

**ENVIRONMENTAL RESTORATION REPORT
AND
ENVIRONMENTAL ASSESSMENT**

**NEPONSET RIVER FISH PASSAGE AND HABITAT RESTORATION PROJECT
NEPONSET RIVER BASIN**

Milton and Boston, Massachusetts

**MMI #2688-02
November 2006**



Prepared for:

Commonwealth of Massachusetts Riverways Program
Department of Fish and Game
251 Causeway Street, Suite 400
Boston, Massachusetts 02114

Prepared by:

Milone & MacBroom, Inc.
99 Realty Drive
Cheshire, Connecticut 06410
(203) 271-1773



LIST OF ACRONYMS

ACEC	Area of Critical Environmental Concern
ACOE	Army Corps of Engineers
APE	Area of Potential Effect
BNAF	Boston Natural Areas Fund
BNAN	Boston Natural Areas Network
BSWC	Boston Sewer & Water Commission
CFR	Code of Federal Regulations
cfs	cubic feet per second
DCR	Massachusetts Department of Conservation and Recreation
DEM	MA Department of Environmental Management
DEP	MA Department of Environmental Protection
DMF	MA Division of Marine Fisheries
DFG	Massachusetts Department of Fish and Game
DFWELE	MA Department of Fisheries, Wildlife, and Environmental Law Enforcement
EA	Environmental Assessment
EIS	Environmental Impact Statement
EOEA	MA Executive Office of Environmental Affairs
EPA	US Environmental Protection Agency
FEMA	US Federal Emergency Management Agency
FONSI	Finding of No Significant Impact
fps	feet per second
MA	Massachusetts
MAPC	Metropolitan Area Planning Council
MDC	Metropolitan District Commission
MEPA	Massachusetts Environmental Policy Act
MHC	MA Historical Commission
MWRA	Metropolitan Water Resources Authority
NEPA	National Environmental Policy Act
NepRWA	Neponset River Watershed Association
NGVD	National Geodetic Vertical Datum
NOAA	National Oceanic and Atmospheric Administration
NRE	Neponset River Estuary
PAH	Poly-aromatic hydrocarbons
PCB	Poly-chlorinated biphenyls.
T&H	Tileston and Hollingsworth
TAC	Technical Advisory Committee
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey



TABLE OF CONTENTS

EXECUTIVE SUMMARY

1.0 PURPOSE AND NEED

1.1	Background.....	1-1
	1.1.1 Introduction.....	1-1
	1.1.2 Project Background.....	1-3
1.2	Proposed Action and Justification.....	1-5
	1.2.1 Proposed Action.....	1-5
	1.2.2 Project Goals and Objectives.....	1-5
	1.2.3 Project Purpose and need.....	1-6
	1.2.4 Relationship to Other Projects and Planning Documents.....	1-6
	1.2.5 Project Stakeholders and Interested Parties.....	1-9
1.3	The NEPA Process.....	1-10
1.4	The MEPA Process.....	1-11
1.5	Joint Document.....	1-11

2.0 AFFECTED ENVIRONMENT

2.1	Overview of the Study Area.....	2-1
2.2	Historical Perspective.....	2-1
	2.2.1 Historical Significance of the Study Area.....	2-1
	2.2.2 Historic Uses of the Neponset River.....	2-4
	2.2.3 Historic Fish Passage in the Neponset River.....	2-6
	2.2.4 Water Supply Uses of the Neponset River.....	2-7
2.3	River Segmentation.....	2-8
	2.3.1 Segment 1 – Baker Dam to the Former Jenkins Dam Site (0+00 to 17+50).....	2-8
	2.3.2 Segment 2 – Former Jenkins Dam Site to the Northern End of the Anabranched Channel (17+50 to 45+00).....	2-11
	2.3.3 Segment 3 – Northern End of the Anabranched Channel to the Trolley Crossing Upstream of Capen Street (45+00 to 65+00).....	2-12
	2.3.4 Segment 4 – Trolley Crossing Upstream of Capen Street to the Blue Hill Parkway (65+00 to 80+00).....	2-12
	2.3.5 Segment 5 – Blue Hill Parkway to the T&H Dam (80+00 to 135+00).....	2-13
	2.3.6 Segment 6 – T&H Dam to the Commuter Railroad Crossing Near West Street (135+00 to 161+00).....	2-15
2.4	Hydrology and Flood Hazards.....	2-16
	2.4.1 Neponset River Gauge Flows.....	2-16
	2.4.2 FEMA Flood Insurance Studies.....	2-17
	2.4.3 Flood Protection.....	2-18

2.5	Water Quality.....	2-18
	2.5.1 Overview.....	2-18
	2.5.2 Contaminants and Nutrients.....	2-21
	2.5.3 Metals and Organic Pollutants.....	2-22
	2.5.4 Summary.....	2-23
2.6	Sediment Quality.....	2-24
	2.6.1 Overview.....	2-24
	2.6.2 Sediment Toxicity.....	2-27
	2.6.3 Summary.....	2-27
2.7	Biological Environment.....	2-28
	2.7.1 Fisheries.....	2-28
	2.7.2 Vegetation.....	2-29
	2.7.3 Inland Wetlands.....	2-32
	2.7.4 Tidal Wetlands.....	2-35
	2.7.5 Wildlife.....	2-35
	2.7.6 Species of Special Concern.....	2-36
2.8	Physical Environment.....	2-36
	2.8.1 Topography.....	2-36
	2.8.2 Bedrock Geology.....	2-37
	2.8.3 Surficial Geology.....	2-37
	2.8.4 Ground Water Gradient.....	2-39
2.9	Aesthetic Environment.....	2-40
2.10	Public Access and Recreational Resources.....	2-40
2.11	Infrastructure.....	2-41
	2.11.1 Baker Dam.....	2-41
	2.11.2 Jenkins Dam.....	2-42
	2.11.3 MWRA Crossing.....	2-42
	2.11.4 Rock Obstruction.....	2-42
	2.11.5 T&H Dam.....	2-42
	2.11.6 Railroad Crossings.....	2-43
	2.11.7 Bridges.....	2-43
	2.11.8 Utility Crossings.....	2-43
2.12	Cultural Resources.....	2-43
	2.12.1 Walter Baker Dam.....	2-43
	2.12.2 Dorchester/Milton Lower Mills Industrial District.....	2-45
	2.12.3 Archaeological Sites at the Baker Dam.....	2-48
	2.12.4 Tileston & Hollingsworth Dam.....	2-49
	2.12.5 Archaeological Sites at the T&H Dam.....	2-51
2.13	Future Conditions without the Project.....	2-51

3.0 SEDIMENT MANAGEMENT ALTERNATIVES

3.1	Introduction.....	3-1
3.2	Substrate Characterization.....	3-2
3.2.1	Segment 1 – Baker Dam to the Former Jenkins Dam Site (0+00 to 17+50)	3-2
3.2.2	Segment 2 – Former Jenkins Dam Site to the Northern End of the Anabranched Channel (17+50 to 45+00)	3-4
3.2.3	Segment 3 – Northern End of the Anabranched Channel to the Trolley Crossing Upstream of Capen Street (45+00 to 65+00)	3-4
3.2.4	Segment 4 – Trolley Crossing Upstream of Capen Street to the Blue Hill Parkway (65+00 to 80+00)	3-4
3.2.5	Segment 5 – Blue Hill Parkway to the T&H Dam (80+00 to 135+00)	3-5
3.2.6	Segment 6 – T&H Dam to the Commuter Railroad Crossing Near West Street (135+00 to 161+00).....	3-5
3.2.7	Pebble Counts.....	3-6
3.3	Sediment Depths and Distribution	3-7
3.3.1	Baker Dam	3-8
3.3.2	T&H Dam.....	3-10
3.4	Sediment Yield and Volumes	3-11
3.5	Sediment Transport Analysis.....	3-13
3.5.1	Overview	3-13
3.5.2	Sediment Resistance to Motion.....	3-14
3.5.3	Sediment Stability Analysis	3-15
3.5.4	Sediment Transport Rates	3-17
3.6	Sediment Management Alternatives	3-17
3.6.1	Management Options.....	3-17
3.6.2	Remediation Technology Feasibility and Effectiveness Analysis	3-21

4.0 RESTORATION ALTERNATIVES CONSIDERED

4.1	Overview of Fish Passage Restoration Alternatives	4-1
4.1.1	Fish Ladders	4-1
4.1.2	Dam Removal.....	4-2
4.1.3	Partial Dam Removal.....	4-2
4.1.4	Roughened Ramps.....	4-3
4.1.5	Bypass Channels.....	4-3
4.1.6	Channel Relocation.....	4-4
4.2	Target Fish Species	4-4
4.3	Hydrologic and Hydraulic Analysis.....	4-7
4.3.1	Hydrologic Analysis	4-7
4.3.2	HEC-RAS Model Description.....	4-9
4.3.3	Existing Conditions	4-10
4.4.4	Proposed Conditions Model Runs	4-14

4.4	Summary of Restoration Alternatives Considered.....	4-14
4.5	Alternatives Considered at the Baker Dam	4-15
4.5.1	Introduction	4-15
4.5.2	Baker Size and Classification.....	4-16
4.5.3	Baker Dam Spillway Capacity	4-16
4.5.4	Tidal Influence	4-18
4.5.5	Alternative B1 – Do Nothing	4-18
4.5.6	Alternative B2 – Fish Ladder	4-19
4.5.7	Alternative B3 – Dam Removal	4-21
4.5.8	Alternative B4 – Rock Ramp	4-24
4.6	Alternatives Considered in the Anabranched Channel.....	4-27
4.6.1	Alternative A1 – Do Nothing	4-27
4.7	Alternatives Considered at the MWRA Pipe Crossing	4-29
4.7.1	Alternative MWRA-1 – Do Nothing	4-29
4.7.2	Alternative MWRA-2 – Rock Ramp	4-30
4.8	Alternatives Considered at the Rock Dam	4-30
4.8.1	Alternative Rock-1 – Do Nothing	4-30
4.8.1	Alternative Rock-2 – Boulder Removal	4-31
4.9	Alternatives Considered at the T&H Dam	4-31
4.9.1	Alternative T1 – Do Nothing	4-32
4.9.2	Alternatives T2a and T2b – Fish Ladder	4-33
4.9.3	Alternative T3 – Dam Removal	4-34
4.9.4	Alternative T4 – Rock Ramp	4-38
4.9.5	Alternative T5 – Bypass Channel.....	4-40
4.9.6	Alternative T6 – Channel Relocation	4-41
4.10	Sediment Disposal Options.....	4-43
4.10.1	Overview	4-43
4.10.2	Off-Site Disposal Options	4-44
4.10.2	On-Site Disposal and In-Situ Remediation.....	4-46
4.11	Alternatives Analysis	4-47
4.11.1	Summary of Alternatives	4-47
4.11.2	Incremental Analysis	4-47
4.11.3	Cost Opinions	4-50
4.12	Recommended Alternatives.....	4-55
5.0	IMPACT EVALUATION	
5.1	Introduction.....	5-1
5.2	Hydrologic Impacts and Flood Hazard Potential.....	5-1

5.2.1	Potential Hydrologic Impacts.....	5-1
5.2.2	Flood Hazard Potential – Baker Dam.....	5-1
5.2.3	Flood Hazard Potential – Anabranched Channel.....	5-2
5.2.4	Flood Hazard Potential – MWRA Pipe Crossing.....	5-4
5.2.5	Flood Hazard Potential – Rock Dam.....	5-4
5.2.6	Flood Hazard Potential – T&H Dam.....	5-4
5.3	Potential Water and Sediment Quality Impacts.....	5-5
5.3.1	Baker Dam.....	5-5
5.3.2	Anabranched Channel.....	5-5
5.3.3	MWRA Pipe Crossing.....	5-6
5.3.4	Rock Dam.....	5-6
5.3.5	T&H Dam.....	5-6
5.4	Potential Biological Impacts.....	5-7
5.4.1	Baker Dam.....	5-7
5.4.2	Anabranched Channel.....	5-8
5.4.3	MWRA Pipe Crossing.....	5-8
5.4.4	Rock Dam.....	5-8
5.4.5	T&H Dam.....	5-9
5.4.6	Anadromous Fish Habitat.....	5-10
5.4.7	Channel Restoration Activities.....	5-10
5.5	Potential Physical Impacts.....	5-10
5.6	Potential Impacts to Aesthetics.....	5-10
5.7	Potential Impacts to Public Access and Recreation.....	5-11
5.8	Potential Impacts to Infrastructure.....	5-11
5.9	Potential Impacts to Cultural Resources.....	5-12
5.10	Regulatory Requirements.....	5-13
5.10.1	Potentially Required Federal Permits and Approvals.....	5-14
5.10.2	Potentially Required State Permits.....	5-14
5.10.3	Potentially Required Local Permits.....	5-15
5.10.4	Summary of Permits.....	5-15
5.11	Next Steps.....	5-15
6.0	CONSULTATION AND COORDINATION	
7.0	DOCUMENT PREPARERS	
8.0	REFERENCES	

TABLES

Table 1-1	Areas of Focus – Neponset River Restoration	1-4
Table 1-2	Neponset River Restoration Studies and Projects	1-7
Table 2-1	Existing Dams on Neponset River.....	2-6
Table 2-2	River Segments and Stationing	2-10
Table 2-3	Mean Monthly Runoff – Neponset River at Milton	2-16
Table 2-4	Summary of FEMA Discharges	2-17
Table 2-5	FEMA Summary of Stillwater Elevations at the Neponset River at Dorchester Bay	2-17
Table 2-6	Water Quality Parameters	2-20
Table 2-7	Neponset Bacterial Pollution Areas (NepWRA 1/1/01-3/31/03).....	2-21
Table 2-8	Summary of Sediment Contamination in the Neponset River in 2001 Compared with 1994 Results	2-25
Table 2-9	PCB Concentrations in Selected Grab and Sediment Core Samples.....	2-27
Table 2-10	Woody Plant Species Observed in the Urban, Channelized River Stretch from Mattapan Square to Baker Dam in 1997	2-29
Table 2-11	Buildings within the Dorchester/Milton Lower Mills Industrial District	2-47
Table 2-12	Archaeological Sites Noted in the Vicinity of Baker Dam.....	2-48
Table 3-1	Neponset River Sediment Size Distribution, Upstream of the Anabranched Channel	3-6
Table 3-2	Percent of Sample Belonging to Particle Size Class, Upstream of the Anabranched Channel.....	3-6
Table 3-3	Neponset River Sediment Size Distribution, Anabranched Channel	3-7
Table 3-4	Percent of Sample Belonging to Particle Size Class, Anabranched Channel	3-7
Table 3-5	Sediment Volumes and Watershed Yield	3-12
Table 3-6	Shear Stress for the Neponset River – 100-Year Flood Flow	3-16
Table 3-7	Modeled Sediment Transport Capacity for the 1-Year Event.....	3-17
Table 3-8	Estimated River Sediment Volumes.....	3-18
Table 3-9	Remediation Technology Effectiveness Assessment	3-22
Table 4-1	Fish Passage Requirements for Target Species.....	4-5
Table 4-2	Neponset River Flows.....	4-9
Table 4-3	Comparison Model Generated Water Surface Elevations (WSEL) for the Mean April Flow Event	4-13
Table 4-4	Summary of Alternatives Considered.....	4-14
Table 4-5	Baker Dam Data	4-15
Table 4-6	Baker Dam Spillway Capacity Analysis.....	4-17
Table 4-7	Tide Elevations.....	4-24
Table 4-8	Rock Ramp Hydraulic Comparison.....	4-25

Table 4-9	Anabranched Channel Data.....	4-27
Table 4-10	Anabranched Channel Dimension Analysis.....	4-28
Table 4-11	T&H Dam Data	4-31
Table 4-12	HEC-RAS Results at T&H Dam – Enhanced Dam Removal Alternate @ Cross Section 142+80.....	4-35
Table 4-13	T&H Dam Bypass Channel (B=10 feet).....	4-41
Table 4-14	T&H Dam Relocated Channel	4-43
Table 4-15	Contaminant Levels for Soil Reuse at Massachusetts Landfills	4-45
Table 4-16	EPA Approved Chemical Waste Landfills	4-46
Table 4-17	EPA Approved Incinerators	4-46
Table 4-18	Fish Passage Efficiencies	4-48
Table 4-19	Incremental Model.....	4-49
Table 4-20	Comparison of Alternatives	4-51
Table 4-21	Cost Summary of Individual Alternatives	4-52
Table 4-22	Cost Summary of Alternative Sets	4-53
Table 4-23	Summary of Projects with Cost Opinions Less than \$10M.....	4-53
Table 4-24	Summary of Recommended Alternatives	4-55
Table 5-1	Summary of Preferred Alternatives	5-1
Table 5-2	HEC-RAS Results at Baker Dam – Full Removal Alternative at Station 90+00.....	5-2
Table 5-3	Predicted Flow Velocities in the Anabranched Channel – Existing Conditions	5-3
Table 5-4	Predicted Flow Velocities in the Anabranched Channel	5-3
Table 5-5	Anabranched Channel HEC-RAS Analysis at Station 38+15.....	5-4
Table 5-6	Summary of Possible Permits	5-17
Table 6-1	Neponset River Coordination Meetings Held by ACOE.....	6-1
Table 6-2	Neponset River Coordination Meetings Held by Massachusetts Riverways Programs	6-2

LIST OF FIGURES

Figure 1-1 Location Plan – Lower Neponset River..... 1-2

Figure 2-1 Aerial Photograph of Project Corridor..... 2-2

Figure 2-2 Neponset River Watershed..... 2-3

Figure 2-3 River Segments and Stationing 2-9

Figure 2-4 Surficial Geology..... 2-38

Figure 2-5 Map of Dorchester/Milton Lower Mills Industrial District, 1980..... 2-46

Figure 2-6 Map of Dorchester/Milton Lower Mills Industrial District, 2001..... 2-46

Figure 2-7 Map of Archaeological Sites in the Project Area 2-49

Figure 3-1 Sediment Substrate Profile..... 3-3

Figure 3-2 Sediment Thickness at the Baker Dam, Station 0+20 3-8

Figure 3-3 Sediment Thickness at the Baker Dam, Station 3+50 3-9

Figure 3-4 Sediment Thickness at the Baker Dam, Station 4+50 3-9

Figure 3-5 Sediment Thickness at the T&H Dam, Station 140+97..... 3-10

Figure 3-6 Sediment Thickness at the T&H Dam, Station 142+00..... 3-11

Figure 4-1 Rainbow Smelt Spawning Area 4-8

LIST OF APPENDICES

Appendix A Conceptual Design Drawings

Appendix B Cost Matrices

TOC.doc

EXECUTIVE SUMMARY

INTRODUCTION

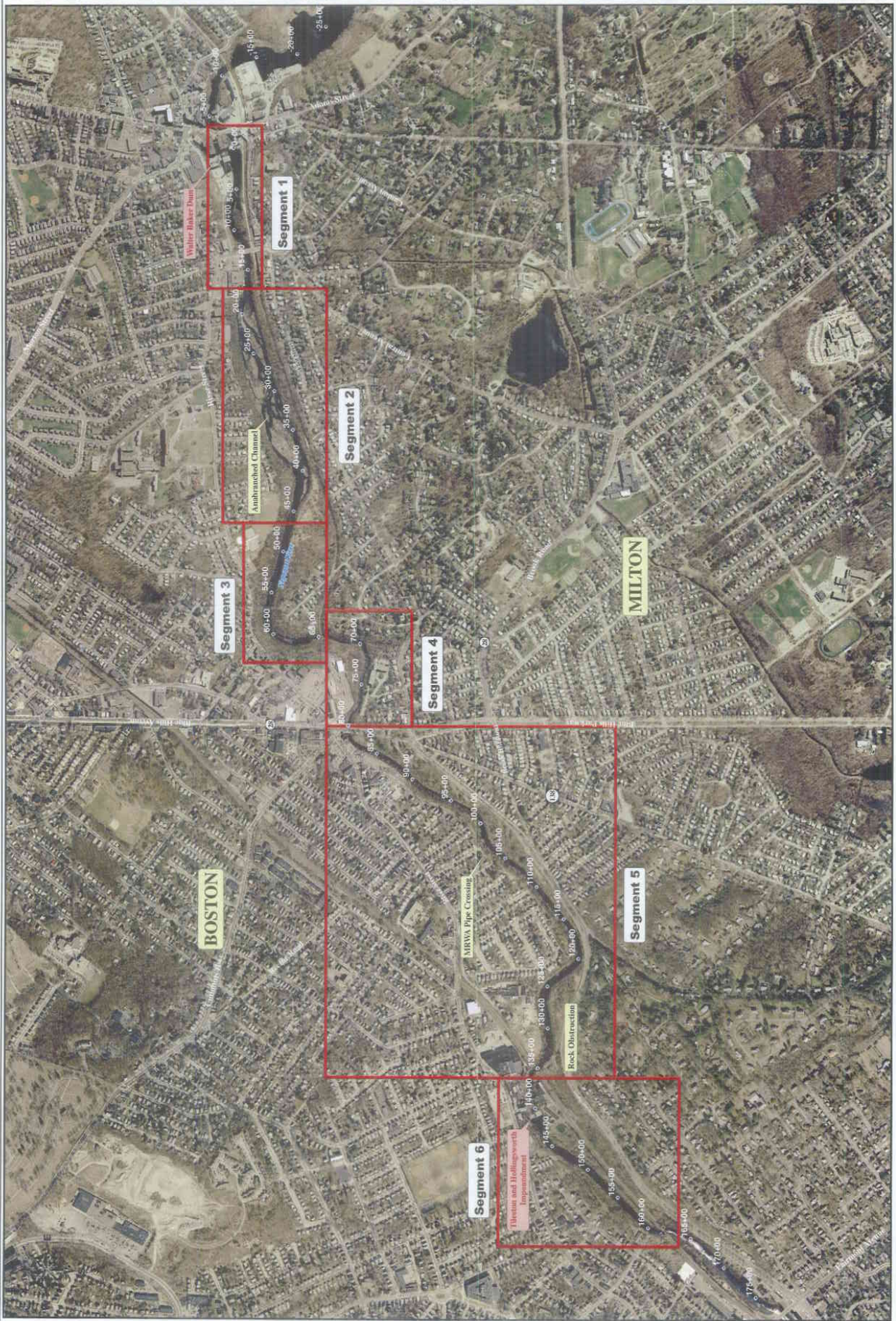
The Massachusetts Riverways Program, a division of the Department of Fish and Game, is undertaking a proposed restoration program of the lower Neponset River in Boston and Milton, Massachusetts. Specifically, this project is aimed at restoring anadromous fish passage and improving habitat quality in the river. This document presents the detailed analysis of restoration alternatives, along with a summary of the comprehensive record of data that has been collected over the past several years. Figure ES-1 is an aerial photograph of the project corridor, with significant landmarks called out.

The Neponset River watershed encompasses approximately 117 square miles and a length of approximately 30 miles from its source at the outlet of the Neponset Reservoir in Foxborough to its outlet in Boston Harbor. The river flows from southwest to northeast through the suburban and urban areas of southwest Foxborough, Sharon, Walpole, Norwood, Canton, Dedham, Milton, and Boston, discharging into Dorchester Bay. The watershed extends into Medfield, Dover, Westwood, Stoughton, Randolph, and Quincy.

The project study area begins just downstream of the Baker Dam, located in the Dorchester-Milton Lower Mills Industrial District and continues upstream past the Tileston and Hollingsworth (T&H) Dam to the confluence with Mother Brook. Below the Baker Dam, the Neponset River flows beneath Adams Street and then downstream through the Neponset River estuary.

The lower Neponset River once supported fresh water and anadromous fish as well as an expansive floodplain system and ecological habitat. Over the last several centuries, the river has been physically and ecologically altered as a result of human activity. The Neponset River corridor is an important resource for maintaining local biodiversity; however the corridor's overall regional biodiversity is limited by its channelization, lack of floodplain areas, limited wetland cover types, bordering land uses, and manmade dams.

Two early industrial run-of-the-river dams are located on the lower reach of the Neponset, both of which block fish passage. These are known as the Baker Dam and the T&H Dam. The Baker Dam is the most downstream of the two structures, located at the head of tide. The T&H Dam is located approximately 2½ miles upstream of the Baker Dam. Other notable physical features between these two dams are summarized in Table ES-1. In an effort to establish a common locational reference, the river has been stationed along its centerline, beginning at Station 0+00 at the Baker Dam and extending to Station 190+00 at the confluence of the Neponset River and Mother Brook, upstream of the T&H Dam. This stationing is reflected in Figure ES-1 and in Table ES-1.



**TABLE ES-1
Areas of Focus – Neponset River Restoration**

<i>Reference Area</i>	<i>River Station #</i>	<i>Comments</i>
Baker Dam	0+00	Dam at crest elevation 13.90 ft. Fish passage barrier.
Anabranched Channel	17+50	Former impoundment bed of Jenkins Dam.
MRWA Pipe Crossing	101+50	Concrete encased utility stream crossing. Fish barrier.
Rock Dam Remnants	124+00	Former dam remnants. Fish passage barrier.
T&H Dam	140+00	Dam at crest elevation 36.50 ft. Fish passage barrier.



View of Baker Dam looking upstream.



View of T&H Dam from the right bank.

As with many urban rivers, present day water quality and benthic sediments in the Neponset reflect urban and industrial discharges with historic contaminants and limited modern point discharges. The U.S. Army Corps of Engineers and the U.S. Geologic Survey have documented contaminated sediments in the Neponset River. Poly-chlorinated biphenyls are the primary pollutant of concern; however polyaromatic hydrocarbons, metals and other contaminants are also present.

In light of the historic alterations to the lower Neponset River, restoration of this river corridor has been the focus of a number of efforts over the past several decades, encompassing a broad spectrum of parameters, including stormwater quality management, treatment of industrial wastewater discharges, hazardous waste clean-up efforts, sediment quality assessment, creation of public parks and trails along the river, public involvement programs, and a host of other improvements. The current restoration effort focuses on aquatic habitat and anadromous fish passage, with water quality and sediment management as integral components thereof.

The following project goals and objectives have been identified by Riverways and other project stakeholders:

- To restore anadromous fish passage in the lower Neponset River, including American shad, alewife, blueback herring, rainbow smelt, and American eel.
- To improve the aquatic and riparian habitat upstream of the Baker and T&H dams.
- To manage and/or remediate PCB-laden sediments such that the lower Neponset River is suitable for anadromous fish spawning and as a resident fishery habitat while reducing the potential threats to public health associated with PCBs and other contaminants.
- To maintain the flood control function of the lower Neponset River.
- To provide for long-term dam safety at the Baker and T&H dam sites.
- To be compatible with the goals of the Department of Conservation and Recreation (DCR) Division of Urban Parks and Recreation, the Neponset River Watershed Association (NepRWA), Boston Natural Areas Network (BNAN), and other community partners in their mission to improve public access to the lower Neponset River for active and passive recreation.
- To recognize historic and cultural resources in and along the river through preservation, proper documentation, and/or interpretation.
- To develop aesthetically pleasing and cost effective restoration solutions.

SEDIMENT MANAGEMENT CONSIDERATIONS

The occurrence of contaminated sediment in the Neponset River within the study area as well as in upstream and downstream reaches has been well documented. The sediment quality is reflective of the river's long history of industrial and urban activities. Several studies have been undertaken to define the extent and degree of contaminant distribution in the Neponset River, with remediation of "hot spots" and past disposal sites. While a variety of contaminant types have been documented, the two that are of greatest concern are poly-chlorinated bicarbons (PCBs) and polyaromatic hydrocarbons (PAHs).

Any restoration activities for fish passage and habitat restoration must consider the proper management and/or remediation of contaminated sediments that may be encountered. This will be particularly important in areas where disturbance to the river bed substrate will occur.

Additionally, sediment transport capacity will be critically important in determining the feasibility of remediation alternatives, particularly since the highest accumulation of sediments tends to occur behind the dams that are blocking fish passage. If these structures were to be altered or removed without addressing the upstream sediment, uncontrolled and/or unwanted release of contaminated sediment could occur, potentially impacting the downstream environment.

While surface sediments contain contaminants, a majority of sediment contamination occurs well below the riverbed or in areas that will not be impacted by fish passage restoration activities. In these instances, stabilization in place may be the most ecologically beneficial action.

Given the importance of proper sediment management in the context of stream restoration alternatives, careful consideration was given to the river substrate quality, characteristics, and susceptibility to erosion potential. Existing and projected post-construction conditions were evaluated with respect to the stability of sediments in the Neponset River, as were the ecological benefits and impacts associated with the management of the river's deposited sediments.

In 2005, The Johnson Company, under contract to Massachusetts Riverways Program, completed a study that evaluated potential management options aimed at reducing the risks to public health and the ecological habitat associated with the exposure to the river's contaminated sediments. The evaluation, entitled *Management Strategies for Ecological Restoration and Contaminant Remediation in the Lower Neponset River* (2005), identified the following management strategies:

- In-situ treatment
- In-situ stabilization
- Capping (isolation and/or erosion protection)
- Sediment removal and on-site or off-site disposal
- Bioengineering
- Natural attenuation

These sediment management options have been evaluated in conjunction with the development of fish passage alternatives. For the options that propose dredging and/or disposal of the sediments behind the Baker and T&H dams, off-site disposal options will depend on the PCB levels in the excavated sediments. Bulk PCB remediation waste containing levels less than 50 ppm may be hauled to and disposed at the following places:

- EPA approved PCB disposal facility;
- Permitted municipal solid waste or non-municipal non-hazardous waste facility (pursuant to Sec 761.61 (a) or (c) of the TSCA); or
- Permitted hazardous waste landfill (pursuant to RCRA Sec. 3004 or Sec 3006).

Bulk PCB remediation waste containing levels at or greater than 50 ppm may be hauled to and disposed at the following locations:

- EPA approved incinerator (pursuant to 40 CFR §761.70);
- EPA approved chemical waste landfill (pursuant to 40 CFR §761.75); or
- Permitted hazardous waste landfill (pursuant to RCRA Sec. 3004 or Sec 3006).

Alternatives to off-site disposal include disposal on-site, in-situ stabilization, or remediation. For example, confined disposal cells that can be located within the river, on-shore, or in adjacent uplands may be used to store the bulk PCB remediation waste. Under the Toxic Substances Control Act (TSCA), the waste must be contained or capped with an appropriate technology that minimizes human exposure and erosion.

RESTORATION ALTERNATIVES CONSIDERED

A total of 28 alternatives were evaluated at the Baker and T&H dams, the anabranch channel, the MWRA crossing, and the rock obstruction/old boulder dam. These are summarized in Table ES-2. Conceptual design drawings for select alternatives are appended to this document, and show plan view, profile, and typical cross sections. Evaluated alternatives include construction of fish ladders, dam removal, rock ramps, bypass channels, and channel relocation in combination with various sediment management techniques. In addition to the primary alternatives, a number of sub-alternatives were also evaluated. The alternatives were measured against the identified project goals and objectives.

As expected, the alternatives and corresponding sub-alternatives present a number of advantages and disadvantages. While some of the alternatives do not propose a sediment management strategy and hence have the advantage of being less costly, they fail to meet all of the goals of the restoration effort.

An incremental analysis model was used to determine the efficiency of different combinations of alternatives. The model was used to determine what set of options results in the highest number of river miles made accessible to the target fish species. Consistent with the methods developed by the Army Corps of Engineers, the incremental cost analysis model was developed to evaluate the effectiveness of a combination of restoration alternatives along the Neponset River. The model uses the following two parameters to determine the efficiency of the selected combination of alternatives and results in the ranking of each:

1. Fish passage efficiency at the downstream and upstream ends; and
2. The number of river miles projected to become available to the target species as a result of the restoration.

**TABLE ES-2
Summary of Alternatives Considered**

<i>Alternative</i>	<i>Description</i>	<i>Sub-alternative</i>
<i>Baker Dam</i>		
B1	Do nothing	
B2	Fish Ladder	a) Left bank
		b) Right bank
B3	Dam Removal	a) No sediment dredging
		b) Full sediment dredging
		c) Containment wall on left bank with in-situ sediment cap
		d) Containment wall on right bank with in-situ sediment cap
B4	Rock Ramp	a) To top of flashboards, full impoundment
		b) To top of concrete weir, partial impoundment
		c) 4% slope
<i>Anabranched Channel</i>		
A1	Do nothing	
<i>MWRA Crossing</i>		
MWRA-1	Do nothing	
MWRA-2	Rock ramp	
<i>Rock Obstruction – Old Boulder Dam</i>		
Rock-1	Do nothing	
Rock-2	Boulder removal	
<i>T&H Dam</i>		
T1	Do nothing	
T2	Fish Ladder	a) Left bank
		b) Right bank
T3	Dam Removal	a) No sediment dredging
		b) Full sediment dredging
		c) Partial removal with in-situ sediment stabilization
		d) Partial removal with containment wall and in-situ sediment cap
T4	Rock Ramp	a) To top of gates, full impoundment
		b) To top of concrete weir, partial impoundment
		c) 4% slope
T5	Bypass Channel	
T6	Channel Relocation	a) Full length relocation
		b) Partial length relocation

Based on the incremental model results, the most efficient (ranking of 1) set of alternatives include:

- B3 & T3: Removal of both the Baker and T&H Dams.
- B3 & T5: Removal of the Baker Dam and construction of a bypass channel at the T&H Dam.
- B3 & T6: Removal of the Baker Dam and relocation of the channel at the T&H Dam.

Table ES-3 presents an alternatives comparison matrix to evaluate each of the alternatives relative to fish passage, habitat restoration, sediment stability, remediation potential, flood impacts, and the ability to meet project goals and objectives. Based upon the evaluation of alternatives in the context of meeting project goals and objectives, the following alternatives are believed to be viable with regard to engineering feasibility and ability to meet project goals and objectives:

Baker Dam

- Alternative B3b – Dam Removal with Full Dredging
- Alternative B3d – Dam Removal with Containment Wall and In-situ Cap on Right Bank
- Alternative B4b – Rock Ramp with Partial Impoundment

T&H Dam

- Alternative T3b – Full Dam Removal with Full Dredging
- Alternative T3d – Partial Dam Removal with Containment Wall and In-Situ Cap
- Alternative T4c – Partial Dam Removal with Rock Ramp @ 4% Slope
- Alternative T5 – Bypass Channel
- Alternative T6b – Partial Length Channel Relocation

Full dam removal (and in the case of the T&H Dam, partial horizontal removal) options are considered to be the most favorable relative to fish passage and restoration of a free-flowing "natural" channel. The rock ramp alternatives have a high degree of fish passage efficiency, but are inferior with respect to upstream channel habitat restoration. The bypass channel and channel relocation alternatives have good potential to create new habitat, but with a greater degree of complexity and cost, given the interaction with the commuter rail line.

All of the above alternatives meet the project goals and objectives, including fish passage, aquatic and riparian habitat improvement, sediment stability and sediment management, maintenance of the flood control function of the river, and long-term dam safety. Other project objectives, including public access, protection of surrounding cultural resources, and aesthetics, can be addressed through the design process.

Preliminary engineering opinions of costs were developed for the most feasible alternatives as well as the no action alternative for each of the two dams. Table ES-4 presents individual alternate costs. Table ES-5 summarizes the costs for the feasible alternative sets in order of their ranking for fish passage. For comparison purposes, the "do nothing" alternative, which includes replacement, operations, and maintenance costs for the two dams, is \$7,250,000. The least costly combination of alternatives with a fish passage ranking of "1" is full removal of the Baker Dam with on-site sediment management via a containment wall on the right bank and in-situ cap, along with a partial horizontal (full vertical) removal at the T&H Dam with on-site sediment management via a containment wall. The least expensive alternative set is full removal of Baker Dam with a partial vertical and horizontal removal at T&H Dam in conjunction with a rock ramp.

**TABLE ES-3
Comparison of Alternatives**

<i>Alternate</i>	<i>Fish Passage</i>	<i>Habitat Restoration</i>	<i>Sediment Stability</i>	<i>Sediment Remediation Potential?</i>	<i>Potential Flood Impacts?</i>	<i>Meets Project Goals & Objectives?</i>	<i>Ecological Risk</i>
Baker Dam Alternatives							
B1 - Do Nothing	-	-	O	-	Yes	No	Low
B2 - Fish Ladder	O	-	O	-	Yes	No	Low
B3 - Dam Removal							
a. No Dredging	+	O	-	-	No	No	High
b. Full Dredging	+	+	+	+	No	Yes	Low
c. Containment Wall - Left Bank	+	+	+	+	No	1	Low
d. Containment Wall - Right Bank	+	+	+	+	No	Yes	Low
B4 - Rock Ramp							
a. Full Impoundment	+	-	O	O	Yes	No	High
b. Partial Impoundment	+	O	O	+	No	Yes	Low
c. 4% Slope	+	O	-	+	No	2	High
Anabranch Channel Alternatives							
A1 - Do Nothing	+	+	+	O	No	Yes	Low
MWRA Pipe Crossing Alternatives							
MRWA-1 - Do Nothing	-	-	O	O	No	No	Low
MRWA-2 - Rock Ramp	+	+	+	O	No	Yes	Low
Rock Dam Alternatives							
Rock-1 - Do Nothing	-	-	O	O	No	No	Low
Rock-2 - Boulder Removal	+	+	+	O	No	Yes	Low
T&H Dam Alternatives							
T1 - Do Nothing	-	-	+	-	No	No	Low
T2 - Fish Ladder	-	-	+	-	Yes	No	Low
T3 - Dam Removal							
a. No Dredging	+	O	-	-	No	No	High
b. Full Sediment Dredging	+	+	+	+	No	Yes	Low
c. Partial Removal with Stabilization	+	O	O	O	No	3	Moderate
d. Partial Removal with Containment Wall	+	+	+	+	No	Yes	Low
T4 - Rock Ramp							
a. Full Impoundment	-	-	+	O	Yes	No	Moderate
b. Partial Impoundment	O	O	O	+	Maybe	No	Low
c. 4% Slope	+	O	O	-	No	Yes	Low
T5 - Bypass Channel	+	O	+	-	No	Yes	Low
T6 - Channel Relocation							
a. Full Length Relocation	+	+	+	+	No	4	Low
b. Partial Length Relocation	+	+	+	+	No	Yes	Low

+ = Good

O = Moderate or Fair

- = Poor

1 Discounted in favor of Alternative B3d

2 Discounted in favor of Alternative B4b

3 Discounted in favor of Alternative T3d

4 Meets project goals, but is not feasible due to physical constraints

TABLE ES-4
Cost Summary of Individual Alternatives

<i>Alternative</i>	<i>Description</i>	<i>Total Cost</i>
<i>Baker Dam Alternatives</i>		
B1	No Action	\$3,625,000
B3a	Dam Removal with No Sediment Dredging	\$708,000
B3b	Dam Removal with Full Sediment Dredging	\$11,038,000
B3c	Dam Removal with Containment Wall and Cap on Left Bank	\$1,437,000
B3d	Dam Removal with Containment Wall and Cap on Right Bank	\$1,557,000
B4b	Rock Ramp to the top of the Concrete Weir	\$10,244,000
<i>T&H Dam Alternatives</i>		
T1	No Action at T&H Dam	\$3,625,000
T2	Fish Ladder	\$419,000
T3b	Full Dam Removal with Full Sediment Dredging	\$7,668,000
T3c	Partial Dam Removal and In-situ Sediment Stabilization	\$1,639,000
T3d	Partial Dam Removal and Containment Wall	\$1,645,000
T4c	Rock Ramp with 4% Slope	\$426,000
T5	Bypass Channel	\$3,634,000
T6b	Partial Length Relocation	\$9,943,000
<i>Other Alternatives</i>		
MWRA-2	Rock Ramp	\$316,000
Rock-2	Boulder Removal	\$45,000

TABLE ES-5
Cost Summary of Alternative Sets

<i>Alternative Set</i>	<i>Action at Baker Dam</i>	<i>Action at T&H Dam</i>	<i>Ranking</i>	<i>Total Cost</i>
B3d & T3d	Removal w/ Containment Wall on Rt Bank	Partial Removal with Containment Wall	1	\$3,201,750
B3d & T5	Removal w/ Containment Wall on Rt Bank	Bypass Channel	1	\$5,190,500
B3d & T3b	Removal w/ Containment Wall on Rt Bank	Full Removal with Full Dredging	1	\$9,224,250
B3d & T6b	Removal w/ Containment Wall on Rt Bank	Partial Length Channel Relocation	1	\$11,499,250
B3b & T3d	Removal w/ Full Dredging	Partial Removal with Containment Wall	1	\$12,683,125
B3b & T5	Removal w/ Full Dredging	Bypass Channel	1	\$14,671,875
B3b & T3b	Removal w/ Full Dredging	Full Dam Removal with Full Dredging	1	\$18,705,625
B3b & T6b	Removal w/ Full Dredging	Partial Length Channel Relocation	1	\$20,980,625
B3d & T4c	Removal w/ Containment Wall on Rt Bank	Partial Removal w/ Rock Ramp @ 4%	2	\$1,982,750
B3b & T4c	Dam Removal w/ Full Dredging	Partial Removal w/ Rock Ramp @ 4%	2	\$11,464,125
B4b & T3d	Rock Ramp w/ Partial Impoundment	Partial Removal w/ Containment Wall	2	\$11,889,375
B4b & T5	Rock Ramp w/ Partial Impoundment	Bypass Channel	2	\$13,878,125
B4b & T3b	Rock Ramp w/ Partial Impoundment	Full Removal with Full Dredging	2	\$17,911,875
B4b & T6b	Rock Ramp w/ Partial Impoundment	Partial Length Channel Relocation	2	\$20,186,875
B4b & T4c	Rock Ramp w/ Partial Impoundment	Partial Removal w/ Rock Ramp @ 4%	3	\$10,670,375

Executive Summary
Environmental Restoration Report and Environmental Assessment
Neponset River Fish Passage and Habitat Restoration Project
November 2006

Table ES-6 summarizes the recommended alternatives, as well as secondary alternatives that should be held in consideration in case one of the preferred alternatives falls through. The preliminary preferred alternative set recommendation is based upon the least costly alternative with a fish passage ranking of "1" that met all of the project goals and objectives.

**TABLE ES-6
Summary of Recommended Alternatives**

<i>Location</i>	<i>Recommended Alternative</i>		<i>Secondary Alternative(s)</i>	
Baker Dam	B3d	Removal w/ Containment Wall and Cap	B3b B4b	Dam Removal with Dredging Rock Ramp
Anabranched Channel	A1	Do Nothing	N/A	N/A
MWRA Pipe Crossing	MWRA-2	Rock Ramp	N/A	N/A
Rock Obstruction	Rock-2	Boulder Removal	N/A	N/A
T&H Dam	T3d	Partial Removal w/ Containment wall and Cap	T4c T5 T3b T6	Rock Ramp @ 4% Slope Bypass Channel Full Removal with Full Dredging Partial Length Channel Relocation

All of the primary and secondary alternatives are believed to meet the project goals and objectives and all are believed to be technically feasible. The ultimate selection of a preferred alternative will depend upon regulatory requirements and success of obtaining permits and approvals; successful land acquisition and easements for construction and long-term operation and maintenance; and available funding. Of particular interest and importance will be the regulatory requirements and "approvability" of constructing containment walls with on-site sediment stabilization and capping at the two dam sites. If this is not acceptable to the regulatory agencies, then the selection of alternatives will need to be revisited.

In addition to the restoration elements involving fish passage and sediment management, channel restoration should be considered as part of any future activities. The existing habitat upstream of the dams consists of long deep pools with low velocities. The pools as well as the trapezoidal flood control channel have little cover and low habitat diversity. Preferred habitat includes mixed pool, runs, and riffles, with intermediate velocities and increased cover. As part of any stream restoration effort, consideration should be given to creating in-stream channel enhancements to add stream features that will increase the diversity in reaches that have long, uniform cross sections, by adding boulders, wood logs, creation of pools, and the like. These types of stream improvements can be coupled with any of the selected alternatives.

EVALUATION OF POTENTIAL PROJECT IMPACTS

Potential impacts have been evaluated for the preferred restoration alternatives presented in Table ES-6 relative to hydrology and hydraulics, water and sediment quality, biology, the

physical environment, aesthetics, public access and recreation, infrastructure, and cultural resources. These are summarized below.

Hydrology – Restoration of the lower Neponset River will not impact the hydrology of the watershed. No detention facilities are proposed and no diversion of water into or out of the watershed will occur. As such, the proposed restoration will neither benefit nor impact the watershed's hydrology.

Hydraulics – No adverse impacts have been identified associated with any of the recommended alternatives. In fact, removal of the Baker Dam will result in a positive benefit with regard to flood hazards upstream of the present dam. Water surface elevations will be lowered under the 100-year flood conditions. Additionally, removal of the weir boards will eliminate an existing flood hazard. At the same time, no negative downstream flood hazard impact is expected, in that the present day dam provides no storage capacity and no downstream flood protection.

At the T&H Dam, the proposed partial horizontal removal will permanently lower the dam crest. The extent to which flood protection is currently provided by lowering water levels at the T&H Dam has not been documented. Without detailed records, operation protocols, and the results of hydrologic modeling for the watershed, the existing flood control benefit, if any, and any impacts thereto as a result of dam removal is unknown. This aspect may require further evaluation as the project proceeds.

None of the recommended alternatives at the remaining sites along the Neponset will adversely impact hydraulics.

Water and Sediment Quality – All of the recommended alternatives incorporate sediment management measures. At the two dam sites, containment wall systems are proposed, allowing for in-situ stabilization and capping. The containment system will reduce the potential for erosion and contamination into the water column. The recommended alternatives at the remaining locations result in stable conditions relative to sediment transport. Water quality is expected to improve with a free-flowing Neponset River channel and the associated elimination of low quality pools behind the dams.

Biological Impacts – Removal of the Baker and T&H dams is expected to have a positive impact on fisheries and wildlife habitat in the lower Neponset River. Their removal will eliminate a fish migration obstruction, will improve water quality, diversify wetland habitats, increase fish spawning areas, and enhance the existing wildlife corridors. This is consistent with the behavior of many dam removals throughout the country. Restoration of the sewer crossing and rock dam will increase the number of miles available to both river herring and rainbow smelt.

Physical Impacts – None of the proposed restoration alternatives will significantly alter the existing topography in the project area. Minor grading will be required to accommodate the in-water restoration; however, this will be limited in scope and magnitude. No significant modifications to surficial or bedrock materials are proposed and therefore significant impacts are expected.

Aesthetic Impacts – Aesthetic quality is often individual-specific and can be highly subjective. Certainly, there are differing opinions relative to the aesthetic quality of water flowing over a dam versus a meandering rocky riffle stream, and strong proponents for both can be found. While removal of the Baker and T&H dams will result in the elimination of the cascading water, the river will be restored to a free flowing water body with riffles and restored banks. The resulting aesthetic quality of the restored sites will be more naturalistic, with less concrete and "hard" landscaping.

Public Access and Recreation – The preferred restoration alternatives are intended to complement ongoing efforts to improve public access and recreation. Currently, the Neponset River is largely off-limits to the public. The banks are steep and much of the length of the river in the lower section is fenced off. By implementing fish passage options, the water level upstream of the dams will decrease. This will provide an opportunity to restore and stabilize the exposed banks with plantings and to address some of the safety issues associated with the existing conditions. Additionally, the removal of the dams will extend the number of unobstructed river miles available to water sport activities such as kayaking and canoeing. The project area will be an accessible, recreational resource to even more residents of Boston and Milton neighborhoods and surrounding, metropolitan towns.

Infrastructure – Numerous types of infrastructure surround the Neponset River, including passenger rail lines, roadways and bridges, and utility pipe crossings. While none of the proposed alternatives are expected to directly or adversely impact infrastructure, a careful site-specific inventory will be necessary as part of the design effort to identify and then rectify any utility and infrastructure conflicts in the areas of proposed disruption.

Cultural Resources – The Baker Dam lies within the Dorchester/Milton Lower Mills Industrial District, a district that is listed on the National Register of Historic Places (NRHP). The dam itself is not a contributing property to the NRHP district because of modern alterations to it, most recently in 1955–1956. The most recent alterations to the T&H Dam occurred in the 1950s. The dam would not likely be considered a contributing property to the T&H Paper Mill complex in a NRHP nomination. The dam has shaped land use patterns both as a resource and as a physical presence on the river and therefore will need to be considered in that context. Any future construction at the Baker or T&H dams will need to occur with the approval of the Massachusetts Historical Commission through the MEPA process.

There are no known cultural resources in the area of the anabranch channel, in the area of the MWRA pipe crossing, or at the rock dam and therefore adverse impacts to cultural resources in this area are not projected to occur.

Regulatory Permitting – Table ES-7 provides a summary of the permits that are likely to be required for the implementation of the restoration project.

**TABLE ES-7
Summary of Possible Permits**

<i>LEGISLATION</i>	<i>PERMIT</i>	<i>PERMITTING AGENCY</i>
National Environmental Policy Act (NEPA)	EA approval, Finding of No Significant Impact (FONSI)	EPA/Office of Federal Activities
Massachusetts Environmental Policy Act (MEPA)	ENF & EIR Certificates	EOEA
Toxic Substances Control Act (TSCA)	Compliance with PCB Regulations, 40 CFR Part 761	EPA
Clean Water Act, Section 404, and Rivers and Harbors Act, Section 10	Permit, Category II (>5,000 sq. feet of wetland or waterbody)	ACOE
National Historic Preservation Act	Section 106 compliance.	MA Historical Commission
Clean Water Act, Section 402, National Pollution Discharge Elimination System	NPDES Permit for construction dewatering	EPA
Clean Water Act, Section 401	Water Quality Certification (>5,000 sq. feet of wetland or waterbody)	DEP
301 CMR 21.00	CZM Consistency Review	EOEA/CZM
MGL Chapter 21E (MA Contingency Plan)	Preliminary site assessment Phase 1 site assessment Phase 2 site assessment Remedial Action Plan	DEP/Bureau of Waste Site Cleanup
Wetlands Protection Act	Order of Conditions	City of Boston Conservation Commission; Town of Milton Conservation Commission
Massachusetts Dam Safety Law Chapter 253, Section 45	Dam Safety Permit	DCR

NEXT STEPS

The following "next steps" are recommended:

- Convene the Technical Advisory Committee to solicit feedback on the alternatives analysis and preliminary selection of a preferred alternative set.
- Conduct additional public and project stakeholder outreach.
- Clarify land ownership adjacent to the T&H Dam.
- Evaluate the extent and degree, if any, of flood control protection afforded by the present day operation of the T&H Dam in comparison to the 100-year floodplain and actual flooding that has occurred in the floodplain in the past.
- Initiate discussions with regulators relative to obtaining preliminary input on the alternatives, as well as confirmation of the necessary permits, approvals, and technical analysis that will be required to implement the project. Work to inform historical groups as well.
- Define sediment management requirements through the Massachusetts Department of Environmental Protection and reassess alternatives, as necessary, dependent upon the results.
- Conduct confirmatory bathymetric survey in the Baker Dam impoundment and sediment probes to define the extent and thickness of sediment behind the dam.
- Conduct tidal monitoring downstream of the Baker Dam.
- Verify volumes of contaminated sediments in the affected remediation areas by contaminant level.
- Conduct subsurface investigations to determine depth to bedrock in the areas of proposed excavation near the Baker and T&H Dams.
- Coordinate with DCR relative to recently completed topographic survey in the project area. As necessary, conduct supplemental upland topographic survey through photogrammetry at and surrounding the Baker and T&H dams, and in the areas of the MWRA pipe crossing and rock dam. Base mapping at a scale that is no greater than 1" = 40' with 1-foot contours is recommended.
- Develop conceptual plans of full dam removal and full sediment removal for the Baker and T&H Dams (Alternatives B3b and T3b).

- Refine preferred alternatives to a preliminary design level, including in-channel habitat enhancement measures.
- Once a preferred set of alternatives is selected, modify the subject environmental restoration report to meet the requirements for a NEPA Environmental Assessment and a MEPA Environmental Impact Report. Conduct the necessary scoping process with state and federal agencies.
- Secure project implementation funding.
- Proceed with regulatory permitting, final design, and construction.

Exec Sum.doc