

ENVIRONMENTAL ASSESSMENT

Eel River Headwaters Restoration Project

Town of Plymouth, Massachusetts

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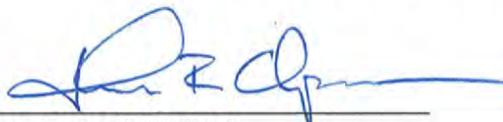
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This Environmental Assessment becomes a federal document when evaluated and signed by the responsible Federal Officials.

31 Aug 2009
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EXECUTIVE SUMMARY

This Environmental Assessment (EA) addresses a proposal by the U.S. Fish and Wildlife Service (Service) and the U.S. Department of Agriculture's Natural Resource Conservation Service (NRCS) to restore a degraded wetland and river system within the headwaters of the Eel River in Plymouth, Massachusetts. The Memorandum of Understanding establishing the Service as the Lead Federal Agency and the NRCS as a Cooperating Agency is included as Appendix A. The Eel River Headwaters Restoration Project (the Project) is a precedent-setting restoration effort to restore approximately 40 acres of a previously-degraded wetland system and nearly 9,000 linear feet of coastal stream channel on land that is currently owned by the Town of Plymouth.

The purpose of the Project is to: increase the natural capacity of the resource area; improve fish passage; promote a healthy coldwater fishery; improve water quality; re-establish rare wetland communities; and provide the public with passive recreational and educational opportunities. The future use of the Project area is as preserved land (Eel River Headwaters Preserve), to be managed by the Town of Plymouth for passive recreational use, conservation, and educational purposes. A majority of site restoration activities are expected to be completed within a year, with follow-up monitoring and planting to occur for several additional years as needed.

The Project will result in a net benefit to wetland resources and an overall increase in wetland acreage for the Eel River watershed, but will require temporary alterations to existing vegetated wetlands. The Project consists of two components: (1) restoration of seven former commercial cranberry bog cells, including the removal of agricultural-related berms and grade controls, restoration of a sinuous stream channel and reconnected floodplain, extensive native wetland plantings, removal of one culverted stream crossing, and improvements at two road crossings; and (2) reconfiguration of a downstream masonry dam and related stream channel improvements involving the partial removal of the dam to allow unrestricted river flow and the renovation and repair of the remainder of the historic structure which will remain in place.

This EA analyzes the potential environmental impacts that would result from the implementation of the Proposed Action. This EA has been prepared in accordance with the National Environmental Policy Act (NEPA) of 1969, the regulations of the Council on Environmental Quality (CEQ) for implementing NEPA [40 Code of Federal Regulation (CFR) 1500-1508], and the implementing regulations (36 CFR 800).

This EA is filed to comply with Section 1508.9 of NEPA, which mandates federal agencies to assist in actions to recover and de-list threatened and endangered species. The Project is a voluntary, proactive aquatic habitat restoration effort, offering numerous ecological benefits and environmental education opportunities with the sole purpose of improving a critical wetland resource area that has been degraded by human activities over time.

This EA analyzes the impacts of four alternatives on the human environment in accordance with NEPA. These include a No Action Alternative, the Proposed Action, and two additional action alternatives. Under the Proposed Action, the upper Eel River ecosystem will be restored to a condition comparable to that likely to have existed in pre-colonial times, and represents a large-scale ecological improvement of a highly-disturbed area. By restoring the ecological health of the Eel River Headwaters' ecosystem, species diversity will be increased, including that of native plant communities and fish populations; fish passage and instream habitat will be enhanced; water quality

will be improved; and rare wetland communities will be restored (including 17,000+ Atlantic White Cedar plantings).

The Proposed Action will have negligible, if any, impacts on air quality, soundscapes, land use, socioeconomics, energy resources, geology, lightscapes, Indian Trust resources, scenic resources, and prime and unique farmlands. Adverse effects to cultural resources, including National Register-eligible or listed cultural resources, will be addressed, pursuant to Section 106 of the National Historic Preservation Act (16 W.S.C. 470f), through a Memorandum of Agreement between the Service, the Massachusetts State Historic Preservation Office, and any consulting parties (36 CFR Part 800, and 33 CFR Part 325).

The Proposed Action will temporarily impact previously disturbed wetlands and a small portion of coastal upland within the Project area. These impacts will be limited to the short-term, and will ultimately result in an overall enhancement of said resources over time.

The Project team is made up of the following federal, state, and local agencies, organizations and groups: the Service, the U.S. Department of Agriculture's Natural Resource Conservation Service (cooperating agency), the Massachusetts Department of Fish & Wildlife's Division of Ecological Restoration, American Rivers, the Town of Plymouth, The Nature Conservancy, Inter-fluve, Inc., Underwood & Associates, LEC Environmental Consultants, Inc., the Horsley Witten Group, Inc., and The Public Archaeology Laboratory, Inc.

The Service finds there will be no significant impacts resulting from the proposed restoration activities of the Project. The Proposed Action provides net benefits that far outweigh its potential impacts on the natural and human environment. Therefore, the Service concludes that a Finding of No Significant Impact (FONSI) be issued for the proposed Project.

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Appendix B	Excerpts from Eel River Restoration Site Plans prepared by Inter-Fluve, Inc. dated November 1, 2007
Appendix C	Intra-Service Section 7 Biological Evaluation prepared by U.S. Fish and Wildlife Service
Appendix D	Eastern Box Turtle (<i>Terrapene carolina</i>) Protection and Habitat Enhancement Plan prepared by LEC Environmental Consultants, Inc.
Appendix E	Memorandum of Agreement between the U.S. Fish and Wildlife Service and the Massachusetts Historical Commission for the Eel River Headwaters Restoration Project, Plymouth, Massachusetts, August 27, 2009

1.0 INTRODUCTION

1.1 Background

In 2003, the Cape Cod Cranberry Growers Association (CCCGA) raised awareness to Natural Resources Conservation Service (NRCS) officials to allocate more money to Massachusetts for the Wetlands Reserve Program (WRP) to help cranberry growers retire bog acreage that was difficult to manage or located in environmentally sensitive areas. At the time, Eel River bogs were split between two owners. With the help of The Nature Conservancy (TNC) and CCCGA, both owners applied to the WRP to remove bog acreage from production, place the land into a permanent WRP easement, and restore them to their pre-agricultural condition. The Town of Plymouth eventually purchased the property from the two owners. NRCS holds a WRP permanent easement on the bog acres and coinciding dikes, and Wildlands Trust holds a conservation restriction on the upland portion of the property.

The Eel River Restoration Project (Project) began as part of the Town of Plymouth's efforts to improve the water quality and instream habitat in the river and the receiving waters of Plymouth Harbor. Major elements of the Project include: dam reconfiguration and fish passage restoration; nearly 9,000 linear feet of natural stream and fish habitat restoration; approximately 40 acres of bog conversion and wetland restoration to natural conditions with native vegetation plantings; 9.6 acres of net increase in state-designated Riverfront Area; and overall improved watershed hydrology.

The Eel River has a groundwater contributing drainage area of about 15 square miles. Hydrology is heavily influenced by the soils in the area, which are largely glacial sand and gravel deposits, and are highly permeable. The drainage basin has the capacity to absorb a tremendous amount of rainfall, which contributes to a substantial groundwater aquifer, and maintains a stable low-flow discharge year-round. The groundwater hydrologic dominance of the region means that the groundwater contributing area is more important than the surface water drainage area when assessing the region.

The most important fish passage barrier within the Project boundary is the Sawmill Pond Dam (also called the Glendale Mill site), located approximately 1,000 feet downstream of Long Pond Road. This masonry wall, earth fill dam is approximately 12 feet high with 10 feet of hydraulic head remaining, and impounds an estimated area of one acre. Currently, the impoundment has partially filled with sediment.

Prior to the stone dam construction, the Eel River maintained a moderately steep slope downstream to the present location of the upstream end of the Russell Mill Pond (Fig. 1). The majority of the Eel River likely has been altered by direct or indirect human activities over the last three centuries. In fact, it is estimated that only approximately 2,800 feet (10.6%) of its entire 5.0-mile length is currently natural or relatively undisturbed. This small undisturbed segment of the stream has a stable channel bed and banks with an armored cobble, boulder, and sand substrate and step pool morphology. The proposed restoration of the upper Eel River will bring the natural or naturalized percentage of the system up to roughly 35%.

1.2 Purpose and Need

The proposed Project is a precedent-setting restoration effort to convert retired commercial cranberry bogs into critical wetland and cold-water stream habitat. The entire Project consists of two phases:

(1) restoration of seven former cranberry bog cells; and (2) reconfiguration of a stone dam and related stream channel improvements.

The purpose of the Project is to restore approximately 40 acres of retired cranberry bog into natural wetlands, restore approximately 9,000 feet of coldwater stream and associated instream and riparian edge habitat, re-open fish passage to approximately 9,000 feet of stream, and enhance passive recreational opportunities. These efforts will result in the enhancement of the following natural and cultural resources: habitat for rare wildlife and plant species; wetlands, waterways, and tidelands; community education and recreation; and overall water quality improvements within the contributing waters of Plymouth Harbor.

Early in the design process, ideas regarding Project performance criteria or “needs” were solicited from the participating Project partners. The following list summarizes the desired Project performance criteria or needs:

- dam removal/fish passage restoration;
- stream restoration/fish habitat improvement;
- restoration of degraded wetland habitat (retired cranberry bogs);
- site restoration requirements of the NRCS’s WRP conservation easement on the property;
- diverse wetland habitat restoration, including Atlantic White Cedar Swamp habitat;
- watershed water quality protection of the downstream impaired waters (MA 303d list) of Plymouth Harbor;
- remediation of contaminated sediments in the retired cranberry bogs and Sawmill Dam impoundment;
- educational opportunities/interpretive signs; and
- walking trails.

The intent of the Project is to improve the historically-altered wetland resource areas within the Eel River watershed. It is designed to substantially improve the hydrology and water quality, vegetation cover, wildlife habitat, and many important wetland and riverine functions for the benefit of the watershed and downstream receiving waters. In order to implement the Project, existing degraded wetland resource areas will be temporarily altered during construction, but the overall, long-term ecological and resource area benefits to Eel River watershed will greatly outweigh impacts associated with temporary construction disturbance from the restoration of degraded habitat.

1.3 Project Issues and Impact Analysis

The Council on Environmental Quality (CEQ) NEPA regulations require that federal agencies “identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review” (Sec. 1506.3). Through a series of permit applications with the oversight of Project partners and participating agencies, potential issues were examined. The Massachusetts Historical Commission (MHC) and Native American Tribes were also invited to participate during the permitting and consultation phase of the proposed Project.

According to CEQ’s definition, no significant issues were raised during the Project scoping, although there may be a degree of inherent conflict between the historic protection and ecological goals of this Project. The simplest ecological approach to the restoration of the Eel River Headwaters system would call for the complete removal of the dam structure, while historic interests would be best served by avoiding and/or minimizing impacts to the structure. The proposed partial reconfiguration

of the dam is a compromise between these two interests that allows the river to flow unimpeded, while still retaining much of the historic structure and rebuilding the portion that is altered.

The cumulative benefits of this Project will substantially outweigh any temporary negative impacts, as shown by the discussions in other sections of this document. The Project will result in important improvements to the ecological condition of riverine and wetland resources, as well as lasting local and regional socioeconomic benefits. The Project does not involve a violation of any federal, state, or local law or requirements imposed for the protection of the environment. Section 7.0 outlines each of the applicable federal and state laws and regulations within which the Project is in compliance.

Impact topics addressed in this document include:

- natural Resources;
- rare Species Habitat;
- existing Structures;
- historic and Archeological Resources; and
- cumulative Effects.

1.4 Alternatives Considered

Based on findings from the Restoration Project Concept Design Report (Gould 2007), advantages and disadvantages of the following four different Project alternatives are presented:

1. the proposed Project to reconfigure the dam, restore natural stream flow, wetlands and vegetation, and replace existing flow restrictions (Proposed Action);
2. a stand-alone dam reconfiguration;
3. a stand-alone wetland restoration of the cranberry bog cells; and
4. a No-Action alternative.

The alternatives are discussed in Section 3.0.

2.0 AFFECTED ENVIRONMENT

The Eel River is a small, groundwater-fed stream system draining from glacial outwash flowing into Plymouth Bay. This Project area encompasses the headwaters from the uppermost section of the existing abandoned commercial cranberry bog complex, across Long Pond Road and across the driveway to TNC's office, to a point just downstream of the Sawmill Pond (Glendale Mill) dam (Fig. 1). A brief description of the existing conditions is provided below for the impact topics. Existing conditions at the site are represented within the site plan excerpts included in Appendix B, and within the attached site photos. Complete copies of the design plans can be provided upon request to the Service, New England Field Office, by emailing Eric_Derleth@fws.gov, or telephone (603)223-2541, extension 14.

2.1 Natural Resources

2.1.1 Wetlands, Waterways & Tidelands

Portions of the proposed activities will occur within wetlands and waterways protected and regulated under municipal, state and federal wetlands laws, including:

- the Town of Plymouth's local bylaw (Article 27);
- Massachusetts Wetlands Protection Act (WPA); and
- Clean Water Act of 1977 (Federal Water Pollution Control Act Amendments of 1972).

While this Project is expected to result in a long-term net benefit to all resource areas, it will require alteration of approximately 40 acres of freshwater wetlands.

2.1.1.1 *Vegetated Wetlands*

The vegetated wetlands consist of a series of seven former commercial cranberry bog cells that were abandoned following the 2002 harvest. Typical of these types of wetlands, the abandoned bogs are dominated by American cranberry (*Vaccinium* spp.) with various herbaceous species and seedlings of pitch pine (*Pinus rigida*) and red maple (*Acer rubrum*) that have since colonized the bogs. Soil composition within the bogs consists of alternating layers of sand and organic matter, overlain on top of parent peat material, which is reflective of commercial cranberry bog operations. The periphery of the bog complex was cut and shaped to build the maintenance road surface, representing a dramatic separation between the upland and bog ecosystem types. Although it cannot be confirmed, the original wetland system was likely a mixed forested (Atlantic White Cedar Swamp, Red Maple Swamp) and emergent wetland complex that is found in the wetland areas of southeastern Massachusetts.

Ground-penetrating radar results suggest that Bogs 2 through 7 were historically a series of kettle depressions. From these data, it appears that surface water elevations could have been controlled by natural berms that existed at each of the current grade control berm locations. Historic USGS topographic maps indicate that Bog 1 may have been a former wet meadow, prior to its conversion to a cranberry bog, although its former condition remains unknown at this time (Fig. 2).

2.1.1.2 *Waterways*

The existing stream within the bogs consists of an artificially straightened channel providing limited shelter, shading, and habitat for both aquatic and wetland-dependent species. Channelization for drainage occurred sometime between the late 1800s and the 1930s, most likely the former. Like most commercial cranberry bogs, the Eel River bogs contain three types of irrigation channels. A main drainage channel runs along the center of each bog and supplies water to smaller cross-ditches that help control the water table elevation. A third ditch, smaller than the main channel flows along the perimeter of the bogs. The main channel is often a simplified or straightened version of what was once the original stream channel. Streamside cranberry bogs such as these are a common feature of southeast Massachusetts, and their channels are generally open, characterized by an unstable and homogeneous substrate, without vegetative cover, and provide an extremely limited instream habitat.

Because of the amount of human disturbance throughout the bog system, it is difficult to determine the location and elevation of the historic channel. Given the amount of surface water leaving the bog

complex (average of 3-4 cfs) and the general slope (0.085%), it is likely that historically, a wetland channel existed and drained the entire system. Furthermore, if a channel did exist, it was likely a highly meandering stream as is typical of most peatland streams. The 1857 map of the area shows the upper end of the Project site as a wetland area called Finney Meadow (Fig. 2). As drawn, the 1857 map suggests that the area was not yet used for cranberry cultivation. The designation as a meadow could mean that the area was a peatland sedge meadow, or it could also represent a cleared area. Several logging rotations in the area could have removed woody vegetation in a swamp area, therefore the true nature of the meadow is unknown at this time.

Prior to the stone dam construction, the Eel River likely maintained a moderately steep slope downstream to the present location of the upstream end of the Russell Mill Pond. Analysis of recent topographic survey data and USGS topographic data indicates the channel slope was likely between 0.8% and 1.2%. From Long Pond Road to Route 3, the Eel River occupies a U-shaped valley approximately 2,000 feet wide that was historically 25-75 feet deep. Deposition of 4-12 feet of sediment in the channel bottom of Bog 1, Sawmill Pond Dam, and the Russell Mill Pond areas has resulted in elevation of the natural floodplain.

The majority of the Eel River channel likely has been altered by direct or indirect human activities over the last three centuries. Only approximately 2,800 feet of the entire 5.0 miles, or 10.6% of channel, is estimated to be natural or relatively undisturbed. This small undisturbed segment of the stream has a stable channel bed and banks, with an armored cobble, boulder, and sand substrate and step pool morphology.

2.1.1.3 Flood Zone

Flood zones are geographic areas defined by the Federal Emergency Management Agency (FEMA), reflecting the severity or type of flooding in the area. The government definition of a floodplain, or high flood risk zone, is an area which has at least a one in one hundred or one percent chance of flooding in any given year. According to the FEMA maps of the area (Fig. 3), Bogs 2 through 7 are not within the 100-year flood zone (Zone A), while the area surrounding Bog 1 and Sawmill Pond is within the 100-year flood zone.

2.1.1.4 Riverfront Area

Riverfront Area is a wetland resource area that is protected and regulated by Massachusetts' state and local wetlands laws. It is the area of land between a river's mean annual high water line and a parallel line measured horizontally and extending 200 feet from the edge of the stream. Riverfront Area includes and overlaps with other resource areas and/or their buffer zones. The majority of the Project footprint falls within this 200-foot Riverfront Area. Under Massachusetts Wetland Protection Act definitions, the Project will result in a net increase in Riverfront Area of approximately 3,670 square feet; the ecological condition of Riverfront Area will also be dramatically improved.

2.1.2 Surface Water and Hydrology

The Eel River flows into Plymouth Harbor at Manters Point. The stream has a groundwater contributing area of about 15 square miles. The Eel River has two main branches that converge about 1.8 miles upstream of the mouth. The characteristics of the two branches are fairly similar, with the northern branch, where the Project is located, being slightly longer.

Within the Project area, the existing stream bed is primarily sand, and the channel cross-sectional morphology is likely quite different from any channel that once existed. Unlike the current trapezoidally-shaped cranberry bog channels, most naturally-occurring wetland channels are narrow and deep relative to their floodplains, and side slopes are often steep or evenly undercut.

Hydrology is heavily influenced by the soils in the area, which are largely glacial sand and gravel deposits that are highly permeable. The drainage basin has the capacity to absorb a tremendous amount of rainfall, which contributes to a substantial groundwater aquifer, and maintains stable discharge year-round. The groundwater-dominated hydrology of the region means that the groundwater contributing area is more important than the surface water drainage area when assessing the region.

2.1.3 Cranberry Bogs

The Project site contains seven former agricultural bogs. As noted above, based on the depth of sand layers and historical information, cranberry culture in the upper Eel River is estimated to have started in the late nineteenth century.

Channelization for drainage occurred sometime between the late 1800s and the 1930s, most likely the former, when the bogs were converted to cranberry culture. The periphery of the bog complex was cut and shaped to build the maintenance road surface. This road separates the upland and bog ecosystem types. Upland areas adjacent to Bogs 2 and 6 contain large excavated areas where sand was removed for spreading or hauling (borrow pits). These scalloped areas remain unvegetated and have somewhat stabilized at the current angle of repose. Some sheet and rill erosion of sand has been noted along cut slopes and excavated hill slopes, but sediment movement into the channels is minimal.

The last cranberry harvest at the Project area was in 2002, and all of the gate boards from the water control structures have since been removed, although the earthen berms separating the bog cells remain.

2.1.4 Surrounding Woodlands

Currently, there are no mature trees in the Eel River cranberry bog complex, but the surrounding uplands are populated by white pine (*Pinus strobus*), pitch pine, and a variety of oak species. White pines, averaging 24+ inch diameter at breast height (DBH), are growing on and around the Sawmill Dam. Dendrochronology samples of these trees suggest that the last logging in the dam site area took place around 1920-1930. Most of the trees in the uplands surrounding the bog complex are of smaller diameter (8 to 12 inches DBH).

2.2 Rare Species Habitat

Northern red-bellied cooters (*Pseudemys rubriventris*), listed as federally-endangered under the Endangered Species Act, are not known to occur in the Project area, but are known to exist in Hoyts-Gunners Exchange Pond, approximately a quarter-mile south of Bog 7. The proposed Project, while not directly impacting preferred coastal plain pond or adjacent sandy nesting habitats, is partially within the critical habitat (includes an area upstream of Long Pond Road) designated for this turtle in

1980, concurrent with the listing of the species (65 FR 21828). An Intra-Service Section 7 Biological Evaluation regarding the Red-bellied Cooter is included as Appendix C.

The Massachusetts Natural Heritage and Endangered Species Program (NHESP) identified the following state-listed rare species, which are protected under the Massachusetts Endangered Species Act (M.G.L. Ch. 131A or MESA), as likely to be found near the Project site (Table 1; Fig. 4). A description of these rare species and their general habitat requirements is available on the NHESP website at www.nhesp.org.

Table 1. List of state- and federally-listed rare species at the Project site as identified from NHESP database.

Species Name	Common Name	Name Category	MESA Category
<i>Terrapene carolina</i>	Eastern Box Turtle	Vertebrate Animal	SC
<i>Notropis bifrenatus</i>	Bridle Shiner	Vertebrate Animal	SC
<i>Ophioglossum pusillum</i>	Adder's-tongue Fern	Vascular Plant	T
<i>Sphenopholis pensylvanica</i>	Swamp Oats	Vascular Plant	T
<i>Pseudemys rubriventris pop. 1</i>	Northern Red-bellied Cooter	Vertebrate Animal	E**
<i>Hemileuca maia</i>	Barrens Buckmoth	Invertebrate Animal	SC

E = "Endangered"

T = "Threatened"

SC = "Special Concern"

**also federally-listed under the Endangered Species Act (ESA)

During Project coordination with the NHESP in 2007 through 2009 around the Eel River Headwaters Project area, NHESP reported that two species of concern, the Eastern Box Turtle and the Bridle Shiner, were known to occur within the Project site.

2.3 Existing Structures (Sawmill Pond Dam and Culverts)

2.3.1 Sawmill Pond Dam

The Sawmill Pond (Glendale Mill) Dam is a stone masonry, earthen fill dam located approximately 1,000 feet downstream of Long Pond Road. The dam is approximately 12 feet high with 10 feet of hydraulic head and impounds an estimated area of one acre. Currently, the impoundment is partially filled with sediment and is the most important fish passage barrier within the Project boundary.

2.3.2 Culverts

The Eel River is conveyed through three culverts within the Project area: beneath Long Pond Road, beneath the TNC driveway, and beneath a berm located downstream of the TNC driveway and upstream of Sawmill Pond. These culverts have resulted in varying degrees of disruption to geomorphic processes and fish passage within Eel River, and are functioning as improperly located grade controls. The Project calls for the removal of each of these obstructions, and replacing them with properly-sized culverts or open channels, as described below.

2.3.2.1 *Long Pond Road Crossing*

The Long Pond Road crossing is a 4-foot-diameter, cast-in-place concrete culvert. The inlet features a sluiceway entrance and the outlet is composed of an antiquated flow control structure that transports water, following a perpendicular turn, through another approximately 3-foot-diameter corrugated metal culvert beneath a small berm. This existing configuration is proposed to be replaced with a 10-foot x 6-foot open bottom box culvert. The design reflects the Massachusetts River and Stream Crossing Standards calling for natural bottom crossings with adequate openness ratio to simulate more undisturbed hydraulic conditions and to allow for the unimpeded passage of fish and wildlife.

2.3.2.2 *TNC Driveway Crossing*

The Eel River also flows beneath a small, single-lane earthen driveway leading to the TNC office, located just downstream of Bog 1. The existing set of culvert pipes beneath this diversion is set slightly higher than the stream bed, near the upstream influence of the Sawmill Dam impoundment. These culverts are partially blocked and do not provide a free and clear flow path. This crossing will be removed and replaced with a 10-foot x 6-foot open bottom box culvert. A stable grade will be established at the crossing location prior to installation, and that elevation will be dependent on the natural channel design grade connecting Bog 1 with the Sawmill Dam impoundment reach. The design will integrate grade control, property access needs, and the Massachusetts River and Stream Crossing Standards.

2.3.2.3 *Earthen Berm Downstream of TNC Driveway Crossing*

Approximately 300 feet downstream from the TNC driveway is an earthen berm approximately 100 feet long and six feet high. As described in the final 2009 Reconnaissance and Intensive (Locational) Historic and Archaeological Report from the Public Archaeology Laboratory (PAL), the berm was originally thought to be related to the Sawmill Pond Dam located downstream, but is now believed to have been associated with water control for cranberry production during the early 20th century. The river currently crosses the berm through a 4-foot diameter riveted sheet iron culvert. The Project proposes to remove the metal culvert, and widen and stabilize the opening in the berm to allow for unrestricted river passage.

2.4 Historic and Archaeological Resources

The proposed Project is located within the South Pond Village Area (MHC Area PLY.Y), which was surveyed and evaluated as eligible for listing in the National Register of Historic Places by PAL in 1996. The MHC has indicated that there are several archaeological sites located in the vicinity of the Project site. Upon review of the Project's Massachusetts Environmental Notification Form (ENF), the MHC requested that the Project team hire a qualified cultural resource consultant to conduct a Reconnaissance Cultural Resources Survey to assess the Project area for important historic properties including the Sawmill (Glendale Mill) site (MHC PLY-HA-19) that is composed of a main dam complex, a mill site foundation, two dam quarry pits, an impoundment, a small upper dam, and a dam borrow pit.

Because of federal funding and permitting, the proposed Project requires a review in compliance with Section 106 of the National Historic Preservation Act of 1966 as amended (see CFR 800). The state

review required by the MHC under 950 CMR 71 has been coordinated with the Section 106 review [see 950 CMR 71.04(2) and 71.04(3)].

A comprehensive Section 106 Phase IA (Reconnaissance Level) Cultural Resources Survey was conducted by PAL under State Archaeological Permit #3091, issued on November 17, 2008, by the MHC/State Archaeologist. The fieldwork and research for the survey was completed in November and December 2008 and the Technical Memorandum was completed on February 6, 2009 (PAL 2009a). Based on the findings of the Reconnaissance Survey, and with concurrence of the MHC, a Section 106 Phase 1B (Intensive) Survey was completed and a final Intensive Report was submitted to and accepted by the MHC in June 2009. The Intensive Survey included updating the MHC inventory forms for the South Pond Village Area (MHC Area PLY.Y) and a field survey of archaeological resources in the vicinity of the Sawmill Pond Dam. The field survey identified important resources, which will assist in their protection, help guide proposed Project construction activities, and form the basis of any required mitigation activities. Copies of the Final Reconnaissance Survey Technical Memorandum (PAL 2009a) and final Intensive Survey Report (PAL 2009b) can be provided upon request to the Service, New England Field Office, by emailing Eric_Derleth@fws.gov, or calling (603)223-2541, extension 14.

3.0 ALTERNATIVES CONSIDERED

3.1 Alternative 1 (Proposed Action): Dam Reconfiguration; Natural Stream Flow, Wetlands and Vegetation Restoration; and Flow Restrictions Removal

The Service, USDA-NRCS, the Town of Plymouth, and other Project partners have recognized that large-scale restoration opportunities in southeastern Massachusetts are rare, particularly because of the density of development and associated watershed impacts. In the case of the Eel River, the watershed is only marginally developed and has surficial geology that promotes groundwater infiltration. The upper Eel River Restoration Project has many advantages that make it a prime candidate for restoration:

- potential restoration of a coldwater stream supporting brook trout, slimy sculpin, and anadromous fish passage;
- potential restoration of an Atlantic White Cedar Swamp site (a state-ranked rare wetland community vulnerable to extirpation in MA);
- example of common southeast MA wetland disturbance regime (commercial cranberry bog) that could be used to demonstrate ecological restoration techniques to others;
- cooperation of several federal, state, and municipal agencies and watershed groups;
- high visibility of the Project site located adjacent to a well-traveled road;
- excellent access for construction;
- integration with a Town of Plymouth recreation trail network;
- nearby to several schools, maximizing educational opportunities; and
- upstream of a major national historic area (Plimoth Plantation).

Restoration under the Proposed Action substantiates the objective of the proposed Project that is to restore the upper Eel River to a naturalized version of the habitat that existed prior to European settlement and is based upon the ecological documentation for the area. Restoration under the Proposed Action would also meet all of the Project “needs” as detailed in Section 1.2. Full restoration is not possible due to the altered hydrology of the Eel River system, altered bordering forestlands, presence of a downstream dam, and the extensive alteration caused by placement of

massive amounts of sand over the historic peatlands. However, given its proximity to an urbanized area, this Project represents a unique opportunity for large-scale reclamation situated within a highly disturbed area.

Restoration under the Proposed Action addresses all of the “Impact Topics” described in Section 1.3: natural resources; rare species habitat; existing structures; historic and archeological resources; and cumulative effects. By restoring natural wetlands, river channel, and floodplain areas, this Project will restore ecological health and increase species diversity, including native plant communities and fish populations; improve water quality (e.g., enhanced nutrient uptake via increased hydrologic residence time); and with careful long-term monitoring, will strive to avoid the potential invasion of aggressive, non-native species. The restored stream channel eventually will be shaded, thus reducing the adverse consequences of summer solar heating that contribute to existing in-stream eutrophication. The shaded conditions and incorporation of fine, coarse, and dissolved organic matter will contribute to the primary production and improvement of the dissolved oxygen content of the stream water.

As a result of the Reconnaissance and Intensive Cultural Resources Surveys, the Sawmill Pond Dam structure (Glendale Mill Complex) has been recommended to the MHC as locally significant and individually eligible to the National Register of Historic Places Historic Places. The Surveys also concluded that the cranberry bog complex has historic value as contributing element to the South Pond Village Area and will be impacted by restoration under the Proposed Action. As more fully detailed in Sections 4.4 and 4.5, the Project Partners have participated in ongoing consultations with the MHC in compliance with Section 106 of the National Historic Preservation Act of 1966, as amended (see 36 CFR 800). A Reconnaissance Level Survey (Section 106 Phase 1A Survey) and an Intensive (Section 106 Phase 1B) Survey (PAL 2009a, 2009b) have been completed for the Project area. Consultation with the MHC will continue to ensure that the final Project design minimizes any potential effects to the dam complex and is consistent with federal, state, regional, and local historic and archaeological plans and policies.

Construction of the Proposed Action will have temporary impacts on the Eel River system environment, including the dredging of the existing cranberry bogs to construct a sinuous stream channel to re-establish natural conditions; installation of large woody material in the stream channel and on the bog surface; filling of the former artificial side channels; and reconstructing a floodplain with a restored microtopography. Potential environmental impacts to the existing threatened, sensitive, and rare plant and wildlife species; wetlands, waterways and tidelands; and historical and archaeological resources are described in Section 4.0 Environmental Consequences of this report.

The “cumulative effect” of the restoration under the Proposed Alternative is overwhelmingly positive. Long-term net benefits of these short-term impacts are believed to far outweigh the negative effects. Benefits that will be realized by the Restoration Project include: the replacement of undersized culverts at Long Pond Road and the TNC driveway to enhance fish passage; and extensive wetland plantings, including the re-establishment of rare wetland communities (e.g., Atlantic White Cedar Swamp communities). Also included are the long-term benefits to the Town of Plymouth that will accrue from the educational and recreational opportunities associated with the enhancement of a municipal foot trail.

3.2 Alternative 2: Reconfiguration of the Sawmill Dam (Glendale Mill) Structure

Reconfiguration of the Sawmill Dam structure will result in the following benefits to the Eel River:

- fish passage restoration;
- restoration of 1,100 linear feet of cobble, boulder stream;
- coldwater habitat restoration opportunities;
- decreased stream temperature;
- increased stream water dissolved oxygen concentration;
- increased diversity of aquatic coldwater dependent taxa (fish, mussels, macroinvertebrates);
- restoration of historic geomorphology; and
- removal of excess nutrients from the ecosystem.

However, stream restoration without wetland restoration of the upgradient cranberry bogs would allow approximately 8,000 feet of the Eel River to remain open and unrestored with little shade or instream habitat improvements, thereby forgoing the value for fish and other aquatic species. There is currently very low habitat complexity in either the wetland (abandoned commercial cranberry bogs) or the stream, and this would remain so for years due to the slow riparian regeneration and the low stream power that would redistribute sediments and large organic material. Without the restoration of adjacent wetlands, the example of successful, large-scale ecosystem restoration would not be realized. The partial habitat restoration associated with Alternative 2 would not, therefore, meet the Project “needs” detailed in Section 1.2.

Restoration under Alternative 2 would not properly address all of the “Impact Topics” described in Section 1.3: natural resources; rare species habitat; existing structures; historic and archeological resources; and cumulative effects. By restoring only a small subset of the natural wetlands, river channel, and floodplain areas, Alternative 2 would make only minimal progress towards the improvement of ecological health and increased species diversity, including native plant communities and fish populations, improvement of water quality (e.g., enhanced nutrient uptake via increased hydrologic residence time), and determent of aggressive, non-native species. The vast majority of the potential wetland and riparian restoration area would go unrestored. Efforts to improve fish passage from the Alternative 2 dam reconfiguration would be partially compromised because upstream fish habitat would not be improved.

Partial restoration under Alternative 2 would have all of the potentially negative impacts of the Proposed Action on the existing, historic Sawmill Pond Dam structure (Glendale Mill Complex), with few of the natural resources and ecological benefits of the Proposed Action. As more fully described in Sections 4.4 and 4.5, restoration under Alternative 2 would still include consultation with the MHC to ensure that the final Project design minimizes any potential effects to the dam complex and is consistent with federal, state, regional, and local historic and archaeological plans and policies.

Construction of Alternative 2 will have temporary impacts on the Eel River system environment, including the dredging of the Sawmill Pond impoundment and the construction of a sinuous stream channel in its place. The “cumulative effect” of the restoration under Alternative 2 is, however, less positive than for the Proposed Action. Alternative 2 still has many of the potential short-term construction-related impacts to natural resources and most of the potential impacts to historic resources, with much less of the long-term net benefits, in comparison to the Proposed Action.

Long-term benefits of the Proposed Action that will not be realized by Alternative 2 include: the replacement of undersized culverts at Long Pond Road and the TNC driveway to enhance fish passage; extensive wetland plantings, including the re-establishment of rare wetland communities (e.g., Atlantic White Cedar Swamp communities); and educational and recreational opportunities associated with the enhancement of a municipal foot trail.

3.3 Alternative 3: Stream/Wetland Restoration, No Dam Reconfiguration

While restoring the wetlands and the stream at the current cranberry bog locations to a more naturalized state would have a clear benefit to the resource areas, allowing the down-gradient dam to remain in place would result in continued degradation of approximately 1,000 feet of the Eel River and the continued existence of a barrier to fish passage. Longitudinal connectivity is widely recognized as critical to the natural flux of energy, material, and nutrients in a stream system, and leaving the dam in place would not alleviate these impediments to natural system functions. Aside from the issue of connectivity and material movement, contaminants that have accumulated in the impoundment would also remain a source for continued leaching downstream. If dam reconfiguration is not included in this Project, the structure will remain a potential safety hazard, which, without long-term maintenance, ultimately will fail sometime in the future. Such an event would result in the uncontrolled release of contaminated impounded sediments downstream, as well as rapid incision and head-cutting in upstream areas. The partial restoration of Alternative 3 would not, therefore, meet the Project “needs” as detailed in Section 1.2.

Restoration under Alternative 3 would not properly address all of the “Impact Topics” described in Section 1.3: natural resources; rare species habitat; existing structures; historic and archeological resources; and cumulative effects. By restoring only a portion of the natural wetlands, river channel, and floodplain areas, Alternative 3 would make incomplete progress towards the improvement of ecological health and increased species diversity, including native plant communities and fish populations, improvement of water quality (e.g., enhanced nutrient uptake via increased hydrologic residence time), and determent of aggressive, non-native species. The portion of the potential wetland and riparian restoration area upstream of the Sawmill Pond Dam and downstream of the TNC driveway would remain in its current unrestored condition. Improvements to fish habitat from the Alternative 3 wetlands restoration would be partially compromised because a substantial fish passage barrier would remain downstream of the restored wetland habitat at the dam site.

Partial restoration under Alternative 3 would avoid any negative impacts of the Proposed Action on the existing, historic Sawmill Pond Dam structure (Glendale Mill Complex). However, the dam structure would remain a potential safety hazard that, without long-term maintenance, ultimately will fail sometime in the future. Such an event would result in the uncontrolled release of contaminated impounded sediments downstream, as well as rapid incision and head-cutting in upstream areas, and a partial loss of the upstream efforts.

Construction of Alternative 3 will have temporary impacts on the Eel River system environment, including dredging of the existing cranberry bogs to construct a sinuous stream channel to re-establish natural conditions; installation of large woody material in the stream channel and on the bog surface; filling of the former artificial side channels; and reconstructing a floodplain with a restored microtopography. The “cumulative effect” of the restoration under Alternative 3 is, however, less positive than for the Proposed Action. Alternative 3 still has most of the potential short-term construction-related impacts to natural resources, with much less of the long-term net benefits, in

comparison to the Proposed Action. Long-term benefits of the Proposed Action that will not be realized by Alternative 3 include the removal of a major barrier to fish passage at the Sawmill Pond Dam, and the restoration of approximately 1,100 feet of stream channel and associated habitat in the area of the current dam impoundment. Additionally, Alternative 3 has the potential for long-term detrimental effects on a portion of the restored area upon eventual dam failure.

3.4 Alternative 4: No-Action Alternative

The No-Action alternative would eliminate the cost of the restoration efforts and would allow Project partners to focus their attention on other projects. This initial cost savings, however, may be the only positive aspect of No-Action. The No-Action alternative would allow the existing flow restrictions within Eel River to remain, would not improve fish passage, and would not improve biological diversity or ecosystem integrity. Over an extended period, natural succession of the bogs will occur, but given the historic alterations to the hydrology of the system, the successional community may not fully function as a natural wetland complex or riverine system, and may over time become vulnerable to invasive species. Streams support complex natural communities, transporting and transforming nutrients, sediments, and organic debris through biological, chemical, and physical interactions to support healthy ecosystems. According to the NHESP, 34% of Massachusetts' river and stream miles support rare or endangered species. The No-Action alternative would not "alter" the existing wetland resource areas, but in doing so, would leave this critical river corridor, and the natural communities that it supports, at risk of becoming increasingly degraded, thereby further reducing species diversity and ecological health. The No-Action alternative would also leave the dam in place, which would perpetuate a potential safety hazard that without long-term maintenance would ultimately lead to the dam's failure sometime in the future. Such an event would result in the uncontrolled release of contaminated impounded sediments downstream, as well as rapid incision and head-cutting in upstream areas.

The Town, USDA-NRCS, and the Service, as well as many other groups, have invested time and effort to protect this abandoned cranberry complex for future restoration. Restoration of the abandoned cranberry bogs in the Eel River could become an important model for remediation of a common wetland disturbance regime (commercial cranberry operations) within wetland and stream peatland systems throughout the country. If a No Action approach is taken, opportunities for environmental education and public interaction will be lost. Natural wetland restoration is the primary goal of this proposed Project; the No-Action alternative would not serve the Project purpose. The complete absence of restoration under Alternative 4 would not, therefore, meet the Project "needs" detailed in Section 1.2.

Inaction under Alternative 4 would not properly address any of the "Impact Topics" described in Section 1.3: natural resources; rare species habitat; existing structures; historic and archeological resources; and cumulative effects. By taking no action of any kind, Alternative 4 would not make any progress towards the improvement of ecological health and increased species diversity, including native plant communities and fish populations, improvement of water quality (e.g., enhanced nutrient uptake via increased hydrologic residence time), and determent of aggressive, non-native species. In addition, several substantial fish passage barriers would remain in place, educational and recreational opportunities would go unfulfilled, and the dam structure would remain a potential safety hazard that, without long-term maintenance, will ultimately fail sometime in the future and result in the uncontrolled release of contaminated impounded sediments downstream with associated rapid incision and head-cutting in upstream areas.

Inaction under Alternative 4 will avoid any temporary impacts on the Eel River system environment, but the “cumulative effect” of no action under Alternative 4 is dramatically less positive than for the Proposed Action. Alternative 4 would achieve none of the long-term net benefits of the Proposed Action. Long-term benefits of the Proposed Action that will not be realized by Alternative 4 include: the removal of a major barrier to fish passage at the Sawmill Pond Dam; the restoration of approximately 40 acres of degraded wetland habitat; the restoration of approximately 9,000 feet of stream channel and associated habitat in the area of the current dam impoundment; the replacement of undersized culverts at Long Pond Road and the TNC driveway to enhance fish passage, extensive wetland plantings, including the re-establishment of rare wetland communities (e.g., Atlantic White Cedar Swamp communities); and educational and recreational opportunities associated with the enhancement of a municipal foot trail.

3.5 Environmentally Preferred Alternative

According to the CEQ guidelines, the Environmentally Preferred Alternative is the alternative that best promotes the following NEPA goals, as outlined in Section 101(b) of the NEPA:

1. fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;
2. assure for all Americans safe, healthful, productive, and esthetically and culturally pleasing surroundings;
3. attain a wide range of beneficial environmental uses without degradation, risk to health or safety, or other undesirable and unintended consequences;
4. preserve important historic, cultural, and natural aspects of our national heritage ... and maintain ... an environment that supports diversity, and variety of individual choices;
5. achieve a balance between population and resource use that will permit high standards of living and a wide sharing of life’s amenities; and
6. enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

The restoration and enhancement of public access to Eel River and its surrounding environment, as described in Alternative 1 (Proposed Action), provides an ecological and social benefit for plants, wildlife, and humans alike. The Eel River Headwaters, a previously disturbed ecosystem, is in need of further human intervention in order to restore its level of ecological function, while also enhancing its overall capacity as an undeveloped recreational and conservation resource. The proposed improvements will have an immediate ecological impact, but also will serve to ultimately enhance and preserve its ecological and recreational resource values for future generations to enjoy. Neighboring properties will benefit from the enhanced value of the Project site and its surrounding environment, including the Saw Mill Pond Dam, Eel River, and the associated cranberry bogs and wetland areas. As a result, Alternative 1, the Proposed Action, is also considered the Environmentally Preferred Alternative.

4.0 ENVIRONMENTAL CONSEQUENCES

This section summarizes the physical, biological, social, and economic conditions of the affected Project area, and the potential changes to those conditions due to implementation of the Project. While the Project will result in the temporary alteration of wetlands and waters of the United States,

in an area previously disturbed, it will also result in long-term net benefits to the resource areas. See proposed conditions for the Project area that are represented on the design site plan excerpts included in Appendix B. Complete copies of the design plans can be provided upon request to the Service, New England Field Office, by emailing Eric_Derleth@fws.gov, or calling (603)223-2541, extension 14.

The proposed restoration of approximately 40 acres of retired commercial cranberry bogs will have important environmental benefits. The Project site currently offers limited ecological value, as former agricultural activities resulted in the removal of all trees, modification of the stream channel, and placement of berms and water control structures to alter hydrology in the seven cranberry bog cells. Restoration activities will include dredging to construct a sinuous stream channel to re-establish natural conditions; filling of former artificial side channels; reconstruction of a floodplain with a restored microtopography; removal of berms and water control structures; replacement of two undersized culverts beneath Long Pond Road and a private driveway; and the complete removal of another culverted stream crossing to enhance fish passage, extensive wetland plantings and re-establishment of rare wetland communities (e.g., Atlantic White Cedar Swamp). The following sections describe the environmental consequences to the existing threatened, sensitive, and rare plant and wildlife species; wetlands, waterways and tidelands; and historical and archaeological resources.

4.1 Natural Resources

Table 2. Impacts to Wetlands, Waterways & Tidelands for Proposed Action (Massachusetts-Designated Resource Areas)

Resource Area	Units	Temporary Construction Alteration	Post-Construction Restoration
Land Under Water	Square Feet	96,968 (bogs) <u>65,841 (dam)</u> 162,809 (total)	147,374 (bogs) <u>16,097 (dam)</u> 163,471 (total)
Bank	Linear Feet	4,900 (bogs) <u>1,328 (dam)</u> 6,228 (total)	7,510 (bogs) <u>1,448 (dam)</u> 8,958 (total)
Bordering Vegetated Wetland	Square Feet	1,489,938 (bogs) <u>73,567 (dam)</u> 1,563,505 (total)	1,488,200 (bogs) <u>128,411 (dam)</u> 1,616,611 (total)
Bordering Land Subject to Flooding (Flood zone)	Square Feet	31,924 (bogs) <u>29,137 (dam)</u> 61,061 (total)	30,637 (bogs) <u>24,045 (dam)</u> 54,682 (total)
Riverfront Area	Square Feet	2,028,224 (bogs) <u>632,131 (dam)</u> 2,660,355 (total)	2,440,645 (bogs) <u>635,803 (dam)</u> 3,076,448 (total)

Sources: Eel River Engineering Designs for Phase I – Cranberry Bogs (February 2009; Inter-fluve, Inc.) and Eel River Engineering Design for Phase II – Sawmill Dam (February 2009; Inter-fluve, Inc.).

Note: Categories are broken out by wetland resource areas as specifically regulated under the Massachusetts Wetlands Protection Act.

4.1.1 Wetlands, Waterways & Tidelands

4.1.1.1 *Vegetated Wetland*

The Project is expected to temporarily disturb a portion of Bordering Vegetated Wetland (BVW). However, once completed, the Project will result in a net increase of almost two acres of restored and revegetated BVW, due to the reconfiguration of the agricultural berms within the bogs and to the conversion of Sawmill Pond to a stream bordered with vegetated wetlands, as well as in improved overall habitat in the entire BVW. These conditions include improved drainage and water quality (from natural channel restoration and dam reconfiguration), restored tree cover and wildlife habitat, and the re-establishment of wetland microtopography and indigenous wetland species (including plantings of red maple and Atlantic white cedar trees).

4.1.1.2 *Waterways*

The Project proposes to replace the entire existing channelized system, and therefore alter a significant length of Inland Bank and Land Under Water Bodies and Waterways (LUW). The restored sinuous channel will increase the linear footage of the Bank (by approximately 3,000 linear feet) due to the meandering nature of the reconstructed stream, increase instream habitat complexity (restoration of riffles and pools, incorporation of woody material), increase vegetative cover, and provide a diversity of flow velocities. The Project will improve the physical stability; water carrying capacity; flushing; the capacity to provide breeding habitat, escape cover and food for fisheries; and the capacity to provide important wildlife habitat functions of the existing stream channel.

In addition, the Project will result in the creation of over 160,000 square feet of additional LUW from the reconfiguration of channels within the bogs and Saw Mill Pond, the new seepage reservoir at Bog 7, and the channel in the North Branch of Bog 1. The largest LUW area increase comes from the new seepage reservoir, which will be created as part of the microtopography excavated below groundwater level.

4.1.1.3 *Flood Zone*

While the Project will temporarily alter six acres of flood zone, approximately the same square footage and flood storage capacity will be restored. While the Sawmill Dam appears to provide some flood storage capacity, the existing impoundment generally maintains a pond elevation at the spillway elevation so the existing dam does not, in fact, provide substantial flood storage capacity. Revegetation of the new floodplain will include targeted planting and seeding of native trees and shrubs to augment the existing native seed bank that is anticipated to germinate once the overlying impounded water is lowered to expose the sediments and seeds. With the creation of additional wetland area and the increased length of a meandering stream corridor, no substantial reduction of flood storage capacity is anticipated from the Project.

Implementation of the Proposed Action will provide increased capacity for the flood zone to provide wildlife habitat for native species. No permanent change is anticipated in: flood storage volume; flood stage or velocity; and the capacity of the floodzone to provide important wildlife habitat functions.

4.1.1.4 Riverfront Area

It is anticipated that the completed Project will have no important adverse impacts on the ability of the Riverfront Area to provide the following functions and values:

- protect the quality of the public water supply;
- provide critical wildlife habitat;
- protect fisheries and shellfish habitats;
- protect groundwater quality; and
- prevent flooding, storm damage and pollution.

Extending 200 feet from the edge of the channel, the Riverfront Area encompasses and overlaps other wetland resource areas, including vegetated wetlands and floodplain. The benefits to the wetlands areas and to waters of the United States resulting from the implementation of the Proposed Action will also be realized within Riverfront Area.

4.1.2 Surface Water and Hydrology

Until the Sawmill Dam is reconfigured and the impounded sediment is removed, it is difficult to determine if any definable stream morphology exists below the sand and silt. Restoration of moderate gradient streams, like the Eel River, following dam reconfiguration usually involves construction of stable banks using fabric encapsulation. The channel bed can be manipulated into a stable riffle and pool or cascade configuration, whichever is appropriate, and then a floodplain is created by building banks until the desired channel width is achieved. Placement of large woody debris and boulders will be incorporated into the stream bank design, while smaller pieces of woody debris will be used for floodplain roughness and overhead cover for fish habitat restoration.

4.1.3 Cranberry Bogs

4.1.3.1 Sediment Considerations for Bog Restoration Activities

In the bogs, approximately 27,500 cubic yards (CY) of sediment will be disturbed during the restoration activities; a majority of this material will be previously imported sand (used during cranberry farming), and only a small portion (approximately 1,600 CY) of underlying peat will be disturbed. This total amount includes dredging to construct a new stream channel (3,000 CY), grading to reshape floodplains, blending the perimeter cut slopes back into the hillside, and removing the sand berms that separate the bog cells. An additional 7,000 CY of sediment are expected to be disturbed during the reconfiguration of the downstream stone dam for a total of 34,500 CY of excavated material. Approximately 16,000 CY will be reused in the bogs to fill existing artificial side channels and create natural microtopographic features.

Preliminary management plans for the remaining 18,500 CY of sediment include reuse in the adjacent former borrow pit areas (the original source of the sand). Preliminary sediment sampling and analysis in the bogs detected a variety of organochlorine insecticides and associated break-down products in the sand/peat interface at levels above ecological screening thresholds. These results are not surprising, given the decades of cranberry cultivation that occurred on-site. Two insecticides were detected at concentrations above Massachusetts Contingency Plan (MCP) reportable concentrations and Method 1 cleanup standards. Bog sediment sampling did not detect heavy metals, PCBs, or PAHs above ecological or human health screening values.

The proposed sediment management approach—including beneficial sediment reuse in the bogs and in the adjacent sand borrow pits—has been discussed at length with Massachusetts DEP staff, and is fully described in the 401 Water Quality Certification Application filed on January 16, 2009. As part of that application, a Dredged Materials Reuse Decision (DMRD) was also filed in order to permit upland reuse of insecticide-impacted peat; this document was also filed with the Plymouth Board of Health in October 2008. The DMRD will be recorded against the property title along with the Order of Conditions recently issued by the Town of Plymouth Conservation Commission.

4.1.3.2 Restoration of Bog 1

Bog 1 creates many possibilities for fish habitat restoration, including large woody debris placement, riffle pool construction, and streamside vegetation. The restored stream through Bog 1 will include a transitional riffle pool channel before entering the steep cascading pool section of the restored impoundment.

4.1.3.3 Restoration of Bogs 2 through 7

Bogs 2 through 7 will be restored to a series of sloped peatlands, each drained by a meandering segment of a contiguous restored portion of Eel River, as well as smaller feeder tributaries. The Project also includes the removal of agricultural-related berms and grade controls within Bogs 2 through 7. Sand application has raised the bog approximately 2.0 feet above the historic peatland elevation. Removal of the sand layer to expose the underlying peat throughout the system was considered in the concept design process, but due to cost considerations and the amount of site disturbance, the overall plan is designed to raise the groundwater elevation as opposed to excavating the sand layer. In addition, because sediment sampling has detected limited concentrations of organochlorine insecticides and byproducts (described in more detail below) in the peat layer, it was decided to limit peat exposure in order to prevent the potential redistribution of contaminated soils.

Eel River channel bottom grade controls are proposed to be raised roughly 1-3 feet in each bog, thus raising the groundwater levels and saturating the riparian soils to create the desired wetland hydrology. This does not preclude partial removal of sand or removal of sand to expose peat in selected areas. The grade control riffles will have slopes from 0.2 to 1.0%, with variable sediment sizes from gravel to cobble.

The overall plan includes both Atlantic White Cedar and Red Maple Swamp restoration areas. Because red maple can be prolific and invade cedar swamps, the two areas will be separated by a buffer peatland. Bog 2 is proposed to be restored to a Red Maple Swamp riparian area, using Bogs 3 and 4 as a buffer with the cedar restoration proposed in Bogs 5, 6, and 7. In this way, stream flow and prevailing winds will minimize the chance of upstream spreading of red maple. Vegetative management will be required as part of the long-term management plan for the Project, and it is anticipated that some red maple seedlings will need to be removed from the other peatland areas (e.g., the planted Atlantic White Cedar Swamp restoration areas) until the Project is deemed a success. Success criteria will be developed as part of the maintenance and monitoring plan.

4.2 Surrounding Woodlands

Drawdown of the dam water level will begin with the removal of trees on the top of the dam. If possible, some of these large pine trees will be removed and stored on-site for later use as large woody debris in the restored stream channel.

4.3 Protection Strategies for Rare Species

Approximately 85% of the Project area (the area upstream of Long Pond Road) falls within critical habitat for the federally-endangered Northern Red-bellied Cooter (65 FR 2128). While not directly impacting coastal pond or adjacent sandy nesting habitats, the Project proponents completed an Intra-Service Section 7 Biological Evaluation that determined that the Project is not likely to adversely affect the Red-Bellied Cooter or adversely modify critical habitat for this species (see Appendix C).

The NHESP determined that the Project will occur within the habitat of the Eastern Box Turtle and the Bridle Shiner. These species are listed as Species of Special Concern in Massachusetts. NHESP has approved the attached “Eastern Box Turtle (*Terrapene carolina*) Protection and Habitat Enhancement Plan” (dated 11/24/2008), as submitted by the Project team for turtle protection measures (Appendix D). The Turtle Protection and Enhancement Plan will serve to create and maintain Eastern Box Turtle nesting habitat at the site. Also included within this plan is a long-term habitat management plan for this species.

NHESP also requires the development and implementation of a protection plan for the Bridle Shiner to address concerns regarding the channel dewatering process and sedimentation controls during the construction phase of the proposed Project. This is being prepared by the Project team in coordination with NHESP staff.

4.4 Existing Structures [Sawmill (Glendale Mill) Pond Dam and Culverts]

4.4.1 Saw Mill (Glendale Mill) Pond and Dam Reconfiguration

The valley shape in this reach of the Eel River dictates the methodologies used for dam reconfiguration and river restoration. The floodplain is narrow, and steep valley walls confine the Project area—exactly the attributes that originally made the site an attractive dam location. Based on data collected to date, dam reconfiguration is proposed to proceed with the following general sequence, although ongoing archaeological monitoring and/or unusual circumstances encountered during construction may slightly modify the restoration approach.

4.4.1.1 *Partial Drawdown and Tree Removal*

The water level of the impoundment will be drawn down in stages to allow the impounded sediments to at least partially dry out prior to removal. By lowering the channel in the impoundment, the surrounding water table will lower and the accumulated sediments will then dry out over time. The sediments here are dominated by sands, and will thus be subject to rapid drying, making mechanical removal easier. This technique will also minimize the head-cutting and channel-widening that could cause mass wasting and transport of material downstream.

After completing consultations with the MHC, and with the assistance of a 36 CFR 61 qualified industrial historian/archaeologist, the drawdown of the impoundment will begin with the removal of trees on the top of the dam. If possible, at least some of these large pine trees will be pulled down and stored on-site for later use as large woody debris in the restored stream channel. Also in consultation with the MHC, the dam structure is proposed to be partially dismantled in the area of the outlet/spillway and then rebuilt with the assistance of a qualified historic masonry contractor to allow for unrestricted river passage. One side of the dam will be left essentially unchanged from its existing condition and the other side will be partially dismantled in a documented manner and then reconstructed to allow for a wider and unrestricted river passage. The dismantled portion of the dam will be rebuilt following the original stone placement documented during the dismantlement. A pedestrian bridge will span the widened river passage.

4.4.1.2 Sediment Considerations for Dam Removal

A conservative estimate of saturated sediment deposited behind the Sawmill Dam structure is approximately 7,000 CY, equating to approximately 450 truckloads (15 CY loads). This sediment is primarily coarse sand in the upper and middle portion of the impoundment with fine sand and silt closer to the dam structure. The impounded sediment around the margins and on the upstream end of the impoundment has a substantial organic and silt component. Sediments will be mechanically removed either by excavation or dredging. Removal of these impounded sediments is important for several reasons, including: (1) limiting the impacts to downstream areas via smothering or contaminant transport, and (2) establishing the natural grade for the restored stream channel and associated floodplains to be constructed in the impoundment area. Mechanical removal of sediments will involve excavation along a parallel bench or constructed pad spurs jutting out into the reservoir. With parallel excavation, long arm excavators perched on the valley slope just inside the current water line can easily reach to the middle of the impoundment from either side. Constructed spurs of gravel or geotextile fabric will allow machines to drive straight out into the impoundment and excavate material on either side.

Preliminary sediment sampling and analysis in the impoundment detected low concentrations of many of the same organochlorine insecticides and associated break-down products found in the upstream cranberry bogs. Low concentrations of certain metals and PAHs associated with stormwater runoff from the upstream road crossing were also detected as noted above. The proposed sediment management approach, including beneficial sediment reuse in the bogs and in the adjacent sand borrow pits, is fully described in the 401 Water Quality Certification Application. As part of that application, a DMRD was also filed in order to permit upland reuse of insecticide-impacted peat; this document was also filed with the Plymouth Board of Health, and will be recorded against the property title.

4.4.1.3 Structure Reconfiguration

With the assistance of a 36 CFR 61 qualified industrial historian/archaeologist and qualified historic masonry contractor, the Sawmill Dam is proposed to be partially dismantled from the top down using a large excavator, as no concrete is assumed to be present in the structure. Proposed plans include leaving the right (south) bank portion of the dam (looking downstream) largely intact, while removing most, if not all, of the left bank (north) portion. A pedestrian footbridge that will become part of a Town of Plymouth trail system is proposed to be built across the breach in the dam. Salvaged materials from the dam are proposed to be used to stabilize the right and left abutments of

the new foot bridge. Confirmation of the exact makeup of the dam's interior will be determined through borings prior to construction. With the MHC concurrence, large boulders are to be salvaged and used in historic preservation or potentially in the channel restoration upstream of the dam. Smaller material may be loaded onto trucks and reused across Long Pond Road near the sand excavation area (former borrow pits) on the northeast corner of Bog 2 (see enclosed Sawmill Dam Design Plans).

4.5 Historic and Archaeological Resources

The Project proponents, including the Service as Lead Federal Agency and the USDA-NRCS as a Cooperating Agency, continue to consult with the MHC in compliance with Section 106 of the National Historic Preservation Act of 1966 as amended (see 36 CFR 800). The Technical Memorandum prepared by PAL (February 6, 2009) presented the results of the Reconnaissance Level Survey (Section 106 Phase 1A Survey) for the Project area, and also recommended the Area of Potential Effect (APE) for the proposed Project, both of which were accepted by the MHC. The final Technical Report, *Reconnaissance and Intensive (Locational) Historical and Archaeological Surveys, Eel River Headwaters Restoration Project, Plymouth Massachusetts*, including recommended actions to mitigate for impacts of the proposed Project, was submitted to the MHC in June 2009 and accepted by the MHC in July 2009. The Service determined that the Proposed Action will have an adverse effect on historic properties within the project area and a draft Memorandum of Agreement (MOA) was developed by the Service which was accepted by the MHC on August 10, 2009.

5.0 PROPOSED MITIGATION

The federal, state, and municipal agencies continue to work closely with the NHESP staff to develop protection and management strategies for the pre-construction, construction, and post-construction phases of the proposed Project to ensure the viability of habitat for federal- and state-listed species determined to exist within the Project area: Red-Bellied Cooter (federal and MA state-endangered), Eastern Box Turtle (MA Special Concern), and Bridle Shiner (MA Special Concern).

The Service continues to work closely with the MHC to ensure that historic and archaeological resources are protected. The Service and its partners have worked with the MHC to apply the Criteria to Adverse Effects in order to mitigate adverse effects (see 36 CFR 800.4-800.5). Pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended (36 CFR 800), a final MOA (see Appendix E) has been signed by the Service, and was submitted to the MHC and the Town of Plymouth for signature on August 27, 2009. The MOA accepts all of the recommended mitigation actions presented in the final Intensive (Phase IB) Survey as Stipulations for the Proposed Action. The final MOA is the basis for moving forward with public notification in the NEPA process. The Project as finally implemented will be consistent with federal, state, regional, and local historic and archaeological plans and policies (see also Section 4.5).

6.0 CONSULTATION AND COORDINATION

The Town of Plymouth consulted the following individuals, federal, state, and local agencies, tribes, and Project team members during the development of this EA:

- Town of Plymouth;
- U.S. Fish and Wildlife Service, Region 5;
- U.S. Department of Agriculture’s Natural Resource Conservation Service;
- U.S. Army Corps of Engineers;
- Massachusetts Office of Coastal Zone Management (Wetland Restoration Program and Massachusetts Bays Program);
- Massachusetts Department of Environmental Protection;
- Massachusetts Department of Fish and Game;
- Massachusetts Riverways Program;
- Massachusetts Historical Commission;
- The Nature Conservancy;
- Inter-fluve, Inc.;
- Horsley Witten Group, Inc.;
- LEC Environmental Consultants, Inc.;
- Eel River Watershed Association;
- Aimlee Laderman, PhD, Yale University;
- Wampanoag Tribal Officer; and
- Narragansett Tribal Officer.

7.0 COMPLIANCE WITH FEDERAL, STATE AND LOCAL LAWS AND POLICIES

The proposed Project has been evaluated for consistency with applicable federal, state, and local laws, regulations, and programs. A brief description of the Project’s compliance with these governing bodies is provided below in Table 3.

Table 3. Consistency with Federal Laws, Regulations, and Programs

Law, Regulation or Program	Compliance Description
Clean Water Act of 1977 (Federal Water Pollution Control Act Amendments of 1972)	Temporary impacts to wetlands subject to jurisdiction of the Clean Water Act Section 404 will be minimized. The Project has been designed to avoid unnecessary impacts and to minimize unavoidable impacts as practicable.
Endangered Species Act of 1973, as Amended (16 USC 1531 et seq.)	Impacts to identified state- and federally-protected species will be minimized during the construction phase of the proposed Project, and will enhance habitat value.
Rivers and Harbors Act of 1899	An application has been filed for a General Permit to the U.S. Army Corps of Engineers in compliance with this act. Permit issued.
Presidential Executive Order 12898 – Environmental Justice	The proposed Project will enhance recreational opportunities for all residents and visitors, regardless of ethnic background. Public hearings and comments are open to the public. Local Native American Tribal Agencies have been notified.
Fish and Wildlife Coordination Act	The Service is the lead federal agency for the Project

	and has played an integral role in the development of the proposed Project plans and the alternatives analysis.
Presidential Executive Order 11990 – Protection of Wetlands	The proposed Project avoids, to the extent possible, the long- and short-term adverse impacts associated with the alteration of wetlands and new construction in wetlands wherever there is a practicable alternative.
Presidential Executive Order 11988 – Floodplain Management	Project impacts to the mapped 100-year floodplain resulting from dredging within the Eel River and Saw Mill Pond Dam will be minimized to the greatest extent practicable.
National Historic Preservation Act of 1966 as amended (16 USC 470 et seq.)	The proposed Project will result in No Adverse Effect to the National Register-eligible or listed cultural resources or, if unavoidable, will follow the Criteria of Adverse Effect.
Water Resources Development Act of 1990	The proposed Project seeks to increase acreage and enhance the quality of wetland resources. This goal is aligned with the WRDA directive of a “no overall net loss” of wetlands.
North American Wetlands Conservation Act of 1989	NAMWCA encourages partnerships among federal agencies and others to protect, restore, enhance, and manage wetlands, and other habitats for migratory birds, fish, and wildlife. The proposed Project involves federal, state, and non-governmental agencies and groups for the purpose of habitat restoration and enhanced ecological function.
Massachusetts Historical Commission Act and regulations at 950 CMR 71.00	The MHC has been consulted and will continue to be involved in the construction and post-construction phase of the Project.
Massachusetts Clean Water Act and regulations at 314 CMR 4.00: Surface Water Quality Standards; 401 Water Quality Certification at 314 CMR 9.00.	The Project will comply with the MA Stormwater Standards through the implementation of a sedimentation and erosion control program throughout the construction process, as outlined in the proposed Site Plans. The Project will not exceed the required surface water quality standard. Submitted 401 WQC application; approval pending.
Massachusetts Office of CZM and regulations at 301 CMR 20.00-26.00	A determination letter has been submitted to CZM in compliance with the Coastal Zone Management Act to ensure that the Project will not negatively affect the MA coastal zone. A response is pending.
Massachusetts Wetlands Protection Act and regulations at 310 CMR 10.00	The Project proponent has received an Order of Conditions from the local Conservation Commission in compliance with MA WPA (3/27/09).
Massachusetts Endangered Species Act	The Project team has been in consultation with NHESP, and impacts to sensitive species have been taken into account during the design process, and will continue to be monitored throughout the construction process.
Massachusetts Rivers Protection Act 1996	The proposed Project is in compliance with the following goals of this act: protect the private or public water supply; protect the groundwater; provide flood control; prevent storm damage; prevent pollution; and protect wildlife habitat.

7.1 Required Permits and Approvals

In addition to this Environmental Assessment, the following permits and/or consultations are also required by state and federal agencies:

- 401 Water Quality Certification (MADEP);
- individual 404 Permit (U.S. Army Corps of Engineers);
- Environmental Notification Form (MA Executive Office of Energy and Environmental Affairs), and a decision under the Massachusetts Environmental Policy Act (MEPA);
- Order of Conditions (Plymouth Conservation Commission/ Mass Department of Environmental Protection (MA DEP);
- MESA Project Review (MA Natural Heritage and Endangered Species Program);
- demolition letter (for dam removal);
- National Pollutant Discharge Elimination System (NPDES) permit (U.S. Environmental Protection Agency); and
- Section 106 Historical Certificate (Massachusetts Historical Commission).

7.2 Public Involvement

Resource agencies, abutters, and other stakeholders have been extensively involved throughout the feasibility and conceptual design planning stages of the Project. The Project is undergoing local, state, and federal permitting processes, as described under the Permits section above. Each permit process requires extensive environmental and planning agency circulation, as well as ample public notice and involvement. Therefore, there are existing and suitable opportunities for a wide variety of specialists, regulators, and residents to comment on and condition the Project's unavoidable short-term impacts.

Public meetings were held with interested government agencies and non-profit groups, including the Eel River Watershed Association, Trout Unlimited, Massachusetts DEP, Massachusetts Riverways Program, Massachusetts CZM, USDA, the Service, the Mass Bays Program, USACE, TNC, and the Town of Plymouth on April 21, 2006, September 6, 2006, and December 12, 2007. A public meeting with abutters of the Project was held in February of 2009. A public meeting for any interested parties was held at the Town of Plymouth Conservation Commission on March 16, 2009, when the Notice of Intent for the Project was presented.

7.3 Decision Framework

There will be no significant impacts resulting from the proposed restoration activities of the Project. The Proposed Action provides net benefits that far outweigh its potential impacts on the natural and human environment. Therefore, the Service concludes that a Finding of No Significant Impact (FONSI) be issued for the Proposed Action.

8.0 REFERENCES

Gould, D. February 8, 2007. "Eel River, MA - Restoration Project Concept Design Report."
Plymouth, MA.

Public Archaeology Laboratory. 2009a. Technical Memorandum: Eel River Headwaters Restoration Project Plymouth Massachusetts, Reconnaissance Cultural Resources Survey. February 2009. 74 pp.

Public Archaeology Laboratory. 2009b. Technical Report: Reconnaissance and Intensive (Locational) Historic and Archaeological Surveys, Eel River Headwaters Restoration Project, Plymouth, Massachusetts. June 2009. 219 pp.