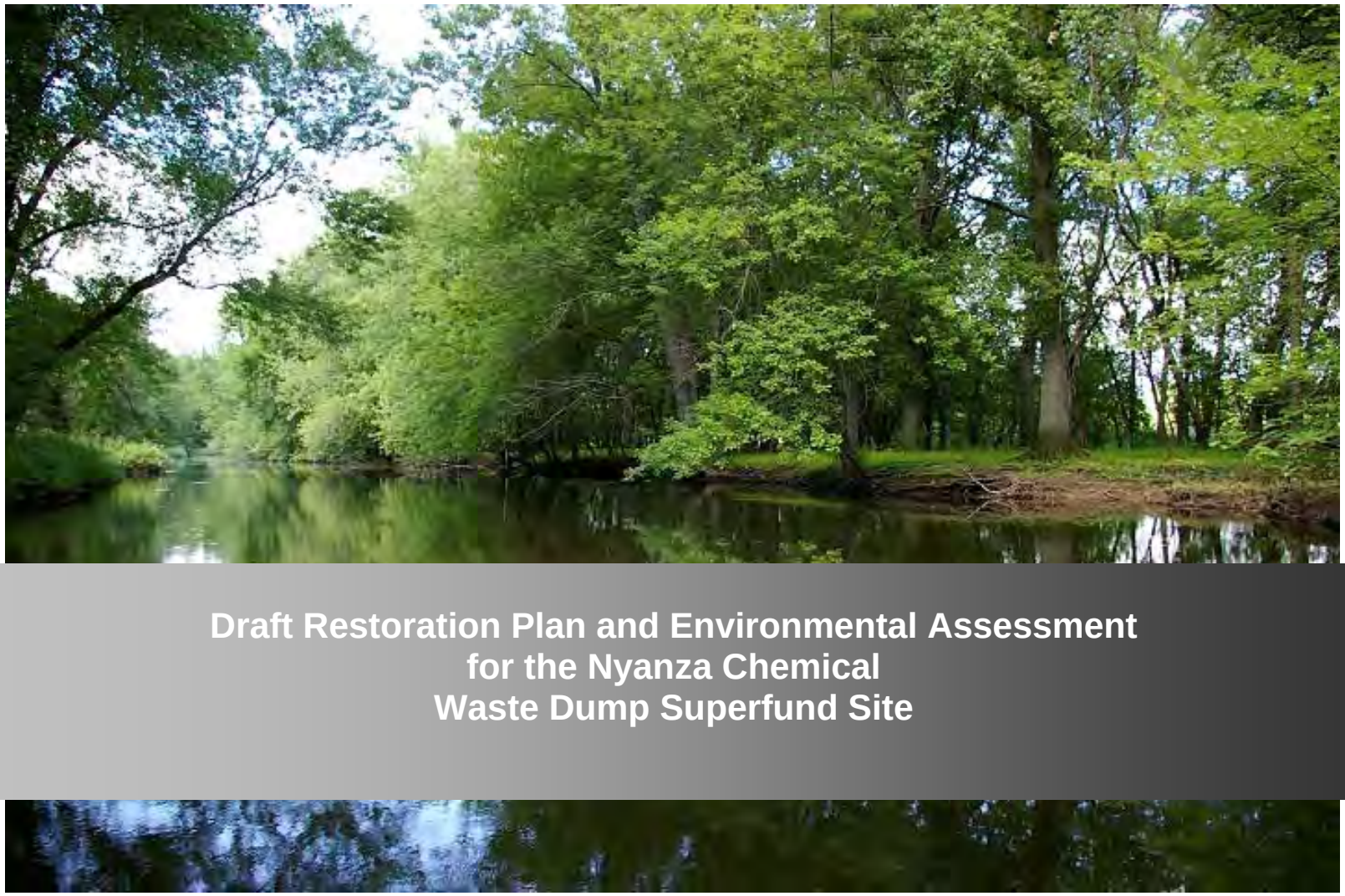

Draft Restoration Plan and Environmental Assessment for the Nyanza Chemical Waste Dump Superfund Site

Prepared for Nyanza NRD Trustee Council:

Commonwealth of Massachusetts

U.S. Fish and Wildlife Service
U.S. National Oceanic and Atmospheric Administration

Prepared by:

Stratus Consulting Inc.
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U.S. Department of the Interior
Approval of the
Draft Restoration Plan and Environmental Assessment
for the
Nyanza Chemical Waste Dump Superfund Site
Town of Ashland, Middlesex County, Massachusetts

In accordance with U.S. Department of the Interior (Department) policy regarding documentation for natural resource damage assessment and restoration projects (521 DM 3), the Authorized Official for the Department must demonstrate approval of draft and final Restoration Plans and their associated National Environmental Policy Act documentation, with concurrence from the Department's Office of the Solicitor.

The Authorized Official for the Nyanza Chemical Waste Dump Superfund Site is the Regional Director for the U.S. Fish and Wildlife Service's Northeast Region.

By the signatures below, the draft Restoration Plan/Environmental Assessment (RP/EA) is hereby approved. This approval does not extend to the final RP/EA. The draft RP/EA shall be released for public review and comment for a minimum of 30 days. After consideration of the public comments received, the RP/EA may be revised to address such comments.

Approved:

Theresa E Rabitoil 9-13-11

Acting Wendi Weber — Date
Acting Regional Director
Northeast Region
U.S. Fish and Wildlife Service

Concurred:

8/12/2011

Mark Barash — Date
Senior Attorney
Northeast Region
Office of the Solicitor

Executive Office of Energy and Environmental Affairs
Approval of the
Draft Restoration Plan/Environmental Assessment

Nyanza Chemical Waste Dump Superfund Site
Natural Resource Restoration

In accordance with Trustee protocol regarding documentation for Natural Resource Damage Assessment and Restoration (NRDAR) projects, the Executive Office of Energy and Environmental Affairs (EEA) is providing its approval of the Draft Restoration Plan/Environmental Assessment (RP/EA) for the Nyanza Chemical Waste Dump Superfund Site Natural Resource Restoration. This approval does not extend to the Final RP/EA.

The Draft RP/EA shall be released for public review and comment for a minimum of 30 days, as required by federal law. After consideration of the public comments received, the RP/EA may be revised to address such comments.

Approved:

11-15-11

Richard K. Sullivan, Jr. Date
Secretary,
EEA
Natural Resource Trustee for the Commonwealth of Massachusetts

Recommending Approval:

11/4/11

Paul Locke Date
Acting Assistant Commissioner
Bureau of Waste Site Cleanup
Massachusetts Department of Environmental Protection

11/7/11

Rosemary Knox Date
Trustee Representative
Nyanza NRD Trustee Council
Massachusetts Department of Environmental Protection

Draft Restoration Plan and Environmental Assessment for the Nyanza Chemical Waste Dump Superfund Site

Prepared for Nyanza NRD Trustee Council:

Commonwealth of Massachusetts

U.S. Fish and Wildlife Service
U.S. National Oceanic and Atmospheric Administration

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November 18, 2011
SC11973

List of Authorities

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U.S. Department of the Interior:
U.S. Fish and Wildlife Service
U.S. Department of Commerce:
U.S. National Oceanic and Atmospheric Administration
Commonwealth of Massachusetts:
Massachusetts Executive Office of Energy and Environmental Affairs, Trustee
Massachusetts Department of Environmental Protection, Trustee Delegate

Legal Authority:

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (as amended), 42 U.S.C. § 9601, *et. seq*.

Federal Water Pollution Control Act (Clean Water Act) (as amended), 33 U.S.C. § 1251, *et. seq*.

Natural Resource Damage Assessment Regulation, 43 C.F.R. Part 11

Oil Pollution Act of 1990 (33 U.S. Code 2701-2761 et seq.)

Massachusetts Oil and Hazardous Material Release Prevention and Response Act (Massachusetts General Laws (M.G.L.) Chapter 21E)

Lead Federal Agency for Restoration Plan: U.S. Department of the Interior (Region 5, U.S. Fish and Wildlife Service)

Lead Federal Agency for Environmental Assessment: U.S. Department of the Interior (Region 5, U.S. Fish and Wildlife Service)

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Acronyms and Abbreviations

ACEC	Area of Critical Environmental Concern
ADA	Americans with Disabilities Act
BERA	Baseline Ecological Risk Assessment
BFREE	Belize Foundation for Research and Environmental Education
BLSF	Bordering Land Subject to Flooding
BMP	best management practice
BRI	BioDiversity Research Institute
BVW	Bordering Vegetated Wetlands
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CISMA	Cooperative Invasive Species Management Area
CMMCP	Central Massachusetts Mosquito Control Project
Comm-PASS	Commonwealth's Procurement Access & Solicitation System
CR	Conservation Restriction
CSCT	Cedar Swamp Conservation Trust
CWA	Clean Water Act
DFG	Massachusetts Department of Fisheries and Game
DOI	U.S. Department of the Interior
EA	Environmental Assessment
EEA	Massachusetts Executive Office of Energy and Environmental Affairs
EIS	Environmental Impact Statement
EJ	Environmental Justice
ENF	Environmental Notification Form
EPA	U.S. Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FIS	Flood Insurance Study
FONSI	Finding of No Significant Impact
GIS	geographic information system
GPS	global positioning system

LID	low impact development
LIP	Landowner Incentives Program
LPCT	Lowell Parks and Conservation Trust
MA DCR	Massachusetts Department of Conservation and Recreation
MA DER	Massachusetts Division of Ecological Restoration
MassDEP	Massachusetts Department of Environmental Protection
MassWildlife	Massachusetts Division of Fisheries and Wildlife
MBTA	Massachusetts Bay Transportation Authority
MEPA	Massachusetts Environmental Policy Act
MESA	Massachusetts Endangered Species Act
M.G.L.	Massachusetts General Laws
MHC	Massachusetts Historical Commission
MOA	Memorandum of Agreement
MoSI	Monitoring Overwinter Survivorship
NAD 83	North American Datum of 1983
NEPA	National Environmental Policy Act
NGO	nongovernmental organization
NGVD 29	National Geodetic Vertical Datum of 1929
NHESP	Natural Heritage and Endangered Species Program
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NRD	natural resource damages
NRDAR	natural resource damage assessment and restoration
NWR	National Wildlife Refuge
OFBA	Office of Fishing and Boating Access
ORW	Outstanding Resource Water
OSHA	Occupational Safety and Health Act
PGP	Programmatic General Permit
PNF	Project Notification Form
POTWs	Publicly Owned Treatment Works
RFR	Request for Response
RP	Restoration Plan
RSC	River Stewardship Council

SuAsCo	Sudbury-Assabet-Concord
T&E	threatened and endangered
TMDL	Total Maximum Daily Load
USACE	U.S. Army Corps of Engineers
U.S.C.	United States Code
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WPA	Wetlands Protection Act

1. Introduction to the Restoration Plan and Environmental Assessment

This Draft Restoration Plan and Environmental Assessment (RP/EA) sets out alternatives and identifies the preferred alternative to restore natural resources and natural resource services that were injured as a result of the release of mercury and other hazardous substances from the Nyanza Chemical Waste Dump Superfund Site (the "Site") located in Ashland, Massachusetts. The Massachusetts Executive Office of Energy and Environmental Affairs (EEA), the U.S. Department of the Interior (DOI), acting through the U.S. Fish and Wildlife Service (USFWS), and the National Oceanic and Atmospheric Administration (NOAA), acting in their capacity as natural resource Trustees on behalf of the public, prepared the Draft RP/EA. Within EEA, the Massachusetts Department of Environmental Protection (MassDEP) administers the Natural Resource Damages (NRD) Program.

A wide range of restoration alternatives was identified through consultation with the public and governmental agencies. Eligibility and evaluation criteria guided the evaluation of alternatives. The ecological and socioeconomic setting of the affected environment, in this case the Sudbury-Assabet-Concord (SuAsCo) Watershed and its communities, was also explored to provide context for this evaluation. In addition, this document constitutes the EA for the proposed restoration of natural resources as defined under the National Environmental Policy Act (NEPA) [42 United States Code (U.S.C.) § 4321 et seq.] and addresses the potential impact of preferred restoration actions on the quality of the physical, biological, and cultural environment.

The preferred restoration alternative includes 12 preferred projects in three categories, summarized as follows:

Aquatic biological resources:

1. Removal of Tire Dump in Forested Wetlands in Ashland (to benefit freshwater wetlands)

2. Control of Aquatic Weeds in the Sudbury River Watershed (to benefit freshwater wetlands and riverine habitat)

3. Habitat Restoration to Benefit Coldwater Fish

4. Concord River Diadromous Fish Restoration: feasibility and stewardship (to benefit diadromous fisheries)

5. Sudbury RiverSchools Program.

Riparian and floodplain resources:

6. Greenways North Field Restoration (to benefit wildlife through restoration of riparian grasslands)

7. Neotropical Connections (to benefit migratory songbirds)

8. Sudbury River Corridor Land Acquisitions (to conserve habitat)

9. Creation of Stearns and Brackett Reservoirs Wildlife Preserve (to conserve habitat).

Recreation and public access:

10. Sudbury River Public Access on Aikens Road (canoe and cartop boat access)

11. Sudbury River Access Improvements at the Great Meadows National Wildlife Refuge (NWR) Headquarters (canoe and cartop boat access)

12. Red Maple Trail: Boardwalk and Wildlife Observation Platform Construction (trails and pathways).

1.1 Trustee Responsibilities and Authorities

When a release of hazardous substances or an oil spill occurs, federal, state, and tribal governments act on behalf of the public as trustees of natural resources under several authorities:

- The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended, commonly known as Superfund (42 U.S. Code § 9601 et seq.)
- The Clean Water Act (CWA) (33 U.S. Code §1251 et seq.)
- The Oil Pollution Act of 1990 (33 U.S. Code 2701–2761 et seq.)
- The Massachusetts Oil and Hazardous Material Release Prevention and Response Act [Massachusetts General Laws (M.G.L.) Chapter 21E].

Natural resources are defined under CERCLA to include “land, fish, wildlife, biota, air, water, ground water, drinking water supplies, and other such resources belonging to, managed by, held in trust by, appertaining to, or otherwise controlled by the United States any state or local government, any foreign government, [or] any Indian [T]ribe” [CERCLA §101(16)]. Trustees assess injuries to natural resources resulting from the release of oil or hazardous substances and

bring claims against responsible parties for monetary damages in order to compensate the public by restoring, replacing, or acquiring the equivalent of natural resources that have been injured to compensate the public. This process is known as natural resource damage assessment and restoration (NRDAR).

Under Section 107(f)(1) of CERCLA, monetary damages awarded through NRD settlements can only be used to restore, replace, or acquire the equivalent of natural resources injured, destroyed, or lost as a result of the release of hazardous substances. Before NRD funds can be expended for this purpose, requirements for planning and public involvement must be met. Section 111(i) of CERCLA requires federal and state trustees to develop and adopt a RP for the use of NRD funds following "adequate public notice and opportunity for hearing and consideration of all public comment." This document describes the public involvement activities undertaken by the Trustees as well as public review and comment opportunities associated with the development of a Final RP.

In addition, the NEPA and its implementing regulations, 40 CFR Parts 1500–1508, require that federal agencies fully consider the environmental impacts of their proposed decisions and that such information is made available to the public. Thus, this RP has been developed to also constitute an EA for the proposed restoration of natural resources as defined under NEPA to address the potential impact of proposed restoration actions on the quality of the physical, biological, and cultural environment

After the Final RP is completed, individual projects may be determined to trigger thresholds established under the Massachusetts Environmental Policy Act (MEPA) and its implementing regulations (M.G.L. c.30, §§ 61–62H, and 301 CMR 11.00). Any such projects will then proceed through a MEPA review prior to implementation. Likewise, some projects may require additional NEPA analysis once the details of the restoration project are further defined (e.g., after the completion of the feasibility/planning portion of the project). Any such additional NEPA analysis will be completed prior to project implementation.

1.2 Summary of Nyanza NRD Settlement

In 1998, the Commonwealth of Massachusetts, NOAA, and the USFWS entered into a NRD settlement, recovering approximately $3 million in damages as compensation for natural resources injured, destroyed, or lost by the release of hazardous substances from or at the Site. Pursuant to the court-entered Consent Decrees, this NRD settlement was allocated as follows: $2.8 million to be expended jointly by the state and federal Trustees and $230,769 to the Commonwealth of Massachusetts for injuries to groundwater at the Site. Since that time, interest earned on the settlement funds has increased the total amount of funding available for restoration activities to approximately $3.7 million.

1.3 Summary of Natural Resource Injuries

The Site is a 35-acre parcel of land located in an industrial area of Ashland south of the Sudbury River (Figure 1). From 1917 to 1978, companies that operated on the Site produced textile dyes and intermediates and generated large volumes of industrial wastes that contaminated soil and sediments, groundwater and surface water, wetlands, and the Sudbury River. The principal contaminant of concern is mercury; other contaminants are chromium, arsenic, lead, and organic compounds such as dichlorobenzene and chlorobenzene. Since 1987, the U.S. Environmental Protection Agency (EPA) has addressed contaminants through interim cleanup actions and four long-term remedial phases focusing on source control and cleanup of the soil, groundwater, wetlands and drainage ways, and the Sudbury River.

Of particular concern to the Trustees and the basis for much of the NRD claim is the Site's impact on the Sudbury River, its floodplain, and associated natural resources. According to EPA, mercury and chromium were used as catalysts in the production of textile dyes from 1917 to 1978. Approximately 2.3 metric tons (2,300 kg) of mercury were used per year from 1940 to 1970, with approximately 45 to 57 metric tons of mercury released to the Sudbury River during this period (U.S. EPA, 2004). Mercury contamination of open water habitats, as well as surface soils and exposed sediments downstream from the Site, reduced the quality of the habitat for fish, amphibians, reptiles, other aquatic organisms, birds, and mammals. In 1986 the Massachusetts Department of Public Health imposed a Freshwater Fish Consumption Advisory for the Sudbury River from Ashland to its confluence with the Assabet and Concord rivers because of elevated levels of mercury in fish tissue. This advisory has continued until the present day. EPA's 2008 Final Supplemental Baseline Ecological Risk Assessment (BERA) also verifies, through site-specific studies, that mercury concentrations are elevated in water and sediments downstream of the Site, as well as in benthic invertebrates, fish, insectivorous birds (e.g., tree swallow, red-wing blackbird); piscivorous birds (e.g., belted kingfisher, hooded merganser); and mammals (mink). (Note: see Figure 2 for the study area included in the BERA.) The 2008 BERA found that although there was evidence of elevated exposure, the concentrations (in different species/biota) do not cause "population-level" effects according to EPA-defined thresholds. However, adverse effects below this threshold level are likely occurring to a variety of species within the site-affected area.

To compensate for natural resources impacted as a result of mercury contamination, the Trustees seek to restore habitats and species similar to those that were identified in remedial investigations and the BERA. Specifically, the Trustees focus on restoring wetland, floodplain, and riverine habitats and species that would utilize these habitats, particularly birds and riverine fish, as well as other aquatic organisms, amphibians, reptiles, and mammals.

Figure 1. Location of Nyanza Superfund Site.

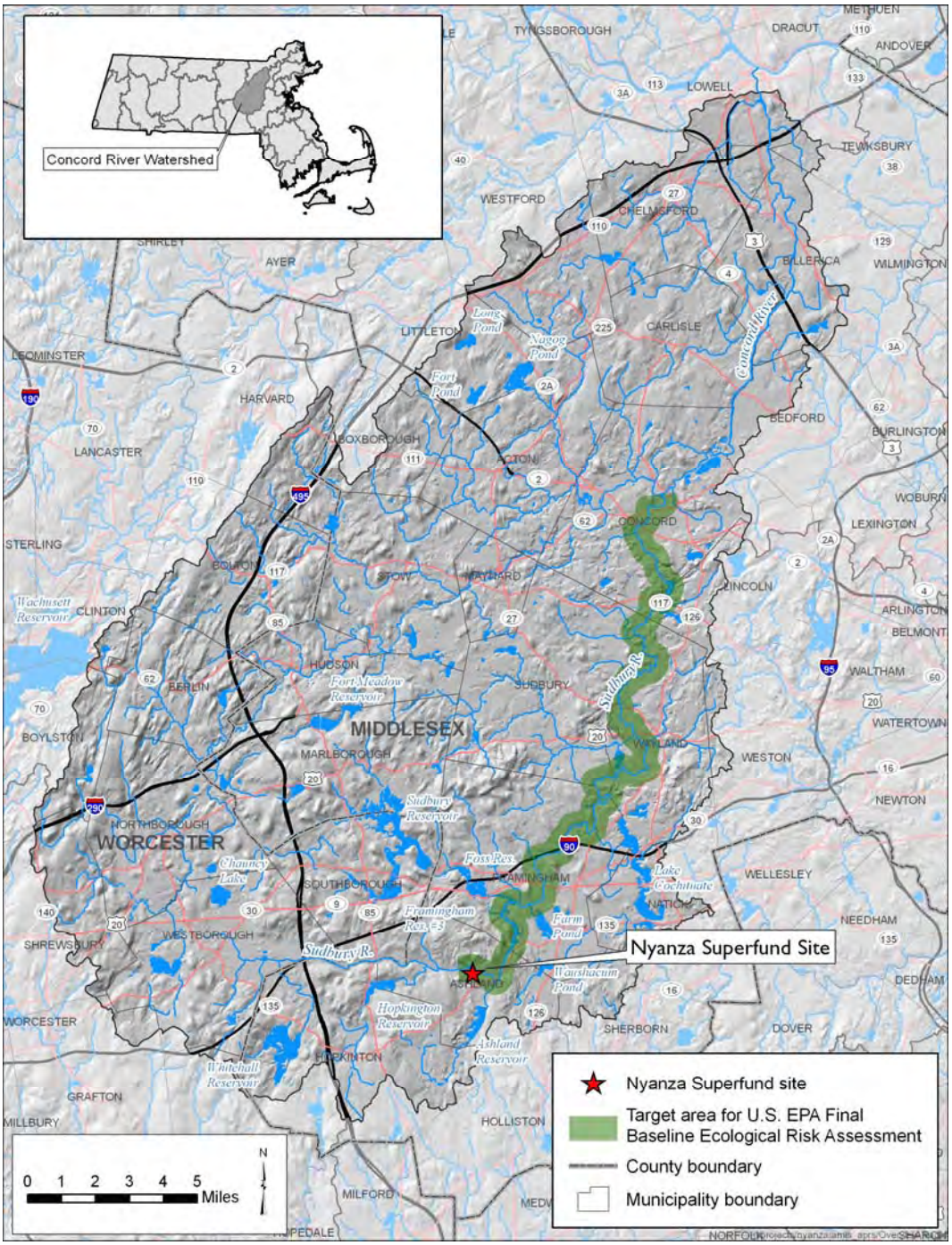

Figure 2. Nyanza Superfund Site in the context of the SuAsCo Watershed. Note that the Sudbury and Assabet rivers join to form the Concord River which discharges to the Merrimack river in Lowell. The EPA Final BERA focused on the stretch of river highlighted in green because of the mercury levels in that area.

1.4 Need for Restoration

The proposed restoration actions are needed to restore natural resources equivalent to those injured by releases of hazardous substances from the Nyanza Site. Based on recommendations set forth in this Draft RP/EA and input from the public, the Trustees will select the preferred restoration alternatives.

1.5 Restoration Goals

The goal of the Nyanza Trustee Council is to develop natural resource restoration projects that restore the injured natural resources of the Sudbury River, including the adjacent wetlands and floodplains, and that also restore the species which are present or historically present, including fish, amphibians, reptiles, other aquatic organisms, birds, and mammals. The objective of restoration planning is to identify restoration projects that will compensate the public for injuries to natural resources that have occurred and will still occur over a lengthy time period, and choose appropriate restoration projects to be implemented with recovered funds.

The Commonwealth of Massachusetts has identified additional restoration goals and criteria for selecting groundwater restoration projects that will be addressed in a separate RP/EA.

Preferred restoration projects restore, replace, or enhance the values of the natural resources injured, or acquire the equivalent of similar resources or services injured. For aquatic resource projects, primary emphasis has been given to restoration projects within and along the mainstem Sudbury River, because these locations are closest to the location of injury. Secondary emphasis has been given to projects that are located within and along the Assabet and Concord rivers but have a positive impact on the injured natural resources and/or their services that are located within, utilize, or historically utilized the Sudbury River Watershed. For migratory birds, the Trustees may consider implementing some projects outside the watershed. These projects would need to demonstrate a positive impact on birds that nest within the Sudbury River Watershed. For projects located in close proximity to the location of injury, the Trustees have considered the potential for contamination or recontamination of the restored resources. Projects will be designed to have minimal intrusive work along the Sudbury River or its banks that could lead to resuspension of contaminated sediments. For example, management and stewardship activities at the Stearns and Brackett Wildlife Preserve will focus on not disturbing the Sudbury River or its banks. Harvesting of water chestnut along the Sudbury River will be coordinated with EPA to avoid disturbing contaminated sediments.

Toward achieving the goal of broadly restoring injured natural resources, the Nyanza Trustee Council identified the following categories of possible restoration activities to be considered in restoration planning:

- Aquatic biological resources and their supporting habitats and food sources
- Riparian and floodplain biological resources and their supporting habitats and food sources
- Water-dependent recreational uses, e.g., recreational fishing.

1.6 Coordination and Scoping

1.6.1 Trustee Council Organization and Activities

In 1998, the Secretary of the EEA, the Secretary of the DOI, and the Under Secretary for Oceans and Atmosphere of NOAA signed a Memorandum of Agreement (MOA) to act on behalf of the public as federal and state Trustees for natural resources for the Nyanza NRD settlement. In addition, MassDEP and EPA were signatories to the MOA to ensure coordination between the Trustees and the remedial agencies. Within EEA, MassDEP administers the NRD Program.

Each Trustee designated a primary representative to the Nyanza Trustee Council. The current Trustee representatives are:

- Rosemary Knox, MassDEP
- Molly Sperduto, USFWS
- Eric Hutchins, NOAA.

For Trustee representative contact information, please see Appendix A.

The Nyanza MOA outlines a framework for the cooperative development and implementation of a RP to restore, replace, and/or acquire the equivalent natural resources affected by the release of hazardous substances from or at the Site. While MassDEP, USFWS, and NOAA have coordinated and cooperated in the development of this RP/EA, the MOA designates the Commonwealth of Massachusetts as the lead administrative Trustee to manage the restoration planning process. The Nyanza Trustee Council's Restoration Coordinator, Karen Pelto, is based at MassDEP. The lead federal Trustee for NEPA documentation and review is the USFWS. Decisions regarding the use of Nyanza NRD settlement funds for restoration activities are made jointly based on unanimous agreement of the Trustees.

1.6.2 Summary of Public Involvement

During 2008 and 2009, the Nyanza Trustee Council met with citizens, community and environmental groups, local and regional officials, and state and federal agencies to explain the restoration planning process and identify restoration projects that address the natural resource injury and meet project selection criteria. In addition to conducting two formal public meetings, Trustee Council representatives and the Restoration Coordinator participated in several meetings hosted by community groups as well as numerous site visits and consultations. These public involvement activities are summarized below.

- On June 11, 2008, the Nyanza Trustee Council hosted the first formal public meeting in Framingham, Massachusetts, to present an overview of the restoration planning process. This overview included information on goals and criteria that would guide the selection of restoration projects and major milestones and opportunities for continued public involvement and input. This informational meeting kicked off public outreach to involve all communities and identify all opportunities for restoration at the earliest possible stage.

  Following the June 2008 meeting, the public and government agencies were invited to submit natural resource restoration project ideas for Trustee Council consideration. These ideas were collected over a 90-day period using a Natural Resource Damage Assessment Restoration Project Information Sheet (OMB Control #0648-0497, expires 9/30/2010; Appendix B). Using this Project Information Sheet, the parties provided information regarding their organization; suggested restoration activities; likely resource, habitat, and/or resource service benefits; project status; and possible partnerships. Respondents were encouraged to include additional information, including maps and diagrams, as appropriate.

  A list of all restoration project ideas submitted to the Trustee Council for consideration, as well as additional projects identified by the Trustee Council, can be found in Appendix C.

- Restoration project ideas could include:

  - Creation of a habitat, natural resource, or service in an area where it did not previously exist
  - Rehabilitation or reestablishment of an area that once provided, but does not currently provide, the targeted natural resource, habitat, or service
  - Enhancement of an existing resource, habitat, or service
  - Preservation/protection that removes a threat to a natural resource, habitat, or service.

- In response to the Trustee Council's request for restoration project ideas, on August 6, 2008, the MetroWest Growth Management Committee, the Sudbury River Watershed Organization, and the SuAsCo Watershed Community Council co-convened an open forum to discuss project ideas and to explore potential partnerships and natural collaborations to help strengthen project proposals. The Nyanza Trustee Council Restoration Coordinator attended this meeting to provide information on the restoration planning process, project eligibility, and evaluation criteria. Meeting participants included organizations, local officials, and individuals who were contemplating a project proposal for the SuAsCo Watershed as part of the RP.

- By September 9, 2008, the Nyanza Trustee Council received a total of 47 project ideas, excluding groundwater restoration submissions. Categories of project ideas included invasive species control, freshwater restoration, diadromous fisheries restoration, land acquisition, education and stewardship, recreation and public access, stormwater management, and resource management and protection.

- To assist in evaluating these project ideas, the Nyanza Trustee Council conducted site visits on August 4, September 12, October 10, and October 28, 2008, and consulted with respondents and appropriate public remedial and natural resource management agencies.

- On November 5, 2008, the Nyanza Trustee Council hosted a second public meeting to discuss proposed restoration project ideas submitted to the Trustees. At this meeting, the next steps in the restoration planning process and additional opportunities for public input were described.

- On October 26, 2009, EEA, acting on behalf of the Nyanza Trustee Council, contracted with Stratus Consulting and its subcontractor, Fuss & O'Neill Inc., to provide additional technical expertise for evaluating restoration project ideas. Additional site visits were conducted on November 16, November 19, and December 10, 2009 to obtain updated information on project status.

- Through site visits and consultations, four additional restoration project ideas were identified. The original 47 project ideas, plus the restoration of wild rice, neotropical migratory bird restoration, freshwater wetlands/tire dump restoration, and additional access improvements at the Great Meadows NWR headquarters, result in 51 project ideas (see Appendix C) that were subject to eligibility and evaluation criteria developed by the Nyanza Trustee Council.

1.6.3 Public Notification

Under CERCLA and NEPA, the Trustees must notify the public of the availability of the Draft RP/EA. The Trustees published the notice of the availability of the Draft RP/EA in the *MetroWest Daily News.* Press releases were issued to local and regional newspapers and notification was circulated to all towns and public meeting participants via email. The document was made available for review at the Ashland Public Library. The document could also be read or downloaded from the web at the following address: http://www.mass.gov/dep/cleanup/sites/nrd/nrdny.htm.

The public will have a 60-day public comment period to review and comment on the Draft RP/EA. Whenever possible, comments should reference specific pages (or sections) in the RP/EA. Comments, suggestions or additional alternatives relating to the RP/EA should be as detailed and specific as possible. Comments should be sent to the attention of Karen Pelto at the following address:

Karen Pelto
Massachusetts Department of Environmental Protection
Bureau of Waste Site Cleanup
One Winter Street, 6th Floor
Boston, MA 02108

or by e-mail to Karen.Pelto@state.ma.us.

The Trustees will review and consider all comments received prior to issuing a Final RP/EA. Summaries of all comments received by the Trustees, the Trustees' responses to comments, along with any clarifications and/or revisions of this document that the Trustees deem appropriate, will appear in the Final RP/EA.

1.6.4 Administrative Record

The administrative record contains the documents pertaining to the Nyanza NRD. The administrative record for the NRD case, including all restoration project ideas submitted to the Nyanza Trustee Council, is housed at the Ashland Public Library, 66 Front Street, Ashland, MA 01721.

2. Affected Environment

This section describes the ecological and socioeconomic environment in which restoration activities would be implemented. The purpose is to summarize the current conditions in the SuAsCo Watershed and provide a foundation for assessing the relative impacts of the restoration

alternatives considered. Regional planning documents, and the conservation and restoration priorities set forth in those documents, were considered in the development of this RP/EA. These planning documents are shown in Table 1 and discussed below. Specific conservation and restoration strategies will be referred to in this RP/EA as appropriate in the evaluation of restoration alternatives, particularly as they relate to the Nyanza Trustee Council restoration goals described in Section 1.5.

Table 1. Selected sources with detailed information on the biological and socioeconomic features of the SuAsCo Watershed

Title	Citation
Final Supplemental Baseline Ecological Risk Assessment, Volume 1: Sections 1–5 for the Nyanza Chemical Waste Dump Superfund Site Operable Unit 4 – Sudbury River Ashland, Massachusetts	U.S. EPA, 2008
Final Comprehensive Conservation Plan for the Great Meadows National Wildlife Refuge	USFWS, 2005b
Final Comprehensive Conservation Plan for the Assabet River National Wildlife Refuge	USFWS, 2005a
Sudbury, Assabet and Concord Wild and Scenic River Conservation Plan	NPS, 1995 (updated 2005)
Assessment Report for the SuAsCo River Watershed	EEA, 2005a
5-Year Watershed Action Plan for the SuAsCo River Watershed	EEA, 2005b
SuAsCo Watershed 2001 Water Quality Assessment Report	MA DEP, 2001
SuAsCo Watershed Greenprint for Growth	SVT, 2001
Greenways Plan for the SuAsCo Watershed	SVT and SuAsCo Watershed Community Council, 2000
MetroFuture: Making a Greater Boston Region	Metropolitan Area Planning Council, 2010

2.1 SuAsCo Environment

The mainstem Sudbury and Assabet rivers join to form the Concord River, which flows into the Merrimack River in Lowell, draining a watershed of 377 square miles. Including tributary streams, there are an estimated 260 named river miles in the watershed. MA DEP (2001) has identified 125 lakes, ponds, and impoundments with a total surface area of 7,147 acres. Several watershed plans identify habitat and recreational resources, as well as critical water quality, water quantity, and other issues and priorities across the watershed (NPS, 1995; Clark, 2000; EEA, 2005a, 2005b).

Natural resources important to protect on a regional scale include key wildlife species and habitat types to support those species, including upland and wetland habitats, and specific natural community types and biodiversity sites within those habitats. Twenty-three municipalities in the SuAsCo Watershed have biodiversity sites within their borders that need protection and management to help protect biodiversity on a regional scale. As of 2000, 45% of these biodiversity sites had been permanently protected. Among these are the Great Meadows NWR and its floodplain forests and marshes, Estabrook Woods in Concord and Carlisle and its extensive forests, Walden Woods in Concord and Lincoln and its unusual bogs, and the Cedar Swamp in Westborough and its rare Atlantic white cedar (*Chamaecyparis thyoides*) groves. Gaps in protection include the western part of the watershed and its unique dry oak forests with seeps, coldwater trout streams, vernal pool clusters, and large field complexes; these habitats support nesting goshawks (*Accipiter gentilis)*, marbled salamanders (*Ambystoma opacum*), bobcats (*Lynx rufus*), bobolinks (*Dolichonyx oryzivorus*), meadowlarks (*Sturnella* spp.), and kestrels (*Falco sparverius*) (Clark, 2000).

Watershed challenges include excessive nutrient enrichment of surface waters contributing to excess algal growth and proliferation of non-native aquatic vegetation; depletion of aquifers, wetlands, ponds, rivers, and streams by groundwater withdrawal and insufficient groundwater recharge; and terrestrial and aquatic habitat fragmentation (NPS, 1995; MA DEP, 2001; EEA, 2005a, 2005b).

2.1.1 Federal Recognition of Ecological Importance

The Sudbury, Assabet, and Concord rivers have been recognized nationally for their unique ecological and cultural resources through the designation of specific reaches as National Wild and Scenic Rivers and through the creation of the Great Meadows and Assabet River NWRs. A number of efforts to restore and enhance wildlife have been undertaken [e.g., USFWS led an effort to establish self-sustaining river herring populations in these rivers, as well as an effort to establish a population of Blanding's turtle (*Emydoidea blandingii*) at the Assabet NWR (USFWS, 2007)]. Each river exhibits distinctive characteristics and experiences unique threats to ecological integrity.

National Wild and Scenic Rivers

In April 1999, Congress designated 29 free-flowing miles of the Sudbury, Assabet, and Concord rivers as Wild and Scenic Rivers in recognition of "outstandingly remarkable" resources in the following categories: recreation, scenery, history, literature, and ecology. This designation encompasses 16.6 miles of the Sudbury River in Framingham (below Danforth Street Bridge), Wayland, Sudbury, Lincoln, and Concord; 4.4 miles of the Assabet River in Concord (1,000 feet below the Damon Mill Dam in West Concord to confluence with the Sudbury and Concord

rivers); and eight miles of the Concord River in Concord, Bedford, and Billerica (upstream of the Route 3 Bridge).

National Wildlife Refuges

The Great Meadows NWR was created "for use as an inviolate sanctuary, or for any other management purpose, for migratory birds" (Migratory Bird Conservation Act, 16 U.S.C. §715d), and is divided into two divisions: the Concord Division (1,542 acres) and the Sudbury Division (2,321 acres) (USFWS, 2005b). The Assabet NWR, formerly known as the Sudbury Training Annex, was created in the fall of 2000, when the Fort Devens Army base transferred 2,230 acres to the USFWS. The Assabet River NWR is located in portions of the Towns of Hudson, Maynard, Stow, and Sudbury and covers approximately 3.5 square miles (USFWS, 2005a).

The Great Meadows NWR provides habitat for a variety of terrestrial and aquatic species. Many migrating waterfowl, shorebirds, wading, and marsh birds utilize the Concord impoundments. Amphibians and reptiles use the marsh habitats. The upland areas support woodcock (*Scolopax* spp.), songbirds, and many raptors (USFWS, 2005b). The Assabet NWR possesses extensive wetland habitats, including a remnant Atlantic white cedar swamp. Of the surrounding upland forests and grasslands, approximately 70% of the refuge land is forested with white pine (*Pinus strobus*) and mixed hardwoods dominating. Along with providing habitat to numerous species considered threatened or endangered by the State of Massachusetts, the Assabet NWR also includes several rare wetland types and a number of vernal pools, which are considered to be habitats of special concern (USFWS, 2005a).

Diadromous fish

In 1999, the USFWS initiated a multi-year effort on the Concord River to restore two species of river herring (blueback herring, *Alosa aestivalis;* and alewife, *Alosa pseudoharengus*). USFWS selected the Concord River because it is the only major tributary of the Merrimack River with a confluence downstream of the Pawtucket Dam in Lowell, which allows diadromous fish (those that live in both fresh and salt water) to traverse between the river and the sea. Also, the Concord and Sudbury rivers contain large amounts of lacustrine and riverine spawning and rearing habitat. Over several years, river herring were transported from the Nemasket River in southeastern Massachusetts to release sites in the Concord and Sudbury rivers. The stocking effort was accomplished with the help of state and federal agencies, environmental groups, and citizen volunteers. Restoration sites for juvenile herring production have been identified on the Assabet and Sudbury rivers and their tributaries. American eel (*Anguilla rostrata*) have also been collected in surveys of the mainstem and tributaries of the Sudbury, Assabet, and Concord rivers (MA DEP, 2001). In addition, American shad (*Alosa sapidissima*) use the Merrimack River for spawning, but this species does not currently utilize tributaries to the Merrimack River, such as the Concord River (Brady et al., 2005).

Sudbury River

The Sudbury River is 41 miles long and originates in Westborough as the outlet of Cedar Swamp Pond. The Cedar Swamp Pond was the first Area of Critical Environmental Concern (ACEC) designated in Massachusetts in recognition of its use as a drinking water supply and uncommon Atlantic white cedar groves. The Sudbury River flows through Ashland into Framingham and then flows north through the Towns of Sudbury, Wayland, Lincoln, and into Concord. The Sudbury River is a relatively low-gradient stream with faster flowing areas and associated riffle and pool complexes limited primarily to the headwater regions of the river and directly downgradient of impoundment dams. The Sudbury River has several distinct sections:

- Upstream of Framingham, the Sudbury River is a narrow, rapidly flowing stream
- In Framingham, the Sudbury River flows through Reservoirs #1 and 2 [Stearns and Brackett reservoirs are currently managed by the Massachusetts Department of Conservation and Recreation (MA DCR)] and into the Saxonville Impoundment
- In Wayland and Sudbury, the Sudbury River flows through the Great Meadows NWR; this 12-mile section changes elevation by only 1 foot, and has been compared to an elongated lake
- In Lincoln and Concord, the Sudbury River discharges into Fairhaven Bay, a lake-like waterbody of the Sudbury River
- The Sudbury River then flows north to its confluence with the Assabet River at Egg Rock in Concord.

The Massachusetts Surface Water Quality Standards designate the most sensitive uses for which surface waters in the Commonwealth shall be protected. Examples of designated uses include public water supply, habitat for fish, other aquatic life and wildlife, fish consumption, primary (swimming) and secondary (boating) contact recreation, and aesthetics. MassDEP routinely conducts sampling in rivers and lakes to assess the quality of surface waters, aquatic habitats, and aquatic species. The assessment of water quality conditions leads to a determination of whether each designated use of a particular water body is *supported* or *impaired* (MA DEP, 2001).

According to the MA DEP (2001), 51% of the river miles in the Sudbury River Watershed are assessed as supporting the Aquatic Life Use; and 28% are assessed as impaired for the Aquatic Life Use. On the mainstem, the Sudbury River from the outlet of Framingham Reservoir #1 to the inlet of Saxonville Pond in Framingham has a moderately impaired benthic macroinvertebrate community. In 1986, the Massachusetts Department of Public Health issued a site-specific fish consumption advisory for the Sudbury River for all towns from Ashland to

Concord due to mercury contamination. Additionally, a site-specific fish consumption advisory has been issued for the Concord River in the Towns of Concord, Carlisle, Bedford, and Billerica due to mercury. For a complete list and maps of fish consumption advisories, see http://www.mass.gov/dph/fishadvisories.

The CWA, under Section 303(d), requires that states identify waterbodies that are not expected to meet surface water quality standards even after required levels of pollution controls have been installed to address point sources of pollution (such as municipal and industrial discharges). These lists of impaired waterbodies are referred to as "303(d) lists." In addition, under Section 305(b) of the CWA, states are required to produce a biennial water quality report that evaluates all waters with respect to their capacity to support designated uses. Beginning in 2002, Massachusetts combined these reporting requirements into an "Integrated List of Waters" that fulfilled the reporting requirements for both Section 303(d) and Section 305(b) (EEA, 2008).

Two segments of the Sudbury River, from the outlet of Saxonville Pond in Framingham to the confluence with the Assabet River in Concord, are listed on the 1998, 2002, 2004, and 2006 versions of the Massachusetts 303(d) list for non-attainment of designated uses due to metals (U.S. EPA, 2010). Also, the 2008 Massachusetts Integrated List of Waters lists those segments as impaired for metals, plus two additional segments in the Sudbury River (from the Fruit Street bridge in Hopkinton/Westborough to the inlet of Framingham Reservoir #2 in Ashland, and from the outlet of Framingham Reservoir #1 to the inlet of Saxonville Pond in Framingham) as impaired for metals (EEA, 2008).

Assabet River

The headwaters of the Assabet River begin in Westborough and feed the reservoir above the George H. Nichols Dam. The Nichols Dam, which is managed by the U.S. Natural Resources Conservation Service, was completed in 1970 as a multipurpose dam that provides flood control and maintains a 380-acre pool for recreation. From the outlet of the dam, the Assabet River flows northeast for 30 miles through Northborough, Marlborough, Hudson, Stow, Maynard, and Concord to its confluence with the Sudbury River at Egg Rock in Concord.

According to the MA DEP (2001), 24.8 miles of the Assabet River mainstem are assessed as impaired for the Aquatic Life Use. Causes of impairment include flow regime alterations, total phosphorus, excess algal growth, non-native aquatic plants, low dissolved oxygen/saturation, and impacted benthic/fish communities. The major known sources of impairment are municipal point source discharges and impacts from hydrostructure/flow regulation/modifications. The Primary, Secondary, and Aesthetics uses are assessed as impaired for the mainstem Assabet River downstream from the Route 20 (Aluminum City) Dam in Northborough to the Powdermill Dam in Acton. Causes of impairment include excess algal growth, debris/floatables/trash, odors, and noxious aquatic plants. The Assabet River is also impaired for the Primary Contact Recreational

Use downstream from the Powdermill Dam to the confluence with the Sudbury River due to elevated counts of fecal coliform bacteria.

The Assabet River is listed on the 1998 (and all previous versions) Massachusetts 303(d) List and the 2002, 2004, 2006, and 2008 Massachusetts Integrated Lists of Waters as impaired primarily for Nutrients and for Organic Enrichment/Low Dissolved Oxygen (EEA, 2008; U.S. EPA, 2010). In 2004, MassDEP prepared a nutrient Total Maximum Daily Load (TMDL) for the nutrient phosphorus (as Total Phosphorus) that requires decreased loadings from Publicly Owned Treatment Works (POTWs) and from certain nonpoint sources, principally sediment phosphorus flux.

Concord River

The Sudbury and Assabet rivers join together at Egg Rock to form the Concord River that flows north for approximately 15 miles through the Towns of Carlisle, Bedford, and Billerica to join the Merrimack River in Lowell. In Billerica, the Talbot Mills and Wamesit Falls (also known as Centennial Island) dams impound the Concord River. The Wamesit Falls or Centennial Island Dam is an active hydropower generator and includes an operational fish ladder maintained by the hydropower operator as a condition of its license from the Federal Energy Regulatory Commission (FERC). The Talbot Mills/Billerica Dam does not have fish passage facilities. (In Lowell, the left segment of the Middlesex Dam has been partially breached and water also flows through the right segment of the dam, but the remaining structures continue to form a hydraulic constriction.) There are also three sets of waterfalls in a one-mile reach on the Concord River in Lowell that provide Class III and IV whitewater for rafting. The Concord River serves as a water supply, with treatment, for the Town of Billerica.

According to MA DEP (2001), none of the 29.6 river miles in the Concord River Watershed support the Aquatic Life Use. Fifteen and one-half river miles of the mainstem Concord River are assessed as impaired because of non-native aquatic macrophyte infestations. Additionally, barriers to fish migration are also suspected of impacting the aquatic life in the Concord River from the Billerica Water Supply Intake in Billerica to Rogers Street Bridge in Lowell. The Concord River from the Rogers Street Bridge to the confluence with the Merrimack River is impaired for the Primary and Secondary Contact Recreational uses because of fecal coliform bacteria, debris/floatables/trash, and excess algal growth. The Concord River is listed on the 1998 (and all previous versions) Massachusetts 303(d) list and the 2002, 2004, 2006, and 2008 Massachusetts Integrated Lists of Waters as impaired primarily for non-attainment of designated uses due to metals, nutrients, pathogens and, below Rogers Street Bridge, noxious aquatic plants (EEA, 2008; U.S. EPA, 2010).

2.2 Socioeconomic Environment

The SuAsCo Watershed encompasses 377 square miles of land in an area of Massachusetts known as "Metro West" and includes all or part of 36 municipalities home to approximately 400,000 people. Acton, Carlisle, Framingham, Hudson, Marlborough, Maynard, Northborough, Southborough, Stow, and Sudbury are entirely within the watershed. Ashland, Bedford, Berlin, Billerica, Bolton, Boxborough, Boylston, Chelmsford, Clinton, Concord, Grafton, Harvard, Holliston, Hopkinton, Lincoln, Littleton, Lowell, Natick, Sherborn, Shrewsbury, Tewksbury, Upton, Wayland, Westborough, Westford, and Weston are partially within the watershed (EEA, 2005a).

The Metropolitan Area Planning Council's region includes many SuAsCo Watershed communities that are characterized as (Metropolitan Area Planning Council, 2008):

- *Regional urban centers*: Framingham, Marlborough, and Lowell are characterized by an urban-scale downtown core with multiple blocks of multi-story, mixed use buildings; moderately dense residential neighborhoods surrounding this core; and (in some cases) lower-density, single-family residential development beyond the downtown core.

- *Maturing suburbs*: Ashland, Southborough, Natick, Wayland, Sudbury, Maynard, Lincoln, Concord, Acton, Bedford, Chelmsford, and Billerica are moderate-density residential communities with a moderate amount of commercial and industrial uses and a dwindling supply of vacant developable land.

- *Developing suburbs*: Hopkinton, Westborough, Hudson, Stow, Bolton, Boxborough, and Carlisle are less-developed towns with large expanses of vacant developable land. Most have recently experienced high rates of growth, primarily through large lot single-family homes. Many of these towns have a well-defined, mixed use town center. Others have town centers with historical and civic significance but no commercial or neighborhood function.

According to EEA, cities and towns within the watershed that include Environmental Justice (EJ) populations are Acton, Framingham, Hudson, Marlborough, Chelmsford, Clinton, Concord, Grafton, Lowell, Tewksbury, Upton, and Westborough (EEA, 2002). In Massachusetts, EJ populations are determined by the following criteria:

- Households earn 65% or less of the statewide household median income
- 25% or more of the residents are minority
- 25% or more of the residents are foreign-born
- 25% or more of the residents are lacking English language proficiency.

Recently, the SuAsCo Watershed has been one of the most rapidly growing areas in Massachusetts. The Interstate-495 Corridor region, comprising all or part of 20 of the watershed's 36 communities, was the fastest growing region in the state in the last decade. In the 20 towns of the Assabet River Basin, alone, population grew by 15% between 1990 and 2000, almost three times the average growth rate throughout the Commonwealth for the same period (SVT, 2001). Recent and projected growth pressure places demand on developable land as well as on water and wastewater services. A significant portion of the headwaters for the watershed rests within these high-growth communities. Population in the I-495 Corridor is projected to increase by 15% between 2000 and 2030; within that time it is projected that 10 communities will exceed their existing water withdrawal allocations (Metropolitan Area Planning Council, 2007).

3. Restoration Evaluation Criteria

While CERCLA and NRD regulations require that restoration activities restore, rehabilitate, replace, or acquire the equivalent of the resources and services that were injured or lost, they do not prescribe which restoration projects are preferred. The natural resource Trustees are provided discretion in identifying and selecting restoration projects.

The Trustees developed evaluation criteria as a tool for assessing project strengths and weaknesses. To develop these criteria, the Trustees first considered the factors that are identified in the DOI regulations as those that should be considered in the evaluation and selection of preferred alternatives (Section 3.1). With these factors as a guide, the Trustees developed eligibility criteria to determine if projects met minimum standards for acceptability (Section 3.2). Projects that met these eligibility criteria were then evaluated against the project evaluation criteria (Section 3.3), using a qualitative assessment of project strengths for each criteria. These qualitative assessments are provided in the project descriptions presented in Section 4.

3.1 Factors Identified for Consideration under the DOI Regulation

The DOI regulations identify the following factors to be considered in the evaluation and selection of preferred alternatives (43 CFR 11.82):

- Technical feasibility
- The relationship of the expected costs of the proposed actions to the expected benefits from the restoration, rehabilitation, replacement, and/or acquisition of equivalent resources
- Cost-effectiveness

- The results of any actual or planned response actions
- Potential for additional injury resulting from the proposed actions, including long-term and indirect impacts, to the injured resources or other resources
- The natural recovery period
- Ability of the resources to recover with or without alternative actions
- Potential effects of the action on human health and safety
- Consistency with relevant federal, state, and tribal policies
- Compliance with applicable federal, state, and tribal laws.

The Nyanza Trustee Council incorporated the 10 factors described above into its Eligibility and Evaluation Criteria. The Nyanza Trustee Council is solely responsible for determining whether proposed restoration project ideas met these criteria.

3.2 Eligibility Criteria Developed by the Trustee Council

Projects must meet the following Eligibility Criteria in order to be further considered and evaluated by the Trustees using the Evaluation Criteria. If any project does not meet the Eligibility Criteria, it will not be given further consideration by the Trustees. A project's demonstrated consistency with the Eligibility Criteria does not guarantee that it will be funded, but merely establishes that the Trustees may further consider the project for possible funding. Conversely, rejection of a proposed project based on these criteria means that the Trustees will not allocate NRD funds for that project, even though the proposed project may yield a restoration benefit to injured natural resources.

The project eligibility criteria[1] are as follows:

1. A proposed project will not be considered eligible for Trustee consideration unless it:
    - Demonstrates significant nexus to the restoration, rehabilitation, replacement, and/or acquisition of the equivalent of natural resources or, if natural resource

1. The project eligibility criteria presented here are modified slightly from the version that was provided to the public during the solicitation of project ideas. The modification to the first eligibility criterion clarifies the intent of the Trustees regarding project nexus. The modification to the third criterion clarifies the intent of the Trustees regarding the need to be protective of health and safety and in compliance with appropriate laws, regulations, and policies.

restoration is not possible or feasible, restoration of natural resource services that were injured by the release of mercury or other hazardous substances from the Nyanza Federal Superfund Site

2. A proposed project will not be considered eligible for Trustee consideration if it:

- In terms of cost, limits the ability of Trustees to expend funds in a manner that accomplishes Trustee restoration goals and/or limits the Trustees' ability to serve a wide geographic area that benefits the restoration priority categories
- Is not protective of health or safety or is prohibited by federal, state, or local law, regulation, or policy
- Is subject to an independent, prior obligation to perform the project pursuant to statute, regulation, ordinance, consent decree, judgment, court order, permit condition or contract, or if it is otherwise required by federal, state, or local law, including but not limited to enforcement actions
- Is inconsistent with or will be undone or negatively impacted by EPA's future remediation work, or will interfere with any ongoing or anticipated remedial actions in the Sudbury River Watershed.

3.3 Evaluation Criteria

The following Evaluation Criteria were applied by the Trustees to prioritize eligible restoration projects through a qualitative assessment of their value and feasibility.[2]

2. The eligibility criteria have been modified since the version presented to the public during the solicitation of project ideas to increase consistency with other DOI natural resource damage assessment RPs. In particular, "generation of measurable results" was moved from the list of medium importance criteria to the list of high importance criteria and "stewardship" was moved from the list of high importance criteria to the list of medium importance criteria. "Protection of project" was removed from the list of supplemental criteria because the degree of project protection is already taken into account in the Trustee assessment of project benefits. "Benefit documentation" also was removed from the list of supplemental criteria because all entities receiving funding will be required to monitor results and document benefits.

High importance (10 criteria)

Focus criteria

1. Priority will be given to projects within the geographic location of the impacted environment or projects that benefit the resources within that environment. Restoration projects shall be located within or adjacent to the Sudbury River mainstem, within the Sudbury River Watershed, or outside the Sudbury River Watershed, but have a positive impact on the injured natural resources or their services that are located within, utilize, or historically utilized the Sudbury River Watershed.

2. Relationship to injured resources (Nexus): Projects that restore, rehabilitate, replace, enhance, or acquire the equivalent of the same or similar resources or services injured are preferred to projects that benefit other comparable resources or services. Consider the types of resources or services injured at the location, and the connection or nexus of project benefits to the injured resources.

Benefit criteria: Ecological

3. Magnitude of benefits: Project addresses a demonstrated need and maximizes the level of restoration, rehabilitation, and/or acquisition of the natural resources equivalent to those that were injured. For example, ecological benefits could be measured in terms of an increase to fish, wildlife, or rare species populations; an increase in native or rare plants in the Sudbury River environment; or an increase in prey species provided for a predator species or the number of acres of habitat to be restored, enhanced, or protected.

4. Natural recovery: Project will clearly provide restoration benefits to injured natural resources or services more quickly than the “natural recovery period.” The natural recovery period is the length of time it would take for the injured resource or service to recover to an optimal condition in the absence of human intervention.

5. Sustainability of benefits: Project will result in long-term, self-sustaining, and comprehensive benefits to injured natural resources and the services they provide. Project will require only periodic maintenance or management that represents a relatively small investment to provide continuing benefits.

Implementation criteria: Feasibility

6. Technical/technological: Project will employ well-known and accepted techniques to achieve stated ecological, engineering, economic, and social objectives. Likelihood of success in proposed project location and expected return of resources and resource services is high.

7. Reasonableness of costs: A project's costs are commensurate with the benefits it provides to injured natural resources or services.

Implementation criteria: Effectiveness

8. Implementation-oriented: Project has a high ratio of Nyanza NRD funding dedicated to implementation (e.g., on-the-ground habitat restoration, rehabilitation, replacement, or land acquisition) compared to general program support and operation.

9. Leveraging of additional resources: Project demonstrates a strong commitment by partners representing a broad range of community and other interests to provide matching funds and in-kind services and to involve volunteers. This leveraging of non-Nyanza NRD resources is preferred because it extends the availability of restoration funds and increases the resource benefits provided by the funds.

10. Generation of measurable results: Project delivers tangible and specific ecological, economic, social, or human use results that are identifiable and measurable, or that may be evaluated using quantitative or professionally accepted methods, so that changes to the Sudbury River Watershed can be documented and evaluated.

Medium importance (6 criteria)

Benefit criteria: Ecological

1. Multiple benefits: Project will provide benefits to the greatest number of species, natural resource types, and services.

2. Avoidance of adverse impacts: Project has little or no potential for adverse environmental impacts, or modifications to the project would considerably decrease benefits to injured natural resources and/or services. Adverse environmental impacts can be short- or long-term, direct or indirect, and include those affecting resources that are not the focus of the project.

Benefit criteria: Socioeconomic

3. Community goals: Project complements one or more community goals, needs, or recommendations as expressed in existing plans that incorporated public input and involvement in their development.

4. Avoidance of adverse impacts: Project has little to no potential for adverse socioeconomic impacts, or modifications to project would considerably decrease benefits to injured natural resources and/or services. Adverse socioeconomic impacts can be

short- or long-term, direct or indirect, and include those affecting resources that are not the focus of the project.

5. Stewardship and public education: Project will result in an "informed citizenry" that will help ensure ongoing environmental stewardship of restored natural resources and their services. Project provides a critical foundation for public involvement in ongoing and future restoration activities in the Sudbury River Watershed. Project provides increased opportunities for public use, appreciation, and enjoyment of natural resources in the Sudbury River Watershed.

Implementation criteria: Feasibility

6. Level of difficulty: Obstacles that may be faced for project implementation (e.g., coordination with multiple outside parties, regulatory permits required, complex design and engineering, and public support) will not interfere with the likelihood of success.

Supplemental criteria (3 criteria)

The following criteria should be considered as appropriate:

1. Pilot projects: Project employs innovative approaches and techniques but includes clear performance criteria, measurable endpoints, and a monitoring and contingency plan appropriate to the project.

2. Enhancement of remediation/response actions: Project clearly complements and enhances completed, ongoing, or planned remediation or response actions by concurrently or subsequently implementing restoration projects.

3. Coordination and integration: Project is clearly coordinated and integrated with other ongoing or planned restoration activities that enable synergistic benefits to injured natural resources and their services.

4. Restoration Alternatives

The Trustees considered a broad set of potential restoration alternatives for this RP/EA, including a "no-action" or "natural recovery" alternative. The proposed alternative identified by the Trustees is a suite of restoration projects that cumulatively aim to compensate for injuries to natural resources at the Site.

During the public meetings, the Trustees outlined a range of administrative mechanisms that can be used to implement restoration projects. These include competitive procurement through Requests for Responses (RFRs), intergovernmental agreements, directed grants such as Cooperative Agreements, and use of existing statewide or nationwide contracts. The Trustees will select the appropriate mechanism for implementation of restoration projects after issuing a final version of this restoration plan.

This section describes the no-action alternative (Section 4.1) and the proposed alternative (Section 4.2), presents detailed descriptions of each of the preferred projects included in the proposed alternative (Sections 4.3–4.5), and describes restoration alternatives that were considered but not recommended for funding (Section 4.6). Descriptions of the restoration projects included in the proposed alternative include an overview of the environmental and socioeconomic consequences associated with individual projects. A broader discussion of potential impacts, including cumulative impacts from implementing the full suite of restoration projects, can be found in Section 5.

4.1 No-Action/Natural Recovery Alternative

A no-action alternative is required to be considered under NEPA [40 CFR § 1502.14(d)]. The selection of this alternative by the Trustees would mean that no actions would be taken by the Trustees to restore injured natural resources, that existing natural resource losses would continue to occur, and that the public would not receive compensation for losses that occurred in the past or are ongoing. This alternative may be used as a benchmark to evaluate the comparative benefit of other actions. Because no action is taken, this alternative also has no cost. This alternative also provides no economic benefits to the population in Ashland, the SuAsCo Watershed, and surrounding areas.

4.2 Summary of Proposed Alternative

The proposed alternative[3] is the alternative that the Trustees believe would best compensate the public for injuries to natural resources resulting from releases of hazardous substances at the Site. This alternative consists of a suite of projects that benefit each of the major categories of injured natural resources.

The Trustees evaluated each of the 51 proposed project ideas (see Appendix C) against the Eligibility Criteria to determine if the project met minimum standards for eligibility. Projects that did not meet these standards were not evaluated further. Projects that met the Eligibility Criteria

3. Under NEPA, the proposed alternative is equivalent to the proposed action.

then were evaluated against the project Evaluation Criteria, using a qualitative assessment of project strengths and weaknesses. Projects that best met the Evaluation Criteria were included in the proposed alternative. Projects that were not included in the proposed alternative are described in Section 4.6, together with an explanation for why the projects were not selected for funding.

The Trustees have grouped preferred projects into two funding tiers. Projects that best met the Evaluation Criteria were placed into Tier 1 for funding. Projects in Tier 1 will have top priority for funding; the Trustees have sufficient funding available to fund all Tier 1 projects. The Trustees acknowledge, however, that uncertainties remain for certain Tier 1 projects, especially those that require landowner approval (which is still pending). Thus, the Trustees may have funding remaining after Tier 1 projects are completed. The priorities for funding within Tier 2 will be decided by the Trustees based, in part, on the outcomes of Tier 1 projects and Trustee judgments regarding what actions are most necessary to compensate for the full suite of natural resource injuries. Thus, not every Tier 2 project is guaranteed funding. Some projects may receive initial funding in Tier 1 and additional funding under Tier 2, if funding levels permit. The Trustees may choose to wait to fund some or all of the Tier 2 projects until they have greater certainty regarding costs in Tier 1.

During the process of project evaluation, the Trustees identified some opportunities to modify the project ideas that had been submitted by government agencies and the public (see Appendix C). For example, in some cases, the Trustees decided that only one or some of the elements of the submitted project best met the evaluation criteria and should be recommended for funding. In other cases, the Trustees combined elements from several project proposals to create a new project that would best meet Trustee criteria and compensate for the losses caused by releases of hazardous substances at the Site.

A summary of projects that were selected for inclusion in the proposed alternative is provided in Table 2. The table provides each project's name, the project category to which it belongs, the proposed Tier 1 and Tier 2 allocations from the NRD settlement, and the project number as listed in Appendix C. Figure 3 provides a map of restoration project locations for projects in the proposed alternative.

The remainder of this section consists of descriptions of each of the projects in the proposed alternative, divided into resource categories. For each project, a "logic model" is provided that briefly describes the key restoration action of a project, the expected short-term result from the proposed restoration action, and the pathway or process that will lead to the desired long-term results. In addition, each project description provides a brief overview of expected maintenance and monitoring requirements for the project so that the Trustees can determine if the desired benefits are being achieved and take corrective actions ("adaptive management") if necessary. Following the proposed alternative, a description is provided of the projects that were not recommended for funding.

Table 2. Summary of projects in the proposed alternative

Project name	Proposed funding allocation – Tier 1	Proposed funding allocation – Tier 2	Project number from Appendix C
Category: Aquatic biological resources and their supporting habitats and food sources			
Removal of Tire Dump in Forested Wetlands (Ashland)	$0 (project was completed by another entity)		Project #15.
Control of Aquatic Weeds in the Sudbury River Watershed	$1,098,000 (in Sudbury River mainstem)	$395,000 (Concord and Assabet rivers water chestnut control)	Combines elements of Projects #22, #23, #25, #26, #27, #32, and #34. Project #24 proposed for Tier 2 funding.
Habitat Restoration to Benefit Coldwater Fish	$300,000		Incorporates Project #9 as a potential location and elements of Project #13.
Concord River Diadromous Fish Restoration: Feasibility and Stewardship	$425,000[a]		Project #40 and also incorporates elements of Project #39.
Sudbury RiverSchools Program	$90,000	$30,000	Incorporates elements from Project #5.
Total for aquatic biological resources	**$1,913,000**	**$425,000**	
Category: Riparian and floodplain biological resources and their supporting habitats and food sources			
Greenways North Field Restoration	$34,000		Incorporates the field restoration component of Project #12.
Neotropical Connections (Belize)	$75,000		Project #38.
Sudbury River Corridor Land Acquisitions	$720,000	$700,000	Incorporates Projects #35, #36, and #37 as potential locations.
Creation of Stearns and Brackett Reservoirs Wildlife Preserve	$540,000		Includes elements of Projects #3, #7, #14, and #45 (Canoe Launch at Fountain Street).
Total for riparian and floodplain biological resources	**$1,369,000**	**$700,000**	

Table 2. Summary of projects in the proposed alternative (cont.)

Project name	Proposed funding allocation – Tier 1	Proposed funding allocation – Tier 2	Project number from Appendix C
Category: Recreation and public access			
Sudbury River Public Access: Aikens Road	$145,000		Moves proposed elements from Project #45 (Canoe Launch at Fountain Street) to an additional location.
Sudbury River Access Improvements: Great Meadows NWR Headquarters	$7,000		Project #51.
Red Maple Trail: Boardwalk and Wildlife Observation Platform Construction	$161,000		Project #47.
Total for recreation and public access	**$313,000**	**$0**	
Total for all categories	**$3,595,000**	**$1,125,000**	

a. For the Concord River Diadromous Fish Restoration Project, the estimated cost for the planning/feasibility stage is $240,000 and the estimated contribution of the Trustees toward potential implementation (including engineering and permitting) is $185,000. This contribution would cover a portion of implementation with additional funding required from other sources.

4.3 Proposed Alternative – Aquatic Biological Resources and their Supporting Habitats and Food Sources

The Nyanza NRD Trustee Council proposes to provide a total of $1,938,000 in Tier 1 funding and $425,000 in Tier 2 funding (if available) to five projects in the restoration priority category of Aquatic Biological Resources and their Supporting Habitats and Food Sources. Collectively, these projects will restore freshwater wetlands, aquatic and riparian habitats, coldwater fisheries, diadromous (migratory) fisheries, and promote improved environmental stewardship of waterways. These projects will directly restore injured natural resources and will also provide enhanced ecosystem services to compensate for losses caused by the release of mercury and other contaminants from the Site.

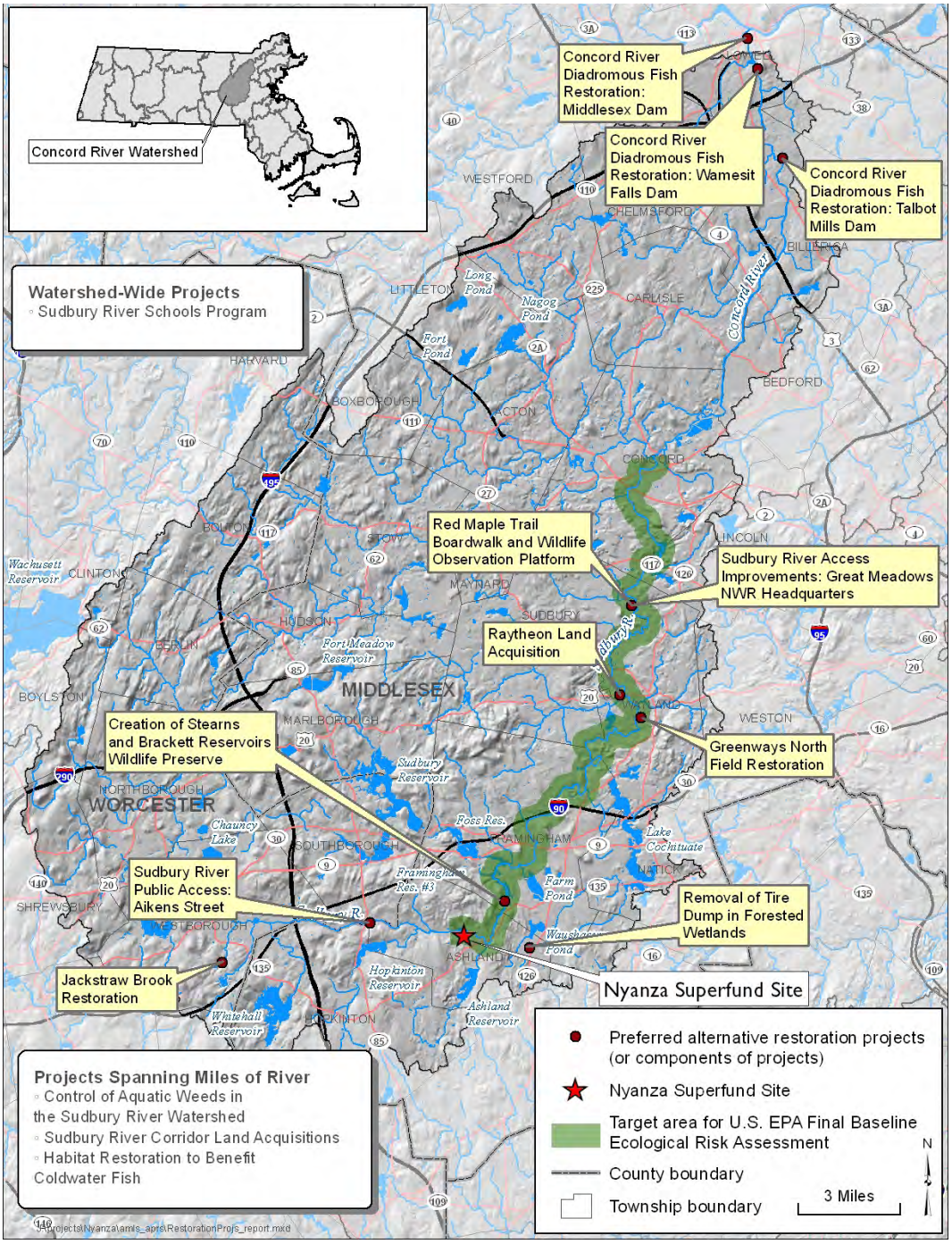

Figure 3. Locations of proposed restoration projects in the proposed alternative. Note that the Neotropical Connections project in Belize is not displayed on this map. The EPA Final BERA focused on the stretch of river highlighted in green because of the mercury levels in that area.

4.3.1 Removal of Tire Dump in Forested Wetlands

This project was identified by the Trustee Council during site visits and selected as a preferred project. Subsequently, beginning in April 2010, the Central Massachusetts Mosquito Control Project (CMMCP) worked with the Town of Ashland to remove tires from the site to remove the potential health hazard of mosquitoes breeding in the tires and spreading disease. Before removal, during removal, and post-removal photographs of the site are provided in Figure 4. Because the CMMCP already has carried out the key activities proposed for this project, the Trustees have no longer included funding for this project in the RP. This project description (written before the project was carried out) is retained here in acknowledgment of the Trustee Council's role in bringing attention to this site.

Figure 4. Tire dump in forested wetland before, during, and after tires were removed.

Photo credit: Town of Ashland.

Restoration objective: To restore ecological functions provided by a forested wetland in Ashland by removing illegally dumped tires, asphalt shingles, and metal waste from a forested wetland. Removal of the tires and other illegally dumped materials will also discourage additional dumping and eliminate artificial mosquito breeding habitat. See Figure 5 for the project logic model.

Figure 5. Removal of Tire Dump in Forested Wetlands – logic model

Restoration actions		Expected short-term result		How benefits are achieved		Desired long-term results
Remove tires and waste from forested wetland.	⇨	Wetland is free from waste; mosquito breeding is curbed.	⇨	Removal of waste opens up habitat for wildlife; mosquito breeding is reduced.	⇨	Wetland has mature vegetation; wildlife habitat is created, wetland functions, and water quality are protected.

Project location: Adjacent to 49 Pond Street (Route 126) in Ashland. See Figure 3 for location.

Project description: Tires and other waste debris have been dumped illegally in a forested wetland located on a property abutting conservation land managed by the Sudbury Valley Trustees and within a complex of lands owned by the Town of Ashland and private trusts. These tires and waste debris degrade wildlife habitat, impede vegetation growth, artificially promote mosquito breeding, and potentially pose a long-term threat to drinking water supplies. This project would consist of removal of the tires and other waste debris for off-site recycling or disposal.

Site description and history: The site consists of an upland area of approximately two acres, surrounded by wetlands that are tributary to the Sudbury River via Washakum Pond. The majority of the site is wooded with young tree growth. Dumped tires are scattered throughout the site but are generally concentrated in four areas, encompassing a total of approximately 0.3 acres of wetlands. Many of the tires are visible above or partially above the surface of the water. The number of tires that are currently in the forested wetland is unknown but is estimated to be at least several hundred. Dumped asphalt shingles are located in one area of the site, with an estimated volume of 80 to 100 cubic yards. Other items that were observed in the dumping area include a rusted, empty 55-gallon drum, several empty pails, a dishwasher, and the frame and other parts of at least one car.

The Town of Ashland Conservation Agent reports that a potential source of the dumping, a vehicle filling station and maintenance garage that was located on Route 126, closed years ago. A tire recycling specialist (J.P. Routhier & Sons, Inc.) noted that all the tires were bias ply tires of makes that were discontinued at least 20 to 30 years ago, with no newer tires observed. The dump has been abandoned for at least 20–30 years and there is no responsible party available to conduct the cleanup.

Expected benefits and timeframe of benefits: Benefits would include removal of an illegal dumping site, improvement of wildlife habitat, and reduction in the potential for mosquito breeding. The benefits of removing artificial mosquito breeding habitat and improving degraded wildlife habitat will begin to be realized as soon as the project is completed. Full benefits would only be achieved once native vegetation and leaf litter are reestablished in the impacted areas.

Environmental and socioeconomic consequences: Environmental consequences are anticipated to be minor during construction, including temporary disturbance of wetland habitat. The long-term environmental consequences are anticipated to be a net benefit after the tires and waste are removed from the wetland and the wetland can recover naturally.

Trustee evaluation and proposed allocation: This project originally was intended by the Trustees to be a Tier 1 project with $89,000 coming from the NRD settlement; however, this funding is no longer needed because the tires were removed from the site by the CMMCP. The Trustees evaluated this project favorably (Table 3) because it benefits forested wetland habitat in Ashland, in close proximity to the Site. The benefits will restore injured resources similar to those impacted by the releases of hazardous substances at the Site. The Trustees also ranked this project high because it will quickly result in a resource improvement for the wetland (as soon as the dump is removed), it will help with mosquito control, and the parcel is contiguous with other areas of protected land.

4.3.2 Control of Aquatic Weeds in the Sudbury River Watershed

Restoration objective: To improve ecological function and water quality in the Sudbury River and adjacent waterways and wetlands by controlling purple loosestrife *(Lythrum salicaria)*, an invasive species in wetlands, and water chestnut (*Trapa natans*), an aquatic invasive species that covers the water surface. Additionally, to improve habitat values for waterfowl and other birds and wildlife by restoring native wild rice (*Zizania aquatica*) populations to river reaches in the Great Meadows NWR where invasive species are controlled. See Figure 6 for the project logic model.

Table 3. Evaluation of Removal of Tire Dump in Forested Wetlands project versus the Trustee criteria. Numbers in parentheses refer to the numbered list of criteria provided in Section 3.3. This table only includes criteria where the project was evaluated as particularly strong compared to other projects.

High importance criteria	Evaluation strengths
Proximity to injured resources (1)	Located within Sudbury River Watershed in the Town of Ashland near the Site. Thus, this project is in close proximity to injured resources.
Relationship to injured resources (2)	Restores resources (freshwater wetland) equivalent to those that were injured.
Magnitude of benefits and demonstrated need (3)	Addresses a long-standing demonstrated need for cleanup in the wetland.
Technical/technological feasibility (6)	Employs well-known and accepted techniques to achieve ecological objectives. Removal of the tires and other material is easily accomplished in a short time period.
Implementation-oriented (8)	Project is dedicated to on-the-ground habitat restoration.
Medium importance criteria	
Avoidance of adverse impacts – ecological (2) and socioeconomic (4)	Has little to no potential for long-term adverse environmental or socioeconomic impacts. Potential impacts from equipment will be mitigated with best management practices (BMPs) and revegetation of any impacted areas.
Stewardship and public education (socioeconomic benefit) (6)	Provides an opportunity for continued stewardship through partnership with the Sudbury Valley Trustees who own an abutting parcel.

Figure 6. Control of Aquatic Weeds in the Sudbury River Watershed – logic model

Restoration actions	Expected short-term result	Pathway/ process	Desired long-term results
Biological control of purple loosestrife with *Galerucella* beetles; mechanical control of water chestnut. Seed native wild rice into sedge meadow habitat following control of invasive species. ⇨	Purple loosestrife and water chestnut dominance are reduced. Wild rice populations increase. ⇨	Decrease in purple loosestrife increases cover of native wetland species; decrease in cover of water chestnut improves water quality, aquatic productivity, and recreation. Increase in wild rice population provides additional food resources for birds and wildlife. ⇨	Wetlands along the Sudbury River dominated by native vegetation; water chestnut kept at a minimal level that does not result in negative ecological or water quality impacts. Wild rice populations are sustained and waterfowl and other birds and wildlife benefits.

Project location: Twenty miles of riverine wetlands from along the Sudbury River from Ashland to Concord for purple loosestrife control. Multiple locations along the Sudbury River, including Heard Pond, Fairhaven Bay, the Sudbury River itself between Route 117 and Route 20, and Carding Mill Pond for water chestnut control.

Project description: Purple loosestrife and water chestnut are invasive species that both pose significant threats to the ecological integrity of the SuAsCo Watershed. Purple loosestrife is present in riverine and freshwater wetlands from the headwaters of the Sudbury and Assabet rivers to and along much of the Concord River. Purple loosestrife outcompetes native wetland vegetation and provides poor habitat for native wetland birds and wildlife. Water chestnut has been a nuisance in the Sudbury River since the mid-1940s (Countryman, 1970). Water chestnut degrades water quality and productivity in rivers and ponds due to the large amount of water surface that is covered by water chestnuts and the resulting decaying biomass. In addition, recreational access can be extremely restricted when the water chestnuts are in full growth because the tangled mass of water chestnut stems in the water makes it difficult or impossible to paddle a boat, fish, or swim (Figure 7). Water chestnut has also been observed to be "crowding out" native wild rice (*Zizania aquatica*) populations along sections of the Sudbury River. This project would consist of large-scale efforts to reduce the dominance of purple loosestrife and water chestnut in the Sudbury River and adjacent waterways and wetlands.

Figure 7. Paddlers in area with water chestnut.

The SuAsCo Cooperative Invasive Species Management Area (CISMA) would coordinate this project. The CISMA group consists of more than 20 project partners who have signed a Memorandum of Understanding to work together to control invasive species in the SuAsCo Watershed (CISMA, 2009). By coordinating this project with CISMA, the Trustees can take advantage of the partner cooperation that is already occurring.

Because of the large amount of funding that the Trustees would be providing to CISMA, the Trustees would require an oversight role in the actual selection of locations and targets for control. The Trustees also would ensure that work on wild rice restoration, which is included as part of this project, would be coordinated with the Great Meadows NWR. In general, the Trustees' priorities for invasive species control would follow the approach specified by the MA

DCR (M.G.L. Chapter 21: Section 37D). The Trustees also would follow the guidance for controlling aquatic plans in MA EEA (2004). Project priority would be as follows:

> First priority shall be projects to manage incipient infestations of aquatic nuisances, second priority shall be projects to prevent or control the further spread of aquatic nuisances, and third priority shall be recurring maintenance projects. In establishing priorities for individual projects, the department shall consider the following: (a) public accessibility and recreational uses; (b) the importance to commercial, agricultural or other interests; (c) the degree of local interest, as manifested by municipal or other contributions to the project; (d) local efforts to control aquatic nuisances; (e) other considerations affecting feasibility, probability of achieving long term control, necessity or advantage of the proposed work; and (f) the extent to which the control project is a development rather than a maintenance project.

Purple loosestrife control: This portion of the project involves a comprehensive approach to control purple loosestrife in riverine wetlands along 20 miles of the Sudbury River. The project would involve mapping wetlands to determine the location and amount of purple loosestrife infestation along the Sudbury River from Ashland to Concord; coordination efforts among municipalities and major landowners along the Sudbury River for the project; and purchase, rearing, and release of *Galerucella sp.* leaf-eating beetles for biological control. The project would be an intensive three-year effort with the goal of eliminating the dominance of purple loosestrife along the Sudbury River and allowing native wetland plants that provide food and shelter for wildlife to thrive.

In 1996, the USFWS began the biological control of purple loosestrife through release of over 200,000 *Galerucella sp*. leaf-eating beetles in Sudbury, Concord, Carlisle, and Maynard. Most of these releases were along the Sudbury and Concord rivers or in wetlands along tributaries of these rivers as well as the Assabet River. Monitoring of beetle-release sites showed that populations have been established in some wetlands along the river, but due to the vast amount of acreage infested with purple loosestrife, the existing population of beetles must be supplemented to speed up and expand the control process. For example, at a site in Walpole, the cover of purple loosestrife was reduced from a starting level of 60% cover in 2000 when beetles were first released to less than 3% cover in 2006 (Massachusetts Office of Coastal Zone Management – Wetlands Restoration Program, 2008). More recent monitoring of the same sites suggests that some re-invasion of purple loosestrife has occurred and the site may benefit from additional beetle releases to maintain the control of purple loosestrife (Georgeann Keer, Massachusetts Division of Ecological Restoration, personal communication, May 11, 2010).

Additionally, the USFWS has willing conservation partners on specific lands adjacent to the Great Meadows NWR, such as the Sudbury Valley Trustees and their Wolbach Farm property in Sudbury and the Greenways Conservation Area in Wayland. The Towns of Southborough, Ashland, Natick, Lincoln, and Concord support biological control of purple loosestrife: the Town of Lincoln has raised and released beetles, and the Town of Ashland proposes to work with their high school environmental club to rear and release beetles. Additionally, the Massachusetts Wetlands Restoration Program[4] provided technical support to the Minuteman Technical High School in Lexington and the Curtis Middle School in Sudbury to raise beetles for release in the watershed.

At the outset of this project, an inventory of the location and extent of purple loosestrife will be conducted and possible beetle release sites will be identified. As beetles have been released at selected sites throughout the watershed in previous years, it is important to document areas where there is already a beetle presence. Biological control of purple loosestrife, which has proven to be very effective elsewhere, requires multiple years of treatment and a recommended coverage of 3,000 to 5,000 beetles per acre per year.

Project monitoring will measure the effectiveness of biological control and will determine if there are conditions that are limiting project success. For example, one hypothesis is that seasonal flooding along the Sudbury River has a negative impact on the overwintering population of beetles, thus reducing project success in subsequent years after beetle release.

Water chestnut control: This portion of the project involves a three-year effort of mechanical control of water chestnut in Heard Pond, Fairhaven Bay (171 acres), the Sudbury River between Route 117 and Route 20 (approximately two miles of river and adjacent wetlands are infested with water chestnut), and Carding Mill Pond. The project would involve comprehensive mechanical removal for a three-year period with the USFWS' mechanical harvester and an additional harvester that would be purchased for this project, and supplemented by mechanical harvest with hand-pulling efforts by summer labor and volunteers. The overall goal of the project would be to maintain and enhance Heard Pond and the Sudbury River as a vibrant resource for wildlife and for people to engage in fishing and boating. Specifically, the goal would be to virtually eradicate water chestnuts in Heard Pond, which has already been the focus of multiple years of intensive control efforts, and reduce biomass of water chestnuts in the Sudbury River to the point where minimal annual efforts at physical removal (hand-pulling only) can keep the water chestnut controlled. If Tier 2 funding is available and the project is making appropriate progress, then the control period may be extended for an additional two years.

4. The Massachusetts Wetlands Restoration Program is now part of the new Massachusetts Division of Ecological Restoration (MA DER) within the Massachusetts Department of Fish and Game (DFG). See http://www.mass.gov/dfwele/der/index.htm.

An existing partnership (Town of Concord, Town of Lincoln, Concord Land Conservation Trust, Hop Brook Protection Association, and USFWS) has been working together on water chestnut control since 2001 using mechanical harvesting and hand-pulling. USFWS owns an aquatic weed harvester, conveyor, and trailer. All partners have shared in the maintenance and use of the equipment to harvest water chestnuts. However, there is significantly more acreage infested with water chestnut than can be controlled by one harvester each year, meaning that not all areas can be targeted during the optimal harvest times in July and August. Water quality and productivity in the river and ponds have continued to degrade due to the large amount of water surface that is covered by water chestnuts and the resulting decaying biomass; recreational access can be extremely restricted when water chestnuts are in full growth. For this project, current and additional partners will continue working together in the same areas but will expand their capability under this project to be able to work simultaneously in their respective areas at the optimum time periods to harvest chestnuts. This three-year effort will not eradicate water chestnuts from the Sudbury River, since the seeds are viable for up to 12 years. However, after this project period, control of water chestnuts will require much less effort.

At the outset of this project, CISMA would coordinate a comprehensive assessment of water chestnut infestation in the Sudbury, Assabet, and Concord rivers and 130 acres of ponds in the Hop Brook Watershed in 2010. Locations would be marked by global positioning system (GPS), including estimates of patch sizes and patch density. A map of outbreaks would be produced and distributed to partners.

In Heard Pond, the goal of this project is to complete ongoing efforts to control water chestnut in Heard Pond and prevent Heard Pond from serving as a source of water chestnut reseeding into the Sudbury River. A contractor will conduct mechanical and physical controls within the pond.

In the Sudbury River, this project will greatly expand efforts to control water chestnut, with a goal of increasing removal of water chestnut biomass by 150% per year over the next three years. Project funding would initially support three years of mechanical effort, including removal by aquatic weed harvesters and physical removal by hand-pulling. If possible, the water chestnuts would be composted and made available to farmers to use as fertilizer. Specifically, project funding would support (1) purchase of additional mechanical harvesting equipment (harvester, conveyor, trailer, hydro-rake), (2) purchase of up to 20 kayaks and canoes outfitted with bins for volunteers or summer staff (high school and college students) to collect water chestnuts and carts to move these boats, (3) funding for a 10-person crew working 40 hours per week for eight weeks during the summer, and (4) coordination of control efforts, pre- and post-monitoring, and report writing. The Trustees propose to fund three years of effort with Tier 1 funding.

If Tier 2 funding is available for this project, additional efforts would be made to continue to fund the water chestnut control for two additional years and also to control water chestnut in the Assabet River and the Concord River. A contractor would control water chestnuts in 10 locations on the Concord River. In the Assabet River, where the infestation is less severe, volunteers would control water chestnut with hand-pulling, supported by the purchase of five additional kayaks and carriers.

Restoration of wild rice: This portion of the project will be led by the Massachusetts Division of Fisheries and Wildlife (MassWildlife) in coordination with CISMA, with the goal of restoring native wild rice (*Zizania aquatica*) populations (Figure 8) to river reaches following invasive species control (Figure 9). Wild rice is an important food source for migratory waterfowl and other birds in the watershed and there are remnant populations along the Sudbury River. Declines in historic wild rice beds have been observed by MassWildlife biologists; factors contributing to this decline may include water quality, boat wakes, and invasive plant species such as purple loosestrife and water chestnut. According to the Atlantic Coast Joint Venture's Waterfowl Management Plan, "Invasive plant species, especially water chestnut chokes long stretches of both the Sudbury and Assabet rivers, crowding out what used to be beds of wild rice" (ACJV, 2005).

Figure 8. Wild rice along the Sudbury River.

Photo credit: Ron McAdow, Executive Director, Sudbury Valley Trustees.

The initial phase of this portion of the project would involve developing detailed project plans for the wild rice restoration effort. Project planning would likely include surveys of historic information about wild rice populations, surveys and mapping of current wild rice distribution, monitoring and maintaining necessary water levels, purchasing and planting green rice, and assessing planting success. Restoration efforts would be undertaken using an adaptive management framework to determine the methods and conditions that result in the greatest degree of success.

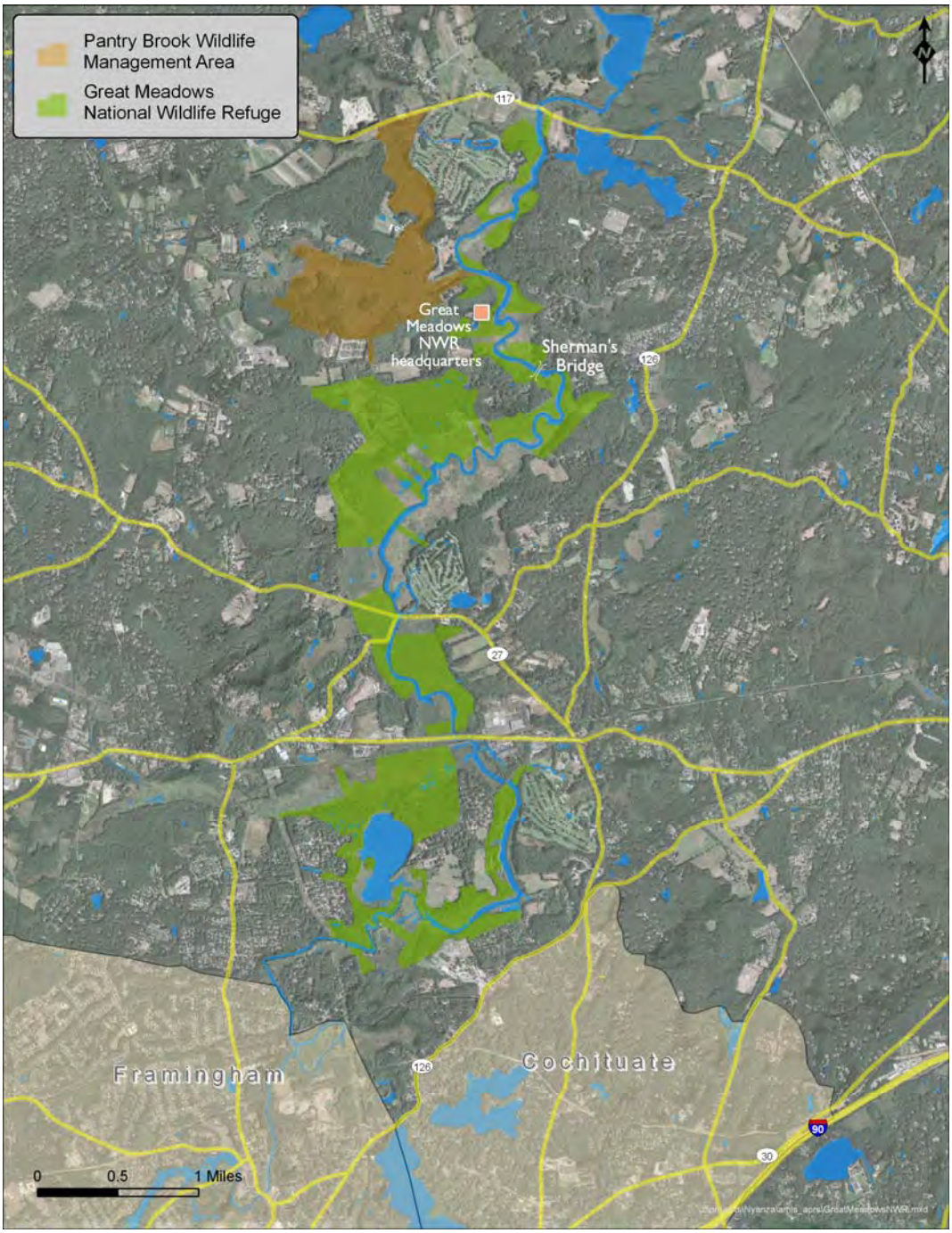

Figure 9. General vicinity for restoration of wild rice portion of Control of Aquatic Weeds in the Sudbury River Watershed project. Note nearby location of the Great Meadows NWR headquarters.

Expected benefits and timeframe of benefits: Benefits would include an improvement in native wetland function, water quality, and recreational access in areas that are currently impacted by invasive species. Additional benefits include increasing coordination efforts between groups and agencies, which will improve the likelihood that these partners will coordinate on other invasive species control and resource management issues. Permitting of the project can begin immediately, with mapping and control efforts occurring during the first summer field season after funding is received. Benefits would increase over the three to five years of the project period, as invasive species populations are reduced by greater amounts each year. The Trustees believe that the benefits will last for at least 25 years, because the project partners have the means and motivation to continue to conduct the necessary followup control efforts after this intensive project is completed.

For the wild rice restoration part of this project, the expected benefits would be an increase in wild rice populations along the Sudbury River that would provide an important food source for a wide variety of birds and wildlife, including waterfowl, blackbirds, mice, muskrat, and deer (McMenemy, 1990). The Atlantic Coast Joint Venture has identified the SuAsCo Watershed as a waterfowl focus area for Massachusetts that "has some of the most productive waterfowl habitat in the state. Although Black Duck production has declined with urbanization, Wood Duck, Mallard, and Canada Goose are plentiful. Both the Great Meadows NWR and the state's Pantry Brook WMA are located in this region" (ACJV, 2005). Thus, wild rice restoration can be expected to benefit important waterfowl populations.

As a tall grass that can grow up to 10 feet high and often grows in colonies or extensive stands, wild rice also provides important shelter for birds and wildlife, including roosting and loafing areas for waterfowl and cover for nestlings. Wild rice also can help maintain good water quality by binding loose soils and decreasing wind speeds in shallow wetland areas (Wisconsin Department of Natural Resources, Undated). Benefits would increase over time, as the wild rice populations become established. The project would likely reach full benefits approximately five years after the restoration efforts begin. This project will be sequenced with the invasive species control efforts and will begin after any necessary invasive species control efforts have occurred. Because wild rice is a perennial plant, benefits should persist for at least 25 years if wild rice populations are successfully established.

Brief overview of maintenance and monitoring: Annual implementation monitoring would be conducted until the project is complete. This monitoring would confirm that project permitting and implementation activities are proceeding on schedule and in accordance with project plans. Effectiveness monitoring during the project period would document decreases in the cover of purple loosestrife and water chestnut in the targeted locations. Following the three- to five-year project period, the project partners would be responsible for ongoing maintenance and monitoring activities, which would likely be coordinated through CISMA. Project funding would not support these ongoing efforts.

Probability of success: The probability of success of this project will depend on successful coordinated efforts across the whole project area. Because CISMA has already engaged a coordinator with experience in invasive species control efforts, the likelihood of large-scale success for this project is increased. The control efforts undertaken through this effort will complement other aquatic invasive species control efforts in the Commonwealth, including a statutory requirement that the new MA DCR establish and maintain an aquatic nuisance control program (M.G.L. Chap. 21. Sec. 37b). This program, including a strategic plan for control of aquatic invasive species, is outlined in a special report to the legislature that highlights the need for communities to take action to address aquatic invasive species in their jurisdiction (MA DCR, 2006). This project supports these legislative goals and provides funding for activities that would not otherwise take place.

The probability of success for this project also is increased because the control methods being undertaken are well-established and have been successfully employed in the project area and in other locations. Mechanical control efforts of water chestnut in Heard Pond have already resulted in significant decreases in water chestnut biomass over the past five years. Biological control of purple loosestrife also has been successful in other locations. Long-term benefits may be limited if project partners do not follow through on their commitments to ongoing maintenance and monitoring; however, the formation of CISMA will help keep project partners accountable for ongoing control efforts.

The probability of success for the wild rice portion of this project is unknown because a project of this type has not been undertaken before in the Sudbury River. The presence of remnant populations of rice beds in the area, anecdotal observations by MassWildlife personnel that wild rice appears to rebound in areas without a water chestnut problem, the commitment to aquatic weed control in this area, and the success of wild rice restoration in other areas of the country all suggest that this project is feasible.

Environmental and socioeconomic consequences: This project will have positive short-term and long-term environmental consequences by removing invasive species that are degrading wetland and aquatic habitats. No chemicals will be used in the control process. *Galerucella* beetles have been widely used for biological control of purple loosestrife and appear to have high "host-specificity" and do not attack other species. In addition, all volunteers and contractors will follows BMPs to ensure that they do not unintentionally spread propagules (seeds, cuttings, or plant parts) of invasive plants to other locations (MA DFW, Undated; Greenfield et al., 2004).

The use of a mechanical harvester for water chestnut may result in a temporary increase in turbidity from resuspension of detritus and organic materials, while hand harvesting would have limited potential for wide-spread turbidity effects (MA EEA, 2004). The locations where the harvester is used would be coordinated with EPA to minimize the risk of disturbing contaminated sediments in the Sudbury River.

There would be short-term and long-term benefits for restoration of native wild rice along the Sudbury River. Sprouting shoots and ripe grains of this species provide important food for ducks, geese and other marsh birds (e.g., rails, red-winged blackbirds, song sparrows), as well as muskrats, beaver and deer. In summer and fall, stands of wild rice provide cover for waterfowl broods and molting adult ducks.

The project will provide a minor socioeconomic benefit by creating summer employment opportunities for high school and/or college students. Long-term socioeconomic benefits are also expected from this project due to increased recreational opportunities in areas where invasive species control improves access to waterways and enhances the recreational experience. There may also be minor positive socioeconomic benefits for recreational users of the river who would likely enjoy the beauty of wild rice.

There is a possibility that widespread control of purple loosestrife may reduce the amount of late-season bee forage and have a negative socioeconomic impact on commercial beekeepers in the watershed. However, native wetland plants can provide replacement forage for bees and the overall negative economic impacts of purple loosestrife invasion are considered to outweigh any economic gains from horticultural or medicinal uses of purple loosestrife (WA Department of Ecology, Undated). Also, purple loosestrife is on the Massachusetts Department of Agricultural Resources "prohibited plant list" and importation, sale, and trade of the plants is banned (MA DAR, 2010), which means that the plant cannot be deliberately introduced or planted to provide bee forage (MA DAR, 2010). Finally, if evidence of impacts to bees is found, CISMA could help mitigate this impact by working with members to promote mowing and management regimes on field sites that benefit late-season bee forage.

Expected permitting requirements: Appropriate permits for engaging in work in wetlands and waterways will be required for the proposed project.

Estimated costs: Control of purple loosestrife for 20 miles of the Sudbury River is estimated to cost $175,000 per year for three years for beetle rearing and release, for a total of $525,000. The Trustees have proposed to allocate $50,000 toward project costs in Heard Pond under the assumption that other sources of matching funds are available to complete the project, which has an estimated total cost of $68,000. For the Sudbury River, control of water chestnut with volunteers and summer labor will cost $269,000 for first-year equipment and mapping costs and $204,000 for three years of labor, supplies, and mobilization costs. The costs for the wild rice portion of this project are estimated at $50,000. The total estimated cost for these high-priority components of the project is $1,098,000.

An additional two years of water chestnut control in the Sudbury River would cost $136,000. In the Concord River, water chestnut control by a contractor is estimated at $250,000 for five years of control. In the Assabet River, water chestnut control is estimated at $9,000 for volunteer support. The total estimated cost for these lower-priority components of the project is $395,000.

Trustee evaluation and proposed allocation: The high-priority components of the project described above are proposed as a Tier 1 project, with total Tier 1 costs estimated at $1,098,000. The lower-priority components of the project, including an additional two years of water chestnut control on the Sudbury River and extending control efforts for water chestnut to the Assabet and Concord rivers, are proposed as a Tier 2 project, with total Tier 2 costs estimated at $395,000.

The project was evaluated favorably versus the Trustee evaluation criteria (Table 4) because of the large negative impact that invasive species have on water quality, aquatic habitat quality, and recreational access in the Sudbury River and adjacent waterways. In addition, restoration of native wild rice populations will restore a supporting habitat and food source for migratory waterfowl and marsh birds. The need to control invasive species at a large regional scale has been known for many years and was the motivation behind the formation of CISMA. This project takes advantage of the coordination and expertise of CISMA and proposes a large-scale effort that has the potential to make a significant long-term difference in the weed populations. This project also complements the aquatic nuisance control program established by the MA DCR as a statutory requirement. In addition, project partners are providing in-kind and matching support for this project, including support for the CISMA coordinator who will be important for the successful implementation of this project.

4.3.3 Habitat Restoration to Benefit Coldwater Fish

Restoration objective: To improve habitat for native coldwater fish in Massachusetts through restoration actions such as reducing erosion, planting appropriate riparian vegetation, and improving in-stream habitat. See Figure 10 for the project logic model.

Project location: Not determined yet. One possible location is the section of Jackstraw Brook from Warren Street upstream to Bertis Adams Way, with an approximate site center of latitude 42.25°, longitude -71.61°.

Table 4. Evaluation of Control of Aquatic Weeds in the Sudbury River Watershed versus the Trustee criteria. Numbers in parentheses refer to the numbered list of criteria provided in Section 3.3. This table only includes criteria where the project was evaluated as particularly strong compared to other projects.

High importance criteria	Evaluation strengths
Proximity to injured resources (1)	Located within Sudbury River Watershed in areas, such as the Great Meadows NWR, that were injured by releases from the Site.
Relationship to injured resources (2)	Enhances injured resources (freshwater wetland and aquatic habitats) through a significant control effort for invasive species. Restoration of wild rice provides a significant food resource to birds and wildlife.
Magnitude of benefits and demonstrated need (3)	Addresses a demonstrated need and maximizes benefits through focused initiative to control invasive species across a large geographic area that cuts across municipal boundaries. The need to control aquatic weeds to protect and enhance wildlife habitats and species diversity is noted in the Great Meadows NWR Comprehensive Conservation Plan (USFWS, 2005b), the Atlantic Coast Joint Venture Waterfowl Management Plan (ACJV, 2005), and the Sudbury, Assabet, and Concord Wild and Scenic River Study River Conservation Plan (NPS, 1995). The Atlantic Coast Joint Venture Waterfowl Management Plan (ACJV, 2005) also notes invasive species as a threat to beds of wild rice.
Technical/technological feasibility (6)	Employs well-known and accepted techniques to achieve ecological objectives. Galerucella beetles have successfully controlled purple loosestrife and intensive mechanical control can reduce water chestnut significantly.
Leveraging of additional resources (9)	Opportunity to leverage non-NRD resources through in-kind services and cash matches. CISMA will provide significant in-kind support by having the expertise of the coordinator available for this project.
Medium importance criteria	
Community goals (3)	Complements USFWS and town efforts; watershed-wide plans identify control of aquatic invasive species as a priority.
Stewardship and public education (socioeconomic benefit) (6)	Provides an opportunity for continued stewardship and volunteer involvement through CISMA partnerships.

Figure 10. Habitat Restoration to Benefit Coldwater Fish – logic model

Possible restoration actions		Expected short-term result		How benefits are achieved		Desired long-term results
Stabilize stream channel; stabilize and revegetate stream banks; restore streambed complexity.	⇨	Reduced stream bank erosion and downcutting; improved habitat complexity.	⇨	Siltation is reduced; erosion is reduced; aquatic habitat improved; vegetation matures over time.	⇨	Fish populations are protected; riparian corridor has mature vegetation; stream banks and channel are stabilized; streambeds are improved.

Project description: This project involves the identification and implementation of habitat restoration actions that would benefit coldwater fish populations in the SuAsCo Watershed. Candidate project locations are coldwater streams that support or historically supported populations of cold water fisheries, including brook trout, threespine stickleback, and burbot. Streams designated as cold water fisheries or Outstanding Resource Waters (ORWs) in the Massachusetts Surface Water Quality Standards (314 CMR 4.00) are likely to be good candidates for this project because they already receive a high level of ecological protection through state-level permitting programs. Restoration work that takes place near headwaters is also favored because headwaters restoration projects are likely to have the greatest positive impact on overall stream and habitat quality.

The Trustees have identified one site, Jackstraw Brook in Westborough, as a possible candidate location for this project. Other sites will be considered by the Trustees if restoration actions can be shown to provide benefits for coldwater fish populations. Jackstraw Brook in Westborough is an important tributary to the Cedar Swamp, the first ACEC designated in the Commonwealth. Cedar Swamp is a tributary to the Sudbury River. Jackstraw Brook is listed as an ORW, and MassWildlife and the U.S. Geological Survey (USGS) have identified a population of native brook trout in the brook.

Candidate streams, such as Jackstraw Brook, will be those where riparian vegetation is degraded or absent – compared to the ideal condition of mature, well-developed riparian forest vegetation along their stream banks (Figure 11). This natural vegetation preserves the floodplain, keeping native soils intact and maintaining the streamside land and stream banks. Vegetative buffers help encourage infiltration of rainfall and runoff and provide absorption for high stream flows, reducing both flooding and drought. The vegetative community of riparian buffers provides habitat for many species of plants and animals, including obligate riparian species, as well as threatened and endangered (T&E) species. The buffer area provides a living cushion between upland land use and water, protecting water quality, the hydrologic regime of the waterway, and stream structure. The naturally vegetated buffer filters out pollutants, captures sediment,

regulates stream water temperature, and processes many contaminants through vegetative uptake. Mature riparian vegetation contributes woody material to the stream system through deadfall, which improves in-stream habitat, reduces stream velocities, and promotes bank and substrate stabilization (Cohen, 1997).

Figure 11. Example of mature riparian vegetation (location is Bogle Brook in Peterborough, New Hampshire).

Credit: Emily Hague/Courtesy of the Monadnock Conservancy (www.MonadnockConservancy.org).

Jackstraw Brook is an example of the degradation to aquatic habitat that can occur when riparian buffers are lost. Residential development has encroached on one reach of Jackstraw Brook stream habitat, resulting in increased flooding and degraded stream habitat. In recent years, several large storms have flooded yards and roads, filled culverts with mud and debris, and threatened to damage residences in the vicinity of Warren Street in Westborough. In addition, upstream from Warren Street, the majority of the land surrounding Jackstraw Brook is landscaped with grass lawns, including locations where lawns are adjacent to the stream bank with little to no riparian buffer (Figure 12). Because the stream's riparian condition is poor, dredging to address a potential blockage of the culvert below Warren Street contributed to a destabilization of the stream, resulting in active downcutting and erosion that has progressed rapidly. Along several of the impacted stream reaches, the stream's banks are eroding severely. In-stream habitat is poor; the stream is relatively fast-flowing, uniformly shallow, lacks shading, and is downcutting. Restoration of the riparian area is likely to improve habitat impediments in the long term by improving bank stability, shading the stream, and providing a future source of woody material.

Figure 12. Jackstraw Brook in Westborough, where riparian vegetation has been replaced with grass, resulting in significant bank erosion.

Improving aquatic and riparian habitats in impacted stream reaches could require one or more restoration measures working in concert. Possible measures include riparian buffer restoration, bank restoration, and grade stabilization. The items described below represent a range of potential measures that could be included as part of the restoration project. The specific measures required will need to be determined through a detailed project planning and permitting phase prior to construction. The design of the final project may include all, or a limited subset of, these measures and will depend on a variety of site-specific factors.

Grade stabilization: Stream habitat degradation may include downcutting and loss of bed sediment in the streambed, generally evolving from downstream to upstream. In general, downcutting in a stream results in the deepening of the channel, exposing stream banks to additional erosion and disconnecting the stream from the adjacent riparian habitat. Downcutting also impacts in-stream habitat complexity such as undercut banks, woody habitat, and riparian vegetation. The discharge of sediment also can harm downstream fish habitat. Grade stabilization can prevent further downcutting and erosion. If grade control is required for a project, there are two general types of measures that can be implemented. First, bed control structures can create a stable point on the channel bed that resists erosion by increasing the size of the bed material and reduces the stream's energy grade line. Second, hydraulic control structures can be used to create a drop in water surface to reduce the energy grade in the degrading reach (NRCS, 2007). Caution must be exercised when designing grade control structures because they can inhibit passage of aquatic species under certain conditions.

Currently, for Jackstraw Brook, the Warren Road crossing serves as a hydraulic control structure, fixing the bed of the stream at a defined point and preventing its degradation. It serves as the downstream limit of the degraded reach. The upstream limit of the degraded reach is not currently known, although it is likely to include natural grade control consisting of large-grained materials, roots, and woody debris in the unaffected reach upstream. It is not yet clear if grade stabilization would be necessary for Jackstraw Brook, since there is potential for the stream to have attained a new equilibrium state since dredging at the culvert occurred. Four crossvane-type grade stabilization structures have been included in the cost estimate prepared for this project, although whether grade control is required and, if so, the type of grade control that is most appropriate will be determined during the design phase for the project. Any need for grade stabilization would be coordinated with the proposed construction project planned by the Town of Westborough at the Warren Street crossing for flood control purposes.

Stream bank stabilization: Although grade control of a stream works to stabilize a stream in the vertical axis, bank stabilization works to stabilize the stream to reduce its horizontal migration. Numerous restoration techniques are available, with the selected method chosen based on the available land area, the level of impact to the stream that can be tolerated, and the potential damages that could be incurred if the bank's position remains dynamic to some degree. Stabilization typically requires addressing geotechnical stability, followed by protecting the

stabilized slope from erosion and sloughing. Well-implemented bank restoration will increase the stream's roughness, slowing velocities and further promoting stability.

An eroded bank often consists of steep-lying soils. Cutting the bank back to a more stable slope will prevent its continued sloughing. Where little land is available, the soil can be reinforced with cells of geotextile fabric and plantings to form a living retaining wall.

The stabilized slope must then be planted and protected to reduce erosion. Erosion protection along the toe of the bank can be performed to hold soils in place by using stones, woody debris (or combination of the two), and slope stabilization in upslope areas that are less frequently or never flooded. Brush mattresses, engineered logjams, root wads, and other structures absorb more stream energy than riprap armoring and can help recruit sediment and additional woody material, better simulating natural processes. Live stakes and long bundles of live woody vegetation (fascines) created from native shrubs can establish quickly, sending roots into soils and forming trees and shrubs to further stabilize soils, shade the stream, and provide sources of future woody debris to aid in restoring in-stream habitat complexity. Natural coconut coir fiber logs can be used as a short-term measure, preventing erosion until plants can establish and then degrading naturally over time.

Upper portions of a bank that are rarely flooded can be seeded with a combination of native conservation seed mix, bare root, balled in burlap, or containerized plantings and stabilized with biodegradable netting to resist erosion while plants establish.

The specific bank stabilization measures that are appropriate for any particular project would be determined during project investigation and design. For example, Jackstraw Brook would benefit from bank stabilization to prevent continued horizontal migration of the stream and to reduce the discharge of eroded bank soils to downstream areas. Several limited areas of Jackstraw Brook's banks in the affected reach appear to be stabilized with stone and with tree and shrub roots. The banks in these areas may only require limited additional planting where existing vegetation is sparse, which would require temporary removal and replacement of stones. In other portions of the reach, the banks are unvegetated and severely eroding and would require intensive bank treatment, which could include regrading the affected areas to a stable slope, planting them, and installing erosion control measures to protect soils until plants can establish. Specific measures would be selected during the planning and design phase.

Riparian buffer restoration: Improving the riparian area is the third component of stream restoration. Although restoration of the riparian buffer minimally affects the short-term stability of the impacted stream reach, in the long term, it is the most important factor in maintaining the stream system stability and habitat. Improvement of the riparian area restores the functions and values provided by vegetative buffers described earlier in this section.

In what follows, required phases in the restoration process are discussed, with potential work in Jackstraw Brook used as an example.

Investigation: During the site investigation phase, wetland resources would be flagged and a resource screening evaluation performed for the impacted area around the stream. A property and topographic survey would be performed for the area. If available, historical stream measurements collected by MA DER would be examined and compared to the new survey data to assess stream stability. The need for additional grade control would be determined in consultation with interested parties and agencies, such as MA DER. Abutting landowners would be contacted to discuss the size of the restoration corridor. Project stakeholders would be consulted for preferred restoration treatment options.

Preliminary design: A conceptual design of treatment options would be prepared that would include, as required, grade stabilization, bank stabilization, and riparian buffer restoration measures, showing rough grading, treatment areas, conceptual details, and limits of impact. The concept would be reviewed with property owners, MassWildlife, MA DER, the town or municipality where the stream is located, and other stakeholders for consideration and comment. The design would need to be coordinated with any proposed construction projects that might involve the stream. For example, for Jackstraw Brook, the design would be coordinated with the proposed construction project planned by the Town of Westborough at the Warren Street crossing for flood control.

Final design: A final design would be prepared for the project that would incorporate comments on the preliminary design and provide detail adequate for construction, including specifying materials and planting schedules.

Permitting: The proposed project first requires landowner permission as well as an agreement to enter into Conservation Restrictions (CRs) on associated properties if the project takes place on private land. Once permission has been obtained, the project likely will require permits from several agencies. The final design would be used for permitting, which is likely to include a Wetlands Protection Act (WPA) Notice of Intent (NOI) to the local town or municipal Conservation Commission for work on inland banks and within a wetland buffer, and an MEPA Environmental Notification Form (ENF) for impacts to inland banks. A 401 Water Quality Certification to the MassDEP would be required for any streams designated as ORWs, and any dredging or filling would require review under this program. The project will also likely require coverage under the U.S. Army Corps of Engineers (USACE) Programmatic General Permit (PGP). Prior to any restoration being implemented, CRs must be executed.

Construction: The project would be constructed according to the permitted plans and specifications. Construction administration and periodic observation would be necessary to ensure proper installation. Receipt of a Water Quality Certification for work in ORWs would require a full-time construction monitor that is approved in advance by the MassDEP.

Expected benefits and timeframe of benefits: Once implemented, stream bank and streambed stabilization actions generally will rapidly reduce the discharge of sediment by reducing erosion from the beds and banks of the impacted reach. The reduction in sediment discharge to the brook would reduce deposition in important fish habitat areas and could also reduce the frequency of clogging of any downstream culverts. The goal of riparian plantings is to reduce erosion and decrease sediment in the stream that could smother fish eggs or food resources important for fish.

Several years following construction, riparian vegetation will begin to shade the reach, reducing stream temperatures and further improving habitat conditions. Gradually, roots and deadfall from the riparian area should contribute to the substrate complexity of the restoration reach, improving its habitat quality and promoting increased habitat connectivity in the 20- to 50-year timeframe, although bank protection measures could improve in-stream habitat immediately.

If this project were implemented in Jackstraw Brook, expected benefits include a reduction in erosion and maintenance of the native brook trout population in Jackstraw Brook. From its headwaters until its outlet in Cedar Swamp Pond (1.9 miles), Jackstraw Brook is designated as an “outstanding resource water” (EEA, 2008). This project has the potential to benefit most of Jackstraw Brook because it is taking place near the headwaters.

Brief overview of maintenance and monitoring: Immediately following construction, watering of plants will be required to ensure establishment. Periodic monitoring of vegetation will be required in the first few years following construction to ensure that stream banks remain stable and that the plantings are not overtaken by invasive species. Survey of longitudinal profiles and cross-sections should continue occasionally to examine channel geomorphology. Monitoring of stream temperature over time will help determine whether the expected increase in riparian vegetation has decreased stream temperatures.

Probability of success: Habitat restoration is being proposed for funding by the Trustees because of its critical importance for protecting coldwater fish populations. Where streams are known to flood, care will need to be taken to ensure that the project can withstand high flows during and following the establishment of vegetation. Following establishment, the project could be impacted by a further destabilizing event, such as additional downcutting of the stream channel, although the improved riparian area would help to reduce these impacts.

For the Jackstraw Brook project, landowners have been contacted regarding their preliminary interest in participating in the project, but landowner agreements have not yet been obtained. Without landowner agreement, the project will not proceed. Assuming landowner agreement and

associated CRs are obtained, the short-term probability of success for the project is high, assuming that the project is properly designed and constructed. The largest long-term threat to the project would be removal of the riparian vegetation by the landowner if the landowner breaks the terms of the CR and the CR is not enforced.

Environmental and socioeconomic consequences: The project is intended to provide long-term environmental benefits through improving coldwater fish habitat by actions such as stabilizing a stream and its banks, improving riverine habitat, and restoring the riparian area of the stream. Short-term consequences may occur if erosion and sediment control measures are not properly implemented or fail or if a large storm were to occur before plantings had established. These occurrences could result in increased discharges of sediment to the stream and loss of the investment in the project. These concerns would be addressed during the permitting process, as presented in the project description section.

Manipulation of a riverine system also risks unintended consequences, such as destabilization of an area that is currently stable or overcompensation for degradation that results in aggradation (accumulation of sediment) in the affected reach. These consequences can be avoided by using appropriate designs, monitoring the completed project, and adjusting the project following construction, if necessary, and by minimizing work below the bankfull width of the stream (e.g., portions of the stream's existing bank have already been stabilized with riprap; these areas should be left intact, perhaps with supplemental live stake plantings between stones).

The project has potential socioeconomic consequences by improving native fish habitat, which benefits the broader community. The project may also provide some benefits to the town where the stream is located and neighboring landowners through a potential decrease in peak flood flows by slowing the water velocities through reaches currently impacted by loss of riparian vegetation and erosion and by stabilizing sediments and bed material that could otherwise decrease pipe capacity. The Jackstraw Brook project would not conflict with the culvert capacity improvements being implemented by the Town of Westborough.

Estimated costs: Costs are not yet known because a project location has not been selected. For the Jackstraw Brook project, a general estimate was made of approximately $90,000 for design, permitting, and construction administration, and $210,000 for construction. These costs would be refined during the project design phase. The project can proceed in phases, with work focused initially on the areas of highest erosion potential. Cost estimates assume that the work will take place on private or public land with landowner permission; land acquisition will not be a part of this project.

Trustee evaluation and proposed allocation: This project is proposed to receive $300,000 in funding in Tier 1 for project planning and implementation. The Jackstraw Brook project was evaluated favorably based on the Trustee evaluation criteria (Table 5) because of its focus on protecting an intact population of brook trout. Opportunities to benefit cold water fisheries such as brook trout in the SuAsCo Watershed are limited.

Table 5. Evaluation of Habitat Restoration to Benefit Coldwater Fish project versus the Trustee criteria. The potential Jackstraw brook project was used as a specific example to allow the Trustees to evaluate the criteria. Numbers in parentheses refer to the numbered list of criteria provided in Section 3.3. This table only includes criteria where the project was evaluated as particularly strong compared to other projects.

High importance criteria	Evaluation strengths
Proximity to injured resources (1)	Located within a tributary to the Sudbury River Watershed.
Relationship to injured resources (2)	Restores injured resources (freshwater fish). Benefiting native fish, such as brook trout, is a high priority for the Trustees.
Magnitude of benefits and demonstrated need (3)	Addresses a demonstrated need to preserve and enhance coldwater fish habitat. Without this project, the habitat may be lost to ongoing sedimentation.
Leveraging of additional resources (9)	Project could leverage expertise of Partners for Fish and Wildlife Program.
Medium importance criteria	
Community goals (3)	Complements Westborough's infrastructure master plan for the Jackstraw Brook Watershed.
Avoidance of adverse impacts – ecological (2) and socioeconomic (4)	Riparian restoration has little to no potential for adverse environmental or socioeconomic impacts.
Stewardship and public education (socioeconomic benefit) (5)	Provides an opportunity for stewardship and public education through partnerships with local landowners.

4.3.4 Concord River Diadromous Fish Restoration: Feasibility and Stewardship

Restoration objective: To assess the potential to restore fish passage at three dams on the Concord River to allow diadromous fish to be restored to 40 miles of their historic habitat in the SuAsCo Watershed. See Figure 13 for the project logic model.

Figure 13. Concord River Diadromous Fish Restoration: Feasibility and Stewardship – logic model

Restoration actions	Expected short-term result	How benefits are achieved	Desired long-term results
Assess fish passage conditions and potential for fish passage restoration at three dams on the Concord River. ⇨	Feasibility study provides recommendations for improving fish passage. ⇨	Review of feasibility study results in decision to implement fish passage. (Note that this step may not happen and is contingent on many factors). ⇨	Diadromous fish passage is restored to the Concord River. Fish are able to travel up to Framingham in the Sudbury River. (Assuming the implementation goes forward.)

Project location: The Concord River in North Billerica and Lowell.

Project description: Diadromous fish were historically present in the streams and rivers of the SuAsCo watershed, but their upstream and downstream passage has been obstructed through construction of dams. In 1999, USFWS initiated a multi-year effort on the Concord and Sudbury rivers to restore two species of river herring (blueback herring (*Alosa aestivalis*) and alewife (*Alosa pseudoharengus*). The Concord River is the only major tributary of the Merrimack River with a confluence downstream of the Pawtucket Dam in Lowell and it has three dams between its headwaters at the confluence of the Sudbury and Assabet rivers to its mouth at the Merrimack River. Effective passage at all three dams on the Concord River would provide access to 12.5 miles of the Concord River, 9.0 miles of the Assabet River, and 17.5 miles of the Sudbury River before the next upstream dams. Two of these dams are located in Lowell and the third is located upstream in North Billerica. Restoring and enhancing fish passage at these dams would open the Sudbury, Assabet, and Concord rivers to migration of native river herring and American eel through portions of nine communities.

Existing fish passage conditions: The Middlesex Dam is the most downstream of the three dams. Breached in the 1980s by flooding, this dam currently consists of two segments that meet at an island in the Concord River. While there is not currently a physical obstruction, the remaining concrete abutments create a hydraulic restriction that allows migration of shad and river herring only during very limited flow conditions (Richard Quinn, USFWS hydraulic engineer, personal communication, as cited in Charles George Natural Resources Trustee Council, 2002).

Figure 14. Wamesit Falls (also known as Centennial Island Dam).

The Wamesit Falls, or Centennial Island, Dam is the second dam on the Concord River (Figure 14). This low-head run-of-river dam supplies water to an active hydropower generator via a small power canal. This dam includes an operational fishway that is maintained by the hydropower operator as a condition of receiving an exemption from licensing by FERC (FERC Project. No. 2998). A series of stones crosses the main river channel just upstream of the fishway entrance. The Lowell Parks and Conservation Trust (LPCT), whose volunteers perform fish counts annually, report that fish are utilizing the fishway. However, the National Marine Fisheries Service (NMFS) and MassWildlife report that fish may be attracted to the base of the Centennial Island Dam rather than to the entrance of the fishway due to differences in attraction flows.

The Talbot Mills Dam, also known as the Faulkner Mills Dam, currently has no provision for fish passage.

Proposed fish passage approaches: There are three proposed locations where fish passage would be restored or enhanced: Middlesex Dam, Centennial Island Dam, and Talbot Mills Dam.

At the Middlesex Dam, the proposed project would include reviewing the remnant dam structures and stream channel to allow up- and down-stream passage of diadromous fish and determining what, if any, actions are necessary to enhance fish passage. An evaluation of the Middlesex Dam in 1999 by the USFWS noted that a simple fishway and an entrance channel could improve upstream passage (Quinn, 1999).

At the Centennial Island Dam, the proposed project would include supporting assessments, based on volunteer-based observational data, of the current passage capability of the existing fishway. The project would improve volunteer capacity and capability to monitor upstream fish passage. Funding would be provided for a part-time volunteer coordinator to organize volunteers, develop training materials, and perform training. Training and observation would be targeted for the times of year when fish are expected to pass through the structure. As this site is a focal point for public stewardship and awareness of the watershed-wide diadromous fish restoration effort; the volunteer coordinator will also conduct community outreach and education as part of recruiting volunteers and publicizing fish passage results. A summary report will be prepared to describe observations recorded during the study period and an interpretive sign will be developed and installed at the fishway or along the Concord River greenway adjacent to the fishway.

At the Talbot Mills Dam, the proposed project involves undertaking a phased approach to investigating the potential feasibility of fish passage. Each phase is intended to fill gaps in existing data that are critical to addressing issues at the dam owner, citizen, municipal, state, and federal agency levels. Public informational meetings will be held throughout the process to afford stakeholders an opportunity to provide input on the proposed project and the proposed alternatives. After the completion of each phase, the Trustee Council will evaluate the analyses and determine practicability of moving forward. Phases 1–3 represent preliminary analyses and Phases 4–5 represent feasibility and design.

Talbot Mills Dam Phases 1–3: Preliminary Analyses

Phase 1: *Deed, property boundary, and licensure investigation.* Uncertainty exists regarding the ownership of the dam, the land underneath it, adjacent properties, dam safety and maintenance, and the licensure status of the dam. A title search would be performed for the structure and adjacent parcels to confirm ownership as well as to determine the status of the dam's license relative to the Massachusetts Waterways Regulations (M.G.L. Chapter 91 and 310 CMR 9.00). Information regarding dam safety and maintenance would also be sought during Phase 1. Additionally, an attempt would be made to identify whether the structure was authorized through any acts or resolves of the Massachusetts Legislature. Include dam safety and maintenance data

At the completion of these data collection, the Trustee Council will seek to obtain access to the site and concurrence with restoration planning efforts from dam owners prior to proceeding to Phase 2 of the project.

Phase 2: *Preliminary hydraulic investigations.* The Town of Billerica withdraws water from the Concord River approximately one mile upstream of the Talbot Mills Dam and has previously expressed concern that removal or modification of the dam could impact their water supply. However, the Fordway Bar, which is a geologic feature located upstream of the impoundment but downstream of the drinking water intake, may control the river water surface elevation at the drinking water intake. A bathymetric survey and hydraulic investigation will be conducted to evaluate potential changes associated with dam modification.

Field surveys will be conducted of river cross-sections at key hydraulic control points and other locations following the Gulf of Maine Council on the Marine Environment's Stream Barrier Removal Monitoring Guide (Collins et al., 2007). Cross-sections would include measurements of the riverbed, surrounding banks, and water surface elevation. Survey control would be established at each location and referenced to Massachusetts State Plan (e.g., North American Datum of 1983, NAD 83) as well as the vertical datum used for the dam (e.g., National Geodetic Vertical Datum of 1929, NGVD 29). These surveys will be supplemented with data from existing sources, including any USGS instream flow studies and models, documentation associated with the Town of Billerica's water supply system and permit requirements, inspection

reports and plans associated with the Talbot Mills Dam, and the Federal Emergency Management Agency (FEMA) Flood Insurance Study (FIS) cross-sections for the river.

A steady-state hydraulic analysis would be prepared using a combination of the survey data and data from other sources. The hydraulic analysis would use accepted modeling software to determine the following:

- Existing conditions, including limits of impounded headwater, during low, normal, and high flow conditions
- Hydraulic characteristics up- and down-stream in the event the dam were removed, breached or otherwise modified for fish passage
- Potential impacts to the water supply intake, existing bridges, and other nearby structures in the event the dam were removed, breached, or otherwise modified for fish passage.

At the completion of Phase 2, the Trustee Council will review the results of the analyses and conduct interagency consultation to discuss changes in water level upstream of the Fordway Bar, particularly any potential effects on the Town of Billerica water supply intake. If the Trustee Council determines that there are no potential effects, or that potential effects can be avoided, minimized, or mitigated, the project will proceed to Phase 3.

Phase 3: *Preliminary sediment analysis.* The quality, quantity, and type of sediment impounded upstream of the Talbot Mills Dam are key data in determining the range of viable fish passage alternatives. Since the Concord River upstream of the Talbot Mills Dam is slow-flowing with a gentle gradient, it is unlikely to carry a large sediment load. However, accumulation of sediment behind the dam is likely to have occurred over time. Management of impounded sediment under certain alternatives such as dam breaching or removal can include removal, stabilization, or release downstream. Thus, knowing the characteristics of sediment to be managed is critical in dictating the design and cost of these alternatives.

Requirements for sediment sampling and analysis in Massachusetts are generally defined by the 401 Water Quality Certification regulations of 314 CMR 9.00. Based on the size of the impoundment upstream of the dam, it is likely that greater than 10,000 cubic yards of sediment may require management. Information gathered during the bathymetric survey conducted during Phase 2 of the project will help refine this estimate. However, projects of this size require preparation of a project-specific sampling and analysis plan. Specific tasks will likely include:

- Gather and review existing sediment data, including those collected by the USGS, MassDEP's Division of Watershed Management, and any large-scale projects recently conducted in the project area that involved instream work.

- Perform a due-diligence review to determine the potential for the accumulated sediment to contain oil and/or hazardous material, as defined by the Massachusetts Contingency Plan, 310 CMR 40.0000, and following the methods of the Massachusetts 401 Water Quality Certification regulations at 314 CMR 9.07.
- Estimate the volume of impounded sediment using the bathymetric survey data collected in Phase 2 of the project, supplemented by additional field survey if necessary.
- Prepare a project-specific sampling and analysis plan and submit to the MassDEP for approval, specifying the sampling parameters, locations, and frequency.
- Upon approval by MassDEP, perform sampling and analysis as specified by the plan.
- Submit data to MassDEP for review and conduct supplementary sampling and analysis as necessary.

At the completion of Phase 3, the Trustee Council will review the results of the analysis and conduct interagency consultation to assess the viability of sediment management options for reuse, stabilization, or release. If the Trustee Council determines that sediment quantity or quality preclude the implementation of any specific fish passage alternatives, those alternatives will not be advanced further to Phase 4, Feasibility and Design.

Talbot Mills Phase 4: Feasibility and Design

Phase 4a: Target diadromous fish species. The target fish species for passage will be refined to determine the limiting factors affecting up- and down-stream migration. Specifically, the evaluation criteria could include migration periods and flow requirements and swimming speeds and durations (cruising and burst). Consultation with state and federal agency fishery experts as well as review of primary source literature will inform the determination of the suitability of potential fish passage approaches. This will, in turn, help inform application of the hydraulic model developed in Phase 2 and applied further in Phase 4d as described below.

Phase 4b: Pre-application conference. The Trustee Council will meet with appropriate state and federal regulatory agencies to obtain a preliminary review of applicable permits and requirements to help inform studies and analyses to be conducted during the feasibility phase. This will include consultations with the Massachusetts Historical Commission (MHC) and Massachusetts Natural Heritage and Endangered Species Program (NHESP) as appropriate.

Phase 4c: Detailed site survey. A detailed topographic, planimetric, and property boundary survey will be performed for the dam and the site surrounding it, including the stream bed, the impoundment bottom, the bridge immediately downstream of the dam, the surrounding grounds, and adjacent buildings. This survey information will be used as the basemap for concept plans

and to assess property ownership and permitting requirements of the proposed alternatives. Survey control would be established at the site and referenced to Massachusetts State Plane (NAD 83) as well as the vertical datum in which the current area topographic maps are drawn (e.g., NGVD 29).

Phase 4d: Additional hydraulic investigation. A steady-state hydraulic analysis will be prepared using the data provided by Phase 2. The hydraulic analysis would use accepted modeling software to determine the following additional conditions:

- Modifications of the dam that would accommodate installation of the types of fishways likely to be most effective for target species
- Methods to increase efficiency of fish passage, if necessary, such as enhancing attraction flows at the entrance of the fishway
- Channel morphology up- and down-stream of the dam in the event the dam were removed, breached, or otherwise modified for fish passage.

Phase 4e: Additional sediment investigation. If sediment quality and quantity are determined to be appropriate for stabilization or release in Phase 3, a sediment transport and redistribution analysis would be performed.

Phase 4f: Conceptual design. Conceptual design drawings would be prepared for up to five alternatives, including plan view sheets; profiles through the dam, a restored channel through the dam and, if necessary, the impoundment, fish ladder(s), and/or fish lift; and cross-sections, showing adequate detail to evaluate the advantages and disadvantages, the environmental impacts and benefits, and an order-of-magnitude estimate of costs for each alternative. Also included in a conceptual design should be major cost items, such as final design, sediment management, and permitting. The conceptual design will also address dam safety considerations, including safety issues after dam removal or modification.

Talbot Mills Phase 5: Final Report

- A preliminary feasibility study report will be prepared to present the findings of this feasibility investigation and recommendations for final design. The report will also include a discussion of environmental impacts, required permitting, the position of dam owners with respect to any proposed work, a discussion of any additional data gathering required, and a budget-level opinion of cost for design, permitting, and construction of the selected alternatives. Include position of the dam owners. A draft of this report would be submitted for review by the Trustee Council and partner state and federal agencies. Comments would then be incorporated and the study report finalized.

Expected benefits and timeframe of benefits: The proposed work at Middlesex Dam will provide a means for improvement of fish passage in a relatively short timeframe following completion. Implementation of fish passage could potentially occur within one to two years. At Centennial Island Dam, the funding will improve volunteer efforts at the structure, which will increase the information available on fish passage through the existing fishway as well as increase public awareness of fish passage activity. These benefits are anticipated within one year of funding. Any proposed modifications to the fishway at Centennial Island Dam would likely need the approval of the USFWS which inspects the fishway as a condition of the dam's FERC exemption. At Talbot Mills Dam, the project involves a feasibility study, which will not result in immediate direct benefit. Direct benefits to fish passage would be realized if the study concludes that fish passage at the dam is feasible and support can be gained from the dam owner, the owners of other properties that could be affected, and other key stakeholders.

The potential benefits from creation of fish passage at Talbot Mills Dam are extremely high. Providing access to anadromous fish (shad, river herring, and American eel) of over 40 river miles of historical spawning habitat would make a substantial contribution to the overall populations of these fish in the whole Merrimack River Watershed. These fish populations would be expected to become self-sustaining after fish passage is created. Recreational opportunities would also be enhanced for fishing and wildlife observation.

Brief overview of maintenance and monitoring: Semi-annual implementation monitoring would provide updates to the Trustees on the progress of the work at Middlesex Dam and Centennial Island Dam and progress on the feasibility study. Ongoing counts of fish passage at the Centennial Island Dam would provide information on whether the work at the Middlesex Dam has increased upstream fish passage toward Centennial Island. Maintenance requirements for any fish passage improvements at the Talbot Mills Dam would be developed as part of the feasibility study.

Probability of success: The project is anticipated to answer outstanding questions that will address the feasibility of implementing fish passage enhancements. Implementation of recommendations at the Middlesex Dam and at the Talbot Mills Dam will depend on the cooperation of the dam owners which is unknown at the point.

Environmental and socioeconomic consequences: The immediate project, including assessing existing passage and performing feasibility studies to improve passage, will not result in environmental or socioeconomic consequences. Future projects, including implementation of recommendations, may result in environmental or socioeconomic consequences. These consequence will be identified as part of the feasibility evaluations and as part of any permitting process.

Estimated costs: The cost for reviewing and updating the passage study for Middlesex Dam is estimated at $15,000. Support of volunteer monitoring efforts, outreach, and reporting for the Centennial Island Dam is estimated at $25,000. The cost of conducting the fish passage feasibility study at Talbot Mills Dam is estimated at $200,000. The cost of implementation of recommendations for fish passage measures is unknown, but could be in excess of $750,000.

Trustee evaluation and proposed allocation: This project is proposed to receive $240,000 in funding in Tier 1 for work at Middlesex Dam, Centennial Island Dam, and completion of the feasibility study at Talbot Mills Dam, and an additional $185,000 in Tier 1 as a contribution for implementation if the project progresses to implementation. The Trustees expect that other sources of funding would be available as matching funds if the project progresses. The project was evaluated favorably versus the Trustee evaluation criteria because of its focus on restoring diadromous fish population to the SuAsCo Watershed. The loss of diadromous fish because of dam blockage has represented a significant biological impoverishment of the system since the dams were constructed in the 19th century. The potential opportunity to restore diadromous fish would directly improve aquatic resources in the Sudbury River, which were injured from releases of hazardous substances at the Nyanza Site. An alewife (river herring) stocking program began in 2000 with the goal of restoring historical runs of river herring to the Concord River. Alewife have been stocked into the Concord, Assabet, and Sudbury rivers. The Great Meadows NWR has helped to locate release sites, release stocked fish, and monitor local rivers for fish passage, as part of their refuge objective of protecting and enhancing habitats to support self-sustaining populations of Federal trust species and wildlife diversity (USFWS, 2005b).

Successful improvement and restoration of fish passage of these three dams may allow diadromous fish to pass as far as Framingham, resulting in benefits to areas directly impacted by the Nyanza site. Specifically, if fish can get past the Talbot Mills Dam, they will have access to more than 40 miles of historical river habitat because the next upstream obstruction is the Saxonville Dam on the Sudbury River in Saxonville, Massachusetts, and a small hydroelectric dam on the Assabet River at the Acton/Maynard line, Massachusetts (Charles George Natural Resources Trustee Council, 2002). The feasibility study supported by this project is a necessary first step, before additional consideration of fish passage can take place. Because of the great potential benefit of this project, the Trustees evaluate this feasibility study favorably (Table 6).

4.3.5 Sudbury RiverSchools Program

Restoration objective: To introduce students and their teachers to native plants and wildlife that depend on healthy rivers and offer engaging programming for exploration and discovery of the river itself. See Figure 15 for the project logic model.

Project location: Schools in five different Sudbury River communities.

Table 6. Evaluation of Concord River Diadromous Fish Restoration: Feasibility and Stewardship project versus the Trustee criteria. Numbers in parentheses refer to the numbered list of criteria provided in Section 3.3. This table only includes criteria where the project was evaluated as particularly strong compared to other projects.

High importance criteria	Evaluation strengths
Proximity to injured resources (1)	Dams are located outside the Sudbury River Watershed but fish passage restoration will have a positive impact on the injured natural resources that historically utilized the Sudbury River. Fish passage at all three dams could restore diadromous fish in the Sudbury River up to Framingham.
Relationship to injured resources (2)	A feasibility study is a necessary prerequisite to restoring injured natural resources (freshwater fish) in the Sudbury River. The resources that would benefit from this project (diadromous fish) are of high environmental value.
Magnitude of benefits and demonstrated need (3)	Addresses a demonstrated need to restore diadromous fish to historic habitat in the Concord River Watershed. The goal of restoring historical runs of fish in the herring family to the Concord River is noted in the Great Meadows NWR Comprehensive Conservation Plan (USFWS, 2005b). The Sudbury, Assabet and Concord Wild and Scenic River Study River Conservation Plan (NPS, 1995) notes the need to promote projects that promote anadromous fish restoration.
Technical/Technological feasibility (6)	Project will employ well-known and accepted techniques for conducting the feasibility study. The study will propose well-known and accepted techniques for achieving fish passage.
Avoidance of adverse impacts – ecological (2) and socioeconomic (4)	The feasibility analysis will not result in environmental or socioeconomic impacts. The potential impacts of fish passage restoration will be evaluated as part of the feasibility study.
Stewardship and public education (socioeconomic benefit) (5)	Opportunity for continued stewardship and public education through volunteer involvement, especially at the Centennial Island Dam; project provides a critical foundation for ongoing and future restoration activities.

Figure 15. Sudbury RiverSchools Program logic model

Restoration actions	Expected short-term result	How benefits are achieved	Desired long-term results
Educate students and teachers about native plants and wildlife; help students explore and discover the river.	Interaction with the river's natural resources increases knowledge and inspires ongoing engagement with the river.	Interaction with the river's natural resources inspires ongoing engagement with the river.	Students and teachers become better environmental stewards of the river and support policies and practices that maintain or increase river health.

Project description: The Sudbury RiverSchools Program builds on an existing successful educational program developed and run by MassAudubon. This program would work with one elementary and one middle/high school in five Sudbury River communities. Activities include a combination of in-class and field-based environmental education.

Specific aspects of the RiverSchools program include:

- Developing and facilitating teacher workshops that provide content information about river habitats and their ecology, specific to the Sudbury River, in addition to methods for incorporating the study of the river into classroom curriculum, including the use of project-based science monitoring projects.
- Building capacity and ongoing support for teachers to develop place-based environmental education and science literacy programs for their students.
- Offering students the opportunity to learn about the ecological significance of the river and the watershed by participating in classroom-based environmental education programs, field studies at the river, and the opportunity to present and share the data they collect during outreach events.
- Assisting with the facilitation of partnerships with schools along the Sudbury River and local conservation organizations and resources.

Content workshops for teachers help to build both a knowledge base and a comfort level with the inquiry-based science and ecological concepts. Content workshops recognize that teachers want to build upon their own knowledge and understanding before they can comfortably utilize the natural world as an "outdoor classroom."

Field study workshops at the Sudbury River provide teachers with the opportunity for hands-on fieldwork which increases the potential that teachers will be able to successfully integrate environmental education into the classroom. It familiarizes teachers with different field study tools, techniques, and methods of bridging fieldwork with ongoing or long-term classroom units.

For students, the RiverSchools program utilizes a combination of in-class and field-based environmental education – Classroom Discovery programs orient students and teachers to their watershed as well as the river in their community, introduce native wildlife dependent on the health of the river system to youth, and prepare students to use field equipment and data collection tools. Habitat Exploration programs include hands-on field work at the river in their school community to make classroom lessons about habitat, food webs, interdependence, and stewardship come to life. As students do field work to study aquatic insects, fish, and wildlife that are dependent on the health of the river, they are asked about their own interdependence

with the river habitat and their responsibility to the health of the watershed (MA Audubon, 2008).

This project includes an additional component that will be integrated with Project 4.4.2 (Neotropical Connections) to communicate the benefits of protecting wintering habitat for bird species that migrate along the Eastern Flyway and utilized the SuAsCo Watershed. Children within the SuAsCo Watershed will be able to learn where "their birds" overwinter by following the migratory pathways of birds outfitted with "solar geolocators" that can track their position during migration. [More information on this component of the project is provided in the Neotropical Connections (Belize) project described in Section 4.4.2.]

Expected benefits and timeframe of benefits: The expected benefits are an increase in ecological knowledge and an increase in stewardship behavior by teachers and students. The timeframe for program delivery once funding is made available follows:

- Needs assessment and pre-program planning (three to six months, ongoing once schools are identified): Identify and meet with the schoolteachers and administrators from potential partner schools in Sudbury River communities.
- Teacher professional development: Occurs in early summer or early fall. Prepares teachers for student programs that occur the following school year.
- Classroom discovery programs: Occurs in early fall or early spring, approximately two to four weeks before habitat exploration/field study programs.
- Habitat exploration/field study program: Occurs two to four weeks after classroom discovery programs.

Brief overview of maintenance and monitoring: The educators for this program engage in ongoing evaluations to increase project success and overcome any hurdles that are encountered during the educational programs. The proposed project proponent (MA Audubon Society) also would provide a more comprehensive summative evaluation that would be conducted annually to report on the types of programs delivered and evidence or metrics of educational success.

Probability of success: The probability of success for the educational programs is high. The proposed project proponent (MA Audubon Society) has extensive experience engaging in these kinds of educational efforts. The probability of success for increasing environmental stewardship into the future is unknown.

Environmental and socioeconomic consequences: There would be no environmental consequences associated with this project. The project has the potential to have a positive socioeconomic consequence if environmental stewardship of the river improves.

Estimated costs: The estimated annual cost of the program is $30,000 for three schools. The cost estimate assumes that the project will engage with two grade levels (one elementary and one middle/high school) in five Sudbury River communities, with an average of four classrooms per grade level.

Trustee evaluation and proposed allocation: This project is proposed to receive $90,000 in funding in Tier 1 to carry out the project for three years. If funding is available, the project would receive $30,000 in funding in Tier 2 for one additional year. The project was evaluated favorably versus the Trustee evaluation criteria because of its focus on hands-on engagement with the river, including monitoring and data collection of river resources (Table 7).

Table 7. Evaluation of Sudbury RiverSchools Program versus the Trustee criteria. Numbers in parentheses refer to the numbered list of criteria provided in Section 3.3. This table only includes criteria where the project was evaluated as particularly strong compared to other projects.

High importance criteria	**Evaluation strengths**
Proximity to injured resources (1)	Located within the Sudbury River Watershed.
Relationship to injured resources (2); magnitude of benefits and demonstrated need (3); stewardship (socioeconomic benefit) (6)	Through education that involves opportunities to interact directly with the river's natural resources, children and adults in the watershed will be better informed about the importance of environmental stewardship, which will help avoid future adverse impacts to the river.
Feasibility (technical/technological) (6)	Project employs well-known and accepted techniques to achieve ecological and social objectives. The project sponsor, MA Audubon Society, has extensive experience conducting these types of educational programs.
Reasonableness of costs (7)	Provides a high value of expected benefit to expected cost because of the low cost of the project and the opportunity to educate hundreds of teachers and students.
Measurable results (5)	Project delivers tangible social and/or human use results that may be evaluated using quantitative or professionally accepted methods.
Medium importance criteria	
Avoidance of adverse impacts – ecological (2) and socioeconomic (4)	Has little to no potential for significant adverse environmental or socioeconomic impacts.
Community goals (3)	Project complements plans for increased environmental stewardship in the Sudbury River Watershed.

4.4 Proposed Alternative – Riparian and Floodplain Biological Resources and their Supporting Habitats and Food Sources

The Nyanza NRD Trustee Council proposes to provide a total of $1,329,000 in Tier 1 funding and $700,000 in Tier 2 funding to four projects in the restoration priority category of Riparian and Floodplain Biological Resources and their Supporting Habitats and Food Sources. Collectively, these projects will restore open grassland habitat in the floodplain of the Sudbury River, protect overwintering habitat for neotropical migratory birds, and acquire land at risk of development in the Sudbury River corridor. The Trustee Council's goal in this restoration project category is to restore riparian and floodplain habitats to sustain native wildlife species that were injured by releases of hazardous substances from the Site.

4.4.1 Greenways North Field Restoration

Restoration objective: To improve wildlife habitat by controlling invasive buckthorn (*Rhamnus cathartica*) in a seven-acre field adjacent to the Sudbury River and encouraging the growth of native species. See Figure 16 for the project logic model.

Figure 16. Greenways North Field Restoration – logic model

Restoration actions		Expected short-term result		How benefits are achieved		Desired long-term results
Control invasive buckthorn in a field by cutting buckthorn by hand in the winter and applying herbicide selectively via backpack sprayer the following summer.	⇨	Buckthorn is greatly reduced or eliminated in the field.	⇨	Native grassland vegetation reestablishes dominance in the field; birds and wildlife make use of open grassland habitat.	⇨	Birds and wildlife requiring open grassland habitat are benefited by increased nesting habitat,

Project location: Adjacent to the Sudbury River in Wayland. See Figure 17 for project location.

Project description: A seven-acre field owned by the Sudbury Valley Trustees adjacent to the Sudbury River has the potential to provide enhanced habitat for insectivorous birds (e.g., tree swallows, song sparrows and house wrens) that use the upland areas along the river for nesting, resting and feeding. The field may also provide nesting habitat for grassland birds, such as bobolinks, field sparrows, Eastern bluebirds and American kestrel (*Falco sparverius*), as well as other birds, wildlife, and insects that make use of fields and field edges. An invasive shrub species (buckthorn) currently dominates the field, despite efforts to control it with mowing. Eradication of the buckthorn is necessary to restore the field to grassland habitat.

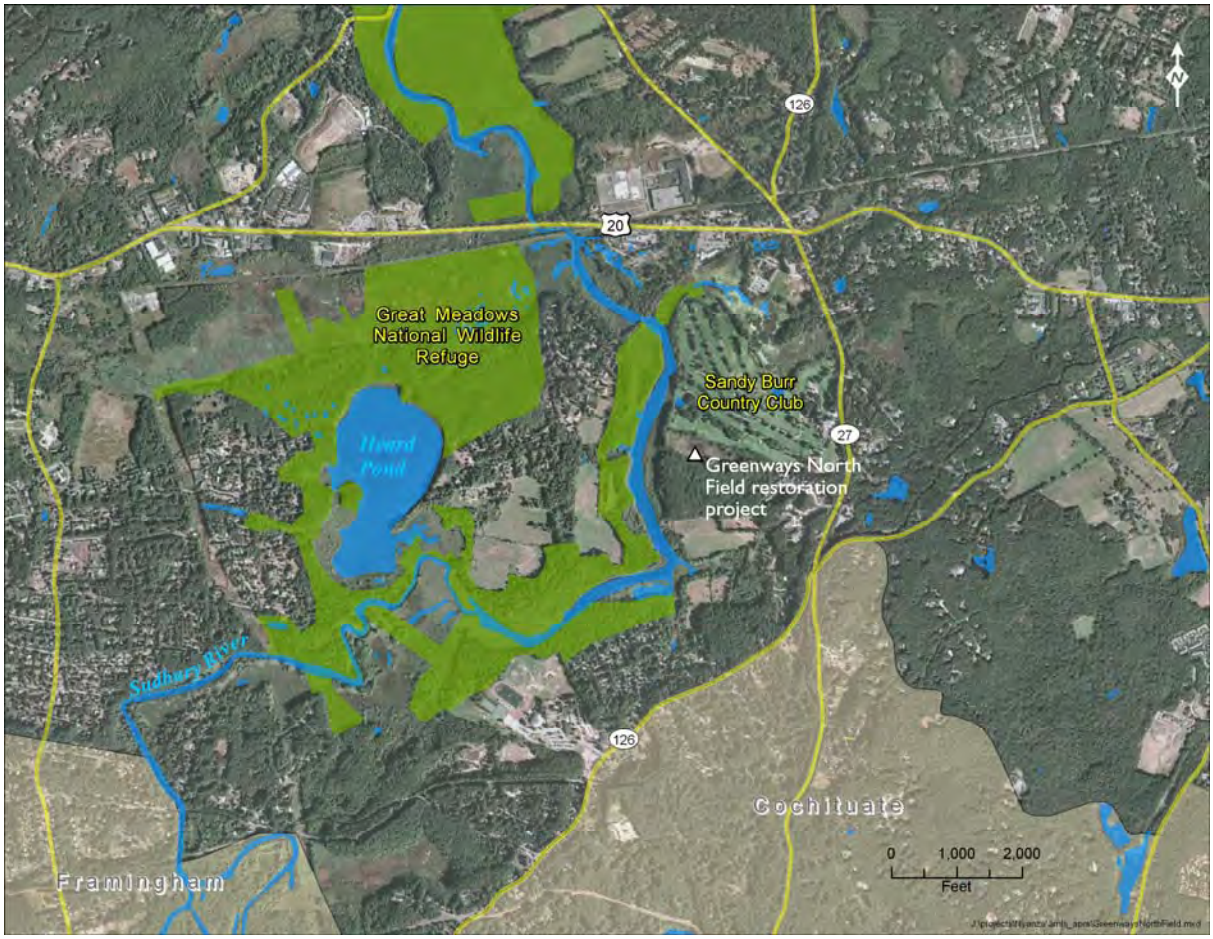

Figure 17. Location of Greenways North Field Restoration project.

Site description and history: The field is owned by Sudbury Valley Trustees and maintained as a conservation area. The field is part of the Wild & Scenic River Corridor (NPS, 1995) and also is located within a MA Natural Heritage Biodiversity Core Habitat Area. The field is mostly wet meadow with upland pockets. The current vegetation composition of the field includes a predominance of sensitive fern, goldenrod, and buckthorn. There are a few isolated plants and patches of purple loosestrife, another invasive species. Restoration of grassland habitat in the field is a priority for the Sudbury Valley Trustees because field habitat has been declining in Massachusetts over the last 50–100 years and it is identified as a priority habitat in MassWildlife's Strategic Action Plan. The SuAsCo Biodiversity Protection and Stewardship Plan also noted that grassland birds are declining in the SuAsCo Watershed as land is lost from agricultural use (Clark, 2000). This project would be the second phase of a buckthorn control

project. The first phase of the project – clearing the invasive shrubs that had grown up around the perimeter – was completed with funding support from the MassWildlife Landowner Incentives Program (LIP). LIP also supports the annual field mowing; however, this mowing has been unsuccessful in controlling buckthorn (SVT, 2008).

Site access: Existing roads and pathways can be used for site access. No habitat would be disturbed for access.

Buckthorn removal: Buckthorn removal at this site would follow the method recommended by the Massachusetts Audubon Society (L. Wagner, Regional Scientist, Massachusetts Audubon Society, personal communication, December 17, 2009), which involves using a combination of hand-cutting the buckthorn, followed by herbicide application, mowing, and additional followup herbicide application in subsequent years to kill recurring growth. This method can eradicate the buckthorn population while maintaining the existing grass species and mature grassland habitat.

Buckthorn would be cut in the winter by hand, and then a foliar spray (triclopyr or "Garlon") would be applied to the cut stems and newly sprouted leaves in July or August with a backpack sprayer. The Massachusetts Audubon Society reports this method to be 95–98% effective in killing buckthorn. Followup treatment may be necessary for a few years, and spraying with Garlon and/or glyphosate (Roundup) would be conducted in late August.

In addition to stalk cutting and selective herbicide application, the field would be mown once every three years in the late summer to early fall to prevent establishment of other woody vegetation, preventing the conversion of the field into forest in the long-term. Mowing would occur after the herbicide has taken effect. The mower blades would be set relatively high, at about 6 inches, to maintain a healthy plant community. If turtles are thought to be present, mower blades would be set at 8 to 12 inches to avoid hitting them. Mowing would be timed to avoid disturbing nesting birds, if any are present.

Expected benefits and timeframe of benefits: The primary desired benefit of the project is the restoration of grassland habitat that is used by nesting and feeding birds and other wildlife. Increased cover and diversity of native grassland vegetation species is another expected benefit of this project.

Project benefits would begin after the first year of winter cutting of buckthorn and are expected to reach full benefit within three years of starting the treatments. The duration of project benefits will depend on effective annual maintenance, including mowing and, potentially, herbicide application at periodic intervals.

Brief overview of maintenance and monitoring: Semi-annual implementation monitoring would be conducted for the first three years of the project. This monitoring would confirm that project permitting and implementation activities are proceeding on schedule and in accordance

with project plans. Following implementation, the presence of buckthorn in the field would be monitored annually using qualitative vegetative surveys. Regrowth of buckthorn would trigger corrective actions (cutting and/or herbicide applications). The effectiveness of the project in creating grassland habitat would be monitored with breeding bird surveys, looking especially for the presence of insectivorous birds and nesting bobolinks. The Sudbury Valley Trustees already conduct breeding bird surveys annually as well as informal butterfly, dragonfly, and damselfly surveys annually.

Maintenance efforts include mowing every three years to maintain habitat benefits and potentially additional selective herbicide applications during the first two to five years. Natural resource damage assessment project funding has been calculated for the first four years of maintenance. After this time period, maintenance will be the responsibility of the Sudbury Valley Trustees, who have a good track record of conducting appropriate maintenance and monitoring on their properties. Because there are populations of buckthorn nearby, birds are likely to continue reseeding the site. Thus, preserving long-term benefits of the project will require regular maintenance actions.

Probability of success: The project has a high probability of success for buckthorn removal, and an open field condition is likely to be maintained by the owners. As a result, the project has a high probability of improving feeding habitat for insectivorous birds that live along the river corridor. Additionally, restoring grassland habitat may result in use of the area by grassland-nesting birds, such as bobolinks. The SuAsCo Biodiversity Protection and Stewardship Plan noted that management of "clusters of fields greater than 10–15 acres" will benefit grassland birds (Clark, 2000). At seven acres, the Greenways field is smaller than this lower threshold. However, it is located less than 500 yards away from other open fields owned by the Town of Wayland that are used for bobolink nesting. This proximity may increase the chance that the Greenways field will also be used by bobolinks.

Environmental and socioeconomic consequences: The project is intended to have a net environmental benefit by eliminating an invasive species and restoring relatively rare open field habitat for use by birds and other wildlife. However, care must be taken to avoid potential environmental impacts due to the use of herbicide in this project and the sensitive natural resources in the project area. The project site includes areas within WPA jurisdiction, including the categories known as "Bank," "Bordering Vegetated Wetlands" (BVW), "Land Under Water," and "Riverfront Area" associated with the Sudbury River and mapped "Estimated Habitat" on the eastern portion of the field, as well as areas subject to the Massachusetts Endangered Species Act (MESA), including mapped "Priority Habitat" for state-listed species that overlaps the Estimated Habitat on the eastern portion of the field.

Expected permitting requirements: Permitting will be required for the proposed project. At a minimum, the proposed project proponent would likely be required to file an NOI with the Wayland Conservation Commission for alteration (herbicide application) within Estimated Habitat, Riverfront Area, and "Buffer Zone" associated with the other regulated resource areas.

It will also be necessary to coordinate with the Massachusetts NHESP for herbicide application within Priority Habitat, which is mapped on the eastern portion of the field. There is a MESA exemption for active management of listed species habitat, but a Conservation and Management Plan must be prepared and reviewed by the MassWildlife to receive the exemption. Additionally, in Massachusetts, a general use herbicide, which includes common commercially-available products, must be applied by a licensed applicator, if being performed on someone else's property for hire, or if being performed as part of the job duties of an employee on lands of the employer.

Estimated costs: $34,000 for cutting buckthorn, selective herbicide application, mowing, project management, and permitting, as well as follow-up cutting and spraying for three years after the initial treatments. The estimated cost assumes that volunteers will do the cutting and a licensed contractor will do the spraying. Cost estimates are based on information provided by the Massachusetts Audubon Society and Broadmoor Wildlife Sanctuary (A. Landry, staff member, Broadmoor Wildlife Sanctuary, personal communication, December 21, 2009).

Trustee evaluation and proposed allocation: This project is proposed to receive $34,000 in Tier 1 implementation funding from the NRD settlement. The proposed project proponent (Sudbury Valley Trustees) will provide matching support for volunteer labor and long-term maintenance. The Trustees evaluated this project favorably (Table 8) because of the potential to increase field habitat in the river corridor and benefit a variety of birds and other wildlife. Specifically, a number of bird species that were impacted by releases of hazardous substances from the Site (e.g., tree swallows, song sparrows, and red-winged blackbirds) will likely utilize the restored field, so this project has a strong nexus to injury.

4.4.2 Neotropical Connections (Belize)

Restoration objective: To benefit neotropical songbird migrants that utilize the SuAsCo Watershed and that were impacted by hazardous releases from the Site by restoring and protecting overwintering habitat sites in Belize. See Figure 18 for the project logic model.

Project location: The project is proposed for the Toledo district in Southern Belize (Figure 19).

Table 8. Evaluation of Greenways North Field Restoration project versus the Trustee criteria. Numbers in parentheses refer to the numbered list of criteria provided in Section 3.3. This table only includes criteria where the project was evaluated as particularly strong compared to other projects.

High importance criteria	Evaluation strengths
Proximity to injured resources (1)	Located adjacent to Sudbury River mainstem.
Relationship to injured resources (2)	Restores habitat type utilized by injured resources (insectivorous birds) and other wildlife. This project provides a direct benefit to injured bird resources.
Magnitude of benefits and demonstrated need (3)	Addresses a demonstrated need and will increase habitat available to grassland birds in an area already used by grassland birds for nesting.
Technical/Technological feasibility (6)	Employs well-known and accepted techniques to achieve ecological objectives; project design is based on the experience of the Massachusetts Audubon Society.
Measurable results (10)	Project results can be evaluated using quantitative or professionally accepted methods for documenting success of buckthorn control and bird or wildlife use of habitat.
Medium importance criteria	
Community goals complemented (1)	Importance of grassland birds to the biodiversity of the SuAsCo Watershed is recognized in the Great Meadows NWR Comprehensive Conservation Plan.
Avoidance of adverse impacts – ecological (2) and socioeconomic (4)	Low quality of current habitat suggests project will avoid environmental and socioeconomic impacts, but herbicide poses risks.
Stewardship and public education (socioeconomic benefit) (5)	Provides an opportunity for continued stewardship through partnership with Sudbury Valley Trustees, the landowner.
Level of difficulty (6)	Similar projects nearby suggest level of technical difficulty is not high, although permits may be difficult to obtain.

Figure 18. Neotropical Connections – logic model

Restoration actions		Expected short-term result		How benefits are achieved		Desired long-term results
Support improved community-based management of forest habitat in Belize; purchase threatened land.	⇨	Forest habitat is improved and protected in Belize.	⇨	Neotropical migrants have an increase in available high-quality overwinter habitat.	⇨	Neotropical migrants overwinter successfully in Belize; as a result, populations of neotropical migrant birds are increased in the eastern flyway.

Figure 19. Approximate location of project in the Toledo District in Belize.

Project description: The Nyanza Trustees propose to restore and protect overwintering habitat in Southern Belize to benefit neotropical songbird migrants such as warblers, flycatchers, and thrushes that were impacted by mercury contamination from the Nyanza Site. In addition, because these species migrate along the Eastern Flyway and make bi-yearly journeys across the United States, impacts resulting at the Nyanza Site result in reductions throughout the flyway, where they feed and rest and provide enjoyment to numerous bird watchers along the way. Therefore to restore these migratory birds for the benefit of both the area where the injury occurred in Massachusetts and throughout the flyway, the Nyanza Trustees propose to support a forest management and protection project in an important bird wintering area in Southern Belize.

Effective restoration efforts for neotropical songbird migrants include components in breeding and wintering habitats. Protecting wintering habitat is especially important as winter food limitations cause mortality on wintering grounds as well as increase mortality during migration and reduce productivity in breeding areas (Holmes, 2007). DOI recently initiated the "Neotropical Connections" program to use restoration funds from NRDAR settlements in the United States to benefit neotropical migrants frequently impacted at hazardous waste sites by enhancing or protecting forest habitats in wintering areas, such as Central America (Figure 20). Utilizing NRDAR funds for the Neotropical Connections Program also supports other ongoing Departmental efforts to protect neotropical migratory birds (e.g., National Park Service Park Flight Program and the USFWS Neotropical Migratory Bird Conservation Grant Program).

Figure 20. Example of intact forest habitat in Belize.

Photo credit: David Evers, Biodiversity Research Institute.

The proposed program would restore and rehabilitate degraded tropical forest to improve wintering habitat for neotropical migrant birds. To achieve this goal, the Belize Foundation for Research and Environmental Education (BFREE), a Florida-based nongovernmental organization (NGO) that manages a field station and private reserve in Southern Belize, would work with local farmers to facilitate the transition from intensive agricultural to sustainable agroforestry. Crops such as the pineapple and banana which will otherwise be grown on the project lands provide very limited habitat benefits to migratory birds and require significant quantities of pesticides and fungicides. Alternatively, sustainable cacao and coffee can be grown under a structurally and floristically diverse forest that provides high-quality habitat for neotropical migrants. Extensive monitoring has shown that the abundance, richness, and diversity of neotropical migrant species in agroforestry systems is significantly greater than in

agricultural monocultures or pastural areas (Perfecto et al., 1996; Estrada and Coates-Estrada, 2005; Harvey and Gonzalez Villalobos, 2007) and that agroforestry systems provide important refugia for resident and migrant birds. Thus, training and paying farmers to reforest cleared land and develop shade-grown agriculture provides significant cost-effective benefits to birds and can be economically sustainable for the local community.

The project area in Southern Belize is vitally important to numerous over-wintering migratory songbird species, including many which utilize the SuAsCo Watershed and were affected by the Nyanza Site. Birds restored by this project will replenish the populations using the Eastern Flyway. Table 9 provides a partial list of migratory birds species expected to benefit from the restoration. Species most affected by contaminant releases from the Nyanza Site are noted.

Table 9. List of species present in Sudbury River Watershed (based on Great Meadows NWR species list) and found wintering in Southern Belize

Great Blue Heron[a]	Gray Catbird[a]
Great Egret	White-eyed Vireo
Snowy Egret	Yellow-throated Vireo
Green Heron[a]	Red-eyed Vireo[a]
Blue-winged Teal	Yellow Warbler[a]
Osprey	Chestnut-sided Warbler[a]
Sharp-shinned Hawk	Magnolia Warbler
Solitary Sandpiper	Black-throated Blue Warbler
Spotted Sandpiper[a]	Yellow-rumped Warbler[a]
Yellow-billed Cuckoo	Black-throated Green Warbler
Common Nighthawk	Black-and-white Warbler
Ruby-throated Hummingbird	American Redstart[a]
Belted Kingfisher[a]	Ovenbird
Eastern Wood-Pewee	Northern Waterthrush[a]
Yellow-bellied Flycatcher	Mourning Warbler
Least Flycatcher[a]	Common Yellowthroat[a]
Great Crested Flycatcher	Wilson's Warbler
Eastern Kingbird[a]	Yellow-breasted Chat
Northern Rough-winged Swallow[a]	Scarlet Tanager[a]
House Wren	Rose-breasted Grosbeak
Blue-gray Gnatcatcher[a]	Indigo Bunting
Gray-cheeked Thrush	Orchard Oriole
Swainson's Thrush	Baltimore Oriole
Wood Thrush	

a. Species most affected by contaminant releases from the Nyanza Site.

Source: Rotenberg et al., 2009.

Under the proposed program, the Trustees would fund BFREE to work with farmers in the Trio Village area to develop a profitable and self sustaining agro-forestry system that allows the forest to re-grow while planting shade-grown organic cacao or coffee. BFREE has been working with local farmers to initiate reforestation activities and to support a local farming cooperative for several years. BFREE would also help promote local farmers by developing green marketing strategies for the bird-friendly cacao and coffee.

The proposed project targets a partially cleared area of forest currently at risk of being permanently converted to intensive agriculture (currently one-half of the area has been cleared for livestock and/or pineapple and banana production and the other one-half is likely to be cleared within the next five years). The area abuts a protected forest (1,153 acres) already owned and managed by BFREE as well as National Park Lands. Under the project, five 30-acre farms would be converted to shade-grown cacao or coffee, and overstory forest species would be allowed to re-grow. BFREE would assist farmers in their efforts to grow shade-grown cacao and/or coffee and help prevent forest conversion to land uses that are incompatible with neotropical migrant habitat. In addition, to help ensure that proposed farming practices are maintained, yearly forest monitoring will be undertaken by BFREE for five years. In addition, BFREE will also monitor bird species diversity and abundance on reforested farms. BFREE has a certified bird bander on staff who already monitors four established MoSI (Monitoring Overwinter Survivorship) sites on the reserve. Additional monitoring assistance may be provided from another U.S.-based NGO such as BioDiversity Research Institute (BRI) of Gorham, Maine, that has provided assistance with a number of previous migratory bird restoration projects.

Expected benefits and timeframe of benefits: The ultimate goal of the project is to benefit populations of neotropical songbird migrant birds that breed and reside in the SuAsCo Watershed and that were impacted due to contaminant releases from the Nyanza Site. Many of these bird populations have been declining, in large part because of overwintering habitat loss and degradation in neotropical locations such as Belize. The specific benefit of this project is to restore and rehabilitate wintering habitat for neotropical migrant birds in Belize. The project will be monitored for a minimum of five years. At the end of the project period, farmers will benefit from a productive agro-forestry system (growth of shade-grown cacao) and will have significant economic incentive to keep the land in forest for the long term, generating significant ongoing restoration benefits for neotropical migrants at no further cost. Increasing survivorship of neotropical migrant songbirds on their wintering grounds will also benefit recreational bird watchers throughout the Eastern Flyway, where these songbirds travel during migration.

Brief overview of maintenance and monitoring: Project maintenance and monitoring would be conducted by BFREE, in conjunction with another U.S.-based NGO such as BRI. This project includes an additional component that will be integrated with the Sudbury RiverSchools Program (see Section 4.3.5) to communicate the benefits of protecting wintering habitat for bird species that migrate along the Eastern Flyway and utilize the SuAsCo Watershed. A number of

individual birds from reforested habitats in Belize will be banded and fitted with "solar geolocators," tiny devices to determine their migratory patterns and nesting locations. These devices record the timing of sunrise and sunset and allow scientists to calculate the daily position of a bird based on its relation to the sun. This new technology was used successfully to track songbirds (wood thrushes and purple martins) from their breeding habitat in Pennsylvania to their winter habitat in Central and South America (Stutchbury et al., 2009). For this project, geolocators would be attached to neotropical migrants in Belize. These birds would be recaptured the following winter to determine where they traveled and nested. In addition, a small number of geolocators would be attached to neotropical migrants in the SuAsCo to track their migration routes, and determine where the birds' wintering habitat is located. Children within the SuAsCo will be able to learn where "their birds" overwinter. Ultimately, children from the watershed will learn about the wintering habitats of local species and exchange information and ideas with the children from these areas. This effort would be coordinated with a neotropical migrant education program that BFREE is currently developing for young school children in Belize. The geolocator monitoring would help demonstrate the connections throughout the Eastern Flyway between neotropical migrant populations in the SuAsCo Watershed and protected overwintering habitats in Belize.

Probability of success: Community-based forest protection efforts have demonstrated significant successes throughout Central America. This program would work through a local organization with established relations with the neighboring communities, and strong track record in developing and implementing environmental projects, while drawing on lessons learned from previous efforts. The Trustees therefore believe this project has a very great likelihood of success.

Environmental and socioeconomic consequences: The project is expected to have positive environmental consequences in the United States and Belize by supporting neotropical migrants. The project would have minimal socioeconomic consequences in the United States. In Belize, the project is designed to have positive socioeconomic consequences because the farmers would initially be paid an amount equivalent to what they would earn from converting land to traditional agriculture and ultimately they would have a steady source of income from shade-grown cacao which can be sold to a local farmer's cooperative in southern Belize.

Expected permitting requirements: U.S. permits are not required for the work in Belize. The individual in charge of the geolocator project will require a federal bird banding permit under the Migratory Bird Treaty Act and a bird banding permit from the MassWildlife.

Estimated costs: The total cost for this program is $75,000. Of that total, $50,000 would be for the work in Belize and would include targeting five farms, of approximately 30 acres each, for agro-forestry conversion; and monitoring neotropical migrant bird densities. In addition, the program would include $25,000 for geolocators that can track neotropical migrants and further

evaluate the success of the project. The costs associated with the educational components of this project were described in Section 4.3.5.

Trustee evaluation and proposed allocation: This project is proposed as a Tier 1 project with $75,000 in implementation funding from the NRD settlement. This project was evaluated favorably (Table 10) because it provides an opportunity to directly benefit neotropical migrants – a resource that was injured because of releases of hazardous substances from the Nyanza Site. As this project would be implemented in Belize, the Trustees would exercise close oversight and guidance such has been done in previous successful foreign migratory bird projects (protecting wintering habitat of shorebirds in South America and seabirds in New Zealand). The Trustees would utilize U.S.-based monitors to ensure that key objectives are maintained. In addition, contracts would be structured to ensure that yearly tasks are completed and evaluated prior to release of additional funds.

Table 10. Evaluation of Neotropical Connections project versus the Trustee criteria. Numbers in parentheses refer to the numbered list of criteria provided in Section 3.3. This table only includes criteria where the project was evaluated as particularly strong compared to other projects.

High importance criteria	Evaluation strengths
Proximity to injured resources (1)	Located outside the Sudbury River Watershed but will have a positive impact on the injured natural resources of the Sudbury River Watershed (migratory birds).
Relationship to injured resources (2)	Restores injured resources (migratory birds).
Magnitude of benefits and demonstrated need (3)	Addresses a demonstrated need and will maintain overwintering habitat available to neotropical migrants.
Measurable results (10)	Project results may be evaluated using quantitative or professionally accepted methods for documenting success of forest protection.
Medium importance criteria	
Community goals complemented (3)	Importance of neotropical birds to the biodiversity of the SuAsCo Watershed is recognized in the SuAsCo Biodiversity Protection and Stewardship Plan developed by the Sudbury Valley Trustees with funding from the EEA.
Avoidance of adverse impacts – ecological (2) and socioeconomic (4)	Project will avoid environmental impacts; socioeconomic impacts in Belize are expected to be positive.

4.4.3 Sudbury River Corridor Land Acquisitions

Restoration objective: To acquire high-priority parcels along the Sudbury River corridor that provide important natural resource benefits and are at risk of development. See Figure 21 for the project logic model.

Figure 21. Sudbury River Corridor Land Acquisitions – logic model

Restoration actions	Expected short-term result	How benefits are achieved	Desired long-term results
Acquire priority parcels along the Sudbury River corridor.	Land is acquired.	Expansion of protected land provides additional habitat for wildlife, and protects water quality from the impacts of future development.	Wildlife populations and water quality in the adjacent Sudbury River are maintained.

Project location: Project locations would be determined when parcels are selected.

Project description: The Trustees intend to use a portion of their settlement funding to acquire land parcels along the Sudbury River that are at risk of development and provide important natural resource benefits. The Trustees intend to solicit agencies, nonprofit organizations, and private citizens for proposed parcels for acquisition. The Trustees would then select parcels for acquisition funding based on the priority criteria they established for acquisition, and funding limitations. Project sponsors would need to identify the agency or nonprofit organization that would hold the CR or acquire the land in fee title. The Trustees intend that land acquisitions funded through the Nyanza settlement will be consistent with the Route 495/MetroWest Corridor Plan, which identifies priority preservation areas as well as priority development areas (http://www.495partnership.org/compact).

The Trustees have already identified one candidate parcel. Raytheon owns a facility located on Route 20 in Wayland which is being redeveloped as the Wayland Town Center. The property includes a 5.5-acre riverfront parcel which has been used unofficially for years as an access point to the Sudbury River. The land adjacent to the river is forested wetland (red maple swamp) and wet meadow. It is adjacent to the Great Meadows NWR and is within the approved acquisition boundary of the refuge. The habitat types, access to the Sudbury River, and proximity to the established refuge render this an exemplary potential land acquisition. In this particular case, Raytheon is willing to donate this property, which will have river access on it, to a nonprofit or

possibly the federal government. Funding is needed to pay for the transaction costs associated with the transfer.

The Trustees expect to solicit additional land protection proposals through a formal RFR made available online through the Commonwealth's Procurement Access & Solicitation System (Comm-PASS; http://www.comm-pass.com/). Applicants will need to prepare a proposal with sufficient information for Trustee review and evaluation, including a map of project location and boundaries, an opinion of value (a certified appraisal will not be required at this stage), an estimated cost of performing due diligence for the parcel (e.g., appraisal, survey, and site assessment), and a description that describes project feasibility and how land protection for the parcel would meet the Trustee review criteria.

The Trustees have identified a number of important attributes for reviewing and prioritizing habitat protection projects. Final selection of parcels will be based on an analysis that considers a variety of factors, including:

- Degree of nexus to injured natural resources
- Context of surrounding land use and land protection status (e.g., Does the parcel provide an opportunity to avoid habitat fragmentation or protect a wildlife corridor?; Does surrounding land use threaten the resource value of a parcel?)
- Whether the parcel has already been identified as a high priority for protection in existing local or regional land-use planning documents (e.g., Is the area designated as special concern – Biomap, Living Waters Core Habitat, ACECs, or Executive Office of EEA Habitat Reserves?; Is it consistent with municipal open space plans/master plans?)
- Type and condition of natural resource benefits provided by the parcel (e.g., Is there evidence of rare/threatened/endangered species or habitat?; Are there exemplary natural communities?; Does it protect a cold water fisheries resources?; Does it receive high values on an Index of Ecological Integrity?)
- Nature and likelihood of development threats (e.g., Is there a demonstrated level of threat to the resources?; Is there a threat to neighboring lands that would reduce the value of the protected parcel?)
- Cost of protection, based on the best mechanism for land protection for that parcel (acquisition, CR, or land transfer) (e.g., Can the parcel be protected at a fair price for its size and location?; Is there an opportunity for leveraging?)
- Long-term maintenance and management needs (e.g., Will public access be allowed?; If so, is the management and degree of public access consistent with resource protection?;

What is the potential for future management problems and costs?; Are there on-site resources (cultural or archaeological) that need to be preserved?).

Expected benefits and timeframe of benefits: The primary desired benefit of the project is the protection of upland, wetland, riparian and floodplain habitat values and protection of water quality from the impacts of development. Project benefits will begin immediately after acquisition and will last indefinitely because the land will be permanently protected from development. For the Raytheon parcel, the primary benefit is the protection of forested wetland and wet meadow habitat values resulting from the ability of the USFWS to protect and manage the parcel in an integrated manner with adjacent NWR land.

Brief overview of maintenance and monitoring: Maintenance or monitoring activities for the land would be specified as part of the conditions for acquisition. The Trustees are expected to favor parcels where minimal management activities would be needed.

Probability of success: The probability of success is high because preliminary analysis has identified multiple parcels along the Sudbury River that are potential targets for acquisition.

Environmental and socioeconomic consequences: The project is expected to have positive environmental consequences by protecting upland, wetland, riparian and floodplain habitats within the Sudbury River Watershed.

Estimated costs: The cost for each parcel is unknown. For the Raytheon parcel, the estimated cost is $20,000 for land transaction and due diligence costs, including survey, contaminants review, and title clearance.

Trustee evaluation and proposed allocation: This project is proposed as both a Tier 1 and Tier 2 project with $720,000 in implementation funding from the NRD settlement for Tier 1 and $700,000 for Tier 2. The project was evaluated favorably (Table 11) because of the importance of protecting riparian and floodplain habitat for the direct benefit to injured resources and for indirect benefit to injured aquatic resources.

Table 11. Evaluation of Sudbury River Corridor Land Acquisitions project versus the Trustee criteria. Numbers in parentheses refer to the numbered list of criteria provided in Section 3.3. This table only includes criteria where the project was evaluated as particularly strong compared to other projects.

High importance criteria	Evaluation strengths
Proximity to injured resources (1)	Located in the Sudbury River Watershed. High priority parcels for acquisition will likely be located near or adjacent to the Sudbury River mainstem.
Relationship to injured resources (2)	Acquires the equivalent of injured resources (wetland, riparian and aquatic habitat) as direct compensation for the injuries that occurred and/or acquires upland habitat to prevent future degradation of injured resources (wetland, riparian and aquatic habitat).

Table 11. Evaluation of Sudbury River Corridor Land Acquisitions project versus the Trustee criteria (cont.). Numbers in parentheses refer to the numbered list of criteria provided in Section 3.3. This table only includes criteria where the project was evaluated as particularly strong compared to other projects.

High importance criteria	Evaluation strengths
Magnitude of benefits and demonstrated need (3)	Addresses a demonstrated need because of the strong development threats in the area and will help protect the river corridor. The importance of protecting land for the health of fish and wildlife on the Great Meadows NWR is noted in the Great Meadows NWR Comprehensive Conservation Plan (USFWS, 2005b). The Atlantic Coast Joint Venture Waterfowl Management Plan (ACJV, 2005) notes a need to acquire more habitats to protect river corridors. The Sudbury, Assabet and Concord Wild and Scenic River Study River Conservation Plan (NPS, 1995) notes the need to pursue the purchase of important river-related lands from willing sellers if parcels come on the market and funding is available.
Sustainability of Benefits (5)	Protection of habitat in perpetuity will result in long-term, self-sustaining benefits.
Technical/Technological feasibility (6)	Project will employ well-known and accepted techniques (land acquisition) to achieve stated ecological objectives.
Reasonableness of costs (7)	Trustees will select parcels for acquisition that provide a high ratio of expected benefits to expected costs.
Medium importance criteria	
Multiple benefits (1)	Provides multiple benefits to species, natural resource types, and services by protecting all the different values of a parcel.
Avoidance of adverse impacts – ecological (2) and socioeconomic (4)	Has little to no potential for significant adverse environmental or socioeconomic impacts. No disturbances are associated with property transfer.
Community goals (3)	Community goals will be complemented because Trustees will consider local or regional land-use planning documents, including municipal open space plans/master plans as a factor in parcel selection.

4.4.4 Creation of Stearns and Brackett Reservoirs Wildlife Preserve

Restoration objective: To protect the Stearns and Brackett Reservoirs, shoreline, and surrounding land from development or unauthorized uses; to develop and implement an appropriate stewardship plan; to enable public access and recreation that is consistent with the stewardship plan; and to promote public education regarding the Nyanza Site, its impacts, remedial cleanup, and NRD restoration efforts. See Figure 22 for the project logic model.

Project location: Framingham Reservoirs #1 and #2; also referred to as the Stearns and Brackett Reservoirs. See Figure 22 for location.

Figure 22. Creation of Stearns and Brackett Reservoirs Wildlife Preserve – logic model

Restoration actions		Expected short-term result		How benefits are achieved		Desired long-term results
Transfer land to Division of State Parks and Recreation; select entity to hold a 99-year conservation lease; complete and implement a stewardship plan; enable safe public access for boating and recreation; promote public education about the Nyanza Site.	⇨	Land is managed for conservation and recreation; public accesses reservoirs for boating and recreation; knowledge of the Nyanza Site and the Sudbury River increases.	⇨	Development of areas is prevented; habitat improved by reducing or eliminating encroachments and controlling invasive species. Boat ramps and access points enable public recreational use of the reservoirs. Educational materials promote public recreation and stewardship.	⇨	Stearns and Brackett reservoirs are protected. Riparian habitat condition improves; erosion decreases in riparian areas. Public values the reservoirs as important locations for boating, recreation, and experience of nature.

Project description: This project would consist of a series of actions to transform the Stearns and Brackett reservoirs, including approximately 12 miles of shoreline and 175 acres of surrounding state-owned land (Figure 23), into a wildlife preserve that will protect and enhance the ecological values of the reservoirs and enable public access for recreation and education. NRD funding is needed to enable the change in management from a water supply stewardship of the reservoirs to manage ecological resources and public access for recreation.

The project includes five elements:

1. Establishing the legal ability to allow public access to these lands and transfer management to a nonprofit organization or other appropriate entity

2. Completing a stewardship plan that contains the information necessary to manage the area adequately as a wildlife preserve

3. Developing boat access to the reservoirs and appropriate educational signage and interpretive materials

4. Helping to create management facilities

5. Providing initial funding for implementation of the stewardship plan.

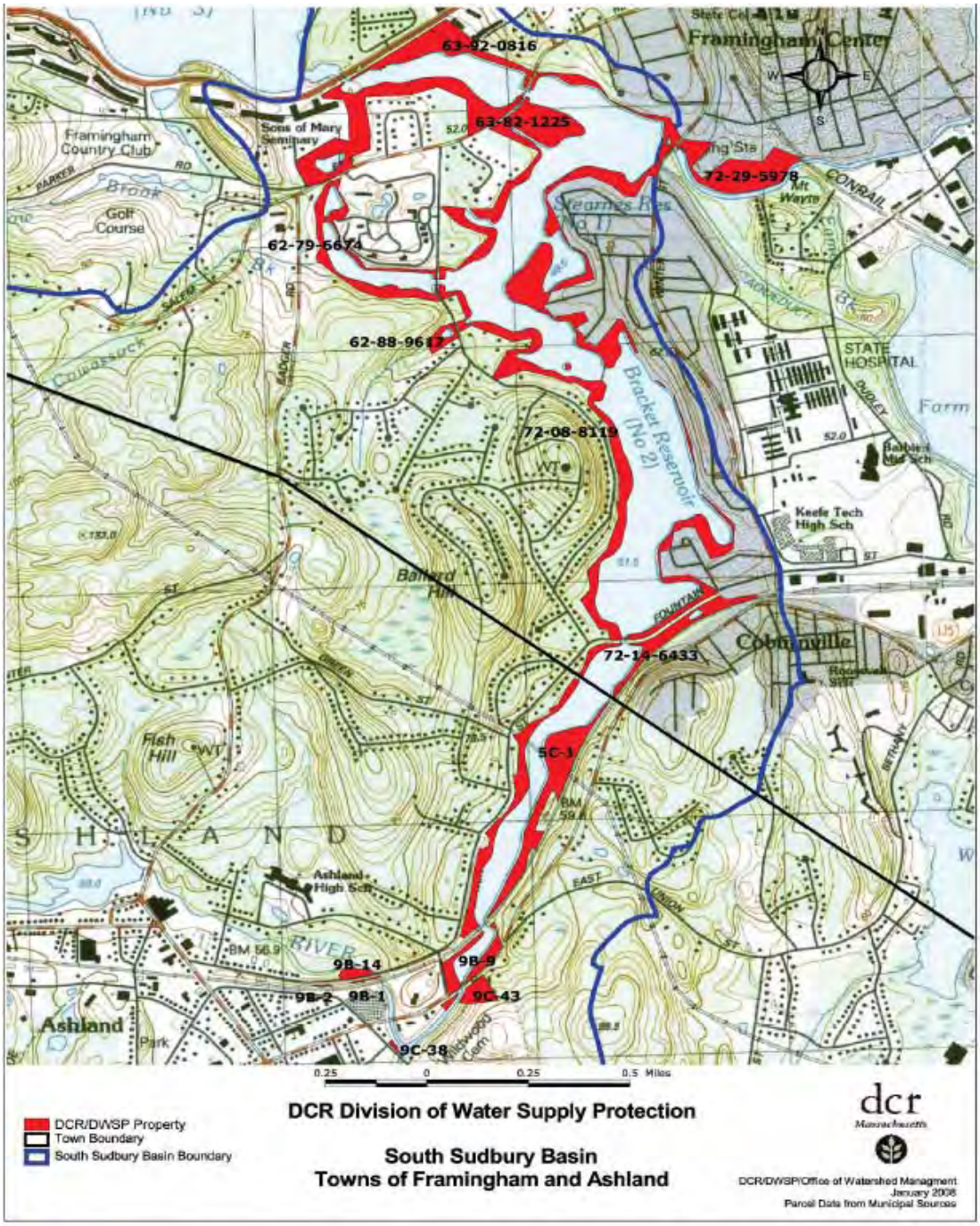

Figure 23. Stearns and Brackett reservoirs and surrounding lands currently managed by the MA DCR Division of Water Supply Protection and proposed for transfer to conservation entity and public access.

Source: Map prepared by the MA DCR Division of Water Supply Protection.

Site description and history: The Brackett Reservoir (also known as Framingham Reservoir #2) is an impoundment on the Sudbury River located in Framingham, Massachusetts. Water flows from the Brackett Reservoir into the Stearns Reservoir (also known as Framingham Reservoir #1) and then continues to flow north in the Sudbury River. The two reservoirs, originally developed in the 19th century as a drinking water supply for the Boston area, have not been used as a drinking water source for decades. The reservoirs and the surrounding 175 acres are owned by the Commonwealth of Massachusetts and are currently managed by the MA DCR, Division of Water Supply Protection. Public use of and access to the two reservoirs are currently prohibited until the Division of Water Supply Protection can find a suitable entity to take control of the lands surrounding Stearns and Brackett reservoirs and manage the property (MA DCR, 2010).

The Brackett Reservoir contains the surface water that received the largest deposition of mercury and other contaminants from the Nyanza Superfund Site. Based on a risk assessment of the site, EPA concluded that exposure to mercury in fish caught and consumed from the Brackett Reservoir or Stearns Reservoir represented a potential risk to individuals under different fish consumption scenarios[5] (Avatar Environmental, 2006; U.S. EPA, 2010). EPA (U.S. EPA, 2010) also determined that human health risks from direct contact (e.g., swimming, wading, walking) or incidental ingestion of surface water or sediment was well below the level that would constitute a significant risk. In part, because of the contamination from the Nyanza Site, the Division of Water Supply Protection does not intend to use these reservoirs as a source of drinking water in the future and has a stated goal of divesting the Division of Management of these properties (MA DCR, 2010).

Element 1 – Establish Ability to Allow Public Access and Transfer Management to a Nonprofit Entity

As stated above, the two reservoirs and surrounding state-owned land are under the control of MA DCR's Division of Water Supply Protection. The Commonwealth has expressed a goal of divesting its holdings of this area either through transfer of management to an interested conservation entity or, potentially, by selling the property. As a part of this NRD-funded project, the MA DCR Commissioner would authorize an internal management transfer of these 175 acres from the Division of Water Supply Protection to the Division of State Parks and Recreation; this land would then be considered an official wildlife preserve. The next step will be for state officials to draft a RFR for a 99-year conservation lease that would preclude the possibility of opening the lands for development. The involved state agencies would also work to file and pass

5. Specifically, the risk assessment concluded: "[t]he exposure to mercury levels in fish caught and consumed from Reach 3 (Reservoir No. 2) represents a potential risk to individuals for all fish consumption scenarios evaluated. The exposure to mercury levels in fish caught and consumed from Reach 4 (Reservoir No. 1) represents a potential risk to individuals in all fish consumption scenarios evaluated except for the adult recreational angler scenario" (Avatar Environmental, 2006).

the legislation necessary to approve the lease. This element would be completed without expenditure of NRD funds.

Element 2 – Complete a Stewardship Plan

A Stewardship Plan for the reservoirs and surrounding areas is needed to enable long-term conservation and management of the area as a wildlife preserve. The Stewardship Plan would include an inventory of the existing natural communities, long-term management requirements, and locations and impacts of any public access facilities. The plan would also include the survey of shorelines completed by MA DCR engineers and would address locations where private landowners have encroached onto public land. A key goal of the Stewardship Plan will be to resolve identified encroachments. The plan would limit any activities in the Sudbury River or on its banks that could lead to resuspension of contaminated sediments.

Element 3 – Develop Boat Access and Appropriate Educational Materials

This element includes development of boat access to the Stearns and/or Brackett reservoirs. The Trustees anticipate developing one boat launch on each reservoir; however, this estimate may be revised based on further review of costs and appropriate locations. The boat launches would include the design, construction, and installation of public information signs or kiosks (not electronic) that provide information about the Nyanza Site, its impacts on the Sudbury River, fish advisories (in multiple languages), remedial cleanup, and NRD restoration efforts that have been planned and implemented. The kiosks would present some information using a permanent format. Seasonal information about topics such as stormwater and educational and recreational programs along the river would be provided within a weather-proof case to allow for updates.

Element 4 – Create Safe Public Access and Management Facilities

A complex of buildings at 322 Salem End Road would be an excellent location for safe public access and to develop the necessary management facilities that would be required for good stewardship of the area as a wildlife preserve. The state has proposed rehabilitating the historic building and associated structure into an education center and offices. This project includes funding targeted only for creation of safe public access and facilities directly needed to manage the wildlife preserve.

Element 5 – Implement Stewardship Plan and Manage Wildlife Preserve

This element includes funding for initial implementation of the Stewardship Plan and management of the wildlife preserve for five years. Activities expected to be implemented include signage and access development, habitat restoration and enhancement, volunteer coordination, public education, liaison with EPA on Brackett Reservoir remediation, invasive plant removal, trail building, and erosion control. The objective is to provide “seed money” and

time to enable the nonprofit group holding the conservation lease to raise funding to endow long-term management.

Expected benefits and timeframe of benefits: Benefits include protection of the reservoirs and surrounding land that is otherwise at risk of being surplused to an entity that would not protect the land and enable public access. The Commonwealth of Massachusetts will continue to own the property in perpetuity for conservation purposes. Transfer of land to a nonprofit entity with a 99-year conservation lease will enable the property to be accessible to the public and facilitate the completion of restoration and stewardship projects. Additional benefits include removal of encroachments in the riparian area and management of natural habitat through invasive plant removal and erosion control. By enabling public access to the reservoirs for boating and recreation (with fishing limited to catch-and-release), this project also will provide significant public recreational benefits. Public education would be enhanced through the signage planned for the boat access locations.

Transfer of land to a nonprofit entity with a 99-year conservation lease is expected to occur in Year 1 after funding is received. Construction of boat ramps, public access, and educational materials is expected to occur in Year 2. Implementation of management and stewardship is expected to occur in Years 2–6. The recreational benefits of creating legal public access will last indefinitely into the future. Removal of encroachments also will result in benefits to riparian and aquatic habitats, including decreased erosion. Maintenance of stewardship and maintenance of the public education displays is expected to occur during the full 99-year conservation lease; however, this depends on the designated nonprofit entity receiving additional funding.

Brief overview of maintenance and monitoring: Semi-annual implementation monitoring would be conducted until the project is complete. This monitoring would confirm that project permitting and implementation activities are proceeding on schedule and in accordance with project plans. If wetland restoration activities require an Order of Conditions under the Massachusetts WPA, then a typical order would require monitoring of restoration measures to ensure that a community dominated by native wetland plants reestablishes within two years following implementation. This monitoring would follow standard procedures for assessing vegetation cover and health.

The Trustees also would request annual reports for five years. These reports would detail stewardship and management activities that occurred, and estimating the levels of public recreational use of the reservoirs. The holder of the conservation easement would be responsible for long-term management and stewardship of the wildlife preserve.

Probability of success: This project requires the state to successfully conclude the internal management transfer of the lands to the Division of State Parks and Recreation and successfully find a qualified entity to hold the 99-year conservation lease. The long-term success of the

project is dependent on the nonprofit entity's ability to maintain management and stewardship of the wildlife preserve. This project has a high probability of success for the successful inter-agency transfer of land, the creation of public access, the development of educational materials, and the successful removal of riparian encroachments during the first five years of funding. The likelihood that the nonprofit entity will be able to find funding for long-term management and stewardship is unknown.

Environmental and socioeconomic consequences: Environmental consequences are anticipated to be minor during construction of public access and removal of encroachments, including temporary disturbance of wetland habitat. The long-term environmental consequences are anticipated to be a net benefit after removal of the shoreline encroachments. Protection of the land will provide (1) a positive environmental benefit by eliminating the risk of development to these lands, and (2) a positive socioeconomic benefit by providing public access to the reservoirs and surrounding state-owned lands.

Expected permitting and legal requirements: Permitting will be required for the proposed project. At a minimum, filing an NOI with the relevant Conservation Commission would be required for the proposed boat ramps. Delineation and survey of wetland resource areas would be required for preparation of the NOI. The Conservation Commission would then issue an Order of Conditions, which would be filed for the property in the Registry of Deeds. If the proposed work results in more than 5,000 square feet of wetlands disturbance, additional permits from the MassDEP and the USACE may be required. There are additional legal requirements associated with the interagency transfers and the need for legislation to be filed and passed to approve the conservation lease.

Estimated costs: The total costs for the project are estimated at $705,000, including $50,000 for developing the stewardship plan and $655,000 for implementing the stewardship plan. These implementation costs include $150,000 for developing boat access and educational signage; $90,000 for providing safe public access and necessary management facilities; $165,000 for further development of the complex of buildings at 322 Salem End Road; and $250,000 for staffing for five years that will implement, oversee, and monitor stewardship and restoration activities.

Trustee evaluation and proposed allocation: This project is proposed as a Tier 1 project with $540,000 coming from the NRD settlement to fund all aspects of the project except for further development of the building complex at 322 Salem End Road. The funding needed to develop the 322 Salem End Road building complex for further use is not included in this proposal. The Trustees evaluated this project favorably (Table 12) because it benefits riparian habitat within the site boundaries. The benefits will restore recreational use to resources that were injured by the releases of hazardous substances at the site. The Trustees also gave this project a high rank because it will provide both protection and public access to the reservoirs and surrounding land.

Table 12. Evaluation of Creation of Stearns and Brackett Reservoirs Wildlife Preserve project versus the Trustee criteria. Numbers in parentheses refer to the numbered list of criteria provided in Section 3.3. This table only includes criteria where the project was evaluated as particularly strong compared to other projects.

High importance criteria	Evaluation strengths
Proximity to injured resources (1)	Located within the Nyanza Site boundary. This project includes areas with injured resources.
Relationship to injured resources (2)	Conserves and restores resources (riparian and floodplain) equivalent to those that were injured.
Magnitude of benefits and demonstrated need (3)	Addresses a need for protection of the reservoirs and surrounding land and enabling public access to large surface-water bodies for recreation.
Technical/technological feasibility (6)	Employs well-known and accepted techniques to achieve ecological objectives. Legal transfer should be feasible and stewardship of wildlife preserve can be achieved with standard natural resource management methods.
Implementation-oriented (8)	Project is dedicated to on-the-ground habitat restoration, recreational access, and education.
Medium importance criteria	
Avoidance of adverse impacts – ecological (2) and socioeconomic (4)	Has little to no potential for long-term adverse environmental or socioeconomic impacts. Potential impacts from work in riparian habitat to create boat launches or public access will be mitigated with BMPs and revegetation of any impacted areas.
Stewardship and public education (socioeconomic benefit) (6)	Provides an opportunity for continued stewardship of the reservoirs through partnership with a conservation entity that would hold the conservation lease. Provides for public education through kiosks and educational materials.

4.5 Proposed Alternative – Recreation and Public Access

The Nyanza NRD Trustee Council proposes to provide a total of $313,000 in Tier 1 funding and $20,000 in Tier 2 funding for three projects in the restoration priority category of Recreation and Public Access. Collectively, these projects will improve fishing and boating access to the Sudbury River and improve pedestrian access to views of the Sudbury River and its adjoining floodplain habitat. The Trustee Council's goal in this restoration project category is to increase recreational services associated with the river for on-water activities (fishing and boating) and for land-based recreational uses that are adjacent to the river. These actions will compensate for recreational services that were impacted by releases of hazardous substances from the Site, including the imposition of fishing consumption advisories in the Sudbury River.

4.5.1 Sudbury River Public Access: Aikens Road

Restoration objective: To improve fishing and boating access to a 2.5-mile reach of the Sudbury River at Aikens Road in Ashland. See Figure 24 for the project logic model.

Figure 24. Sudbury River Public Access: Aikens Road – logic model

Restoration actions		Expected short-term result		How benefits are achieved		Desired long-term results
Construct a fishing and cartop boating access point with parking on public land.	⇨	Access point is open to the public.	⇨	Individuals use the access point for fishing and boating on the Sudbury River.	⇨	Recreational use services on the Sudbury River in Ashland increase.

Project location: South side of the Sudbury River. See Figure 25 for project location map.

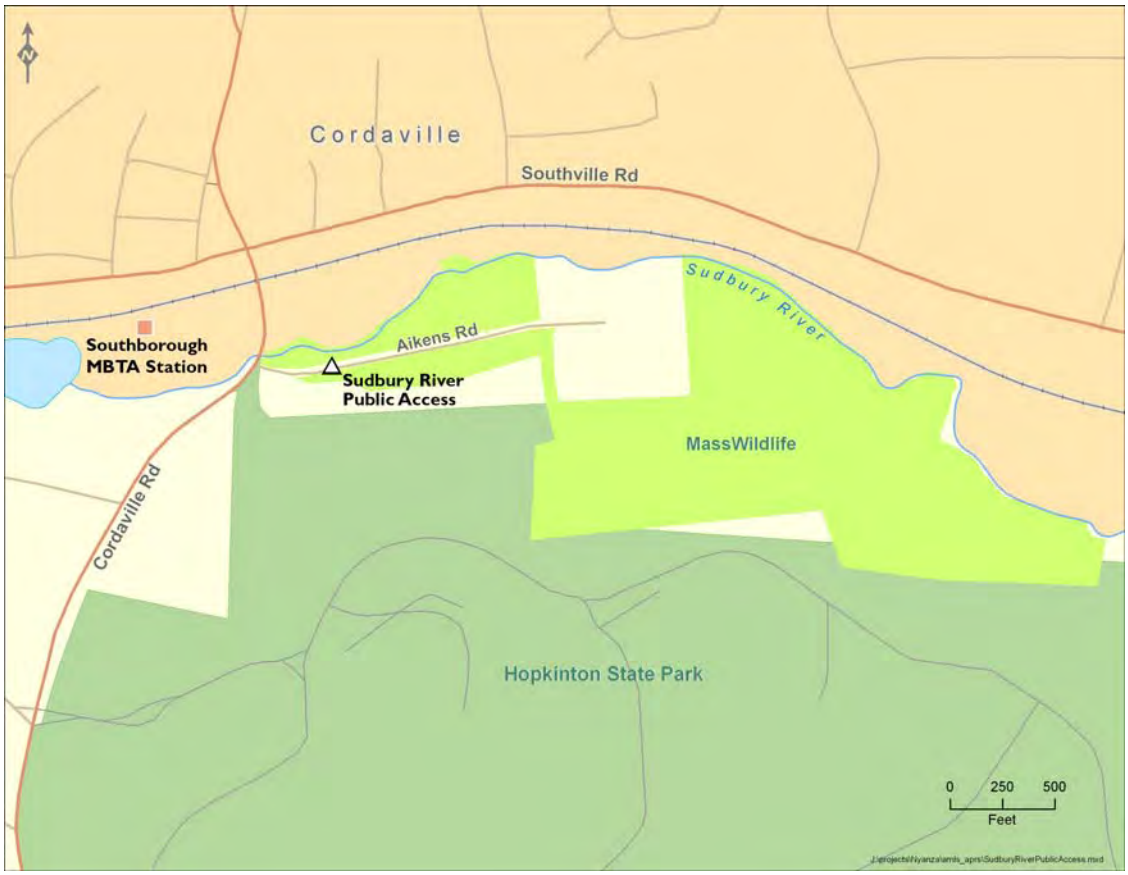

Figure 25. Location of Sudbury River Public Access: Aikens Road project.

Project description: Currently, fishing and boating access to the upper reaches of the Sudbury River are limited. The Massachusetts Office of Fishing and Boating Access (OFBA) maintains two cartop boating access areas in Ashland, one at Pine Hill Road and one at High Street. However, upstream from High Street, the river passes through a relatively undeveloped area. The few road crossings provide poor access to the river, with informal roadside parking that poses a safety hazard, and little public land that can accommodate fishing or boating access. The Sudbury River Watershed Organization and other stakeholder groups advocated for full recreational access to a millpond in the Sudbury River adjacent to the new Southborough Massachusetts Bay Transportation Authority (MBTA) commuter rail station when the station was being developed; however, this public access point never materialized, disappointing interested parties.

However, MassWildlife owns approximately 57 acres east of Cordaville Street, south of and along the Sudbury River, within 500 yards of the Southborough MBTA commuter rail station. Aikens Road, a public road, passes through this property to a single-family residence that remains on a 10-acre lot surrounded by the MassWildlife parcels. To the south is Hopkinton State Park.

The MassWildlife property provides a potential location for fishing and cartop boating access. Access in this area is currently limited to the Cordaville Street (Route 85) bridge, which is currently an informal access point. Informal parking for approximately three to four cars is currently available, although it is located on the inside of a curve with poor visibility. Little opportunity currently exists for carrying or launching a boat at this location. The north side of Aikens Road along the river could be widened slightly to accommodate vehicular parking, and a walking path could be formed down the bank to the river to provide access. These improvements would increase capacity for users as well as provide a safer location for access. It appears that use has been limited in the past because the public does not know that the area is available for access.

From this location, a paddler would be able to travel approximately 2.5 miles downstream to the next formal river access site at High Street in Ashland, which is also maintained by OFBA. There are two minor potential obstructions for paddling, including a longstanding beaver dam less than one-half mile downstream, and a series of riffles approximately one mile downstream (upstream of an MBTA bridge). It appears to be possible to portage around both obstructions on public property, and one or both of them could potentially be navigable under certain flow conditions.

Use of the MassWildlife property for river access is generally consistent with the purpose of these public lands, which are intended for recreation, fishing, hunting, and public access, rather than conservation. Dedication of a relatively small portion of this property to improve access is consistent with these uses.

OFBA has established criteria and preferred design and construction methods for cartop access points that would apply to the proposed project. The major goals include providing access areas that require little or no maintenance, providing access for disabled persons, and being cost-effective to construct. The following design criteria generally meet these goals:

- Providing access pathways with grades of 5% or less, using switchbacks if necessary, and widths of 5 to 6 feet.
- Construct parking areas and foot paths of a well-graded, erosion-resistant granular material. OFBA has used a dense-graded crushed stone with success in the past. Other potential materials include finer grained material, such as stone dust, which can be bound with a stabilizing product.
- Provide signage to divert users from the existing informal access area to the new, formal access area.
- Provide 6 to 10 parking spaces.
- Install bollards at path heads to prevent vehicular access.

OFBA can design and obtain permits for these types of projects. However, OFBA personnel resources are limited, such that the design by a consultant with review and comment by OFBA is preferred.

Expected benefits and timeframe of benefits: Benefits include providing safe fishing access along the upper Sudbury River, thereby reducing the use of a popular but relatively unsafe fishing location, and providing improved boating access to a 2.5-mile reach of the Sudbury River that is currently difficult to access. Benefits are expected immediately following construction, and the facility will be usable indefinitely.

Brief overview of maintenance and monitoring: The Trustees would request semi-annual implementation monitoring updates until the project was completed. After completion, OFBA projects are designed to be low maintenance and require little monitoring, and site maintenance is turned over to a managing authority post-construction. In this case of the proposed Sudbury River access location on Aikens Road, the Northeast District of MassWildlife would be the managing authority and is able to perform maintenance on an as-needed basis (P. Huckery, MassWildlife Northeast District Manager, personal communication, May 5, 2010). The Trustees may choose to conduct a formal or informal survey of public use at the site (possibly through cooperation with a local watershed group) to evaluate the benefits of the access point.

Probability of success: Very good. A potential risk would be that the new access site does not effectively replace the current informal access locations, and is underused. This risk can be reduced through installation of signage at the informal access points informing river users of the new access location nearby on Aikens Road, and signs on Aikens Road clearly indicating the new access location.

Environmental and socioeconomic consequences: The environmental consequences of this proposed project are minor. Tree clearing and minor grading along the banks of the Sudbury River will require filing of an NOI with the local Conservation Commission. However, the project will have minor impacts considering that the scope of the project is limited. Additionally, the project will promote and improve water-dependent uses of the river, which will qualify as a "Limited Project" under the Massachusetts WPA, allowing the issuing authority to consider reduced performance standards.

From a socioeconomic perspective, river access is now generally limited by privately-owned land, the MBTA rail line, and public land with no formal access. The project will improve access for many in the community, resulting in socioeconomic benefits from enhanced usage.

Estimated costs: Approximately $25,000 for survey, design, and permitting, plus approximately $120,000 for construction, for a total of $145,000.

Trustee evaluation and proposed allocation: This project is proposed to receive $145,000 in funding in Tier 1 for completion of the recreational access. The project was evaluated favorably versus the Trustee evaluation criteria because of its focus on restoring fishing and boating access to the Sudbury River in Ashland, in areas where recreational services were impacted by releases of hazardous substances at the Nyanza Site. Because of the great potential benefit for the public in the area, the Trustees evaluate this project favorably (Table 13).

Table 13. Evaluation of Sudbury River Public Access: Aikens Road project versus the Trustee criteria. Numbers in parentheses refer to the numbered list of criteria provided in Section 3.3. This table only includes criteria where the project was evaluated as particularly strong compared to other projects.

High importance criteria	Evaluation strengths
Proximity to injured resources (1)	Provides access to the Sudbury River mainstem in close proximity to impacted environment.
Relationship to injured resources (2)	Restores injured resource services by creating additional river access sites for fishing and recreational boating.
Magnitude of benefits and demonstrated need (3)	Addresses a demonstrated need for improved access to the Sudbury River in this locale.
Sustainability of Benefits (5)	Project will require only periodic maintenance or management to provide continuing benefits.

Table 13. Evaluation of Sudbury River Public Access: Aikens Road project versus the Trustee criteria (cont.). Numbers in parentheses refer to the numbered list of criteria provided in Section 3.3. This table only includes criteria where the project was evaluated as particularly strong compared to other projects.

High importance criteria	Evaluation strengths
Technical/Technological feasibility (6)	Employs well-known and accepted techniques to achieve ecological objectives. The Massachusetts OFBA has extensive experience implementing this type of project.
Leveraging of additional resources (9)	Opportunity to potentially leverage in-kind design and permitting services through the Massachusetts OFBA.
Measurable results (10)	Project delivers tangible social and/or human use results that may be evaluated using quantitative or professionally accepted methods.
Medium importance criteria	
Avoidance of adverse impacts – ecological (2) and socioeconomic (4)	Has little to no potential for significant adverse environmental or socioeconomic impacts. Disturbances associated with construction of the access point will be minimal.
Community goals (3)	Complements the management objectives of the SuAsCo River Watershed Action Plan, which calls for increased public access to waterways (Ambient Engineering and SuAsCo Watershed Community Council, 2005).

4.5.2 Sudbury River Access Improvements: Great Meadows NWR Headquarters

Restoration objective: To improve boater access to the Sudbury River at the Great Meadows NWR headquarters in Sudbury and reduce overcrowding at the Shermans Bridge Road access location. See Figure 26 for the project logic model.

Figure 26. Sudbury River Access Improvements: Great Meadows NWR Headquarters – logic model

Restoration actions		Expected short-term result		How benefits are achieved		Desired long-term results
Provide canoes, kayaks, and boat carts to the public at the Great Meadows NWR headquarters.	⇨	Visitors use the equipment to access the Sudbury River.	⇨	Popularity of the Great Meadows NWR headquarters as an access point increases.	⇨	Recreational use services on the Sudbury River increase and recreational conflicts and resource impacts at Shermans Bridge Road decrease.

Project location: At the Great Meadows NWR headquarters in Sudbury. See Figure 9 for location of Sherman's Bridge Road and the Great Meadows NWR headquarters.

Project description: The Great Meadows NWR headquarters provides direct access to the Sudbury River down an approximately ¼-mile walking path. However, this access point is rarely used by boaters because of the need to carry boats a long distance from the parking lot. In addition, visitors to the NWR who do not own a boat are unable to access the river for recreation.

This project involves purchasing two canoes, two kayaks, and three boat carts (and appropriate personal floatation devices, paddles, etc.) for the use of visitors to the NWR headquarters. The NWR would establish a system for allowing access to the equipment. The NWR staff has indicated their interest and support of this project. Initially, the equipment may only be available on weekdays when refuge staff would be present to help "check out" the equipment. The NWR is planning to work on a system that would also allow equipment access on the weekends. The refuge is open daily from sunrise to sunset.

Expected benefits and timeframe of benefits: The project is anticipated to benefit members of the public who desire improved recreational access to the Sudbury River as well as individuals who do not own boats and would like to experience canoeing or kayaking. Benefits will begin as soon as the equipment is purchased and made available and individuals start to access the equipment.

Brief overview of maintenance and monitoring: Boats and equipment are likely to need periodic maintenance and replacement. The budget includes a line item for replacement, assuming that some degree of loss will occur. Monitoring the frequency of equipment use can be done by NWR staff. This monitoring would determine whether the project is successfully increasing recreational boating at the Great Meadows NWR headquarters.

Probability of success: The probability of success and demand for this equipment is unknown but likely to be high, given the popularity of the nearby Shermans Bridge Road for boating access and the difficulty of obtaining parking at that location during popular times.

Environmental and socioeconomic consequences: There would be no environmental consequences associated with this project. The project has the potential to have a positive socioeconomic consequence if the equipment use enhances recreational experiences and decreases conflicts and traffic at Sherman Road Bridge.

Estimated costs: The estimated cost for purchase of four boats and related equipment is approximately $4,300. The cost for purchase of three heavy-duty boat carts with large stainless steel name plates (to reduce theft) is approximately $1,100. The project also includes a 30% maintenance or replacement contingency of $1,600 for a total project cost of $7,000. USFWS

would provide in-kind services associated with storing, maintaining, and developing a process for lending out the equipment.

Trustee evaluation and proposed allocation: This project is proposed to receive $7,000 in funding in Tier 1. The Trustees evaluated this project favorably because of its focus on improving fishing and boating access in a popular location and its low cost (Table 14).

Table 14. Evaluation of Sudbury River Access Improvements: Great Meadows NWR Headquarters project versus the Trustee criteria. Numbers in parentheses refer to the numbered list of criteria provided in Section 3.3. This table only includes criteria where the project was evaluated as particularly strong compared to other projects.

High importance criteria	Evaluation strengths
Proximity to injured resources (1)	Provides access to the Sudbury River mainstem in an area that was impacted by releases from the Site.
Relationship to injured resources (2)	Restores injured resource services by improving access for fishing and recreational boating.
Magnitude of benefits and demonstrated need (3)	Addresses a demonstrated need for improved access to the Sudbury River in this locale. The Great Meadows NWR Comprehensive Conservation Plan (USFWS, 2005b) notes the need to build a public that understands, appreciates, and supports refuge goals for wildlife by providing opportunities for canoeing and kayaking to enhance opportunities for wildlife observation, photography, fishing, and hunting.
Reasonableness of costs (7)	Provides a high value of expected benefit to expected cost because of the low cost of the project and the opportunity to benefit hundreds of visitors.
Measurable results (10)	Project benefits can be evaluated using quantitative or professionally accepted methods by surveying visitor use of boat carts.
Medium importance criteria	
Avoidance of adverse impacts – ecological (2) and socioeconomic (4)	Has little to no potential for significant adverse environmental or socioeconomic impacts.
Community goals (3)	Complements the Great Meadows NWR Comprehensive Conservation Plan (USFWS, 2005b), which includes a strategy to provide opportunities for canoeing and kayaking on the Concord and Sudbury rivers to enhance opportunities for wildlife observation, photography, fishing, and hunting.

4.5.3 Red Maple Trail: Boardwalk and Wildlife Observation Platform Construction

Restoration objective: To improve pedestrian access on a popular woodland walking trail at the Great Meadows NWR headquarters that overlooks the Sudbury River and floodplain habitat. See Figure 27 for the project logic model.

Figure 27. Red Maple Trail: Boardwalk and Wildlife Observation Platform Construction – logic model

Restoration actions	Expected short-term result	How benefits are achieved	Desired long-term results
Construct a boardwalk and wildlife observation platform. ⇨	Individuals use the boardwalk and platform. ⇨	Trail accessibility increases visitor contact with the river and adjacent floodplain resources. ⇨	Recreational use services on the Sudbury River increase through enhanced participation and enjoyment.

Project location: Adjacent to the Great Meadows NWR grounds in Sudbury, along the alignment of the existing Red Maple Trail.

Project description: Significant scenic and educational opportunities are available at the Great Meadows NWR headquarters area in Sudbury. The area contains a trail network with interpretive stations, a shelter used to host educational events, scenic views and access to the Sudbury River, and a variety of habitat and ecological resources. The Red Maple Trail begins at the refuge headquarters parking area, travels south around a small excavated pond, then continues west. A north branch from a split in the trail crosses the headquarters access road, and a west branch meets Weir Hill Road. A second trail, the Weir Hill Trail, begins at the refuge headquarters building, follows the Sudbury River in an easterly direction, then turns northwest, passing over Weir Hill. The trail then parallels Weir Hill Road, crosses the headquarters access road, and joins with the Red Maple Trail (Figure 28).

Access to portions of the trail network can be difficult for the public. The Weir Hill Trail is steep as it passes over Weir Hill, so it is less accessible during some times of the year and to some people. Access on the Red Maple Trail can also be problematic. The red maple swamp that the trail passes through is low-lying, so it is often flooded, and muddy areas persist throughout much of the year. Additionally, tree roots pose a tripping hazard in many areas.

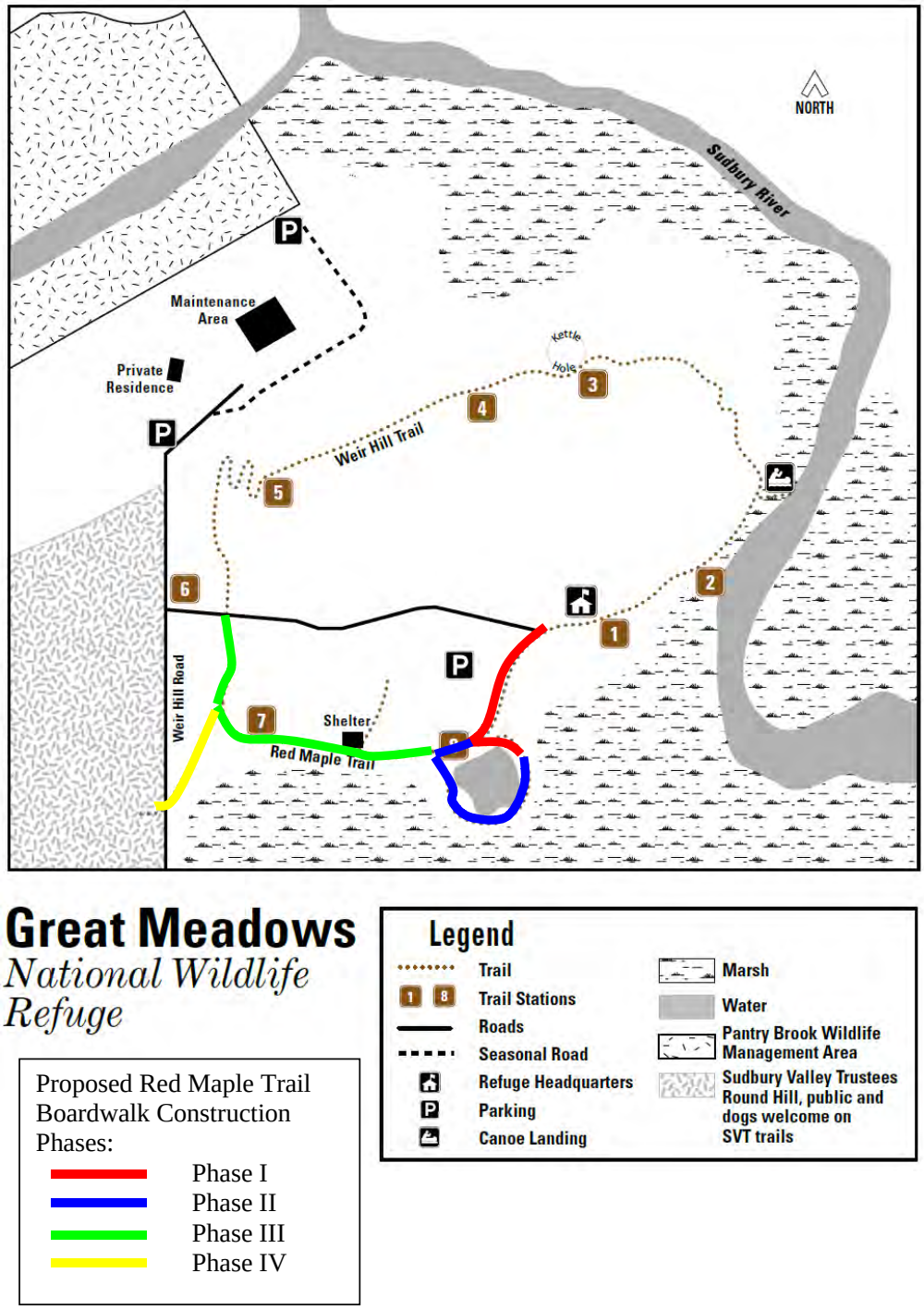

Figure 28. Proposed phased construction for Red Maple Trail boardwalk. Trail brochure map used with permission of the Great Meadows NWR.

While these two trails in their current form provide adequate unimproved access to many members of the public, the refuge headquarters currently has limited outdoor facilities that are Americans with Disabilities Act (ADA) compliant. Upgrades to the trail system would improve overall access to natural resources at the facility. Since the Red Maple Trail is generally flat, it is a better candidate for access improvements.

The proposed project consists of improvements to the Red Maple Trail through installation of an elevated boardwalk over tree roots and wet sections, and installation of a stone dust path in upland areas where roots are less prevalent. An elevated wildlife observation platform would be installed along the bank of the Sudbury River at a location that overlooks a wide area of marsh southeast of the facility. Two interpretive panels would also call attention to ecological and wildlife resources in the area.

The boardwalk areas would be constructed similar to an existing section of boardwalk recently installed along the Red Maple Trail. Precast concrete parking space curb stops would be laid directly on the ground surface perpendicular to the axis of the trail, forming the base. Decay-resistant beams would be laid on the curb stops and fixed in place with strapping and masonry nails. Composite decking material would then form the travel surface. The paths would be five to six feet in width. In areas where elevating the path is unnecessary, existing soil would be removed, edging installed to define the limits of the path, and the middle filled with compacted stone dust. The observation platform would be constructed of wood posts on concrete footings supporting a wood-framed deck with composite decking. Several trees may need to be cut along the path's route to provide a corridor of adequate width.

Phase I of the project includes improvement of the trail from the parking lot to the east side of the marsh, construction of the wildlife observation platform, and fabrication and installation of two interpretative panels. Phase II includes continuing the boardwalk around the pond back to the parking lot to complete a loop. Phase III would continue the boardwalk along the alignment of the existing trail to the headquarters entrance road; and Phase IV would continue the boardwalk out to Weir Hill Road where it would then connect to Sudbury Valley Trustee trails on Round Hill.

Expected benefits and timeframe of benefits: The project is anticipated to benefit members of the public who are mobility-impaired by improving the walking surface, and increasing the recreational and educational opportunities that are available to everyone. The project would also be of value to families using strollers. Additionally, the improvements will facilitate use of the trail by visitors during particularly busy times of year and when the trail is flooded. Benefits will begin as soon as the improved sections of trail are open to the public and are expected to last at least 20 years, before boardwalk replacement would be required. The Red Maple Trail is accessible two ways: from the Great Meadow NWR headquarters parking lot which is open daily from 6 a.m. to 6 p.m. and from a small parking area on Weir Hill Road that allows people to enter the trail from the road.

Brief overview of maintenance and monitoring: The boardwalk portions of the path are anticipated to last 20 years before replacement is required, although segments may need occasional adjustment or repair. Portions of the path with a stone surface need to be regraded occasionally, but the dense graded material that is proposed has been shown to be long-lasting and resistant to erosion in applications constructed by OFBA (T. Smith, Civil/Environmental Engineer, Massachusetts Office of Fishing and Boating Access, personal communication, November 16, 2009).

Probability of success: The probability of success is high. The USFWS has a high level of experience constructing boardwalks and recreational paths similar to the one proposed here. The proposed improvements will improve access for existing visitors at the facility and could potentially attract additional visitors as well.

Environmental and socioeconomic consequences: The environmental and socioeconomic consequences of this project would be relatively minor.

Several resources subject to protection by the Massachusetts WPA may be incidentally impacted by the proposed project, including Bordering Land Subject to Flooding (BLSF), BVW, and Riverfront Area. Coordination with the local Conservation Commission through submission of a WPA NOI may be necessary to ensure consistency with the WPA performance standards. Construction of the boardwalk across wetland areas may be allowable as a WPA limited project under 310 CMR 10.53(3)(j) provided that the structures are constructed on pilings or posts to avoid restriction of water flow and to allow light penetration to maintain vegetation. It is likely that the majority of the wet areas along the course of the path would qualify as BVW if delineated, such that the boardwalk crossing these sections would be required to meet the WPA performance standards. Otherwise, the boardwalk could be lower to the ground similar to the existing sections, provided that any endangered species concerns are satisfied, as discussed later in this section.

The proposed project may result in some fill to wetlands that are subject to federal and state jurisdiction under Sections 401 and 404 of the CWA. However, these fills are minor and are likely to be below permitting thresholds (5,000 square feet of fill). The Sudbury River through the refuge is not an ORW; ORW status would trigger a 401 Water Quality Certification application for the proposed project.

Minor tree removal in the riparian area is also subject to the jurisdiction of the Rivers Protection Act. The project would result in clearing of some vegetation in the outer riparian area (outer 100 feet of the 200-foot riparian area) associated with the Sudbury River, decreasing the resource's vegetative buffer somewhat. The project would need to demonstrate consistency with the interests and performance standards of the WPA and associated regulations. It is important to note, however, that 310 CMR 10.53(6) allows issuance of an Order of Conditions for

construction of footpaths in a riverfront area, provided that the work's impacts are minimized and that the project's design is consistent with the uses proposed.

Floodplain impacts are anticipated to be small since the proposed fill volumes, which include only the volume of boardwalk components below the 100-year flood elevation, are small. However, a Conservation Commission could request compensatory storage to be provided for fill in floodplain areas following requirements of the WPA as pertaining to BLSF.

Additionally, the proposed project site is also located within mapped state-listed endangered species habitat. Coordination with the Massachusetts NHESP under MESA would be required during permitting to ensure that the project will avoid adverse impacts to state-listed endangered, threatened, and special concern species.

Estimated costs: Project costs as estimated by the USFWS are presented in Table 15. Costs assume that the project is built by USFWS staff with assistance from volunteers.

Table 15. Cost elements for the Red Maple Trail: Boardwalk and Wildlife Observation Platform Construction. Estimates provided by USFWS.

Description	Cost if built by staff and volunteers
Phase I of boardwalk, approximately 300 feet from the parking lot, observation platform, two interpretative panels, and railing where necessary	$55,000
Phase II of boardwalk from platform, around pond, back to parking lot (approximately 600 feet)	$30,000
Phase III of boardwalk; an east-west section between pond and north-south section off facility driveway, approximately 600 feet and a north-south section to driveway, approximately 525 feet in length	$56,000
Phase IV: Boardwalk connection to Weir Hill Road, approximately 200 feet in length	$10,000
Permitting	$10,000
Design	In-kind by staff and volunteers
Total	$161,000

Trustee evaluation and proposed allocation: This project is proposed to receive $161,000 in Tier 1 funding for Phases 1–4 of the project. The project was evaluated favorably versus the Trustee evaluation criteria because of its accessible location at the NWR, the potential for high levels of visitor and recreational use, its accessibility to all members of the public including the mobility impaired, and its close proximity to the Sudbury River, allowing visitors to increase their understanding and appreciation of the resource values of the Sudbury River (Table 16).

Table 16. Evaluation of the Red Maple Trail: Boardwalk and Wildlife Observation Platform Construction project versus the Trustee criteria. Numbers in parentheses refer to the numbered list of criteria provided in Section 3.3. This table only includes criteria where the project was evaluated as particularly strong compared to other projects.

High importance criteria	Evaluation strengths
Proximity to injured resources (1)	Located adjacent to Sudbury River mainstem in close proximity to impacted environment.
Relationship to injured resources (2)	Restores injured resource services by creating additional river access sites for recreational fishing, and wildlife viewing.
Magnitude of benefits and demonstrated need (3)	Addresses a demonstrated need to provide access for a broader public by creating a trail accessible for the disabled, strollers, and casual visitors. The Great Meadows NWR Comprehensive Conservation Plan (USFWS, 2005b) notes the need to build a public that understands, appreciates, and supports refuge goals for wildlife by providing and maintaining public use trails to enhance opportunities for wildlife observation and photography and also notes the need to provide self-guided trails for the public.
Medium importance criteria	
Community goals (3)	Complements the management objectives of the USFWS, as expressed in the Great Meadows NWR Comprehensive Conservation Plan.
Stewardship and public education (socioeconomic benefit) (5)	Provides an opportunity for stewardship through opportunities for volunteers to help with the trail construction and public education through signage along the trails.

4.6 Alternatives Considered but Not Recommended for Funding

The Trustees received many restoration project ideas in response to their request for project submittals (see Appendix C for the complete list of submissions). The project ideas that best met the evaluation criteria were included in the proposed alternative and described in Sections 4.3–4.5. The remaining project ideas were not selected for funding because they ranked lower against the evaluation criteria compared to the projects included in the proposed alternative. In some cases, the Trustees took elements from a project idea that was not recommended for funding, and incorporated those elements into a project that was proposed as part of the proposed alternative. The Trustees chose projects for funding that best fit their criteria and that could be accomplished with the limited resources available to the Trustees. A recommendation for no funding should not be viewed as a judgment on the overall environmental or educational value of a project idea.

A summary of the project ideas not recommended for funding is provided in Table 17, together with a description of the evaluation criteria where the project scored low compared to the proposed alternative projects.

Table 17. Proposed restoration project ideas not recommended for funding

Project title	Project number in Appendix C	Project category	Key criteria contributing to lower evaluation results (numbers in parentheses refer to enumerated high importance criteria in Section 3.3)
Aquatic resources			
Restoration of Cold-Water Fish in the Sudbury River Basin	10	Aquatic resources	This project was limited to studies (including hydrologic and water quality support and an environmental history) which yield a relatively low magnitude of natural resource benefit compared to projects that implement restoration (2, 3, 4, 5).
Coordinated Dam Management of the upper Sudbury River	11	Aquatic resources	Performance of studies, planning, and outreach yield a relatively low magnitude of natural resource benefits compared to projects that implement restoration (2, 3, 4, 5). Obstacles that may be faced for project implementation (e.g., coordination with multiple outside parties, regulatory and policy requirements) create uncertainty regarding whether the project could be completed successfully, and thus the level of difficulty is high (6).
Creation of Sudbury River Overlay District	16	Aquatic resources	Project is highly similar to actions that will likely be required in the future for municipality compliance with stormwater permits (eligibility criteria).
Wastewater Ground Discharge in the Indian Brook Watershed	17	Aquatic resources	Performance of studies yields a relatively low magnitude of natural resource benefits compared to projects that implement restoration (2, 3, 4, 5).
Chemical Brook Drainline	19	Aquatic resources	The Trustees believe that this project does not fit into their mandate because the town has the responsibility to alleviate flooding and protect public safety (eligibility criteria).
Stormwater Improvements – Framingham and Concord	18 and 21	Aquatic resources	Project is highly similar to actions that are otherwise required, or may be required in the future, for Framingham and Concord's compliance with their stormwater permits (eligibility criteria).
Aquatic Invasives Species Control (Water Chestnut) (Concord)	27	Aquatic resources	Elements of this project are incorporated into Project 4.3.2, Control of Aquatic Weeds in the Sudbury River Watershed.

Table 17. Proposed restoration project ideas not recommended for funding (cont.)

Project title	Project number in Appendix C	Project category	Key criteria contributing to lower evaluation results (numbers in parentheses refer to enumerated high importance criteria in Section 3.3)
Aquatic resources (cont.)			
Biological Control of Water Chestnut	28	Aquatic resources	Performance of research studies yields a relatively low magnitude of natural resource benefits compared to projects that implement restoration (2, 3, 4, 5). The level of difficulty for this project is high because obstacles that may be faced for project implementation (e.g., coordination with multiple outside parties, the Department of Agriculture (USDA) regulatory and policy requirements) create uncertainty regarding whether the project could be completed successfully (6).
Eradication of Water Chestnut on Fiske Pond in Natick	29	Aquatic resources	Located within the Sudbury River Watershed but does not directly benefit injured resources in the Sudbury river (1, 2).
Eradication of Milfoil in Lake Cochituate	30	Aquatic resources	Located within the Sudbury River Watershed, but does not directly benefit injured resources in the Sudbury river (1, 2).
Invasive Plant Control (Lincoln)	31	Aquatic resources; riparian/flood-plain resources	Located within the Sudbury River Watershed but is not in close proximity to impacted environment and resources (1).
Fisheries Resources Protection and Restoration	41	Aquatic resources	The component of this project that proposed "Identify the opportunities and barriers to restoring fish passage at the Talbot Mills dam in Billerica" was incorporated into the "Concord River Diadromous Fish Restoration Project." Additional activities proposed for this project focused primarily on planning and outreach activities that yield a relatively low likelihood of natural resource benefits compared to projects that primarily focus on implementing restoration actions (2, 3, 4, 5).
Geographic information system (GIS)-based map of Sudbury River Fish Communities and Impediments to Fish Passage	42	Aquatic resources	The project focused on GIS database and application development. The project would yield a relatively low magnitude of natural resource benefit compared to projects that implement restoration (2, 3, 4, 5).

Table 17. Proposed restoration project ideas not recommended for funding (cont.)

Project title	Project number in Appendix C	Project category	Key criteria contributing to lower evaluation results (numbers in parentheses refer to enumerated high importance criteria in Section 3.3)
Aquatic resources (cont.)			
Hydrologic and Water-Quality Support for Fisheries Restoration in Reaches of Sudbury River	43	Aquatic resources	This project is partly incorporated into the feasibility analysis that will be part of the Concord River Diadromous Fish Restoration: Feasibility and Stewardship project.
Environmental History of Fish Runs and Wetland Meadows	44	Aquatic resources	Performance of studies, planning, and outreach yield a relatively low magnitude of natural resource benefits compared to projects that implement restoration (2, 3, 4, 5).
Riparian and floodplain resources			
Greenways North Field Restoration: Eastern Spadefoot Toad portion only	12	Riparian and floodplain resources	Proposed activities are in conflict with the preferred project on the Greenways north field. In addition, the project is experimental and does not employ well-known and accepted techniques to achieve outcomes, and thus is considered to have a low likelihood of success (6).
Sudbury River Riparian Buffer Restoration	13	Riparian and floodplain resources	This project is partly incorporated into the Habitat Restoration to Benefit Coldwater Fish project. As initially proposed, the high proportion of costs associated with the identification of projects for implementation detracts from the benefits of the proposed project (8).
Terrestrial Invasive Species Control	33	Riparian and floodplain resources	Located within the Sudbury River Watershed, but does not benefit injured resources in the Sudbury River as directly as the preferred aquatic weed control project (1, 2).
Recreation and public access			
Canoe launch at Fountain Street	45	Recreation and public access	Proposed elements of this project are included in Project 4.5.1, Sudbury River Public Access: Aikens Road; and Project 4.4.4, Creation of Stearns and Brackett Reservoirs Wildlife Preserve.
Sudbury River Access Improvements: Sherman's Bridge Road	46	Recreation and public access	Site visit determined that technical feasibility of improving access is low because of the narrow road corridor (6).

Table 17. Proposed restoration project ideas not recommended for funding (cont.)

Project title	Project number in Appendix C	Project category	Key criteria contributing to lower evaluation results (numbers in parentheses refer to enumerated high importance criteria in Section 3.3)
Recreation and public access (cont.)			
Sudbury River Access Improvements: River Road	46	Recreation and public access	Site visit determined that technical feasibility of improving access is low because of the narrow road corridor (6).
Upper Sudbury River Public Access for Fishing and Trails	48	Recreation and public access	Proposed elements of this project are included in Project 4.5.1, Sudbury River Public Access: Aikens Road.
Riverwalk Bridge at Mill Pond River	49	Recreation and public access	Proposed activities provide limited enhancement of existing recreational resources (2, 3). Project costs are high compared to benefits provided to injured natural resources (7).
River Room in Wayland and Path to River	50	Recreation and public access	There is considerable uncertainty regarding whether the project could be completed successfully because an Activity and Use Limitation under M.G.L. 21E Part 6 and 310 CMR 40.0000 is in place for part of the path route and for the proposed location of the boat house, which prohibits recreational activities or use for public access purposes (6). Also, the relationship of expected benefits to expected costs is low because boaters will not require the path to reach the boat access point and the boat facility may have limited appeal outside of Wayland (8).
Community-based education (note: The Trustees originally received project submittals in this category but did not retain this category as part of the proposed alternative).			
Protection through Education in Natick	1	Community-based education	Compared to projects that bring people to the river and directly educate river users and decision-makers, potential for project to provide ecological or recreational benefits is limited in scope; likelihood for restoration of natural resources or natural resource services is low (2, 3).
Sudbury River NRD Projects Web-based Information Center	2	Community-based education	Compared to projects that bring people to the river and directly educate river users and decision-makers, potential for project to provide ecological or recreational benefits is limited in scope; likelihood for restoration of natural resources or natural resource services is low (2, 3).

Table 17. Proposed restoration project ideas not recommended for funding (cont.)

Project title	Project number in Appendix C	Project category	Key criteria contributing to lower evaluation results (numbers in parentheses refer to enumerated high importance criteria in Section 3.3)
Community-based education (cont.) (note: The Trustees originally received project submittals in this category but did not retain this category as part of the proposed alternative).			
"Come Enjoy the Sudbury River" Outreach and Education Campaign	4	Community-based education	The Trustees believe that this project does not fit into their mandate because EPA has the responsibility to educate the public regarding what is safe versus unsafe recreation on the Sudbury River (eligibility criteria).
Sudbury River Environmental Education Program/Institute	5	Community-based education	A key component of this project, school-based education, was proposed for funding in Project 4.3.5, Sudbury Schools Environmental Stewardship Program.
Educational/ Interpretive Signage	6	Community-based education	Already implemented by EPA as part of remedial work.
"Restoring the Sudbury River": Outreach and Education Materials	7	Community-based education	A component of this project will be included in the educational kiosks that are part of Project 4.4.4, Creation of Stearns and Brackett Reservoirs Wildlife Preserve.
Construction of Visitor Center at Lake Cochituate	8	Community-based education	Project costs are high compared to educational benefits provided (7).
Public Awareness Campaign and Low Impact Development (LID) Demonstration Projects for Stormwater Utility	20	Community-based education	Project is highly similar to actions that will likely be required in the future for municipality compliance with stormwater permits (eligibility criteria).

5. Environmental and Socioeconomic Impacts of Restoration Alternatives

The environmental and socioeconomic consequences associated with each individual restoration project in the proposed restoration alternative were identified in Section 4. This section provides a description of the cumulative impacts of the proposed alternative and compares these impacts to those of the no-action alternative.

Over the long-term, the proposed restoration projects that together form the proposed restoration alternative identified in this draft RP/EA would provide positive environmental and socioeconomic benefits for the Sudbury River Watershed. The analysis of impacts assumes that all of the Tier 1 and Tier 2 restoration projects would be implemented. If funding is not sufficient for implementation of all Tier 2 projects, then the cumulative impact of restoration (both positive and negative) would be lessened.

5.1 Environmental Impacts of the Proposed Alternative

Overall, the cumulative environmental impact of the proposed alternative would be positive because natural resources would benefit from the proposed restoration actions. Descriptions of impacts for specific categories of environmental resources are detailed below.

5.1.1 Water Resources

Over the long-term, the proposed alternative will have a net positive impact on water resources in the Sudbury River Watershed. During implementation of the projects that require construction equipment (e.g., Habitat Restoration to Benefit Coldwater Fish, Sudbury River Public Access: Aikens Road, Red Maple Trail: Boardwalk and Wildlife Observation Platform Construction), there may be temporary increases in sediment transport and in the turbidity level of adjacent surface water. Temporary impacts would be minimized by following BMPs for in-stream work and conforming to all requirements of the permits that would be necessary to conduct the project. For any work conducted in the riparian zone, the restoration activities ultimately would stabilize and revegetate stream banks and result in a long-term decrease in erosion and an improvement in water quality.

Other projects in the proposed alternative also would have long-term positive impacts on water resources. The project to control aquatic weeds would remove a detrimental component of the aquatic ecosystem and prevent large mats of water chestnut from decaying and reducing oxygen levels. Land acquisitions that protect floodplain land at risk of development will be a priority for acquisition because of the importance of these lands for maintaining water quality. Finally, the education and stewardship projects have a long-term goal of improving water quality through public education.

5.1.2 Vegetation Resources

The restoration projects in the proposed alternative would enhance vegetation resources in aquatic, riparian, and floodplain habitats in the following ways:

- Control of aquatic weeds would have a direct benefit on native vegetation. Control of purple loosestrife would allow native wetland vegetation to regrow in marshy areas, while control of water chestnut would promote native macrophytes that are outcompeted by large floating mats of water chestnut. Within this project, restoration of wild rice would restore an important native species that provides a valuable food resource for birds and wildlife.

- Habitat Restoration to Benefit Coldwater Fish would likely involve revegetating streambanks with appropriate native riparian vegetation to help stop bank erosion.

- Greenways North Field Restoration would restore native grassland vegetation in an area currently dominated by invasive buckthorn.

- Land acquisition projects would benefit vegetation resources by preventing development.

5.1.3 Fish and Wildlife Resources

The restoration projects in the proposed alternative would enhance fish and wildlife resources in the Sudbury River Watershed in the following ways:

- Control of Aquatic Weeds in the Sudbury River Watershed would benefit fish and wildlife by restoring native habitat conditions. Within this project, restoration of wild rice would provide a valuable food resource for birds and wildlife.

- Habitat Restoration to Benefit Coldwater Fish has a key objective of benefiting populations of coldwater fish, including native brook trout.

- The Concord River Diadromous Fish Restoration feasibility study provides the first step toward the potential restoration of diadromous fish across a significant portion of the SuAsCo Watershed.

- Greenways North Field Restoration would benefit native insectivorous and grassland birds.

- Neotropical Connections would benefit neotropical migrant bird species through the protection of overwintering habitat in a forest in Belize.

- Land acquisition projects would benefit fish and wildlife by protecting habitat and water quality.

The proposed recreational projects are not expected to have a negative impact on fish and wildlife resources. The Great Meadows NWR Comprehensive Conservation Plan (USFWS, 2005b) conducted "compatibility determinations" and determined that fishing, non-motorized boating, wildlife observation, and photography are compatible with the purpose of the NWR and will not harm the refuge when conducted during current refuge open hours (daylight only) and in designated locations. The proposed recreational projects also would follow the standards of the Sudbury, Assabet, and Concord Wild and Scenic River Study River Conservation Plan (NPS, 1995) to be managed in a way that prevents degradation of the rivers' land and water resources.

5.1.4 Special Status Species

Federally listed T&E species were not noted as present in the SuAsCo Watershed in the SuAsCo Biodiversity Protection and Stewardship Plan (Clark, 2000). This plan does note the presence of several state listed threatened species in different habitat types, including the Blanding's turtle (*Emydoidea blandingii*; marshes, ponds, vernal pools, sandy uplands); Britton's violet (*Viola brittoniana*; wet meadow), king rail (*Rallus elegans*; emergent and deep marsh), grasshopper sparrow (*Ammodramus savannarum*; grassland), and marbled salamander (*Ambystoma opacum*; mixed oak/white pine forest).

The proposed restoration actions are not expected to have negative impacts on any of these species. Actions to reduce invasive species in marsh and pond habitat and create grassland habitat may have positive impacts on these species, although it is unknown if any of these species are present in the proposed restoration areas. In general, any disturbances resulting from construction activities at the restoration sites would be of relatively short duration (1–3 years) and are unlikely to negatively impact these species. These restoration projects would provide long-term benefits to habitat for any threatened or special status species.

5.1.5 Air and Noise

The use of heavy equipment to implement some of the projects may generate local air pollution, especially from diesel engines and noise pollution that could disturb wildlife on a temporary basis. Because the work will be temporary and will only occur during daylight hours and in limited locations, wildlife likely will be able to avoid the noise and air pollution impacts.

5.1.6 Geology and Minerals

The proposed alternative would not have a negative impact on geology or mineral resources. The proposed restoration projects would not result in any change in mining activity in the area or in any change in the use of mineral resources.

5.1.7 Soils

The proposed alternative would have a positive impact on soils because many of the projects would result in decreased erosion and increased soil stability. Specifically, the Habitat Restoration to Benefit Coldwater Fish project and the promotion of BMPs for the river would improve soil stability and soil management.

5.2 Cultural and Socioeconomic Impacts of the Proposed Alternative

Overall, the cumulative cultural and socioeconomic impacts of the proposed alternative would be positive because the human population in the area affected by the proposed alternative would benefit from the proposed restoration actions. Descriptions of impacts for specific categories of cultural and socioeconomic considerations are detailed below.

5.2.1 Lands and Access

The proposed restoration actions that make up the proposed alternative would not conflict with local, state, or federal policies for land management. Land acquisition would conform to the policies of the agency accepting the land. Parcels proposed for acquisition are expected to be consistent with existing management plans such as the Greenways Plan for the SuAsCo Watershed (SVT, 2000). The proposed alternative would have a minimal impact on existing land use. Depending on the parcels pursued for acquisition, there could be a change in land use for a parcel from private land to public land accessible for recreation.

Opportunities for public access and recreation along the Sudbury River will increase as a direct result of implementation of the preferred alternative. The new public access point at Aikens Road will be an important access point for fishing and recreational boating in Ashland. Provision of boats and boat carts at the Great Meadows NWR headquarters also will increase access to the Sudbury River. Construction of the Red Maple Trail will provide access to floodplain habitat that has been inaccessible because of muddy terrain as well as access to views of the river.

5.2.2 Air, Noise, and Visual Resources

Because most of the restoration work is planned for locations away from residential areas, the air, noise, and visual impacts to human populations would be minimal. The exception could be during the implementation of the Habitat Restoration to Benefit Coldwater Fish project which could potentially take place in close proximity to residential housing. During the implementation

of the project, some temporary negative impacts would occur. As described above under environmental impacts, implementation of the project could generate local air and noise pollution, disrupt the scenic "viewshed" of the area, and temporarily increase erosion in the stream. Because the work would be temporary and would only occur during daylight hours and in limited locations, the overall impact to air, noise, and visual resources would be limited and temporary.

5.2.3 Cultural and Historical Resources and Native American Religious Concerns

The project with the greatest potential impact on cultural and historical resources is the Concord River Diadromous Fish Restoration project if the project proceeds to the implementation phase. During the feasibility stage of the project (proposed for Tier 1 funding), a Project Notification Form (PNF) will be submitted to the Massachusetts Historic Commission for review. There are significant archeological resources and Native American religious concerns on Weir Hill at the Great Meadows NWR. However, the proposed Red Maple Trail boardwalk construction is not located near the surveyed areas and will have no impact on the archeological resources present at the Great Meadows NWR. The remainder of the projects will not involve ground disturbing activities that would require a cultural inventory.

5.2.4 Socioeconomic Impacts

The proposed restoration projects included in the proposed alternative would have a cumulative positive socioeconomic impact on the communities of the SuAsCo Watershed and the surrounding areas. Although there would potentially be short-term negative impacts to air and noise resources during construction of the Habitat Restoration to Benefit Coldwater Fish restoration project, these impacts would be outweighed by the long-term benefits for improved recreational access and improved education and stewardship resulting from implementation of the preferred alternative. Improved water quality in the Sudbury River also provides a positive socioeconomic impact for local communities.

Each of the projects that would enhance or protect fish and wildlife habitats would help to preserve the natural resource base that is threatened by rapid development in the SuAsCo Watershed. In the short-term, implementation of the restoration projects would have a minor positive economic effect on the area through potential employment opportunities, either directly or indirectly through the supply chain for materials. The general land use patterns of the area would not be affected by the projects because the proposed land protection projects would be protecting habitat that is already in a natural state. The protection projects would have a minimal or neutral impact on the local tax base because a payment in lieu of taxes would be made for acquired parcels that are taken out of the tax base.

5.2.5 Environmental Justice

This alternative would benefit several of the cities and towns within the SuAsCo Watershed that include EJ populations, including Framingham, Concord, and Westborough (EEA, 2002).

5.3 Impacts of the No-Action Alternative

Under the no-action alternative, no habitats would be preserved, restored, or enhanced beyond what agencies and organizations such as the Sudbury Valley Trustees, the Sudbury River Watershed Organization, Great Meadows NWR, and Massachusetts agencies such as the MA DER, OFBA, and MassWildlife are already doing in the area with limited existing resources. Aquatic and riparian habitats would continue to be degraded along the Sudbury River and in adjacent habitats. Aquatic invasive species would continue to spread, posing a greater impact to native species, recreation, and water quality. Cold water fish and diadromous fish populations would continue to decline. Neotropical migrants would continue to decline because of threats to wintering habitat. Fishing and boating recreational opportunities would continue to be limited by access points. Local populations would not benefit from improved recreational opportunities and increased education and stewardship. Future generations would not have access to an improved environment.

5.4 Cumulative Impacts of the Proposed Alternative and the No-Action Alternative

The cumulative impacts of the proposed alternative and the no-action alternative are summarized in Table 18 and discussed below.

The Trustees selected the restoration projects included in the proposed alternative to improve natural resources as compensation for natural resource injuries. Therefore, the cumulative environmental impact from implementing the restoration projects is expected to be beneficial. Any impacts to air quality, water quality, or noise associated with implementation of the projects are expected to be minimal and short-term. The projects would result in long-term benefits to water quality, vegetation, fish, birds, and wildlife in and around the project sites. There also would be long-term socioeconomic benefits to the area through educational programs, protection and improvement of natural resources, and improved recreational opportunities. Any cultural impacts associated with implementation of the fish passage project would be mitigated according to requirements of the MHC.

Table 18. Comparison of impacts by alternative

Category of impact	No-action alternative	Proposed action/proposed alternative
Habitat impacts	No additional habitats preserved, restored, or enhanced. Continued impairment of aquatic, riparian, and floodplain resources.	Aquatic, riparian, and floodplain habitats would be preserved, restored, and enhanced.
Biological impacts	Continued ongoing adverse impacts to fish and wildlife.	Improvements to fish and wildlife resulting from habitat improvements and potential restoration of fish passage.
Cultural resource impacts	No impacts to historic properties.	Potential adverse effects to cultural resources at the dam sites. These would be mitigated by appropriate actions.
Native American religious concerns	No impacts expected.	No impacts expected.
Environmental justice	No benefits to area residents, including minority and low-income populations.	Benefits to area residents, including minority and low-income populations, from improved local recreational opportunities and education about safe recreation.
Socioeconomic impacts	No positive indirect economic impacts on the local economy.	Restoration activities would generate short-term economic benefits. Improved water quality, habitat protection, and increased recreational opportunities would generate long-term economic benefits.
Indirect impacts	No indirect impacts.	Indirect beneficial impacts expected through improved habitat for fish, birds, and wildlife in the project areas.
Cumulative impacts	Cumulative impacts would be negative because of continued degradation of aquatic, riparian, and floodplain habitats under current conditions.	Cumulative impacts expected to be beneficial through long-term benefits to water quality, fish, and wildlife in and around the project sites.

Under the no-action alternative, there would be no positive change to habitats or wildlife beyond the actions taken by other agencies and organizations with limited funding. There would be no short-term impacts associated with project implementation and no long-term benefits from implementation of the proposed alternative. In short, the public would not be compensated for the extensive injuries to natural resources resulting from the release of hazardous substances at the Nyanza Superfund Site.

6. Compliance with Other Authorities

The following federal, state, and local laws, regulations, and policies may affect completion of the restoration projects. Compliance with these authorities was considered as part of the restoration planning process. All project sponsors that receive NRD funding will be responsible for obtaining necessary permits and complying with relevant local, commonwealth, and federal laws, policies, and ordinances.

6.1 Laws

6.1.1 Federal Laws

National Environmental Policy Act

NEPA requires that federal agencies consider the environmental impacts of proposed actions and reasonable alternatives to those actions. The Authorized Official will determine, based on the facts and recommendations in this document and input from the public, whether this EA supports a "Finding of No Significant Impact" (FONSI), or whether an "Environmental Impact Statement" (EIS) will need to be prepared.

Clean Water Act

The CWA is intended to protect surface water quality, and regulates discharges of pollutants into waters of the United States. All proposed restoration projects will comply with CWA requirements, including obtaining any necessary permits for proposed restoration actions. Restoration projects that move material in or out of waterways and wetlands, or result in alterations to a stream channel, typically require CWA Section 404 permits. Dam removal actions also require 404 permits. Project sponsors will be required to obtain the appropriate permits before restoration work begins.

As part of the Section 404 permitting process, consultation under the Fish and Wildlife Coordination Act, 16 USC §661 *et seq.* generally occurs. This act requires that federal agencies consult with the USFWS, the NMFS, and state wildlife agencies to minimize the adverse impacts of stream modifications on fish and wildlife habitat and resources.

Compliance with the Rivers and Harbors Act, 33 USC §401 *et seq*., generally occurs as part of the Section 404 permitting process. The Rivers and Harbors Act prohibits unauthorized obstruction or alteration of navigable waters. Any required permits under the Rivers and Harbors Act are generally included with the Section 404 permitting process.

Endangered Species Act

The Federal Endangered Species Act of 1973, as amended, 16 USC §§ 1531 *et seq.*, was designed to protect species that are threatened with extinction. It provides for the conservation of ecosystems upon which these species depend and provides a program for identification and conservation of these species. Federal agencies are required to ensure that any actions are not likely to jeopardize the continued existence of a T&E species. No federal T&E species are known to reside in areas that would be affected by the proposed restoration projects. However, project sponsors may be required to consult with the Endangered Species Program of the USFWS before implementation in certain cases.

Migratory Bird Treaty Act

The Migratory Bird Treaty Act of 1918 as amended, 16 USC §§ 703–712, protects all migratory birds and their eggs, nests, and feathers and prohibits the taking, killing, or possession of migratory birds. The proposed restoration actions would not result in the taking, killing, or possession of any migratory birds. The Neotropical Connections project and other projects would benefit migratory birds.

National Historic Preservation Act

The National Historic Preservation Act (NHPA) of 1966, as amended, 16 USC §§ 470 et seq., is intended to preserve historical and archaeological sites. Compliance with the NHPA would be undertaken through consultation with the State Historic Preservation Office, which in Massachusetts is the Massachusetts Historic Commission, established by M.G.L. Ch. 9, s. 26.

If the diadromous fish restoration project proceeds to the implementation phase, consultation under the NHPA would be required.

Occupational Safety and Health Act

The Occupational Safety and Health Act (OSHA) of 1970, as amended, 29 USC §§ 651 *et seq*., governs the health and safety of employees from exposure to recognized hazards, such as exposure to toxic chemicals, excessive noise, mechanical dangers, and unsanitary conditions. All work conducted on the proposed restoration actions will comply with OSHA requirements.

National Historic Preservation Act of 1966 (16 U.S.C. 470)

Section 106 of this statute requires that federal agencies take into account the impact that their actions (permitting, licensing, funding) may have on historic properties. “Historic property” is any district, building, structure, site, or object that is eligible for listing in the National Register of Historic Places because the property is significant at the national, state, or local level in

American history, architecture, archeology, engineering, or culture. Federal agencies consult and coordinate with State Historic Preservation Officers (SHPO)/Tribal Historic Preservation Officers (THPO) and other consulting parties to identify historic properties that may be affected by the proposed project and assess adverse effects of the actions.

Native American Graves Protection and Repatriation Act of 1990 (25 U.S.C. 3001–3013), Antiquities Act (16 U.S.C. 431–433), and Archaeological Resources Protection Act, as amended (16 U.S.C. 470aa–470 mm)

These laws are relevant for projects occurring on lands owned by federal or tribal governments. Projects proposed for the Great Meadows NWR would be subject to these laws. The Native American Graves Protection and Repatriation Act protects Native American "human remains, funerary objects, sacred objects, or objects of cultural patrimony" on federally owned or controlled lands and on Indian tribal or Native Hawaiian land. The Archaeological Resources Protection Act (also known as the "Antiquities Act") protects resources at least 100 years old that are of archeological interest. Great Meadows NWR will be responsible for confirming that the proposed sites for the restoration projects would not disturb any remains, objects, or resources subject to these laws.

North American Wetlands Conservation Act (103 Stat. 1968; 16 U.S.C. 4401–4412)

Public Law 101-233, enacted December 13, 1989, provides funding and administrative direction for implementation of the North American Waterfowl Management Plan and the Tripartite Agreement on wetlands among Canada, the United States, and Mexico.

National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668dd–668ee) as amended

This act defines the Refuge System as including wildlife refuges, areas for protection and conservation of fish and wildlife which are threatened with extinction, wildlife ranges, game ranges, wildlife management areas, and waterfowl production areas. The Secretary is authorized to permit any use of an area provided such use is compatible with the major purposes for which such area was established. The purchase considerations for rights-of-way go into the Migratory Bird Conservation Fund for the acquisition of lands. By regulation, up to 40% of an area acquired for a migratory bird sanctuary may be opened to migratory bird hunting unless the Secretary finds that the taking of any species of migratory game birds in more than 40% of such area would be beneficial to the species.

The Act requires an Act of Congress for the divestiture of lands in the system, except (1) lands acquired with Migratory Bird Conservation Commission funds, and (2) lands can be removed from the system by land exchange, or if brought into the System by a cooperative agreement, then pursuant to the terms of the agreement.

National Wildlife Refuge System Improvement Act of 1997

Public Law 105-57, amends the National Wildlife System Act of 1966 (16 U.S.C. 668dd–ee), providing guidance for management and public use of the refuge system. The Act mandates that the Refuge System be consistently directed and managed as a national system of lands and waters devoted to wildlife conservation and management.

The Act establishes priorities for recreational uses of the Refuge System. Six wildlife dependent uses are specifically named in the act: hunting, fishing, wildlife observation and photography, and environmental education and interpretation. These activities are to be promoted on the Refuge System, while all non-wildlife dependent uses are subject to compatibility determinations.

A compatible use is one which, in the sound professional judgment of the Refuge Manager, will not materially interfere with or detract from fulfillment of the Refuge System Mission or refuge purpose(s).

Refuge Recreation Act of 1962

This Act authorizes the Secretary of the Interior to administer refuges, hatcheries, and other conservation areas for recreational use, when such uses do not interfere with the area's primary purposes. It authorizes construction and maintenance of recreational facilities and the acquisition of land for incidental fish and wildlife oriented recreational development or protection of natural resources. It also authorizes the charging of fees for public uses.

Wild and Scenic Rivers Act (P.L. 90-542, as amended)

The Wild and Scenic Rivers Act contains the following provisions that are relevant to the Nyanza RP:

"SECTION 1(b) It is hereby declared to be the policy of the United States that certain selected rivers of the Nation which, with their immediate environments, possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural or other similar values, shall be preserved in free-flowing condition, and that they and their immediate environments shall be protected for the benefit and enjoyment of present and future generations.

SECTION 7. (a) The Federal Power Commission [FERC] shall not license the construction of any dam, water conduit, reservoir, powerhouse, transmission line, or other project works under the Federal Power Act (41 Stat. 1063), as amended (16 U.S.C. 791a et seq.), on or directly affecting any river which is designated in section 3 of this Act as a component of the national wild and scenic rivers system or which is hereafter designated for inclusion in that system, and **no department or agency of the United States shall assist by loan, grant, license, or otherwise in the construction of any water resources project that would have a direct and adverse effect on the values for which such river was established**, as determined by the Secretary charged with its administration." (emphasis added)

In April 1999 Congress designated 29 miles of the Sudbury Assabet and Concord rivers as Wild and Scenic. Their outstanding Wild and Scenic resources are recreation, scenery, ecology, historical and archaeological resources, and literary values.

6.1.2 State Laws

Article 97 of the Commonwealth of Massachusetts Constitution (1972)

> "The people shall have the right to clean air and water, freedom from excessive and unnecessary noise, and the natural, scenic, historic, and esthetic qualities of their environment; and the protection of the people in their right to the conservation, development and utilization of the agricultural, mineral, forest, water, air and other natural resources is hereby declared to be a public purpose. The general court shall have the power to enact legislation necessary or expedient to protect such rights."
>
> "In the furtherance of the foregoing powers, the general court shall have the power to provide for the taking, upon payment of just compensation therefore, or for the acquisition by purchase or otherwise, of lands and easements or such other interests therein as may be deemed necessary to accomplish these purposes. Lands and easements taken or acquired for such purposes shall not be used for other purposes or otherwise disposed of except by laws enacted by a two thirds vote, taken by yeas and nays, of each branch of the general court."

Executive Office of Energy and Environmental Affairs (M.G.L. c. 21A) and its land acquisition regulations (M.G.L. Chapter 51.00) and policies (1995)

EEA has adopted policies governing appraisals, environmental site assessments and surveys with respect to acquisition of acquisitions of real property for Article 97 purposes or interests therein.

Inland Fisheries and Game, M.G.L. Chapter 131: Section 47. Riparian proprietors; enclosure of waters

Section 47. No riparian proprietor of a natural pond other than a great pond, or of an artificial pond of any size, or of a non-navigable stream, shall enclose the waters thereof within the limits of his own premises unless he furnishes a suitable passage for all anadromous fish naturally frequenting such waters to spawn; nor shall any riparian proprietor enclose the waters of any such pond or stream for the purpose of artificial propagation, cultivation and maintenance of fish, except shiners as authorized in section fifty-two, unless he first procures a propagator's license under section twenty-three authorizing him so to do.

A person, without the written consent of the proprietor or lessee of a natural pond which is not a great pond, or of an artificial pond of any size, or of a non-navigable stream, where fish are lawfully propagated or maintained under authority of a license under this chapter, shall not take, or attempt to take, fish therefrom.

Marine Fish and Fisheries, M.G.L. Ch. 130, s. 19

For the purpose of providing suitable passage for salt water fish coming into fresh water to spawn, the Massachusetts Division of Marine Fisheries, may (1) seize and remove, summarily if need be, at the expense of the owner using and maintaining the same, all illegal obstructions, except dams, mills or machinery, to the passage of such fish; (2) examine all dams and other obstructions to such passage in brooks, rivers, and streams, the waters of which flow into coastal water, where in his judgment fishways are needed; and (3) shall determine whether existing fishways, if any, are suitable and sufficient for the passage of such fish in such brooks, rivers, and streams or whether a new fishway is needed for the passage of fish over such dam or obstruction; and he shall prescribe by written order what changes or repairs, if any, shall be made therein, and where, how and when a new fishway shall be built, and at what times the same shall be kept open and shall serve a copy of such order upon the person maintaining the dam or other obstruction.

Massachusetts Antiquities Act (M.G.L. Chapter 9, Section 27) and its implementing regulations (950 CMR 70 and 71)

MHC was established by the legislature in 1963 to identify, evaluate, and protect important historical and archaeological assets of the Commonwealth. The act and its implementing regulations provide for MHC review of state projects, State Archaeologist's Permits, the protection of archaeological sites on public land from unauthorized digging, and the protection of unmarked burials. The MHC is the office of the State Historic Preservation Officer, as well as the office of the State Archaeologist. Any new construction projects or renovations to existing buildings that require funding, licenses, or permits from any state or federal governmental agencies must be reviewed by the MHC for impacts to historic and archaeological properties.

Massachusetts Area of Critical Environmental Concern (M.G.L. c. 21A, s. 2(7); 301 CMR 12.00)

ACECs are those areas within the Commonwealth where unique clusters of natural and human resource values exist and which are worthy of a high level of concern and protection. These areas are identified and nominated at the community level and are reviewed and designated by the state's Secretary of Environmental Affairs. ACEC designation creates a framework for local and regional stewardship of critical resources and ecosystems. After designation, the aim is to preserve and restore these areas and all EEA agencies are directed to take actions with this in mind.

Massachusetts Clean Waters Act (M.G.L. 21, Sections 26-53)

Authorizes MassDEP to take all action necessary or appropriate to secure to the Commonwealth the benefits of the Federal Water Pollution Control Act, as amended, and other federal legislation pertaining to water pollution control by establishing a program for prevention, control, and abatement of water pollution through permits, municipal, regional and interstate planning, water quality standards, sampling and reporting, and financial and technical assistance.

Massachusetts Contingency Plan, 310 CMR 40.0000

The Massachusetts Contingency Plan is intended to comport with and complement the National Contingency Plan promulgated by the EPA under CERCLA, as amended. The MCP provides for the protection of health, safety, public welfare, and the environment by establishing requirements and procedures for assessment and response actions following release or threat of release of oil and/or hazardous material.

Under the provisions of 310 CMR 40.1012: Application of Activity and Use Limitations, (1) the purpose of an Activity and Use Limitation is to narrow the scope of exposure assumptions used to characterize risks to human health from a release pursuant to 310 CMR 40.0900, by specifying activities and uses that are prohibited and allowed at the disposal site in the future. 310 CMR 40.1012 establishes rules for determining when an Activity and Use Limitation must be used, when one cannot be used, and when one may be a factor to be considered in appropriately characterizing soil and groundwater at a disposal site, pursuant to 310 CMR 40.0923(3).

Massachusetts Endangered Species Act, M.G.L. Ch. 131A and its implementing regulations (321 CMR 10.00)

MESA is the Commonwealth analogue to the Federal Endangered Species Act. MESA lists species as "endangered," "threatened," or a "species of special concern." Before project implementation, project sponsors will be required to consult with the Massachusetts Natural

Heritage Endangered Species Program to ensure that proposed activities do not have a negative effect on species listed under MESA.

Massachusetts Environmental Policy Act, M.G.L. Ch. 30 §61 *et seq.*

MEPA is the Commonwealth's equivalent of NEPA; it requires that Commonwealth agencies consider and minimize the impacts of their actions on the environment. For a project that requires MEPA and NEPA review, consolidation of these two processes is encouraged. After the Final RP is completed, individual projects that are determined to trigger MEPA thresholds will be required to proceed through a MEPA review.

Massachusetts Surface Water Quality Standards (314 CMR 4.00)

Designates the most sensitive uses for which the various waters of the Commonwealth shall be enhanced, maintained, and protected; prescribes the minimum water quality criteria required to sustain the designated uses; and contains regulations necessary to achieve the designated uses and maintain existing water quality including, where appropriate, the prohibition of discharges.

Public Waterfront Act ("Chapter 91"), M.G.L. Ch. 91

The Division of Wetlands and Waterways within the MassDEP administers Chapter 91, which is designed to protect the public's rights for fishing, waterfowl hunting, and navigation in Massachusetts waterways. All project sponsors with actions that affect waterways will be required to seek the approval of the Division of Wetlands and Waterways under Chapter 91, before implementation. If the diadromous fish restoration project proceeds to the implementation phase, consultation under Chapter 91 would be required. Other projects that affect waterways also would be required to seek approval before implementation.

Wetlands Protection Act, M.G.L. Ch. 131 §40 and Rivers Protection Act, St. 1996, C. 258

The WPA restricts the removal, filling, dredging, or alteration of fresh and salt water wetlands and coastal areas. The Rivers Protection Act strengthens and expands the WPA to protect watercourses and adjacent lands. Local conservation commissions, under oversight from the MassDEP, are responsible for permitting under these acts. All project sponsors whose actions would be subject to these acts will be required to seek approval of the relevant local conservation commissions before proceeding with implementation, as well as notifying nearby landowners and any other affected parties.

401 Water Quality Certification for Discharge of Dredged or Fill Material, Dredging, and Dredged Material Disposal in Waters Within the Commonwealth (314 CMR 9.00)

These regulations are promulgated by MassDEP to carry out its statutory obligations to certify that proposed discharges of dredged or fill material, dredging, and dredged material disposal in waters of the United States within the Commonwealth will comply with the Surface Water Quality Standards and other appropriate requirements of state law.

6.1.3 Local Laws

As appropriate, restoration actions will consider and comply with local plans and ordinances. Relevant local plans could include shoreline and growth management plans. Relevant ordinances could include but not be limited to zoning, construction, noise, and wetlands. For example, in Massachusetts, municipal Conservation Commissions are empowered to administer the WPA (M.G.L. Chapter 131 s. 40) and may also adopt local bylaws as well as undertake other activities such as natural resource planning and land acquisition "for the promotion and development of the natural resources and for the protection of watershed resources of said city or town."

6.2 Policies and Directives

6.2.1 Federal Policies and Directives

The following federal policies and Presidential Executive Orders may be relevant to the proposed restoration projects in the proposed alternative.

U.S. Fish and Wildlife Service Mitigation Policy (Fish and Wildlife Service Manual, 501 FW 2)

This USFWS policy seeks to ensure "no net loss" of fish and wildlife habitat as a result of USFWS actions. The Trustees do not anticipate that any of the proposed projects will result in adverse impacts to habitat.

Executive Order 11988 – Floodplain Management

Under this 1977 Executive Order, federal agencies are directed to avoid the occupancy, modification, and development of floodplains, when there is a practical alternative. For example, the proposed boat access site at Aikens Road would not be subject to this Order, because boat access by definition must extend through the floodplain to the water's edge. For all projects, the Trustees will work to ensure that any floodplain impacts are minimized.

Executive Order 11990 – Protection of Wetlands

This Executive Order instructs federal agencies to avoid adverse impacts associated with destruction or modification of wetlands. The Trustees will work to make sure that any wetlands impacts associated with proposed projects are minimized and all necessary permits are obtained.

Executive Order 12898 – Environmental Justice

This Executive Order instructs federal agencies to assess whether minority or low-income populations would be disproportionately impacted by agency actions. There are EJ populations in the SuAsCo Watershed in Acton, Framingham, Hudson, Marlborough, Chelmsford, Clinton, Concord, Grafton, Lowell, Tewksbury, Upton, and Westborough (EEA, 2002). The proposed projects are not expected to adversely affect the environment or human health for these EJ populations. Some of the proposed alternatives (especially in the education and recreation categories) are likely to provide benefits to these communities.

U.S. Fish and Wildlife Service Great Meadows NWR Comprehensive Conservation Plan

The Comprehensive Conservation Plan provides long term guidance for management decisions; sets forth goals, objectives, and strategies needed to accomplish refuge purposes; and, identifies the Service's best estimate of future needs.

Concord, Assabet, & Sudbury Wild & Scenic River Stewardship Council

The River Stewardship Council (RSC) was established to coordinate conservation of the 29-mile Wild and Scenic River segment. The RSC functions as an official advisory committee to the National Park Service on federal permits affecting the rivers' outstanding resources. The RSC has representatives from the Towns of Bedford, Billerica, Carlisle, Concord, Framingham, Lincoln, Sudbury, Wayland, as well as the Organization for the Assabet River, Sudbury Valley Trustees, the Commonwealth of Massachusetts (appointed by the Governor), USFWS, the National Park Service, and the SuAsCo Watershed Community Council (added in 2005).

At the local level, the RSC serves an advisory function; its stated purpose is to "promote the long-term protection of the rivers by (1) bringing together on a regular basis various parties responsible for river management; (2) facilitating agreements and coordination among them; (3) providing a focus and a forum for all river interests to discuss and make recommendations regarding issues of concern; and (4) coordinating implementation of [the] River Conservation Plan."

6.2.2 State and Local Policies

Massachusetts EEA Land Acquisition Policies

Under the provisions of 301 CMR 51.05, the EEA (then referred to as the Executive Office of Environmental Affairs), established a set of four land due diligence acquisition policies on August 1, 1995. The policies cover appraisals, environmental site assessments, surveys, and title examinations reports.

Environmental Justice Policy of the Executive Office of Energy and Environmental Affairs

It is the policy of the EEA that EJ shall be an integral consideration to the extent applicable and allowable by law in the implementation of all EEA programs, including but not limited to, the grant of financial resources, the promulgation, implementation and enforcement of laws, regulations, and policies, and the provision of access to both active and passive open space. Working with EJ Populations, EEA will take direct action as part of the implementation of this policy to restore degraded natural resources, to increase access to open space and parks, and to address environmental and health risks associated with existing and potential new sources of pollution. This EJ Policy applies to all agencies of the EEA.

Other State and Local Policies

Proposed restoration projects will consider and comply with other relevant state and local policies and directives such as the EEA EJ Policy and MassDEP's Stormwater Discharge Policy.

7. List of Preparers

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- Rosemary Knox, EEA
- Molly Sperduto, USFWS
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8. List of Agencies, Organizations, and Parties Consulted for Information

Parties consulted for information include all of the organizations listed in Appendix C that submitted project information forms.

Additional parties consulted include the following:

- Federal agencies
  - Chris Waldron, USGS
  - Libby Herland, USFWS (Great Meadows NWR)
  - Doug Smithwood and Joe McKeon, USFWS
  - Bart Hoskins and Daniel Keefe, EPA
  - Lee Steppacher, National Park Service
- State agencies
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  - John O'Leary and Brandon Kibbe, DFG (MassWildlife)
  - Margaret Kearns and Georgeann Keer, DFG (MA DER)
  - Terry O'Brien, DFG (OFBA)
  - William Salomaa, MA DCR (Office of Dam Safety)
  - Elizabeth Sorenson, MA DCR (ACEC Program)
  - John Scannell and Joel Zimmerman, MA DCR (Office of Watershed Management)

- David Buckley, MassDEP (Bureau of Waste Site Cleanup)
- Gerard Kennedy, MA Department of Agricultural Resources (Agricultural Environmental Enhancement Program)

- Local agencies and other organizations
  - Jane Calvin, Executive Director, LPCT
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  - Matthew Selby, Conservation Officer, Town of Ashland
  - Lou Wagner, Regional Scientist, Massachusetts Audubon Society
  - David Evers, BRI
  - Jacob Marlin, BFREE
  - Thomas Raphael, Chairman, Middlesex Canal Commission.

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B. Project Information Form

NATURAL RESOURCE DAMAGE ASSESSMENT
RESTORATION PROJECT INFORMATION SHEET

Organization:				**Project Name:**	
Organization Web Page:				**Project Location,**	
Contact Name:				**Town & Watershed**	
Contact Title:				**Latitude/Longitude:**	
Contact Address:					
Contact Phone:		**Contact Fax:**		**Contact E-Mail:**	

Restoration Activity

Resource/Habitat/Service	☐ Marine/Estuarine Wetland ☐ Freshwater Wetland ☐ Groundwater ☐ Biological (Fish, Birds, Wildlife) ☐ Upland ☐ Recreational ☐		
Restoration Result	☐ Creation ☐ Rehabilitation ☐ Enhancement ☐ Protection ☐ _____	**Project Size:** _____	**Affected Area:** _____

Project Status (please provide as much information as is currently available)

Activity	**Funded?**	**Completed?**	**Additional Notes**
Planning/Design/Permitting:	☐ **Yes** ☐ **No** ☐ **n/a**	☐ **Yes** ☐ **No** ☐ **n/a**	
Property or Resource Acquisition:	☐ **Yes** ☐ **No** ☐ **n/a**	☐ **Yes** ☐ **No** ☐ **n/a**	
Construction:	☐ **Yes** ☐ **No** ☐ **n/a**	☐ **Yes** ☐ **No** ☐ **n/a**	
Maintenance and Future Activities:	☐ **Yes** ☐ **No** ☐ **n/a**	☐ **Yes** ☐ **No** ☐ **n/a**	
Future Construction & Oversight:	☐ **Yes** ☐ **No** ☐ **n/a**	☐ **Yes** ☐ **No** ☐ **n/a**	
Restoration Monitoring:	☐ **Yes** ☐ **No** ☐ **n/a**	☐ **Yes** ☐ **No** ☐ **n/a**	
Conservation Servitude/Easement		☐ **Yes** ☐ **No** ☐ **n/a**	
Other (_____):	☐ **Yes** ☐ **No** ☐ **n/a**	☐ **Yes** ☐ **No** ☐ **n/a**	

Restoration Description and Benefits

Project Partners

Organization	Contact Information	Project Involvement

C. Restoration Projects Considered by the Trustee Council

Table C.1 presents a list of all restoration project ideas submitted to the Trustee Council for consideration, as well as additional projects identified by the Trustee Council.

Table C.1. Natural resource restoration project ideas submitted to the Nyanza Trustee Council or identified by Trustees through site visits and consultations

Project #	Project title	Organization	Summary
Environmental education and stewardship[a]			
1	Protection through Education	Town of Natick	Educate Natick residents and groups on value of SuAsCo Watershed and steps to protect natural resources.
2	Sudbury River NRD Projects Web Based Info Center	Sudbury River Watershed Organization	Website to showcase Nyanza NRD projects; post news articles about Nyanza cleanup; host real-time information on water quality and habitat conditions through monitoring programs; feature recreational activities and access along Sudbury River.
3	Public Information Kiosk	Town of Ashland	Design, construct, and install public information kiosks to educate public about Nyanza, its impacts to Sudbury River and Town of Ashland, and cleanup and restoration efforts.
4	"Come Enjoy the Sudbury River:" Outreach & Education Campaign	SuAsCo Watershed Community Council	Conduct education and outreach campaign to restore safe water-dependent recreational use of Sudbury River, and dispel negative image of the river cast by Nyanza mercury pollution.
5	Sudbury River Environmental Education Program/ Institute	SuAsCo Watershed Community Council	Design and offer environmental education programs for youth, families, and adults in a variety of contexts such as schools, community events, recreation programs, libraries, and conservation leadership institutes.
6	Educational/Interpretive Signage	Town of Concord, Division of Natural Resources	Install multilingual signage (Spanish, Portuguese, and English) along Sudbury, Assabet, and Concord rivers at known fishing locations, warning people of dangers of eating fish caught in these waterways.

Table C.1. Natural resource restoration project ideas submitted to the Nyanza Trustee Council or identified by Trustees through site visits and consultations (cont.)

Project #	Project title	Organization	Summary
7	"Restoring the Sudbury River:" Outreach & Education Materials	SuAsCo Watershed Community Council	Create education and outreach materials on all NRD projects on Sudbury River, explaining benefits to the river and how the public can help on individual projects or by emulating the project elsewhere. Using one entity to create education materials will provide consistency and continuity to the river-wide restoration effort.
8	Construction of Visitor Center	MA DCR	Plan and construct visitor center at the public day use facility to be accessible to the public for programs and meetings as well as provide interpretive materials about the origin, history, and use of Lake Cochituate as a public water supply and recreational resource.
Freshwater habitat restoration			
9	Jackstraw Brook Restoration and Culvert Replacement	Cedar Swamp Conservation Trust (CSCT)	Replace the Warren Road culvert and restore Jackstraw Brook, a tributary of the Cedar Swamp ACEC, designated ORW and cold-water fishery.
10	Restoration of Cold-Water Fish in The Sudbury River Basin	USGS and Sudbury River Watershed Organization	Study to address characteristics making one sub-basin able to support a cold-water fishery and the other not. Findings could help prevent marginal cold-water streams from becoming unsuitable cold-water habitat and identify measures to restore cold-water fisheries.
11	Coordinated Dam Management of the Upper Sudbury River	DFG Riverways Program	Develop and implement a reservoir release management plan for major dams along the upper Sudbury River, to more closely resemble a natural flow regime downstream and improve the ecological conditions.
12	Greenways North Field Restoration	Sudbury Valley Trustees	Restore a 7+ acre field in the Greenways Conservation Area, located along the Sudbury River in Wayland to provide habitat for wildlife that use fields and field edges and/or creation of a wet meadow with small pools to create eastern spadefoot toad (*Scaphiopus holbrookii*) habitat.
13	Sudbury River Riparian Buffer Restoration	Sudbury River Watershed Organization	Rehabilitate riparian buffers to restore natural stream functions and aquatic habitats through research and investigation, demonstration plantings, targeted public outreach and education, subsidized native plant sales, restoration activities, and monitoring of results.

Table C.1. Natural resource restoration project ideas submitted to the Nyanza Trustee Council or identified by Trustees through site visits and consultations (cont.)

Project #	Project title	Organization	Summary
14	Creation of Stearns and Brackett Reservoirs Wildlife Preserve	MA DCR	Transform 12 miles of shoreline and 175 acres of state-owned land into a Wildlife Preserve: (1) rehabilitate historic building into an education center, offices, and a regional conference center using green technologies to showcase residential energy and water conservation techniques; (2) establish wetland, upland, and riparian sites to demonstrate natural restoration processes for mercury contamination, invasive species control, and wildlife habitat enhancement; and (3) identify and develop public access and recreation opportunities, such as hiking, fishing, and boating.
15	Removal of Tire Dump in Forested Wetlands	Sudbury Valley Trustees; Town of Ashland	Remove illegally dumped tires, asphalt shingles, and metal waste from a forested wetland in Ashland.
Watershed management and protection			
16	Creation of Sudbury River Overlay District	Metropolitan Area Planning Council	Develop toolkit and sample bylaws to be implemented by 10 communities along the Sudbury River: stormwater best practices, LID techniques, landscaping standards and guidelines, groundwater recharge techniques, and invasive species control methods.
17	Wastewater Ground Discharge in the Indian Brook Watershed	CSCT	Conduct hydrogeology study and permitting and acquire land for alternative wastewater ground discharge to recharge Indian Brook, a stressed tributary supporting the Hopkinton State Park Reservoir.
18	Framingham Stormwater Improvements	Town of Framingham, Conservation Commission, and Department of Public Works	Improve stormwater quality: (1) purchase vactor truck to routinely clean not only catch basins and manholes, but pipes and swirl concentrators; and (2) purchase and install stormwater quality management structures at one or more locations.
19	Chemical Brook Drainline	Town of Ashland	Replace the Chemical Brook drain to ensure its integrity and to alleviate the storm surge that floods the Fire Station and other downtown areas.

Table C.1. Natural resource restoration project ideas submitted to the Nyanza Trustee Council or identified by Trustees through site visits and consultations (cont.)

Project #	Project title	Organization	Summary
20	Public Awareness Campaign and Low Impact Development Demonstration Projects for Stormwater Utility	Town of Framingham Department of Public Works	Implement a stormwater utility: Initiate public awareness program including LID demonstration projects; undertake water quality analyses of Sudbury River and major tributaries to monitor improvements; analyze and evaluate different stormwater utility programs; research legal and permitting issues; and develop implementation plan.
21	Stormwater Management Improvements	Town of Concord, Division of Natural Resources	Incorporate infiltration design for all roadway reconstruction projects to reduce peak discharge rates and volumes, as well as maximize groundwater recharge.
Invasive plant species control			
22	Biological Control of Purple Loosestrife	USFWS	Undertake focused multi-year effort to supplement existing *Galerucella* beetle population to speed up and expand purple loosestrife control and restore native plants that provide food and shelter for wildlife.
23	Sudbury River Invasive Species Removal (Loosestrife)	Town of Ashland	Involve Ashland in program for purchase, rearing, and release of *Galerucella* beetles.
24	Water Chestnut Control on Concord and Assabet Rivers	USFWS	Institute program for mechanical control and hand-pulling of water chestnut (*Trapa natans*), as well as comprehensive investigation of both rivers to determine total extent of infestation.
25	Heard Pond Water Chestnut Project	Wayland Surface Water Quality Committee	Manage water chestnut in Heard Pond through contracted services for intensive hand-pulling in addition to mechanical harvesting.
26	Mechanical Control of Water Chestnut on Sudbury River and Associated Ponds	USFWS	Support community lease program for aquatic weed harvester to control water chestnut, allowing the partners to use leased harvesters at multiple sites during the optimal time, restricting the ability of chestnut to rebound each year.
27	Aquatic Invasives Species Control (Water Chestnut)	Town of Concord, Division of Natural Resources	Institute leasing program that would allow partners to use leased harvesters at multiple sites during the optimal time, restricting the ability of chestnut to rebound each year.

Table C.1. Natural resource restoration project ideas submitted to the Nyanza Trustee Council or identified by Trustees through site visits and consultations (cont.)

Project #	Project title	Organization	Summary
28	Biological Control of Water Chestnut	USFWS	Conduct formal host specificity investigation into biological control of water chestnut, including (1) complete test plant list to be approved by USDA; (2) additional host specificity test run in China and for critical plants in a U.S. quarantine facility (Cornell University); and (3) submission of a proposal to USDA for release of these beetles.
29	Eradication of Water Chestnut	MA DCR	Continue eradication of water chestnut from Fiske Pond beyond the first phase, which began in 2008.
30	Eradication of Milfoil	MA DCR	Eradicate Eurasian watermilfoil (*Myriophyllum spicatum*) from Lake Cochituate using herbicides and mechanical control.
31	Invasive Plant Control	Lincoln Conservation Department	Fund one or more invasive plant specialists to coordinate field work from inventorying to removal and also education and outreach throughout the watershed.
32	SuAsCo Cooperative Invasive Species Management Area	USFWS	Fund CISMA coordinator to implement regional approach to inventory and control invasive plant species, which cross landownership lines.
33	Terrestrial Invasives Species Control	Town of Concord, Division of Natural Resources	Work with USFWS and other partners to control invasive terrestrial plants from the water's edge of the Sudbury River (and possibly the Assabet and Concord rivers) up to the first road crossing or 100 feet from the river, whichever is further, through mechanical, chemical, and hand-pulling efforts.
34	Restoration of Wild Rice	MassWildlife	Restore native wild rice (*Zizania aquatica*) populations to river reaches in Great Meadows NWR to improve habitat values for waterfowl and other birds and wildlife.

Table C.1. Natural resource restoration project ideas submitted to the Nyanza Trustee Council or identified by Trustees through site visits and consultations (cont.)

Project #	Project title	Organization	Summary
Land acquisition/habitat conservation			
35	Raytheon Land Acquisition	USFWS	Support cost of services associated with acquisition, including survey, contaminants review, and title clearance, of a parcel owned by Raytheon on Route 20 in Wayland.
36	Reach 8 Wildlife Habitat Acquisitions	Sudbury Valley Trustees	Acquire lands for wildlife habitat within Reach 8, a Primary Target Area delineated by EPA, with a primary focus on riparian habitat/freshwater wetlands in the Towns of Wayland and Sudbury.
37	79 Lincoln Lane, Sudbury	Sudbury Conservation Commission	Outright fee purchase of a 1.2-acre parcel on Lincoln Lane in Sudbury, the only remaining developable lot along this stretch of the Sudbury River.
38	Neotropical Connections (Belize)	USFWS	Protection of overwintering habitat in Southern Belize to benefit neotropical songbird migrants that were impacted by mercury contamination from the Nyanza Site.
Diadromous fishery restoration and stewardship			
39	Anadromous Fish Monitoring and Stewardship	LPCT	Support for continuing and expanding an alewife (*Alosa pseudoharengus*) monitoring program.
40	Fish Passage Restoration	LPCT	Support for feasibility analysis, planning, and design, and restoration/construction that would restore fish passage through current fish barriers in Lowell.
41	Fisheries Resources Protection and Restoration	Organization for the Assabet River	Conduct series of related projects to protect and restore a natural assemblage of fish, including anadromous, catadromous, and fluvial dependent fish, in the Sudbury, Assabet and Concord rivers.
42	GIS-based Map of Sudbury River Fish Communities and Impediments to Fish Passage	USGS, Massachusetts-Rhode Island Water Science Center	Develop a GIS application to permit online users to use new navigation and tracing tools in the USGS Massachusetts StreamStats Application to determine the total stream length and fish community classifications of river reaches located upstream or downstream of selected barriers to fish passage.

Table C.1. Natural resource restoration project ideas submitted to the Nyanza Trustee Council or identified by Trustees through site visits and consultations (cont.)

Project #	Project title	Organization	Summary
43	Hydrologic and Water-Quality Support for Fisheries Restoration in Reaches of Sudbury River	USGS	Conduct up to three hydrologic surveys or simulations needed to support an improved fishery in the Sudbury River.
44	Environmental History of Fish Runs and Wetland Meadows	Brandeis University	Conduct research concerning the history of fish runs and dams in the river system and long-term changes in the vegetation and management of the river meadows, from pre-European times to the 20th century.
Recreation and public access			
45	Canoe Launch at Fountain St.	Town of Ashland	Create new roof-top boat access off Fountain Street and parking for shoreline recreational fishing to enhance and encourage recreational use of Sudbury River.
46	Sudbury River Access Improvements	USFWS	Fund engineering studies and permitting of improvements to two popular access points along Sudbury River located on Great Meadows NWR – River Road and Shermans Bridge Road in Wayland.
47	Red Maple Trail Boardwalk and Wildlife Observation Platform	USFWS	Construct Phase I of wheelchair accessible boardwalk and wildlife observation platform overlooking the Sudbury River at the Great Meadows NWR.
48	Upper Sudbury River Public Access for Fishing and Trails	Sudbury River Watershed Organization	Improve and create access for fishing and canoeing in Upper Sudbury River.
49	Riverwalk Bridge at Mill Pond River	Ashland Open Space Committee	Design and construct pedestrian span bridge over narrow inlet at Mill Pond in Ashland to link two sections of the "Riverwalk Trail," part of the regional Bay Circuit Trail.
50	River Room in Wayland and Path to River	Marilynn Gentry and Ellen Tohn, Wayland	Support creation of "river room" and pathway to the planned boat launch, and boat storage facility for a community-based boating program.
51	Sudbury River Access Improvements: Great Meadows NWR Headquarters	Trustee Council	Purchase boating equipment and boat carts for the use by visitors to the Great Meadows NWR headquarters to reduce overcrowding at Sherman Road Bridge.

a. Projects were submitted to the Trustees for consideration under this category (environmental education and stewardship). In preparing this RP, the Trustees assigned some of these projects to other resource categories.