoid
Dicranum moss
Flat-tufted feather-moss
Pincushion moss
Three-lobed bazzania

Associated Rare Plants

Giant rattlesnake-plantain

Associated Rare Animals

Early hairstreak

Examples on Conservation Lands You Can Visit

- Big Reed Pond Preserve – Piscataquis Co.
- Black Mountain, Mahoosuc Public Lands – Oxford Co.
- Chamberlain Lake Public Lands – Piscataquis Co.
- Cranberry Brook, Moosehorn National Wildlife – Washington Co.
- Western Mountain, Acadia National Park – Hancock Co.

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Montane Spruce - Fir Forest

State Rank S5

Spruce - Fir - Wood-sorrel - Feather-moss Forest

Community Description

These closed canopy or sometimes patchy canopy forests are dominated by red spruce (50-95% cover); fir is a common associate (up to 35% cover) in younger stands and in canopy gaps, and yellow birch is the most common hardwood. Other conifers (northern white cedar, hemlock, or white pine) occasionally reduce the spruce dominance to as low as 40% cover. Striped maple is typical in the shrub layer, along with tree saplings. The herb layer is well developed (>15% cover, and often >30%), with tree regeneration and an assortment of herbs. Dwarf shrubs are conspicuously absent, except for a bit of velvet-leaf blueberry. Most of the ground surface is a lush mosaic of feather-mosses and leafy liverworts.

Soil and Site Characteristics

These forests occur on cool and moist microsites at moderate elevations (600'-2500', perhaps slightly higher), and north of 45 degrees latitude. Slopes are moderate to steep (5-50%), and usually north, west, or east facing. Soils are mostly well drained (some imperfectly drained), sandy to loamy, of moderate depth (25-50 cm), with pH 5.0-5.5.

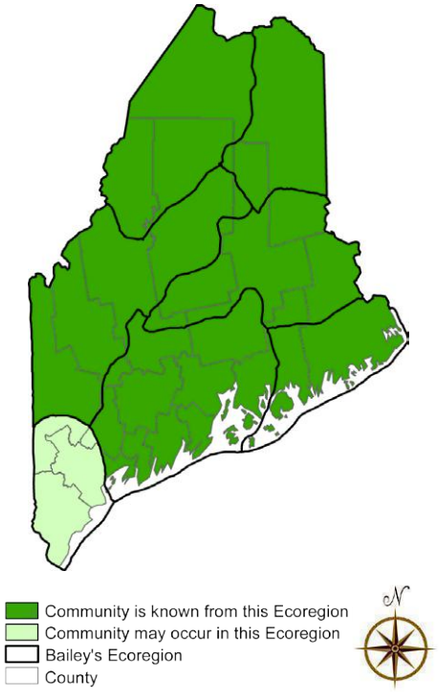
Diagnostics

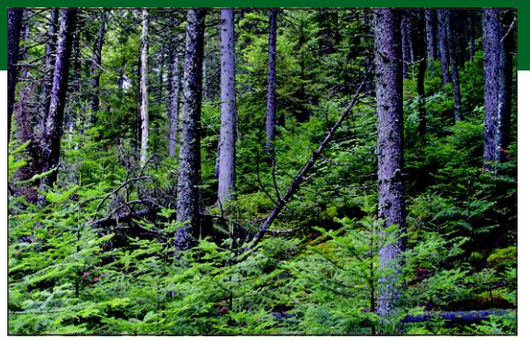
Red spruce is dominant, and yellow birch is the most abundant hardwood. Herbaceous species exceed 15% cover, with montane/boreal herbs such as bluebead lily, northern wood-sorrel, creeping snowberry, mountain wood fern, and/or rose twisted stalk locally common. Byoids exceed 40% cover, with a large proportion of feather-mosses.

Similar Types

Fir - Heart-leaved Birch Subalpine Forests can share many species and often grade into this type as elevation decreases, but will have fir more abundant than spruce in the canopy, shorter trees, and canopy gaps more frequent. Spruce - Fir - Broom-moss Forests have similar canopies but much more depauperate herb and bryoid layers. They usually occur on somewhat drier sites and lack the assortment of montane/boreal herbs and the most common mosses will be broom-mosses rather than feather-mosses. Some Maritime Spruce - Fir Forests have a similar herb layer, but if so they have more canopy fir and occur along the immediate coast.

Location Map





Montane Spruce – Fir Forest

Conservation, Wildlife, and Management Considerations

This is the characteristic spruce - fir type of mountain slopes just below the subalpine zone, and it is extensively harvested and managed. Spruce budworm has impacted many sites as well, creating patchy forest structure. Some areas of high ecological quality, in the hundreds of acres, are known but not necessarily designated as areas reserved from harvesting. Almost all are within a landscape of managed forest rather than surrounded by land that has been permanently cleared and converted to other uses.

This community type may be utilized as nesting habitat by a number of coniferous forest specialist bird species, such as the sharp-shinned hawk, yellow-bellied flycatcher, bay-breasted warbler, Cape May warbler, blackpoll warbler, northern parula, blackburnian warbler, boreal chickadee, Swainson's thrush, red crossbill, white-winged crossbill, gray jay, and spruce grouse.

Distribution

Western Maine westward (New England - Adirondack Province).

Landscape Pattern: Large Patch, mostly as hundreds of acres.

Characteristic Plants

These plants are frequently found in this community type. Those with an asterisk are often diagnostic of this community.

Canopy
Balsam fir*
Red spruce*
Yellow birch*

Sapling/shrub
Balsam fir*
Red maple
Striped maple

Dwarf Shrub
Velvet-leaf blueberry

Herb
Bluebead lily*
Bunchberry
Canada mayflower
Creeping snowberry*
Goldthread
Northern wood-sorrel*
Painted trillium
Starflower

Bryoid
Common broom-moss*
Mountain fern moss
Red-stemmed moss
Three-lobed bazzania

Associated Rare Plants

Boreal bedstraw
Lesser wintergreen

Associated Rare Animals

Bicknell's thrush

Examples on Conservation Lands You Can Visit

- Deboullie Ponds Public Lands – Aroostook Co.
- Elephant Mountain, Appalachian Trail – Franklin Co.
- Lower Horns Pond Trail, Bigelow Preserve – Franklin Co.
- Traveler Mountain, Baxter State Park – Piscataquis Co.
- Whitecap Mountain, Appalachian Trail – Piscataquis Co.

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Subalpine Fir Forest

Fir - Heart-leaved Birch Subalpine Forest

State Rank S3

Community Description

Balsam fir, or mixtures of fir and heart-leaved birch, form a dense canopy of somewhat stunted trees. Patches of heart-leaved birch and mountain ash are common where wind, fire, or landslides have created openings, along with a dense shrub layer of mountain ash, hobblebush, and regenerating fir. Herbs may be sparse, or may form locally dense patches in openings; wood ferns and big-leaved aster in particular tend to be patchy. In some expressions of this type that have developed after fire, the canopy consists almost entirely of paper birch or heart-leaved birch. Fir waves, an unusual landscape pattern of linear bands of fir dieback and regeneration, are another variant of this community.

Soil and Site Characteristics

These forests are commonly found above 2700' on level ridgetops and steep, upper slopes. The mineral soil layer is thin, typically 10-30 cm, and rocky. Natural disturbances such as landslides, wind, fire, and spruce-budworm can exert lasting influences on community dynamics. Recurrent landslides can keep some areas in birch - mountain-ash dominance.

Fir Waves on Crocker Mountain

Diagnostics

Fir or heart-leaved birch (occasionally paper birch) are dominant in a subalpine setting.

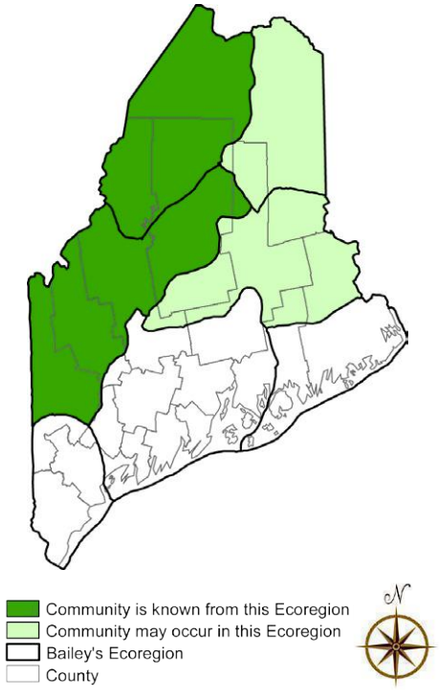
Similar Types

One form of the Maritime Spruce - Fir Forest type is compositionally very similar but occurs at sea level in the extreme environment of the Downeast coast. Decreasing in elevation, this type can grade into Spruce - Fir - Wood-sorrel - Feather-moss Forest or Spruce - Fir - Broom-moss Forest, which are distinguished by their higher proportion of spruce in the canopy and by less stunted trees.

Conservation, Wildlife, and Management Considerations

Although subalpine forests are naturally dynamic as they cycle through periods

Location Map



Subalpine Fir Forest

of weather and insect damage and regeneration, they appear to be relatively stable in overall extent and are extensive on Maine's higher mountains. Many major occurrences are well protected within public lands or private conservation lands. On the few remaining sites on private lands, timber harvesting, recreation, and windpower development could cause lasting impacts. At some sites, past harvesting has resulted in prolific growth of hay-scented and mountain wood fern, inhibiting tree regeneration.

This high-elevation forest community type may be used as nesting habitat by a number of high elevation and/or coniferous forest specialist bird species, such as the spruce grouse, dark-eyed junco, bay-breasted warbler, black-backed woodpecker, white-throated sparrow, and blackpoll warbler. The rare Bicknell's thrush inhabits structurally complex forests above 2500'. The rock vole and long-tailed shrew both inhabit cool moist crevices in rocky habitat at high elevations. Northern bog lemmings may inhabit wet sub-alpine spruce - fir forests in which peat moss is present.

Distribution

Western and central Maine westward (New England - Adirondack Province); likely extends northeasterly to the Gaspé Peninsula.

Landscape Pattern: Large Patch

Characteristic Plants

These plants are frequently found in this community type. Those with an asterisk are often diagnostic of this community.

Canopy

Balsam fir*
Heart-leaved paper birch
Paper birch*
Red spruce

Sapling/shrub

Balsam fir*
Black spruce*
Heart-leaved paper birch*
Mountain ash*
Wild-raisin

Herb

Balsam fir*
Big-leaved aster*
Bluebead lily
Mountain wood fern*
Northern wood-sorrel
Spinulose wood fern*
Starflower

Bryoid

Common broom-moss
Three-lobed bazzania

Associated Rare Plants

Northern comandra

Examples on Conservation Lands You Can Visit

- Baxter State Park – Piscataquis Co.
- Big Squaw Mountain Public Lands – Piscataquis Co.
- Bigelow Preserve Public Lands – Somerset Co.
- Crocker Mountain, Appalachian Trail – Franklin Co.
- Mahoosuc Mountain, Mahoosuc Public Lands – Oxford Co.
- Sugarloaf Mountain, Appalachian Trail – Franklin Co.

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Spruce - Fir Krummholz

Spruce - Fir - Birch Krummholz

State Rank S3

Community Description

Krummholz refers to the zone between treeline and more open alpine vegetation, where tree species are limited by the harsh conditions to a dense shrub growth-form. Black spruce, balsam fir, and heart-leaved paper birch form masses of stunted and wind swept trees 0.5-2 m high. Mountain alder may be locally common, and mountain ash and mountain shadbush are occasional. Total shrub cover is often close to 100%, and these areas may be all but impenetrable. Boreal herbs, such as bluebead lily and Canada mayflower, grow with patches of mosses in small openings among the shrubs, but total herb cover is sparse. Bryoids may be extensive beneath the trees.

Soil and Site Characteristics

This type occupies upper mountain slopes above treeline, typically at elevations of 2700 - 3700'. The cool conditions, lingering snows, and frequent fog and clouds create a fairly moist microclimate, but the sites are very exposed to wind and storms.

Black Spruce Cones

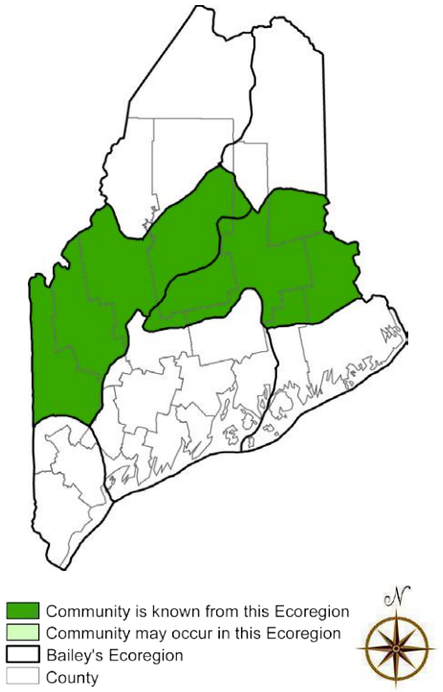
Diagnostics

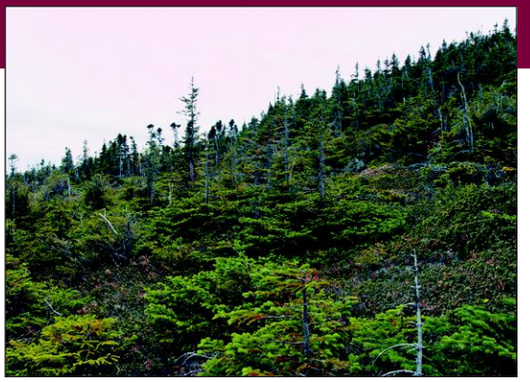
These are forests of the treeline zone in which dwarfed and matted trees form a dense shrub layer 0.5-2 m high; usually strongly coniferous.

Similar Types

Rocky Summit Heath can grade into or form a patchwork with this community, but it features lower tree cover (<25%) and more heath shrubs and open spaces. Fir - Heart-leaved Birch Subalpine Forest shares many overstory species and can grade into this community but is distinguished by having more upright trees and a fairly well developed herbaceous layer.

Location Map





Spruce – Fir Krummholz

Conservation, Wildlife, and Management Considerations

Krummholz is extensive on Maine's higher mountains, and most major occurrences are well protected within public lands or private conservation lands. The historic extent has been somewhat reduced by the development of ski areas, and proposals for wind generators could impact other sites. Because traversing this vegetation is so miserable, off-trail impacts from hikers are minimal, in contrast to other alpine/subalpine vegetation types.

This high-elevation dwarfed forest community type provides habitat for Bicknell's thrush, which only inhabits structurally complex forests above 2500'. Coniferous forest specialists like blackpoll warblers and spruce grouse are common associates in this community.

Distribution

Upper-elevation ridges of Maine's western and central mountains (mostly in the New England - Adirondack Province), extending westward and southward along the Appalachians, and likely to the Gaspé Peninsula.

Landscape Pattern: Large Patch

Characteristic Plants

These plants are frequently found in this community type. Those with an asterisk are often diagnostic of this community.

Sapling/shrub
Balsam fir*
Black spruce*
Heart-leaved paper birch*

Dwarf Shrub
Alpine bilberry*
Labrador tea*

Herb
Black crowberry
Bluebead lily
Bunchberry
Canada mayflower
Creeping snowberry
Mountain cranberry
Stiff clubmoss

Bryoid
Common broom-moss
Fringed Ptilidium liverwort
Red-stemmed moss

Associated Rare Plants

Northern comandra

Associated Rare Animals

Bicknell's thrush

Examples on Conservation Lands You Can Visit

- Baldpate Mountain, Grafton Notch State Park – Oxford Co.
- Bigelow Preserve Public Lands – Somerset Co.
- Goose Eye Mountain, Mahoosuc Public Lands – Oxford Co.
- Mt. Abraham – Franklin Co.
- Mt. Katahdin, Baxter State Park – Piscataquis Co.
- Saddleback Mountain, Appalachian Trail – Franklin Co.

Maine Natural Areas Program

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Spruce - Fir Wet Flat

State Rank S4

Spruce - Fir - Cinnamon Fern Forest

Community Description

This natural community is a fairly homogeneous forest type in which red spruce, black spruce, or red-black spruce hybrids grow on poorly drained, level to gently sloping sites. Balsam fir may be present in regenerating patches or stands but tends to give way to the longer-lived spruces over time. Stands often form even-aged blocks hundreds to thousands of acres in size. The even-aged structure likely results from the past influences of spruce-budworm, fire, harvesting, blowdowns, or a combination of multiple factors.

Cinnamon fern and three-seeded sedge are typical in these types statewide. In northern Maine, understory herbs and shrubs are sparse, and the forest floor is dominated by a dense carpet of mosses – typically Sphagnum species, three-lobed bazzania, and red-stemmed moss. Dwarf heath shrubs may be abundant at St. John Valley sites, which approach boreal 'muskeg'. In southern Maine, red maple may be sub-dominant. At sites near the coast, skunk cabbage may be a prominent understory species.

Soil and Site Characteristics

Sites usually occur along drainages or low flats where soil remains moist throughout the growing season and may be saturated or temporarily flooded in the springtime. The substrate is acidic mineral soil and may be very stony, with or without an organic layer (<30 cm) on top. More information is needed statewide to determine if this type should be split into two separate types, reflecting northern and southern Maine variants.

Diagnostics

Sites occur on moist to saturated mineral soils, usually with a dense carpet of mosses and liverworts. Closed canopies are dominated by spruce (>40% cover), or are rarely more open where red maple or northern white cedar mixes with spruce. Wetland plants occur in the herb layer, usually including cinnamon fern and three-seeded sedge.

Similar Types

Other spruce - fir types occur on better-drained upland soils and gentle to steeper slopes. Red Maple - Sensitive Fern Swamps can be similar but will have more red maple and less spruce and fir. Spruce - Larch Wooded Bogs can have similar species composition (especially where black spruce is dominant) but occur on peat deposits (>30 cm) rather than on mineral soils.

Location Map

Spruce – Fir Wet Flat

Conservation, Wildlife, and Management Considerations

Nearly all known occurrences of this community type in Maine have been harvested in the past, and many have a history of natural disturbance such as fire or spruce-budworm. Large (>1000 acres) examples free from human disturbance are scarce. Forest management with natural regeneration generally does not with result in conversion of this type. Studies on some examples on public and private conservation lands may provide further information on the natural dynamics in these systems.

These stands may serve as deer wintering areas and may also provide habitat for pine marten and Canada lynx, depending on the age and successional stage. This community type may be used as nesting habitat by a number of coniferous forest specialist bird species, including the yellow-bellied flycatcher, sharp-shinned hawk, black-backed woodpecker, pine grosbeak, green heron, black-throated green warbler, Blackburnian warbler, common yellowthroat, Wilson's warbler, spruce grouse, blackpoll warbler, and the rare rusty blackbird.

Distribution

Statewide, more common and extensive northward. Characteristic of the Laurentian Mixed Forest Province and New England - Adirondack Province.

Landscape Pattern: Large Patch

Characteristic Plants

These plants are frequently found in this community type. Those with an asterisk are often diagnostic of this community.

Canopy

Black spruce*
Larch
Northern white cedar
Red maple
Red spruce*
White pine

Sapling/shrub

Alder*
Balsam fir
Black huckleberry*
Mountain holly*
Red maple
Wild-raisin

Dwarf Shrub

Leatherleaf*
Lowbush blueberry*
Rhodora*
Sheep laurel*

Herb

Bunchberry
Cinnamon fern*
Dwarf raspberry*
Goldthread
Skunk cabbage
Three-seeded sedge*

Bryoid

Red-stemmed moss*
Sphagnum mosses*
Three-lobed bazzania

Associated Rare Animals

Rusty blackbird

Examples on Conservation Lands You Can Visit

- Chamberlain Lake Public Lands – Piscataquis Co.
- Round Pond Public Lands – Aroostook Co.

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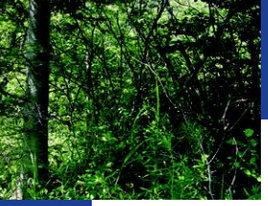


Alder Thicket

Alder Shrub Thicket

State Rank S5

Community Description

These tall (1-3 m) shrub dominated wetlands are characterized by dense growth of alder. Speckled alder is most typical, but rarely mountain alder or smooth alder may predominate. Red maple, gray birch, or other trees may be scattered sparsely above the shrubs. The herb layer is usually well developed (>35% cover), and is a variable mixture of forbs, graminoids, and ferns. The bryoid layer is patchy and dominated by peat mosses, especially *Sphagnum girghensonii*, *S. palustre*, and *S. magellanicum*.

Soil and Site Characteristics

This type occurs in basin wetlands that are usually saturated and may be seasonally flooded throughout the season. It is usually on muck or on peat. This type is very common as wet cleared areas revert to forest, such as old beaver meadows.

Diagnostics

These are shrub-dominated wetlands on peat or muck soils, often only temporarily flooded, in which alders dominate and comprise >20% cover, usually >40%.

Spotted Turtle

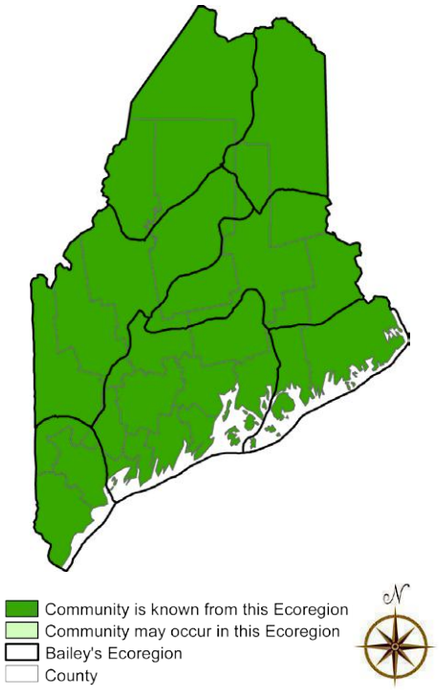
Similar Types

Alder Floodplains occur on mineral soils along medium to large rivers rather than in basins. Tussock Sedge Meadows, Bluejoint Meadows, and Mixed Graminoid - Shrub Marshes may have alder as a sub-dominant species, with lower cover than the graminoids. Mountain Holly - Alder Woodland Fens occur as part of a peatland and have mountain holly or heath shrubs mixed with the alder. Dogwood - Willow Shoreline Thickets often contain alder, but it is sub-dominant.

Conservation, Wildlife, and Management Considerations

Well distributed and well replicated. These shrublands, especially when they occur in close proximity to open water, may provide habitat for common bird species such as common yellowthroat, alder flycatcher, Wilson's warbler, and Lincoln's sparrow. Some occurrences of this community type support vernal pools, which are important breeding habitat for a variety of amphibians including wood frogs, spotted salamanders, and blue-spotted salamanders. Rare turtles like the wood turtle, or Blanding's and spotted turtles in southern Maine, may feed on amphibian egg masses present in such pools.

Location Map



Alder Thicket

Distribution

Statewide; extending in all directions from Maine.

Landscape Pattern: Small to Large Patch

Examples on Conservation Lands You Can Visit

- Bigelow Preserve Public Lands – Somerset Co.
- Bradley Wildlife Management Area – Penobscot Co.
- Branch Lake Wildlife Management Unit – Hancock Co.
- Kennebunk Plains Preserve – York Co.
- Muddy River Wildlife Management Area – Sagadahoc Co.
- Narraguagus Wildlife Management Unit – Washington Co.
- Redington Pond Public Lands – Franklin Co.

Characteristic Plants

These plants are frequently found in this community type. Those with an asterisk are often diagnostic of this community.

Sapling/shrub

Balsam fir*
Black spruce*
Common blackberry*
Gray birch*
Hardhack*
Meadowsweet
Mountain alder*
Red maple*
Speckled alder*

Herb

Bluejoint
Cinnamon fern
Flat-topped white aster*
Royal fern
Sensitive fern*
Swamp dewberry*
Three-seeded sedge
Tussock sedge*
Wild calla

Bryoid

Sphagnum mosses*

Associated Rare Plants

Bog bedstraw
Northern bog sedge

Associated Rare Animals

Blanding's turtle
Spotted turtle
Wood turtle

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Sedge - Heath Fen

Sedge - Leatherleaf Fen Lawn

State Rank S4

Community Description

This open peatland type is dominated by a layer of mixed dwarf heath shrubs and sedges. Small larches, rarely tree sized, are often scattered across the surface but contribute little cover. Leatherleaf, sweetgale, or bog rosemary may be the dominant shrub, and shrub cover is generally 20-40%. Sedges contribute 20-70% cover. Narrow-leaved cotton-grass, few-seeded sedge, and Michaux's sedge are typical dominants. Pitcher plants are usually present. The ground layer is a carpet of peat mosses, often with tracings of large cranberry running across the surface.

Soil and Site Characteristics

This type occurs in open peatlands, often in areas transitional from raised bog (ombrotrophic) to fen (minerotrophic) conditions. Sites are typically acidic (pH 4.0-5.4) but sometimes circumneutral. Peat substrate is saturated to the surface, or nearly so. This type most often occurs at low to moderate elevations.

Diagnostics

Open peatland vegetation consists of sedges and dwarf shrubs (leatherleaf, bog rosemary, sweetgale). Sedge cover exceeds shrub cover. Dominant sedges include few-seeded sedge, coast sedge, Michaux's sedge, white beakrush, and narrow-leaved cotton-grass.

Sheep Laurel

Similar Types

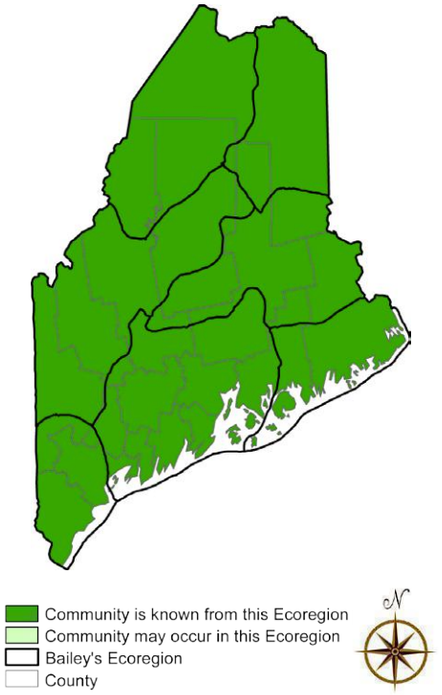
Leatherleaf Boggy Fen is shrubbier, has more leatherleaf than sedge cover, and has tufted cotton-grass or tawny cotton-grass as prominent sedges. Sheep Laurel Dwarf Shrub Bog is drier and shrubbier and features sheep laurel as the dominant shrub. Low Sedge - Buckbean Fen Lawn occurs in similar, although usually somewhat wetter settings. It has a greater dominance of sedges than shrubs and often features mud sedge and podgrass. Mixed Tall Sedge Fen can consist of leatherleaf among sedges, but the sedges will be large and robust species such as slender sedge, beaked sedge, and inflated sedge.

Conservation, Wildlife, and Management Considerations

This community type is well represented in Maine and is fairly stable in extent, with several examples on public lands and private conservation lands. Impoundment or draining would have negative impacts on bog hydrology and on vegetation. Slow vegetation growth rates, due to the nutrient poor setting, result in slow recovery from physical disturbances, such as recreational trail use. If disturbance, such as trail crossing, is a priority, traversing during frozen conditions or using boardwalks can minimize impacts.

Several rare dragonflies may be found in this community, especially in very wet locations with abundant peat moss (often suspended in the water column). The Quebec emerald is found in northern Maine, and the ringed boghaunter is restricted to the southern part of the state in York and southern Oxford Counties. In northwestern Maine this type may support the bog fritillary butterfly, which uses small cranberry as its larval host plant.

Location Map



Distribution

Statewide, though more common northward. Throughout northern New England and New York; Canadian distribution unknown.

Landscape Pattern: Small Patch

Sedge – Heath Fen

Characteristic Plants

These plants are frequently found in this community type. Those with an asterisk are often diagnostic of this community.

Sapling/shrub

Larch*
Mountain holly*

Dwarf Shrub

Bog rosemary*
Large cranberry*
Leatherleaf*
Sheep laurel
Small cranberry

Herb

Bog aster*
Bog goldenrod
Coast sedge*
Few-flowered sedge*
Few-seeded sedge*
Narrow-leaved cotton-grass*
Pitcher plant
Round-leaved sundew
Slender sedge
Spatulate-leaved sundew
White beak-rush*
Yellowish sedge

Bryoid

*Sphagnum magellanicum**

Associated Rare Animals

Quebec emerald
Ringed boghaunter

Examples on Conservation Lands You Can Visit

- Acadia National Park – Hancock Co.
- Great Heath Public Lands – Washington Co
- Great Wass Island Preserve – Washington Co
- Number Five Bog Public Lands – Somerset Co.
- Salmon Brook Lake Bog Public Lands – Aroostook Co.
- St. John River Preserve – Aroostook/ Somerset Co.

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Small Whorled Pogonia

Isotria medeoloides

States where the small whorled pogonia, an orchid, is found.

Photos by USFWS; Sarena Selbo (right) and Susi vonOettingen (left)

The small whorled pogonia is a threatened species. Threatened species are animals and plants that are likely to become endangered in the foreseeable future. Endangered species are animals and plants that are in danger of becoming extinct. Identifying, protecting, and restoring endangered and threatened species is the primary objective of the U.S. Fish and Wildlife Service's endangered species program.

What is the small whorled pogonia?

Appearance - The small whorled pogonia is a member of the orchid family. It usually has a single grayish-green stem that grows about 10 inches tall when in flower and about 14 inches when bearing fruit. The plant is named for the whorl of five or six leaves near the top of the stem and beneath the flower. The leaves are grayish-green, somewhat oblong and 1 to 3.5 inches long. The single or paired greenish-yellow flowers are about 0.5 to 1 inch long and appear in May or June. The fruit, an upright ellipsoid capsule, appears later in the year.

Range - Although widely distributed, the small whorled pogonia is rare. It is found in 17 eastern states and Ontario, Canada. Populations are typically small with less than 20 plants. It has been extirpated from Missouri, New York, Vermont, and Maryland.

Habitat - This orchid grows in older hardwood stands of beech, birch, maple, oak, and hickory that have an open understory. Sometimes it grows in stands of softwoods such as hemlock. It prefers acidic soils with a thick layer of dead leaves, often on slopes near small streams.

What is the small whorled pogonia? (continued)

Reproduction - This pogonia flowers from mid-May to mid-June, with the flowers lasting only a few days to a week. It may not flower every year but when it does flower, one or two flowers are produced per plant. If pollinated, a capsule forms that contains several thousand minute seeds. The pogonia appears to self-pollinate by mechanical processes. The flower lacks both nectar guides and fragrance and insect pollination has not been observed.

Why is the small whorled pogonia threatened?

Habitat Loss and Degradation - The primary threat to the small whorled pogonia is the past and continuing loss of populations when their habitat is developed for urban expansion. Some forestry practices eliminate habitat. Also, habitat may be degraded or individual plants lost because of recreational activities and trampling.

Collection - As with all rare orchids, the small whorled pogonia is vulnerable to collecting for commercial or personal use.

What Is being done to prevent extinction of the small whorled pogonia?

Listing - The small whorled pogonia was added to the U.S. List of Endangered and Threatened Wildlife and Plants in 1982 as an endangered species. In 1994 it was reclassified to threatened.

Recovery Plan - The U.S. Fish and Wildlife Service prepared a recovery plan and revised that plan in 1992. The Recovery Plan describes and prioritizes actions needed to help recover the species.

Research - Many small whorled pogonia populations are being monitored to determine long-term population trends. Habitat management techniques, such as reducing shade through selected tree removal are being investigated.

Habitat Protection - A variety of government and private conservation agencies are working to preserve the small whorled pogonia and its habitat. Voluntary protection agreements have also been made with some private landowners.

What can I do to help prevent extinction of species?

Learn - Learn more about the small whorled pogonia and other endangered and threatened species. Understand how the destruction of habitat leads to loss of endangered and threatened species and our nation's plant and animal diversity.

Volunteer - Volunteer at your local zoo, wildlife refuge or nature center. Work with their staff or other community members to maintain and restore local habitat.

Protect – Protect native plants by cleaning your shoes after hiking to avoid spreading invasive plants seeds and staying on trails if you are hiking in an area with rare plants in the the understory.

Grow Natives - Grow native plants in your lawn and garden but obtain the plants from local nurseries, do not dig up native plants from natural areas. Avoid using invasive, non-native plants in landscaping, such as purple loosestrife, bush honeysuckles and burning bush.

U.S. Fish & Wildlife Service
1 Federal Drive
Fort Snelling, Minnesota 55111
612/713-5350
http://www.fws.gov/midwest/endangered

January 2008

FEDERALLY THREATENED

MDIFW

Canada Lynx

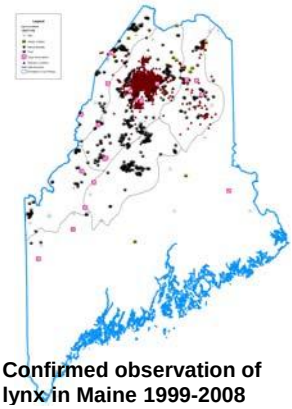
(*Lynx canadensis*)

Description

The loup cervier, lucivee, and Indian devil are all names used by old-time Maine woodsmen for the elusive Canada lynx. This forest-dwelling cat is found in northern latitudes and high mountains where deep snow and spruce/fir forest are common. Both lynx and bobcats are found in Maine. Lynx are more common in northern and western Maine and bobcats are more common in eastern and southern Maine. Although lynx are similar in size and appearance to bobcats, lynx appear larger because of their long legs. Lynx have long black tufts of fur on their ears and a short, completely black-tipped tail. Bobcats have shorter tufts on their ears, and the tip of their tail is black on top and white underneath. A lynx winter coat is light gray and faintly spotted, and the summer coat is much shorter and has a reddish-brown cast. Lynx have unusually large, densely haired feet that help them travel over snow. Adult males average about 33½ inches long and weigh between 26 and 30 pounds. Females are about 32 inches long and average 19 pounds.

Range and Habitat

Lynx are common throughout the boreal forest of Alaska and Canada. The southern portion of their range once extended into the U.S. in the Rocky Mountains, Great Lakes states, and the Northeast. Today, in the Lower-48 states they are known to exist in Montana, Washington, Maine, and Minnesota and have been reintroduced to Colorado. Lynx have also been observed in New Hampshire and Vermont, but their status is not known.



Confirmed observation of lynx in Maine 1999-2008

In Maine, lynx are most common in the spruce/fir flats of Aroostook and Piscataquis counties and northern Penobscot, Somerset, Franklin and Oxford Counties, where snow depths are often the highest in the state. Historic and recent observations suggest lynx also occasionally occur in portions of eastern Maine.

Today, the majority of northern Maine's spruce/fir forests are comprised of young dense sapling trees created after a major forest disturbance. During the late 1970s and 1980s, a major insect outbreak damaged or killed most of Maine's spruce and fir. As a result, large areas of spruce and fir were cut. Thirty years later these regenerating sapling spruce and fir stands supported the highest densities of snowshoe hares, the primary food for lynx. Through the 1990s, lynx populations increased and by 2006 reached record high numbers. Current models suggest between 600 and 1,200 adult lynx likely occupied northern and western Maine spruce/fir flats.

Life History and Ecology

Mating occurs during March, and 1-7 young are born 60-65 days later in May. Lynx in Maine have produced litters of 1-5 kittens (average 3 kittens/litter when hares were abundant). Lynx dens in Maine consist of a bed under thick regenerating fir trees or elevated downed logs. The female raises the kittens. Kittens leave the den area in late June or early July and stay with the female for a full year.

Lynx are highly specialized to hunt snowshoe hare, which comprise over 75 percent of their diet. Lynx consume one or two hares a day. In the summer, the diet is more varied and may include grouse, small mammals, and squirrels.

Although lynx were once considered nocturnal, lynx are actually active during both day and night. Males are solitary for most of the year except the breeding

season. Females and their kittens (family groups) hunt together to increase hunting success. Size of the home range varies with snowshoe hare density, habitat, and season. In Maine, male home ranges are twice as large as a female's home range; when hares are abundant males use areas equivalent to half a township (18 square miles). Home ranges of male and female lynx overlap, with a female lynx sharing her entire range with a male. A male may share portions of his home range with 1 to 3 adult female lynx.

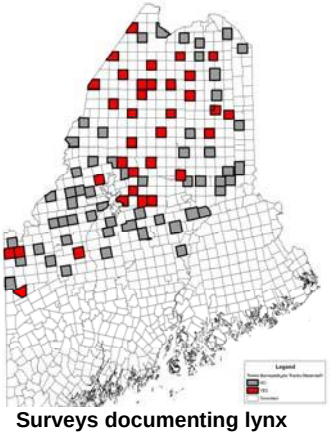
In northern Canada and Alaska, snowshoe hare and lynx populations undergo a 10-year cycle. The USFWS, University of Maine, and MDIFW are studying snowshoe hare and lynx fluctuations in Maine. Between 2000 and 2005, snowshoe hares were common and exceeded 2/hectare in regenerating spruce/fir clearcuts, most female lynx produced litters, litters were large, most kittens survived their first year, home ranges were small, and lynx densities were high. Between 2006 and 2009, snowshoe hare densities declined to 1/hectare, fewer lynx gave birth to kittens, litters were smaller, but home range size did not change and most kittens survived. In 2010, most female lynx had kittens and snowshoe hares were common.

Threats

Lynx in Maine are part of a larger population that includes southern Quebec and western New Brunswick. Lynx move between these areas. When hares are less common, these areas may be more important to maintaining lynx in Maine. Although competition with other predators, incidental catches of lynx in traps, and roads may kill some lynx, habitat loss will have the greatest influence on future lynx numbers. As the climate warms, northern hardwoods may become more common in northern Maine and winters with more rain could cause lynx to move northward. Changes in forest ownerships patterns that lead to more human development and roads in northern Maine could be detrimental to lynx. Although regenerating conifer clearcuts that are dense or moderately stocked provides ideal habitat for lynx and snowshoe hares, forest management activities that promote young dense conifer understories can also support lynx and snowshoe hare. The recent passage of the Maine Forest Practices Act (FPA) that promotes partial harvest of forest has the potential to influence future amounts of habitat for lynx. The FPA allows forest managers to clearcut large areas to improve or create wildlife habitat when prescribed and justified by a certified wildlife professional. If landowners continue to use partial harvesting techniques, shelterwood and overstory removals in maturing spruce/fir forest can also foster dense conifer regeneration. The USFWS, University of Maine, and MDIFW are working together to determine what types and amount of habitat are needed to support lynx and guide forest management activities in Maine.

Conservation and Management

Lynx likely have always been present in Maine, but populations have fluctuated. Several hundred to over a thousand animals may occupy the state when snowshoe hares and optimal habitat conditions are common. In 1997, lynx was considered for state listing, but due to insufficient information to assess the status of lynx in Maine, lynx were identified as a Species of Special Concern. In 1999, MDIFW and the U.S. Fish and Wildlife Service (USFWS) began a 12-year telemetry study to determine the status of lynx in Maine. A year later, the USFWS listed the lynx as threatened in Maine and 13 other states due to concerns of inadequate management of forests on Federal lands in the western US. Maine's lynx population had been increasing due to the abundance of young dense spruce/fir forest in northern Maine. By 2006, the number of lynx in Maine exceeded Maine's state listing criteria, thus lynx remained a Species of Special Concern. Although lynx are sometimes caught in traps set for other furbearers, trapping and hunting seasons for lynx have been closed in Maine, since 1967. Under the U.S. Endangered Species Act, the capture and live release of a listed species is considered a "take", and is prohibited unless a permit or other allowance is granted by the USFWS. Currently, the USFWS is considering our application for an incidental take permit to cover the accidental catches of lynx by trappers. The ESA requires the USFWS designates Critical Habitat and develop a recovery plan for listed species. In 2009, the USFWS designated 10,000 square miles of critical habitat in northern Maine. Although, the USFWS has not developed a recovery plan for lynx, an interim recover plan outline has been developed.



Surveys documenting lynx tracks in Maine (2003-2008)

Much of our knowledge of lynx in Maine comes from a study conducted near Clayton Lake from 1999-2010 where 85 lynx were radio-tagged and 42 dens and 111 kittens were observed. This study documented lynx spatial and habitat use, dispersal distances, sources of mortality, and reproductive rates. We also tested several survey techniques to document lynx occupancy rates. We found winter track surveys to be the most effective and efficient survey for documenting lynx presence. Between 2003 and 2008, MDIFW initiated winter snow track survey to assess the relative abundance and distribution of lynx throughout their range in Maine. In northern Maine, lynx were found in more than 70% of the towns that were surveyed. At the edge of their range in Maine, fewer areas were occupied by lynx.

In the late 1990s, dense regenerating spruce/fir reached record high levels as the widespread clearcuts of the 1980s attained prime conditions for snowshoe hares. Lynx populations increased and by 2006, Maine's lynx population reached a record high. However, the cutting of spruce and fir at the rate which occurred in the 1980's was not sustainable. More than 48% of Maine's spruce and fir are sapling size trees that support hares and lynx.

Currently, there isn't sufficient younger spruce/fir (<30%) to replace these trees as they age. Snowshoe hare and lynx populations will likely decline, but future habitat conditions will likely be sufficient for lynx to persist. Older stands of spruce and fir that foster dense understories of younger spruce and fir can also benefit lynx. Land managers and biologist will work together to ensure that sufficient dense young spruce and fir are present on the landscape.

Recommendations:

- Follow MDIFW recommendations to minimize the incidental take of lynx while trapping other furbearers.

Forest Management

- Forest management activities in northern Maine's spruce/fir forest will be most beneficial to lynx, because these area support long-periods of deep snow, where a lynx's large feet give them a competitive advantage to other forest carnivores.
- Forest management activities that promote a sustainable supply of moderately-dense to densely stocked spruce and fir sapling trees will benefit lynx and snowshoe hare.
- Forest harvest activities that promote large connected blocks of young spruce/fir will support higher densities of lynx and snowshoe hare.
- Ensure that large blocks of moderately to densely stocked spruce/fir sapling understories are distributed widely over the landscape of northern and western Maine.
- Conserve large blocks of unfragmented forestland.
  - Avoid the construction of new high-volume/high-speed highways in currently undeveloped areas of northern and western Maine.
  - Avoid permanent loss of spruce/fir forest in northern and western Maine from development.

For more information contact Maine's Mammal Program at (207) 941-4466.

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Eastern small-footed myotis

Status

Federal status: G3 N3, Not listed
NH state status: S1, Endangered
ME state status: S1S2, Special Concern

The eastern small-footed bat is considered one of the rarest bats in the eastern U.S. although its abundance is extremely difficult to assess or predict due to lack of appropriate survey and monitoring techniques. One expert in New York believes it may be much more abundant than many people think. Populations of the bat are believed to have declined in recent years. The bat may be locally abundant in some areas. About 3,000 individuals have been documented in 125 known hibernacula, 60% of which are from two sites in New York. 80% of known occurrences are ranked D, indicating concern for long-term persistence, while only 7% are ranked A or B, indicating healthy protected populations. The total number counted is very low compared to the number of caves and mines surveyed in eastern North America, but this may be due to their roosting habits.

The expert panel indicated that there is not enough information to know if viability is a concern. This species appears to have always been rare, so it is unknown if numbers have changed locally. Individual hibernacula have decreased because some mines have been reopened or closed off entirely.

Distribution

M. leibii populations are small and scattered, and occupy an apparently discontinuous range, from the Ozark Mountains of Arkansas, Missouri and Oklahoma, through the Appalachian Mountains northward to southeastern Ontario, and the New England states. To date the largest seemingly contiguous area occupied by the bat is mountainous areas of New York, Pennsylvania, West Virginia and Virginia

New Hampshire's only known colony hibernates in an abandoned, gated mine in Coos County, just north of the WMNF. Individual bats have been captured during summer bat surveys in the state. One bat was captured in the Bartlett Experimental Forest on the WMNF. A lactating female was captured in New Boston, NH. In Maine, a probably small-footed myotis was found in 1993 in Milton Township in an abandoned gold mine shaft.

Habitat

M. leibii occupy different habitats in summer and winter, and in summer males and females use different roosts. The summer and winter habitats are usually close to one and other.

Because of their apparent rarity and small size, radio-tagging studies of this species have been limited, so very little summer roost or foraging information is available. Small summer maternity roosts have been found under rocks on hillsides and open ridges, in cracks and crevices in rocky outcrops and talus slopes, beneath the bark of dead and dying trees, in buildings, and in bridge expansion joints. It is uncertain whether the

roosts documented in trees were of the eastern form (now called *M. leibii*) or the western form (*M. ciliolabrum)*, which were once taxonomically lumped and called *Myotis leibii*.

In summer, males are non-reproductive and separate from female; their habitat preferences are not known. They have been netted near the entrances to abandoned mines, caves, and railroad tunnels. Other potential roost sites are thought to include sandstone rock shelters, cliffs, and trees. Based on winter behavior and a lack of known colonies, males are thought to form small groups or roost singly.

For most bats, water is important when they emerge from summer day roosts, so proximity to water may be an important factor for *M. leibii* roosts. In addition, they may forage over streams and wetlands, where insects are usually abundant.

In winter, caves and abandoned or inactive mines typically serve as hibernacula, which have been reported from elevations of 250-675 meters. These bats roost alone or in small groups. They often hang from the ceiling but are also found under rock slabs on the cave floor, or in small cracks and crevices.

M. leibii are hardy bats. They prefer dry passages in relatively cold caves where temperatures may drop below freezing and humidity is low. They frequently roost in areas subject to drafts near the mouth of caves, and often hibernate in caves less than 150 m (500 feet) in length. *M. leibii* will leave a hibernaculum if the temperature rises above 4°C (40° F).

Range-wide, forested lands are probably important to the survival of these bats. Most roost sites and hibernacula that have been found are in forested landscapes. Forested areas around cave and mine openings are used for foraging and as roost sites before entering hibernation. More importantly, forests near cave and mine openings are thought to influence humidity and temperature levels inside the hibernaculum. What conditions are important around a cave or mine is not known and likely varies depending on the site.

Limiting Factors

Vandalism, harassment, and destruction of roosting bats are major problems because many people do not like bats. Species like *Myotis leibii* that use human dwellings and other structures in summer are often exterminated as 'pests,' even though proven exclusion techniques exist. Because these bats have low numbers and low reproductive rates (i.e., only one young per year), it can take a long time for populations to rebound after part of a colony is destroyed.

All mine reclamation methods other than gating with bat-friendly gates (e.g., back-filling, sealing with concrete, blasting) can cause loss of hibernacula and roosting habitat. The same is true for caves and abandoned railroad tunnels that are closed. Even in places where appropriate gates are used, caves and mines less than 500 ft in length, which are important to this species, are often ignored because so few bats would use them as hibernacula.

Rock-climbing may disturb or harm bats that roost on cliffs. Use of cracks for hand and foot holds can disturb or injure roosting bats. Scrubbing cracks for use as holds and insertion of anchors can injure or kill bats, and may change the habitat suitability.

Replacement of bridges that have expansion joints with new bridges lacking such joints can eliminate suitable roosting habitat and displace roosting bats. Bridge maintenance activities in warm-weather months may disturb any *M. leibii* roosting in bridges.

Timber harvest may affect summer roosts and hibernaculum conditions.

Roads and trails can increase access to cave and mine hibernacula, resulting in increased disturbance to bats and use of these sites as garbage dumps. Traffic on well-traveled roads can result in direct mortality of bats.

The use of insecticides and other pesticides to control insects can substantially reduce eastern small-footed bat prey. In addition, bats eat large numbers of insects every night and live a long time, which allows toxic chemicals to accumulate in their body tissue.

Wind turbines have been shown to kill bats. How significant this threat may be is unknown.

Only a small percentage of the land area occupied by *M. leibii* is in public ownership. Therefore much of the management responsibility for this bat is with the private sector. Basic information is needed in all aspects of this species' biology, especially habitat use and related threats.

Viability concern

The expert panel indicated that there is not enough information on this species' status to know if viability is a concern. However the global and national rankings, along with documentation of occurrence on the WMNF, make it an automatic Regional Forester's Sensitive Species for the Forest. There are many threats facing a species whose numbers are thought to be low, and whose reproductive and survival rates also are low. Identification as Sensitive is probably appropriate until more is learned about this species.

Management activities that might affect populations or viability

WMNF management does not affect many of the threats facing this species. The Forest does not have any known hibernacula. However rock climbing and timber harvest are activities we control on the Forest.

Rock-climbing is allowed anywhere that it is not expressly prohibited. The Forest has the authority to close cliffs or parts of cliffs to protect rare species; this approach could be used if *Myotis leibii* are found roosting on a cliff. Working with the climbing community to increase awareness and reduce potentially damaging practices, such as scrubbing, also would reduce the potential for impacts.

It is uncertain whether this species uses trees and snags for summer roosting. Until more information shows they do not, it should be assumed that they may use trees with peeling bark and snags. This means that summer timber harvest could reduce suitable roosting habitat and directly impact individuals. Retention of snags and trees with peeling bark could reduce potential impacts.

No wind turbines currently exist on the WMNF. However occasional requests come in. If a permit is ever given for this type of structure, there is potential for impacts to the small-footed bat.

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BCI Species Profiles

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Myotis septentrionalis

northern myotis (Vespertilionidae)
Myotis septentrionalis
northern myotis

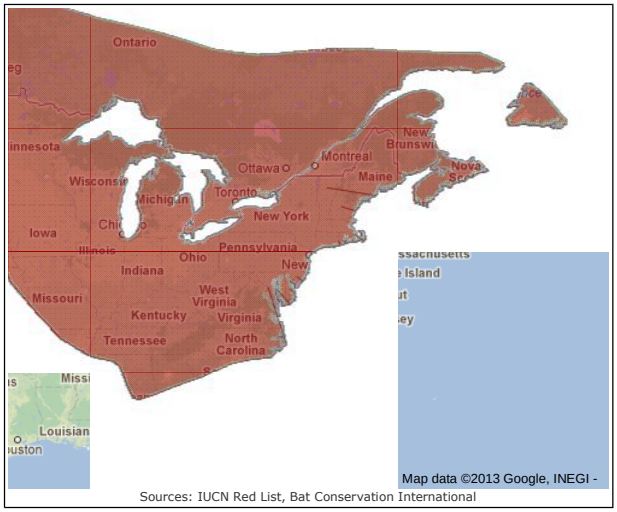
Family Name: Vespertilionidae
Genus: Myotis
Species Name: septentrionalis

Pronunciation: my-oh-tis sep-ten-tree-oh-nal-is
Common Name: northern myotis

The Northern myotis (formerly Myotis keenii), in part is widely distributed across eastern North America from Manitoba across southern Canada to Newfoundland, south to northern Florida, west through the south central states and northwest to the Dakotas. It is found in dense forest stands and chooses maternity roosts beneath exfoliating bark and in tree cavities, much like the Indiana myotis. And, like the Indiana myotis, the Northern myotis relies upon caves and underground mines for hibernation sites, where it typically chooses cooler sites than eastern pipistrelles and little brown myotis (Myotis lucifugus).

Unlike the Indiana myotis though, this species is generally more solitary and is most often found singly or in very small groups. During the summer, the Northern myotis appears especially reliant upon forested habitats and is found in greater densities in the northern areas of its range than in the south. Little is known about its food habits, although it has been observed foraging along forest edges, over forest clearings, at tree-top level, and occasionally over ponds.

Approximate Range:



Sources: IUCN Red List, Bat Conservation International

To learn more, read about this bat in our BATS magazine archive:

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Myotis lucifugus

little brown myotis (Vespertilionidae)
Myotis lucifugus
little brown myotis

Family Name: Vespertilionidae
Genus: Myotis
Species Name: lucifugus

Pronunciation: my-oh-tis loo-ciff-a-guss
Common Name: little brown myotis

The little brown myotis is abundant throughout forested areas of the U.S. as far north as Alaska. It ranges from Alaska to Labrador and Newfoundland (Canada), south to southern California, northern Arizona, and northern New Mexico. In the West it is found mainly in mountainous and riparian areas in a wide variety of forest habitats; from tree-lined xeric-scrub to aspen meadows and Pacific Northwest coniferous rain forests. This species is especially associated with humans, often forming nursery colonies containing hundreds, sometimes thousands of individuals in buildings, attics, and other man-made structures.

In addition to day roosts in tree cavities and crevices, little brown myotis seem quite dependent upon roosts which provide safe havens from predators that are close to foraging grounds. Little brown myotis forage over water where their diet consists of aquatic insects, mainly midges, mosquitoes, mayflies, and caddisflies. They also feed over forest trails, cliff faces, meadows, and farmland where they consume a wide variety of insects, from moths and beetles to crane flies. Individuals can catch up to 1,200 insects in just one hour during peak feeding activity.

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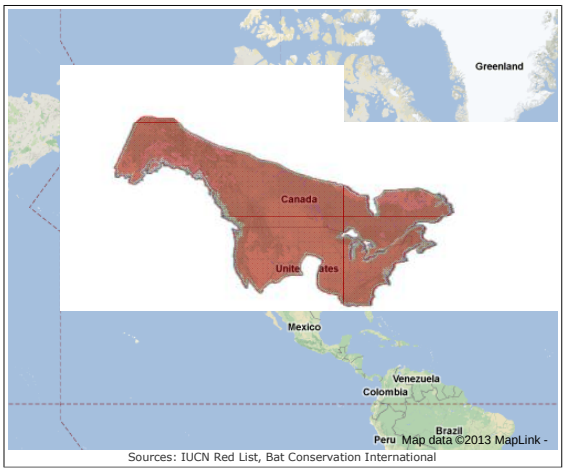

Sources: IUCN Red List, Bat Conservation International

To learn more, read about this bat in our BATS magazine archive:

Bats: A Farmer's Best Friend
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Lasiurus cinereus

hoary bat (Vespertilionidae)
Lasiurus cinereus
hoary bat

Family Name: Vespertilionidae
Genus: Lasiurus
Species Name: cinereus

Pronunciation: lay-zee-your-us sa-near-ee-us
Common Name: hoary bat

Hoary bats are one of America's largest and most handsome bats. With their long, dense, white-tipped fur, they have a frosted, or hoary, appearance. Humans rarely get the chance to see these magnificent bats; they are not attracted to houses or other human structures, and they stay well-hidden in foliage throughout the day. They typically roost 10-15 feet up in trees along forest borders. In the summer, hoary bats don't emerge to feed until after dark, but during migration, they may be seen soon after sundown. They sometimes make round trips of up to 24 miles on the first foraging flight of the night, then make several shorter trips, returning to the day roost about an hour before sunrise. Between late summer and early fall, they start their long journey south, migrating to subtropical and possibly even tropical areas to spend the winter.

Traveling in waves, they are often found in the company of birds, who also migrate in groups. For the rest of the year, however, hoary bats remain solitary. They are among the most widespread of all bats, found throughout most of Canada and the United States and south into Central and South America. The hoary bat is Hawaii's only native land mammal. Stray individuals have been found from Iceland to Orkney Island as well as in Bermuda and the Dominican Republic.

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Source: IUCN Red List

To learn more, read about this bat in the BATS magazine archive:

The Little-known World of Hoary Bats
How North America's Bats Survive the Winter
`Ope`ape`a: Hawaii's Elusive Native Bat
The Project to Save the Hawaiian Bat
Hide and Seek: In Search of Forest Bats

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Lasionycteris noctivagans

silver-haired bat (Vespertilionidae)
Lasionycteris noctivagans
silver-haired bat

Family Name: Vespertilionidae
Genus: Lasionycteris
Species Name: noctivagans

Pronunciation: lay-zee-oh-nick-ter-is nock-ti-vah-gans
Common Name: silver-haired bat

Silver-haired bats are among the most common bats in forested areas of America, most closely associated with coniferous or mixed coniferous and deciduous forest types, especially in areas of Old Growth. They form maternity colonies almost exclusively in tree cavities or small hollows. And like many forest-roosting bats, silver-haired bats will switch roosts throughout the maternity season. Because silver-haired bats are dependent upon roosts in Old Growth areas, managing forests for diverse age structure and maintaining forested corridors are important to these bats.

It is estimated that these bats require snag densities of at least 21 per hectare and often forest management practices have fallen far short of this figure. Unlike many bat species, silver-haired bats also appear to hibernate mainly in forested areas, though they may be making long migrations from their summer forest to a winter forest site. Typical hibernation roosts for this species include small tree hollows, beneath exfoliating bark, in wood piles, and in cliff faces. Occasionally silver-haired bats will hibernate in cave entrances, especially in northern regions of their range. Like big brown bats, the silver-haired bats have been documented to feed on many insects perceived as pest species to humans and/or agriculture and forestry.

Even though they are highly dependent upon Old Growth forest areas for roosts, silver-haired bats feed predominantly in disturbed areas, sometimes at tree-top level, but often in small clearings and along roadways or water courses. Though their diets vary widely, these bats feed chiefly on small, soft-bodied insects. Silver-haired bats have been known to take flies, midges, leafhoppers, moths, mosquitoes, beetles, crane flies, lacewings, caddisflies, ants, crickets, and occasional spiders.

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Source: IUCN Red List

To learn more, read about this bat at our BATS magazine archive.

Bats and Old-Growth Forests: Are Both Vanishing?
Hide and Seek: In Search of Forest Bats

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Lasiurus borealis

eastern red bat (Vespertilionidae)
Lasiurus borealis
eastern red bat

Family Name: Vespertilionidae
Genus: Lasiurus
Species Name: borealis

Pronunciation: lay-zee-your-us bor-ee-al-is
Common Name: eastern red bat

Eastern red bats are North America's most abundant "tree bats." They are found wherever there are trees east of the Rocky Mountains from Canada to as far south as central Florida. Eastern red bats roost right out in the foliage of deciduous or sometimes evergreen trees. Despite their bright red color, these bats are actually rather cryptic, looking like dead leaves or pine cones. They are perfectly camouflaged as they hang curled-up in their furry tail membranes, suspended from a single foot, twisting slightly in the breeze. For the most part, red bats are solitary, coming together only to mate and to migrate. Females even roost singly when rearing young. Unlike most bats, Eastern red bats often give birth to twins and can have litters of up to five young, though three young is average.

During the day, pups hold on to their mothers with one foot and on to a perch with the other. Mothers leave their young alone at night when they go out to feed, but if necessary, they will move them to new locations. Pups begin flying at three to four weeks and are weaned only a few weeks later. In the summertime red bats are among the earliest evening fliers, typically feeding around forest edges, in clearings, or around street-lights where they consume predominantly moths. In the fall they perform long-distance migrations using the same migratory routes along the Atlantic seaboard as many birds. In the late 1800s, there were reports of large migratory flocks passing over in the daytime, but no such sightings have been made this century. Very little is known about their winter habitat or behavior. In some areas of the southeastern U.S., Eastern red bats have occasionally been encountered flying up out of the leaf litter in advance of prescribed burns done during the late fall.

They are known to survive body temperatures as low as 23 degrees F. Their long, silky fur provides extra protection from severe cold, and they also use their heavily furred tail membrane like a blanket, wrapping themselves up almost completely. While in hibernation, red bats respond to subfreezing temperatures by raising their metabolic rate to maintain a body temperature above their critical lower survival limit.

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Source: IUCN Red List

To learn more, read about this bat in the BATS magazine archive:

Where the Bats Are Part I: Plants and Trees
How North America's Bats Survive the Winter

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Eptesicus fuscus

big brown bat (Vespertilionidae)
Eptesicus fuscus
big brown bat

Family Name: Vespertilionidae
Genus: Eptesicus
Species Name: fuscus

Pronunciation: ep-tess-a-cus fuss-cuss
Common Name: big brown bat

The big brown bat is found in virtually every American habitat ranging from timberline meadows to lowland deserts, though it is most abundant in deciduous forest areas. It is often abundant in suburban areas of mixed agricultural use. This species ranges from extreme northern Canada, throughout the United States and south to the extreme southern tip of Mexico. Traditionally, these bats have formed maternity colonies beneath loose bark and in small cavities of pine, oak, beech, bald cypress and other trees. Common maternity roosts today can be found in buildings, barns, bridges, and even bat houses. Small beetles are their most frequent prey, yet big brown bats will consume prodigious quantities of a wide variety of night-flying insects.

They are generalists in their foraging behavior and habitat selections, seemingly showing little preference for feeding over water vs. land, or in forests vs. clearings. Like all insect-eating bats, big brown bats contribute mightily to a healthy environment and are vital players in the checks and balances of insect pests. Numerous feeding studies of big brown bats exist indicating that they consume significant crop and forest pests including ground beetles, scarab beetles, cucumber beetles, snout beetles and stink bugs, in addition to numerous species of moths and leafhoppers. Like many bat species, reproductive females often can consume their body weight in insects each night. In fact, a colony of 150 big brown bats can consume enough adult cucumber beetles in one summer to prevent egg-laying that would produce 33 million of their root-worm larvae, a major pest of corn (Whitaker, 1995).

Big brown bats clearly rank among America's most beneficial animals. And, as they are forced out of traditional forest habitats due to encroaching human populations, logging, and habitat modification, they will move into increasingly close human contact, taking up residence in buildings and other man-made structures. But, humans and bats can coexist peacefully. Sometimes designing bat-specific artificial roosts are the best options to keep bats out of our homes, yet near enough so that we can continue to benefit from their insect-eating capabilities. Though many species, like the big brown, still rank among our most abundant and widespread bats, they nevertheless deserve attention from conservation and education initiatives for healthy environments.

Bats, Beetles, and Bugs
The Northern Bat's North American Relative
How North America's Bats Survive the Winter
Hide and Seek: In Search of Forest Bats
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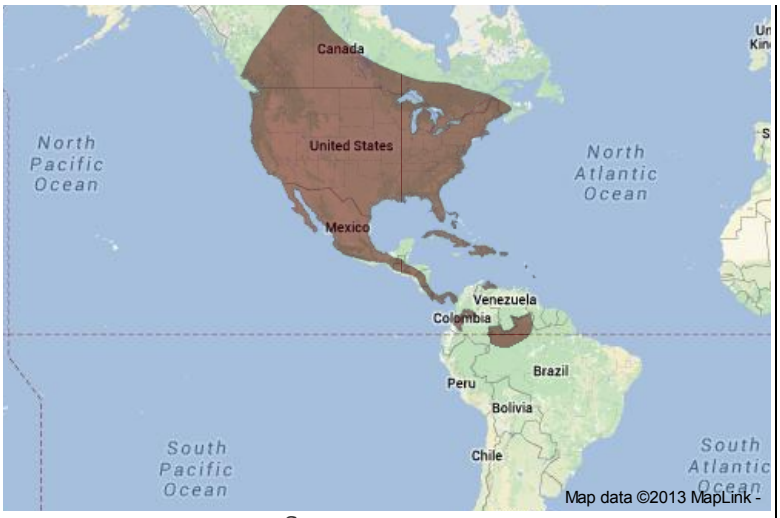

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Perimyotis subflavus

tri-colored bat (Vespertilionidae)
Perimyotis subflavus
tri-colored bat

Family Name: Vespertilionidae
Genus: Perimyotis
Species Name: subflavus

Pronunciation: Peri-my-otis sub-flave-us
Common Name: tri-colored bat

The tri-colored bat (formerly known as the eastern pipistrelle) is one of the most common species of bats found throughout the eastern forests of America – from Nova Scotia and Quebec, south throughout the east coast of Mexico into northern Central America. But, surprisingly little is known about its daytime summer or maternity roosts. These bats are among the first bats to emerge at dusk each night, and their appearance at tree-top level indicates that they may roost in foliage or in high tree cavities and crevices.

They are not often found in buildings or in deep woods, seeming to prefer edge habitats near areas of mixed agricultural use. Where information about their foraging behavior is known, these bats have been found to feed on large hatches of grain moths emerging from corn cribs, indicating that they may be of important agricultural benefit. Tri-colored bat cannot withstand freezing temperatures and are among the first bats to enter hibernation each fall and among the last to emerge in spring. Hibernation sites are found deep within caves or mines in areas of relatively warm (close to 50E F), stable temperatures. These bats have strong roost fidelity to their winter hibernation sites and may choose the exact same spot in a cave or mine from year to year. As with many forest bat species which spend their winters underground, far more is known about their hibernation habitats and behavior than is known about their summer needs.

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Source: IUCN Red List

To learn more, read about this bat in our BATS magazine archive:

How North America's Bats Survive the Winter
Bats in Palms: Precarious Habitat

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Inland Fisheries & Wildlife

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Bald Eagles

Identification: Our national symbol is highly recognizable. However, some observers do not realize their different appearance in the first 3 – 4 years. Immature eagles are generally dark with varying degrees of lighter mottling. They are full grown when fledged at 3 months of age. At 5 years of age, a (sexually mature) adult bald eagle has a pure white head and white tail that sharply contrast the dark brown feathering elsewhere on the body. In flight, notice the relatively long head / neck profile (about 50% of the length of the tail) unlike smaller proportions on a golden eagle silhouette.

Adult plumage

© Paul Cyr, Crown of Maine Photography

Immature plumage

© Betsy Marcello

If you see an immature eagle, several head features allow ageing. First-year juveniles

are dark colored especially on head feathers, beak color, and iris color. A second-year bird has buffy areas on its head and throat. By the third-year, head feathers are whitish except for a conspicuous dark eye stripe; also, the beak color and iris are yellowing.

Second-year bald eagle

© Paul Cyr, Crown of Maine Photography

Third year bald eagle

© Charlie Todd, MDIFW

Natural history briefs: Bald eagles are creatures of habit. What seems "the same eagle perched on the same limb of the same tree" may be a series of individuals over time. They are selective about food sources, perches, nocturnal roosts, and especially nests.

Typical perches of bald eagles, Aroostook County

© Paul Cyr, Crown of Maine Photography

Maine's bald eagles are primarily fish eaters at inland settings on the lakes and rivers. In coastal estuaries and (especially) offshore, they eat a more varied diet adding seabirds and waterfowl. Eagles will perch along shorelines waiting for prey. Hunting flights are usually extended glides low over open water: trying to stay dry while catching a meal on the wing. If they get too wet, they will use their wings like oars and remain on the shore or a very low perch in order to dry out before attempting to fly again.

Although some leave the state, many bald eagles remain through the winter in Maine. Scavenging carrion becomes more prevalent as ice cover greatly limits food availability.

Conservation: Stewardship of bald eagle nesting habitat by landowners has been solicited since 1972 in Maine. From 1980 to 2009, MDIFW applied Essential Habitat rules at eagle nests under the Maine Endangered Species Act. Land purchases and conservation easements now provide a lasting safety net for → 400 eagle territories to safeguard recovery. An array of conservation organizations is integral to this strategy.

Site fidelity by nesting eagles over time, Penobscot County

© Sharon Fiedler

Generations of bald eagles will use the same nesting territory sequentially over decades. In fact, the same nest is often reused if its ever enlarging size does not harm the tree. A Sagadahoc County nest found in 1963 measured 20 feet vertically; biologists conservatively estimated it had been in use for at least 60 years.

National management guidelines have been adopted to minimize disturbances of nesting eagles under the authority of a federal law, the Bald Eagle – Golden Eagle Protection Act. These are now the primary legal standard applicable to bald eagle nests in Maine.

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Golden Eagle

Golden eagles in Maine? It is possible to see one, but always a challenge. Report any sightings and suspected nest locations to MDIFW, but beware the common mistake of misidentifying a juvenile bald eagle. Please review the subtle identification tips.

Golden eagle (adult)

Bald eagle (juvenile)

© William Hanson, Next Era Energy

Identification: *A Golden Eagle is generally NOT larger than a Bald Eagle!* Wingspans, weights, and most field characteristics of the two eagle species native to North America are quite similar when viewed from a distance. Both eagles are larger at more northerly latitudes. A bald eagle visiting from Florida will seem quite small. A golden eagle passing through Maine from northernmost Quebec will appear relatively large.

Here are some tips for distinguishing golden eagles and bald eagles, tailored to Maine:

Golden Eagle	distinctions	Bald Eagle
Uplands, especially mountains	**typical habitat**	Shores of lakes, rivers & coast

Wings tips elevated slightly above horizontal plane (= slight dihedral)	**soaring flight**	Wings held in a straight-line horizontal plane, side-to-side
Smaller head & longer tail relative to body & wing proportions; head & neck length < 50% tail length	**silhouette in flight**	Larger head & shorter tail relative to body & wing size; head & neck length ~ 50% of tail length
Appears uniformly dark except amber streaks on head & neck and buffy wing bar on upper wing edge	**adult plumage**	White head & tail sharply contrast with dark feathers elsewhere on body & wings
Uniformly dark except amber streaks on nape & buffy wing bar	**subadult plumage**	Mostly dark feathers with variable white mottling patterns
Same except distinctive broad band of white at base of tail feathers	**juvenile plumage**	Uniformly dark except for light highlights in underwing axillars
Lower leg has tawny feathers down to ankle; short dark beak with yellow cere at base; flight feathers (especially tail) are faintly barred	**seeing an eagle at very close range**	Lower leg is bright yellow & unfeathered; large beak changes from black to yellow in first 5 years; flight feathers not barred

Status: Golden eagles have been designated an Endangered Species in Maine since 1986. This is the most widely distributed, successful species of eagle in the world. It lives in all continents of the northern hemisphere. Nevertheless, the species has always been a rarity in Maine and most of eastern North America.

Cliff nest in Piscataquis County

© Charlie Todd, MDIFW

Juvenile golden eagle, Franklin County

© Walter Spofford

Conservation: Counts at fall hawk watches in the Atlantic flyway imply recent increases. The eastern population (PDF) is gaining attention on all fronts: the breeding range centered in northern Quebec, wintering areas concentrated in the Mid-Atlantic States, and migration corridors between these regions. Maine hosts golden eagles in all seasons, but is currently on the edge of both the breeding and wintering range in the East. Most migrants in the East pass west of Maine. Very few golden eagles are in the state at any time of year.

The last record of golden eagles nesting in Maine was in 1997. This cliff nest (above) has persisted for at least 70 years. Residency of golden eagles here dates back at least to

1736. Native Americans of the Abenaki Nation named another location in northern Maine for the historic presence of golden eagles: a sketch there in 1689 may be one of the earliest nesting records in North America.

Maine's extensive forests are greatly limit foraging opportunities in open uplands, a preference of the species. An unusual diet of wading birds resulted in high contaminants exposure. Maine's last nesting pair failed to hatch eggs every year during 1985 – 1997. A fledgling golden eagle has not been photographed in Maine since this 1960 image.

Credits

Black-crowned Night Heron - *Nycticorax nycticorax*

Classification

Phylum: Chordata
Class: Aves
Order: Ciconiiformes
Family: Ardeidae
Genus: Nycticorax

U.S. Fish and Wildlife

Click on the images for a larger view.

Characteristics


U.S. Fish and Wildlife

The black-crowned night heron is 23-28 inches tall. It has a wingspan of almost four feet. It is a medium-sized heron with a stocky body and short legs and neck. It has a black crown and back, gray wings and a white underside. Adults have red eyes and yellow legs and feet. In breeding season adults have two long white plumes on their heads. Females and males look alike, but females are a little smaller. Immature night herons have a gray-brown head, chest, and belly streaked with white. Their eyes are yellow and they have gray legs. Black-crowned night herons don't have adult plumage until they are about three years old.

Range

The black-crowned night heron breeds from Washington; Saskatchewan, Canada; Minnesota; and New Brunswick, Canada south to southern South America. It is not found in the Rocky Mountain region. It winters in the southern United States. Migration happens in large flocks and almost always at night.

Habitat

The black-crowned night heron lives in fresh and saltwater marshes, swamps, lakes and wooded streams.

Diet

The black-crowned night heron hunts for food in the early morning hours and at dusk. It stands and waits for prey like frogs and fish to pass by and them snatches them up with its bill. It sometimes raids the nests of other herons and birds and steals the chicks. It also eats amphibians, crustaceans, insects and small mammals.

Life Cycle


U.S. Fish and Wildlife

The female black-crowned night heron lays three to five eggs in a nest in the reeds or thicket and occasionally in a tree. The nests are made of sticks and twigs. The chicks hatch in 24-26 days. Both parents incubate the eggs and feed the chicks regurgitated food. Black-crowned night herons nest in colonies and will often nest with other bird like ibises and other herons. The chicks will fledge in 42-49 days.

Behavior

Male night herons use their nests to attract a mate. The same nest may be used for many years.

Image Credits: Clipart.com unless otherwise noted

Bicknell's Thrush

Catharus bicknelli

The Bicknell's thrush is a migratory passerine (or songbird) that summers in the northeastern U.S. and southeast Canada. This relative of the robin is an extreme habitat specialist, nesting primarily in stunted montane spruce-fir forests, found at or near the highest elevations of mountains. Conservationists throughout the species' range consider the Bicknell's thrush to face a multitude of threats as one of the rarest birds in North America.

Because of its specialized habitat requirements, Bicknell's thrush populations are extremely vulnerable. Monitoring data from the last 10 years indicates a stable population in the U.S. and steep declines in the Canadian population due to habitat loss, predation and pollution. Climate change may also be a threat to the Bicknell's thrush.

Credit: T.B. Ryder

A banded Bicknell's thrush.

Characteristics

The Bicknell's thrush is a medium-sized bird, about 6.3 to 6.7 inches in length, and weighs about an ounce. It is characterized by its light olive-brown upper parts, white (and sometimes slightly yellow-tinted) belly and spotted breast, with some chestnut coloration on its tail and wings. Outside of breeding, males and females are only distinguishable by the male's larger size.

The Bicknell's thrush was once believed to be a subspecies of the grey-cheeked thrush, which it closely resembles. However, due to differences between the thrushes in behavior, song, habitat, distribution, morphology and genetics, ornithologists determined in 1995 that Bicknell's thrush is its own species.

Life Cycle

The Bicknell's thrush is a migratory bird that breeds in subalpine forests, which are composed of stunted fir and spruce thickets, in the northeastern U.S. and southeastern Canada. By early November, most Bicknell's thrushes have migrated and established winter territories in the broadleaf forests of the Greater Antilles, the group of Caribbean islands comprising Cuba, Puerto Rico, Jamaica, and Hispaniola (which includes Haiti and the Dominican Republic). Here they can be found throughout middle and high elevation sites.

By the end of May, both males and females have returned to their breeding grounds in the northeast. Males typically return several days earlier than females, and breeding begins upon the females' arrival.

The Bicknell's thrush begins breeding at about one year of age and is known to have a highly unusual mating system. The mating system, termed "female-defense polyandry," is unique to the Bicknell's thrush and one other passerine in North America. Females mate with more than one male per breeding season, ensuring multiple males for feeding and protection of the young. More than one male cares for mixed paternity brood.

This highly specific bird prefers to nest in montane fir and spruce forests, usually in recently disturbed areas characterized by dense understory, low canopy, and an abundance of snags, shrubs, moss, stumps and deadfall for desirable shelter and nesting areas. Nests are constructed with twigs and are usually dense and cup shaped, with a lining of moss. Clutch sizes consist of around three to four bluish green eggs with light brown speckling.

Food

On its high elevation summer range, the Bicknell's thrush is primarily a ground forager, eating mostly insects, from larval moths, butterflies, and ants to bees, cicadas, and spiders. They may also feed on fruit, such as bunchberries, blueberries and wild grapes. Small fruits of similar size compose a great proportion of this thrush's winter and migration diet. Nesting females often eat snails, which are believed to provide much-needed calcium for strong egg production. During the

Credit: Credit: Steve Faccio, Vermont Center for Ecostudies

Bicknell's thrush with chicks.

winter, the Bicknell's thrush feeds on small fruits and insects at middle- and high-elevation sites.

Causes for Concern

Habitat Loss and Alteration

The Bicknell's thrush has been identified as a high conservation priority within the international birding community, as it is highly susceptible to several threats. Immediate threats to the species include habitat loss from forestry, energy and recreational developments on the breeding grounds and habitat loss from subsistence farming and logging on the wintering ground. A potentially significant threat in the future is the potential loss of habitat that could result from climate change, which might mean a nearly complete loss of this species' high elevation breeding habitat in the U.S. over the course of the next century.

As the climate warms, the montane spruce and fir forests may disappear from the Bicknell's thrush's current breeding range within the northeast U.S. These coniferous trees currently exist as "islands" of suitable habitat and are predicted to "migrate" northward and upwards in elevation as temperatures increase. This vegetative migration is expected to result in the nearly complete elimination of Bicknell's thrush habitat.

In addition, temperature increases could lead to more hurricanes and other severe weather events that would reduce forage opportunities and threaten long-term existence of the tropical forests that the Bicknell's thrush depends on. Biologists have not determined if the Bicknell's thrush will be able to adapt to these changes.

Another potential consequence of climate change for the Bicknell's thrush might be the creation of a variance between arrival time to the breeding grounds and the abundance of prey. Currently, the arrival time is regulated by day length, and the abundance of insects and fruits is linked to temperature. If temperatures rise and spring occurs earlier, the food supply may also peak earlier and late-arriving birds may not have adequate food supplies. As a result, the reproductive success of late-arriving birds may suffer.

Predation

Predation may also be a threat. In the thrush's breeding habitat, red squirrels live and feed mainly on spruce and fir cones in the montane forests. Red squirrel populations are cyclical and dependent on the production of large cone crop, which can be highly variable from year to year. In years when red squirrels are abundant, predation of eggs and nestlings can be high. Increased temperatures resulting from climate change could increase cone crops, and as a result, predation by red squirrels may also increase. While red squirrel predation of nestlings and eggs has been recognized as a concern for some time, predation of adults wasn't well documented. However, recently, researchers conducting studies on the wintering grounds in the Dominican Republic documented predation of adult Bicknell's thrush by introduced black and Norway rats. This predation is believed to occur while adults are night roosting. Researchers have not yet determined the effects of red squirrel or rate predation and its impacts to Bicknell's thrush populations.

Pollution

Biologists have also identified pollution from industrial sources as a concern for the Bicknell's thrush and its habitat. The decline of high elevation red spruce has been linked to accumulation of acidic ions in the atmosphere. This could be a result of calcium removal from the already nutrient-poor soils typical of the Bicknell's high elevation breeding habitat. Mercury deposition, primarily from industrial sources is also a concern. Data demonstrates that accumulation rates are 2 to 5 times greater in some high elevation sites than in others. In addition, older birds have higher mercury blood concentration levels than do younger birds, suggesting that these birds are accumulating mercury through time. While this information is cause for concern, the effects that these mercury burdens will have on the Bicknell's thrush are not fully understood.

Taking Action

Recently, the U.S. Fish and Wildlife Service was petitioned to list the Bicknell's thrush as either a threatened or endangered species under the Endangered Species Act. As a result, the Service will conduct a thorough assessment of the status and threats to the Bicknell's thrush. In an effort to secure the future of existing Bicknell's thrush populations, the Service, other management agencies and conservation organizations have focused on predicting and monitoring the effects of climate change, managing and protecting habitat, and restoring existing populations.

U.S. Fish & Wildlife Service
1 800/344 WILD
www.fws.gov
August 2012

Credit: Credit: Steve Faccio, Vermont Center for Ecostudies

Bicknell's thrush.

Species

print close

VU Rusty Blackbird *Euphagus carolinus*

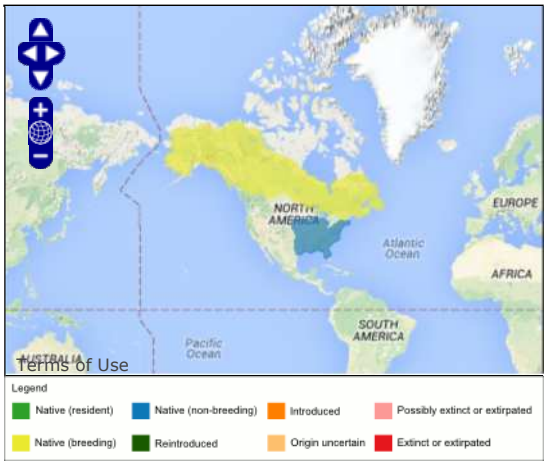
Key facts	
Current IUCN Red List category	Vulnerable
Family	Icteridae (New World blackbirds)
Species name author	(M
Population size	mature individuals
Population trend	Decreasing
Distribution size (breeding/resident)	5,290,000 km^2
Country endemic?	No
Links to further information	
- Additional Information on this species	

Justification
This species has experienced a long term population decline which has been rapid during the past decade. For this reason it is currently classified as Vulnerable. More accurate survey data may warrant a re-evaluation of its status.

Taxonomic source(s)
Cramp, S.; Perrins, C. M. 1977-1994. *Handbook of the birds of Europe, the Middle East and Africa. The birds of the western Palearctic*. Oxford University Press, Oxford.

Identification
A medium-sized blackbird with a square-tipped tail and thick bill. Males are entirely black, faintly glossed greenish. The eye is yellow. Females are dark grey-black and lack the glossy sheen of males. Immature birds are brown with a paler supercilium, darker wings and tail and some dark barring on males. **Similar spp.** very similar to Brewer's Blackbird *Euphagus cyanocephalus*, but males of that species have a blue body gloss with contrasting violet head and females are browner. Also structurally, rusty blackbird has a finer bill and less elegant gait. **Voice** Males sing a squeaky but sweet rising *kush-a-lee*.

Distribution and population
Euphagus carolinus has a large range, breeding across the boreal zone of North America from New England, through **Canada** to Alaska and winters widely across the south-eastern **United States**. The population was estimated at 2 million individuals based on data from the North American Breeding Bird Survey collected during the 1980s and 1990s. This figure is now likely to be a considerable overestimate as the species continues to decline. Estimates of the global decline since 1966 vary between 85% and 99%. This ongoing decline follows a longer term decline that began prior to 1950. The reasons for this dramatic decline remain poorly understood.



Population justification
The population is estimated to number anywhere between 0.2-2 million individuals (R. Greenberg *in litt.* 2006).

Trend justification
Two sources provide quantitative estimates of decline for the species: Breeding Bird Survey (BBS) and Christmas Bird Counts (CBC). Sauer *et al.* (2005) provide an estimate for annual declines for a 39 year period of 12.5% per year, derived from BBS data. The estimated trend for the period 1996-2005 is a 1.8% decline per year, equating to a 16.6% decline over ten years. The CBC returns an estimated global decline for this period of 5.1% per year (CI = 2.4- 6.7%) which corresponds to a decline of 40.8% over the past decade. Interpreting the two estimates, the population is believed to have declined by >30% over the past ten years (R. Greenberg in litt. 2006). Butcher and Niven (2007) also combined data from the two sources, estimating a large and statistically significant population decrease over the last 40 years in North America (83.8% decline over 40 years, equating to a 36.6% decline per decade).

Ecology
It breeds in boreal wetlands, primarily around ponds and streams within the boreal forest. It winters primarily in wooded wetlands and is not strongly associated with open agricultural habitats.

Threats
The reasons behind current trends are poorly understood but several threats are suspected to be causing the declines. The destruction and conversion of boreal wetlands (predominantly in the southern boreal forests) is a significant threat to the species. Strip-mining for tar sands is expected to increase in the future, with up to 300,000 ha of Canada's boreal forest and wetland predicted to be directly affected over the next 30 to 50 years (Wells *et al.* 2008). Other possible threats include boreal wetland drying and chemical change resulting from global climate change, depletion of available calcium resulting from acid precipitation, increase in methyl mercury, loss of wooded wetlands in the south-east U.S. winter range, and mortality associated with past and ongoing blackbird control efforts.

Conservation Actions Underway
The species is not currently listed under the United States Endangered Species Act but there is an International Rusty Blackbird Technical Group set up to research trends, threats and actions for this species. **Conservation Actions Proposed**
Continue to monitor population trends. Identify the reasons behind long-term declines. Devise suitable actions to reverse declines. Consider listing under US Endangered Species Act. Protect suitable habitat.

References
Jaramillo, A.; Burke, P. 1999. *New World blackbirds: the icterids*. Christopher Helm, London.

Wells, J., Casey-Lefkowitz, S., Chavarria, G., Dyer, S. 2008. Danger in the Nursery: Impact of Tar Sands Oil Development in Canada's Boreal Forest. Boreal Songbird Initiative, National Resources Defense Council, Pembina Institute.

Further web sources of information
Explore HBW Alive for further information on this species

Search for photos and videos, and hear sounds of this species from the Internet Bird Collection

Text account compilers
Bird, J., Butchart, S., Derhé, M., Ekstrom, J.

Contributors
Butcher, G., Greenberg, R., Wells, J.

IUCN Red List evaluators
Butchart, S., Symes, A.

Recommended citation
BirdLife International (2014) Species factsheet: *Euphagus carolinus*. Downloaded from http://www.birdlife.org on 02/12/2014. Recommended citation for factsheets for more than one species: BirdLife International (2014) IUCN Red List for birds. Downloaded from http://www.birdlife.org on 02/12/2014.

This information is based upon, and updates, the information published in BirdLife International (2000) Threatened birds of the world. Barcelona and Cambridge, UK: Lynx Edicions and BirdLife International, BirdLife International (2004) Threatened birds of the world 2004 CD-ROM and BirdLife International (2008) Threatened birds of the world 2008 CD-ROM. These sources provide the information for species accounts for the birds on the IUCN Red List.

To provide new information to update this factsheet or to correct any errors, please email BirdLife

To contribute to discussions on the evaluation of the IUCN Red List status of Globally Threatened Birds, please visit BirdLife's Globally Threatened Bird Forums.

Additional resources for this species

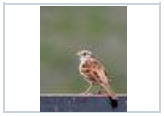
0

Zonotrichia albicollis

White-throated Sparrow

learn more about names for this taxon

add to a collection



Zonotrichia albicollis TRUSTED
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Source: Flickr: EOL Images

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IUCN threat status: Least Concern (LC)

Brief Summary

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learn more about this article

The White-throated Sparrow (*Zonotrichia albicollis*) breeds in coniferous and mixed coniferous-deciduous forests and around forest edges, clearings, bogs, brush, and open woodlands; in migration and on its wintering grounds, these sparrows are also found in deciduous forest and woodland, scrub, and parks and gardens. White-throated Sparrows breed mainly in Canada, with some additional breeding populations in the northernmost portions of the Great Lakes states and in parts of the northeastern United States. They winter along the Pacific coast of the United States (but are relatively rare here) and in approximately the southeastern half of the United States from New Mexico to Kansas, Ohio, and New Hampshire.

This common and widespread sparrow is named for its conspicuously and strongly outlined white throat. It has rusty brown upperparts, a dark bill, dark crown stripes, and a dark eyeline. The broad "eyebrow" (above the eye) is yellow in front of the eye, with the remainder either tan or white (two distinct color morphs). Juveniles have a grayish eyebrow and throat with heavily streaked breast and sides.

The song, which is often heard even in winter, is a thin pensive whistle, generally two single notes followed by three triple notes: "*Oh sweet Canada Canada Canada*" (or "*Old Sam Peabody, Peabody, Peabody*"). The sharp *tink* and lisping *tseep* calls are frequently heard from flocks of sparrows in

Found in 7 classifications

see all

Species recognized by NCBI Taxonomy:

Cellular organisms +
Eukaryota +
Opisthokonta +
Metazoa +
Eumetazoa +
Bilateria +
Deuterostomia +
Chordata +
Craniata +
Vertebrata +
Gnathostomata +
Teleostomi +
Euteleostomi +
Sarcopterygii +
Tetrapoda +
Amniota +
Sauropsida +
Sauria +
Archosauria +
Dinosauria +
Saurischia +
Theropoda +
Coelurosauria +
Aves +
Neognathae +
Passeriformes +
Passeroidea +
Fringillidae +
Emberizinae
Emberizin
Zonotri
Zono
Zono
Zono
Zono
Zono

Reviewed by 3 curators

learn how to curate

Cyndy Parr
Jackdaw of all trades

Leo Shapiro

thickets.

White-throated Sparrows eat mainly seeds and insects. Insects make up a large part of the diet during the breeding season (and young are fed mainly on insects), but the winter diet consists mainly of "weed" and grass seeds. Especially in fall, many berries may be consumed. White-throated Sparrows forage mainly on the ground under or close to dense thickets, scratching in the leaf litter with both feet.

White-throated Sparrows almost always nest on the ground, at a site well hidden by low shrubs, grass, or ferns. They may occasionally nest above ground up to a height of several meters. The nest (built by the female) is an open cup made of grass, twigs, weeds, and pine needles and lined with fine grass, rootlets, and animal hair. The 4 to 5 eggs (sometimes 3 or 6, rarely 2 or 7) are pale blue or greenish blue and marked with reddish brown and lavender. Eggs are incubated (by the female only) for around 11 to 14 days. Both parents feed the nestlings. Young typically leave the nest 8 to 9 days after hatching, but are tended by the parents for at least another 2 weeks.

Researchers have identified behavioral differences associated with the white-striped versus tan-striped morphs. Both males and females may exhibit either color, but adults nearly always mate with the opposite color morph. White-striped males tend to be more aggressive and to sing more than tan-striped males. White-striped females also sing, but tan-striped females generally do not. Pairs involving a tan-striped male and white-striped female usually form more quickly than the opposite combination. Tan-striped adults tend to feed their young more than white-striped adults.

Migration occurs mostly at night. White-throated Sparrows tend to migrate relatively late in the fall, gradually moving south to their wintering grounds.

(Kaufman 1996; AOU 1998; Dunn and Alderfer 2011)

- Supplier: Leo Shapiro

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128 other items

National Museum of Natural History Bird Garden
22 other items

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239 other items

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762 other items , 9 members

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Andrea Wiggins

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Cyndy Parr marked "n630_w1150" as trusted on the "Zonotrichia albicollis" page.
12 MONTHS AGO
reply

Cyndy Parr marked "n630_w1150" as trusted on the "Zonotrichia leucophrys" page.
12 MONTHS AGO
reply

Cyndy Parr marked "n630_w1150" as trusted on the "Junco hyemalis" page.
12 MONTHS AGO
reply

Leo Shapiro set "White-throated Sparrow (Zonotrichia albicollis) color morphs" as an exemplar on "Zonotrichia albicollis (Gmelin, 1789)".
OVER 1 YEAR AGO
reply

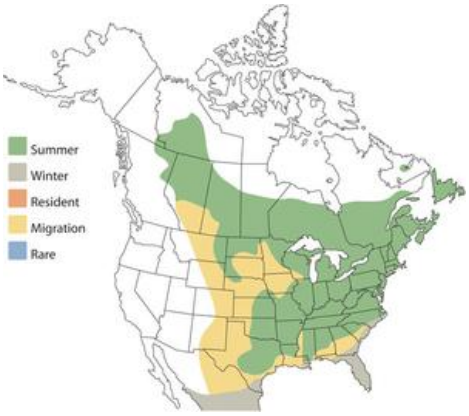
Leo Shapiro marked "Zonotrichia albicollis (White-throated Sparrow)" as trusted on the "Zonotrichia albicollis" page.
OVER 1 YEAR AGO
reply

post comment

Black-and-white Warbler

Mniotilta varia

Rick and Nora Bowers/VIREO



Family

Wood Warblers

Description

5" (13 cm). Black and white stripes, including crown. Male has black throat; female's throat white. Creeps on tree trunks and branches

Voice

A thin, high-pitched, monotonous weesy-weesy-weesy-weesy, like a squeaky wheelbarrow.

Listen

two males counter-singing

complex songs #1

alarm chips

songs #2

songs #1

complex songs #2

Habitat

Primary and secondary forests, chiefly deciduous. During migration, parks, gardens, and lawn areas with trees and shrubs.

Range

Breeds from southern Mackenzie, northern

Alberta, and central Manitoba east to Newfoundland, and south to southern United States east of Rockies. Winters from southern parts of Gulf Coast states southward.

Discussion

This conspicuous warbler arrives in the North early in spring, usually by mid- to late April. It is known for its habit of creeping around tree trunks and along larger branches in search of insect food in crevices in or under the bark; hence its old name, "Black-and-white Creeper." Unlike the Brown Creeper, which only moves up a tree, this species can climb in any direction.

Nesting

4 or 5 purple-spotted white eggs in a ground nest composed of leaves, grass, and rootlets, and lined with hair and fern down. Nest is found at the base of a tree, stump, or rock.

Similar Species

Black-throated Gray Warbler

4 1/2-5" (11-13 cm). Head striped black and white; black bib on throat; white below, with black stripes on sides; gray back, with black striping; 2 white wing bars and white outer tail feathers.

Read more

Blackpoll Warbler

5 1/2" (14 cm). Breeding male gray streaked above, with black cap, white cheeks and underparts, blackish streaks on sides.

Read more

Bridled Titmouse

4 1/2 -5" (11-13 cm). Warbler-sized. Gray above, whitish below, with gray crest bordered with black and a "bridle" joining eye line and throat patch.

Read more

Black-capped Chickadee

4 3/4-5 3/4" (12-15 cm). Black cap and throat, white cheeks, gray back, dull white underparts. Wing feathers narrowly and indistinctly edged with white. Difficult to separate from Carolina Chickadee.

Read more

Brown Creeper

5-5 3/4" (13-15 cm). Smaller than a sparrow. A slender, streaked, brown bird, tinged with buff on flanks, usually seen creeping up tree trunks, using long, stiff tail for support.

Read more

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Gyrinophilus porphyriticus

Spring Salamander, Blue Ridge Spring Salamander, Carolina Spring Salamander, Kentucky Spring Salamander, Northern Spring Salamander

family: Plethodontidae
subfamily: Hemidactyliinae

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View distribution map using BerkeleyMapper.

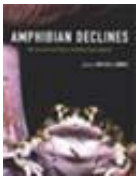
	Conservation Status (definitions)
IUCN (Red List) Status	Least Concern (LC) See IUCN account.
NatureServe Status	Use NatureServe Explorer to see status.
CITES	No CITES Listing
Other International Status	None
National Status	None
Regional Status	None

iNaturalist.org

Can you confirm these amateur observations of *Gyrinophilus porphyriticus*?

Add your own observation of *Gyrinophilus porphyriticus* »

Lannoo Account | Raffaëlli Account | AmphibiaWeb Account | IUCN Account



The following account is modified from *Amphibian Declines: The Conservation Status of United States Species*, edited by Michael Lannoo (©2005 by the Regents of the University of California), used with permission of University of California Press. The book is available from UC Press.

Gyrinophilus porphyriticus (Green, 1827)
Spring Salamander

Christopher K. Beachy[1]

1. Historical versus Current Distribution. Spring salamanders (*Gyrinophilus porphyriticus*) range from the middle of Maine southwest along the Appalachian spine (Dunn, 1926; Brandon, 1967c; French, 1976; Petranka, 1998). Brandon (1966c) recognized four subspecies. Northern spring salamanders (*G. p. porphyriticus*) are found throughout most of New England, New York, and Pennsylvania, and in portions of Ohio, West Virginia, Virginia, Tennessee, North

Carolina, Georgia, Alabama, and extreme northwestern Mississippi (Engelhardt, 1919; Warfel, 1937; Fowler and Sutcliffe, 1952; Thurow, 1954; Brandon, 1966c; Graham, 1981; Graham and Stevens, 1982; Lazell and Raithel, 1986; Petranka, 1998). A disjunct population occurs near Cincinnati in southwestern Ohio. Kentucky spring salamanders (*G. p. duryi*) are found in western West Virginia, northeastern Kentucky, and south-central Ohio (Brandon, 1967c; Petranka, 1998), with a single record documented in Tazewell County, Virginia (Newman, 1954a). Carolina spring salamanders (*G. p. dunni*) are found in southwestern North Carolina, northwestern South Carolina, northern Georgia, and northeastern Alabama (Brandon, 1966c, 1967c). Blue Ridge spring salamanders (*G. p. danielsi*) occur in extreme western North Carolina (Brandon, 1966c, 1967c).

The range of the species apparently is the same currently (Petranka, 1998) as when Dunn (1926) first summarized the range of spring salamanders. It is probable that *G. porphyriticus* consists of several cryptic species. Southern Appalachian populations exhibit significant life history variation, morphometric differentiation, and ethological isolation among parapatric populations (Bruce, 1972, 1978; Beachy, 1996; Adams and Beachy, 2001).

Petranka (1998) notes that deforestation is a threat to many populations of spring salamanders.

2. Historical versus Current Abundance. Spring salamanders are well-known for being difficult to find. Repeated trips to classic salamander localities usually results in finding one or two spring salamanders and often none at all (Bruce, 1972a, 1978a; Beachy, 1996). The habitat (see "Adult Habitat" below) simply proves difficult to penetrate, and the salamanders that are obtained seem to be the occasional animals that are active on the surface. Current densities seem in line with historical densities. This means that in most of their range, spring salamanders have always been difficult to obtain.

3. Life History Features.

A. Breeding. Courtship is in streamside conditions with oviposition being in headwater seeps (Beachy, 1996, 1997b).

i. Breeding migrations. Do not occur. Courtship occurs during the winter from December–February (Bruce, 1972a; Beachy, 1996, 1997b). Oviposition occurs during the late spring and summer (Green, 1925; Bishop, 1941b; Organ, 1961c; Bruce, 1972a, 1980).

ii. Breeding habitat. Same as adult habitats. Most females lay their eggs during the summer; embryos hatch in late summer or autumn (Green, 1925; Organ, 1961c; Bruce, 1972a, 1978a, 1980).

B. Eggs.

i. Egg deposition sites. Few egg masses have been found. Females likely lay their eggs deep in underground recesses in streams and seeps. Females attach their eggs to the undersides of rocks or other cover objects (Noble and Richards, 1932). Eggs are 3.5–4.0 mm in diameter (Bishop, 1941b; Bruce, 1969, 1972a).

ii. Clutch sizes. Ova numbers range from 39–63; clutch sizes vary from 16–106 and are related to female body size. Females brood (Bishop, 1924; Organ, 1961c; Bruce, 1978a). Hatchlings range in size from 18–22 mm TL in the southern Appalachians (Bruce, 1978a), and to 26 mm TL in New York (Bishop, 1924; see also Petranka, 1998).

C. Larvae/Metamorphosis.

i. Length of larval stage. Bruce (1980) estimates a modal larval length of 4 yr, with some individuals metamorphosing after 3–5 yr. Weber (1928)

and Bishop (1941b) suggest a 3 yr larval length. Estimates of larval period are difficult because large samples of larvae are difficult to obtain.

ii. Larval requirements.

a. Food. Larvae feed at night. Spring salamander larvae feed on a variety of prey, including the following invertebrates: oligochaetes, arachnids, isopods, centipedes, crayfish, and insects including mayflies, odonates, stoneflies, and dipterans. Spring salamanders also will feed on vertebrates including salamander eggs, two-lined salamander (*Eurycea bislineata* complex) adults and larvae, and adult Ocoee salamanders (*Desmognathus ocoee*; Bruce, 1979; Resetarits, 1991; Beachy, 1994; Gustafson, 1994). Spring salamanders are cannibalistic and will feed on smaller conspecific larvae (Burton, 1976; Bruce, 1979).

b. Cover. Larvae are found most frequently beneath stones and logs or in gravel beds in springs, seeps, or spring-fed streams. Spring salamanders occasionally are found in lakes (Bishop, 1941b). Larvae are nocturnal; they are secretive during the day, where they can be found in subterranean cracks and crevices, sometimes far below the surface (Bruce, 1980; 2003). At night, individuals emerge to forage (Resetarits, 1991). Spring salamander larvae generally do not occur in large numbers (Bruce, 1972a, 1978a), but densities can reach as high as 5–10/m2 in streambeds in Virginia (Resetarits, 1991, 1995; see also Petranka, 1998).

Larvae have been found in caves in Kentucky, Virginia, and West Virginia (Green and Brant, 1966; Cooper and Cooper, 1968; see also Petranka, 1998).

iii. Larval polymorphisms. Unknown and unlikely.

iv. Features of metamorphosis. Metamorphosis occurs at about 55–65 mm SVL in populations below 1,200 m, and 61–70 mm in montane populations. Metamorphosis generally occurs from July–August, but has been reported from March–October (Bishop, 1941b). Bruce (1979) hypothesized that time to metamorphosis reflects an evolutionary response to food resources available to larvae and adults.

v. Post-metamorphic migrations. Unknown.

vi. Neoteny. Unknown.

D. Juvenile Habitat. The juvenile habitat is the same as for adults.

E. Adult Habitat. Adults are most abundant in the headwater sections of small tributaries and small streams that lack fishes, in seepages and caves, and can sometimes be found in roadside ditches (Petranka, 1998). Bruce (1972a) notes that in the Piedmont of South Carolina, populations are associated with springs and small streams in deep ravines covered with mature hardwood forest (see also Petranka, 1998). Citing Cooper and Cooper (1968), Besharse and Holsinger (1977) note that while spring salamanders are found in springs and cave streams in the south-central Appalachians, they are more common in caves than in springs in limestone areas.

F. Home Range Size. Unknown.

G. Territories. Unknown.

H. Aestivation/Avoiding Dessication. Unknown and unlikely.

I. Seasonal Migrations. Unknown and unlikely.

J. Torpor (Hibernation). Spring salamanders in the southern Appalachians remain active throughout the year. Less is known about these animals in the northern part of their range. Despite ice cover, it is likely that

spring salamanders remain active below ground.

K. Interspecific Associations/Exclusions. Spring salamanders are voracious predators of other salamanders (see "Feeding Behavior" below). Although there is no evidence that the presence of spring salamanders excludes other species, spring salamanders restrict two-lined salamander nocturnal feeding activity, causing slower growth rates and increased mortality in two-lined salamander larvae in regions where they co-occur (Resetarits, 1991; Beachy, 1994; Gustafson, 1994). Larger spring salamanders can also reduce the growth rates of smaller conspecifics (Gustafson, 1994; see also Petranka, 1998). Where spring salamanders co-exist with black-bellied salamanders (*D. quadramaculatus*), there is no evidence that they compete for food (Beachy, 1994).

Spring salamanders will co-occur in streams with fishes, but reach their highest densities in the absence of fishes (Petranka, 1998). Resetarits (1995) demonstrates that in the presence of trout fingerlings, spring salamanders use shallower habitats.

L. Age/Size at Reproductive Maturity. Males become reproductively mature at about 55 mm SVL, with no obvious sexual dimorphism (Bruce, 1972a; see also Petranka, 1998). Males at low to intermediate elevations become sexually mature shortly after metamorphosing (3–4 yr, see above); males in high elevation populations require up to 1 yr longer (Bruce, 1972a), at as large as 81 mm SVL.

Females in low elevation populations can mature shortly after metamorphosing (3–4 yr), as small as 61 mm SVL. Females at higher elevations mature when they are older and larger (Bruce, 1972a; see also Petranka, 1998).

M. Longevity. Unknown. Assuming a median larval period of 4 yr, most animals attain sexual maturity at anywhere from 4–6 yr (Bruce, 1972a, 1978a, 1980).

N. Feeding Behavior. While spring salamander adults are feeding generalists, according to Petranka (1998), food habit tendencies vary regionally. Adults in northern populations tend to feed on invertebrates, including annelids, snails, centipedes, millipedes, arachnids (spiders and mites), and insects. Insect prey includes mayflies, caddisflies, stoneflies, dipterans, hymenopterans, and hemipterans (Bishop, 1941b; Culver, 1973). In northern populations, cannibalism and preying on other salamander species such as northern dusky salamanders (*Desmognathus fuscus*) is known, but thought to be uncommon (Hamilton, 1932).

In southern populations, spring salamander adults are voracious consumers of salamanders (Wright and Haber, 1922; King, 1939; Bishop, 1941b; Martof, 1955; Huheey and Stupka, 1967; Bruce, 1972a, 1979). They are known to feed on the following salamander species: pygmy salamanders (*Desmognathus wrighti*), adult and larval northern two-lined salamanders (*Eurycea bislineata*), Ocoee salamanders, Jordan's salamanders (*Plethodon jordani*), southern red-backed salamanders (*P. serratus*), southern Appalachian salamanders (*P. oconoluftee*), and red salamanders (*Pseudotriton ruber*). They also are known to be cannibalistic. Invertebrate prey include annelids, centipedes, and insects such as coleopteran larvae. Adult spring salamanders have a higher tendency than larvae to feed on other salamanders.

O. Predators. Northern water snakes (*Nerodia sipedon*) and common garter snakes (*Thamnophis sirtalis*) prey on spring salamanders (Uhler et al., 1939). Smaller individuals are cannibalized by larger individuals (Burton, 1976).

P. Anti-Predator Mechanisms. Spring salamanders use defensive postures. Adults produce noxious skin secretions that are known to repel

shrews (Brodie et al., 1979). Spring salamanders are thought to be part of the Batesian mimicry complex that also involves red salamanders (*Pseudotriton ruber*) and the red eft stage of eastern newts (*Notophthalmus viridescens*; Howard and Brodie, 1973; Brandon and Huheey, 1975, 1981).

Q. Diseases. Unknown.

R. Parasites. Ranik (1937) studied the parasites of Blue Ridge spring salamanders and found two protozoans, *Hexamastix batrachorum* and *Prowazekella longifilis*, and one nematode, *Omeia papillocauda*.

4. Conservation. With the caveat that spring salamanders are difficult to find, current densities appear to be in line with historical densities. Petranka (1998) notes that deforestation is a threat to many populations of spring salamanders. Spring salamanders are considered Endangered in Mississippi, Threatened in Connecticut (http://dep.state.ct.us), of Special Concern in Massachusetts (www.state.ma.us), and of Concern in Rhode Island.

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Literature references for *Amphibian Declines: The Conservation Status of United States Species*, edited by Michael Lannoo, are here.

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Atlantic Salmon

Salmo salar

While at one time hundreds of thousands of Atlantic salmon made their epic migration from the oceans of Greenland to their natal rivers in Maine, now it would be a privilege to see even a few of these powerful creatures. Depleted by a combination of overfishing, pollution and dams, this once-prominent salmon species is severely reduced. Now we must rely on fish hatcheries to provide enough young for the species to survive.

Historically in North America, Atlantic salmon once stretched from Ungava Bay, Canada, to the rivers of Long Island Sound, but now the only remaining wild U.S. populations swim in Maine rivers.

Early life

Atlantic salmon spawn in freshwater rivers and streams during autumn. Eggs remain in gravel substrates and hatch during winter. Tiny young salmon, called fry, emerge from the gravel in spring.

USFWS

Atlantic salmon fry with sac

Until now, the salmon have looked like any other minnow, but soon dark bands and red spots can be seen on their sides. The colorful juvenile salmon, called parr, remain in freshwater one to three years before undergoing "smoltification" to prepare for migrating to the ocean.

Atlantic salmon are anadromous, meaning they travel from the sea to spawn in fresh water. These fish are highly migratory, undertaking long marine migrations between U.S. rivers and a wide expanse of the northwest Atlantic Ocean.

The journey

Most Atlantic salmon of U.S. origin spend two winters in the ocean before returning to freshwater to spawn. These adult Atlantic salmon average from 28 to 30 inches long and weigh from 8 to 12 pounds. Although uncommon, adults can grow as large as 30 pounds. In the United States, most adult Atlantic salmon ascend Maine rivers beginning in spring and continuing through the autumn, with migration peaking in June.

Going home

So how do these fish find their way from the oceans of Greenland all the way back to their natal rivers? Well, it isn't GPS or a map. Atlantic salmon actually imprint upon their home river by olfactory sense during smoltification.

Imprinting allows Atlantic salmon to recognize the chemical fingerprint of their home river. Using this olfactory ability, the salmon can find their way home from the middle of the ocean to the stream where they were born.

The recovery story

Atlantic salmon populations have been declining since the Industrial Revolution because of dam construction with no or inadequate fish passage, pollution, overfishing, illegal fishing, habitat loss and other factors. The most significant threats now are poor marine survival and dams obstructing fish passage.

In December 2000, wild Atlantic salmon populations in small coastal rivers in Maine – the Dennys, East Machias, Machias, Pleasant, Narraguagus, Ducktrap, Sheepscot rivers and Cove Brook – were protected as endangered under the Endangered Species Act.

Together, the U.S. Fish and Wildlife Service and the State of Maine have a river-specific stocking program working toward the restoration and stability of the Atlantic salmon populations in Maine rivers.

USFWS

Craig Brook National Fish hatchery

Craig Book National Fish Hatchery is the oldest public salmon hatchery in the nation and the last refuge in the United States for federally endangered Atlantic salmon. Craig Brook raises and releases up to 1.5 million juvenile salmon – 1-inch fry and 6-inch smolts – to recover populations.

As part of a river-specific stocking program begun in 1994, young Atlantic salmon are captured each year from the Dennys, Machias, East Machias, Pleasant, Narraguagus and Sheepscot rivers and brought to the hatchery to be raised as broodstock. The Atlantic salmon recovery program at Craig

USFWS

Atlantic salmon female

Brook mimics the species' river-specific life cycle. Offspring are raised separately by river population and released as fry or smolts into their parents' home river, thereby protecting the genetic integrity of the salmon in each of these watersheds.

Biologists also release 2 million juvenile fish each year to restore the Atlantic salmon population in Maine's largest river, the Penobscot. The Penobscot lost all its native salmon north of Bangor by the mid-20th century, but has become America's greatest salmon restoration success story.

The Penobscot River has the only salmon population with sufficient numbers of returning adults to support an adult capture program. About 400 returning adult females and 200 males are temporarily captured for use as broodstock. They are released after artificial spawning. Most of the returning Penobscot adults are allowed to pass unobstructed at Veazie Dam to continue their upstream migration to spawn naturally in the river's headwaters.

More salmon rivers have protection

Based on a review of the status of Atlantic salmon in Maine, in June 2009 NOAA's Fisheries Service and the U.S. Fish and Wildlife Service redefined the population of Gulf of Maine Atlantic salmon and extended Endangered Species Act protection to salmon in large Maine rivers to help prevent extinction and to recover the imperiled population.

In addition to salmon originally protected in 2000, Atlantic salmon from the Penobscot, Kennebec and Androscoggin rivers now have Endangered Species Act protection. Salmon in these larger rivers were added because they are genetically similar or reside in watersheds with similar conditions to those found in the coastal rivers of Maine.

The restoration story

The Nashua, North Attleboro, Pittsford, Richard Cronin and White River national fish hatcheries produce salmon fry to restore lost populations in the Connecticut, Merrimack and Pawcatuck rivers. Salmon in these rivers are not protected by the Endangered Species Act. Hundreds of people, from schoolchildren to adults, assist each spring in stocking fry into these rivers and their tributaries as an investment in the future of Atlantic salmon.

U.S. Fish & Wildlife Service
300 Westgate Center Drive
Hadley, MA 01037
413/253 8200

Federal Relay Service
for the deaf and hard-of-hearing
1 800/877 8339

U.S. Fish & Wildlife Service
1 800/344 WILD
http://www.fws.gov

June 2009

STATE ENDANGERED

Roaring Brook Mayfly

(Epeorus frisoni)

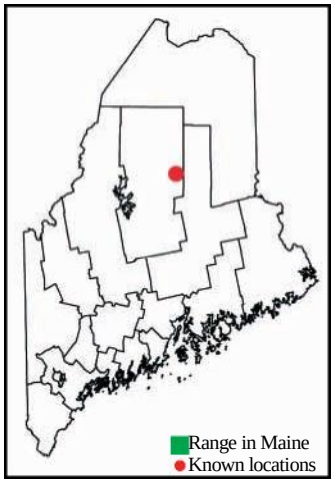
Mark McCollough

Description

The Roaring Brook mayfly is less than $^1/_2$ inch long. Its upright wings are of a similar length. Two long cerci, or tails, protrude from the abdomen. The body is light yellowish tan, and the thorax (midsection) is light golden-brown. It can be distinguished from other flat-headed mayflies by a complex pattern of veins in its wings and the structure of its genitalia. The nymph has not been described.

Range and Habitat

The Roaring Brook mayfly is currently known only from Roaring Brook at the base of Mt. Katahdin. It is a high-gradient, clear mountain stream characterized by cascades, large boulders, and coarse granite bottom. The stream is subject to annual flooding from snowmelt, and flows year-round. Although it is believed this mayfly may be endemic to this locality, it could be present in other cold subalpine streams in the Katahdin area. A recent statewide survey of mayflies failed to locate this species in similar streams in mountainous regions of Maine.



Life History and Ecology

Mayflies have three life stages: nymph (aquatic phase), subimago (pre-adult that emerges from the stream), and imago (adult). The life history of the Roaring Brook mayfly is poorly known. It likely has a single-year life cycle. Adults emerge in late August. Subimagos probably remain close to the stream, where they cling to streamside vegetation and molt into final adult form. Adults only live for a few days and do not feed. Males and females gather over the brook in mating swarms. Females lay their eggs over the water surface. Eggs likely overwinter in the stream bottom and hatch the following spring. Nymphs undergo several instars, or size classes, as they molt and grow. Nymphs occur in stream bottoms scoured by the currents and ice. Mayfly nymphs feed on leaf detritus that fell into the stream the previous fall and has been broken down by other aquatic insect larvae and bacteria. Nymphs travel to the surface and emerge as adults, usually on summer evenings. Mayflies in Roaring Brook are likely an important source of food for brook trout, bats, dragonflies, and other wildlife.

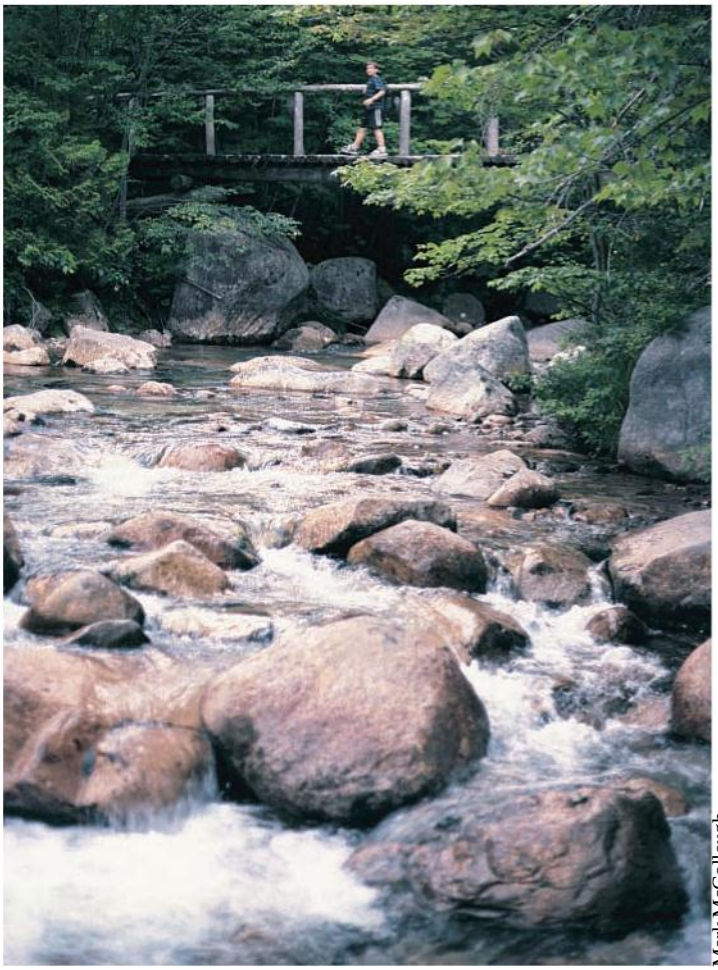
Threats

There are no known threats to the species other than the inherent vulnerability of potentially being located at only a single site in the world, which is why this species is state-listed as endangered. Roaring Brook is protected for its entire length in Baxter State Park.

Conservation and Management

In 1946, Dr. B.D. Burks of the Illinois Natural History Survey described five new species in the family Heptageniidae, or flat-headed mayflies. Among these was a mayfly discovered by T.H. Frison on August 26, 1939 in Roaring Brook at the base of Mt. Katahdin in Baxter State Park. To date, it has been found nowhere else. Despite being one

of the rarest mayflies in the world, it is notable that no one has visited Roaring Brook to look for it since its initial discovery. Therefore, its current status and populations are unknown. Biologists are initiating surveys in 2003 to reconfirm the existence of this rare insect. Additional high-elevation streams need to be surveyed also to determine whether this mayfly may occur at other locations. Because its location is well-protected, there are no specific conservation recommendations except maintaining the water quality of Roaring Brook.



Mark McCollough

The icy waters of Roaring Brook in Baxter State Park are habitat for the Roaring Brook mayfly.

STATE THREATENED

Northern Bog Lemming

(Synaptomys borealis)

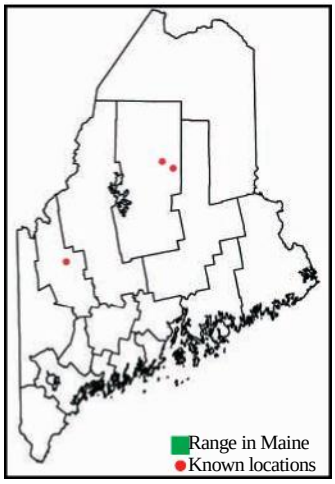
Mark McCollough

Description

The northern bog lemming is among Maine's rarest and most elusive mammals. Like the Canada lynx, it is more numerous in the North and reaches the southern edge of its range here. Unlike the lynx, it has not received federal listing attention, associated research, and surveys, and its status remains a mystery.

The northern bog lemming is a small mammal about the size of a vole (about one ounce). The bog lemming has a blunt nose, short tail, and somewhat grayer coat than the common red-backed vole *(Clethrionomys gapperi)*. The upper parts are dull brown, and are slightly brighter on the rump. Toward the head the fur has a grizzled appearance. The underside is grayish. The tail is brown above and paler below, and the feet are dark grayish. Bog lemmings have a groove along the outer edge of each incisor, which similar-looking species of voles do not have.

Two species of bog lemmings, the northern and southern *(S. cooperi)*, live in Maine. They are very similar in appearance and are difficult to distinguish. Unlike the southern bog lemming, the northern species has rusty-tipped fur at the base of the ears. Also, female northern bog lemmings have eight mammae, while southern bog lemmings only have six. Tooth structures must be examined under magnification to confirm identification of the two species. The northern bog lemming does not have closed triangles on the outer surface of its molars, and it has a sharp projection pointing back from the roof of the mouth.



Range and Habitat

The northern bog lemming is widely distributed across northern North America, ranging from Alaska to Labrador and south to Washington and Maine. This species has not been found in great numbers anywhere, with the exception of moderate-sized populations in Alaska and around the Hudson Bay. It is less common at the southern extent of its range, which includes Maine and adjacent New Hamp-shire.

In Maine, the northern bog lemming has been found at five locations, including two sites in Baxter State Park. The species has also been captured in three locations in New Hampshire: along the Wild River not far from the Maine/New Hampshire border, near the base of Mt. Washington, and on Mt. Mooselauke. Most occurrences are at elevations of 2000 feet or greater. In other parts of the spe-cies' range, it occurs at much lower elevations, where its habitat needs are provided by a northern tundra-like habitat, rather than an alpine environ-ment.

The northern bog lemming usually occurs in moist, wet meadows or boggy areas, often in con-junction with arctic or alpine tundra and spruce-fir forests. Frequently it occurs near a spring or other source of water or near lush, mossy logs and rocks. Specimens found in Maine are associated with deep, moist sphagnum, both in low- and high-elevation settings.

Life History and Ecology

Limited information is available on the ecology of this species. The northern bog lemming constructs runways above ground or below the leaf litter. The nest is located either above ground concealed in vegetation, or several inches below ground. It is lined with dried leaves and grasses, and occasionally fur. Northern bog lemmings are social animals that live in colonies. Foods include sedges, grasses, raspberry seeds, and the fungus *Endogone*. Predators may include mammals, hawks, owls, and snakes. Little is known about the species' reproduc-tive behavior, although it may be similar to that of the southern bog lemming, which breeds through-out the year and may produce several litters. The gestation period lasts 21-23 days, and a litter may contain 1-8 young. When born, the young are blind, naked, and helpless, and weigh about a tenth of an ounce.

Threats

Because the northern bog lemming is found in so few sites and in such low numbers in Maine, it is vulnerable to extirpation. Suitable habitat is not abundant in Maine. Mountain elevations above 2,700 feet are subject to special regulations in Maine, but development of ski areas or wind power could be harmful. Wind power development has been proposed for one known site in western Maine. The discovery of northern bog lemmings at low-altitude spruce-fir forests in Baxter State Park may indicate broader habitat use. Sensitive microhabitats (especially wet, sphagnum ground cover) within forests could be altered by logging equipment on non-frozen ground. Additional research is needed to better understand the full range of habitats used. Competition with other small mammals may also limit the species' distribution.

Conservation and Management

The northern bog lemming was listed as threatened in Maine in 1986, because of its apparently low numbers and limited distribution. As yet, no specific conservation plans have been implemented for this species. Further information on habitats used by the species in Maine is needed to develop appro-priate conservation measures. Moist, high-elevation mossy areas seem to be optimal habitat. The north-ern bog lemming shares these habitats with other rare small mammals, including the yellow-nosed vole and rock shrew (both Species of Special Con-cern). Once the lemming's habitat needs are better understood, land use should be carefully planned to protect the lemming and other rare species. Systematic small mammal surveys are needed. A recent small mammal inventory in northwestern Maine yielded two new records of northern bog lemmings.

Recommendations:

✔ Prior to land development or forest harvesting, consult with a biologist from MDIFW to assist with planning.

✔ Deliver any bog lemming specimens to MDIFW to confirm identification. Note the site location as accurately as possible so MDIFW can locate and protect associated northern bog lemming populations.

✔ Minimize impacts to high elevation habitats that may potentially harbor northern bog lemmings and associated species (cool, moist, mossy areas of a boreal or alpine character). Survey these areas for the species' presence.

✔ To preserve the vegetation and physical structure required by the northern bog lemming, do not stray off marked trails, especially in fragile alpine areas on Mt. Katahdin, Bigelow Mountain, and high elevation areas on the Appalachian Trail.

Enclosure 6

Baseline Survey for Amphibians and Reptiles at Three Navy Installations in Maine

January 2015

APPENDIX G

SERE School Flora and Fauna Lists

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Table G-1. Flora of the SERE School.

COMMON NAME	SCIENTIFIC NAME	ORIGIN[1]	TYPE[2]
Maple Family	**Aceraceae**		
Striped maple	*Acer pensylvanicum*	N	P
Red maple	*Acer rubrum*	N	P
Sugar maple	*Acer saccharum*	N	P
Mountain maple	*Acer spicatum*	N	P
Holly Family	**Aquifoliaceae**		
Catberry	*Ilex mucronata*	N	P
Aralia or Ivy Family	**Araliaceae**		
Wild sarsaparilla	*Aralia nudicaulis*	N	P
Sunflower Family	**Asteraceae**		
Western pearly everlasting	*Anaphalis margaritacea*	N	P
Canadian horseweed	*Conyza canadensis*	N	A
Parasol whitetop	*Doellingeria umbellata*	N	P
Parasol whitetop	*Doellingeria umbellata* var. *umbellata*	N	P
Bigleaf aster	*Eurybia macrophylla*	N	P
Spotted joe pye weed	*Eutrochium maculatum*	N	P
Common boneset	*Eupatorium perfoliatum*	N	P
Sweetscented joe pye weed	*Eutrochium purpureum*	N	P
Whorled wood aster	*Oclemena acuminata*	N	P
Gall of the earth	*Prenanthes trifoliolata*	N	P
Goldenrod	*Solidago* sp.		
Canada goldenrod	*Solidago canadensis*	N	P
New England aster	*Symphyotrichum novae-angliae*	N	P
New York aster	*Symphyotrichum novi-belgii*	N	P
Balsalm Family	**Balsaminaceae**		
Jewelweed	*Impatiens capensis*	N	A
Birch Family	**Betulaceae**		
Gray alder	*Alnus incana*	N	P
Yellow birch	*Betula alleghaniensis*	N	P
Paper birch	*Betula papyrifera*	N	P
Gray birch	*Betula populifolia*	N	P
Beaked hazelnut	*Corylus cornuta*	N	P
Honeysuckle Family	**Caprifoliaceae**		
Hobblebush	*Viburnum lantanoides*	N	P
Withe-rod	*Viburnum nudum* var. *cassinoides*	N	P
St. John's Wort Family	**Clusiaceae**		
Virginia marsh St. Johnswort	*Triadenum virginicum*	N	P

COMMON NAME	SCIENTIFIC NAME	ORIGIN[1]	TYPE[2]
Cypress Family	**Cupressaceae**		
Eastern redcedar	*Juniperus virginiana*	N	P
Eastern white cedar	*Thuja occidentalis*	N	P
Dogwood Family	**Cornaceae**		
Bunchberry dogwood	*Cornus canadensis*	N	P
Dodder Family	**Cuscutaceae**		
Threeleaf goldenthread	*Coptis trifolia*	N	P
Sedge Family	**Cyperaceae**		
Sedge	*Carex* sp.	I/N	P
Brownish sedge	*Carex brunnescens*	N	P
Fringed sedge	*Carex crinita*	N	P
Nodding sedge	*Carex gynandra*	N	P
Greater bladder sedge	*Carex intumescens*	N	P
Blue Ridge sedge	*Carex lucorum*	N	P
Eggbract sedge	*Carex ovalis*	N	P
Fox sedge	*Carex vulpinoidea*	N	P
Needle spikerush	*Eleocharis acicularis*	N	A
Tall cottongrass	*Eriophorum angustifolium*	N	P
Woolgrass	*Scirpus cyperinus*	N	P
Bulrush	*Scirpus* sp.	N	A/P
Bracken Family	**Dennstaedtiaceae**		
Eastern hayscented fern	*Dennstaedtia punctilobula*	N	P
Moss Family	**Dicranaceae**		
Dicranum moss	*Dicranum* spp.	N	-
Sundew Family	**Droseraceae**		
Lance-leaved sundew	*Drosera adelae*	N	P
Wood Fern Family	**Dryopteridaceae**		
Common ladyfern	*Athyrium filix-femina*	N	P
Mountain woodfern	*Dryopteris campyloptera*	N	P
Spinulose woodfern	*Dryopteris carthusiana*	N	P
Crested woodfern	*Dryopteris cristata*	N	P
Intermediate woodfern	*Dryopteris intermedia*	N	P
Western oakfern	*Gymnocarpium dryopteris*	N	P
Sensitive fern	*Onoclea sensibilis*	N	P
Heath Family	**Ericaceae**		
Laurel	*Kalmia* sp.	N	P
Lowbush blueberry	*Vaccinium angustifolium*	N	P
Highbush blueberry	*Vaccinium corymbosum*	N	P
Bog cranberry	*Vaccinium macrocarpon*	N	P

COMMON NAME	SCIENTIFIC NAME	ORIGIN[1]	TYPE[2]
Pea Family	**Fabaceae**		
Shameplant	*Mimosa pudica*	I	A
Rabbitfoot clover	*Trifolium arvense*	I	A
Red clover	*Trifolium pratense*	I	P
White clover	*Trifolium repens*	I	P
Currant Family	**Grossulariaceae**		
Prickly currant	*Ribes lacustre*	N	P
Moss Family	**Hylocomiaceae**		
Hylocomium feather moss	*Hylocomium* spp.	N	-
Splendid feather moss	*Hylocomium splendens*	N	-
Moss Family	**Hypnaceae**		
Hypnum moss	*Hypnum* spp.	N	-
Knights plume moss	*Ptilium crista-castrensis*	N	-
Iris Family	**Iridaceae**		
Harlequin blueflag (Blue flag iris)	*Iris versicolor*	N	P
Rush Family	**Juncaceae**		
Rush	*Juncus* sp.	I/N	A/P
Canadian rush	*Juncus canadensis*	N	P
Liverwort Family	**Myliaceae**		
Mylia	*Mylia* spp.	N	-
Mint Family	**Lamiaceae**		
Brittlestem hempnettle	*Galeopsis tetrahit*	I	A
American water horehound	*Lycopus americanus*	N	P
Northern bugleweed	*Lycopus uniflorus*	N	P
Blue skullcap	*Scutellaria lateriflora*	N	P
Leafy Liverwort Family	**Lepidoziaceae**		
Threelobed bazzania	*Bazzania trilobata*	N	-
Lily Family	**Liliaceae**		
Bluebead	*Clintonia borealis*	N	P
Dogtooth violet	*Erythronium americanum*	N	P
Canada mayflower	*Maianthemum canadense*	N	P
Feathery false lily of the valley	*Maianthemum racemosum* sp. *racemosum*	N	P
Red trillium	*Trillium erectum*	N	P
Painted trillium	*Trillium undulatum*	N	P
Club-Moss Family	**Lycopodiaceae**		
Stiff clubmoss	*Lycopodium annotinum*	N	P
Fan clubmoss	*Lycopodium digitatum*	N	P
Rare clubmoss	*Lycopodium obscurum*	N	P

COMMON NAME	SCIENTIFIC NAME	ORIGIN[1]	TYPE[2]
Flowering Plants Family	**Lythraceae**		
Purple loosestrife	*Lythrum salicaria*	I	P
Indianpipe Family	**Monotropaceae**		
Indianpipe	*Monotropa uniflora*	N	P
Evening Primrose Family	**Onagraceae**		
Fireweed	*Chamerion angustifolium* ssp. *angustifolium*	N	P
Royal Fern Family	**Osmundaceae**		
Cinnamon fern	*Osmunda cinnamomea*	N	P
Royal fern	*Osmunda regalis*	N	P
Woodsorrel Family	**Oxalidaceae**		
Mountain woodsorrel	*Oxalis montana*	N	P
Pine Family	**Pinaceae**		
Balsam fir	*Abies balsamea*	N	P
Tamarack	*Larix laricina*	N	P
Black spruce	*Picea mariana*	N	P
Red spruce	*Picea rubens*	N	P
Grass Family	**Poaceae**		
Bluejoint	*Calamagrostis canadensis*	N	P
Virginia wildrye	*Elymus virginicus*	N	P
Red fescue	*Festuca rubra*	N	P
Rattlesnake mannagrass	*Glyceria canadensis*	N	P
Buckwheat/Smartweed Family	**Polygonaceae**		
Arrowleaf tearthumb	*Polygonum sagittatum*	N	A
Moss Family	**Polytrichaceae**		
Polytrichum moss	*Polytrichum* sp.	N	-
Polytrichum moss	*Polytrichum commune*	N	-
Primrose Family	**Primulaceae**		
Earth loosestrife	*Lysimachia terrestris*	N	P
Starflower	*Trientalis borealis*	N	P
Buttercup Family	**Ranunculaceae**		
Devil's darning needles	*Clematis virginiana*	N	P
Threeleaf goldthread	*Coptis trifolia*	N	P
Buttercup	*Ranunculus* sp.	I/N	-
Columbine meadow-rue	*Thalictrum aquilegifolium*	I	P
King of the meadow	*Thalictrum pubescens*	N	P
Rose Family	**Rosaceae**		
Serviceberry	*Amelanchier* sp.	N	-
Strawberry	*Fragaria ananassa*	N	P
Pin cherry	*Prunus pensylvanica*	N	P

COMMON NAME	SCIENTIFIC NAME	ORIGIN[1]	TYPE[2]
Chokecherry	*Prunus virginiana*	N	P
Blackberry	*Rubus* sp.	I/N	-
American red raspberry	*Rubus idaeus*	I/N	P
American mountain ash	*Sorbus americana*	N	P
White meadowsweet	*Spiraea alba*	N	P
White meadowsweet	*Spiraea alba* var. *latifolia*	N	P
Steeplebush	*Spiraea tomentosa*	N	P
Bedstraw	**Rubiaceae**		
Bedstraw	*Galium* spp.	I/N	A/P
Figwort Family	**Scrophulariaceae**		
White turtlehead	*Chelone glabra*	N	P
Willow Family	**Salicaceae**		
Quaking aspen	*Populus tremuloides*	N	P
Black willow	*Salix nigra*	N	P
Figwort Family	**Scrophulariaceae**		
Canada toadflax	*Nuttallanthus canadensis*	N	A
Peat Moss Family	**Sphagnaceae**		
Sphagnum	*Sphagnum* sp.	N	-
Sphagnum	*Sphagnum platyphyllum*	N	-
Recurved sphagnum	*Sphagnum recurvum*	N	-
Marsh Fern Family	**Thelypteridaceae**		
Long beechfern	*Phegopteris connectilis*	N	P
New York fern	*Thelypteris noveboracensis*	N	P
Mosses and Liverworts Family	**Thuidiaceae**		
Thuidium moss	*Thuidium* spp.	N	-
Elm Family	**Ulmaceae**		
American elm	*Ulmus americana*	N	P

1 - I = invasive or introduced, N = native,
2 - A = annual, P = perennial
Common and scientific names generally follow the USDA Plant Database naming convention (USDA NRCS 2013)
Sources: United States Department of the Navy (Navy) 2012 and United States Department of Agriculture Natural Resources Conservation Service 2013

Table G-2. Mammals Known to Occur at the SERE School.

COMMON NAME	SCIENTIFIC NAME
Bat Family	**Vespertillonidae (Order Chiroptera)**
Big brown bat	*Eptesicus fuscus*
Eastern small-footed bat[1]	*Myotis leibii*
Little brown bat[1]	*Myotis lucifugus*
Northern long-eared bat[1]	*Myotis septentrionalis*
Silver haired bat[1]	*Lasionycteris noctivagans*
Eastern red bat[1]	*Lasiurus borealis*
Hoary bat[1]	*Lasiurus cinereus*
Tri-colored bat[1]	*Perimyotis subflavus*
Deer Family	**Cervidae (Order Artiodactyla)**
Moose	*Alces alces*
White-tailed deer	*Odocoileus virginianus*
Dog Family	**Canidae (Order Carnivora)**
Eastern coyote	*Canis latrans*
Cat Family	**Felidae (Order Carnivora)**
Bobcat	*Lynx rufus*
Weasel Family	**Mustelidae (Order Carnivora)**
Fisher	*Martes pennanti*
American marten	*Martes americana*
Short-tailed weasel	*Mustela erminea*
Long-tailed weasel	*Mustela frenata*
Unknown Mustelid species	*Mustela* sp.
North American river otter	*Lontra canadensis*
Bear Family	**Ursidae (Order Carnivora)**
American black bear	*Ursus americanus*
Beavers Family	**Castoridae (Order Rodentia)**
American beaver	*Castor canadensis*
New World Porcupine Family	**Erethizontidae (Order Rodentia)**
Porcupine	*Erethizon dorsatum*
New World Mice and Rats Family	**Muridae (Order Rodentia)**
Deer mouse	*Peromyscus maniculatus*
Unknown mouse	*Peromyscus* sp.
Vole Family	**Cricetidae (Order Rodentia)**
Meadow vole	*Microtus pennsylvanicus*
Rabbit Family	**Leporida (Order Lagomorpha)**
Snowshoe Hare	*Lepus americanus*
Squirrel Family	**Sciuridae (Order Rodentia)**
Red squirrel	*Tamiasciurus hudsonicus*

Source: Navy 2012

1 - Listed as rare, threatened, or endangered species (See Table G-5)

Table G-3. Birds Known to Occur at the SERE School.

COMMON NAME	SCIENTIFIC NAME
Heron Family	**Ardeidae**
Black-crowned night heron[1]	*Nycticorax nycticorax*
Hawk and Eagle Family	**Accipitridae**
Northern goshawk	*Accipiter aentilis*
Cooper's hawk	*Accipiter cooperii*
Sharp-shinned hawk	*Accipiter striatus*
Red-tailed hawk	*Buteo jamaicensis*
Rough-legged hawk	*Buteo lagopus*
Broad-winged hawk	*Buteo platypterus*
Bald eagle[1]	*Haliaeetus leucocephalus*
Osprey	*Pandion haliaetus*
Kingfisher Family	**Alcedinidae**
Belted kingfisher	*Megaceryle alcyon*
Duck, Goose, and Swan Family	**Anatidae**
Mallard	*Anas platyrhynchos*
American black duck	*Anas rubripes*
Canada goose	*Branta canadensis*
Red-breasted merganser	*Mergus serrator*
Waxwing Family	**Bombycillidae**
Cedar waxwing	*Bombycilla cedrorum*
Cardinal Family	**Cardinalidae**
Indigo bunting	*Passerina cyanea*
Rose-breasted grosbeak	*Pheucticus ludovicianus*
New World Vulture Family	**Cathartidae**
Turkey vulture	*Cathartes aura*
Treecreeper Family	**Certhidae**
Brown creeper	*Certhia americana*
Crow and Jay Family	**Corvidae**
American crow	*Corvus barchyrhynchos*
Common raven	*Corvus corax*
Blue jay	*Cyanocitta cristata*
Sparrow Family	**Emberizidae**
Dark-eyed junco	*Junco hyemalis*
Swamp sparrow	*Melospiza georgiana*
Song sparrow	*Melospiza melodia*
Chipping sparrow	*Spizella passerina*
White-throated sparrow[1]	*Zonotrichia albicollis*

COMMON NAME	SCIENTIFIC NAME
Falcon Family	**Falconidae**
American kestrel	*Falco sparverius*
Merlin	*Falco columbarius*
Peregrine falcon[1]	*Falco peregrinus*
Finch Family	**Fringillidae**
Common redpoll	*Acanthis flammea*
Purple finch	*Haemorhous purpureus*
American goldfinch	*Spinus tristis*
Swallow Family	**Hirundinidae**
Tree swallow[1]	*Tachycineta bicolor*
Blackbird and Oriole Family	**Icteridae**
Red-winged blackbird	*Agelaius phoeniceus*
Rusty blackbird[1]	*Euphagus carolinus*
Baltimore oriole	*Icterus galbula*
Common grackle	*Quiscalus quiscula*
Thrasher, Mockingbird, Trembler, and Catbird Family	**Mimidae**
Gray catbird	Dumetella carolinensis
Titmouse and Chickadee Family	**Paridae**
Black-capped chickadee	*Poecile atricapillus*
Boreal chickadee	*Poecile hudsonicus*
Wood Warbler Family	**Parulidae**
Golden-crowned warbler	*Basileuterus culicivorus*
Canada warbler[1]	*Cardellina canadensis*
Mourning warbler	*Geothlypis philadelphia*
Common yellowthroat	*Geothlypis trichas*
Black-and-white warbler[1]	*Mniotilta varia*
Nashville warbler	*Oreothlypis ruficapilla*
Northern waterthrush	*Parkesia noveboracensis*
Ovenbird	*Seiurus aurocapilla*
Northern parula	*Setophaga americana*
Black-throated blue warbler	*Setophaga caerulescens*
Bay-breasted warbler	*Setophaga castanea*
Yellow-rumped warbler	*Setophaga coronata*
Blackburnian warbler	*Setophaga fusca*
Magnolia warbler	*Setophaga magnolia*
Palm warbler	*Setophaga palmarum*
Chestnut-sided warbler[1]	*Setophaga pensylvanica*

COMMON NAME	SCIENTIFIC NAME
Yellow warbler[1]	*Setophaga petechia*
Pine warbler	*Setophaga pinus*
American redstart[1]	*Setophaga ruticilla*
Blackpoll warbler	*Setophaga striata*
Cape May warbler	*Setophaga tigrina*
Black-throated green warbler	*Setophaga virens*
Pheasant, Partridge, and Turkey Family	**Phasianidae**
Ruffed grouse	*Bonasa umbellus*
Woodpecker Family	**Picidae**
Northern flicker	*Colaptes auratus*
Pileated woodpecker	*Dryocopus pileatus*
Downy woodpecker	*Picoides pubescens*
Hairy woodpecker	*Picoides villosus*
Yellow-bellied sapsucker	*Sphyrapicus varius*
Kinglet Family	**Regulidae**
Ruby-crowned	*Regulus calendula*
Golden-crowned kinglet	*Regulus satrapa*
Nuthatch Family	**Sittidae**
Red-breasted nuthatch	*Sitta canadensis*
White-breasted nuthatch	*Sitta carolinensis*
Hummingbird Family	**Trochilidae**
Ruby-throated hummingbird	*Archilochus colubris*
Wren Family	**Troglodytidae**
Winter wren	*Troglodytes hiemalis*
Thrush Family	**Turdidae**
Bicknell's thrush[1]	*Catharus bicknelli*
Veery[1]	*Catharus fuscescens*
Hermit thrush	*Catharus guttatus*
Swainson's thrush	*Catharus ustulatus*
American robin	*Turdus migratorius*
Flycatcher Family	**Tyrannidae**
Olive-sided flycatcher[1]	*Contopus cooperi*
Alder flycatcher	*Empidonax alnorum*
Yellow-bellied flycatcher	*Empidonax flaviventris*
Least flycatcher[1]	*Empidonax minimus*
Willow flycatcher	*Empidonax trailii*
Great crested flycatcher	*Myiarchus crinitus*
Eastern phoebe	*Sayornis phoebe*

COMMON NAME	SCIENTIFIC NAME
Vireo Family	**Vireonidae**
Warbling vireo	*Vireo gilvus*
Red-eyed vireo	*Vireo olivaceus*
Philadelphia vireo	*Vireo philadelphicus*
Blue-headed vireo	*Vireo solitarius*

1 - Listed as rare, threatened, or endangered; or USFWS bird of conservation concern (See Table G-5).

Sources: Navy 2007, Navy 2012, Cornell Lab of Ornithology 2013, and Navy 2013a

Table G-4. Herpetofauna, Fish, and Invertebrates Known To Occur at the SERE School.

COMMON NAME	SCIENTIFIC NAME[1]
AMPHIBIANS	
Toad Family	**Bufonidae (Order Anura)**
American toad	*Anaxyrus americanus*
Tree Frog Family	**Hylidae (Order Anura)**
Spring peeper	*Pseudacris crucifer*
True Frog Family	**Ranidae (Order Anura)**
Green frog	*Lithobates clamitans*
Pickerel frog	*Lithobates palustris*
Mink frog	*Lithobates septentrionalis*
Wood frog	*Lithobates sylvatica*
Mole Salamander Family	**Ambystomatidae (Order Caudata)**
Spotted salamander	*Ambystoma maculatum*
Lungless Salamander Family	**Plethodontidae (Order Caudata)**
Northern dusky salamander	*Desmognathus fuscus*
Northern two-lined salamander	*Eurycea bislineata*
Northern spring salamander[2]	*Gyrinophilus porphyriticus porphyriticus*
Eastern red-backed salamander	*Plethodon cinereus*
Newt Family	**Salamandridae (Order Caudata)**
Eastern newt	*Notophthalmus viridescens*
REPTILES	
Nonvenomous Snake Family	**Colubridae (Order Squamata)**
Common garter snake	*Thamnophis sirtalis*
Pond Turtle Family	**Emydidae (Order Anura)**
Eastern painted turtle	*Chrysemys picta picta*
FISH	
Suckers Family	**Catostomidae**
White sucker	*Catostomus commersonii*
Sculpins Family	**Cottidae**
Slimy sculpin	*Cottus cognatus*
Minnows and Carps Family	**Cyprinidae**
Blacknose dace	*Rhinichthys atratulus*
Creek chub	*Semotilus atromaculatus*
Trout and Salmon Family	**Salmonidae (Order Salmoniformes)**
Brook trout[2]	*Salvelinus fontinalis*
Eel Family	**Anguillidae**
American eel	*Anguilla rostrata*
INVERTEBRATES	
Brush-Footed Butterfly Family	**Nymphalidae (Order Lepidoptera)**
Mourning cloak	*Nymphalis antiopa*

COMMON NAME	SCIENTIFIC NAME[1]
Skipper Family	**Hesperiidae (Order Lepidoptera)**
Hobomok skipper	*Poanes hobomok*
Leaf Beetle Family	**Chrysomelidae (Order Coleoptera)**
Dogwood leaf beetle	*Calligrapha* sp.
Wasps	**Hymenoptera Order**
Unidentified wasp sp.	unknown
Dragonflies	**Odonata Order**
Unidentified dragonfly sp.	unknown
Caddisflies	**Trichoptera Order**
Unidentified caddisfly sp.	Unknown

1 - Taxonomy from the Integrated Taxonomic Information System (ITIS 2013)

2 - Listed as rare, threatened, or endangered species (See Table G-5)

Sources: Navy 2012, ITIS 2013, Naval Facilities Engineering Command Mid-Atlantic 2013, and Navy 2013b

Table G-5. Federal and State Listed Rare, Threatened, Endangered, and Special Concern Species Known or with the Potential to Occur at the SERE School.

COMMON NAME	SPECIES NAME	STATUS[1]		OCCURRENCE[2]
		FEDERAL	STATE	
PLANTS				
Small whorled pogonia	*Isotria medeoloides*	T	E	P
MAMMALS				
Eastern cougar	*Felis concolor couguar*	Extinct	-	Extinct
Canada lynx	*Lynx canadensis*	T	-	P
Penobscot meadow vole	*Microtus pennsylvanicus shattucki*	-	SC	P
Eastern small-footed bat	*Myotis leibii*	-	SC	O
Little brown bat	*Myotis lucifugus*	-	SC	O
Northern long-eared bat	*Myotis septentrionalis*	T	SC	O
Eastern red bat	*Lasiurus borealis*	-	SC	O
Hoary bat	*Lasiurus cinereus*	-	SC	O
Silver haired bat	*Lasionycteris noctivagans*	-	SC	O
Tri-colored bat	*Perimyotis subflavus*	-	SC	O
New England cottontail	*Sylvilagus transitionalis*	C	E	P
Northern bog lemming	*Synaptomys borealis*	-	T	P
BIRDS				
Grasshopper sparrow	*Ammodramus savannarum*	-	E	P
American pipit	*Anthus rubescens*	-	E (b)	P
Golden eagle	*Aquila chrysaetos*	-	E	P
Great blue heron	*Ardea herodias*	-	SC	P
Short-eared owl	*Asio flammeus*	-	T (b)	P
Upland sandpiper	*Bartramia longicauda*	BCC	T	P
American bittern	*Botaurus lentiginosus*	BCC		P
Whip-poor-will	*Caprimulgus vociferous*	-	SC	P
Canada warbler	*Cardellina canadensis*	BCC	SC	O
Bicknell's thrush	*Catharus bicknelli*	UR, BCC	SC	O
Veery	*Catharus fuscescens*	-	SC	O
Chimney swift	*Chaetura pelagica*	-	SC	P
Black tern	*Chlidonias niger*	-	E	P
Northern harrier	*Circus cyaneus*	-	SC	P
Sedge wren	*Cistothorus platensis*	-	E	P
Evening grosbeak	*Coccothraustes vespertinus*	-	SC (b)	P
Yellow-billed cuckoo	*Coccyzus americanus*	PT	SC	P
Olive-sided flycatcher	*Contopus cooperi*	BCC	SC	O
Eastern wood-pewee	*Contopus virens*	-	SC	P
Prairie warbler	*Dendroica discolor*	-	SC	P
Chestnut-sided warbler	*Dendroica pensylvanica*	-	SC	O

COMMON NAME	SPECIES NAME	STATUS[1]		OCCURRENCE[2]
		FEDERAL	STATE	
Yellow warbler	*Dendroica petechia*	-	SC	O
Snowy egret	*Egretta thula*	BCC	-	P
Least flycatcher	*Empidonax minimus*	-	SC	O
Horned lark	*Eremophila alpestris*	-	SC (b)	P
Rusty blackbird	*Euphagus carolinus*	BCC	SC	O
Peregrine falcon	*Falco peregrinus*	BCC (b)	E	O
Bald eagle	*Haliaeetus leucocephalus*	DL, BCC (b)	SC	O
Barn swallow	*Hirundo rustica*	-	SC	P
Harlequin duck	*Histrionicus histrionicus*	-	T	P
Wood thrush	*Hylocichla mustelina*	BCC	SC	P
Least bittern	*Ixobrychus exilis*	BCC	E	P
Loggerhead shrike	*Lanius ludovicianus*	-	SC	P
Hudsonian godwit	*Limosa haemastica*	BCC (nb)		P
Eastern screech owl	*Megascops asio*	-	SC	P
Black-and-white warbler	*Mniotilta varia*	-	SC	O
Black-crowned night heron	*Nycticorax nycticorax*	-	T	O
Fox sparrow	*Passerella iliaca*	-	SC	P
Eastern towhee	*Pipilo erythrophthalmus*	-	SC	P
Horned grebe	*Podiceps auritus*	BCC (nb)	-	P
Pied-billed grebe	*Podilymbus podiceps*	BCC	-	P
Purple martin	*Progne subis*	-	SC	P
Bay-breasted warbler	*Setophaga castanea*	BCC	-	O
American redstart	*Setophaga ruticilla*	-	SC	O
Northern rough-winged swallow	*Stelgidopteryx serripennis*	-	SC	P
Least tern	*Sterna antillarum*	E	E	P
Eastern meadowlark	*Sturnella magna*	-	SC	P
Tree swallow	*Tachycineta bicolor*	-	SC	O
Brown thrasher	*Toxostoma rufum*	-	SC	P
Lesser yellowlegs	*Tringa flavipes*	BCC (nb)	SC	P
Solitary sandpiper	*Tringa solitaria*	BCC (nb)	-	P
Eastern kingbird	*Tyrannus tyrannus*	-	SC	P
Tennessee warbler	*Vermivora peregrina*	-	SC	P
White-throated sparrow	*Zonotrichia albicollis*	-	SC	O
AMPHIBIANS				
Blue-spotted salamander	*Ambystoma laterale*	-	SC (diploid populations only)	P
Northern spring salamander	*Gyrinophilus porphyriticus porphyriticus*	-	SC	P
Northern leopard frog	*Lithobates pipiens*	-	SC	P

COMMON NAME	SPECIES NAME	STATUS[1]		OCCURRENCE[2]
		FEDERAL	STATE	
REPTILES				
Wood turtle	*Glyptemys insculpta*	UR	SC	P
FISHES				
Brook stickleback	*Culea inconstans*	-	SC	P
Creek chubsucker	*Erimyzon oblongus*	-	SC	P
Longnose dace	*Rhinicthys cataractae*	-	SC	P
Atlantic salmon	*Salmo salar*	E	-	P
INVERTEBRATES				
Roaring Brook mayfly	*Epeorus frisoni*	-	SE	P
Early hairstreak	*Erora laeta*	-	SC	P
Quebec emerald	*Somatochlora brevicincta*	-	SC	P
Ringed boghaunter	*Williamsonia lintneri*	-	SC	P

1 - Status: BCC = USFWS Birds of Conservation Concern (USFWS 2008), C = Candidate species for listing, DL = Delisted, E = Endangered, PE = Proposed Endangered, PT = Proposed Threatened, SC = Species of Concern (MDIFW 2013), T = Threatened, UR = Under Review for listing under the ESA, (b) = ranking applies to breeding population, (c) = BCC status is for the non-listed subspecies or population of threatened and endangered species, (nb) = BCC status is for non-breeding population

2 - Occurrence: O = Occurs; P = Potential to occur

Sources: United States Fish and Wildlife Service 2008, Maine Department of Inland Fisheries and Wildlife 2011, United States Fish and Wildlife Service 2011, Maine Department of Inland Fisheries and Wildlife 2013, and United States Fish and Wildlife Service 2013

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APPENDIX H

National Bald Eagle Management Guidelines

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NATIONAL BALD EAGLE MANAGEMENT GUIDELINES

U.S. Fish and Wildlife Service

May 2007

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INTRODUCTION

The bald eagle (*Haliaeetus leucocephalus*) is protected by the Bald and Golden Eagle Protection Act (Eagle Act) and the Migratory Bird Treaty Act (MBTA). The MBTA and the Eagle Act protect bald eagles from a variety of harmful actions and impacts. The U.S. Fish and Wildlife Service (Service) developed these National Bald Eagle Management Guidelines to advise landowners, land managers, and others who share public and private lands with bald eagles when and under what circumstances the protective provisions of the Eagle Act may apply to their activities. A variety of human activities can potentially interfere with bald eagles, affecting their ability to forage, nest, roost, breed, or raise young. The Guidelines are intended to help people minimize such impacts to bald eagles, particularly where they may constitute "disturbance," which is prohibited by the Eagle Act.

The Guidelines are intended to:

(1) Publicize the provisions of the Eagle Act that continue to protect bald eagles, in order to reduce the possibility that people will violate the law,

(2) Advise landowners, land managers and the general public of the potential for various human activities to disturb bald eagles, and

(3) Encourage additional nonbinding land management practices that benefit bald eagles (see Additional Recommendations section).

While the Guidelines include general recommendations for land management practices that will benefit bald eagles, the document is intended primarily as a tool for landowners and planners who seek information and recommendations regarding how to avoid disturbing bald eagles. Many States and some tribal entities have developed state-specific management plans, regulations, and/or guidance for landowners and land managers to protect and enhance bald eagle habitat, and we encourage the continued development and use of these planning tools to benefit bald eagles.

Adherence to the Guidelines herein will benefit individuals, agencies, organizations, and companies by helping them avoid violations of the law. However, the Guidelines themselves are not law. Rather, they are recommendations based on several decades of behavioral observations, science, and conservation measures to avoid or minimize adverse impacts to bald eagles.

The U.S. Fish and Wildlife Service strongly encourages adherence to these guidelines to ensure that bald and golden eagle populations will continue to be sustained. The Service realizes there may be impacts to some birds even if all reasonable measures are taken to avoid such impacts. Although it is not possible to absolve individuals and entities from liability under the Eagle Act or the MBTA, the Service exercises enforcement discretion to focus on those individuals, companies, or agencies that take migratory birds without regard for the consequences of their actions and the law, especially when conservation measures, such as these Guidelines, are available, but have not been implemented. The Service will prioritize its enforcement efforts to focus on those individuals or entities who take bald eagles or their parts, eggs, or nests without implementing appropriate measures recommended by the Guidelines.

The Service intends to pursue the development of regulations that would authorize, under limited circumstances, the use of permits if “take” of an eagle is anticipated but unavoidable. Additionally, if the bald eagle is delisted, the Service intends to provide a regulatory mechanism to honor existing (take) authorizations under the Endangered Species Act (ESA).

During the interim period until the Service completes a rulemaking for permits under the Eagle Act, the Service does not intend to refer for prosecution the incidental “*take*” of any bald eagle under the MBTA or Eagle Act, if such take is in full compliance with the terms and conditions of an incidental take statement issued to the action agency or applicant under the authority of section 7(b)(4) of the ESA or a permit issued under the authority of section 10(a)(1)(B) of the ESA.

The Guidelines are applicable throughout the United States, including Alaska. The primary purpose of these Guidelines is to provide information that will minimize or prevent violations only of *Federal* laws governing bald eagles. In addition to Federal laws, many states and some smaller jurisdictions and tribes have additional laws and regulations protecting bald eagles. In some cases those laws and regulations may be more protective (restrictive) than these Federal guidelines. If you are planning activities that may affect bald eagles, we therefore recommend that you contact both your nearest U.S. Fish and Wildlife Service Field Office (see the contact information on p.16) and your state wildlife agency for assistance.

LEGAL PROTECTIONS FOR THE BALD EAGLE

The Bald and Golden Eagle Protection Act

The Eagle Act (16 U.S.C. 668-668c), enacted in 1940, and amended several times since then, prohibits anyone, without a permit issued by the Secretary of the Interior, from “taking” bald eagles, including their parts, nests, or eggs. The Act provides criminal and civil penalties for persons who “take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export or import, at any time or any manner, any bald eagle ... [or any golden eagle], alive or dead, or any part, nest, or egg thereof.” The Act defines “take” as “pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb.” “Disturb’’ means:

> "Disturb means to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior."

In addition to immediate impacts, this definition also covers impacts that result from human-induced alterations initiated around a previously used nest site during a time when eagles are not present, if, upon the eagle=s return, such alterations agitate or bother an eagle to a degree that injures an eagle or substantially interferes with normal breeding, feeding, or sheltering habits and causes, or is likely to cause, a loss of productivity or nest abandonment.

A violation of the Act can result in a criminal fine of $100,000 ($200,000 for organizations), imprisonment for one year, or both, for a first offense. Penalties increase substantially for additional offenses, and a second violation of this Act is a felony.

The Migratory Bird Treaty Act
The MBTA (16 U.S.C. 703-712), prohibits the taking of any migratory bird or any part, nest, or egg, except as permitted by regulation. The MBTA was enacted in 1918; a 1972 agreement supplementing one of the bilateral treaties underlying the MBTA had the effect of expanding the scope of the Act to cover bald eagles and other raptors. Implementing regulations define "take" under the MBTA as "pursue, hunt, shoot, wound, kill, trap, capture, possess, or collect."

Copies of the Eagle Act and the MBTA are available at: http://permits.fws.gov/ltr/ltr.shtml.

State laws and regulations
Most states have their own regulations and/or guidelines for bald eagle management. Some states may continue to list the bald eagle as endangered, threatened, or of special concern. If you plan activities that may affect bald eagles, we urge you to familiarize yourself with the regulations and/or guidelines that apply to bald eagles in your state. Your adherence to the Guidelines herein does not ensure that you are in compliance with state laws and regulations because state regulations can be more specific and/or restrictive than these Guidelines.

NATURAL HISTORY OF THE BALD EAGLE

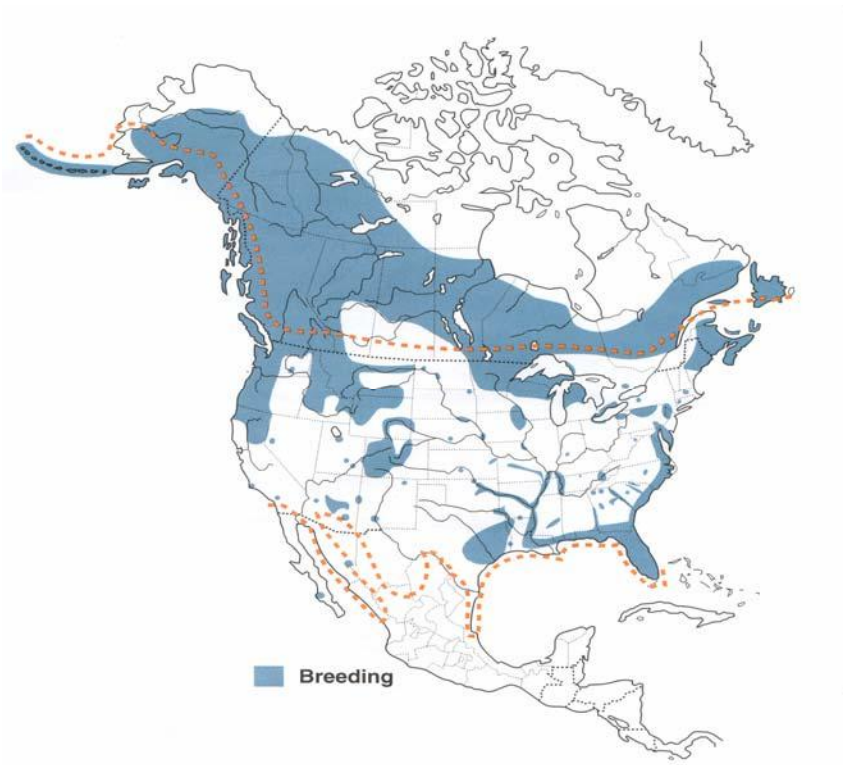
Bald eagles are a North American species that historically occurred throughout the contiguous United States and Alaska. After severely declining in the lower 48 States between the 1870s and the 1970s, bald eagles have rebounded and re-established breeding territories in each of the lower 48 states. The largest North American breeding populations are in Alaska and Canada, but there are also significant bald eagle populations in Florida, the Pacific Northwest, the Greater Yellowstone area, the Great Lakes states, and the Chesapeake Bay region. Bald eagle distribution varies seasonally. Bald eagles that nest in southern latitudes frequently move northward in late spring and early summer, often summering as far north as Canada. Most eagles that breed at northern latitudes migrate southward during winter, or to coastal areas where waters remain unfrozen. Migrants frequently concentrate in large numbers at sites where food is abundant and they often roost together communally. In some cases, concentration areas are used year-round: in summer by southern eagles and in winter by northern eagles.

Juvenile bald eagles have mottled brown and white plumage, gradually acquiring their dark brown body and distinctive white head and tail as they mature. Bald eagles generally attain adult plumage by 5 years of age. Most are capable of breeding at 4 or 5 years of age, but in healthy populations they may not start breeding until much older. Bald eagles may live 15 to 25 years in the wild. Adults weigh 8 to 14 pounds (occasionally reaching 16 pounds in Alaska) and have wingspans of 5 to 8 feet. Those in the northern range are larger than those in the south, and females are larger than males.

Where do bald eagles nest?

Breeding bald eagles occupy "territories," areas they will typically defend against intrusion by other eagles. In addition to the active nest, a territory may include one or more alternate nests (nests built or maintained by the eagles but not used for nesting in a given year). The Eagle Act prohibits removal or destruction of both active and alternate bald eagle nests. Bald eagles exhibit high nest site fidelity and nesting territories are often used year after year. Some territories are known to have been used continually for over half a century.

Bald eagles generally nest near coastlines, rivers, large lakes or streams that support an adequate food supply. They often nest in mature or old-growth trees; snags (dead trees); cliffs; rock promontories; rarely on the ground; and with increasing frequency on human-made structures such as power poles and communication towers. In forested areas, bald eagles often select the tallest trees with limbs strong enough to support a nest that can weigh more than 1,000 pounds. Nest sites typically include at least one perch with a clear view of the water where the eagles usually forage. Shoreline trees or snags located in reservoirs provide the visibility and accessibility needed to locate aquatic prey. Eagle nests are constructed with large sticks, and may be lined with moss, grass, plant stalks, lichens, seaweed, or sod. Nests are usually about 4-6 feet in diameter and 3 feet deep, although larger nests exist.



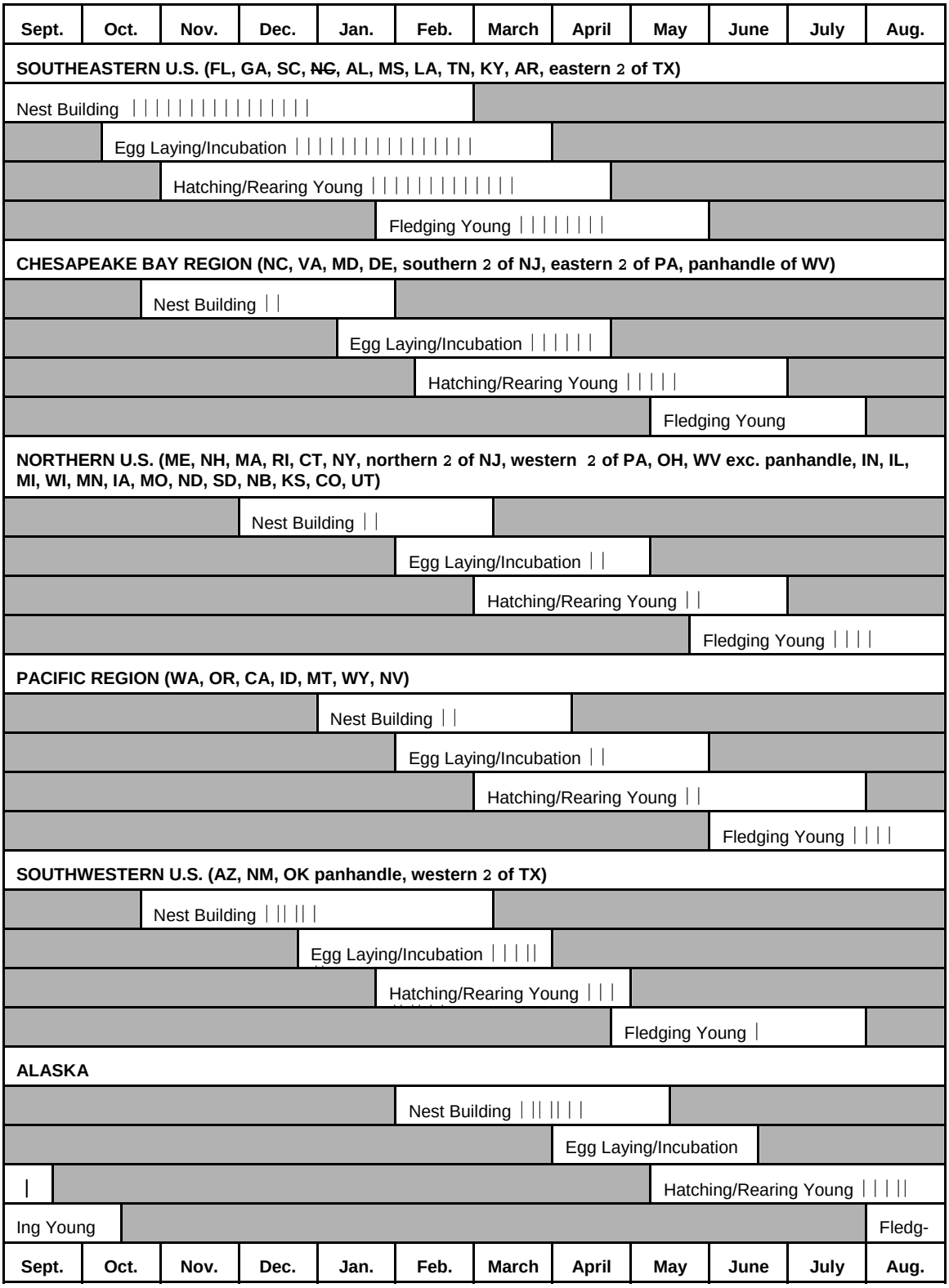
The range of breeding bald eagles in 2000 (shaded areas). This map shows only the larger concentrations of nests; eagles have continued to expand into additional nesting territories in many states. The dotted line represents the bald eagle's wintering range.

When do bald eagles nest?

Nesting activity begins several months before egg-laying. Egg-laying dates vary throughout the U.S., ranging from October in Florida, to late April or even early May in the northern United States. Incubation typically lasts 33-35 days, but can be as long as 40 days. Eaglets make their first unsteady flights about 10 to 12 weeks after hatching, and fledge (leave their nests) within a few days after that first flight. However, young birds usually remain in the vicinity of the nest for several weeks after fledging because they are almost completely dependent on their parents for food until they disperse from the nesting territory approximately 6 weeks later.

The bald eagle breeding season tends to be longer in the southern U.S., and re-nesting following an unsuccessful first nesting attempt is more common there as well. The following table shows the timing of bald eagle breeding seasons in different regions of the country. The table represents the range of time within which the majority of nesting activities occur in each region and does not apply to any specific nesting pair. Because the timing of nesting activities may vary within a given region, you should contact the nearest U.S. Fish and Wildlife Service Field Office (see page 16) and/or your state wildlife conservation agency for more specific information on nesting chronology in your area.

Chronology of typical reproductive activities of bald eagles in the United States.



How many chicks do bald eagles raise?
The number of eagle eggs laid will vary from 1-3, with 1-2 eggs being the most common. Only one eagle egg is laid per day, although not always on successive days. Hatching of young occurs on different days with the result that chicks in the same nest are sometimes of unequal size. The overall national fledging rate is approximately one chick per nest, annually, which results in a healthy expanding population.

What do bald eagles eat?
Bald eagles are opportunistic feeders. Fish comprise much of their diet, but they also eat waterfowl, shorebirds/colonial waterbirds, small mammals, turtles, and carrion. Because they are visual hunters, eagles typically locate their prey from a conspicuous perch, or soaring flight, then swoop down and strike. Wintering bald eagles often congregate in large numbers along streams to feed on spawning salmon or other fish species, and often gather in large numbers in areas below reservoirs, especially hydropower dams, where fish are abundant. Wintering eagles also take birds from rafts of ducks at reservoirs and rivers, and congregate on melting ice shelves to scavenge dead fish from the current or the soft melting ice. Bald eagles will also feed on carcasses along roads, in landfills, and at feedlots.

During the breeding season, adults carry prey to the nest to feed the young. Adults feed their chicks by tearing off pieces of food and holding them to the beaks of the eaglets. After fledging, immature eagles are slow to develop hunting skills, and must learn to locate reliable food sources and master feeding techniques. Young eagles will congregate together, often feeding upon easily acquired food such as carrion and fish found in abundance at the mouths of streams and shallow bays and at landfills.

The impact of human activity on nesting bald eagles
During the breeding season, bald eagles are sensitive to a variety of human activities. However, not all bald eagle pairs react to human activities in the same way. Some pairs nest successfully just dozens of yards from human activity, while others abandon nest sites in response to activities much farther away. This variability may be related to a number of factors, including visibility, duration, noise levels, extent of the area affected by the activity, prior experiences with humans, and tolerance of the individual nesting pair. The relative sensitivity of bald eagles during various stages of the breeding season is outlined in the following table.

Nesting Bald Eagle Sensitivity to Human Activities

Phase	Activity	Sensitivity to Human Activity	Comments
I	Courtship and Nest Building	Most sensitive period; likely to respond negatively	Most critical time period. Disturbance is manifested in nest abandonment. Bald eagles in newly established territories are more prone to abandon nest sites.
II	Egg laying	Very sensitive period	Human activity of even limited duration may cause nest desertion and abandonment of territory for the breeding season.
III	Incubation and early nestling period (up to 4 weeks)	Very sensitive period	Adults are less likely to abandon the nest near and after hatching. However, flushed adults leave eggs and young unattended; eggs are susceptible to cooling, loss of moisture, overheating, and predation; young are vulnerable to elements.
IV	Nestling period, 4 to 8 weeks	Moderately sensitive period	Likelihood of nest abandonment and vulnerability of the nestlings to elements somewhat decreases. However, nestlings may miss feedings, affecting their survival.
V	Nestlings 8 weeks through fledging	Very sensitive period	Gaining flight capability, nestlings 8 weeks and older may flush from the nest prematurely due to disruption and die.

If agitated by human activities, eagles may inadequately construct or repair their nest, may expend energy defending the nest rather than tending to their young, or may abandon the nest altogether. Activities that cause prolonged absences of adults from their nests can jeopardize eggs or young. Depending on weather conditions, eggs may overheat or cool too much and fail to hatch. Unattended eggs and nestlings are subject to predation. Young nestlings are particularly vulnerable because they rely on their parents to provide warmth or shade, without which they may die as a result of hypothermia or heat stress. If food delivery schedules are interrupted, the young may not develop healthy plumage, which can affect their survival. In addition, adults startled while incubating or brooding young may damage eggs or injure their young as they abruptly leave the nest. Older nestlings no longer require constant attention from the adults, but they may be startled by loud or intrusive human activities and prematurely jump from the nest before they are able to fly or care for themselves. Once fledged, juveniles range up to ¼ mile from the nest site, often to a site with minimal human activity. During this period, until about six weeks after departure from the nest, the juveniles still depend on the adults to feed them.

The impact of human activity on foraging and roosting bald eagles

Disruption, destruction, or obstruction of roosting and foraging areas can also negatively affect bald eagles. Disruptive activities in or near eagle foraging areas can interfere with feeding, reducing chances of survival. Interference with feeding can also result in reduced productivity (number of young successfully fledged). Migrating and wintering bald eagles often congregate at specific sites for purposes of feeding and sheltering. Bald eagles rely on established roost sites because of their proximity to sufficient food sources. Roost sites are usually in mature trees where the eagles are somewhat sheltered from the wind and weather. Human activities near or within communal roost sites may prevent eagles

from feeding or taking shelter, especially if there are not other undisturbed and productive feeding and roosting sites available. Activities that permanently alter communal roost sites and important foraging areas can altogether eliminate the elements that are essential for feeding and sheltering eagles.

Where a human activity agitates or bothers roosting or foraging bald eagles to the degree that causes injury or substantially interferes with breeding, feeding, or sheltering behavior and causes, or is likely to cause, a loss of productivity or nest abandonment, the conduct of the activity constitutes a violation of the Eagle Act's prohibition against disturbing eagles. The circumstances that might result in such an outcome are difficult to predict without detailed site-specific information. If your activities may disturb roosting or foraging bald eagles, you should contact your local Fish and Wildlife Service Field Office (see page 16) for advice and recommendations for how to avoid such disturbance.

RECOMMENDATIONS FOR AVOIDING DISTURBANCE AT NEST SITES

In developing these Guidelines, we relied on existing state and regional bald eagle guidelines, scientific literature on bald eagle disturbance, and recommendations of state and Federal biologists who monitor the impacts of human activity on eagles. Despite these resources, uncertainties remain regarding the effects of many activities on eagles and how eagles in different situations may or may not respond to certain human activities. The Service recognizes this uncertainty and views the collection of better biological data on the response of eagles to disturbance as a high priority. To the extent that resources allow, the Service will continue to collect data on responses of bald eagles to human activities conducted according to the recommendations within these Guidelines to ensure that adequate protection from disturbance is being afforded, and to identify circumstances where the Guidelines might be modified. These data will be used to make future adjustments to the Guidelines.

To avoid disturbing nesting bald eagles, we recommend (1) keeping a distance between the activity and the nest (distance buffers), (2) maintaining preferably forested (or natural) areas between the activity and around nest trees (landscape buffers), and (3) avoiding certain activities during the breeding season. The buffer areas serve to minimize visual and auditory impacts associated with human activities near nest sites. Ideally, buffers would be large enough to protect existing nest trees and provide for alternative or replacement nest trees.

The size and shape of effective buffers vary depending on the topography and other ecological characteristics surrounding the nest site. In open areas where there are little or no forested or topographical buffers, such as in many western states, distance alone must serve as the buffer. Consequently, in open areas, the distance between the activity and the nest may need to be larger than the distances recommended under Categories A and B of these guidelines (pg. 12) if no landscape buffers are present. The height of the nest above the ground may also ameliorate effects of human activities; eagles at higher nests may be less prone to disturbance.

In addition to the physical features of the landscape and nest site, the appropriate size for the distance buffer may vary according to the historical tolerances of eagles to human activities in particular localities, and may also depend on the location of the nest in relation

to feeding and roosting areas used by the eagles. Increased competition for nest sites may lead bald eagles to nest closer to human activity (and other eagles).

Seasonal restrictions can prevent the potential impacts of many shorter-term, obtrusive activities that do not entail landscape alterations (e.g. fireworks, outdoor concerts). In proximity to the nest, these kinds of activities should be conducted only outside the breeding season. For activities that entail both short-term, obtrusive characteristics and more permanent impacts (e.g., building construction), we recommend a combination of both approaches: retaining a landscape buffer *and* observing seasonal restrictions.

For assistance in determining the appropriate size and configuration of buffers or the timing of activities in the vicinity of a bald eagle nest, we encourage you to contact the nearest U.S. Fish and Wildlife Service Field Office (see page 16).

Existing Uses

Eagles are unlikely to be disturbed by routine use of roads, homes, and other facilities where such use pre-dates the eagles' successful nesting activity in a given area. Therefore, in most cases *ongoing* existing uses may proceed with the same intensity with little risk of disturbing bald eagles. However, some *intermittent, occasional, or irregular* uses that pre-date eagle nesting in an area may disturb bald eagles. For example: a pair of eagles may begin nesting in an area and subsequently be disturbed by activities associated with an annual outdoor flea market, even though the flea market has been held annually at the same location. In such situations, human activity should be adjusted or relocated to minimize potential impacts on the nesting pair.

ACTIVITY-SPECIFIC GUIDELINES

The following section provides the Service=s management recommendations for avoiding bald eagle disturbance as a result of new or intermittent activities proposed in the vicinity of bald eagle nests. Activities are separated into 8 categories (A – H) based on the nature and magnitude of impacts to bald eagles that usually result from the type of activity. Activities with similar or comparable impacts are grouped together.

In most cases, impacts will vary based on the visibility of the activity from the eagle nest and the degree to which similar activities are already occurring in proximity to the nest site. Visibility is a factor because, in general, eagles are more prone to disturbance when an activity occurs in full view. For this reason, we recommend that people locate activities farther from the nest structure in areas with open vistas, in contrast to areas where the view is shielded by rolling topography, trees, or other screening factors. The recommendations also take into account the existence of similar activities in the area because the continued presence of nesting bald eagles in the vicinity of the existing activities indicates that the eagles in that area can tolerate a greater degree of human activity than we can generally expect from eagles in areas that experience fewer human impacts. To illustrate how these factors affect the likelihood of disturbing eagles, we have incorporated the recommendations for some activities into a table (categories A and B).

First, determine which category your activity falls into (between categories A – H). If the activity you plan to undertake is not specifically addressed in these guidelines, follow the recommendations for the most similar activity represented.

If your activity is under A or B, our recommendations are in table form. The vertical axis shows the degree of visibility of the activity from the nest. The horizontal axis (header row) represents the degree to which similar activities are ongoing in the vicinity of the nest. Locate the row that best describes how visible your activity will be from the eagle nest. Then, choose the column that best describes the degree to which similar activities are ongoing in the vicinity of the eagle nest. The box where the column and row come together contains our management recommendations for how far you should locate your activity from the nest to avoid disturbing the eagles. The numerical distances shown in the tables are the closest the activity should be conducted relative to the nest. In some cases we have included additional recommendations (other than recommended *distance* from the nest) you should follow to help ensure that your activity will not disturb the eagles.

Alternate nests

For activities that entail permanent landscape alterations that may result in bald eagle disturbance, these recommendations apply to both active and alternate bald eagle nests. Disturbance becomes an issue with regard to alternate nests if eagles return for breeding purposes and react to land use changes that occurred while the nest was inactive. The likelihood that an alternate nest will again become active decreases the longer it goes unused. If you plan activities in the vicinity of an alternate bald eagle nest and have information to show that the nest has not been active during the preceding 5 breeding seasons, the recommendations provided in these guidelines for avoiding disturbance around the nest site may no longer be warranted. The nest itself remains protected by other provisions of the Eagle Act, however, and may not be destroyed.

If special circumstances exist that make it unlikely an inactive nest will be reused before 5 years of disuse have passed, and you believe that the probability of reuse is low enough to warrant disregarding the recommendations for avoiding disturbance, you should be prepared to provide all the reasons for your conclusion, including information regarding past use of the nest site. Without sufficient documentation, you should continue to follow these guidelines when conducting activities around the nest site. If we are able to determine that it is unlikely the nest will be reused, we may advise you that the recommendations provided in these guidelines for avoiding disturbance are no longer necessary around that nest site.

This guidance is intended to minimize disturbance, as defined by Federal regulation. In addition to Federal laws, most states and some tribes and smaller jurisdictions have additional laws and regulations protecting bald eagles. In some cases those laws and regulations may be more protective (restrictive) than these Federal guidelines.

Temporary Impacts

For activities that have temporary impacts, such as the use of loud machinery, fireworks displays, or summer boating activities, we recommend seasonal restrictions. These types of activities can generally be carried out outside of the breeding season without causing disturbance. The recommended restrictions for these types of activities can be lifted for alternate nests within a particular territory, including nests that were attended during the current breeding season but not used to raise young, after eggs laid in another nest within the territory have hatched (depending on the distance between the alternate nest and the active nest).

In general, activities should be kept as far away from nest trees as possible; loud and disruptive activities should be conducted when eagles are not nesting; and activity between the nest and the nearest foraging area should be minimized. If the activity you plan to undertake is not specifically addressed in these guidelines, follow the recommendations for the most similar activity addressed, or contact your local U.S. Fish and Wildlife Service Field Office for additional guidance.

If you believe that special circumstances apply to your situation that increase or diminish the likelihood of bald eagle disturbance, or if it is not possible to adhere to the guidelines, you should contact your local Service Field Office for further guidance.

Category A:
Building construction, 1 or 2 story, with project footprint of ½ acre or less.
Construction of roads, trails, canals, power lines, and other linear utilities.
Agriculture and aquaculture – new or expanded operations.
Alteration of shorelines or wetlands.
Installation of docks or moorings.
Water impoundment.

Category B:
Building construction, 3 or more stories.
Building construction, 1 or 2 story, with project footprint of more than ½ acre.
Installation or expansion of marinas with a capacity of 6 or more boats.
Mining and associated activities.
Oil and natural gas drilling and refining and associated activities.

	If there is no similar activity within 1 mile of the nest	***If there is similar activity closer than 1 mile from the nest***
If the activity will be visible from the nest	660 feet. Landscape buffers are recommended.	660 feet, or as close as existing tolerated activity of similar scope. Landscape buffers are recommended.
If the activity will not be visible from the nest	Category A: 330 feet. Clearing, external construction, and landscaping between 330 feet and 660 feet should be done outside breeding season. Category B: 660 feet.	330 feet, or as close as existing tolerated activity of similar scope. Clearing, external construction and landscaping within 660 feet should be done outside breeding season.

The numerical distances shown in the table are the closest the activity should be conducted relative to the nest.

Category C. Timber Operations and Forestry Practices

- Avoid clear cutting or removal of overstory trees within 330 feet of the nest at any time.

- Avoid timber harvesting operations, including road construction and chain saw and yarding operations, during the breeding season within 660 feet of the nest. The distance may be decreased to 330 feet around alternate nests within a particular territory, including nests that were attended during the current breeding season but not used to raise young, after eggs laid in another nest within the territory have hatched.

- Selective thinning and other silviculture management practices designed to conserve or enhance habitat, including prescribed burning close to the nest tree, should be undertaken outside the breeding season. Precautions such as raking leaves and woody debris from around the nest tree should be taken to prevent crown fire or fire climbing the nest tree. If it is determined that a burn during the breeding season would be beneficial, then, to ensure that no take or disturbance will occur, these activities should be conducted only when neither adult eagles nor young are present at the nest tree (i.e., at the beginning of, or end of, the breeding season, either before the particular nest is active or after the young have fledged from that nest). Appropriate Federal and state biologists should be consulted before any prescribed burning is conducted during the breeding season.

- Avoid construction of log transfer facilities and in-water log storage areas within 330 feet of the nest.

Category D. Off-road vehicle use (including snowmobiles). No buffer is necessary around nest sites outside the breeding season. During the breeding season, do not operate off-road vehicles within 330 feet of the nest. In open areas, where there is increased visibility and exposure to noise, this distance should be extended to 660 feet.

Category E. Motorized Watercraft use (including jet skis/personal watercraft). No buffer is necessary around nest sites outside the breeding season. During the breeding season, within 330 feet of the nest, (1) do not operate jet skis (personal watercraft), and (2) avoid concentrations of noisy vessels (e.g., commercial fishing boats and tour boats), except where eagles have demonstrated tolerance for such activity. Other motorized boat traffic passing within 330 feet of the nest should attempt to minimize trips and avoid stopping in the area where feasible, particularly where eagles are unaccustomed to boat traffic. Buffers for airboats should be larger than 330 feet due to the increased noise they generate, combined with their speed, maneuverability, and visibility.

Category F. Non-motorized recreation and human entry (e.g., hiking, camping, fishing, hunting, birdwatching, kayaking, canoeing). No buffer is necessary around nest sites outside the breeding season. If the activity will be visible or highly audible from the nest, maintain a 330-foot buffer during the breeding season, particularly where eagles are unaccustomed to such activity.

Category G. Helicopters and fixed-wing aircraft.
Except for authorized biologists trained in survey techniques, avoid operating aircraft within 1,000 feet of the nest during the breeding season, except where eagles have demonstrated tolerance for such activity.

Category H. Blasting and other loud, intermittent noises.
Avoid blasting and other activities that produce extremely loud noises within 1/2 mile of active nests, unless greater tolerance to the activity (or similar activity) has been demonstrated by the eagles in the nesting area. This recommendation applies to the use of fireworks classified by the Federal Department of Transportation as Class B explosives, which includes the larger fireworks that are intended for licensed public display.

RECOMMENDATIONS FOR AVOIDING DISTURBANCE AT FORAGING AREAS AND COMMUNAL ROOST SITES

1. Minimize potentially disruptive activities and development in the eagles' direct flight path between their nest and roost sites and important foraging areas.

2. Locate long-term and permanent water-dependent facilities, such as boat ramps and marinas, away from important eagle foraging areas.

3. Avoid recreational and commercial boating and fishing near critical eagle foraging areas during peak feeding times (usually early to mid-morning and late afternoon), except where eagles have demonstrated tolerance to such activity.

4. Do not use explosives within ½ mile (or within 1 mile in open areas) of communal roosts when eagles are congregating, without prior coordination with the U.S. Fish and Wildlife Service and your state wildlife agency.

5. Locate aircraft corridors no closer than 1,000 feet vertical or horizontal distance from communal roost sites.

ADDITIONAL RECOMMENDATIONS TO BENEFIT BALD EAGLES

The following are additional management practices that landowners and planners can exercise for added benefit to bald eagles.

1. Protect and preserve potential roost and nest sites by retaining mature trees and old growth stands, particularly within ½ mile from water.

2. Where nests are blown from trees during storms or are otherwise destroyed by the elements, continue to protect the site in the absence of the nest for up to three (3) complete breeding seasons. Many eagles will rebuild the nest and reoccupy the site.

3. To avoid collisions, site wind turbines, communication towers, and high voltage transmission power lines away from nests, foraging areas, and communal roost sites.

4. Employ industry-accepted best management practices to prevent birds from colliding with or being electrocuted by utility lines, towers, and poles. If possible, bury utility lines in important eagle areas.

5. Where bald eagles are likely to nest in human-made structures (e.g., cell phone towers) and such use could impede operation or maintenance of the structures or jeopardize the safety of the eagles, equip the structures with either (1) devices engineered to discourage bald eagles from building nests, or (2) nesting platforms that will safely accommodate bald eagle nests without interfering with structure performance.

6. Immediately cover carcasses of euthanized animals at landfills to protect eagles from being poisoned.

7. Do not intentionally feed bald eagles. Artificially feeding bald eagles can disrupt their essential behavioral patterns and put them at increased risk from power lines, collision with windows and cars, and other mortality factors.

8. Use pesticides, herbicides, fertilizers, and other chemicals only in accordance with Federal and state laws.

9. Monitor and minimize dispersal of contaminants associated with hazardous waste sites (legal or illegal), permitted releases, and runoff from agricultural areas, especially within watersheds where eagles have shown poor reproduction or where bioaccumulating contaminants have been documented. These factors present a risk of contamination to eagles and their food sources.

CONTACTS

The following U.S. Fish and Wildlife Service Field Offices provide technical assistance on bald eagle management:

Alabama	Daphne	(251) 441-5181
Alaska	Anchorage	(907) 271-2888
	Fairbanks	(907) 456-0203
	Juneau	(907) 780-1160
Arizona	Phoenix	(602) 242-0210
Arkansas	Conway	(501) 513-4470
California	Arcata	(707) 822-7201
	Barstow	(760) 255-8852
	Carlsbad	(760) 431-9440
	Red Bluff	(530) 527-3043
	Sacramento	(916) 414-6000
	Stockton	(209) 946-6400
	Ventura	(805) 644-1766
	Yreka	(530) 842-5763
Colorado	Lakewood	(303) 275-2370
	Grand Junction	(970) 243-2778
Connecticut	(See New Hampshire)	
Delaware	(See Maryland)	
Florida	Panama City	(850) 769-0552
	Vero Beach	(772) 562-3909
	Jacksonville	(904) 232-2580
Georgia	Athens	(706) 613-9493
	Brunswick	(912) 265-9336
	Columbus	(706) 544-6428
Idaho	Boise	(208) 378-5243
	Chubbuck	(208) 237-6975
Illinois/Iowa	Rock Island	(309) 757-5800
Indiana	Bloomington	(812) 334-4261
Kansas	Manhattan	(785) 539-3474
Kentucky	Frankfort	(502) 695-0468
Louisiana	Lafayette	(337) 291-3100
Maine	Old Town	(207) 827-5938
Maryland	Annapolis	(410) 573-4573
Massachusetts	(See New Hampshire)	
Michigan	East Lansing	(517) 351-2555
Minnesota	Bloomington	(612) 725-3548
Mississippi	Jackson	(601) 965-4900
Missouri	Columbia	(573) 234-2132
Montana	Helena	(405) 449-5225
Nebraska	Grand Island	(308) 382-6468
Nevada	Las Vegas	(702) 515-5230
	Reno	(775) 861-6300
New Hampshire	Concord	(603) 223-2541
New Jersey	Pleasantville	(609) 646-9310
New Mexico	Albuquerque	(505) 346-2525
New York	Cortland	(607) 753-9334
	Long Island	(631) 776-1401
North Carolina	Raleigh	(919) 856-4520
	Asheville	(828) 258-3939
North Dakota	Bismarck	(701) 250-4481
Ohio	Reynoldsburg	(614) 469-6923
Oklahoma	Tulsa	(918) 581-7458
Oregon	Bend	(541) 383-7146
	Klamath Falls	(541) 885-8481
	La Grande	(541) 962-8584
	Newport	(541) 867-4558
	Portland	(503) 231-6179
	Roseburg	(541) 957-3474
Pennsylvania	State College	(814) 234-4090
Rhode Island	(See New Hampshire)	
South Carolina	Charleston	(843) 727-4707
South Dakota	Pierre	(605) 224-8693
Tennessee	Cookeville	(931) 528-6481
Texas	Clear Lake	(281) 286-8282
Utah	West Valley City	(801) 975-3330
Vermont	(See New Hampshire)	
Virginia	Gloucester	(804) 693-6694
Washington	Lacey	(306) 753-9440
	Spokane	(509) 891-6839
	Wenatchee	(509) 665-3508
West Virginia	Elkins	(304) 636-6586
Wisconsin	New Franken	(920) 866-1725
Wyoming	Cheyenne	(307) 772-2374
	Cody	(307) 578-5939

National Office
U.S. Fish and Wildlife Service
Division of Migratory Bird Management
4401 North Fairfax Drive, MBSP-4107
Arlington, VA 22203-1610
(703) 358-1714
http://www.fws.gov/migratorybirds

State Agencies

To contact a state wildlife agency, visit the Association of Fish & Wildlife Agencies' website at http://www.fishwildlife.org/where_us.html

GLOSSARY

The definitions below apply to these National Bald Eagle Management Guidelines:

Communal roost sites – Areas where bald eagles gather and perch overnight – and sometimes during the day in the event of inclement weather. Communal roost sites are usually in large trees (live or dead) that are relatively sheltered from wind and are generally in close proximity to foraging areas. These roosts may also serve a social purpose for pair bond formation and communication among eagles. Many roost sites are used year after year.

Disturb – To agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior.

In addition to immediate impacts, this definition also covers impacts that result from human-caused alterations initiated around a previously used nest site during a time when eagles are not present, if, upon the eagle=s return, such alterations agitate or bother an eagle to a degree that injures an eagle or substantially interferes with normal breeding, feeding, or sheltering habits and causes, or is likely to cause, a loss of productivity or nest abandonment.

Fledge – To leave the nest and begin flying. For bald eagles, this normally occurs at 10-12 weeks of age.

Fledgling – A juvenile bald eagle that has taken the first flight from the nest but is not yet independent.

Foraging area – An area where eagles feed, typically near open water such as rivers, lakes, reservoirs, and bays where fish and waterfowl are abundant, or in areas with little or no water (i.e., rangelands, barren land, tundra, suburban areas, etc.) where other prey species (e.g., rabbit, rodents) or carrion (such as at landfills) are abundant.

Landscape buffer – A natural or human-made landscape feature that screens eagles from human activity (e.g., strip of trees, hill, cliff, berm, sound wall).

Nest – A structure built, maintained, or used by bald eagles for the purpose of reproduction. An **active** nest is a nest that is attended (built, maintained or used) by a pair of bald eagles during a given breeding season, whether or not eggs are laid. An **alternate** nest is a nest that is not used for breeding by eagles during a given breeding season.

Nest abandonment – Nest abandonment occurs when adult eagles desert or stop attending a nest and do not subsequently return and successfully raise young in that nest for the duration of a breeding season. Nest abandonment can be caused by altering habitat near a nest, even if the alteration occurs prior to the breeding season. Whether the eagles migrate during the non-breeding season, or remain in the area throughout the non-breeding season, nest abandonment can occur at any point between the time the eagles return to the nesting site for the breeding season and the time when all progeny from the breeding season have

dispersed.

Project footprint – The area of land (and water) that will be permanently altered for a development project, including access roads.

Similar scope – In the vicinity of a bald eagle nest, an existing activity is of similar scope to a new activity where the types of impacts to bald eagles are similar in nature, and the impacts of the existing activity are of the same or greater magnitude than the impacts of the potential new activity. Examples: (1) An existing single-story home 200 feet from a nest is similar in scope to an additional single-story home 200 feet from the nest; (2) An existing multi-story, multi-family dwelling 150 feet from a nest has impacts of a greater magnitude than a potential new single-family home 200 feet from the nest; (3) One existing single-family home 200 feet from the nest has impacts of a lesser magnitude than three single-family homes 200 feet from the nest; (4) an existing single-family home 200 feet from a communal roost has impacts of a lesser magnitude than a single-family home 300 feet from the roost but 40 feet from the eagles' foraging area. The existing activities in examples (1) and (2) are of similar scope, while the existing activities in example (3) and (4) are not.

Vegetative buffer – An area surrounding a bald eagle nest that is wholly or largely covered by forest, vegetation, or other natural ecological characteristics, and separates the nest from human activities.

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APPENDIX I

SERE School Wildland Fire Management Plan

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NAVFAC Atlantic Biological Resource Services

Contract: N62470-08-D-1008; Task Order: WE40

Final July 2014

Wildland Fire Management Plan, Center for Security Forces Detachment Kittery Survival, Evasion, Resistance, and Escape Facility (SERE East)

Prepared for:
The U.S. Department of the Navy
Naval Facilities Engineering Command Mid-Atlantic

Prepared by:
Tetra Tech, Inc.
1320 North Courthouse Road, Suite 600
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NAVFAC Naval Facilities Engineering Command

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Center for Security Forces Detachment Kittery Survival, Evasion, Resistance, and Escape Facility (SERE East)

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Arlington, VA 22201

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FINAL
WILDLAND FIRE MANAGEMENT PLAN

CENTER FOR SECURITY FORCES DETACHMENT KITTERY SURVIVAL, EVASION, RESISTANCE, AND ESCAPE FACILITY (SERE EAST)

Approving Officials:

Commanding Officer SERE School	Date
Emmett Carawan Naval Facilities Engineering Command Mid-Atlantic, Regional Natural Resources Manager	Date
Ian Trefry SERE School Natural Resources Manager	Date

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ACRONYMS AND ABBREVIATIONS

° C	degrees Celsius
° F	degrees Fahrenheit
%	percent
ac	acre(s)
AST	aboveground storage tank
AT	Appalachian Trail
BLM	Bureau of Land Management
SERE School	Center for Security Forces Detachment Kittery Survival, Evasion, Resistance, and Escape Facility
CFR	Code of Federal Regulations
cm	centimeter(s)
CNRMA	Commander, Navy Region Mid-Atlantic
CO	Commanding Officer
CPO	Chief Petty Officer
DoD	United States Department of Defense
ft	feet/foot
GIS	Geographic Information System
ha	hectare(s)
in	inch(es)
INRMP	Integrated Natural Resources Management Plan
Installation	Survival, Evasion, Resistance, and Escape School
km	kilometer(s)
m	meter(s)
MDIFW	Maine Department of Inland Fisheries and Wildlife
MFS	Maine Forest Service
mi	mile(s)
MPB	Multi-Purpose and Public Works Area
NAVFAC	Naval Facilities Engineering Command
Navy	U.S. Department of the Navy
n.d.	No date
NFES	National Fire Education System
NFP	National Fire Plan
NPS	National Park Service
NRCS	Natural Resources Conservation Service

NRM	Natural Resources Manager
NRP	Natural Resources Program
NWCG	National Wildfire Coordinating Group
OPNAVINST	Chief of Naval Operations Instructions
PMS	Project Management System
PWD-ME	Public Works Department Maine
SERE	Survival, Evasion, Resistance, and Escape
SPCC	Spill Prevention Control and Countermeasures
U.S.	United States
USC	United States Code
USDA	United States Department of Agriculture
USFS	United States Forest Service
USDOI	United States Department of Interior
USFWS	United States Fish and Wildlife Service
WFLC	Wildland Fire Leadership Council
WFMP	Wildland Fire Management Plan
WMA	Wildlife Management Area

1.0 INTRODUCTION

1.1 PURPOSE

The Center for Security Forces Detachment Kittery Survival, Evasion, Resistance, and Escape Facility (SERE East, hereafter referred to as the SERE School or Installation) is a Department of Defense (DoD) installation located in Franklin County in western Maine (Figure 1-1). The Installation's primary mission is to provide advanced survival training support for future aircraft carrier pilots. The SERE School program includes the following activities: scheduling and conducting SERE School classes including survival classes, providing liaison with other DoD activities concerning ongoing and proposed SERE School training, and conducting training for SERE School instructors. The SERE School property is strategically located to meet operational and training requirements of the United States (U.S.) Department of the Navy (Navy) (see Section 3.5 *Military Mission* for additional details).

The purpose of the SERE School Wildland Fire Management Plan (WFMP) is to help guide wildland fire management so that appropriate measures are taken to enhance and maintain the natural resources of the Installation, which support the goals of military training and management of natural resources, as well as protect the human health and safety of Installation staff and trainees. An assessment of encroachment issues for the Installation identified a significant fire risk associated with the lack of an active forest management program and identified this as a critical security issue (Navy 2013). Although natural forest conditions are required for training purposes, an unmanaged forest is far more likely than a managed forest to catch fire and there are usually more serious consequences and impacts once fires start and spread. Not only does the lack of a fire management plan compromise the safety of SERE School students and instructors, but the dense tree cover that supplies the necessary characteristics for training also would be diminished by a forest fire on the Installation (Navy 2013). To help address these dangers, the WFMP is a tool that provides guidelines for fire management programs, activities and methods that will be utilized by the Navy and the SERE School to attain habitat and land management objectives established for the Installation, and protocols needed to ensure the health and safety of SERE School personnel in the event of a wildland fire. Ultimately, this WFMP was developed to reduce wildland fire potential, outline program safety, protect and enhance valuable natural resources, integrate applicable federal and state fire reporting requirements, and implement ecosystem management goals and objectives at the SERE School.

In order to sustain and enhance the high quality military training environment in the present day and into the future, the SERE School must have an effective wildland fire management program that minimizes the threat and potential damage from wildland fires, thereby helping to ensure that environmental conditions can be maintained and encroachments to training minimized, while still achieving natural resource management goals. In accordance with the SERE School Integrated Natural Resources Management Plan (INRMP), the SERE School wildland fire program provides guidance and support for the control of wildfires that occur on the Installation, with assistance provided by local authorities as needed, and to assist local authorities with control of wildland fires that occur adjacent to the Installation.

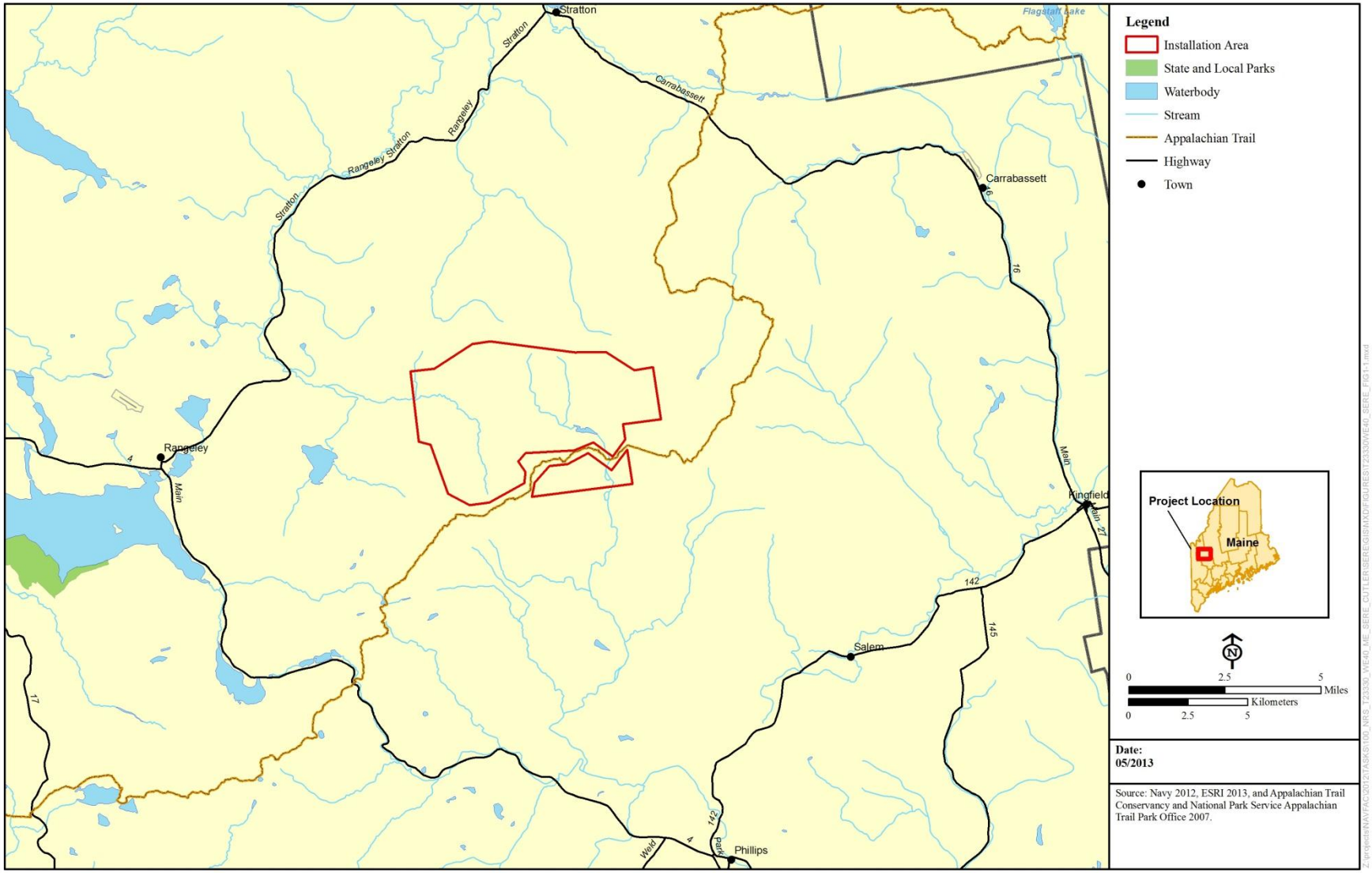


Figure 1-1. Regional Location of the SERE School, Redington, Maine.

This WFMP is organized into discreet sections, which provide the overall context for implementation of the SERE School WFMP. As appropriate, appendices have been included that contain pertinent background information. Section 1 *Introduction* describes the location of the SERE School in the context of wildland fire management. Section 2 *Policies and Partnerships* describes relevant fire policies and plans, partnerships, and mutual agreements. Section 3 *Wildland Fire Management Context* describes the regional wildland fire management context including characteristics of the regional landscape, SERE School military mission and facilities, SERE School forestry management programmatic objectives and projects as outlined in the SERE School INRMP, goals and objectives of the WFMP, a regional history of wildland fires, SERE School land management considerations, regional wildland fire management strategies, local law enforcement and fire protection services, and SERE School organization and responsibilities. Section 4 *Wildland Fire Operational Guidance* describes SERE School Wildland Fire Operational Guidance including management response, emergency action plan, fire protection and management resources, interagency coordination, restoration and rehabilitation, wildland fire prevention and education, records and reporting, and WFMP reviews and updates. Section 5 *References* provides a list of references cited in this document.

1.2 LOCATION

The SERE School is located approximately 110 miles (mi) (177 kilometers [km]) north of Portland, Maine, and 70 mi (113 km) northwest of Augusta, Maine (Figure 1-1). Situated on the Rangeley Mountain Range, the entire Installation is located within Redington Township, an unorganized township in Franklin County, Maine. The SERE School sits in the Carrabassett Valley just south of Bigelow Preserve, and approximately 16 mi (26 km) east of the Town of Rangeley, the nearest town. The SERE School encompasses two parcels totaling 12,466 acres (ac) (5,045 hectares [ha]) that are separated by the Appalachian Trail (AT) corridor (Figure 1-1). The main parcel (north of the AT) is approximately 11,320 ac (581 ha) in size, and the southern parcel is approximately 1,146 ac (464 ha). All SERE School developed areas and facilities are located in the main parcel, including the Multi-Purpose and Public Works Area (MPB), two Static Camps (Alpha and X-ray camps), the Redington Village Site, and several scattered small buildings and shelters along the roadsides (Figure 1-2).

Redington Village

Source: I. Trefry

Adjacent lands are largely owned by several large timber companies and the National Park Service (NPS).

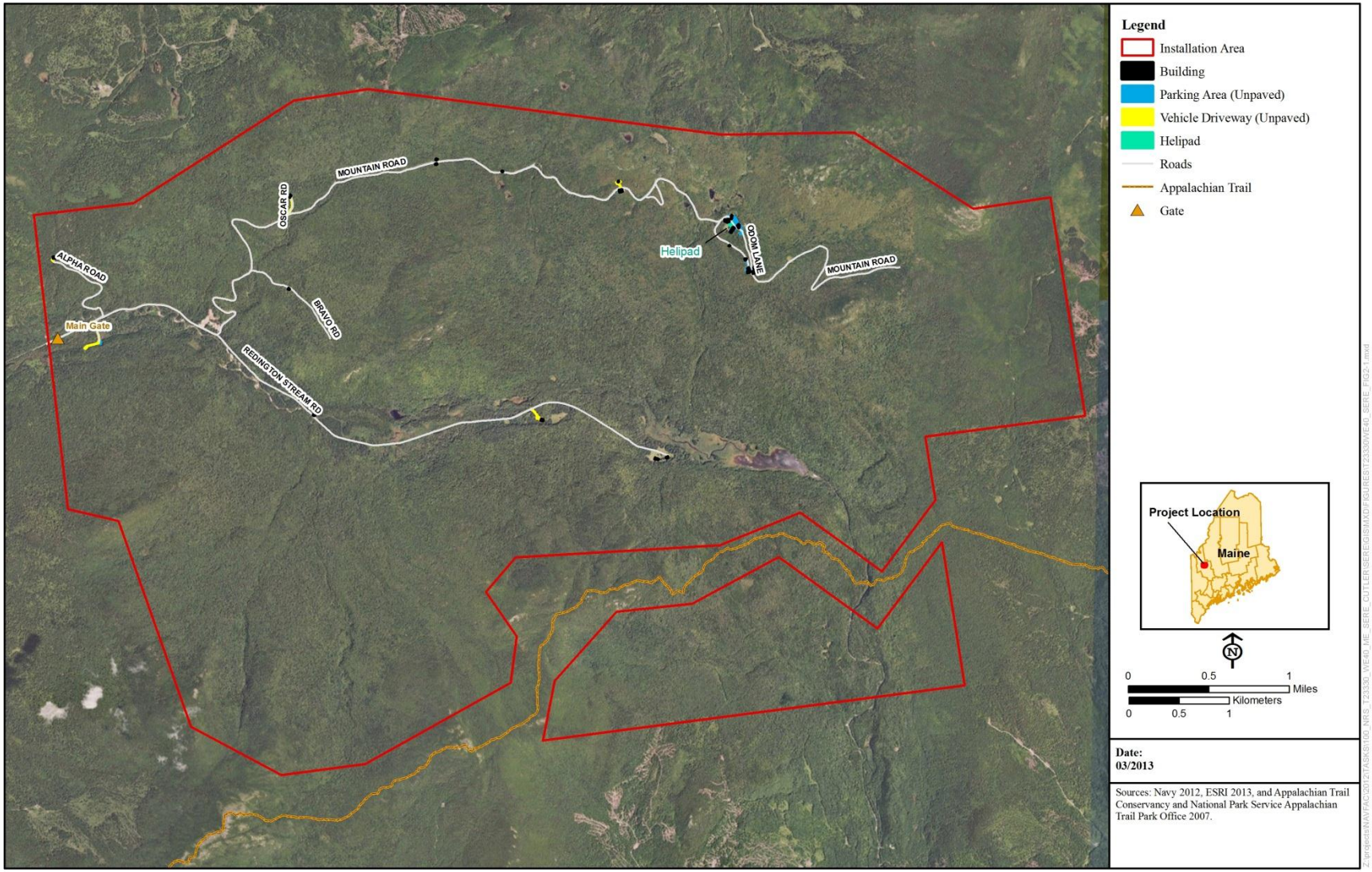


Figure 1-2. Site Details of the SERE School, Redington, Maine.

2.0 POLICIES AND PARTNERSHIPS

The SERE School WFMP was developed in accordance with applicable federal, state, and local laws and regulations, including guidance issued by the U.S. Department of Interior (USDOI), U.S. Fish and Wildlife Service (USFWS), DoD, and the Navy.

2.1 FIRE POLICIES AND PLANS

2.1.1 Federal Wildland Fire Management Policy

The *Federal Wildland Fire Management Policy* was developed in 1995 and updated in 2009. This policy is the primary interagency wildland fire policy document, developed and approved under the authority of the Wildland Fire Leadership Council (WFLC). The following guidelines from the *Federal Wildland Fire Management Policy* were used to develop the SERE School WFMP (WFLC 2009).

- Wildland fire management agencies will use common standards for all aspects of their fire management programs to facilitate effective collaboration among cooperating agencies.
- Agencies and bureaus will review, update, and develop agreements that clarify the jurisdictional inter-relationships and define the roles and responsibilities among local, state, tribal and federal fire protection entities.
- Responses to wildland fire will be coordinated across levels of government regardless of the jurisdiction at the ignition source.
- Fire management planning will be intergovernmental in scope and developed on a landscape scale.
- Wildland fire is a general term describing any non-structural fire that occurs in the wildland, and consist of two distinct types: 1) wildfires – unplanned ignitions or prescribed fires that are declared wildfires; and 2) prescribed fires – planned ignitions.
- A wildland fire may be concurrently managed for one or more objectives, which can change as the fire spreads across the landscape. Objectives are affected by changes in fuels, weather, and topography; varying social understanding and tolerance; and involvement of other governmental jurisdictions having different missions and objectives.
- Management response to a wildland fire on federal land is based on objectives established in an applicable land, resource and/or fire management plan.
- Initial reaction to human-caused wildfires will be to suppress the fire at the lowest cost, with the fewest negative consequences, with respect to firefighter and public safety.
- Managers will use a decision support process to guide and document wildfire management decisions. The process will provide situational assessment, analyze hazards and risk, define implementation actions, and document decisions and rationale for those decisions.

2.1.2 Interagency Standards for Fire and Fire Aviation Operations

The *Interagency Standards for Fire and Fire Aviation Operations* (National Interagency Fire Center 2013) was developed by the U.S. Department of Agriculture (USDA) Forest Service (USFS) and three USDOI agencies: Bureau of Land Management (BLM), NPS, and USFWS. It provides fire and fire aviation program management direction for these agencies. Employees engaged in fire management activities also must comply with all agency-specific health and safety policies. The following key points summarize the information contained in this guidance that is applicable to the SERE School WFMP:[1]

- Firefighter and public safety are the first priority in all fire management activities.
- Trained and qualified people will perform fire management activities.
- Trained and certified employees will be involved in wildland fire management programs as necessary. Agency administrators are responsible for ensuring involvement, and that employees are able to conduct their duties in the program.
- Fire management activities will be performed on an interagency basis with input from all interested parties as necessary.
- Wildland fire should be viewed as an ecological process and should be incorporated into the planning process as a tool to ensure completion of identified resource management objectives when appropriate and the Fire Management Plan includes such measures.
- Once personnel are committed to a fire incident, these human resources become the highest priority for protection. Prioritization decisions between property and natural or cultural resources should be based on relative protection values, proportionate with fire management costs.
- Regions will perform safe, cost-effective fire management programs in support of land, natural, and cultural resource management plans through appropriate planning, staffing, training, and equipment.
- Management actions taken on wildland fires will ensure firefighter and public safety, minimize costs, evaluate benefits and protection values, and be compliant with natural and cultural resource objectives (National Interagency Fire Center 2013).

2.1.3 United States Department of the Interior Plans and Policies

As discussed in Sections 2.1.1 *Federal Wildland Fire Policy* and 2.1.2 *Interagency Standards for Fire and Fire Aviation Operations*, the *Federal Wildland Fire Management Policy* and the *Interagency Standards for Fire and Fire Aviation Operations* provide guidance on fire management and fire operations for several agencies including the USDOI. Additionally, the

[1] The document also contains guidance pertaining to lands with combustible vegetation under the management of BLM, NPS, USFWS, and the USFS, as well as prescribed burns, neither of which is applicable to wildland fire management at the SERE School.

USDOI has collaborated on several wildland fire policies, including the *National Cohesive Wildland Fire Management Strategy* (2011), the *Quadrennial Fire Review* (2009), several plans associated with *A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment* (USDOI and USDA 2001), *Managing the Impact of Wildfires on Communities and the Environment* (USDOI and USDA 2000) (which formed the basis of what is now referred to as the National Fire Plan [NFP]), and the *Federal Wildland Fire Management Policy* (1995) (USDOI Office of Policy Management and Budget, Office of Wildland Fire no date [n.d.]). The NPS also developed the *Appalachian Trail Fire Management Plan* in 2005 (USDOI NPS 2005).

The 2011 *National Cohesive Wildland Fire Management Strategy* was developed by the WFLC in response to requirements of the Federal Land Assistance, Management, and Enhancement Act of 2009. The strategy addresses wildfire problems facing the U.S. and focuses on three key areas: restoration and maintenance of resilient landscapes, fire adapted communities, and responding to wildland fires (USDOI Office of Policy Management and Budget, Office of Wildland Fire n.d.). The strategy utilizes a collaborative, science-based approach in seeking solutions to wildland fire management issues on all lands, and includes active involvement of all levels of government and non-governmental organizations, as well as the public.

The 2009 *Quadrennial Fire Review* is a strategic assessment process that is conducted every four years to evaluate current mission strategies and capabilities against best estimates of fire management of the future environment. This integrated review is a joint effort of the five federal natural resource management agencies (BLM, NPS, USFWS, Bureau of Indian Affairs, and USFS) and their state, local, and tribal partners that constitute the wildland fire community. The objective is to create an integrated strategic vision document for fire management (USDOI Office of Policy Management and Budget, Office of Wildland Fire n.d.).

Following the development of *A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment, 10-Year Comprehensive Strategy* (USDOI and USDA 2001), two implementation plans were developed and approved in 2002 and 2006. These plans identified the desired outcomes, performance measures, and responsibilities for the four goals of the plan that were established: improving fire prevention and suppression, reducing hazardous fuels, restoring ecosystems, and promoting community assistance. The *10-Year Comprehensive Strategy* established in 2001 includes collaboration among federal, state, tribal, and local governments as well as non-governmental organizations. The coordinated 10-year strategy aims to manage wildfire, remove hazardous fuels, restore and rehabilitate fire damaged lands, and promote community assistance. The core principles of the strategy are collaboration, priority setting, and accountability (USDOI Office of Policy Management and Budget, Office of Wildland Fire n.d.).

The NFP was developed in August 2000 by the USDA and the USDOI as requested by President Clinton and following a severe wildland fire season (Pinchot Institute for Conservation 2002 and USDOI Office of Policy Management and Budget, Office of Wildland Fire n.d.). The NFP is the foundation document for the federal government fire program, and was developed with the intent of actively responding to severe wildland fires and their impacts to communities, while ensuring sufficient firefighting capacity for the future (Forests and Rangelands 2012). The NFP provides an outline for how the U.S. will develop an integrated response to severe wildfires to ensure sufficient firefighting resources are available for the future, ecosystems damaged by fires are

restored, communities and economies are rebuilt, and the risk of fire reduced through treatment of hazardous fuels.

The NFP requires a range of wildland fire management activities on and near federal lands, and includes the following five "key points:"

1. Maintain a cost-effective level of preparedness in firefighting and prevention;
2. Invest in projects to reduce fire risk with focused effort in wildland urban interface areas;
3. Work with communities to reduce the risks of catastrophic fire;
4. Rehabilitate fire-damaged wildland and restore high-risk ecosystems; and
5. Establish and maintain a high level of accountability including oversight reviews, progress tracking, cost analysis, and performance monitoring.

The local AT Park Ranger is responsible for fire management on AT lands. The 2005 *Appalachian Trail Fire Management Plan* supports the current management practice of suppressing all fires on AT lands. This fire suppression approach is based on a number of factors, including the narrowness of the AT corridor and the proximity of private lands. Site-specific exceptions may be made on a case-by-case basis if needed to preserve significant resource values. The *Appalachian Trail Fire Management Plan* is implemented in accordance with the regulations and directions governing the protection of historic and cultural properties as outlined in USDOI Manual, Part 519 and Code of Federal Regulations (CFR) (36 CFR 800). Section 106 of the National Historic Preservation Act of 1966, as amended, sets the requirements for federal agencies protection of historic properties. Implementation of the *Appalachian Trail Fire Management Plan* also meets the requirements of the Federal Wildland Fire Management Policy and Program Review; USDOI Director's Order 18, Wildland Fire Management, dated November 17, 1998; and USDOI Manual 620.

2.1.4 United States Fish and Wildlife Service Policy

As discussed in Sections 2.1.1 *Federal Wildland Fire Policy* and 2.1.2 *Interagency Standards for Fire and Fire Aviation Operations*, the *Federal Wildland Fire Management Policy* (Interagency Federal Wildland Fire Policy Review Working Group 2001) and the *Interagency Standards for Fire and Fire Aviation Operations* (National Interagency Fire Center 2013) provide guidance on fire management and fire operations for several agencies including the USFWS. Further USFWS-specific fire policy is contained in the USFWS Service Manual (Part 621: Fire Management; 20 March 2012), and includes the following guidelines (USFWS 2012):

- Employee and public safety supersedes all other fire management program priorities.
- Fire risk is reduced through training, mitigating hazards, and using safety equipment and personal protective equipment combined with comprehensive risk management.
- Fire management planning is an interagency collaboration and should involve all partners who share boundaries with the property.
- Land with burnable vegetation must have a fire management plan that is annually reviewed unless the USFWS Regional Director determines and documents that a fire management plan is not necessary.

- Only trained and qualified personnel may participate in fire management duties.
- Public use and access restrictions should be imposed during times of high fire danger.
- Areas that are damaged by wildland fires must be rehabilitated if they are unlikely to recover naturally.
- Prescribed fire and other hazardous fuel treatments should be used when appropriate to manage and restore natural resources and/or to reduce the risk of wildfire.

The USFWS also has developed guidance and plan templates for *Interagency Fire Management* (USFWS 2008). This guidance and plan template are intended to assist those developing fire management plans for USFWS lands. Emphasis of the updated guidance and plan template is on identification of goals, objectives, strategies, and operation constraints as they relate to fire management. Although the Installation is not located on USFWS lands, the *Interagency Fire Management* guidance and template provided by the USFWS were used as the basis for development of this WFMP for the SERE School.

2.1.5 National Wildfire Coordinating Group

The NWCG attempts to improve coordination and integration of state, tribal, and federal wildland fire programs while recognizing individual agency missions and also serving as an information source and discussion forum for short and long-term wildland fire management issues (NWCG n.d.).

The purpose of NWCG is to:

- provide national leadership and establish, implement, maintain, and communicate policy, standards, guidelines, and qualifications for wildland fire program management; and
- provide a forum in which issues, both short and long term, involving standards and program implementation can be coordinated, discussed, and resolved.

NWCG is made up of the USFS; four USDOI agencies including BLM, NPS, Bureau of Indian Affairs, and the USFWS; and state forestry agencies through the National Association of State Foresters. The goal of NWCG is to provide more effective execution of each agency's fire management program by utilizing a formalized system to agree upon standards of training, equipment, qualifications, and other operational functions (NWCG n.d.).

Current and historic NWCG documents are maintained in a Project Management System (PMS) available online at *http://www.nwcg.gov/pms/pms.htm*, and are assigned unique identifying numbers following the PMS heading. Additionally, documents also may be assigned a National Fire Education System (NFES) number. Although the PMS and NFES numbers may be different, they correspond to the same document and both numbers are listed on recent NWCG publications. Publications can be searched by either the PMS or NFES number at the NWCG publications website listed above.

2.1.6 United States Department of Defense

Chief of Naval Operations Instructions OPNAVINST 11320.23G outlines the Navy's Fire and Emergency Service Program. The purpose of the Navy Fire and Emergency Service Program is to provide policy, guidance, structure, and standardization, and to establish responsibilities for the provision of fire and emergency services at Navy installations. This is accomplished through an integrated system comprised of prevention, fire protection engineering, public education, emergency medical services, structural firefighting, aircraft rescue and firefighting, shipboard firefighting, technical rescue, wildland firefighting, incident command, hazardous materials, and chemical, biological, radiological, nuclear, and high-yield explosive response. Although the SERE School does not employ fire and emergency services personnel, the structure of this WFMP has been aligned with the Fire and Emergency Service Program by establishing and maintaining effective and efficient fire and emergency response procedures that incorporates fire and injury prevention, public education, and all-hazards response capabilities for the SERE School.

2.2 PARTNERSHIPS AND MUTUAL AGREEMENTS

Currently there are no formal partnerships or mutual agreements in place between the Navy and local, regional or national fire protection agencies. The town of Rangeley does have a contract with the Town of Redington for fire services that encompass the SERE East parcel.

The SERE School will adopt a collaborative approach to control, suppression and reduction in the risk of wildland fires at the local, regional, and national levels. Establishing communication with local fire departments, including the Town of Rangeley Fire Chief and Maine Forest Service (MFS) Fire Wardens is key to successful fire control at the Installation. The fire department and state appointed wardens provide the closest forces capable of responding safely to a wildland fire incident, since the Installation does not maintain dedicated firefighting personnel. These local relationships will be fostered by encouraging joint meetings for training and information sharing, and participation in the fire management decision-making processes. MFS resources include qualified personnel with experience in wildland firefighting, and caches of firefighting equipment, such as portable pumps and forestry hoses. These resources could be accessed should the nature of fuels and fire behavior require additional support beyond what can be provided by the local fire department in the Town of Rangeley. Additional firefighting services could be provided by the local region of the USFS, which is the Eastern Region (Region 9), comprising 20 states, ranging from Minnesota to Maine. The USFS Eastern Region is responsible for providing firefighting services for 16 National Forests and one Prairie Grassland. The closest USFS Offices to the SERE School are located at the White Mountain National Forest in Campton, New Hampshire; and Green Mountain and Finger Lakes National Forests located in Rutland, Vermont. USFWS refuges in New England region that have fire suppression resources include Rachel Carson in Wells, Maine; Sunkhaze Meadows in Old Town, Maine; Moosehorn in Calais, Maine; and Nulhegan Basin Division of the Silvio O. Conte Fish and Wildlife Refuge in Brunswick, Vermont.

Fire protection resources available at the SERE School are described in Section 4.3 *Fire Protection Resources.*

3.0 WILDLAND FIRE MANAGEMENT CONTEXT

This section provides information related to the wildland fire management context, starting from the Western Mountains regional scale down the SERE School's programmatic, management, and natural and cultural settings. The section begins with a description of the regional landscape and the history of wildland fires and management strategies in the greater region. Wildland fires on SERE School property fall under the jurisdiction of several local and state law enforcement agencies and fire protection services, which are also detailed. This is followed by a description of the Installation's military mission and its relation to wildland fire risk, SERE School programmatic objectives and forestry management projects as described in the SERE School INRMP, wildland fire management goals and objectives, and land management considerations. This section concludes with a summary of SERE School roles and responsibilities pertaining to the management and protection of natural resources, including associated wildland fire risks.

3.1 REGIONAL LANDSCAPE

3.1.1 Biophysical Region

The SERE School is located in the Western Mountains Biophysical Region, which extends from Boundary Bald Mountain along the Maine-Quebec border to the Mahoosuc Range in southwestern Maine. The region is characterized by a mountainous landscape, which is highly dissected by small, steep-sided streams. Elevations in the region average from 1,000–2,000 feet (ft) (300–610 meters [m]); however elevations over 3,000 feet occur at the SERE School. Bedrock in this region is extremely complex, composed of pelites and sandstones, with intrusions of various aged plutons (McMahon 1990).

3.1.2 Regional Climate

The regional climate is characterized by cold winters and warm summers. Because maritime air masses have year-round access to the eastern seaboard, precipitation is evenly distributed throughout the year. Severe winter conditions are often experienced within the Northern Climatological Division of Maine. Winter temperatures are typically in the low 20s degrees Fahrenheit (°F) (-6 degrees Celsius [°C]), though extreme low temperatures are not uncommon (NOAA National Climatic Data Center 2012). Summers are generally mild with air temperatures typically in the low 50s °F (10 °C) minimum and maximum temperatures in the mid- to upper-80s °F (30 °C). Hot days, where the temperature reaches 90 °F (32 °C), are infrequent. The warmest month of the year is July with an average maximum temperature of 76 °F (24 °C), and January is typically the coldest month of the year with an average minimum temperature of 1 °F (-17 °C). Temperature variations between night and day tend to be moderate during the summer with a daily temperature difference of 21 °F (12 °C), and moderate during winter with an average daily temperature difference of 19 °F (11 °C) (NOAA National Climatic Data Center 2012).

The average annual precipitation recorded at the Rangeley Station is 43.2 inches (in) (109.7 centimeters [cm]), with rainfall fairly evenly distributed throughout the year. The wettest month of the year is June with an average rainfall of 4.6 in (11.7 cm) (NOAA National Climatic Data Center 2012). Some of the higher mountains produce a rain shadow effect with precipitation as high as 50.0 in (127.0 cm) on windward slopes and less than 35.0 in (88.9 cm) on leeward slopes

(McMahon 1990). Winter precipitation in the form of snow averages approximately 117 in (297 cm) per season, usually stretching from late October through April (NOAA National Climatic Data Center 2012). The prevailing low temperatures and densely wooded terrain typically prevent rapid melting in the spring.

Wind is primarily out of the southwest during the summer, and north and west in the winter. The sun shines approximately 45 percent of the time over much of northern Maine and fog is frequent during the spring, summer, and fall (Navy 2007).

3.1.3 Regional and Installation Soil Types

The Western Mountains Biophysical Region is characterized by various soils at distinct elevations throughout the region. At elevations greater than 2,500 ft (762 m), soils are cold, acidic, and generally well drained. Thin, freely drained, organic soils also are common at high elevations. At middle and lower elevations, soils are typically deep, somewhat poorly drained Telos, Monarda and Colonel coarse loamy soils. Ice-contact glaciofluvial deposits and stream alluvium fill many of the valleys in this region and soils derived from these deposits tend to be well to excessively drained gravels, sands, and sandy loams (McMahon 1990).

The soils on SERE School lands were classified and mapped in 1988 by the USDA Soil Conservation Service, now the USDA Natural Resources Conservation Service (NRCS). Twenty-four (24) different soil types have been identified at the Installation. The primary soil type present at the SERE School is the Marlow-Dixfield association, moderately steep, very stony, which comprises approximately 18.3 percent (%) (2,278.3 ac [922.0 ha]) of soil types present. These soil components are located on upland ridges with slopes of 15–25%. The Marlow component is derived from granite and/or coarse-loamy lodgment till from mica schist and is moderately well drained. The Dixfield component is derived from coarse-loamy lodgment till from mica schist, and is well drained. These soils do not meet the hydric soil criteria. Of the 24 soil types present, two meet the hydric soil criteria (Bucksport and Markey soils; Brayton-Peacham-Markey association, gently sloping, very stony), compromising approximately 1.8% (223.3 ac [90 ha]) of the Installation (USDA NRCS 2009).

3.1.4 Vegetation Communities and Forest Types

The SERE School is located in the Adirondack–New England Mixed Forest–Coniferous Forest–Alpine Meadow Province of the Mountains Division, within the Humid Temperate Domain Ecoregion of the United States (Bailey 1995). This transitional province grades between boreal forest and broadleaf deciduous forest, and is a mixture of deciduous and coniferous forest types. Within this region vertical zonation is present with hardwoods (sugar maple [*Acer saccharum*], yellow birch [*Betula allegheniensis*], and beech [*Fagus* sp.]) occupying the valleys. The SERE School also contains stands of red spruce (*Picea rubens*) and balsam fir (*Abies balsamea*), which are common on ridge tops, and subalpine forest, which is made up almost exclusively of balsam fir at elevations greater than 2,500 ft (762 m). On treeless peaks, alpine communities such as dwarf shrub heath, sedge or rush meadow, fellfield, snowbank, and alpine bog occur in the krummholz zone (McMahon 1990). Krummholz communities are characterized by a dense, strongly coniferous shrub growth-form, stunted due to the harsh conditions (Gawler and Cutko 2010). Ribbed fens are believed to reach their southern extent in North America in the northern

part of this region. These ecosystems are common in the sparsely populated western mountains of Maine where large industrial timberland corporations historically owned the majority of the land and regularly harvested trees in support of the pulp and paper industry. With the exception of other smaller federal and state parcels in the western mountains, the SERE School provides one of the largest contiguous blocks of forest in the region that has not been harvested since 1961.

Woody species of northern affinity that occur in the western and central mountain regions of Maine include mountain paper birch (*Betula cordifolia*), purple crowberry (*Empetrum eamesii* ssp. *atropurpureum*), black crowberry (*E. nigrum*), cloudberry (*Rubus chamaemorus*), bearberry willow (*Salix uva-ursi*), northern blueberry (*Vaccinium boreale*) (historic), bog blueberry (*V. uliginosum* ssp. *uliginosum*), lingonberry (*V. vitis-idaea),* and squashberry (*V. edule*). Woody species richness in the western and central mountain regions of Maine, which averages 105 species, is low relative to most other regions of the state. Appendix D, Enclosure 1 provides a MFS brochure that contains information on Maine forests. Forest types specific to the Installation are described in Section 3.8.3 *SERE School Forestry Resources.*

3.1.5 Natural Disturbance Regimes

The natural disturbance regime for the mountains of western Maine includes fire, insects and disease, wind, snow/ice, and water movement. These are important determinants of ecosystem structure and function that provide for a naturally occurring diversity of species, but also are factors of wildland fire risk. The most common disturbances in the area are large blow downs resulting from hurricanes or other severe wind events, as well as smaller area singletree phenomena. Insect and disease disturbances have resulted from gypsy moth (*Lymantria dispar*), spruce budworm (*Choristoneura fumiferana*), spruce beetle (*Dendroctonus rufipennis*), and severe beech bark disease. Higher elevation forests are often characterized by an even-aged wind throw disturbance phenomenon known as fir-waves. In general, wind disturbance is relatively high within the region, resulting in fir waves in the upper slopes of the mountains in western Maine (Maine Nature Conservancy 1998). Also, spruce (*Picea* spp.) decline at higher elevations is related to severe winter injury and soil cation depletion (acidic soils). Forest fires are most likely to occur during the spring season in the Rangeley area, but are rare.

Moose (*Alces alces*)
Source: I. Trefry

Mammal activity in the region also can affect wildland fire risk. In upland regions, forests dominated by intolerant trembling aspen (*Populus tremuloides*) and birch (*Betula* spp.) alternate with forests dominated by spruce and fir (*Abies* sp.). Browsing by moose (*Alces alces*) over a period of 20–40 years can convert an aspen stand into one dominated by conifers. As stands of conifers mature, they become increasingly favorable habitat for spruce budworm and other insects (Navy 2007). Eventually, outbreaks occur, portions of the system are converted back into early successional aspen, and the combined upland

system undergoes stable, long-period oscillations. As the upland regions undergo these oscillations, the valley bottoms alternate between flooded plains and moist meadows. American beavers (*Castor canadensis*) maintain the flooded state by cutting streamside aspen, birch, and other tree species for food and by damming the streams to create ponds. When the supply of aspen is insufficient, beavers abandon their dams, the dams break, and the ponds are soon replaced by meadows. This relatively rapid change, a consequence of a decreasing supply of aspen, may be thought of as a loss of stability in the ecosystem. The upland and lowland cycles tend to entrain each other because of the interaction between beavers and aspen. Fires also play a role in synchronizing cycles over large spatial areas, because conifers killed by the spruce budworm provide an abundance of fuel (Ludwig et al. 1997). Section 3.2 *Regional History of Wildland Fires* includes information on significant fires known to have occurred in the region.

3.1.6 Local Land Practices

Regional land use in the vicinity of the SERE School includes timber harvesting, recreation, and land conservation. The NPS (which manages the AT) and large timber companies (which are common throughout the region) are the two most regionally important landowners that abut the SERE School. The Dallas Company, Franklin Timberlands, Inc., and Mead Oxford Corporation are three of the large timber companies which abut the SERE School property.

The AT crosses the Saddleback Range, which includes the peaks of Saddleback, The Horn, and Saddleback Junior; and represents one of the most dramatic high-elevation hiking opportunities on the entire 2,160-mi (3,476-km) AT. The portion of the AT located adjacent to the SERE School is predominately used in the late spring, summer and early fall. It is most closely accessed from the Saddleback Ski Area located approximately 2 mi (3 km) southwest of the SERE School boundary. A trailhead that provides access to the AT is located on State Highway 16/27 south of Stratton, Maine. Trail hikers also can access the trail from several unimproved roads that traverse the region, and via a trailhead located off of Route 4, approximately 6 mi (10 km) from the Town of Rangeley.

Several Ecological Reserves are located within 40 mi (80 km) of the SERE School. These properties are maintained and managed by the Maine Department of Conservation to protect Maine's biological diversity, and provide research and long-term environmental monitoring and education opportunities. Additionally, several state parks and reserved land units are located within approximately 50 mi (80 km) of the SERE School, including Rangeley Lake State Park (869 ac [352 ha]), Grafton Notch State Park (3,000 ac [1,214 ha]), Bald Mount Blue State Park (8,000 ac [3,238 ha]), Chain of Ponds (1,100 ac [445 ha]), Dead River Public Reserved Land (4,771 ac [1,931 ha]), Mountain Public Reserved Land (1,873 ac [758 ha]), Richardson Public Reserved Land (22,000 ac [8,903 ha]), and Four Ponds Public Reserved Land (6,000 ac [2,428 ha]) in Maine (Maine Bureau of Parks and Lands 2009); and Umbagog Lake State Park (1,350 ac [546 ha]) in New Hampshire (New Hampshire Division of Parks and Recreation n.d.). These state parks and preserves offer recreational opportunities and provide important habitat for hundreds of wildlife species.

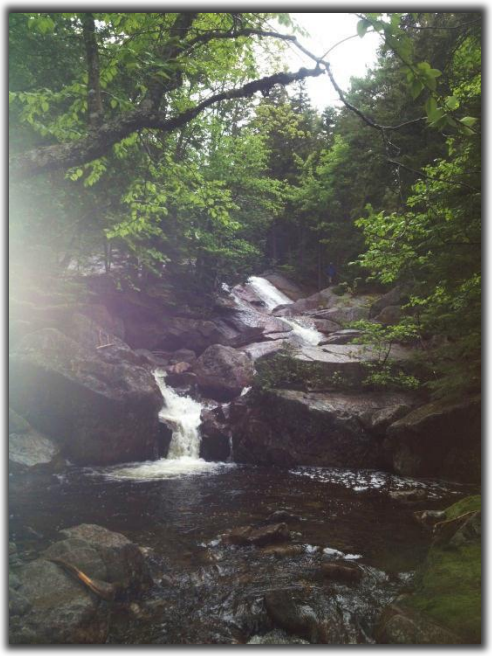
Lastly, several wildlife management areas (WMAs) also are located within 50 mi (80 km) of the SERE School, including Stump Ponds WMA (40 ac [16 ha]), Fahi Pond WMA (277 ac [112 ha]), Mercer Bog WMA (317 ac [150 ha]), Chesterville WMA (1,340 ac [542 ha]), and Black

Brook Flowage WMA (750 ac [304 ha]). WMAs are owned or leased by the Maine Department of Inland Fisheries and Wildlife (MDIFW) for the purposes of wildlife management and recreational opportunities such as canoeing, fur trapping, fishing, hunting, and wildlife watching (MDIFW 2010).

3.2 REGIONAL HISTORY OF WILDLAND FIRES

The SERE School was actively logged by the Georgia–Pacific logging company until the Navy started leasing the area in 1961. There has been one significant forest fire documented on the SERE School property, which occurred in 1962 as a result of a lightning strike, and burned a large section of the northeastern portion of the Installation (approximately 8,000–10,000 ac [3,238–4,047 ha]). Since the Navy began leasing the property in 1961, no logging or prescribed burns have occurred (Navy 2013), which increases the potential risk of forest fire damage as a result of the increased fuel loads (downed/dead trees and underbrush and debris build-up) that are present throughout much of the Installation property.

Downed and dead trees on the Installation
Source: L. Quillen



Redington Falls
Source: B. Dresser

Natural causes of wildland fires for the region include lightning strikes, as well as the potential for human-caused fires to spread to the Installation from outside the property boundaries as a result of adjacent land uses. Year to year weather patterns also may influence the risk of wildland fires, such as extended periods of warm temperatures and/or reduced rainfall, which increase the threat of forest fires; however, generally the highest risk for wildland fires to occur in this region is during the spring season. The lack of a perimeter fence or adequate signage, combined with the proximity of the Installation to the AT and a mapped location of a scenic waterfall on the property (Redington Pond Falls), increases the potential for trespassing (Navy 2013). This creates liability concerns from the possibility that an errant camp fire could spark a devastating forest fire. The lack of any formal logging activities on the Installation since 1961 also contributes to the risk of wildland fires due to increased fuel loads from build-up of downed trees and debris (see Section 3.2 *Regional History of Wildland Fires*).

3.3 REGIONAL WILDLAND FIRE MANAGEMENT STRATEGIES

The Northeast Regional Strategy Committee was formed from state, federal, and private entities to facilitate collaboration across all stakeholders to address the complexity of wildland fire issues that can span across regions. The Committee produced the *Northeast Regional Action Plan* that provides goals, desired outcomes, investment options, outcome measures, and priority implementation actions for the Northeast Cohesive Strategy Region, which covers 20 states in the Midwestern and northeastern U.S. and the District of Columbia. The guidance provided in this plan assists the partners in wildland fire management within the northeast region towards making progress in achieving the overarching national goals, which are the same as those described for the *National Cohesive Wildland Fire Management Strategy* developed by the WFLC and described in Section 2.1.3 *United States Department of the Interior Plans and Policies*. Wildland fire management in the northeast region is the result of collaboration, partnerships, and cooperation among the states in the region and the District of Columbia; fire compacts; federal fire management agencies, including the USFS, Bureau of Indian Affairs, NPS, and USFWS; tribal governments; and many local fire departments (Forest and Rangelands 2013).

2013 Northeast Regional Action Plan:

http://www.forestsandrangelands.gov/strategy/documents/rsc/northeast/NERAP_Final2013April.pdf

3.4 LAW ENFORCEMENT AND FIRE PROTECTION SERVICES

The Installation region is served by several local and state law enforcement agencies and fire protection services, as described in this section.

3.4.1 Local Law and Fire Protection Agencies

Local law enforcement is provided by the Franklin County Sheriff's Department, Maine State Police, and Rangeley Police Department. The Franklin County Emergency Management Agency also provides services in response to emergency situations. If these agencies need access to the Installation to respond to an emergency they would need to be escorted by Navy personnel via the main gate. If a Navy escort is not available and the main access gate is locked, the Navy authorizes law enforcement or fire protection agencies to cut the lock or use a capable vehicle to force entry and obtain access to the Installation.

The Installation does not employ any trained fire personnel. Fire protection services would be provided by the Town of Rangeley Fire Department, in response to structural fires, or other minor fires not under the jurisdiction of the MFS.

Additional information about local and state fire emergency agencies:

Franklin County Sheriff's Department:
http://franklincountyso.net/wp/?page_id=39

Franklin County Emergency Management Agency:
http://www.franklincountyema.org/db/?page_id=37

Maine State Police: http://www.maine.gov/dps/msp/

Maine Office of State Fire Marshall: http://www.maine.gov/dps/fmo/index.htm

Town of Rangeley: http://www.maine.gov/local/town2.php?t=Rangeley

3.4.2 Maine Forest Service and Fire Danger Rating System

The MFS would be the primary response agency for wildland fires that occur at or near the Installation. While MFS tries to contain fires from spreading to nearby areas, its primary obligation is to protect forest resources, rather than homes and buildings. MFS personnel are not allowed to enter buildings due to the lack of relevant training and equipment provided to firefighters. In the event that MFS personnel require access to the Installation for the purpose of responding to a wildland fire, they would need to be escorted onto the Installation by Navy personnel via the main gate. If a Navy escort is not available and the main access gate is locked, the Navy authorizes MFS to cut the lock or use a capable vehicle to force entry and obtain access to the Installation.

The MFS provides a daily fire report for each of the seven weather zones established in Maine, including the fire danger rating system, which identifies the risk of fire (fire danger). Fire danger ratings range from low to moderate, high, very high, and extreme. These ratings are useful in predicting and preparing for wildland fire outbreaks. The MFS fire danger ratings are based on a national fire danger rating system, and described as follows:

- **Low:** Fuels do not ignite readily from small firebrands, although a more intense heat source, such as lightning, may start many fires in duff (decaying leaves and branches covering forest floor) or punky wood (soft/rotten wood). Fires in open cured grassland may burn freely a few hours after rain, but wood fires spread slowly by creeping or smoldering, and burn in irregular fingers. There is little danger of spotting.
- **Moderate:** Fires can start from most accidental causes, but with the exception of lightning fires in some areas, the number of starts is generally low. Fires in open-cured grassland will burn briskly and spread rapidly on windy days. Wood fires spread slowly to moderately fast. The average fire is of moderate intensity, although heavy concentrations of fuel, especially draped fuel, may burn hot. Short-distance spotting may occur, but is not persistent. Fires are not likely to become serious, and control is relatively easy.
- **High:** All fine dead fuels ignite readily and fires start easily from most causes. Unattended brush and campfires are likely to escape. Fires spread rapidly and short-distance spotting is common. High-intensity burning may develop on slopes, in

concentrations of fine fuel. Fires may become serious and their control difficult, unless they are hit hard and fast while small.

- **Very High:** Fires start easily from all causes and spread rapidly and increase quickly in intensity immediately after ignition. Spot fires are a constant danger. Fires burning in light fuels may quickly develop high-intensity characteristics, such as long-distance spotting and fire whirlwinds, when they burn into heavier fuels. Direct attack at the head of such fires is rarely possible after they have been burning more than a few minutes.
- **Extreme:** Fires under extreme conditions start quickly, spread furiously, and burn intensely. All fires are potentially serious. Development into high-intensity burning will usually be faster and occur from smaller fires than in the very high danger class. Direct attack is rarely possible, and may be dangerous, except immediately after ignition. Fires that develop headway in heavy slash or in conifer stands may be unmanageable while the extreme burning condition lasts. Under these conditions, the only effective and safe control action is on the flanks until the weather changes or the fuel supply lessens (MFS 2013).

The Fire Danger Report, issued daily by the Maine Forest Service, is available here: http://www.maine.gov/dacf/mfs/wildfire_danger_report/index.html.

3.5 MILITARY MISSION

The SERE School's primary mission is to provide training in a remote natural environment that is conducive to teaching military personnel survival, rescue, evasion, and resistance skills. The SERE School provides year-round training, emphasizing the basic skills necessary for long-term survival, including evasion of capture by hostile forces; resistance to interrogation, indoctrination and exploitation; and escape when captured and held by the enemy.

Navy pilots and other flight personnel are the typical military personnel that receive training at the SERE School. Basic SERE School training is conducted approximately 23 times each year, with courses typically consisting of 12 days, including about seven days of field instruction. Each course trains up to a maximum of 62 students by an even greater number of instructors. Training activities that historically occurred at the SERE School, but which have been discontinued, include cold weather survival training, Explosive Ordnance and Demolition Mobile Unit exercises, and 10-day Advanced Evasion Exercises. The Installation also was historically used as a Tomahawk Cruise Missile testing, training, and recovery site for non-explosive simulation or testing.

The nature of the mission at the SERE School does not contribute to fire risks because there are no live fire exercises, firing ranges, pyrotechnics or explosives used at the Installation. During training exercises, live fire is simulated with compressed air. Additionally, students and instructors follow wildland fire prevention protocols including placing fires on gravel or road surfaces and implementing mandatory fire watch during all fire building exercises.

The SERE School mission activities are not expected to change over the next 10 years, with the exception of potential increases in the demand and need for this type of training opportunity, which would likely result in an increased number of classes offered throughout the year.

3.6 SERE SCHOOL INRMP PROGRAMMATIC OBJECTIVES AND FORESTRY MANAGEMENT PROJECTS

Management of forest resources to reduce the risks of wildland fires will occur as part of the integrated management of natural resources at the SERE School, as outlined in this plan and the Installation INRMP. Several programmatic objectives for management of forestry resources, and general forestry management practices have been established for the SERE School as part of the INRMP developed for the Installation. The following are the programmatic objectives identified for forestry management in the SERE School INRMP:

- Protect and promote sustainable management of forest resources;
- Manage forest habitats to promote use by trainees and a diverse range of wildlife species, including protection of trees that include edible parts, mature tree stands and snags, and protection of tree species that provide suitable nesting and foraging habitat for wildlife;
- Manage forest habitats to maintain wildlife travel corridors, streamside protection, and aesthetic buffer zones;

Installation Forestland
Source: J. Sweitzer

- Maintain forest habitats to enhance plant community diversity;
- Maintain forest habitats to ensure consistency with an ecosystem approach to forest management;
- Manage forest habitats to reduce risk of wildfire in consideration of the military mission and safety of Navy personnel in accordance with the SERE School WFMP; and
- Monitor forest resources for pests and disease.

General forestry management practices identified in the INRMP for the SERE School include:

- General forestry management including mature tree stands protection, impact avoidance for tree species that provide important forage for birds and other wildlife, forest characterization and management, monitoring for forest pests and disease;
- Environmental and natural resources training; and
- GIS management, data integration, access, and reporting.

Forestry management projects identified in the INRMP will directly support the WFMP goals and objectives identified for the SERE School. These include:

- Conduct an update of the 1998 basic characterization for SERE School forest types. The updated forestry survey should include delineation of each stand type, which is an easily defined area of the forest containing the same species mixture with similar heights, ages, diameters, densities, soils, health, or other unifying characteristics (Maine Department of Agriculture, Conservation and Forestry, MFS 2012). Data collected during the field assessment should include dominant and common tree species, sizes, age class, absolute density, soils, topography, key habitat features, and any other distinctive features.
- Upon completion of the updated forest characterization assessment (INRMP Project 35), a forest management plan will be developed in coordination with the MFS to include management of dense forest conditions (including salvage of downed trees and debris for firewood, timber sales, and reducing the risk of wildland fire), identification of areas containing abundant edible plants, and management of forest resources in response to natural disturbances. Appendix D, Enclosure 1 provides a MFS brochure that contains information on development of a fire management plan.
- Establish partnerships with state and federal agencies, non-governmental organizations, and/or universities to promote the conservation and study of natural resources at the SERE School. Potential partners include the North Atlantic Landscape Conservation Cooperative, National and Maine Audubon Society chapters, Institute for Bird Populations, The Nature Conservancy, The Wilderness Society, and the Vermont Center for EcoStudies.
- Conduct a climate change vulnerability assessment in partnership with other United States Department of Defense installations, federal and state agencies, non-governmental organizations, and/or universities. The assessment should focus on future climate change projections, impacts of altered species' distribution patterns, and variations in ecological processes such as drought, fire, and flood for Navy installations located in Maine.

Installation Wetland

Source: I. Trefry

- Develop an environmental awareness program focused on educating and training SERE School and Public Works Department–Maine (PWD-ME) personnel on protection of natural resources topics including implementing best management practices for erosion control and trail maintenance, wetland protection, management of nuisance wildlife, and protection of rare, threatened, endangered, and special concern plant and wildlife species known to occur.
- Provide periodic training for SERE School personnel and PWD–ME environmental staff regarding implementation of erosion and sediment control measures and use of effective best management practices. Maine Department of Environmental Protection provides annual erosion and sediment control courses.

- Provide professional training for PWD-ME environmental staff to include Field Techniques for Invasive Plant Management, Conservation Biology (both courses offered at the National Conservation Training Center), and Pest Applicator Certification Training (offered by the Armed Forces Pest Management Board).
- Work with the Naval Facilities Engineering Command Mid-Atlantic GeoReadiness Center to develop Geographic Information Systems (GIS) for storing SERE School natural resources data.
- Provide training to environmental staff to maintain the SERE School GIS database.

3.7 SERE School Wildland Fire Management Goals and Objectives

The goals of the SERE School WFMP were developed in accordance with federal, state, and local policies and regulations, and in support of applicable guidance discussed in Section 2.1 *Fire Policies and Plans*. The primary goals of this WFMP are to maintain forest conditions to support the training mission, and provide fire preparedness and identification of fire prevention activities for the Installation. The following goals and objectives have been established for wildland fire management at the SERE School, and will assist in meeting these primary goals.

- Make firefighter and public safety the highest priority of every fire management activity.
- Protect SERE School students, instructors, and personnel from wildland fire hazards by establishing safety zones and identifying evacuation routes.
- Suppress all wildland fires in a safe, efficient, and cost-effective manner.
- Prevent wildland fires through establishment and maintenance of firebreaks and reduction of fire loads.
- Educate instructors and students about the scope and effect of wildland fire management, including identification, prevention, hazard/risk assessment, rehabilitation, and fire's role in ecosystem management.
- Ensure access roads that are critical for fire suppression are maintained to a standard suitable for local fire department equipment.
- Collaborate with local, state, and federal partners when planning and implementing wildland fire preparedness, prevention, and suppression actions (see Contact List in Enclosure 1, Appendix A).
- Develop restoration guidelines for areas impacted by wildland fire.

3.8 SERE School Land Management Considerations

The lack of active forest management or timber harvesting at the SERE School since 1961 has resulted in dense forest habitat conditions. It is important to note that a detailed assessment of existing fuel loads at the SERE School has not been conducted, so it is unknown if a high density fuel load is associated with current forest conditions. There are no plans for conducting forest thinning or active fire management at the Installation; however, an assessment of the forest density and fuel load conditions should be conducted to determine if these activities should be implemented in the future to reduce the risk of wildland fire.

Currently, wood collection consists of the collection of firewood for heating and campfires by removing dead or down trees, generally within a short distance of roads in support of training activities. This serves the purpose of reducing fuel loads along Installation roads and increasing their firebreak capabilities. Dense forest conditions and the natural variety of animals and edible plants that occurs at the SERE School are necessary to support the military mission of the Installation (see Section 3.5 *Military Mission*).

The OPNAVINST 5090.1C-Ch-1 defines forest management as those actions designed for the production and sale of forest products and for maintaining the health and vigor of forest ecosystems. Actions include timber management, forest administration, timber sales, reforestation, afforestation, timber stand improvement, timber access road construction and maintenance, forest protection, and other directly related functions. Although active forest management is not practiced at the Installation, the Navy manages forest resources using active forest management tactics such as application of the programmatic objectives and general forestry management practices described in Section 3.6 *SERE School INRMP Programmatic Objectives and Forestry Management Projects*.

3.8.1 Developed Areas of the Installation

Facilities at the SERE School property are located in several developed areas (Figure 1-2). One of the largest developed areas of the property is the MPB, which is approximately 2.0 ac (0.8 ha) in size. It includes barracks, operations and maintenance buildings, administrative buildings, supply and storage and other base support buildings. A new hostage resistance training classroom has been constructed on a 1.0-ac (0.4-ha) parcel near the main compound, and provides an imitation prisoner of war camp that is used in resistance and escape training scenarios. Support buildings consist of a generator building and a water treatment facility. A fire tank booster pump station, leach field, helipad, and access and service roads are other components of the MPB.

Static Camp Alpha includes several structures and a camping area that serves as the winter orientation center for SERE School students upon arrival. A second Static Camp, X-ray, consists of a new classroom facility and outhouse-latrine that serves as the summer orientation center. There also are several isolated and scattered small buildings, such as the gatehouse and a few small shelters on the roadsides.

The final developed area that is utilized for training is the old abandoned Redington Village site. One of the structures at this site has been modified to provide temporary accommodations for instructors and students.

3.8.2 Natural and Cultural Resources

Wildland fire management at the SERE School is implemented in coordination with the natural and cultural resources management strategies identified in the Installation INRMP and cultural resources management plan. Forest habitats constitute the primary natural resources at the SERE School, including high elevation habitats and waterbodies that support a diversity of flora and fauna such as inland waterfowl/wading bird habitat, potential Atlantic salmon habitat, shorebird feeding and staging areas, potential significant vernal pools, and deer wintering areas. The

majority of the SERE School property is left undeveloped in its natural state to support the military mission of the Installation. As stated in Section 3.2 *Regional History of Wildland Fires*, the lack of active forest management or timber harvesting at the SERE School has resulted in dense forest habitat.

View of Installation and regional peaks from Installation high elevation habitat

Source: I. Trefry

The most recent cultural resources survey conducted at the SERE School determined that there is a low likelihood for prehistoric archaeological resources to be located within the SERE School property (Louis Berger & Associates, Inc. 1996). Phase IA reconnaissance of several areas at the Installation, including Redington Village, Redington Pond, and Redington Pond Dam, indicated the presence of late nineteenth to twentieth century materials. A few remnant structures remain from the late Redington Village Settlement, and are not officially part of the training facility. Two adjacent outbuildings were constructed in 2013 to support training activities.

3.8.3 SERE School Forestry Resources

A 1999 inventory of natural community types at the SERE School characterized approximately 97% of the land (12,199 ac [4,937 ha] as forested (Figure 3-1) (Navy 2007). Although the majority of the SERE School property is composed of shade tolerant habitat types, nearly 4,000 ac (1,619 ha) contain shade intolerant, early successional species such as pin cherry (*Prunus pensylvanica*), aspen, and paper birch (Table 3-1) (Braun et al. 1992, Navy 2007). Adjoining lands, primarily owned and managed for timber harvesting, can be expected to be logged on a rotational basis, providing early successional forest along the common boundaries and throughout the region.

Early successional forest habitat

Source: I. Trefry

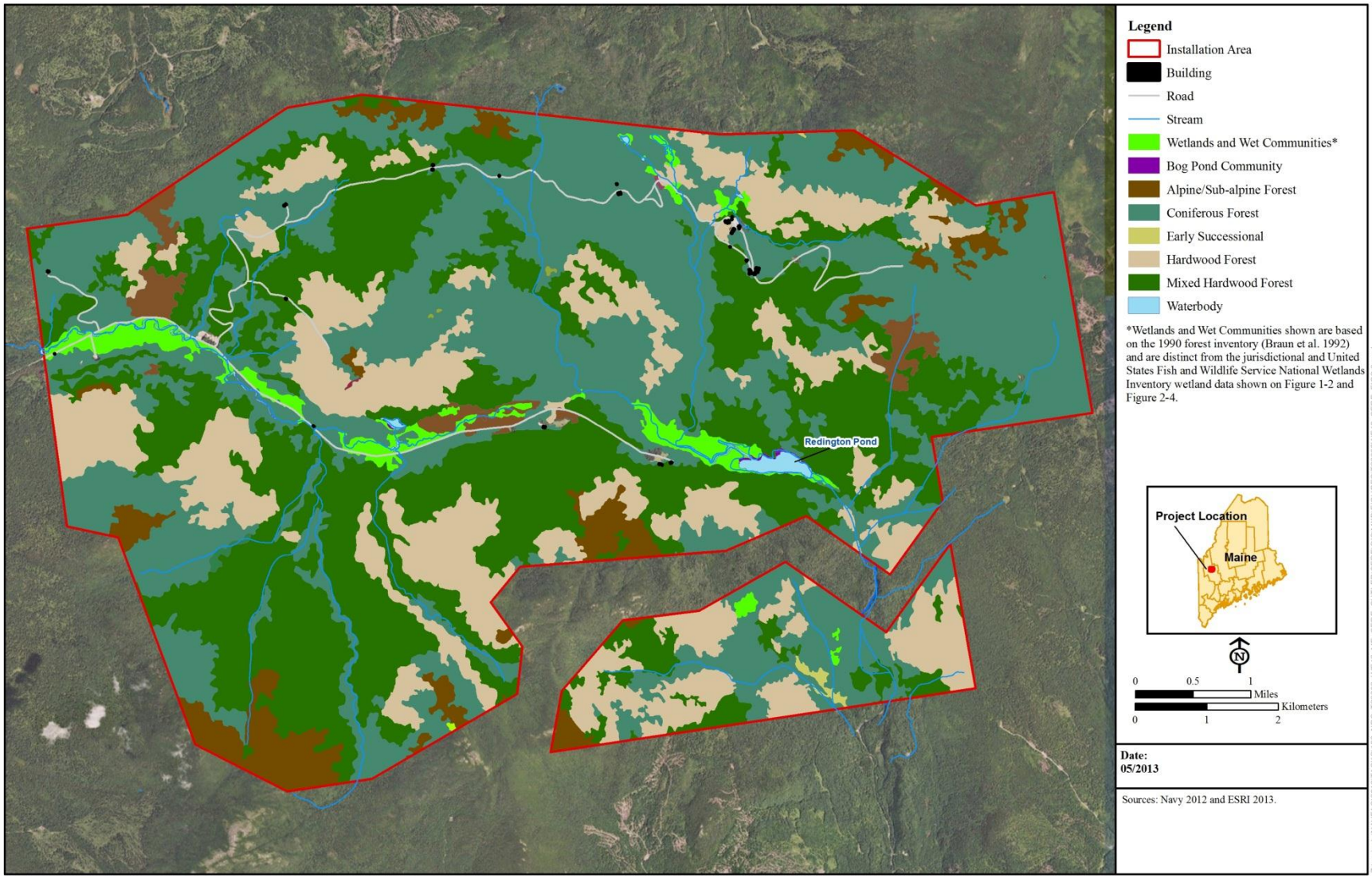


Figure 3-1. Forest Community Types of the SERE School, Redington, Maine.

Table 3-1. Forest Community Types of the SERE School, Redington, Maine.

Major Habitat Unit	Society of American Foresters Cover Type Codes	Acres
Paper birch – red spruce – balsam fir	35	5,262
Red spruce – balsam fir	33	2,556
Paper birch	18	1,817
Aspen	16	1,304
Pin cherry	17	639
Red maple	108	621
Total Forested Acreage		**12,199**

Sources: Braun et al. 1992 and USFS n.d.

Representative forest habitat of the Installation

Source: I. Trefry

3.8.4 Hazardous Materials

The Installation has a Spill Prevention Control and Countermeasures (SPCC) Plan in place that outlines requirements and recommendations for responding to oil or hazardous material spills, and contains details on the location, capacity, material, material stored, and type of secondary containment for Installations aboveground storage tanks (ASTs). In the event of a spill, all procedures outlined in the SPCC Plan for the SERE School would be followed. The SPCC Plan was revised in June 2012 and establishes specific procedures for responding to the release, minimizing the effects, and removal of hazardous spill materials. Appropriate contact persons and procedures also are included in the SPCC in the event of a spill. In the event of a spill emergency, the SPCC Plan guidelines include notifying the local Fire Department or Police Department. If necessary, a natural resources damage assessment would be performed in accordance with the Oil Pollution Act of 1990 (33 United States Code [USC] 2701-2761) under the control of the Commander, Navy Region Mid-Atlantic (CNRMA). A copy of this Plan is

located in the Moose Pit (Building 624) and at the MPB (Building 566) (Aerostar Environmental Services, Inc. 2012).

Although the Installation has been designed to minimize the potential for releases of oil to surface and/or groundwaters, the SPCC describes the Installation's preparedness for preventing the discharge of oil/fuel and release of petroleum products to the environment, and establishes procedures for responding to the release, minimizing the effects, and removing the released material, should a spill occur. All personnel are trained in the handling and disposal of hazardous materials per OPNAVINST 5100.28 (Hazardous Material User's Guide).

As required by the Federal Water Pollution Control Act (Section 311 (j) (1) (c)) and specific U.S. Environmental Protection Agency regulations on Oil Pollution Prevention (40 CFR Part 112), the SPCC identifies capacities of underground or ASTs. No underground storage tanks are present at the SERE School. The Installation has 22 ASTs (Figure 3-2a and Figure 3-2b), with a total capacity of 11,425 gallons (43,248 liters) of oil (Aerostar Environmental Services, Inc. 2012). All ASTs are located away from vehicular traffic areas and are protected against accidental damage from vehicles. All ASTs have adequate secondary containment as defined by 40 CFR 112.7, and are constructed of steel that is compatible with oil/fuel storage. ASTs and containers are used to store heating oil (K-1 kerosene), diesel fuel (for vehicles, generators and power supplies, and fire pump), and hazardous wastes/hazardous substances (gasoline for vehicles). The potential for a hazardous material spill at the SERE School is primarily limited to four specific areas: MPB, both static camps, and the training compound.

3.9 SERE SCHOOL ORGANIZATION AND RESPONSIBILITIES

A flow chart that outlines the Navy's protocol for responding to fire emergencies is provided in Appendix A, Enclosure 2, and includes management responsibilities, and procedures for responding to wildland fires. The SERE School Command Organization chart included in Appendix B outlines the management hierarchy for the SERE School.

Establishment of additional firebreaks and identification of additional evacuation routes are needed to improve fire safety at the SERE School. PWD-ME and SERE Command will work with cooperating agencies and appropriate interested parties to develop a timeline and priorities for completion of these improvements to reduce the risk of wildland fire at the Installation. Improvements will consider current ecosystem management goals and other natural resource program objectives outline in the Installation's INRMP.

Figure 3-2a. Hazardous Materials Locations (East) of the SERE School, Redington, Maine.

Figure 3-2b. Hazardous Materials Locations (West) of the SERE School, Redington, Maine.

3.9.1 Roles and Responsibilities

The Natural Resources Program (NRP) at the SERE School is encompassed within a region-wide Navy NRP that is overseen by the PWD-ME Natural Resources Manager (NRM) based at Portsmouth Naval Shipyard, Kittery, Maine, under the direction of the Portsmouth Naval Shipyard Commanding Officer (CO). Onsite, day-to-day facility management is handled by the NAVFAC PWD-ME site supervisor located at the SERE School. The PWD-ME NRM ensures compliance with applicable local, state, and federal regulations regarding management and protection of natural resources. The PWD-ME NRM and the NAVFAC PWD-ME site supervisor also promote environmental awareness to staff and recreational users of the SERE School. In addition to managing forest resources and associated wildland fire risks at the SERE School, the NRP is broadly responsible for management of water, vegetation, fish and wildlife and their habitats, hazardous wastes, and management of rare, threatened, and endangered flora and fauna that occur at the Installation. Each of these areas of responsibility must be managed to balance potential conflicts among different interests and the operational mission of the SERE School. The concept of integrated management of natural resources both justifies and requires that internal and external stakeholders contribute to the management of natural resources.

The SERE School CO is responsible for implementing the WFMP, and, with assistance from the Chief Petty Officer (CPO) who functions as the SERE School Fire Warden, is responsible for determining the appropriate action to take in the event of a wildland fire at or near the Installation. All SERE School personnel are responsible for detecting and reporting wildland fires to the SERE School CO and CPO, and if necessary, contacting local fire agencies if protection services are needed. Section 4.8 *Records and Reporting* provides information to be obtained and reported as relevant to the CO, CPO, or emergency responders in the event of a fire at or near the SERE School. The SERE School fire response a protocol is identified in Appendix A, Enclosure 2.

3.9.2 Safety Training

As stated in Section 3.5 *Military Mission*, students and instructors are trained in wildland fire prevention protocols which include placing fires on gravel or road surfaces, and implementing a mandatory fire watch during all fire building exercises.

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4.0 WILDLAND FIRE OPERATIONAL GUIDANCE

A full range of fire management program elements should be reviewed and considered when developing operational guidance for wildland fire management at the SERE School. These include establishing appropriate management response protocols; developing an emergency action plan; identifying fire protection resources; coordinating with local, state, and federal agencies as appropriate; and identifying rehabilitation and restoration activities.

4.1 APPROPRIATE MANAGEMENT RESPONSE

4.1.1 Staff

All SERE School personnel are responsible for detecting and reporting wildland fires to the SERE School CO, and if necessary, contacting local fire agencies if protection services are needed. A flow chart outlining the fire response protocol for responding to fire emergencies at the SERE School is provided in Appendix A, Enclosure 2. In the event of a fire at the SERE School:

- staff will determine the location of the fire and record 6-8 digit coordinates if possible;
- staff will identify ASTs or other fire hazards (such as vehicles or other explosive materials) in proximity to the fire;
- the CO and/or CPO will notify all SERE School instructors and personnel leaders within the danger area, and will determine if emergency response is required;
- if support from local fire responders is deemed necessary, staff will notify local firefighters (Town of Rangeley Fire Department or MFS) and local law enforcement of the fire emergency;
- the CO and/or CPO will determine if evacuation of the Installation is necessary, and if deemed necessary, they will secure the Installation, identify all safe evacuation routes, and mobilize personnel for evacuation;
- the CO and/or CPO will notify SERE School personnel when all fires have been extinguished and the affected area is clear; and
- the CO and CPO will coordinate with the installation NRM to determine if restoration is required to restore affected areas to natural conditions.

4.1.2 Priorities

Maintaining the health and safety of all SERE School personnel is the first priority in the event of a wildland fire. No natural resources or property value is worth exposing humans to high-risk situations. If evacuation is determined to be necessary to maintain the safety of Installation personnel, the Installation will be secured and staff mobilized to evacuate the Installation as quickly and safely as possible.

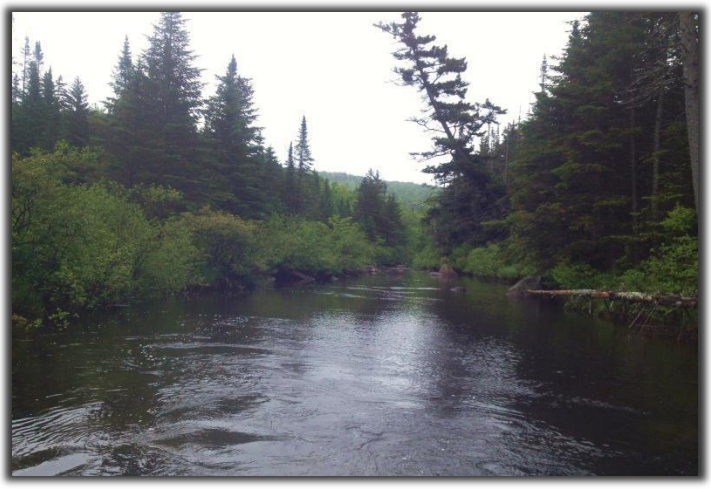
4.1.3 Seasonal Considerations and Detection

A small number of wildland fires occur in western Maine, which makes it difficult to determine what an average fire season entails for the region. Many wildland fires occur after snowmelt in the spring but prior to tree green-up, within a fairly narrow window between April and early June. During October and early November, a fall fire season may occur after leaves have fallen and prior to early season snowfall. Summer fires are very rare in this region, but may occasionally occur during periods of drought, or as a result of lightning strikes. Appendix D, Enclosure 1 provides a Franklin County Emergency Management Agency brochure on seasonal tips for emergency preparedness, including fire preparedness.

The CO (or their designee) should review the daily fire report provided by MFS to identify the fire danger rating (see information provided in Section 3.4.2 *Maine Forest Service and Fire Danger Rating System* and Section 4.8 *Records and Reporting*) for the region on a daily basis. Fire danger ratings range from low, moderate, high, very high, to extreme, and should be used to predict and prepare for potential outbreaks of wildland fire.

4.2 EMERGENCY ACTION PLAN

The Installation does not employ any trained fire personnel (see Section 4.3 *Fire Protection Resources*). Law enforcement and fire protection agencies that require access to the Installation to respond to emergency situations would need to be escorted by Navy personnel onto the Installation via the main gate. If a Navy escort is not available and the main access gate is locked, the Navy authorizes law enforcement or fire protection agencies to cut the lock or use a capable vehicle to force entry and obtain access to the Installation. If the main access roads (Redington Stream or Mountain roads) are blocked by fire, the primary evacuation route will be by foot via the Blue Line trail that provides access to Redington Pond and the AT from the main compound area located near the eastern end of Mountain Road (Figure 4-1). Other potential escape routes on the property include a trail that accesses the mountain ledges on the northern portion of the property from the MPB and an old abandoned railroad grade that runs from the now abandoned Redington logging camp to Orbeton Stream to the southeast of the main parcel (Jackson and Schank 2001 cited in Navy 2103), and trails that lead off the property to the north and east as shown on Figure 4-1. The existing helipad located in the MPB also could be used to evacuate personnel and/or bring in firefighting supplies and equipment, if needed. Potential evacuation routes also are identified in the SERE School Instructor Manual. The CO or CPO will ultimately determine the safest evacuation route that should be used in the event of a fire emergency (see Fire Response Protocol in Appendix A, Enclosure 2).



Orbeton Stream

Source: B. Dresser

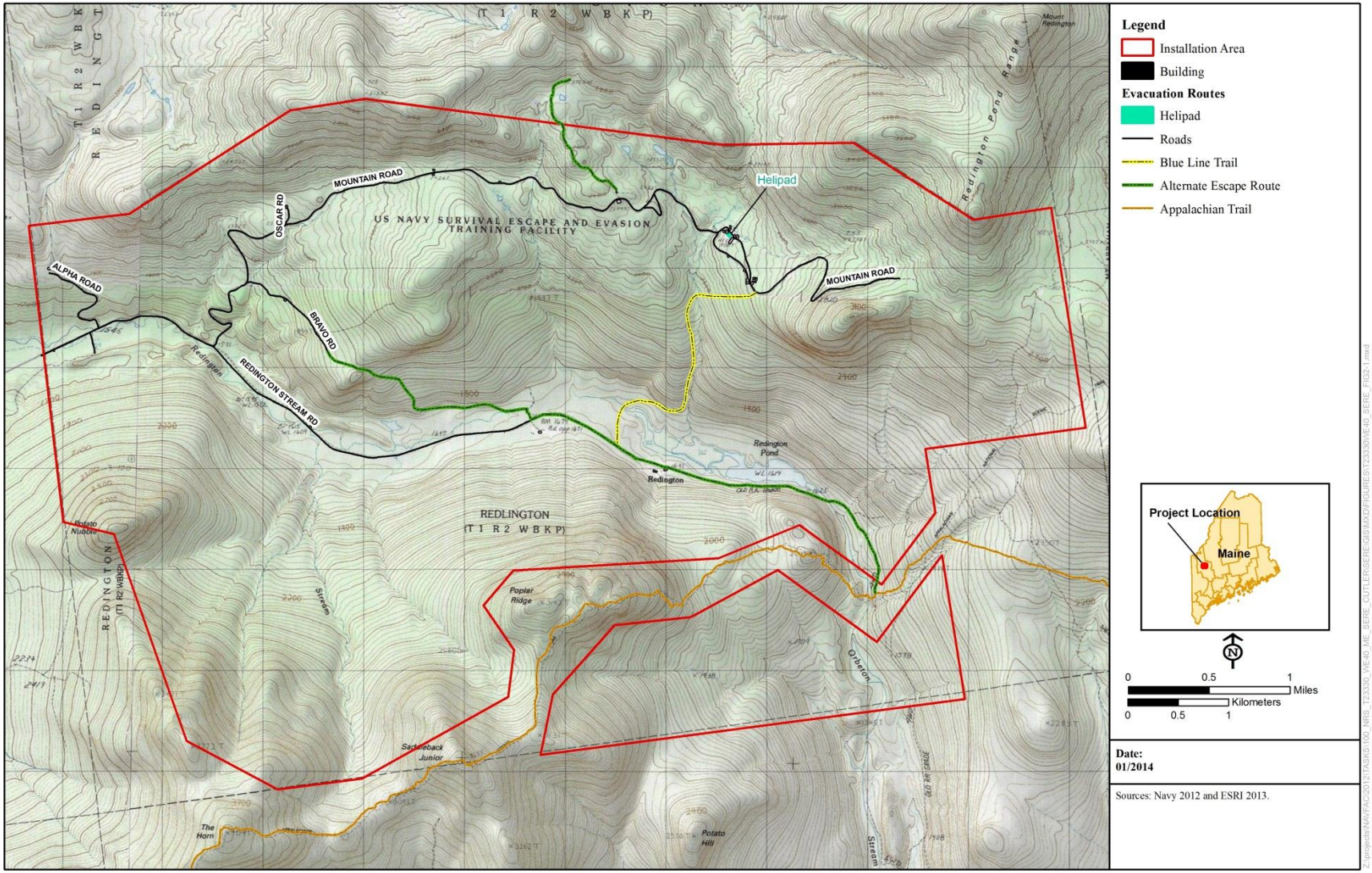


Figure 4-1. Evacuation Routes of the SERE School, Redington, Maine.

If a significant fire event occurs, the Navy's priority for the Installation is to secure the Installation and evacuate all personnel safely. In the event a wildland fire is observed, personnel will notify CPO and CO of fire location, size, severity, and location of any above ground storage tanks in proximity to the fire that could present a fire hazard. The CPO and CO will determine if evacuation of the Installation is required. If evacuation is warranted, they will notify all personnel at the Installation, secure the Installation, and mobilize personnel to begin evacuation procedures. The CPO and CO will notify fire responders and law enforcement of the fire if fire protection services are needed, and provide information on intent to evacuate the property, if relevant. A flow chart that outlines the Navy's protocol for responding to fire emergencies is provided in Appendix A, Enclosure 2. Once the fire has been contained and the Installation is deemed safe to return to, the CO and CPO will notify SERE School personnel. Within a few days of containment of the fire, the CO and CPO will determine if restoration of areas affected by the fire is needed to restore forests and other vegetation to their natural condition.

A fire instruction is currently being developed for the SERE School, a copy of which will be included in Appendix C when it becomes available. Although details of the instruction are not currently available, it will provide guidelines for emergency actions in the event of a wildland fire. To ensure that this WFMP aligns with the recommendations and requirements of the fire instruction, both documents should be reviewed and the WFMP updated as necessary to align the wildland fire management strategies with Navy policy once the fire instruction is available. Having a consolidated management plan available will enable staff to quickly respond to wildland fire emergencies.

4.3 FIRE PROTECTION RESOURCES

Redington Pond

Source: I. Trefry

The SERE School does not have an organized fire department or firefighting vehicle onsite, and instructors, students, and personnel are not equipped with personal protective equipment. Fire protection resources at the Installation include fire extinguishers in all buildings; a fire tank booster pump station and a helipad, which are components of the Public Works area; and the existing water supply (Figure 4-2). Road maintenance equipment, such as dump trucks, front end loaders, grade-alls, and excavators also may be available for fire suppression or post-restoration of fire affected areas, if needed, however SERE School staff have not been specifically trained in these techniques. The SERE School can obtain water for fire protection purposes from a small reservoir on Tumble Down Brook approximately 300 ft (91 m) upstream of the MPB. This reservoir is less than 1 mile (1.6 km) from the headwaters. Redington Pond is not suitable for collection of water from aerial bucket drops, due the build-up of debris and shallow depths associated with this waterbody. Figure 4-2 identifies three suitable waterbodies to the west/southwest of the Installation that could potentially be used for obtaining water for firefighting purposes based on depth information available for these resources. These include Saddleback Lake, Rock Pond, and Midway Pond.

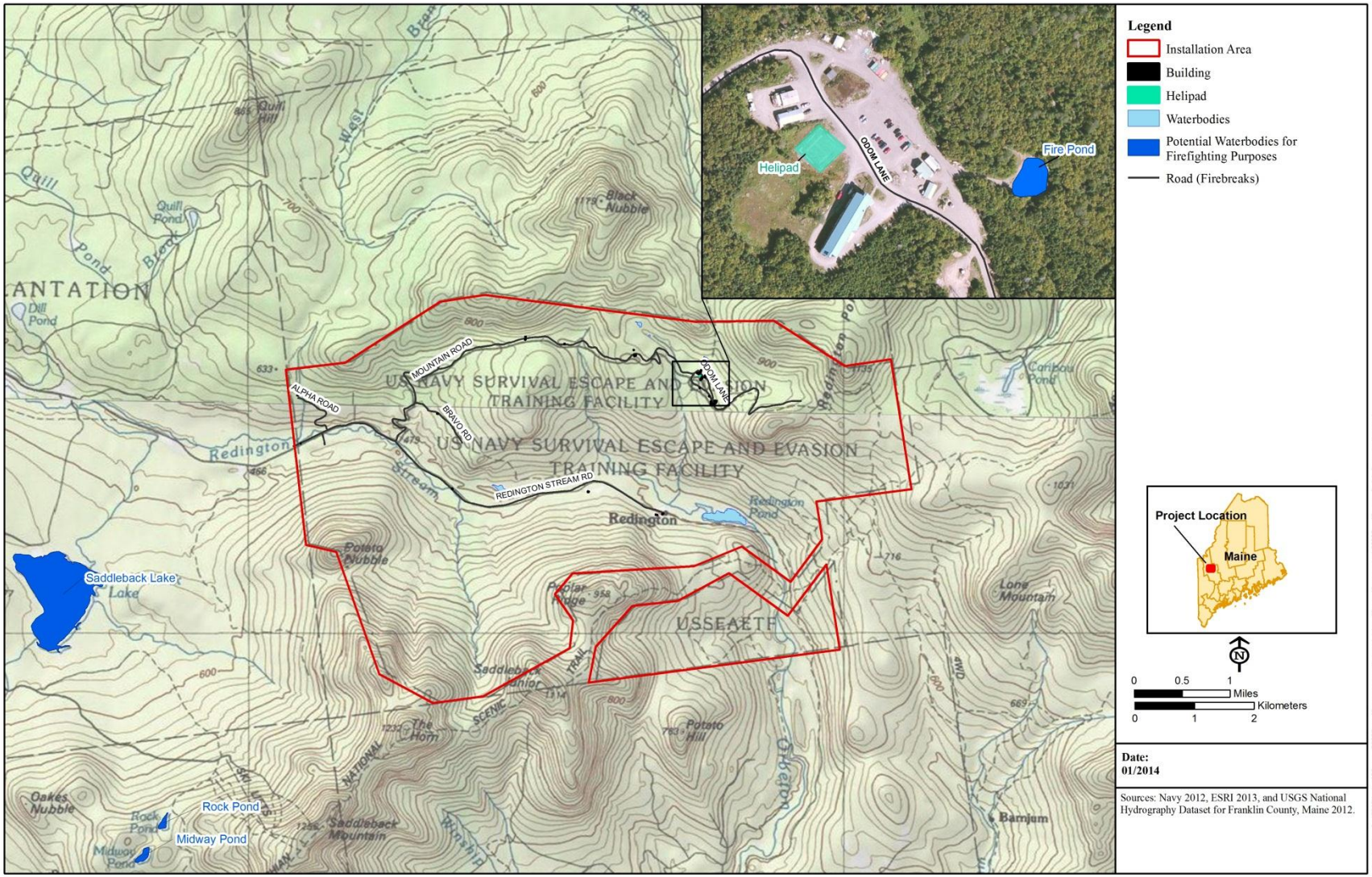


Figure 4-2. Fire Protection Resources at or in the vicinity of the SERE School, Redington, Maine.

Vegetation surrounding Installation buildings is maintained to reduce fire risk, and roads are maintained to provide firebreak protection. Instructors and SERE School personnel are equipped with hand-held radios and vehicle-mounted radios, which could be used to communicate with Navy and local officials during a fire-related emergency.

Firebreak (Typical Installation Roadway)
Source: J. Sweitzer

4.4 INTERAGENCY COORDINATION

As noted in Section 3.3 *Regional Wildland Fire Management Strategies*, wildland fire management in the northeast region is the result of collaboration, partnerships, and cooperation among the states in the region and the District of Columbia; fire compacts; federal fire management agencies, including the USFS, Bureau of Indian Affairs, NPS, and USFWS; tribal governments; and many local fire departments (Forest and Rangelands 2013). Although development and implementation of this plan has not been coordinated with local agencies, if necessary or requested, a copy of this document would be provided to USFWS, USFS, MFS, and the local fire department for their records and/or for their review and comment. Additionally, and as noted in Section 3.9 *SERE School Organization and Responsibilities*, PWD-ME and SERE Command will work with cooperating agencies and appropriate interested parties to develop a timeline and priorities for completion of Installation improvements to reduce the risk of wildland fire, to include consideration of current ecosystem management goals and other natural resource program objectives outline in the Installation's INRMP.

4.5 WILDLAND FIRE MANAGEMENT RESOURCES

Several agencies and organizations offer guides, workshops, and trainings on a variety of wildfire safety topics. The NWCG produces several guides related to wildfire management such as a field manager's guide and an incident training specialist field guide. The MFS offers Forest Ranger training and the Firewise Communities Program offers workshops, trainings, and web-based interactive trainings geared towards homeowners, forestry professionals, firefighters, and others. Ongoing and future courses cover topics such as landscaping, firefighter safety,

preventing home ignitions, understanding fire behavior in the wildland/urban interface, and wildfire planning and suppression.

Appendix D, Enclosure 1 provides a Firewise Communities Program brochure for developing communities that are compatible with nature, and includes information on completion of hazard assessments and landscaping practices. Appendix D, Enclosure 2 provides a list of useful internet resources that should be consulted for further information on wildland fire management.

4.6 WILDLAND FIRE RESTORATION AND REHABILITATION

Natural recovery is the preferred method of restoring fire damaged areas; however areas where erosion control measures or soil stabilization measures are needed should be identified and remediated as needed. Additionally, clearing of fire damaged areas that pose a human health or safety issue should be addressed. All fires over five acres will be evaluated by the Navy and SERE School staff to determine what, if any, rehabilitation is needed. If restoration is deemed necessary to restore forest health, a seeding and planting plan, using native species, will be developed within 90 days of the determination. The NRM, with assistance from Naval Facilities Engineering Command (NAVFAC) Foresters, will determine the level of post-restoration that is needed on a site-by-site basis.

It is recommended that rehabilitation efforts be undertaken within three years of containment of a wildland fire to repair or improve fire-damaged lands that are unlikely to recover naturally to management-approved conditions, or to repair or replace minor facilities damaged by the fire. Rehabilitation actions may include chemical, manual, and mechanical removal of invasive species, and planting of native species to restore or establish a healthy, stable ecosystem; tree planting to reestablish burned habitat, reestablish native tree species lost in a fire, and preventing establishment of invasive plants; and repair/replacement of fire damage to minor operational facilities such as signs and fences. Appendix D, Enclosure 1 provides a MFS brochure that contains information on invasive plant species associated with Maine forests.

4.7 WILDLAND FIRE PREVENTION AND EDUCATION

The emphasis of wildfire suppression and preparedness is ultimately protection of human life and property, including abutting landowner resources, and protection of resources critical to the military mission. Maintenance of access roads for emergency equipment will be the primary focus of future preparedness efforts, as well as identification and reduction of hazardous fuel loads, and establishment of additional firebreaks and evacuation routes (if determined that these are needed to reduce the risks of wildland fires at the Installation). A secondary priority is protection of hydrologic features from the effects of severe wildfires.

Wildland fire prevention measures that are in place include limiting or prohibiting campfires used for training purposes during high wind conditions or days having an extreme fire danger rating. In addition the collection of firewood along Installation roads and around developed areas helps maintain their firebreak potential and provide an evacuation route for SERE School personnel. These firebreaks are maintained to provide their intended protection of Installation resources and personnel in the event of a fire by helping firefighters contain and extinguish flames as quickly as possible, and reducing the potential for fires to spread. Permanent firebreaks

are typically four times wider than the highest downwind fuels, help to slow fire advancement, provide a basal point to attack fires, and provide an evacuation route in the event of fire flares. Permanent firebreaks should run in opposite direction of the prevailing winds. Some of the drawbacks of establishing permanent firebreaks include the loss of native habitat, increased potential for wind and water erosion, and an increased potential for establishment of invasive plant species. An alternative to establishing permanent firebreaks include creation of temporary firebreaks with flame retardant foam, which is often more effective at reducing advancement of fires and damage; or creation of temporary fire breaks where needed to contain spread of fires with heavy road maintenance equipment. Roads should be continually maintained by removing dead wood and other fuel sources along roadsides to provide firefighters access to the wildland fires and ensure multiple evacuation routes are available.

Dead and downed wood at Installation

Source: L. Quillen

An environmental awareness program focused on educating and training SERE School and PWD-ME personnel on protection of natural resources topics will be developed as part of implementation of the Installation INRMP. Wildland fire education will be included as a component of the proposed environmental awareness program. In addition to providing information on wildland fire management strategies and protocols identified in this WFMP, the environmental awareness program can be used to educate SERE School staff and trainees on the importance of protection and management of SERE School natural resources, and identify state and federal laws and regulations, and Navy policy related to natural resources management, and protection of rare, threatened, endangered, and special concern plant and wildlife species known to occur and their habitats. Other information included in the environmental awareness program includes implementation of BMPs for erosion control and trail maintenance, and wetland protection, and management of nuisance wildlife.

Installation forest trail

Source: I. Trefry

4.8 RECORDS AND REPORTING

All SERE School personnel involved in reporting of wildland fires should record and report the following information for each fire:

- date, time, and location of the fire;
- approximate size of the fire;
- known or estimated cause of the fire;
- ignition and/or fuel source(s);
- number of personnel and equipment used to respond and control the fire, including agencies or service providers involved;
- source and estimated amount of water and/or other fire control methods used to combat the fire; and
- if possible, documentation of fire perimeters using global positioning system data.

A year-end report should be submitted to the National Fire Incident Reporting System and Office of State Fire Marshall that includes the total acreage burned on the Installation and a determination of fire cause.

It is recommended that the CO ensures that situation reports are completed and submitted. Appendix A, Enclosure 3 contains a Fire Incident Reporting Form that is helpful when reporting fire incidents at the Installation. This form documents the date, time, and location of the fire; approximate size of the fire; known or estimated cause of the fire; ignition and/or fuel source(s); and summary of response activities.

It is recommended that fire weather records and reports be reviewed daily during the fires season (April through June, October and November) and weekly for periods of low fire danger. As discussed in Section 3.4.2 *Maine Forest Service and Fire Danger Rating System*, the MFS provides a daily fire report for each of Maine's seven weather zones, including the fire danger rating. The NOAA National Weather Service Forecast Office includes fire weather predictors, such as lightning activity and transport wind speed, in addition to traditional weather elements as a component of its weather forecast for Rangeley, Maine.

The NOAA National Weather Service Forecast Office weather forecast with fire elements for Rangeley, Maine is available here:
http://forecast.weather.gov/MapClick.php?site=gyx&FcstType=graphical&MapType=3&site=gyx&CiTemplate=1&map.x=173&map.y=89

NOAA National Weather Service Storm Prediction Center produces fire weather outlooks, comprising of a current (Day 1–2) outlook and a future (Day 3–8) outlook. The purpose of the outlook reports is to delineate areas within the contiguous U.S. where the pre-existing fuel conditions, combined with forecast weather conditions during the next 8 days will result in a significant threat for wildfires.

The NOAA National Weather Service Storm Prediction Center current and future fire weather outlooks are available here:
http://www.spc.noaa.gov/products/fire_wx/overview.html

4.9 WFMP Reviews and Updates

SERE School CO will review this WFMP annually to identify and incorporate necessary updates into the plan. Most importantly, the contact names and phone numbers listed in Appendix A should be checked annually for accuracy. Reviews of the WFMP also will determine if any goals, objectives, or management strategies require revision based on updates to other natural resources plans such as the INRMP. SERE School Command will decide if changes are significant enough to justify re-approval of the plan.

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APPENDIX A

Navy Fire Response Protocol

Enclosure 1 Law Enforcement, Fire and Emergency Services Contact List

Enclosure 2 SERE School Fire Response Protocol

Enclosure 3 Fire Incident Reporting Form

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Enclosure 1. Law Enforcement, Fire and Emergency Services Contact List

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SERE School Wildland Fire Management Plan Contact List				
Agency	**Phone Numbers**	**Address**	**Web Address**	**Email Address**
Maine Forest Service	(207) 827-1800	87 Airport Road Old Town, Maine 04468	http://www.maine.gov/dacf/mfs/index.shtml	dacf@main.gov
Town of Rangeley, Fire Rescue Department	Tom Pellerin, Fire Chief Fire Chief: (207) 864-3800 Fire Department: (207) 864-2161 Fax: (207) 864-3578	15 School Street Rangeley, Maine	Town of Rangeley http://www.maine.gov/local/town2.php?t=rangeley	firechief@rangeleyme.org
Town of Rangeley Police Department	Phillip Weymouth, Police Chief Main and Fax: (207) 864-3579	Mailing: PO Box 1112 Rangeley, ME 04970 Physical Location: Robbins Avenue Rangeley, ME 04970	Town of Rangeley http://www.maine.gov/local/town2.php?t=rangeley	policechief@rangeleyme.org
Franklin County Sheriff's Department	Sheriff Scott Nichols Sheriff's Office: (207) 778-2680 Fax: (207) 778-6485	123 County Way Farmington, ME 04938	http://franklincountyso.net/wp/	scottnichols@franklincountyso.net
Franklin County Emergency Management	Main: (207) 778-5892 Fax: (207) 778-5894	140 Main Street, Suite 1 Farmington, Maine 04938	http://www.franklincountyema.org/db/	Director Tim Hardy thardy@fncome.com Deputy Director Amanda Simoneau asimoneau@fncome.com
Maine Emergency Management Agency	Toll Free (In-State Only): (800) 452-8735 Main: (207) 624-4400	72 State House Station 45 Commerce Drive Augusta, Maine 04333	www.maine.gov/mema/	
Maine State Police	24-Hour Regional Communications Center, Augusta Maine (207) 624-7076 or (800) 452-4664	Maine State Police Headquarters 42 State House Station 45 Commerce Drive Augusta, Maine 04333-0042	http://www.maine.gov/dps/msp/	Public Information Officer, Stephen McCausland Stephen.McCausland@maine.gov
Office of the State Fire Marshall	Joseph Thomas, Fire Marshal: (207) 626-3871 Main/Investigations Division: (207) 626-3870 Inspections Division/Plans Review Division (Main): (207) 626-3880 or Rich McCarthy, Assistant Fire Marshal (207) 626-3886 After Hours Emergency (Maine State Police): 800-452-4664	52 State House Station Augusta, Maine 04333-0052	http://www.maine.gov/dps/fmo/index.htm	Plans Review Division Assistant Fire Marshal, Richard McCarthy richard.mccarthy@maine.gov Ronald Peaslee ronald.j.peaslee@maine.gov Richard Nason richard.c.nason@maine.gov

SERE School Wildland Fire Management Plan Contact List				
Agency	**Phone Numbers**	**Address**	**Web Address**	**Email Address**
USDA Forest Service, Region 9, Eastern Regional Office	Main: (414) 297-3600 Fax: (414) 297-3808	626 East Wisconsin Ave. Milwaukee, WI 53202	http://www.fs.usda.gov/main/r9/home	Not applicable
National Park Service, Northeast Region	Mike Caldwell, Acting Regional Director (215) 597-7013	U.S. Custom House 200 Chestnut Street, Fifth Floor Philadelphia, PA 19106	http://www.nps.gov/nero/	Not applicable
Appalachian Trail Conservancy, New England Regional Office	Main: (413) 528-8002 Fax: 413-528-8003	Kellogg Conservation Center P.O. Box 264 South Egremont, MA 01258	http://www.appalachiantrail.org/	atc-nero@appalachiantrail.org General inquiries: info@appalachiantrail.org Report an Incident: incident@appalachiantrail.org
Trust for Public Land, Maine Office	Main: (207) 772-7424	30 Danforth Street Suite 106 Portland, Maine 04101	http://www.tpl.org/	maine@tpl.org

Enclosure 2. SERE School Fire Response Protocol

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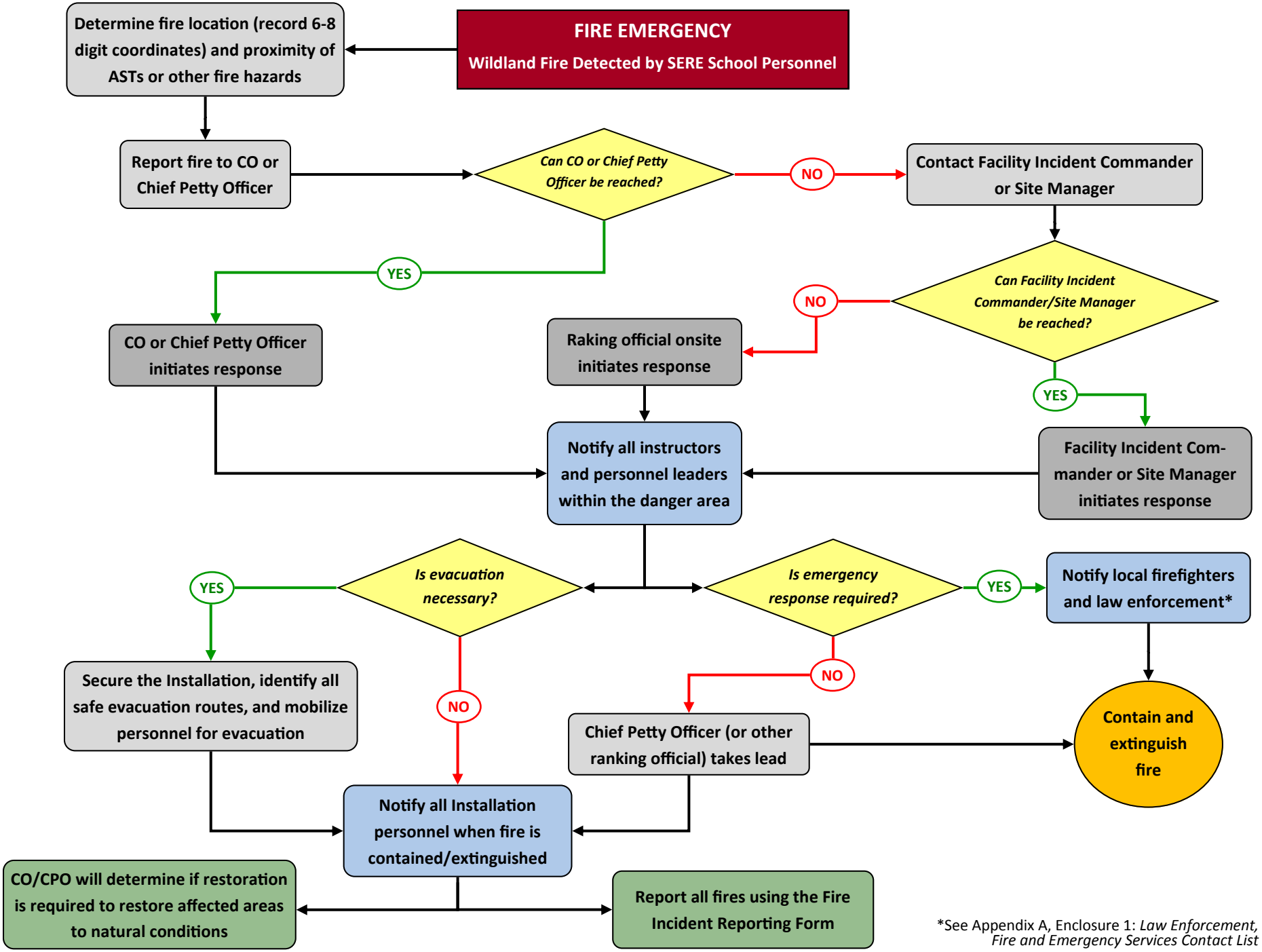

*See Appendix A, Enclosure 1: *Law Enforcement, Fire and Emergency Services Contact List*

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Enclosure 3. Fire Incident Reporting Form

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SERE School Fire Incident Reporting Form

Name _____ Today's date _____

Date of fire (discovery/start) _____ Controlled/extinguished date _____

Location (circle one) Main Parcel Southern Parcel Lat/Long coordinates _____

Other location/site details (e.g., vegetation burned, topography, elevation) _____

_____

Acres burned _____ Structures burned/destroyed? (circle one) Yes No

Cause* _____

*Common fire causes: military mission, lightning, equipment use (non-military), smoking, campfire, debris burning, arson, miscellaneous

Remarks _____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Year to date: Total # fires _____ Total fire acreage _____

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APPENDIX B

SERE School Organization

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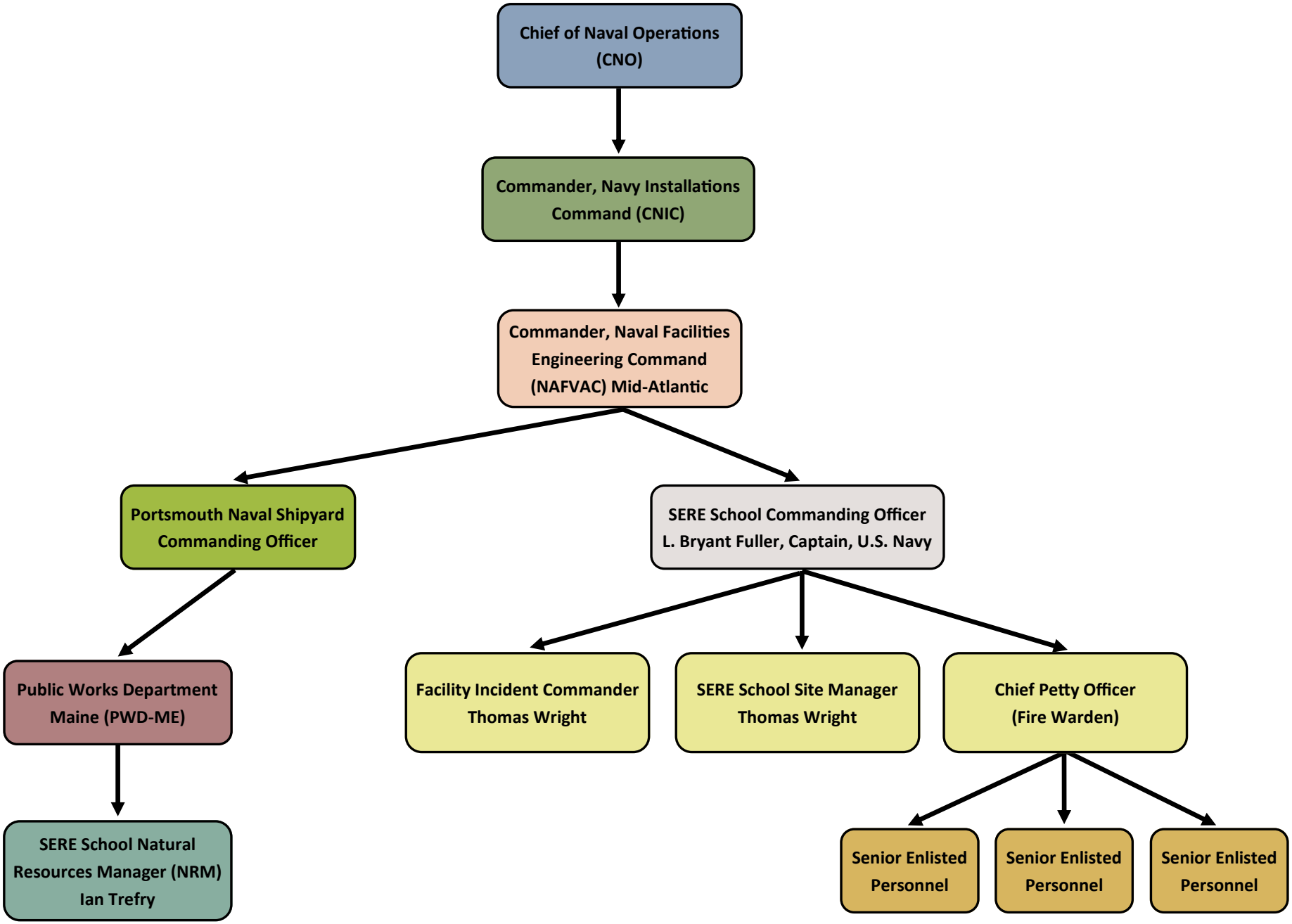
SERE School Organizational Chart



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APPENDIX C

SERE School Fire Instruction

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[Placeholder – The SERE School Fire Instruction is currently under development.]

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APPENDIX D

Resources

Enclosure 1 Brochures

Enclosure 2 Internet Resources

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Enclosure 1. Brochures

- The Maine Forest
- Developing a Forest Management Plan
- Franklin County Emergency Management Agency
- Communities Compatible with Nature
- Invasive Plants in Maine Forests

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INFORMATION SHEET 19
REVISED: August 2009

The Maine Forest

Maine Forest Service, DEPARTMENT OF CONSERVATION, 22 State House Station, Augusta, ME 04333

Maine is the most heavily forested state in the nation with 90% (17.8 million acres) of its land base growing trees.[1] Maine's forests provide many benefits to the state, the region, and the nation:

- a home to more than 20,000 species of wildlife;[2]
- an economic resource that directly employs nearly 23,000 people;[3]
- an annual $1.7 billion contribution to Maine's Gross State Product through forest-based manufacturing.[4]
- a renewable energy resource for wood-burning electricity generating plants - as well as fuelwood for thousands of homes. Wood provides over 20% of electrical needs and 25% of Maine's energy needs.[5]
- the energy for approximately 20% of the electricity used in Maine.[6]
- a green landscape for our homes and communities;
- $1.15 billion in revenues from forest-related recreation and tourism activities;[7] and,
- the largest and most diverse forest products industry of the states in the Northern Forest region.[8]

Additional Facts about Maine's Forests

- 95% of Maine timberland is privately owned, with small non-industrial private forest landowners holding more than 6.2 million acres.[9]
- Over 7.6 million acres of forestland are certified as well-managed.[10]
- Maine's forested watersheds provide clean water that fills rivers, streams, lakes, and wetlands, sustains fisheries, and flows from faucets of homes and businesses. Maine's forests are critically important to the supply of clean and affordable drinking water.[11]
- Maine's forest industry harvests 6 - 7 million cords of wood each year to build homes, make furniture, paper, and other products.[12] Replanting of trees is rarely necessary, as Maine's forests reseed themselves naturally with an abundance of trees.
- Of the 65 tree species in Maine's forests, only 20 are primarily used commercially for paper, lumber, and other products.[13] These include:
  - Spruce, fir, and hemlock for structural lumber and paper production;
  - Eastern white pine for interior (finish) wood;
  - Cedar for its weathering qualities; and
  - Hardwoods, such as maple, birch, and oak, for flooring, furniture, paper production, and dozens of specialty wood products.

Tree and Forest Facts:

- Trees are a renewable resource. Forest products are also recyclable and biodegradable.[14]
- Each American uses the equivalent of a 100-foot tall tree each year.[15]
- The average single-family home (2,000 sq. ft.) can contain 15,824 board feet of lumber and up to 10,893 square feet of panel products.[16]
- A large healthy tree may have as many as 200,000 leaves on it. Over a 60-year life span, such a tree would grow and shed 3,600 pounds of leaves, returning about 70% of their nutrients back to the soil.[17]
- A tree can be a natural air conditioner. The evaporation from a single large tree can produce the cooling effect of 10 room size air conditioners operating 20 hours a day.[18]

- Sustainably managed forests provide insurance against pollution from roads, sewers and storm water runoff. Put simply, the surface and ground waters flowing out of forests are less contaminated than the rain and snow that falls on the forest.[19]

And there's more...

- To grow a pound of wood, a tree uses 1.47 pounds of carbon dioxide and gives off 1.07 pounds of oxygen. An acre of trees might grow 4,000 pounds of wood in a year, using 5,880 pounds of carbon dioxide and giving off 4,280 pounds of oxygen in the process. Each person needs 365 pounds of oxygen every year.[20]
- For every pound of wood which decays (or burns), the process reverses: 1.07 pounds of oxygen is used up and 1.47 pounds of carbon dioxide is put back into the air.[21]
- Each year, paper is used to publish more than 2 billion books, 350 million magazines, and 24 billion newspapers in the United States.[22]
- Over 57% of all paper consumed in this country was recovered for recycling in 2008.[23]
  - Over half the recycled material used for paper comes from recovered paper and from wood wastes left by lumber manufacturing.[24]
  - Paper can be recycled 4 to 5 times before the fibers lose their strength and wash out. New fibers added to the old can lengthen this recycling process.[25]

Sources

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[25] Society of American Foresters. 2009. op. cit.

For more information, please contact:
Maine Forest Service
DEPARTMENT OF CONSERVATION
22 State House Station
Augusta, ME
04333-0022
(207) 287-2791 or
1-800-367-0223
forestinfo@maine.gov

Be Woods Wise!
Practical advice for your land and trees from the Maine Forest Service.

INFORMATION SHEET 3
March 2012

Developing a Forest Management Plan

Maine Forest Service, DEPARTMENT OF CONSERVATION, 22 State House Station, Augusta, ME 04333

Forest landowners value their land for many reasons: from realizing an economic return (from timber or other sources) to providing ecological values (wildlife habitat, water and soil protection, carbon storage) and personal enjoyment (for recreation, solitude or other purposes). A well-written forest management plan is a blueprint for ensuring these diverse values will be available.

Why Develop a Management Plan?

Whether you are an experienced woodland owner or are just starting out, there is no substitute for the guidance and direction provided by a forest management plan.

If you:

- **Want income from your land now or in the future,**
- **Care about the appearance, health or condition of your woods,**
- **Hope to own your woodland for many years,**
- **Want to leave a healthy and productive forest as a legacy for your family,**

Then consider developing a forest management plan.

Just as you plan decisions in your life related to your own health, retirement or career, you should plan decisions related to your forest.

You might want to have a plan prepared to meet the requirements of the Tree Growth Tax Law, green certification (such as the American Tree Farm program), or other state or federal programs.

How Do I Prepare a Management Plan?

A forest management plan does not have to be hard to create or difficult to understand. Some woodland owners develop their own plans, but most hire a licensed forester. In order to start the planning process, you need to know what you want to achieve with your forest. A talk with a consulting forester or your local Maine Forest Service District Forester can help give you a general sense of where you want to go, and then a plan will tell you how to get there.

What Should be in a Management Plan?

A comprehensive forest management plan should provide the information necessary and a flexible framework for achieving your goals including:

- Statements of your goals and objectives.
- Current condition of the woodland and potential for future benefits.
- Possible actions to achieve your objectives.
- Environmental laws that might apply.

Landowner Objectives. One of the most important parts of any management plan is a clear statement of the landowner's objectives (these could also be thought of as your goals, motivations, values or philosophy). These statements will guide the focus and content of the plan and the development of recommendations.

General Information. There should be information that puts the property and the plan into context. This might include details of the location of the property (such as town, county and state; tax map and lot; deed book and page), the owners, the plan preparer, the date the plan was prepared and the period covered by the plan. In addition the text should have a general description of the amount of land that is forestland, wetland, and non-forestland.

Maps. Maps sufficient to meet the needs of the landowner should be included in a plan. At a minimum there should be a map that shows the woodlot's position in the landscape, one that shows stand and parcel boundaries, and one that shows soil type boundaries. Maps should present a good picture of the property.

Current Woodlot Conditions. A description of the woodlot will flesh out the picture of the property provided by the maps. It might include an account of ownership and land use history, terrain, hydrology (streams, waterbodies, and wetlands), soils, access by roads and/or trails, and a description of boundary lines. Additionally, a description of any legal restrictions applying to the woodland should be included.

Non-timber Attributes. Regardless of management goals, most management plans will include

information about components of the parcel not directly related to timber production. This information could be important for legal considerations. Some things that might be included are a check for the presence of threatened or endangered species, rare and exemplary communities, and historical, cultural, or archaeological sites. In addition the plan might describe fish and wildlife habitat, water quality and waterbodies, recreational opportunities and aesthetic qualities.

Stand Descriptions. A ***stand*** is an easily defined area of the forest with similar species mixture, heights, ages, diameters, densities, soils, health or other unifying characteristics. Each stand has its own economic and environmental potential and limitations so management options are usually outlined by stand.

A stand description typically has information about stand size (in acres), tree species present, tree size, stand history, health, *stocking*[1], quality, and growth rate. In addition, a description of non-timber properties might be included. Each stand description should have a statement of long-range objectives directly related to (1) your goals and (2) the ability of the stand to meet those goals.

Stand Prescriptions. Just as a doctor's prescription takes into account the overall condition of a patient, a forester's stand prescription takes into account the overall condition of the stand. The prescription also reflects the landowner's goals. The stand prescriptions should include suggestions to meet your objectives including: if, how and when to harvest, how to protect environmental values, how to enhance wildlife values, how to protect or encourage regeneration—in short the guidance you need to ensure the values you consider important are provided. A rough timeframe for completing forestry activities outlined in the plan and the beginning and end of the planning period should be included.

[1]***Stocking***—A description of the number of trees, basal area, or volume per acre in a forest stand compared with a desired level for balanced health and growth; usually expressed qualitatively (for example, well stocked or poorly stocked).

"A land ethic…reflects the existence of an ecological conscience, and this in turn reflects a conviction of individual responsibility for the health of the land. Health is the capacity of the land for self-renewal. Conservation is our effort to understand and preserve this capacity."

~Aldo Leopold *A Sand County Almanac* 1949

Remember:

- A plan is just the start. As the landowner, you will be the one to make sure it is put into action. Foresters, harvesters and other natural resource professionals can help accomplish your goals. If you need assistance finding these professionals, do not hesitate to call your Maine Forest Service District Forester.
- Just as your forest is a living system, your management plan should be considered a living document. Unpredictable events (for example ice storms, hurricanes, fires, insects and diseases) might influence the steps needed to reach your goals. Also, your goals or circumstances might change. Don't be afraid to change your plan. In any event, your plan should be updated once every 10 to 15 years.

Where Can I Find Assistance?

Your Maine Forest Service District Forester can be your first contact in the management planning process. S/he can walk your woodland with you, answer your questions and give you the information you need to make the next steps.

Financial assistance, in the form of federal cost-share programs, property tax reduction, and income tax credit, is also available for forest management activities including management planning.

Further Reading from the Maine Forest Service:

Info Sheet #11: State Income Tax Credit for Forest Management Planning
www.maine.gov/doc/mfs/pubs/pdf/fpminfo/11_tax_credit_fmp.pdf.

Info Sheet # 17: The Maine Tree Growth Tax Law
www.maine.gov/doc/mfs/pubs/pdf/fpminfo/17_tgtl.pdf

…and more at:
http://www.maine.gov/doc/mfs/woodswise

For more information, please contact:
Maine Forest Service
DEPARTMENT OF CONSERVATION
22 State House Station
Augusta, ME
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(207) 287-2791 or
1-800-367-0223
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www.maineforestservice.gov

Take Control in an Emergency

You may not be able to control severe weather events, or a truck loaded with chemicals overturning near your home, BUT you can control how well you and your family survive a disaster by planning ahead.

Having an emergency plan to follow can make an emergency situation safer and less scary. It can give you a chance to check on an elderly neighbor, relative or friend to make sure they are ok.

Be Prepared

- Make emergency kits.
- List emergency numbers
- Stay informed
- Create a family emergency plan.
- Create a family communication plan.

Start Planning Today!

Prepare for Spring!

Spring Safety Tips:

- If you live in a flood prone area have an emergency evacuation plan.
- NEVER drive a car or walk through a flooded roadway.
- DO NOT Drive Around Road Barriers.
- DO NOT attempt boating in flood waters.

Prepare for Summer!

Summer Safety Tips:

- Go inside when a thunderstorm approaches.
- Don't use electrical equipment.
- Stay away from isolated trees. Crouch down if in an open area.
- In extreme heat, do not leave children and pets in a closed vehicle.
- Eat well balanced meals and drink plenty of water.
- Check on family and friends, especially the elderly.

Practice Preparedness in Fall!

Planning Tips for Fall:

- Review and update your home emergency plans. Have a family fire drill.
- Check your smoke alarms and change the batteries.
- Make sure everyone can use a fire extinguisher.
- Clean the woodstoves and store wood and flammable items away from the stove.
- Have your furnace serviced.

Prepare for Winter!

Winter Safety Tips:

- Take storm warnings seriously.Stay informed.
- Make a plan for what to do when the power goes out.
- Keep extra batteries for a radio and flashlights.
- Have extra food and water on hand.
- Have extra blankets or sleeping bags.
- If you have a generator, make sure you have it in working order and run it outside away from your home.

Franklin County Emergency Management Agency

140 Main Street, Suite 1
Farmington, ME 04938
207-778-5892
207-778-5894 FAX
Director: Tim Hardy
Deputy Director: Amanda Simoneau

The mission of the Franklin County Emergency Management Agency is to prepare for the unexpected natural or man-made emergency and lessen the effects of the disaster on the lives and property of the citizens in the county.

Are you prepared for an emergency?

We Can Help You!

www.franklincountyema.org/db

Find us on Facebook!

http://www.facebook.com/pages/Franklin-County-Emergency-Management-Agency/386742974735314

MAKE YOUR DISASTER EMERGENCY KIT

Your Disaster Emergency Kit

Everyday life may be different and difficult during an emergency situation. Services you rely on may be disrupted. You might have to "shelter in place" or stay home for a few days. You might have to leave your home for the safety of a shelter. An emergency kit can make all the difference in how well you can cope with disruptions from an emergency.

At the very least, an emergency kit should contain:

- **Emergency phone numbers**
- **A cell phone charger**
- **A Family Communications plan**
- **Water. Plan one gallon for each person per day.**
- **Two weeks of prescription medicines and a first aid kit.**
- **Chlorine bleach, plastic bags, paper towels, and personal hygiene items.**
- **Extra blankets and clothing for warmth.**
- **Pet supplies and vaccination papers.**

For More Information visit:

www.franklinema.org/db
www.maine.gov
www.ready.gov
www.fema.gov

Resources

Franklin Memorial Hospital: 207-778-6031
111 Franklin Health Commons
Farmington, ME 04938
Crisis Hotline: 1-888-568-1112

Mt. Abram Regional Health Center
207-265-4555
25 Depot Street
Kingfield, ME 04947

Rangeley Regional Health Center
207-864-4010
42 Dallas Hill Rd.
Rangeley, ME 04970

Strong Health Center
207-684-4010
177 North Main St.
Strong, ME 04983

Western Maine Family Health Center
80 Main St.
Livermore Falls, ME 04254

Additional Resources:

Call 211 or www.211maine.org
Western Maine Community Action: 207-645-3764
United Methodist Economic Ministry: 207-678-2611
Maine office for Elder Services: 1-800-262-2232
The CommunityConnector.org

STAY INFORMED

Local radio and TV stations will provide information during emergencies and severe weather events. Tune in during an emergency and listen for alerts, cancelations, shelter information or safety instructions.
For up-to-date information, tune to WKTJ, FM 99.3 or www.993ktj.com

Franklin County Emergency Management Program

Are you an individual who would need assistance in an emergency if it were necessary for you to go to emergency sheltering or you had to stay in place at home for several days? Do you, or a loved one living with you, have problems with physical or mental challenges? In an emergency situation that could be difficult for you, the **F**ranklin **C**ounty **E**mergency **M**anagement **A**gency would like to know who you are where you are located so that assistance can be provided. You can register with the FCEMA. The registration is confidential, kept secure and only used for the purpose of your safety in an emergency situation. For more information or to register with the Farnklin County Emergency Management Agency, contact: Director Tim Hardy, 207-778-5892 or print the registration on line at: www.franklincountyema.org/db

VOLUNTEERS MAKE A DIFFERENCE

CERT Community Emergency Response Team (CERT) is a team of volunteers who meet once a month, train for emergency preparedness and assist when the director needs them during an emergency

A.R.E.S. The Amateur Radio Emergency Service team, (ARES) sometimes referred to as HAM operators are volunteers who provide emergency communications using an emergency.

If you'd like more information about either organization, contact the FCEMA office at 207-778-5892.

COMMUNITIES *Compatible With* NATURE

Over the past century, America's population has nearly tripled, with much of the growth flowing into traditionally natural areas. These serene, beautiful settings are attracting more residents every year. This trend has created an extremely complex landscape that has come to be known as the wildland/ urban interface: a set of conditions under which a wildland fire reaches beyond trees, brush, and other natural fuels to ignite homes and their immediate surroundings.

Consequently, in nearly all areas of the country, the wildland/urban interface can provide conditions favorable for the spread of wildfires and ongoing threats to homes and people.

Many individuals move into these picturesque landscapes with urban expectations. They may not recognize wildfire hazards or might assume that the fire department will be able to save their home if a wildfire ignites. However, when an extreme wildfire spreads, it can simultaneously expose dozens — sometimes hundreds — of homes to potential ignition. In cases such as this, firefighters do not have the resources to defend every home.

Wildland fires are a natural process. Making your home compatible with nature can help save your home and, ultimately, your entire community during a wildfire.

Homeowners who take proactive steps to reduce their homes' vulnerability have a far greater chance of having their homes withstand a wildfire.

The nation's federal and state land management agencies and local fire departments have joined together to empower homeowners with the knowledge and tools to protect their homes through the National Firewise Communities Program. Firewise Communities is designed to encourage local solutions for wildfire safety by involving firefighters, homeowners, community leaders, planners, developers, and others in efforts to design, build, and maintain homes and properties that are safely compatible with the natural environment. The best Firewise approach involves a series of practical steps that help individuals and community groups work together to protect themselves and their properties from the hazard of wildfire. Using at least one element of a Firewise program and adding other elements over time will reduce a homeowner's and a community's vulnerability to fire in the wildland/urban interface.

Wildland fires are a natural process. Making your home compatible with nature can help save your home and, ultimately, your entire community during a wildfire.

FIREWISE COMMUNITIES

How Homes Ignite

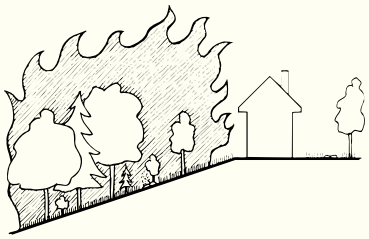
Wildfires are much less likely to ignite a home if the home has been prepared with simple landscaping, construction, and maintenance methods such as those recommended by the National Firewise Communities Program.

To understand a home's wildfire risk and what you can do to can protect it, first consider how wildfires spread. Wildfires do not always burn everything in their paths — fire behavior is affected by fuel, weather, and terrain. Here is a look at the role these elements play:

Fuel: Fuel includes anything that burns – trees, shrubs, grass, homes, fences, sheds, and other vegetation and structures. Fine fuels, such as dead grass and pine needles, spread fire faster than coarse fuels, such as dead twigs and branches.

- *Surface fuels* include dry grass, shrubs, pine needles, dead branches and twigs. Surface fires tend to be relatively low-intensity fires, but homes are at risk if there are continuous fuels that can burn right up to the house.
- *Ladder fuels* include tall brush, low branches, and other fuels that can carry fire from a low-intensity ground fire up into the tops of the trees, known as the crowns or canopies.
- *Crown fuels* are flammable tops of trees and tall shrubs, also called canopies. Once a wildfire becomes a crown fire, it spreads rapidly and reaches extreme intensity. Research suggests that homes must be within 100 feet of the flames to be directly ignited by a high-intensity crown fire, and breaks in tree canopies, such as roads and utilities, frequently keep high-intensity crown fire from directly reaching communities. During a high-intensity wildfire, homes are far more likely to be threatened by firebrands (burning embers) that can be carried more than a mile by strong winds and start separate fires that lead right up to the home.

Weather: Dry, windy weather contributes significantly to the spread of wildfire. Drought conditions accompanied by low humidity lead to dry vegetation that burns easily. Wind can cause wildfires to grow quickly, to die down, or to change direction. Wind can also carry firebrands long distances — up to a mile or more.



Terrain: Generally, fire moves more quickly uphill and has longer flames than on level ground or when spreading downhill. Even the direction of the slope and how much sunlight or wind an area receives can impact fire behavior.

Burning embers can be carried more than a mile by strong winds.

Continuous fuels that lead right up to the house can put homes at risk.

FIREWISE COMMUNITIES

Hazard Assessment

Fire history is not a reliable indicator of fire hazard. For example, lack of recent wildfires may lead to a buildup of dry vegetation, and therefore could become a contributor to intense fire conditions. Or, a recent high-intensity fire may have removed vegetation and perhaps reduced the chances for high-intensity fire for decades to come.

The following pages outline a number of steps you, your family, and your community can take to prepare for potential wildfires. The first step is to look at the climate, vegetation, and terrain of your community to determine the hazards facing your property. The following categories are general descriptions of hazards that will help guide you when deciding how to best protect your home. Not all characteristics must be present. The category that most closely resembles the characteristics of your area determines your hazard level. For information about hazard assessment of your area, contact your local fire department or state forestry office.

Low Hazard Areas:

- *Vegetation:* Limited wildland. Forest and other heavy vegetation is not continuous and is interspersed with urban development. Area contains primarily short grass, low shrubs, light herbaceous (nonwoody) plants, such as groundcover, bedding plants, and perennials, and deciduous trees, such as aspen, poplar, maple, oak, and beech.
- *Weather:* Humid climate with a short dry season. May experience hot, dry, windy conditions, but not necessarily every year.

Moderate Hazard Areas:

- *Vegetation:* Wildland continuous around and throughout the community. Tall, heavy grass; small, flammable shrub species; and broadleaf evergreens.
- *Weather:* Periods of dry, windy conditions at least once a year. Climate includes a dry season or is in a prolonged drought.

High Hazard Areas:

- *Vegetation:* Dense vegetation surrounding the community; high-flammability vegetation and tree canopies; medium to tall evergreen broadleaf and coniferous shrubs.
- *Weather:* Multiple occurrences of dry, windy conditions throughout the year. Area in a prolonged drought, or dry climate with a dry season that lasts more than three months.

All Areas:

Regardless of vegetation, weather, and terrain, the following conditions put any home at risk if a wildfire ignites in the area:

- Flammable roof (See “Firewise Home Construction”).
- Flammable materials within five feet of the home such as high-flammability plants or dried leaves and pine needles.
- Continuous path of fuels within 10 feet of the home. More materials burning close to each other will lengthen the flames and cause a higher risk of igniting the home (see “A Lean, Clean, and Green Landscape”).
- Firewood piles within 30 feet of the home.
- Flammable attachments, such as wood boardwalks, decks, fences, utility buildings. If it is attached to the house, consider it part of the house.

For information about hazard assessment of your area, contact your local fire department or state forestry office.

FIREWISE COMMUNITIES

A Lean, Clean, and Green Landscape

Firewood and Propane Tanks: During cold wet seasons, it is generally acceptable to stack firewood near the home for easy access. However, during dry seasons, firewood should be kept at least 30 feet from the home. If it must be kept closer to the home, consider storing it in a fire-resistant container with an incline on the lid. Be sure to keep the area around the container clear of debris. Propane tanks should be kept 30 feet from the home or at the distance designated by local fire codes, whichever is greater. Be sure there are no flammable materials around it, such as firewood or dead leaves.

Landscaping is among the first elements of a home that others notice. The balance of colorful plants, trees, shrubs, rocks, mulch, and other landscaping materials helps establish a home's personality, and it can enhance the beauty and value of any property. If managed effectively, landscaping can also serve as a fuel break, protecting a home in the event of a wildfire.

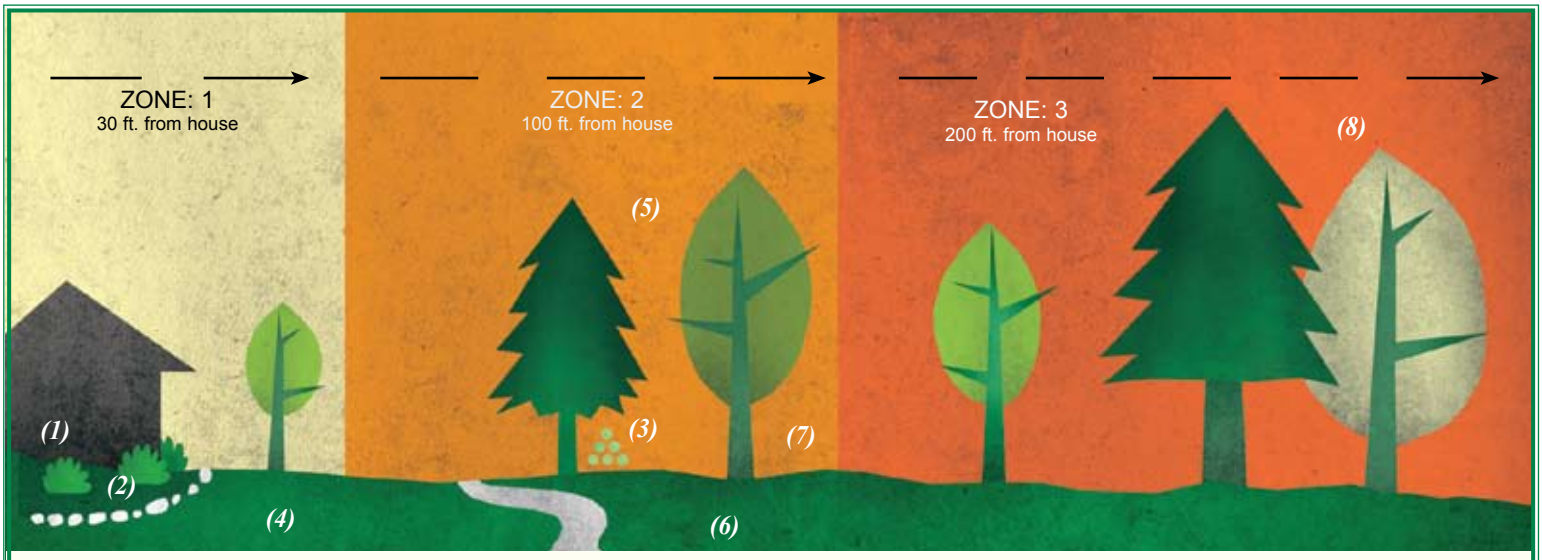
The primary goal for Firewise landscaping is fuel reduction — limiting the level of flammable vegetation and materials surrounding the home and increasing the moisture content of remaining vegetation. Firewise landscaping also allows plants and gardens to reveal their natural beauty by leaving space between individual and groups of plants and trees.

Whether conducting regular maintenance on existing landscaping or designing a new setting, the following tips can help homeowners prepare the area surrounding the home for an intense wildfire.

Consider the entire "home ignition zone," which extends up to 200 feet from the home in high hazard areas. Firewise Communities divides this area into three zones, depending on the hazard level for your area. Assess your landscaping several times a year to ensure that it is lean, clean, and green.

"Firewise measures can help make homes and landscapes as beautiful as they are safe. Today's fire-resistant building materials can be attractive and complement the area's culture and style, and Firewise landscaping techniques can actually improve the aesthetic quality of your home by clearing out dry and dead vegetation and allowing space between trees and plants."

Michele Steinberg, Firewise Communities Program Manager
NATIONAL FIRE PROTECTION ASSOCIATION



ZONE 1: 30 feet adjacent to the home (All Hazard Areas)

For all hazard levels, this area should be well-irrigated and free from fuels that may ignite your home, such as dry vegetation, clutter, and debris. Flammable attachments to the home, such as wooden decks, fences, and boardwalks, are considered part of the house. The perimeter should extend 30 feet beyond these attachments.

Lean

- Plants in this area should be limited to carefully spaced plantings that are low-growing and free of resins, oils, and waxes that burn easily. For a list of low-flammability vegetation for your area, contact your state forester, forestry office, or local landscape specialist. *(1)*
- Mow the lawn regularly. Prune all trees so the lowest limbs are at least six to 10 feet from the ground.
- Space flammable conifer trees 30 feet between crowns to reduce the risk of crown fire. Remember, trees that hang over the house will deposit leaves and branches on the house and immediate area.
- Within five feet of the home, use nonflammable landscaping materials, such as rock, pavers, annuals, and high-moisture-content perennials. Be sure to remove dead leaves and stems immediately.

Clean

- Remove dead vegetation, such as leaves and pine needles from gutters, under your deck, and within 10 feet of your home. Be sure to keep the area clean of flammable debris. *(2)*
- This is generally where patio furniture, swing sets, and other accessories are located. If you live in a moderate to high hazard area, consider fire-resistant material for these accessories, and be sure to keep the area around them clear of debris. Keep patio cushions inside the house when not in use during periods of high fire potential.
- Firewood stacks and propane tanks should not be located in this area. Keep them at least 30 feet from the home. *(3)*

Green

- Water plants and trees regularly to ensure that they are healthy and green, especially during the fire season. Mulch should also be kept watered, as it can become flammable when dry. *(4)*
- Consider xeriscaping, especially in areas with low water supply and/or water-use restrictions. Xeriscaping is a popular method for conserving water through creative use of landscaping features that are fire-resistant, yet require limited irrigation. Contact your local nursery or landscape architect for more information.

ZONE 2: 30 to 100 feet from the home (Moderate and High Hazard Areas)

For moderate and high hazard areas, Zone 2 extends 30 feet to 100 feet from the home. Plants in this zone should be low-growing, well-irrigated, and less flammable.

- Leave 30 feet between clusters of two to three trees, or 20 feet between individual trees. *(5)*
- Encourage a mixture of deciduous and coniferous trees. Most deciduous trees do not support high-intensity fires.
- Give yourself added protection with “fuel breaks,” such as driveways, gravel walkways, and lawns. *(6)*
- Prune trees so branches and leaves are at least 6 to 10 feet above the ground. Remove heavy accumulations of woody debris. *(7)*

ZONE 3: 100 to 200 feet from the home (High Hazard Areas)

In high hazard conditions, this area should be thinned out as well, though less space is required than in Zone 2. Remove heavy accumulation of woody debris, such as piles of stem wood or branches. Thin trees to remove smaller conifers that are growing between taller trees. Reduce the density of tall trees so canopies are not touching to reduce the ability for high-intensity crown fire to reach your home. *(8)*

Contact your state forester or landscape specialist for more information about Firewise landscaping.

FIREWISE COMMUNITIES

Firewise Home Construction

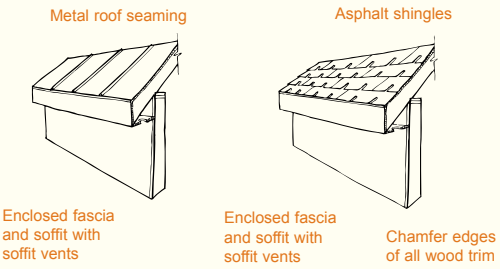
"When considering improvements to reduce wildfire vulnerability, the key is to consider the home in relation to its immediate surroundings, that is, consider the home ignition zone. The home's vulnerability is determined by the exposure of its external materials and design to flames and firebrands during extreme wildfires. The higher the fire intensities within the home ignition zone, and the greater the firebrand exposure from the wildfire, the more you need nonflammable construction materials and a resistant building design."

JACK COHEN,
USDA Forest Service

FIRE SCIENCES LABORATORY
MISSOULA, MONT.

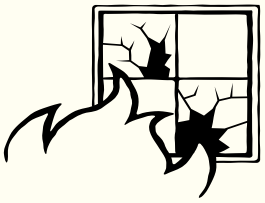
Even if a landscape is designed in perfect compliance with Firewise recommendations, fire may still reach your home. For example, heavy winds can carry firebrands over the tops of trees to land on a roof. If that were to happen to your home, your home's exterior must play an important role in preventing ignitions that could lead to total home destruction. Keep in mind that the home ignition zone includes the home, in relation to its immediate surroundings within 100 to 200 feet.

Use Rated Roofing Material: The roof can be the part of your home most vulnerable during extreme wildfires. If firebrands fall on a roof with untreated, nonrated roofing, the entire roof can ignite, destroying the home. In contrast, roofing material with a Class A, B, or C rating, such as composition shingle, metal, and clay or cement tile, is fire-resistant and will help keep the flame from spreading.



Use Fire-Resistant Building Materials on Exterior Walls: Wall materials that resist heat and flames include cement, plaster, stucco and masonry, such as concrete, stone, brick or block. Though some materials, such as vinyl, are difficult to ignite, exposure to extreme heat causes a loss of integrity. These materials may fall away or melt, providing the firebrands with a direct path into the home. If your home has vinyl siding, use metal screening over openings that will become exposed if the siding falls away.

Use Double-Paned or Tempered Glass: Exposure to the heat of a wildfire can cause glass on exterior windows to fracture and collapse, allowing firebrands to enter the home. Double- paned glass can help reduce this risk by providing an added layer of protection. Tempered glass is the most effective option, as it has a higher heat tolerance and is less likely to break. For skylights, glass is less penetrable than plastic or fiberglass, which can melt at lower temperatures.



Exposure to heat from a wildfire can cause windows to break. Double-paned or tempered glass windows offer added protection

Enclose Eaves, Fascias, Soffits, and Vents: Eaves, fascias, soffits, and vents should be "boxed" or enclosed with metal screens to reduce the size of the openings. Vent openings should be screened to help prevent firebrands or other objects larger than 1/8" from entering your home.

Protect Overhangs and Other Attachments: Overhangs and other attachments, such as room additions, bay windows, decks, porches, carports and fences, are often very vulnerable to flames or firebrands. Remove all fuels from around these areas. Box in the undersides of the overhangs, decks and balconies with noncombustible or fire-resistant materials to reduce the possibility of ignition. Make sure fences constructed of flammable materials, such as wood, don't attach directly to your home. Remember: if it is attached to house, it's part of your house.

FIREWISE COMMUNITIES

Firewise Communities/USA

Firewise community projects can be as varied as residents' imaginations. Following are just a few examples of what neighborhoods can do to protect their communities.

Host a "Chipping Day" for residents to remove excess vegetation from their property, as well as community property.

Conduct Firewise landscaping and construction information sessions at a local home improvement retailer.

Modify homeowner association covenants to include Firewise concepts.

Enlist local fire staff to conduct a wildfire hazard overview at a community meeting.

Distribute Firewise information at community festivals. Include homeowner tips in community newsletters.

Firewise Communities/USA

In addition to preparing your home and family for potential wildfires, consider working with your neighbors to prepare your entire community. When a community has taken preemptive measures to prepare homes to survive a wildfire, the fire service is able to focus resources on the main body of the fire instead of individual structures.

In cooperation with National Association of State Foresters (NASF), Firewise Communities has developed a nationwide program to recognize communities that maintain an appropriate level of fire readiness.

Working with local wildland fire staff, fire-prone communities can earn Firewise Communities/ USA status by meeting the following criteria:

- Enlist a wildland/urban interface specialist to complete a community assessment, and create a plan that identifies agreed-upon achievable solutions to be implemented by the community.
- Sponsor a local Firewise Task Force Committee, Commission or Department that maintains the Firewise Communities/ USA program and tracks its progress or status.
- Observe a Firewise Communities/USA Day each spring that is dedicated to a local Firewise project.
- Invest a minimum of $2 per capita annually in local Firewise projects. (Work by municipal employees or volunteers using municipal and other equipment can be included, as can state/federal grants dedicated to that purpose.)
- Submit an annual report to Firewise Communities/USA that documents continuing compliance with the program.

This program is of special interest to small communities and neighborhood associations that are willing to mitigate against wildfire by adopting and implementing programs tailored to their needs. The communities create these programs themselves with cooperative assistance from state forestry agencies and local fire staff. Contact your state forestry office or visit the Firewise Communities/USA Web site *(www.firewise.org/usa)* to find out more about how to begin the assessment process.

"The collaboration among the governmental agencies and our community has been remarkable. Representatives from the city, county, state and national government offered information, but no edicts. They were so willing to share their expertise, but they also were sensitive to the fact that the property being addressed is private and that we, as owners, would be making all the decisions. The Firewise program here in Hyde Park is a terrific example of government and citizenry working together with full cooperation."

Sally Butler, Resident
HYDE PARK ESTATES — SANTA FE, N.M.

Firewise is a Program of the National Fire Protection Association which provides wildland/urban interface resources for firefighter safety, community planning, landscaping, construction, and maintenance to help protect people, property, and natural resources from wildland fire. Web site visitors can view streaming video; online learning courses, download checklists, school education materials, and other information; browse an extensive list of helpful links; and use a searchable library of national, state, and local documents on a wide range of wildfire safety issues. Communities can also contact Firewise staff for assistance in hazard planning and mitigation.

National Fire Protection Association | *www.nfpa.org*
National Firewise Communities Program | *www.firewise.org*

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INFORMATION SHEET 7
OCTOBER 2005

Invasive Plants in Maine Forests

Maine Forest Service, DEPARTMENT OF CONSERVATION, 22 State House Station, Augusta, ME 04333

What are Invasive Plants?

Invasive plants are able to grow rapidly and aggressively enough to out-compete and displace locally adapted native plants. Many species of invasive plants, but not all, have been brought by people to North America from Europe and Asia.

Why are Invasive Plants a Concern?

Invasive plants can make it difficult to achieve many of the objectives that landowners commonly have for their woodlands. For example, invasive plants compete for resources with desired tree species, especially young seedlings. This can make it difficult to establish new seedlings to replace the larger trees when they die or are harvested. Some invasive plants, particularly species of vines, such as Asiatic bittersweet, can even kill valuable mature trees by smothering or strangling them. Other species, such as Japanese barberry, often form dense thorny thickets. These thickets can make it nearly impossible to access the woods for work or enjoyment. Because invasive plants can out-compete native species, they can also lead to a reduction in the diversity of species present in the forest.

What Makes a Plant Invasive?

Not all non-native species of plants are invasive; in fact many non-native species never escape from cultivation. Of the species that do escape into the wild most never become invasive. Botanists use what is called the "tens" rule to describe how many plant species are likely to become invasive. According to the tens rule only one in ten non-native species is likely to escape into the wild. Of those that escape, only one in ten is likely to become invasive. Certain species of plants have characteristics that make them more likely to become invasive. In general, invasive plants have most of the following characteristics:

- They are habitat generalists, able to invade a range of sites;
- Their seeds germinate early and they leaf out before native plants;
- They out-compete native plants through shading and nutrient competition;
- They have few, if any, natural predators here;
- They reproduce both sexually and vegetatively;
- They have long flowering and fruiting periods and produce many seeds;
- They are pollinated by wind or by generalist pollinators; and/or,
- Their seeds are dispersed over long distances (e.g., by birds, wind, water or people).

What Invasive Plants Species are Causing Problems in Maine Forests?

Although there are many species of plants that are considered invasive in Maine, there are a few species that are of particular concern in the forest. These species include:

- Japanese barberry (*Berberis thunburgii*)
- Honeysuckle (*Lonicera* sp.)
- Asiatic bittersweet (*Celastrus orbiculatis*)
- Common buckthorn (*Rhamnus carthatica*)
- Glossy buckthorn (*Frangula alnus*)
- Autumn olive (*Elaeagnus umbellata*)

Many of these species already are causing serious problems, particularly in southern and coastal Maine and the islands. Norway maple (*Acer platanoides*) is another species of concern. Currently, it is mostly a problem around cities and towns, but it has the potential to become more widely established. Some of these invasive species, such as the honeysuckles, Asiatic bittersweet and autumn olive are particularly problematic along forest edges and in young forest stands. Others such as the buckthorns and Japanese

barberry are able to invade the understories of undisturbed mature forests.

How Can I Keep My Woods From Being Invaded?

Learn to identify invasive plant species. There are many excellent sources available to help you identify invasive plants. Fact sheets on the species listed in this information sheet, as well as, additional species of concern are available from the Maine Natural Areas Program website or by phone or mail request:

http://www.mainenaturalareas.org/docs/program_activities/invasive_plants_factsheets.php

157 Hospital Street
State House Station #93
Augusta, Maine 04333
(207) 287-8044

Don't plant invasive species in your woodlands or near the edges of your yard. Many invasive plants are still sold legally by nurseries. Know which plants are invasive and don't plant them near the wild lands. The University of Maine Cooperative Extension maintains a list of nurseries that sell native landscaping plants. The list can be accessed at the following website or by contacting your county extension office:

http://www.umext.maine.edu/onlinepubs/htmpubs/2502.htm

Get ahead of the invasion. Once invasive plants are well established getting rid of them can be very difficult and costly. Therefore, prevention and early detection are key to keeping the invaders at bay. Because invasive plants are so aggressive, they tend to occupy disturbed areas more rapidly than native species. Therefore, it is particularly important to determine if there are invasive plants present in the forest understory *before creating a disturbance such as a timber harvest*. Identifying and removing a few individuals of an invasive species before a harvest could prevent a full-scale invasion later on.

How Can I Control Invasive Plants in My Woods?

There are two primary methods of controlling invasive plants; mechanical and chemical.

Mechanical control involves cutting and or pulling up the undesirable plants. Mechanical control is most effective when entire plants, including the roots, are removed. Mechanical control is best suited to situations with few plants where a thorough job can be done. Before using mechanical control, check on which method is most effective for the target species.

Chemical control involves the use of an herbicide to kill the plants. An advantage of chemical control is the proper herbicide, properly applied, can kill the entire plant. Some types of herbicide may only be applied by licensed pesticide applicators, but many are available to the general public. Information on the laws and rules governing pesticide use in Maine can be obtained from the board of pesticide control:

(207) 287-2731
http://www.maine.gov/agriculture/pesticides/laws/index.htm

The labels on all herbicide containers contain information on what types of plants they control, how to apply them and the necessary safety precautions that you must take when using them. ***ALWAYS READ THE LABEL AND FOLLOW THE DIRECTIONS WHEN USING ANY HERBICIDE!*** Different types of herbicide are designed to kill different types of plants, so reading the label is essential to be sure you are using the correct type. Improper application can harm or kill desirable native plants along with the targeted invasive species. For controlling woody invasive species, the mechanical control and chemical control methods can also be combined. The combined method involves cutting the invasive plants and then applying an herbicide to the cut stumps. This kills the roots and prevents sprouting.

Can I Get Help Controlling Invasive Plants in My Woodlot?

Landowners with more than 10 acres of forestland who have a qualifying stewardship forest management plan are eligible to apply for cost share money to help pay for invasive plant control in their forests. Contact your nearest Maine Forest Service District Forester for more information on these programs.

For more information, please contact:
Maine Forest Service
DEPARTMENT OF CONSERVATION
22 State House Station
Augusta, ME
04333-0022
(207) 287-2791 or
1-800-367-0223
forestinfo@maine.gov

Be Woods Wise!
Practical advice for your land and trees from the Maine Forest Service.

www.maineforestservice.gov

Enclosure 2. Internet Resources

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Internet Resources

Federal

- National Fire Incident Reporting System (http://www.nfirs.fema.gov/)
- National Interagency Fire Center (http://www.nifc.gov/index.html)
- National Oceanic and Atmospheric Administration National Weather Service Forecast Office for Rangeley, Maine (http://forecast.weather.gov/MapClick.php?site=gyx&FcstType=graphical&MapType=3&site=gyx&CiTemplate=1&map.x=173&map.y=89)
- National Oceanic and Atmospheric Administration National Weather Service storm Prediction Center, Fire Weather Outlooks (http://www.spc.noaa.gov/products/fire_wx/overview.html)
- National Park Service, Northeast Region (http://www.nps.gov/nero/)
- U.S. Fire Administration (http://www.usfa.fema.gov/)
- U.S. Forest Service, Fire and Aviation Management (http://www.fs.fed.us/fire/)
- U.S. Forest Service, Incident Command System Forms (http://www.fs.fed.us/fire/planning/nist/ics_forms.htm)
- Wildland Fire Leadership Council (http://www.forestsandrangelands.gov/leadership/)

State

- Maine Department of Public Safety, Office of State Fire Marshall (https://maine.gov/dps/fmo/index.htm)
- Maine Emergency Management Agency, Fire Safety and Prevention: Wildland Fires (http://www.maine.gov/mema/prepare/prep_print.shtml?id=163445)
- Maine Forest Service (http://www.maine.gov/doc/mfs/)
- Maine Forest Service, Be Woods Wise (http://www.maine.gov/dacf/mfs/policy_management/woodswise/index.html)
- Maine Forest Service, Wildlife Danger Report (http://www.maine.gov/dacf/mfs/wildfire_danger_report/index.html)
- Maine Forest Service, Forest Policy and Management Information Sheets (http://www.maine.gov/dacf/mfs/policy_management/information_sheets.html)
- Maine State Police (http://www.maine.gov/dps/msp/)

Local

- Franklin County Emergency Management Agency (http://www.franklincountyema.org/db/)
- Franklin County Sheriff's Department (http://franklincountyso.net/wp/?page_id=39)
- Town of Rangeley (http://www.maine.gov/local/town2.php?t=Rangeley)

Navy

- Navy Fire and Emergency Service Program, Chief of Naval Operations Instructions 11320.23G (http://doni.daps.dla.mil/Directives/11000%20Facilities%20and%20Land%20Management%20Ashore/11-300%20Utilities%20Services/11320.23G.pdf)

Other

- Forests and Rangelands (http://www.forestsandrangelands.gov/)
- National Fire Protection Association Firewise Communities Program (http://www.firewise.org/about.aspx)
- National Wildfire Coordination Group (http://www.nwcg.gov/pms/pms.htm)

APPENDIX J

SERE School Natural Resources Project Implementation Schedule

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Table J-1. SERE School Natural Resources Project Schedule, Redington Township, Franklin County, Maine.

Project No.[1]	Management Areas[1]				Project Description	INRMP Section	Schedule (FY[1])	Prime Legal Drivers / Initiatives[2]	Navy ERL[1, 3]	Cost Estimate	Funding Sources[4]
	LA	FW	FO	OR							
1	X				Conduct a **delineation of all surface waters** at the SERE School (Installation), to include wetlands and streams at a minimum.	3.1.1.2	2014	A, B, C, F	3		AO
2	X				Conduct an **assessment of potential riparian buffer restoration or enhancement areas**. Where riparian restoration or enhancement opportunities exist, such as at the Alpha and Multi-Purpose Building sites, along roads, and along Redington Stream, use bioengineering techniques to stabilize compromised streambanks and plant using native species.	3.1.1.2	2015	C, D, E, F	2		AO, FR, Non-DoD
3	X				Conduct **annual erosion surveys** to identify soil erosion problem areas. These surveys should focus on the identification of areas of erosion along roadways, trails and footpaths, and areas of ground disturbance adjacent to and along edges of wetlands and surface waters; inspection of previously identified problem areas; and inspection of recently constructed erosion and sedimentation remediation areas.	3.1.1.3	Annual	C, D, F	3		AO, Non-DoD, OM&N
4	X				Develop and implement **erosion remedial and preventive measures** to protect water quality and ensure shoreline stabilization, based on annual survey results (Project 3) and previous streambank assessments.	3.1.1.3	Annual	C, D, F	3		AO, Non-DoD, OM&N
5	X			X	Prepare and implement an **erosion control plan** for all earth-disturbing activities. The plan will incorporate the results of annual erosion surveys (Project 3) and previously completed streambank assessments, and will include erosion remedial and preventive measures to protect water quality and ensure streambank stabilization. The plan will include training materials for SERE School personnel including recommendations for conducting trail maintenance and best management practices (BMPs) to use during construction and ground-disturbing activities.	3.1.1.3 and 3.4.2	As needed	C, D, F	3		AO, Non-DoD, OM&N

Project No.[1]	Management Areas[1]				Project Description	INRMP Section	Schedule (FY[1])	Prime Legal Drivers / Initiatives[2]	Navy ERL[1, 3]	Cost Estimate	Funding Sources[4]
	LA	FW	FO	OR							
6	X	X			A **water quality baseline inventory**, to include inventory of surface waters that may support Atlantic salmon (*Salmo salar*), shall be designed and implemented for the SERE School in accordance with existing United States Department of the Navy (Navy) water quality monitoring protocols. Specific protocols for the SERE School shall be established to assure that water quality does not drop below natural levels and water quality is maintained to provide quality habitat for Atlantic salmon.	3.1.1.3 and 3.2.2	2014	B, C, D, H	3		AO, FR, Non-DoD
7	X				Conduct a **natural community type survey** of the SERE School to ground-truth available geographic information system (GIS) data of the vegetative community types present, and to collect additional natural community type data based on current scientific information.	3.1.2	2015	A, B	3		AO, FR, Non-DoD
8	X				Conduct a survey to establish a **baseline inventory of edible plants** at the Installation, especially in training areas. Conduct follow-up surveys at least every five years of known edible plant areas to identify positive and negative trends associated with these resources.	3.1.2	2014	A, B	3		AO, Non-DoD
9	X				Conduct **annual site surveys to proactively identify new occurrences of invasive species and to monitor restoration sites for growth**. An annual survey of the SERE School waterbodies also should be conducted to evaluate the presence of invasive aquatic species, such as Eurasian milfoil (*Myriophyllum spicatum*) and hydrilla (*Hydrilla verticillata*). If these or other invasive aquatic species are identified, coordinate with Maine Department of Environmental Protection to determine if actions to remove these species are necessary.	3.1.2	Annual	A, B	2		AO, FR, Non-DoD
10	X				**Develop a plan to remove and restore areas infested with invasive plant species**, including terrestrial and aquatic species identified in Project 9. For small stands, it is preferred that all aboveground biomass as well as the underground rhizome by which they spread be manually removed. If manual removal is not feasible, stands should be treated with an approved herbicide such as glyphosate.	3.1.2	2015	A, B	2		AO, FR, Non-DoD

Project No.[1]	Management Areas[1]				Project Description	INRMP Section	Schedule (FY[1])	Prime Legal Drivers / Initiatives[2]	Navy ERL[1, 3]	Cost Estimate	Funding Sources[4]
	LA	FW	FO	OR							
11	X		X		Upon completion of the updated forest characterization assessment (see Project 34), a **forest management plan** will be developed in coordination with the Maine Forest Service to include management of dense forest conditions (including salvage of downed trees and debris for firewood, timber sales, and reducing the risk of wildland fire), identification of areas containing abundant edible plants, and management of forest resources in response to natural disturbances. During their review of this INRMP, the USFWS Umbagog NWR also expressed interest in providing guidance and recommendations to the Navy for development and implementation of the forest management plan.	3.1.3 and 3.3.1	2016	A, B	1		AO, FR, Non-DoD, OM&N
12	X	X			Conduct a comprehensive **vernal pool survey** of the SERE School using Maine Department of Inland Fisheries and Wildlife (MDIFW) protocols. Survey should include identification of all potential vernal pools using a combination of desktop review and site visits to ground-truth and survey each potential vernal pool. Survey should be conducted during the appropriate survey window as determined by MDIFW to record evidence of use by breeding, obligate vernal pool species. Recording unique features of the pools, photographic documentation, and GIS mapping of each pool also should be conducted.	3.1.4 and 3.2.2	2014	A, B, H	3		AO, FR, Non-DoD
13	X				Conduct **a plant survey and habitat assessment within the appropriate season for rare, threatened, endangered, or special concern plant species** with the potential to occur at the Installation.	3.1.9	2014	A, B	3		AO, FR, Non-DoD
14	X	X	X		**Establish partnerships** with state and federal agencies, non-governmental organizations, and/or universities to promote the conservation and study of natural resources at the SERE School. Potential partners include the North Atlantic Landscape Conservation Cooperative, National and Maine Audubon Society chapters, Institute for Bird Populations, The Nature Conservancy, The Wilderness Society, and the Vermont Center for EcoStudies.	3.1.10, 3.2.5, and 3.3.2	2014	A, B, G, H	1		AO, FR, LP, Non-DoD

Project No.[1]	Management Areas[1]				Project Description	INRMP Section	Schedule (FY[1])	Prime Legal Drivers / Initiatives[2]	Navy ERL[1, 3]	Cost Estimate	Funding Sources[4]
	LA	FW	FO	OR							
15	X	X	X		Conduct a **climate change vulnerability assessment** in partnership with other United States Department of Defense installations, federal and state agencies, non-governmental organizations, and/or universities. The assessment should focus on future climate change projections, impacts of altered species' distribution patterns, and variations in ecological processes such as drought, fire, and flood for Navy installations located in Maine.	3.1.10, 3.2.5, and 3.3.2	2015	A, B, H	2		AO, FR, LP, Non-DoD
16	X	X	X	X	Develop an **environmental awareness program** focused on educating and training SERE School and Public Works Department–Maine (PWD-ME) personnel on protection of natural resources topics including implementing BMPs for erosion control and trail maintenance, wetland protection, management of nuisance wildlife, and protection of rare, threatened, endangered, and special concern plant and wildlife species known to occur.	3.1.11, 3.2.7, 3.3.3, 3.4.2, and 3.4.3	2014	A, B, C, F, G, H	2		AO, FR, LP, Non-DoD, OM&N
17	X		X	X	Provide periodic **training for SERE School personnel and PWD–ME environmental staff regarding implementation of erosion and sediment control measures and use of effective BMPs**. Maine Department of Environmental Protection provides annual erosion and sediment control courses.	3.1.11, 3.3.3, and 3.4.2	Every two years	A, B, C, D, E, F	2		AO, Non-DoD, OM&N
18	X				Provide **training for environmental and grounds maintenance staff for identification of wetlands, and for avoiding impacts to key vegetation species and wetland habitats** identified for conservation and protection.	3.1.11	Every two years	A, B, C, D, E, F	2		AO, FR, Non-DoD
19	X	X	X		Provide **professional training for PWD-ME environmental staff to include Field Techniques for Invasive Plant Management, Conservation Biology** (both courses offered at the National Conservation Training Center), **and Pest Applicator Certification** Training (offered by the Armed Forces Pest Management Board).	3.1.11, 3.2.7, and 3.3.3	Annual	A, B, C, F	2		AO, FR, Non-DoD
20	X	X	X	X	Work with the Naval Facilities Engineering Command Mid-Atlantic GeoReadiness Center to **develop a GIS system for storing SERE School natural resources data**.	3.3.4, 3.2.8, 3.3.4, and 3.4.5	2014	A, B	2		AO
21	X	X	X	X	Provide **training to environmental staff to maintain the SERE School GIS database**.	3.3.4, 3.2.8, 3.3.4, and 3.4.5	Annual	A, B	2		AO

Project No.[1]	Management Areas[1]				Project Description	INRMP Section	Schedule (FY[1])	Prime Legal Drivers / Initiatives[2]	Navy ERL[1, 3]	Cost Estimate	Funding Sources[4]
	LA	FW	FO	OR							
22		X			Conduct **baseline surveys to assess the presence of mammals and invertebrates** at the SERE School. Survey methods should yield a comprehensive species list and representative data for the diversity and relative abundance of mammals and invertebrates occurring at the SERE School.	3.2.1	2014	A, B, G	2		AO, FR, Non-DoD
23		X		X	Conduct a **deer population survey** to determine if populations would support development of a hunting program at the SERE School.	3.2.1 and 3.4.2	2014	A, B	1		AO, FR, Non-DoD
24		X		X	Using the results of the baseline mammal survey (Project 23) and the deer population survey (Project 24), work with the SERE School Command to **determine if a hunting program can be developed** for the SERE School.	3.2.1 and 3.4.2	2015	A, B	1		AO, FR, Non-DoD
25		X		X	Work with the SERE School Officer in Charge to **develop a fishing instruction** for the SERE School to include restrictions, MDIFW fishing regulations, and catch and size limits.	3.2.2 and 3.4.2	2014 and then every five years, or more frequently as needed	A, B, H	1		AO, FR
26		X			Conduct **periodic surveys during the appropriate season for rare, threatened, endangered, and special concern mammal species**, for species known or with the potential to occur at the Installation.	3.2.3.3	2014 and then every five years, or more frequently as needed	A, B, H	3		AO, FR, Non-DoD
27		X			Conduct **periodic surveys during the appropriate season for rare, threatened, endangered, and special concern bird species** known or with the potential to occur at the Installation.	3.2.3.3	2014 and then every five years, or more frequently as needed	A, B, G, H	3		AO, FR, Non-DoD
28		X			Conduct **periodic surveys during the appropriate season for rare, threatened, endangered, and special concern invertebrate species** known or with the potential to occur at the Installation. Survey should include terrestrial and aquatic invertebrate species and habitats that support these species, and identification of habitat that directly supports pollinators.	3.2.3.3	2014 and then every five years, or more frequently as needed	A, B, H	3		FR, AO, Non-DoD
29		X			Work with the Maine Atlantic Salmon Commission to develop and implement an **Atlantic salmon habitat protection program**.	3.2.3.3	2014	A, B, H	3		AO, FR, LP, Non-DoD

Project No.[1]	Management Areas[1]				Project Description	INRMP Section	Schedule (FY[1])	Prime Legal Drivers / Initiatives[2]	Navy ERL[1, 3]	Cost Estimate	Funding Sources[4]
	LA	FW	FO	OR							
30		X			The Navy will work with U.S. Fish and Wildlife Service and the Maine Atlantic Salmon Commission to **determine whether Redington Pond dam should be removed** to improve on and offsite habitat conditions for native fish species, including Atlantic salmon.	3.2.3.3	2014	A, B, H	3		AO, FR, LP, Non-DoD
31		X			Conduct periodic **golden eagle (*Aquila chrysaetos*) monitoring** within suitable habitat at the SERE School. If golden eagle nest locations are identified, global positioning system information for these sites will be shared with the cooperating natural resource agencies (i.e. U.S. Fish and Wildlife Service, MDIFW) as appropriate.	3.2.3.3	2014 and then every three years	A, B, G, H	3		AO, FR, Non-DoD
32		X			Establish a **partnership with Maine and National Audubon Society chapters to conduct surveys and monitoring of rusty blackbird (*Euphagus carolinus*) populations** at the SERE School.	3.2.3.4	2014	A, B, G	3		AO, FR, LP, Non-DoD
33		X			Conduct **biannual monitoring, or more frequently as needed, of invasive and nuisance wildlife** including beavers, bats, moose, and bear to determine whether wildlife removal, relocation, or other remedial actions are necessary to protect natural resources and/or human health and safety.	3.2.4	Biannual	A, B, C, F	2		AO, FR, Non-DoD, OM&N
34			X		Conduct an **update of the 1998 basic characterization for SERE School forest types**. The updated forestry survey should include delineation of each stand type, which is an easily defined area of the forest containing the same species mixture with similar heights, ages, diameters, densities, soils, health, or other unifying characteristics (Maine Department of Agriculture, Conservation and Forestry, Maine Forest Service 2012). Data collected during the field assessment should include dominant and common tree species, sizes, age class, absolute density, soils, topography, key habitat features, and any other distinctive features.	3.3.1	2014	A, B	2		AO, FR, Non-DoD

1 – ERL = Environmental Readiness Level; FO = Forestry; FW = Fish and Wildlife; FY = Fiscal Year; LA = Land Management; No. = Number

2 – A = Chief of Naval Operations Instruction 5090.1C, Change 1; B = Sikes Act Improvement Act, as amended; C = Clean Water Act; D = Soil and Water Conservation Act, as amended; E = Executive Order 11988, *Floodplain Management*; F = Executive Order 11990, *Protection of Wetlands*; G = Migratory Bird Treaty Act; H = Federal Endangered Species Act of 1973 (16 United States Code Section 1531 et seq.)

3 – ERL 4 = compliance requirement; ERL 3 = Navy proactive involvement; ERL 2 = Navy or DoD policy requirement; ERL 1 = Navy environmental stewardship

4 – AO = Agricultural Outleasing Funds; FR = Forestry Revenues; LP = Legacy Program; Non-DoD = Non-Department of Defense Funds; OM&N = Operations and Maintenance, Navy (Environmental Fund)

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APPENDIX K

Department of Defense INRMP Template Crosswalk Table

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Table K-1. Cross-Reference of *Integrated Natural Resources Management Plan* Guidance for Navy Installations to DoD INRMP Template

DoD *Integrated Natural Resources Management Plan* Template	Cross – Reference to SERE School Table of Contents
Title Page	**Title Page**
Signature Page	**Signature Page**
Executive Summary	**Executive Summary**
Table of Contents	**Table of Contents**
1. Overview	**1.0 Introduction**
a. Purpose	1.1 Purpose and Authority
b. Scope	1.0 Introduction; 1.4.2 History, and 2.0 Existing Conditions
c. Goals and Objectives	1.2 Goals and Objectives
d. Responsibilities	1.3 Responsibilities
(1) Installation stakeholders	1.3.1 Internal stakeholders
(2) External stakeholders	1.3.2 External stakeholders
e. Authority	1.1 Purpose and Authority
f. Stewardship and Compliance	5.5 Project Development and Classification
g. Review and Revision Process	Plan Updates (Pre – Executive Summary)
h. Management Strategy	1.5 Overview of Natural Resources Management
i. Other Plan Integration	1.10 INRMP Integration with other Plans
2. Current Conditions and Use	**2.0 Existing Conditions**
a. Installation Information	1.4.1 Location and 2.1 Site Details
(1) General Description	1.4.1 Location and 2.1 Site Details
(2) Regional Land Uses	2.2.5 Regional Land Use and 2.2.13 Regional Conservation Lands
(3) Abbreviated History and Pre-Military Land Use	1.4.2 History
(4) Military Mission	1.4.3 Military Mission
(5) Operations and Activities	1.0 Introduction, 1.2 Site Details, and 1.4.3 Military Mission
(6) Constraints Map	1.6 Opportunities and Constraints and Figure 1-2
(7) Opportunities	1.6 Opportunities and Constraints and Figure 1-2
b. General Physical Environment	2.2 Land Resources
	2.2.1 Physiographic Location
	2.2.2 Natural Disturbance Regimes
	2.2.3 Climate
	2.2.4 Land Use
	2.2.5 Regional Land Use

	2.2.6 Geology, Topography, and Soils
	2.2.6 Water Resources
	2.2.12 Cultural Resources
c. General Biotic Environment	2.2.8 Natural Communities and Vegetation
	2.2.9 Noxious Weeds and Invasive Plants
	2.2.10 Rare Communities and Significant Wildlife Habitat
	2.2.11 Rare, Threatened, and Endangered Plants
	2.3 Fish and Wildlife Resources (Mammals, Birds, Herpetofauna, Fish, Invertebrates, Nuisance and Invasive Wildlife Species, Zoonosis Prevention, and Rare, Threatened, and Endangered Fish and Wildlife)
	2.4 Forestry Resources
	2.5 Outdoor Recreation Resources
(1) T & E Species and Species of Concern	2.2.11 Rare, Threatened, and Endangered Plants and 2.3.7 Rare, Threatened, and Endangered Fish and Wildlife
(2) Wetlands and Deep Water Habitats	2.2.7.4 Wetlands
(3) Fauna	2.3 Fish and Wildlife Resources (Mammals, Birds, Herpetofauna, Fish, Invertebrates, Nuisance and Invasive Wildlife Species, Zoonosis Prevention, and Rare, Threatened, and Endangered Fish and Wildlife)
(4) Flora	2.2.8 Natural Communities and Vegetation and 2.2.11 Rare, Threatened, and Endangered Plants
3. Environmental Management Strategy and Mission Sustainability	**5.0 INRMP Implementation**
a. Supporting Sustainability of the Military Mission and the Natural Environment	5.1 Supporting Sustainability of the Military Mission and the Natural Environment
(1) Integrate Military Mission and Sustainable Land Use	5.1.1 Integration of the Military Mission and Land Use
(2) Define Impact to the Military Mission	5.1.2 Impacts to the Military Mission
(3) Describe Relationship to Range Complex Management Plan or other operation area plan	5.1.3 Relationship of Range Complex Management Plan or Other Operation Area Plans
b. Natural Resources Consultation Requirements	5.2 Natural Resources Consultation Requirements
c. NEPA Compliance	5.4 NEPA Compliance

d. Beneficial Partnerships and Collaborative Resource Planning	1.9 Partnerships and Outreach
e. Public Access and Outreach	1.8 Public Access and 1.9 Partnerships and Outreach
(1) Public Access and Outdoor Recreation	1.8 Public Access and 2.5 Outdoor Recreation
(2) Public Outreach	1.9 Partnerships and Outreach
f. Encroachment Partnering	1.7 Encroachment and Adjacent Land Use
g. State Comprehensive Wildlife Plans	2.3.7 Rare, Threatened and Endangered Fish and Wildlife Species
4. Program Elements	**3.0 Natural Resources Management Programmatic Objectives**
a. T & E Species Management and Species Benefit, Critical Habitat, and Species of Concern Management	3.1.10 Rare, Threatened, Endangered and Special Concern Plant Species Management and 3.2.3 3.1.10 Rare, Threatened, Endangered and Special Concern Fish and Wildlife Species Management
b. Wetlands and Deep Water Habitats	3.1.1 Water Resources Management
c. Law Enforcement of Natural Resources	3.2.6 Conservation Law Enforcement
d. Fish and Wildlife Management	3.2 Fish and Wildlife Management
e. Forestry Management	3.4 Forestry Management
f. Vegetation Management	3.1.2 Vegetation Management and 3.1.5 Rare Communities and Significant Wildlife Habitat Management
g. Migratory Birds Management	3.2.3.4 Migratory Bird Management
h. Invasive Species Management	3.1.3 Noxious Weeds and Invasive Plants Management
i. Pest Management	3.1.3 Noxious Weeds and Invasive Plants Management, 3.1.12 Environmental and Natural Resources Training, and 3.2.4 Invasive and Nuisance Wildlife Species Management
j. Land Management	3.1 Land Management
k. Agricultural Outleasing	Not applicable
l. Geographical Information Systems (GIS) Management, Data Integration, Access, and Reporting	3.1.13 GIS Management, Data Integration, Access, and Reporting
m. Outdoor Recreation	3.4 Outdoor Recreation Management
n. Bird Aircraft Strike Hazard	Not applicable
o. Wildland Fire Management	3.1.4 Wildland Fire Management

p. Training of Natural Resources Personnel	3.1.12, 3.2.7, 3.3.3, and 3.4.4 Environmental and Natural Resources Training
q. Coastal/Marine Management	Not applicable
r. Floodplains Management	3.1.1.1 Watersheds and Floodplains Management
s. Other Leases	3.1.8 Leases
5. Implementation	**5.0 INRMP Implementation**
a. Summarize Process of Preparing Prescriptions that Drive the Projects	4.0 SERE School Natural Resources Programmatic Objectives Management Areas
b. Achieving No Net Loss	5.3 Achieving No Net Loss
c. Use of Cooperative Agreements	5.8 Use of Cooperative Agreements and Partnerships
d. Funding	5.6 Funding Sources

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APPENDIX L

Acceptable Management Practices for Bat Control Activities in Structures - A Guide for Nuisance Wildlife Control Operators. U.S. Fish and Wildlife Service, Hadley, MA.

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A PRODUCT OF THE WHITE-NOSE SYNDROME NATIONAL PLAN

Acceptable Management Practices for Bat Control Activities in Structures

- A Guide for Nuisance Wildlife Control Operators.

White-nose Syndrome Conservation and Recovery Working Group

4/1/2015

Recommended Citation:

White-nose Syndrome Conservation and Recovery Working Group. 2015. Acceptable Management Practices for Bat Control Activities in Structures - A Guide for Nuisance Wildlife Control Operators. U.S. Fish and Wildlife Service, Hadley, MA.

Contents

Acceptable Management Practices for Bat Control Activities in Structures

The purpose of this document is to provide consistent Acceptable Management Practices (AMPs) for nuisance wildlife control operators (NWCOs) to reduce impacts on bats during bat control or removal activities in structures. These guidelines were developed in concert among NWCOs, state and federal agencies, private conservation organizations, and the Centers for Disease Control in response to recent catastrophic population declines and changes to the protection status of many bat species due to white-nose syndrome (WNS). These AMPs are recommended for use with all structure-dwelling bat species, regardless of their conservation status.

NWCOs regularly interface with the public and are an integral voice for bat conservation. NWCOs are also an important resource for information on the size and geographical distribution of bat colonies and are thus encouraged to communicate with their state biologists, regardless of whether a colony is being evicted from a structure or not. State biologists, in turn, can provide additional resources and information on bats to homeowners and cooperating NWCOs.

This document is designed to provide minimum practices for safely addressing human-bat conflicts, while minimizing disturbance to bats and preventing the further spread of WNS. General background information is included on the significance of, threats to, and biology and behavior of bats in order to illustrate the context and justification for these standards. Please contact your state wildlife agency to determine if there are specific details about time-of-year restrictions, regulations, threatened and endangered species laws, and/or permits in the state where you conduct work.

Helpful Definitions:

- *Eviction/venting* refers to the use of one-way doors and exits to remove bats from a structure by utilizing their natural tendency to leave the roost at night.
- *Exclusion* refers to closing gaps and sealing holes to prevent bats from entering or re-entering a structure.

Significance of Bats

A great deal of misinformation exists about bats. NWCOs have an opportunity to educate their clients on the significance of bats to humans and the environment, while dispelling common myths. The following talking points may be useful. *More resources can be found in* ***Appendix B***.

- Bats are important to our ecosystem, and ultimately our economy. Most bat species in the United States eat insects, including those insects that are agricultural, forest, and disease-spreading pests. During the summer, a bat can eat half its body weight in insects each night.

- Bats have inspired scientific advancements for humans including navigational aids for the blind, blood-clot medications, low-temperature surgery, and military sonar.

Bat Myths and Truths

Myth: *Bats are rodents and will cause similar destruction to a structure.*
Truths: Bats are not rodents, but are mammals in the order *Chiroptera*, meaning literally "hand wing". Bats do not nest, chew, or claw their way into a structure, but instead take advantage of structural openings or areas of disrepair on the outside of a building. However, bats do leave droppings and urine in roost areas, which can cause health concerns.

Myth: *Bats have many offspring and their populations are stable.*
Truths: Bats are long-lived and have a low reproductive rate. Bats can live up to 30 years and most species produce only one or two young per year. Therefore, drastic population declines, such as those caused by WNS, are very difficult for bats to recover from.

Myth: *All bats are rabid.*
Truths: Bats are a reservoir for rabies virus, and persons who may have had direct contact with bats should be assessed by a medical provider. The naturally occurring infection rate in bats has been documented at only 1% or less in common structure-dwelling species (Trimarchi, 1977; Pybus, 1986). While human rabies deaths are rare in the United States, bats are typically responsible for 1-3 cases each year. Many times these exposures were either unrecognized or went unreported to health officials, so care should always be taken when potential exposures to bats may occur.

Threats to Bats

Bats are faced with a variety of threats including habitat loss (*e.g.*, loss of roost structures and foraging areas), incompatibility with human technology and development (*e.g.*, pesticide use, wind energy development), and outright persecution by people. The most significant threat to hibernating North American bats in recent years is from the disease WNS, first documented in 2007. The following facts about WNS are useful speaking points when discussing bats with the public.

- WNS is named for the white fungus observed growing around the noses of affected bats (Blehert et al., 2008). This aggressive fungus attacks the exposed skin of bats while they hibernate, resulting in dehydration, unrest, and increased activity (Lorch et al., 2011; Reeder et al., 2007).

- Affected bats quickly burn through stored energy and often die in the caves and mines where they hibernate, or out on the landscape (Turner et al., 2011).

- As of December 2014, WNS has been confirmed in 25 states and five Canadian provinces and the causative fungus, *Pseudogymnoascus destructans*, has been found in three additional states.

- Over 5.7 million bats have been estimated to have died as a result of this disease, which continues to spread (USFWS, 2012).

- Federal and state agencies, as well as universities and private organizations, are working together to track and understand WNS. There is no evidence to suggest that WNS has any direct effect on humans.

- Despite significant advances in understanding this deadly disease, much remains unknown about WNS, its spread, and the long-term consequences of losing significant numbers of bats.

- As a result of the drastic population declines caused by WNS, it has become increasingly important to reduce other sources of bat mortality.

- Aggregations of bats in human structures during summer are almost exclusively females and their young. Negative impacts to the low number of WNS-survivors or their young may significantly alter the rate of population recovery.

- **NWCOs have an opportunity to contribute to the conservation of our remaining bats by following simple guidelines for dealing with bats encountered in structures.**

Bat Biology and Behavior:

The purpose of this information is to guide NWCOs in their understanding of seasonal bat behavior and roosting locations within structures.

Each fall, bats migrate either to warmer climates or to hibernation areas. During this time, bats may use structures as temporary stop-over roosts. Long-distance migratory species may use bouts of torpor, a short state of decreased physiological activity, to save energy, while hibernating species engage in repeated, longer bouts of torpor to save energy in cold climates. Hibernating bat species arrive at their hibernation sites in the fall, typically returning year after year to the same caves, abandoned mines, other underground features, or occasionally buildings, where the climate is favorable and stable. Bats mate during the fall swarming period and build fat reserves for the winter ahead. During torpor and hibernation, a bat's heart rate, respiratory rate, and body temperature decrease to conserve energy during the winter months. Females store sperm over the winter and ovulate in the spring, thereby delaying pregnancy until food sources (i.e., insects) are available again (Whitaker and Hamilton, 1998).

Bats emerge in the spring and migrate back to their summer ranges, which may be nearby or several hundred miles or more from their winter roost. Summer roosts are generally found beneath loose tree bark or in tree crevices, but rocks, wood piles, bridges, or buildings***** are also commonly used. Female bats find warm roost sites to raise young and many species form maternity colonies, numbering sometimes hundreds or even thousands if space allows. These colonies return to the same familiar roosts each year, unless a site becomes unsuitable or inaccessible (Humphrey and Cope, 1976).

Bat pups (young-of-the-year) are generally born in early- to mid-summer, following a roughly two-month gestation period for most species. Most females give birth to just one pup per year. Pups nurse for about four weeks, or until they are grown enough to begin flying. Young bats may not be weaned

and able to feed on their own until mid- to late-summer (Whitaker and Hamilton, 1998). Males live separately from females during summer and are not involved in pup rearing; they are more transient and solitary but may form small bachelor groups.

Bats emerge from their day roosts around dusk to forage for insects such as moths, beetles, midges, and mosquitoes. They hunt among the trees, in forest clearings, over water bodies, above meadows and cliffs, and in our neighborhoods, using echolocation to navigate and find their prey. Bats alternate between periods of feeding and rest. Bats may use "night roosts" to rest between feeding bouts. Night roosts may include open spaces, such as porch ceilings and under bridges.

Colonies disband in late summer, and bats begin making their way back to their hibernacula or winter roosts.

Bats are generally active at temperatures above 50 degrees Fahrenheit and typically drop into torpor below that temperature or find a location that remains at 35-50 degrees Fahrenheit for hibernation, though microclimate requirements vary by species (Altringham, 1996).

***** For some adaptable bat species, buildings and other human-made structures can offer warm, safe, virtually permanent shelters for day-roosting, pup-rearing, and occasionally even hibernation. In addition, they can serve as temporary night-roosts and migratory stop-overs. Structures have become an important resource for bats where natural habitat is limited or dwindling. Consequently, bats are more likely to come into direct contact with people, sometimes presenting a nuisance or health concern.

Species Identification:

There is a great deal of behavioral variability among bat species. Knowing what species is present in a structure can inform eviction/exclusion timing and techniques. **NWCOs should become familiar with the species most commonly encountered in their area and follow state and federal laws, or contact their state wildlife agency for guidance as bats are not always visible during nuisance control activities for accurate species identification**. ***Appendix A*** *includes a list of bat species commonly found in structures, along with their current (2014) listing status and susceptibility to WNS.*

Seasonal Restrictions:

In the absence of a public health threat, evictions and exclusions should not be performed during the maternity season. In North America, the maternity season, when flightless young might be present, can extend from early April to late August, depending on the species, region, and seasonal weather patterns. Roost closure during the maternity season has been documented to result in lower reproductive success (Brigham and Fenton, 1986). Attempts to evict or exclude bats at this time can result in the death of flightless young, as well as an increase in the number of adult bats and orphaned pups that enter the living space, potentially heightening the risk of human/bat contact and rabies exposure. Insects and foul odors may also result from the death of entrapped bats. **Contact your state wildlife agency for time-of-year restrictions** as maternity season varies by region and species. In the absence of specific guidance

from your state biologist, **maternity season should be considered to begin April 1 and continue through August 31 each year.**

In the absence of a public health threat, evictions and exclusions should not occur during the winter months if there is a history or evidence of winter bat activity in the building. Some species (*e.g.*, the big brown bat) hibernate in buildings and do not regularly exit the structure because there is usually no food source available. Therefore, eviction/venting activities are likely to be ineffective or can result in bats exiting the structure in inclement weather, and exclusion work may result in trapped bats dying inside the roost or ending up in the living space while searching for another exit.

Bat-Proofing the Living Space:

During the maternity season, or when bats are suspected to be hibernating in the building, the best option for protecting concerned homeowners and public health is to bat-proof the living space, or provide "interior seals". This work consists of locating openings (typically areas where air flows) leading into the living space from attics, garages, walls, or any place that bats are roosting. Entry/exit points can be as small as 5/8-inch round or 1/4-inch wide and 3/4-inch long that open into the living space. Likely openings may include:

- Attic hatches and doors
- Chimneys
- Fireplaces
- Around piping or plumbing
- Open windows or loose windowsills
- Openings around air conditioners and ducts
- Louver fans
- Screens in disrepair
- Pet doors

Getting a Single Bat out of the Living Space:

Bats may occasionally find their way into a living space, especially during the summer months when young-of-the-year are becoming more independent. This is not necessarily an indication that a bat is rabid. If there are concerns about rabies exposures, do not release the bat. Call your local or state public health department to determine if the bat will need to be tested for rabies. Homeowners should contact their physician or health department, and follow the Center for Disease Control's guidelines to determine if a rabies exposure has occurred, as exposures are not always apparent. *See **Appendix B** for resources.*

If no potential for rabies exposure has occurred and weather conditions are appropriate (above 50 degrees F, no rain or high winds), a bat found in a living space can be safely released outside. Close doors to contain the bat in one room, then open windows and exterior doors to the room and stand against a wall while watching for the bat to exit on its own. If physical capture is necessary, wait for the

bat to land on a wall or other surface. A container such as a kitchen strainer or a clear plastic container with a piece of cardboard slid over the opening can be used to safely contain and move the bat. **Leather gloves** are strongly recommended. For the safety of the bat, pets, and the general public, released bats should be placed up off the ground on a window sill or large tree branch or released from at least 4 feet above the ground where they have a better chance of dropping into flight. *An illustrated guide to removing a bat from the living space and a video link can be found in* ***Appendix B****.*

Bats found in buildings during the winter may not survive if released outside in below-freezing temperatures, high winds, or heavy rain. Contact your state wildlife agency or local wildlife rehabilitators for help if you encounter a bat in a building during these types of inclement weather.

Effective Bat Evictions:

The only effective way to permanently get bats out of structures without harm and to prevent re-entry is to perform a humane eviction, using one-way venting at the primary entries/exits, and a complete exclusion, by sealing up any secondary holes, cracks, or crevices in the structure that could serve as potential entry/exit points. Materials and techniques for conducting bat evictions and exclusions are provided in the Professional Standards of Practice for Structural Management for Wildlife Control Operators (Standards), available through the National Wildlife Control Operators Association. In addition, roost areas that harbor accumulations of guano may contain other health risks, such as histoplasmosis, which are also outlined within the Standards.

An inspection of the living space is recommended before and after eviction work takes place. If bats are found or reported in the living space, refer to the resources in Appendix B for safe removal.

One-way exit devices (i.e., venting) allow bats to leave the structure but not re-enter and are an acceptable and effective means of eviction outside of the maternity season. One-way exit devices must be constructed out of a material that does not have any sharp edges or parts that could damage a bat's wings or form any spaces for bats to become tangled in.

Bats can enter any crevice ¼'' inch or wider. Bat-sized crevices may be found on all sides of a building and are often not visible from the ground level. An evening emergence survey ("bat watch") can help to identify the bats' primary access points while engaging the homeowner and gathering pre-eviction baseline data, but a close visual inspection is often needed to locate secondary entrances and other potential access points. Therefore, it is the responsibility of the NWCO to have appropriate training and resources to safely access all sides of the structure, with special attention to the eaves.

Because not all bats will exit every night, one-way exits should be left in place for a minimum of five nights, including at least three consecutive nights of weather conducive to bat flight (temperatures above 50 degrees F, winds below 10 mph, and no sustained or heavy rains) before they are removed and the holes are sealed. If weather conditions are not conducive to bat flight while the devices are in place, the time period should be extended until at least three consecutive good weather nights are achieved.

If time permits, it is also suggested that someone (*e.g.*, the homeowners) watch the vented exits on the last night before the hole is permanently sealed, to verify that no bats remain inside the roost. If bats are found to have re-entered the roost, or if the NWCO discovers that a vent has detached or become loose enough to allow re-entry, then the device should be re-installed and left in place again for the five night minimum.

Contractors should be prepared to make multiple visits throughout the exclusion process, between initially setting up the vent(s), sealing crevices on all sides, and removing vents. **Even for experienced professionals, it may take SEVERAL TRIES to successfully bat-proof a building.**

Bats generally return to the same summer roosts year after year and may go to great lengths to get back into a roost following exclusion. Therefore, eviction/venting and exclusion work should be careful and thorough, and erecting alternate roost structures (i.e., specially-designed bat houses) nearby for displaced bats is recommended.

Note: Night roosts of bats are generally in open areas (*e.g.*, under porches), not usually the inside of a building. However, bat guano may be found under the open roost. Eviction of night roosting bats will most often not be necessary, but the roost spot can be made unattractive to returning bats by hanging ribbons or mylar balloons, which create movement.

Unacceptable Methods

Methods that include poisoning, trapping (*e.g.*, cages, sticky traps), exterminating, translocating, or in any other way harming, harassing, or killing bats do not meet the AMPs outlined in this document. These methods are illegal in many states and can result in increased cost to the homeowner. In addition, some of these methods may actually be dangerous to people and pets.

Decontamination for WNS:

Decontamination is vitally important for the protection of bats and their habitats and is the primary management option currently at our disposal to slow the risk of transmitting the fungus that causes WNS. While the current recommendations focus heavily on the treatment of equipment in cave and mine habitats, NWCOs should not underplay the potential risk associated with any bat-related work. By following the National Decontamination Protocol, NWCOs will minimize their individual risk of transmitting the fungus when conducting work involving close/direct contact with bats, their environments, and/or associated materials. *See decontamination guidelines in Appendix C or at www.whitenosesyndrome.org*

For EPA-registered pesticides, including anti-microbials, “the label is the law,” and label directions specify the types of materials (*e.g.*, porous vs. impervious surfaces) that can be treated. Associated safety data sheets provide important supplementary product information. In addition, some NWCO equipment may need to be cleaned to the manufacturer’s specifications and then, where permissible by the manufacturer’s guidance, be decontaminated following the WNS protocol.

In addition to items mentioned in the National Decontamination Protocol, disposal or decontamination should be considered for, but not limited to, items used by NWCOs that frequently come in contact with bats or their habitat such as: cones, tubes, chutes, and mesh used to construct one-way doors. *See Appendix C for a more detailed list.*

Please check with the appropriate federal, state, or tribal agency/organization for current management regulations/requirements prior to conducting any eviction/exclusion. Some state/federal regulatory or land management agencies may have supplemental documents that provide additional requirements or exemptions specific to bat evictions/exclusions on lands under their jurisdiction. For the long-term benefit of bats and their habitats, compliance, whether mandatory or recommended, will ensure the most responsible approach to bat exclusions are being implemented.

Bat Houses:

Because bats naturally return to the same location year after year (Neilson and Fenton, 1994), individuals may attempt to reenter the structure they have been excluded from or spend precious time and energy searching for a roost, thereby lowering reproductive output (i.e., producing fewer offspring) (Brigham and Fenton, 1986). Young born earlier in the summer have a significantly higher probability of surviving their first year than those born later in the season (Frick et al., 2009). Therefore, bat houses are recommended as alternative housing for displaced bats. Ideally, bat houses should be erected a few months to a year before a scheduled exclusion to give bats time to find and explore the new roosting option, and should be installed near the original roost to maximize the likelihood of bats finding the new habitat.

There is no guarantee that bats will use a bat house, but research has shown that bat houses can be successfully occupied during and after an eviction (Kiser and Kiser, 1999; Brittingham and Williams, 2000). Choosing the proper location, placement, design, color, and materials are all important factors for increased success (Tuttle et al., 2013). These attributes can vary by species and geographical region. *Guides to bat house design and placement can be found in* ***Appendix B****.*

Landowners interested in improving their property by enhancing natural roosting options such as large diameter trees, can **contact their state for forest best management practices** that will benefit local bat species.

This document is the product of the multi-agency WNS Conservation and Recovery Working Group established by the National WNS Plan (A National Plan for Assisting States, Federal Agencies, and Tribes in Managing White-Nose Syndrome in Bats, finalized May 2011). This Acceptable Management Practices guidance document will be updated as necessary to include the most current information and guidance available www.whitenosesyndrome.org/NWCO

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Appendix A – Common Structure-Dwelling Bat Species Information:

The following table is provided as an example of the information that can be obtained through your state wildlife agency for each of the species you may encounter in structures:

SPECIES COMMON NAME	SPECIES SCIENTIFIC NAME	RANGE	SEASONAL STRUCTURE USE	TYPICAL COLONY SIZE	WINTER BEHAVIOR	NOTES ON STRUCTURE USE	IDEAL TIME OF YEAR FOR EVICTIONS	WNS CONFIRMED/ SUSCEPTIBLE	FEDERAL T&E STATUS (Year updated)	STATE T&E STATUS (Year updated)
EXAMPLE for VERMONT: Little brown bat	*Myotis lucifugus*	State-wide	April through October	Hundreds	Hibernates in Caves/ Abandoned Mines	Commonly uses attics, barns, churches, bat houses	September 1 through November 1	Confirmed, Significant declines due to WNS	Not Listed	Endangered (2014)

Appendix B - Resources:

Contact your **state wildlife agency or partners for time of year guidelines** that apply to your geographic area. A list of contacts can be found at: http://www.whitenosesyndrome.org

More information about bats, their biology and behavior:

- Animal Diversity
  - http://animaldiversity.ummz.umich.edu/accounts/Chiroptera/
- Bat Conservation International
  - http://www.batcon.org
- Organization for Bat Conservation
  - http://www.batconservation.org/
- US Geological Service
  - http://www.npwrc.usgs.gov/resource/mammals/housebat/
- US Fish and Wildlife Service
  - http://www.fws.gov/asheville/pdfs/beneficialbats.pdf
- US Forest Service
  - http://www.fs.fed.us/biology/wildlife/bats.html
- Save Lucy the Bat
  - http://savelucythebat.org/
- Conserve Wildlife Foundation of New Jersey
  - http://www.conservewildlifenj.org/protecting/projects/bat/

Information about White-nose Syndrome:

- US White-nose Syndrome website
  - https://www.whitenosesyndrome.org/
- "Battle for Bats" video:
  - http://vimeo.com/76705033

Eviction/Exclusion standards:

- National Wildlife Control Operators Association Bat Standards Training Course
  - http://nwcoa.com/bat_standards.html

Decontamination guidelines:

- https://www.whitenosesyndrome.org/

Rabies and other health concerns:

- Your state or local Department of Health
  - http://www.healthguideusa.org/local_health_departments.htm
- Centers for Disease Control
  - http://www.cdc.gov/rabies/

Removing a single bat from the living space:

- Bat Conservation International
  - http://www.batcon.org/index.php/resources/for-specific-issues/bats-in-buildings/there-s-a-bat-in-my-house
  - Video: http://www.youtube.com/watch?v=mzax0V0DG_M

Bat rehabilitation:

- Rehabilitation Guidance for White-nose Syndrome Affected Bats
  - http://www.whitenosesyndrome.org
- Bat World
  - http://batworld.org/what-to-do-if-you-found_a_bat/
- International Wildlife Rehabilitation Council
  - http://theiwrc.org/
- National Wildlife Rehabilitator Association
  - http://www.nwrawildlife.org/

Bat house design and placement:

- Bat Conservation International
  - http://www.batcon.org/index.php/resources/getting-involved/install-a-bat-house
- Organization for Bat Conservation
  - http://www.batconservation.org/bat-houses
- Pennsylvania Game Commission
  - http://www.portal.state.pa.us/portal/server.pt?open=514&objID=631013&mode=2
- Bat Conservation and Management
  - http://www.batmanagement.com/Batcentral/batcentral.html
- Bat World
  - http://batworld.org/bat-house-information/

Appendix C – Decontamination Protocols:

- The latest up-to-date White-nose Syndrome (WNS) decontamination protocols can be found at: https://www.whitenosesyndrome.org
- The following table outlines equipment frequently used by NWCOs to evaluate and perform bat evictions and exclusions, along with tips on proper decontamination and disposal to prevent the spread of WNS.
- For EPA-registered pesticides, including anti-microbials, "the label is the law," and label directions specify the types of materials (*e.g.*, porous vs. impervious surfaces) that can be treated. Associated safety data sheets provide important supplementary product information. In addition, some NWCO equipment may need to be cleaned to the manufacturer's specifications and then, where permissible by the manufacturer's guidance, be decontaminated following the WNS protocol.

Guano Mitigation Equipment	***Typically used within a structure's attic or interior living space.***	***Comment***
Disposable personal protective equipment	Tyvek suit, gloves and booties, light duty mask	Dispose of properly following each guano mitigation project or entry into bat roosting areas.
Non-disposable equipment	Clothing, shoes, clip boards	Bag before transport and then decontaminate following WNS guidelines.
Respirators	Typically multiple use style with removable filters	Dispose of filters after each job, and decontaminate respirator following WNS guidelines.
Vacuums	HEPA vacuums are typically used to remove guano and have two components, the unit itself and the hose/nozzle component	Dispose of vacuum bags after each guano mitigation project and clean hard-surfaced unit, hose and nozzle following WNS decontamination guidelines.
Lights	Lights, headlamps and other cursory items used to illuminate the work area in an attic or interior space	Decontaminate according to WNS guidelines.
Clean room setup	Drop cloths, etc., often removed along with guano and insulation	Dispose of following each guano mitigation project.