United States
Department
Of Agriculture

Natural
Resources
Conservation
Service

SUPPLEMENTAL WATERSHED PLAN No. 10 & ENVIRONMENTAL EVALUATION

For Rehabilitation of the
Tyler Floodwater Retarding Dam
SuAsCo Watershed
Middlesex County, Massachusetts

Prepared By:
U.S. Department of Agriculture
Natural Resources Conservation Service

FINAL
February 2013

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SUPPLEMENTAL WATERSHED PLAN NO. 10 & ENVIRONMENTAL EVALUATION
FOR REHABILITATION OF THE TYLER FLOODWATER RETARDING DAM
SuAsCo Watershed
Middlesex County, Massachusetts

Prepared By:
U.S. Department of Agriculture
Natural Resources Conservation Service

In Cooperation With:
Massachusetts Department of Conservation and Recreation
Middlesex Conservation District
Massachusetts Division of Fisheries & Wildlife

AUTHORITY

The original watershed work plan was prepared, and works of improvement have been installed, under the authority of the Watershed Protection and Flood Prevention Act of 1954 (Public Law 83-566) as amended. The rehabilitation of the Tyler Floodwater Retarding Dam is authorized under Public Law 83-566 (as amended), and as further amended by Section 313 of Public Law 106-472.

ABSTRACT

The Tyler Dam no longer provides the original protection planned for the watershed due to a greater-than-planned increase in development of the upstream drainage area. For current and future build-out development conditions, the dam does not meet current Natural Resources Conservation Service performance and safety standards for a high hazard dam. The local project sponsors have chosen to rehabilitate the dam to address the identified safety deficiencies. The purposes of the proposed rehabilitation of the Tyler Dam are to maintain the present level of flood control benefits and comply with current performance and safety standards. Rehabilitation of the dam will require the following recommended modifications to the structure: armoring the crest of the dam and a portion of the downstream slope of the dam. Project installation cost is estimated to be $1,145,000, of which $763,000 will be paid from Small Watershed Rehabilitation funds and $382,000 from local funds.

CONTACT

For further information, contact Luis E. Laracuente, State Conservation Engineer, USDA/NRCS, 451 West Street, Amherst, MA 01002-2953, 413-253-4362.

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Supplemental Watershed Plan No. 10 & Environmental Evaluation
for Rehabilitation of Tyler Floodwater Retarding Dam
SuAsCo Watershed
Middlesex County, Massachusetts

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List of Acronyms and Abbreviations

°F	Degrees Fahrenheit
ACB	Articulated Concrete Block
APE	Area of Potential Effect
BMP	Best Management Practice
BVW	Bordering Vegetated Wetland
CAA	Clean Air Act
CFR	Code of Federal Regulations
CMR	Code of Massachusetts Regulations
CO	Carbon monoxide
CWA	Clean Water Act
DCR	Massachusetts Department of Conservation and Recreation
DEP	Massachusetts Department of Environmental Protection
DEM	Massachusetts Department of Environmental Management
DFW	Massachusetts Division of Fisheries and Wildlife
DWM	Massachusetts Division of Watershed Management
EAP	Emergency Action Plan
EFH	Essential Fish Habitat
EPA	United States Environmental Protection Agency
ESA	Endangered Species Act
FBH	Freeboard Hydrograph
FEMA	Federal Emergency Management Agency
FWS	United States Fish and Wildlife Service
HEC-RAS	Hydrologic Engineering Center – River Analysis System
HUC	Hydrologic Unit Code
IDF	Inflow Design Flood
LUWB	Land Under Waterbodies
MassGIS	Massachusetts Geographic Information System
MEPA	Massachusetts Environmental Protection Act
MESA	Massachusetts Endangered Species Act
M.G.L.	Massachusetts General Laws
NAAQS	National Ambient Air Quality Standards
NAVD88	North American Vertical Datum 1988
NED	National Economic Development

NEPA	National Environmental Policy Act
NHESP	Natural Heritage and Endangered Species Program
NHPA	National Historic Preservation Act
NO_2	Nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NRCC	Northeast Regional Climate Center
NRCS	Natural Resources Conservation Service
O&M	Operation and Maintenance
O_3	Ozone
OARS	Organization for the Assabet, Sudbury, and Concord Rivers
OZn	Nashoba Formation
P&G	Policies and Guidelines
Pb	Lead
PL	Public Law
PMF	Probable Maximum Flood
PMP	Probable Maximum Precipitation
PSH	Principal spillway hydrograph
Qah	High stage Glacial Lake Assabet deposits
Qal	Alluvium deposits
Qas	Low stage Glacial Lake Assabet deposits
Qrt	River-terrace deposits
Qs	Swamp deposits
Qt	Till deposits
SCS	Soil Conservation Service
SDH	Stability Design Hydrograph
SHPO	State Historic Preservation Officer
SITES	Site Analysis Integrated Development Environment
SO_2	Sulfur dioxide
THPO	Tribal Historic Preservation Officer
TMDL	Total Maximum Daily Load
TR-60	Technical Release 60
USACE	United States Army Corps of Engineers
U.S.C.	United States Code
USCB	United States Census Bureau
USDA	United State Department of Agriculture
USGS	United States Geologic Survey

WinDAM B	Windows™ Dam Analysis Modules B
WPA	Massachusetts Wetlands Protection Act

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CHANGES REQUIRING PREPARATION OF A SUPPLEMENT

INTRODUCTION

The Tyler Floodwater Retarding Dam (referred to hereafter as the "Tyler Dam" or the "dam") is one of ten floodwater retarding dams built between 1962 and 1987 in the watershed of the Sudbury, Assabet, and Concord Rivers (known as the SuAsCo watershed). One site, Constance M Fiske Dam in the Town of Framingham, was singled out as the Baiting Brook Watershed Project. The remaining nine dams, including the Tyler Dam, were authorized to provide flood protection benefits in a 48 square mile subwatershed by the Natural Resources Conservation Service's (NRCS) 1958 Watershed Work Plan for Watershed Protection and Flood Prevention, SuAsCo Watershed, Middlesex and Worcester Counties, Massachusetts and nine supplemental plans[1]. The Tyler Dam was constructed in 1980 in the City of Marlborough, Middlesex County, Massachusetts (Figure 1, Appendix C-1). The dam impounds flow along the Assabet River, upstream of Robin Hill Street. Figure 2 (Appendix C-1) depicts the dam on an aerial photograph.

CHANGES IN THE WATERSHED

The Tyler Dam was built under the Watershed Protection and Flood Prevention Act of 1954[2] for the purpose of flood prevention. Since construction, however, land use changes (urban development) upstream of the dam have resulted in an increase of the quantity of stormwater runoff and a shorter time of concentration for the uncontrolled drainage area. In addition, recent climatology studies have shown that the frequency of extreme rainfall events has increased significantly over the years. Based on the rainfall data provided by the Northeast Regional Climate Center (NRCC), storms once considered to have a 1-percent annual exceedance probability are not likely to occur almost twice as often. As a result, the Tyler Dam is predicted to be overtopped by p to 3.42 and 4.52 feet during the freeboard hydrograph (FBH) under the current and future watershed build-out conditions, respectively (AMEC 2012).

The Massachusetts Department of Conservation and Recreation (DCR) applied to the NRCS for funding assistance for rehabilitation of the dam to comply with current federal guidelines to ensure continued flood damage protection downstream of the dam.

Hydrologic Engineering Center – River Analysis System (HEC-RAS) and Windows™ Dam Analysis Modules B (WinDAM B) modeling indicates that the Tyler Dam does not meet all of the NRCS design criteria for a High Hazard dam. The results of the modeling indicate that, under existing and future build-out conditions, the dam is overtopped by as much as 4.52 feet during the routing of the FBH. The results also indicate that downstream tailwater conditions reduce the effectiveness of the dam. The tailwater conditions appear to be primarily caused by a series of low-profile bridge crossings and channel conveyance limitations.

[1] The original Plan and the first four supplements were prepared by the Soil Conservation Service, (SCS) which was the former name of the NRCS.
[2] Public Law (PL) 83-566

An engineering analysis was conducted to determine if the Tyler Dam qualifies for a reduction in the FBH storm, which is generated by the probable maximum precipitation (PMP) storm, per the NRCS's Technical Release 60 (TR-60) for a High Hazard dam. The results of the analysis indicate that the difference in water surface elevations between non-breach and breach conditions for both the PMP storm and the selected IDF (64% PMP) downstream of the Tyler Dam is less than the 2-foot maximum permitted by Federal Emergency Management Agency (FEMA)-94 (FEMA 2004) and the NRCS to justify a reduction in the FBH. The NRCS criteria further requires that the incremental damages for the selected storm be the same as, or greater than, the incremental damages at the PMP storm. A comparison for both storms indicates that the incremental damages for the selected storm are higher than that for the PMP storm.

Consequently, the 64% PMP storm qualifies as the selected IDF. This requirement was strongly objected by the owner of the dam, the DCR. As a result, the design criteria set forth by the NRCS in TR-60 for a High Hazard Dam was applied. The NRCS granted a waiver allowing for a variance from the TR-60 criteria which allowed the top-of-dam to be established at the current elevation of 240.64 NAVD88 (Appendix E-2).

Dam failure would result in flood damages to approximately 850 residences, 39 non-residential properties, 8 major roads, 1 school, and 3 bridges, plus utilities in the floodplain. Dam failure would also potentially cause the loss of life of residents, workers, or motorists. Dam safety deficiencies are related to overtopping of the dam under existing and future watershed build-out conditions. The results of the PSH analysis indicate that the principal spillway does not have enough capacity to pass the 1-day/10-day 100-year storm without overtopping the auxiliary spillway. However, TR-60 criteria for the principal spillway capacity do not apply for structural spillways and consequently the auxiliary spillway crest does not have to be raised.

CHANGES PROPOSED BY THE SUPPLEMENT PLAN

As a result of greater-than-expected increases in development within the watershed, the Tyler Dam no longer provides the flood protection benefits it was designed to provide. To address the performance standards for the dam safety, the proposed improvements to the dam include armoring the crest of the dam and a portion of the downstream slope of the dam.

Supplemental Watershed Plan No. 10 & Environmental Evaluation For Rehabilitation of the Tyler Floodwater Retarding Dam SuAsCo Watershed Middlesex County, Massachusetts 3rd Congressional District

SUMMARY OF WATERSHED PLAN

Project Name: Rehabilitation of the Tyler Floodwater Retarding Dam[3], SuAsCo Watershed

Authorization: Public law (PL) 83-566 Stat. 666 as amended (16 U.S.C.[4] Section 1001 *et seq*.) 1954

Sponsors: Massachusetts Department of Conservation and Recreation
Middlesex Conservation District
Massachusetts Division of Fisheries & Wildlife (DFW)

Description of Recommended Plan: Under the recommended plan, the crest of the Tyler Dam and a portion of the downstream slope would be armored with articulated concrete blocks (ACBs) to provide additional protection against erosion when overtopped during the PMF storm event (FBH). The existing principal spillway, dam embankment elevation, and the existing auxiliary spillway would not be altered as part of the proposed rehabilitation. The evaluated life of the rehabilitation structure is 68 years.

Resource Information:

Latitude and Longitude:	Lat: 42.345128	Lon: -71.615929
8 Digit HUC[5] Number:	01070005	
Size of SuAsCo watershed:	241,000 acres (377 mi^2)	
Drainage area of the Tyler Dam:	25,280 acres (39.5 mi^2)	

Climate (Middlesex County):

Average annual precipitation:	46.94 inches		
Average seasonal snowfall:	53.2 inches		
Average winter temperature:	28.0 °F	Average winter daily minimum:	18.5 °F
Average summer temperature:	69.1 °F	Average summer daily maximum:	80.3 °F
Average (50%) freeze-free period of 172 days:		April 27 – October 16	

Source: NRCS (2006)

[3] Tyler Floodwater Retarding Dam is not identified in the original SuAsCo Watershed Plan (SCS 1958). It is designated as MA310 in the NRCS list of PL-566 dams, as 3-14-28-14 by the DCR Office of Dam Safety, and as MA01229 in the National Inventory of Dams database.
[4] United States Code
[5] Hydrologic Unit Code

Topography:

The SuAsCo watershed lies within an area of previous glaciation, and many glacial features are present. In addition, the watershed is characterized by the prevalence of swamps, ponds, and lakes. The drainage pattern is dendritic with many tributary streams. Within the SuAsCo watershed, the Assabet River has a steeper gradient than the lower Sudbury River and upper Concord River and as a result has a more rapid runoff of floodwaters (SCS 1958). Figure 1 (Appendix C-1) depicts the site on a location map.

Watershed Size:

Land Use in the Tyler Dam drainage area:

	Acres	% of drainage area
Agricultural	1,518	6
Forest	9,859	39
Developed, residential	5,814	23
Developed, commercial/industrial	3,286	13
Other (wetlands, open land, water, etc.)	4,803	19
Total	*25,280*	*100*

Source: MassGIS (2009a)

Land Ownership:

Tyler Dam drainage area:	Private 80 %	State-Local 19 %	Federal 1 %
Tyler floodplain area:	Private 89 %	State-Local 10 %	Federal 1 %

Source: MassGIS (2012)

Number of farms (Middlesex County): 579
Average farm size (Middlesex County): 57 acres
Source: Massachusetts Farm Bureau (2002)

Prime and important farmland:

	Drainage area (acres)	Floodplain (acres)
Prime farmland	4,477	267
Farmland of statewide importance	3,162	111
Farmland of unique importance	1,488	943

Source: MassGIS (2010)

Population and Demographics:

Project Beneficiary Profile: The primary beneficiaries of the project are residential, industrial, and commercial property owners in the floodplain of the Assabet River; the City of Marlborough; the Towns of Berlin and Hudson; and the Commonwealth of Massachusetts.

Characteristic	Marlborough	Middlesex Co.	Massachusetts	United States
Per capita income	$37,130	$39,194	$33,203	$26,059
Median annual household income	$69,078	$75,534	$62,072	$50,046
Median house value	$323,100	$403,500	$334,100	$179,900
Median age	38.5	38.5	39.1	37.2
Population	38,499	1,503,085	6,547,629	308,745,538
Population age 65 and over	12.6%	13.1%	13.8%	13.0%
Unemployment rate	5.2%	5.6%	6.9%	6.9%
Poverty level	3.9%	5.4%	8.2%	11.3%
Minority population	19.4%	20.3%	20.2%	27.9%

Source: U.S. Census Bureau (USCB) (2011)

Relevant Resource Concerns:

Wetlands: Estimated wetlands within the impoundment area, as interpreted and classified by the Massachusetts Department of Environmental Protection (DEP) at the Tyler Dam include Bordering Vegetated Wetlands (BVWs), Banks, Land Under Waterbodies (LUWB), and Riverfront Area wetland types as defined by 310 CMR[6] 10.00. Figure 3 (Appendix C-1) depicts the DEP mapped wetlands mapping in the vicinity of the dam.

Wetland Type	**Acres**
Bog	14
Deep marsh	138
Open water	754
Shallow marsh meadow or fen	393
Shrub swamp	280
Wooded swamp, coniferous	6
Wooded swamp, deciduous	1,174
Wooded swamp, mixed forest	60
Total	*2,819*

Source: MassGIS (2009b)

Floodplains: Land uses within the 2,610-acre floodplain downstream of the dam:

	Acres	% of floodplain area
Agricultural	49	2
Forest	544	21
Developed, residential	82	3
Developed, commercial/industrial	59	2
Other (wetlands, open land, water, etc.)	1,876	72
Total	*2,610*	*100*

Source: MassGIS (2009a)

[6] Code of Massachusetts Regulations

Highly Erodible Land (acres):
Tyler Dam drainage area: 6,170 acres
Tyler Dam floodplain: 766 acres
Source: MassGIS (2010)

Fisheries and Wildlife: Tyler Dam has no permanent pool and therefore provides limited habitat for fish, most of which occurs within the Assabet River itself. However, the area of the impoundment provides for wildlife habitat. Fish surveys conducted in other locations not in proximity to the Dam for the Assabet River identified 17 fish species (DWM 2005). Wildlife resources expected to be associated with the area surrounding the Tyler Dam would be species tolerant of human activities such as small mammals (gray squirrel [*Sciurus carolinensis*], raccoon [*Procyon lotor*], striped skunk [*Mephitis mephitis*], Virginia opossum [*Didelphis virginiana*], and small rodents) and resident and migrant birds.

Threatened and Endangered Species: No federally or state listed species are known to occur in the vicinity of the dam (refer to letters in Appendix E-2). Figure 4 (Appendix C-1) shows the Massachusetts Natural Heritage and Endangered Species Program (NHESP) identified estimated habitats for rare species in proximity to the dam.

Cultural Resources: No historic properties that are listed on or eligible for listing on the National Register of Historic Places (National Register) are present in the project's Area of Potential Effect (APE). Construction will occur within the area of previous disturbance for the dam. In a letter dated 17 November 2011, the Massachusetts State Historic Preservation Office (SHPO) concurred that the project will not affect any historic properties (refer to Appendix E-2). The Tribal Historic Preservation Office (THPO) for the Wampanoag Tribe of Gay Head Aquinnah was contacted in a letter dated 28 October 2011 (refer to Appendix E-2). Coordination was deemed complete as of 17 December 2012.

Problem Identification: The Tyler Floodwater Retarding Dam does not meet all of the current NRCS dam safety design criteria. The dam does not meet the current Massachusetts dam safety regulations for both current and ultimate build-out land use conditions. For existing and future build-out conditions, the dam is overtopped by 4.52 feet during the routing of the FBH storm. It was also determined that downstream tailwater conditions reduce the effectiveness of the spillway system to freely pass the FBH and significantly contribute to overtopping the dam. The tailwater conditions appear to be primarily caused by a series of low-profile bridge crossings, including the Robin Hill Street Bridge located immediately downstream of the Tyler Dam, and channel conveyance limitations. Dam failure would result in flood damages to approximately 850 residential buildings, 39 non-residential buildings, 1 school, 8 roads, and 3 bridges and public utilities. Dam failure would also potentially cause the loss of life of residents, workers, or motorists.

Alternative Plans Considered:

Alternative 1 – Future Without Project (No Federal Action Alternative)
The DCR, the owner of the dam, and the agency under which the Commonwealth's dam regulations are implemented, has determined that it would rehabilitate the dam to meet current NRCS dam safety standards if federal funding assistance is not provided. The DCR

may use other alternative rehabilitation methods other than those identified in this Plan or develop their own plan to bring the dam into compliance with federal standards. As such, the dam will be rehabilitated regardless of any federal funding that may be provided under Alternative 2 below.

From herein, the "No Federal Action" Alternative shall be interpreted as the "No Action" Alternative.

Alternative 2 – Rehabilitation (National Economic Development [NED] Alternative)
In this alternative, the Tyler Floodwater Retarding Dam would be rehabilitated by armoring the crest of the dam and a portion of the downstream slope of the embankment to provide protection against overtopping during the PMF event.

Additional alternatives were considered, but not carried forward for additional analysis as further discussed in the *Alternatives* section of this Plan.

Project Purpose: Flood prevention. Rehabilitation of the Tyler Dam is necessary to meet current state and federal safety and performance standards and guidelines.

Principal Project Measure: Rehabilitation of the Tyler Dam involves one primary action:

- Armoring the crest of the dam and a portion of the downstream slope.

Project Cost:

	PL 83-566 funds	Other funds	Total
Construction	$532,000	$258,000	$790,000
Engineering	$179,000	$0	$179,000
Technical Assistance	$0	$0	$0
Relocation	$0	$0	$0
Real Property Rights	$0	$0	$0
Project Administration	$52,000	$28,000	$80,000
Permitting	$0	$96,000	$96,000
Total	*$763,000*	*$382,000*	*$1,145,000*
Annual O&M[7]	$0	$18,640	$18,640

Project Benefits: Economic benefits of the project are derived from ensuring the continued flood prevention purpose of the Tyler Dam by meeting current performance and safety standards. Benefits are based on continuing flood protection to the downstream area, which has an annual benefit of $179,100. Rehabilitation would also minimize the risk of loss of life to residents and motorists traveling on downstream roadways within the breach flood area. Project benefits would continue to be derived through recreational opportunities and incidental benefits would continue to be derived through maintenance of wildlife habitat and groundwater recharge. Net average annual equivalent benefits between the Future with Federal Project (Rehabilitation Alternative) and the Future without Federal Project (No Federal Action Alternative) = $0.

[7] Operation and Maintenance

Identified Resource Concerns:

Concern	Degree of Concern	Degree of Significance to Decision Making
Dam safety	High	High
Human health and safety	High	High
Flood damages	High	High
Wetlands	Moderate	Moderate
Wildlife Habitat	Moderate	Moderate
Water Resources	Moderate	Low
Threatened and endangered species	Moderate	Low
Water quality	Moderate	Low
Fish habitat	Moderate	Low
Prime farm land	Moderate	Low
Forest resources	Moderate	Low
Cultural resources	Moderate	Low
Migratory birds	Moderate	Low
Riparian areas	Moderate	Low
Air quality	Low	Low
Environmental Justice and civil rights	Low	Low
Social resources	Low	Low
Aesthetics	Low	Low
Sedimentation and erosion	Low	Low
Recreation	Low	Low
Invasive species	Low	Low
Land use	Low	Low
Natural areas	Low	Low
Scenic beauty	Low	Low
Soil resources	Low	Low

Environmental Values Changed or Lost:

Resource	Impact
Air quality	Short-term impact from construction equipment emissions.
Floodplains	No effect; no new structures in floodplain; existing floodplain hydrology maintained.
Wetlands	0 acres permanent impact to wetlands; potential minor, temporary impact to wetlands adjacent to construction area may occur (<1 acre); wetlands to be avoided if possible and restored with native vegetation if affected by construction.

Resource	Impact
Fisheries and fish habitat	No long-term effect, existing fisheries maintained; temporary disturbance near construction area.
Wildlife and wildlife habitat	Potential minor loss of less than 1 acre of wildlife habitat; temporary disruption near construction area (<1 acre); disturbed areas would be re-planted with native vegetation; construction noise may cause wildlife to relocate temporarily.
Threatened and endangered species	No effect.
Land use	No effect.
Cultural resources	No effect.
Recreation	Minimal, temporary effect.
Prime farmland	No effect.

Direct Beneficiaries:

Onsite: 0
Offisite: 12 residential buildings and 5 non-residential buildings

Benefit to Cost Ratio:

Authorized Rate – Not yet determined
Current Rate – 3.75 %

Funding Schedule: 2012 – 2017

Federal Funds: $763,000
Non-Federal Funds: $382,000

Period of Analysis:

68 years

Evidence of Unusual Interest: There is no evidence of unusual Congressional or local interest in the project.

Major Conclusions: Rehabilitation of Tyler Floodwater Retarding Dam is necessary to minimize the risk of loss of life and property damage within the potential breach area and to allow the continuance of flood prevention (flood damage reduction) benefits.

Areas of Controversy: There are no known areas of controversy.

Issues to be Resolved: There are no issues to be resolved.

Permits and Consultations: The site-specific need for permits and mitigation, if required, will be determined during final design. The owner, the DCR, will be responsible for obtaining the necessary local, state, and federal permits. The NRCS is required by PL 83-566 to coordinate with federal agencies regarding required consultations with other federal regulatory agencies. The potential permits as well as the required consultations are outlined below:

NRCS Required Consultations:

- Section 7 Endangered Species Act[8] (ESA) consultations with the U.S. Fish and Wildlife Serve (FWS)
- Section 106 National Historic Preservation Act[9] (NHPA) consultation with SHPO and the Tribal Historic Preservation Office (THPO) of the Wampanoag Tribe of Aquinnah

DCR Potential Permits and Consultations:

- National Pollutant Discharge Elimination System (NPDES) general permit for construction
- Section 404 Clean Water Act[10] (CWA) permitSection 401 Water Quality Certificate
- Chapter 253 Permit to Construct or Alter a Dam
- Chapter 91 Waterways License
- Order of Conditions through the Massachusetts Wetlands Protection Act[11] (WPA)
- Massachusetts Environmental Policy Act[12] (MEPA) review

[8] 16 U.S.C. § 1531
[9] 16 U.S.C. 470 *et seq*.
[10] 33. U.S.C. § 1251 *et seq*
[11] 131 Massachusetts General Laws (M.G.L.) 40
[12] 30 M.G.L. Sec. 61-62H

PURPOSE AND NEED FOR ACTION

The purpose of the project is to provide continual flood protection for downstream communities, residences, utilities, and to prevent the loss of life. The proposed federal action is needed to meet current federal and state dam safety guidelines and standards and to continue to reduce flood damages to 850 residences, 39 non-residential properties, 8 major roads, 1 school, and 3 bridges, plus utilities in the floodplain downstream.

PURPOSE AND NEED FOR SUPPLEMENT

The purpose of the proposed dam rehabilitation project is to continue to reduce flood damages up to the 100-year flood elevation by complying with current performance and safety standards and to reduce the risk to human life. Failure of the dam would cause serious damage to homes and commercial facilities downstream of the dam and potentially result in loss of life. Rehabilitation of the dam is needed to protect downstream properties, public utilities, highways, and a railroad and to reduce the risk of loss of life. Rehabilitation of the dam would extend the service life by 67 years and ensure the continued safe service of the dam throughout its original 100-year evaluation period.

This Supplemental Watershed Plan and Environmental Evaluation was prepared to evaluate the rehabilitation of the Tyler Dam. The dam was built in 1980 in accordance with the 1958 SuAsCo Watershed Plan. An amendment to PL 83-566, the Watershed Rehabilitation Amendments of 2000 (PL 106-427), Section 313, authorizes funding and technical assistance to upgrade dams under the U.S. Department of Agriculture (USDA) Watershed Program. The rehabilitation upgrade of the Tyler Dam is authorized under this amendment. This Supplemental Plan documents the planning process by which the NRCS provided technical assistance to the local sponsors, technical advisors, and the public in addressing resource issues and concerns within the Assabet River watershed downstream of the Tyler Dam. The DCR cooperated in the preparation of the plan by leading the public meeting, reviewing technical studies (hydrology and hydraulic modeling, preliminary engineering), and reviewing this Preliminary Draft Supplemental Plan – Environmental Evaluation.

WATERSHED PROBLEMS AND OPPORTUNITIES

Modeling results indicate that the Tyler Dam does not meet all of the current NRCS design criteria or the current Massachusetts dam safety regulations for both current and ultimate build-out land use conditions. For current and ultimate build-out conditions the dam is overtopped by as much as 4.52 feet, during the routing of the FBH.

The Tyler Dam provides approximately $179,100 in average annual flood damage reduction benefits for the Assabet River watershed. The beneficiaries of the structure are the Commonwealth of Massachusetts, the City of Marlborough, and the Towns of Berlin and Hudson.

Primary concerns are the safety of the dam and the potential problems that failure of the dam would cause. Associated downstream hazards include 850 residential buildings, 39 commercial

and industrial developments, 8 roads, 1 school, and 3 bridges. The Emergency Action Plan (EAP) for the Tyler Dam estimates that an uncontrolled breach of the dam would cause flood damages to residences commercial properties, roads, and utilities in the floodplain (Haley and Aldrich 2007). Catastrophic failure of the Tyler Dam would also potentially cause the loss of life of residents, workers, or motorists.

Opportunities that would be realized through the implementation of this watershed rehabilitation plan are:

- Compliance with current dam safety criteria,
- Protection of human health and safety,
- Protection of infrastructure and transportation systems,
- Maintenance of flood control benefits,
- Prevention of increased flooding in the floodplain

SCOPE OF THE ENVIRONMENTAL EVALUATION

A scoping process was used to define project needs, determine important issues and formulate alternatives. Scoping included a public meeting; written requests for input from state, local, and federal agencies; and coordination meetings with appropriate agencies. A steering committee of NRCS, DCR, and technical experts was also formed to assist in the formulation and evaluation of alternatives.

Stakeholder agencies that were contacted concerning the proposed project are:

Middlesex Conservation District
Massachusetts Department of Conservation and Recreation
Massachusetts Division of Fisheries and Wildlife
Massachusetts Department of Fish & Game, Riverways Program
Massachusetts Department of Environmental Protection
City of Marlborough
Organization for the Assabet, Sudbury, and Concord Rivers (OARS)
Massachusetts Executive Office of Energy and Environmental Affairs
Massachusetts Executive Office of Energy and Environmental Affairs, Environmental Policy Act Office
U.S. Environmental Protection Agency (EPA) Region 1, Regulatory Section
U.S. Army Corps of Engineers, Regulatory Division
Massachusetts Office of Dam Safety
Massachusetts Historical Commission
Wampanoag Tribe of Gay Head (Aquinnah)

Table A presents the the relevant concerns as a result of the scoping process.

Table A: Resource Concerns to the Proposed Action

Item/Concern	Relevant to the Proposed Action?		Rationale
	Yes	No	
NED Principles and Guidelines (P&G)	X		Alternative 2 (below) is the NED Alternative.
Air quality	X		Minimal, temporary impact
Coastal zone management areas		X	The project site is not located within a coastal zone management area
Coral reefs		X	There are no coral reefs in the vicinity of the project site.

Table A: Resource Concerns to the Proposed Action

Item/Concern	Relevant to the Proposed Action?		Rationale
	Yes	No	
Aesthetics/Scenic beauty			Minimal, temporary impact.
Cultural resources	X		Analysis of effects required by the NHPA[13]; no historic sites present in APE
Dam safety	X		Primary concern of sponsors and NRCS
Ecologically critical areas		X	There are no ecologically critical areas in the vicinity of the site.
Environmental justice and civil rights	X		No impact. There are no Environmental Justice Zones within the project site.
Essential fish habitat (EFH)		X	There is no EFH in proximity to the dam.
Fish habitat	X		Minimal, temporary impact.
Flood damages	X		Primary concern of sponsors and NRCS
Floodplain management	X		No impact. The project will not result in any impacts to floodplain elevations.
Forest resources	X		Minimal impact. Construction will be conducted on the dam and downstream slope, mostly herbaceous vegetation.
Highly erodible cropland		X	None affected by the project.
Human health and safety	X		Primary concern of sponsors and NRCS.
Invasive species	X		Minimal impact. The area contains only limited areas with invasive species. Vegetated areas disturbed will be restored with native vegetation. Precautionary measure and BMPs[14] will be utilized to reduce the risk of spreading invasive species to or from the site.

[13] 16 U.S.C. § 470 *et seq*.
[14] Best Management Practices

Table A: Resource Concerns to the Proposed Action

Item/Concern	Relevant to the Proposed Action?		Rationale
Land use	X		No impact. The land use of the area will not change as a result of the dam rehabilitation.
Migratory birds	X		Minimal, temporary impact.
National Parks, Monuments, and Historical Sites		X	There are no national parks or historical sites in the project area.
Natural areas	X		Minimal, temporary impact. After construction is completed, disturbed areas will be restored to their natural condition.
Parklands		X	There are no park lands in the vicinity of the project.
Prime and unique farmland	X		No prime or unique farmland will be affected by project.
Public health and safety	X		Primary concern of sponsors and NRCS
Recreation	X		Minimal, temporary impact (< 1 acre)
Regional water resource plans		X	There are no regional water resource plans in effect for the area.
Riparian areas	X		Minimal, temporary impact.
Scientific resources		X	There are no scientific resources in the vicinity of the project area.
Sedimentation and erosion	X		Minimal temporary impact
Sole source aquifers		X	There are no sole source aquifers in the vicinity of the project area.
Social issues	X		Minimal, temporary impact
Soil resources	X		Soil resources will not be affected by the project.
Threatened and endangered species	X		Analysis of effects required by ESA[15]; no federally or state protected species present.
Waters of the U.S.	X		Minor, temporary impact resultant during construction.
Water quality	X		Minor, minimal, temporary impact.
Water resources	X		No impact
Water supply		X	Concern of sponsors; no impact to existing well fields.

[15] 16 U.S.C. § 1531

Table A: Resource Concerns to the Proposed Action

Item/Concern	Relevant to the Proposed Action?		Rationale
Wetlands	X		Analysis of effects required by CWA[16] and Executive Order 11990; potential for minor, temporary impact from construction; no permanent impact.
Wild and scenic rivers		X	There are no wild or scenic rivers in the vicinity of the site.
Wildlife habitat	X		Concern of sponsors; possible minor loss of habitat (< 1 ac)

[16] 33 U.S.C. § 1251 *et seq*.

AFFECTED ENVIRONMENT

The area potentially affected by rehabilitation of the Tyler Dam is the dam structure itself, the area adjacent to the dam that could be affected by construction, and the flood protection area downstream of the dam. The following discussions of existing conditions focus on these areas, plus the general project vicinity—the City of Marlborough—where appropriate.

EXISTING CONDITIONS

Original Project

The Tyler Dam is one of nine floodwater-retarding structures under the 1958 SuAsCo Watershed Plan authorized by PL 83-566[17]. The dam was constructed in 1980 with federal assistance provided by the USDA, Soil Conservation Service (SCS, meow the NRCS). Subsequently, nine supplements to the original plan have been prepared, six of which have been approved[18], between 1964 and 2012. Through these supplements, two of the original dams were removed from the plan and three others were added, of which Tyler Dam was one of these dams; and, as a result, nine floodwater retarding structures were planned and constructed between 1962 and 1980 for watershed protection and flood prevention. Four additional supplements have been prepared and approved or are in the process of becoming approved beginning in 2009. As originally authorized in the 1964 Supplemental Plan 1 (the Plan in which the Tyler Dam was authorized), Tyler Dam had the single purpose of flood prevention.

The Middlesex Conservation District and the Northeastern Worcester County Conservation District were the original local sponsoring organizations for the SuAsCo Watershed Plan. The three conservation districts in Worcester County have combined into one district, known as the Worcester County Conservation District. Through the supplemental planning process and reorganization of state agencies, by 1996 the local sponsoring organizations also included the DFW and the Massachusetts Department of Environmental Management (DEM). Further state reorganizations since 1996 have resulted in renaming DEM as DCR. DCR is the local sponsoring organization for this supplement because it is the owner of the dam and has requested federal assistance for rehabilitation of the dam from NRCS.

Description of Existing Dam

The Tyler Dam was originally designed and constructed as a federal high hazard dam, a hazard classification given to dams whose failure "may cause loss of life or serious damage to homes, industrial and commercial buildings, important public utilities, main highways, or railroads." The structure and the impoundment are shown on Figure 2 (Appendix C-1).

The dam consists of three primary elements; the principal spillway, the auxiliary spillway, and the earthen dam embankment. The Tyler Dam has a total structural height of approximately 38.5

[17] As amended by PL 106-427, November 9, 2000.

[18] Supplemental Watershed Plan No. 6 for the Hop Brook Dam, Supplemental Plan No. 8 for the Rawson Hill Brook Dam, and Supplemental Plan No. 9 for the Lester G. Ross Dam have been prepared and are currently in the process of becoming approved at the time this Final Plan was published.

feet, an overall length of 1,500 feet, and a crest width (top of the dam) of 15 feet. The dam is transected by Robin Hill Street, which crosses the dam from southwest to northeast approximately 500 feet west of the spillway system. Robin Hill Street is a paved roadway with an elevation slightly above the dam itself. To the west of the roadway, the earthen embankment extends approximately 600 feet to the left abutment.

The principal spillway is comprised of a 26-foot high, 58-foot long, and 17-foot wide two stage ungated reinforced concrete riser. The reinforced concrete riser leads to a 9-foot wide by 7-foot high reinforced concrete outlet conduit with four reinforced concrete anti-seep collars to control seepage. The outlet conduit discharges into a rock rip-rap lined stilling basin that extends from the base of the dam to Robin Hill Street. Under base flow conditions, flow from the Assabet River enters the riser through a 6.375-foot by 6.75-foot rectangular opening that connects to the rectangular conduit.

The auxiliary spillway is located in the right embankment section of the dam, directly downstream of the riser. The auxiliary spillway has a vegetated approach slope with buttressed wing walls and a buttressed headwall that divides the concrete apron into 13 separate sections. The auxiliary spillway discharges into a rock rip-rap lined stilling basin, which is approximately 300 feet long and extends to the Robin Hill Street Bridge.

The Tyler Dam has a maximum embankment height of approximately 38.5 feet with no impoundment during normal operating conditions. However, during impoundment conditions with the water level at the top of the dam (elevation 240.64 feet NAVD88[19]), the storage capacity of Tyler Dam is estimated to be approximately 5,500 acre-feet.

Existing Structural Data

Table B provides a summary of the existing structural data for the Tyler Floodwater Retarding Dam.

Table B: Existing Structural Data – Tyler Floodwater Retarding Dam

Year completed	1980
Drainage area	25,280 acres (39.5 mi^2)
Stream	Assabet River
Purpose	Flood prevention
Dam type	Earthen embankment
Dam height	38.5 feet
Dam crest length	1,500 feet
Dam crest elevation (minimum)	240.64 feet NAVD88
Storage:	
Total, maximum pool	5,500 acre-feet
Total, auxiliary spillway crest	1,463 acre-feet

[19] North American Vertical Datum 1988 (NOTE: the NAVD88 is 0.76 feet lower than all the elevations shown on the as-built plans.)

Table B: Existing Structural Data – Tyler Floodwater Retarding Dam

Principal spillway:	
Type	Reinforced concrete drop structure
Low stage inlet height	6.75 feet
Low stage inlet size	6.375 x 6.75 feet
Upper stage inlet height	2.5 feet
Outlet conduit size	9 x 7
Auxiliary Spillway:	
Type	Reinforced concrete
Width	275 feet
Principal spillway high stage crest elevation	226.25 feet NAVD88
Auxiliary spillway crest elevation	230.31 feet NAVD88
Top of dam (minimum crest) elevation	240.64 feet NAVD88

Dam Safety and Flood Damages: Both the federal government, under NRCS dam safety standards, and the DCR (301 CMR 10.00) have developed specific dam safety criteria.

As previously discussed, the dam does not meet current federal and state dam design and safety criteria. As such, the dam no longer provides the flood prevention services it was originally designed for. The Tyler Dam provides approximately $179,100 in average annual flood damage reduction benefits for the SuAsCo watershed. The beneficiaries of the structure are the Commonwealth of Massachusetts, the City of Marlborough, and the Towns of Berlin and Hudson. Primary concerns are the safety of the dam and the potential problems that failure of the dam would cause. Failure of the dam would impact 850 residences, 39 non-residential properties, 8 major roads, 1 school, and 3 bridges, plus downstream public utilities, and could result in the potential loss of life. Therefore, rehabilitation of the dam is necessary in order to bring the dam into compliance with federal and state dam safety guidelines and standards. Rehabilitation of the dam would conform to the NRCS dam safety standards and the DCR standards[20] for a high hazard dam and large structure, respectively.

Hydrologic and hydraulic modeling of the freeboard storm predicts that the dam would be overtopped by as much as 4.52 feet for current land use and build-out conditions. Overtopping of the dam could lead to embankment erosion and dam failure.

Physical Features and Environmental Factors

Project Location: The Tyler Dam is located in the City of Marlborough in Middlesex County, Massachusetts (Figure 1, Appendix C-1). The dam impounds water along the Assabet River, which begins as a small stream from the headwaters located at the George H. Nichols Dam in the Town of Westborough, Worcester County. The Assabet River flows north for approximately 30 miles from the Nichols Dam to its confluence with the Sudbury River in Concord, Massachusetts. The Assabet and Sudbury Rivers form the Concord River which flows north

[20] 302 CMR 10.00

15.5 miles to its confluence with the Merrimack River in Lowell, Massachusetts. The SuAsCo Watershed encompasses a large network of tributaries that drain approximately 377 square miles in Middlesex and Worcester counties.

Climate: The average annual precipitation for Middlesex County is 46.94 inches, of which, approximately 40 percent falls between May and September. The average seasonal snowfall is 53.2 inches. In winter, the average temperature is 28.0 degrees Fahrenheit (ºF), and the average daily minimum is 18.5 ºF. In summer, the average temperature is 69.1 ºF, and the average daily maximum temperature is 80.3 ºF (NRCS 2006).

Geology and Soils: The project area is underlain by the Nashoba Formation (OZn), an Ordovician aged metamorphic unit within the Nashoba Zone (Zen et al. 1983). The OZn includes sillimanite schist and gneiss, amphibolite, biotite gneiss, calc-silicate gneiss, and marble.

According to the Surficial Geologic Map of the Clinton Quadrangle (Koteff 1966), the surficial geology in the project area is primarily characterized by swamp deposits (Qs) and river-terrace deposits (Qrt). The Qs consist of muck, peat, silt, and sand. The Qrt consists of slightly coarser materials: silt, sand, and gravel. Adjacent to the swamp and river-terrace deposits are till (Qt) and alluvium (Qal). The Qt deposits in the area are described as a light to dark gray, poorly sorted, unstratified mixture of silt, sand, gravel, and boulders with minor amounts of clay. The Qal deposits consist solely of silt and sand. Additionally, Glacial Lake Assabet deposits (Qah and Qas), consisting of sand, gravel, and silt deposited in or graded to Glacial Lake Assabet, are found along the edges of the site and extending throughout much of the surrounding area. Both high (Qah) and low (Qas) stage deposits are observed.

Upland soils in the vicinity of the Tyler Dam are dominated by Charlton-Hollis-Rock outcrop complex, Windsor loamy sand, and Udorthents sandy. Charlton-Hollis-Rock outcrop complex soils consist of very deep and shallow soils that occur on upland areas where the relief is affected by the underlying bedrock. Windsor loamy sand soils are very deep and excessively drained soils that occur on glacial outwash plain and on top of glacial stream terraces and deltas. Udorthents sandy soils occur on nearly level to rolling terrain and are typically excessively drained to well drained soils which occur on glacial outwash plains, terraces, kames, and eskers (NRCS 2009a). Figure 5 (Appendix C-1) depicts the mapped soils in the vicinity of the dam.

Hydric soils in the vicinity of the Tyler Dam are dominated by Swansea muck, Freetown muck, Saco mucky silt loam, Scarboro mucky fine sandy loam, Sudbury fine sandy loam, and Udorthents wet substratum. Swansea muck soils are very deep, nearly level, and very poorly drained soils which occur in depression or in low, level areas. Freetown muck soils are very deep, nearly level, very poorly drained soils that occur on organic soil in depressions and along streams and rivers. Saco mucky silt loam soils are very deep, nearly level, and very poorly drained soils which occur in the lowest parts of floodplains adjacent to major streams and rivers. Sudbury fine sandy loam soils are very deep, gently sloping, and are moderately well drained soils that occur in low areas and shallow depressions on glacial outwash plains and terraces. Udorthents, wet substratum soils are nearly level to hilly and generally consist of drained and very poorly drained soils that have been filled-in with various types of soil material, rubble, and

refuse (NRCS 2009a). Figure 5 (Appendix C-1) depicts the mapped soils in the vicinity of the dam.

Topography: The SuAsCo watershed lies within an area of previous glaciation, and many glacial features are present. In addition, the watershed is characterized by the prevalence of swamps, ponds, and lakes. The drainage pattern is dendritic with many tributary streams. Within the SuAsCo watershed, the Assabet River has a steeper gradient than the lower Sudbury and upper Concord Rivers and as a result has a more rapid runoff of floodwaters (SCS 1958).

Prime Farmland: Prime farmland, as defined by the USDA, is land that has the best combination of physical and chemical characteristics for producing food, forage, fiber, and oilseed crops and is available for those uses. These soils can exist as cultivated land, pasture land, forest land, or other land, but they are not urban or built-up land or water areas (NRCS 2011). Prime farmland is protected by the Farmland Protection Policy Act[21] in order to "minimize the extent to which federal programs contribute to the unnecessary and irreversible conversion of farmland to non-agricultural uses" (NRCS 2008).

Soils that are designated as prime farmland and are present in the Tyler Dam drainage area are the Sudbury fine sandy loam soil. Table C presents the acreages of soils designated as prime farmland, farmland of statewide importance, or farmland of unique importance in the Tyler Dam drainage area and the downstream floodplain.

Table C: Important Farmland Soils

Soil Designation	Drainage Area (acres)	Floodplain (acres)
Prime Farmland	4,477	267
Farmland of statewide importance	3,162	111
Farmland of unique importance	1,488	943

Source: MassGIS (2010)

Highly Erodible Land: Highly erodible land is described in 7 CFR[22] Subpart B. In general, highly erodible land is classified as land that is highly susceptible to either wind or water erosion. As such, soils which have a high erodibility index are often categorized as highly erodible. As summarized in Table D, 34 percent of the Tyler Dam drainage area and 13 percent of the downstream floodplain are highly erodible lands.

[21] 7 U.S.C. § 4201 *et seq*.
[22] Code of Federal Regulations

Table D: Highly Erodible Land

	Drainage Area		Floodplain	
	Acres	**Percent**	**Acres**	**Percent**
Highly erodible land	6,170	34	766	29
Potentially highly erodible land	6,391	35	353	14
Not highly erodible land	3,870	21	1,491	57

Source: MassGIS (2010)

Water Quality: The Assabet River is designated by the state as a Class B Warm Water Fishery, which is defined as waters designated "as a habitat for fish, other aquatic life, and wildlife, and for primary and secondary contact recreation" (DWM 2005). The OARS conducts water quality monitoring of the Assabet River. Recently available water quality data for the Upper Assabet River headwaters are presented in Table E (OARS 2011).

Table E: Water Quality and Stream Health, Upper Assabet River, November 13, 2010

Parameter	Result	Water Quality Standards
Total nitrogen	12.6 mg/L	0.71 mg/L
Total phosphorus	0.35 mg/L	0.31 mg/L
Total suspended solids	4 mg/L	Free from flowing, suspended and settleable solids in concentrations and combinations that would impair any use assigned to (Class B waters)
Dissolved oxygen	9.92 mg/L	>5.0 mg/L
pH	6.50	6.5 – 8.3
Water temperature	9.24 ºC	<28.3 ºC
Streamflow	N/A	N/A

Note: mg/L = milligrams/liter; cfs = cubic feet per second; ºC = degrees Celsius (centigrade)
Source: (OARS 2011)

The Massachusetts Division of Watershed Management (DWM) summarized water quality in the Assabet River (DWM 2005):

> Historically, wastewater discharges and water withdrawals for public supply have deleteriously affected the Assabet River. A nutrient total maximum daily load (TMDL) for the Assabet River was completed in 2004. Implementation of the TMDL requires removal of total phosphorus to 0.1 mg/L in the effluent of the major municipal wastewater treatment plant and evaluation of the feasibility sediment remediation to reduce phosphorus flux from the sediments.

Rehabilitation of the Tyler Dam is not expected to have a significant effect on water quality because it has no permanent impoundment.

Water Resources: Water resources are generally broadly defined as aquatic resources such as groundwater and surface water. In the context of this Plan-EE, water resources specifically refer to those resources which are otherwise not discussed (i.e., aquifers and groundwater). The Tyler Dam is located in the Concord aquifer drainage basin. There are two medium-yield aquifers located in proximity to the dam; however, neither of them are located within the potential project area.

Wetlands: A map of freshwater wetlands, as interpreted and classified according to cover type by the DEP using aerial photographs, was obtained from MassGIS data (Figure 3, Appendix C-1). Wetland types within the drainage area of the dam are listed in Table F.

Table F: DEP-Mapped Wetlands Summary

Wetland Type	Approximate Acreage
Wooded Swamp Deciduous	1,174
Wooded Swamp Coniferous	6
Wooded Swamp Mixed Trees	60
Shrub Swamp	280
Shallow Emergent Marsh or Fen	393
Deep marsh	138
Open Water	754
Bog	14
TOTAL	***2,819***

Source: MassGIS (2009b)

The extents of the wetlands were assessed in the vicinity of the dam and in the area where construction access could potentially be located in June of 2011. State-regulated wetland resources identified during the infield assessment include BVWs, Banks, LUWB, and Riverfront Area as defined by 310 CMR 10.55 – 10.58. A brief description of these resources is provided below. Figure 6 (Appendix C-1) shows the extents of the field-assessed wetlands.

Bordering Vegetated Wetland – BVWs were indentified along the southern and eastern portions of the dam embankment and auxiliary spillway. As a state-regulated freshwater wetland, a 100 foot regulated buffer zone is applied to its boundary. These wetlands include a mosaic of wetland habitats including forested swamps, shrub-swamps, and shallow and deep emergent marshes. Dominant vegetation in these wetlands include red maple (*Acer rubrum*), swamp white oak (*Quercus palustris*), broad-leaf cattail (*Typha latifolia*), sensitive fern (*Onoclea sensibilis*), jewelweed (*Impatiens capensis*), dark-green bulrush (*Scirpus atrovirens*), spotted joe-pye weed (*Eupatorium maculatum*), lurid sedge (*Carex lurida*), tussuck sedge (*Carex stipata*), woolgrass (*Scirpus cyperinus*), and poison ivy (*Toxicodendron radicans*). Soils in these wetlands exhibit dark chromas, some mottling, saturation, and other indicators typical of hydric soils.

Banks – Bank wetland resources are generally limited to the lands immediately adjacent to the banks of the Assabet River and immediately downstream of the outfall. Onsite Banks are mostly vegetated and are comprised of mineral soils. Dominant vegetation within the Banks areas

includes red maple, swamp white oak, jewelweed, sensitive fern, woolgrass, dark green bulrush, lurid sedge, and poison ivy.

Land Under Water Bodies and Waterways – This area is immediately adjacent to the dam and is limited to land under the Assabet River and contributing spillway. Generally, this land is limited to mineral soils.

Riverfront Area – Riverfront Area is defined as the area of land between a river's mean annual high water line and a parallel line measured 200 feet horizontally from this high water line. The Assabet River is defined as a river as it is a perennial body of water that empties into another river. The boundary of the Riverfront Area associated with the Assabet River extends landward 200 feet from the mean annual high water line. Riverfront Area located within the potential project construction areas consists of existing cleared and previously disturbed land associated with Tyler Dam.

Waters of the U.S.: The term "waters of the U.S." is generally defined under 40 C.F.R. 230.3(s) as all waters that are currently or have previously been used for interstate or foreign commerce, interstate wetlands and surface waters (e.g., lakes, ponds, impoundments, etc.) and tributaries thereof, and the sea. As such, the aquatic resources in the vicinity of the dam that would be characterized as waters of the U.S. include the wetlands, the Assabet River and any associated tributaries, and any impoundments behind the dam. Any proposed impacts to a water of the U.S. is regulated by the CWA and would likely require a Section 404 permit and/or a Section 401 Water Quality Certificate.

Forest Resources: The area surrounding the Tyler Dam contains limited forested resources. Forest resources are broadly defined as areas that are dominated by mature trees. As such, forest resources are generally present adjacent to the dam itself, outside of the footprint of the dam. These areas are dominated by mixed hardwood successional forest. Dominant tree species consist of maples (*Acer* spp.) and oaks (*Quercus* spp.) The forest resources in proximity of the dam are generally considered to be in good condition, mainly due to their undisturbed condition. These areas also typically serve as migratory corridors to various wildlife species and provide valuable ecotones with other habitats they are adjacent to (e.g., marshes, developed areas, maintained grass, etc.)

Fish and Wildlife Resources: The area surrounding Tyler Dam consists of undeveloped land bordered by moderately developed residential land and roadways. As such, the wildlife resources in the area are comprised of those species which are tolerant of human disturbances such as common fauna species found throughout the northeast United States. Typical wildlife species found in the area of the dam include gray squirrel, raccoon, striped skunk, Virginia opossum, white-tail deer (*Odocoileus virginiana*), and small rodents as well as resident and migrant birds including great blue heron (*Ardea herodias*), mallard (*Anas platyrhynchos*), and Canada goose (*Branta canadensis*) in addition to common woodland avian species.

A large percentage of the watershed's amphibians, reptiles, birds, and mammals depend on wetland or riparian habitat. Common amphibians are the red-backed salamander (*Plethodon cinereus*), American toad (*Bufo americanus*), wood frog (*Rana sylvaticus*), green frog (*Rana*

clamitans), gray treefrog (*Hyla versicolor*), and spring peeper (*Pseudacris crucifer*). Reptiles include the painted turtle (*Chrysemys picta*), common garter snake (*Thamnophis sirtalis*), and northern water snake (*Nerodia sipedon*).

The DFW conducted fish surveys at one station in the upper Assabet River in proximity to the dam in 2001. That survey identified 17 fish species, as listed in Table G (DWM 2005). Tyler Dam is not expected to have a significant effect on aquatic life because it has no permanent impoundment.

Table G: Fish Species in the Assabet River

Common Name	**Scientific Name**
American eel	*Anguila rostrata*
Banded sunfish	*Enneacanthus obesus*
Black crappie	*Pomoxis nigromaculatus*
Blacknose dace	*Rhinichthys atratulus*
Bluegill	*Lepomis macrochirus*
Brown bullhead	*Ameiurus nebulosus*
Creek chub	*Semotilus atromaculatus*
Chain pickerel	*Esox niger*
Fallfish	*Semotilus corporalis*
Golden shiner	*Notemigonus crysoleucas*
Largemouth bass	*Micropterus salmoides*
Pumpkinseed	*Lepomis gibbosus*
Redbreast sunfish	*Lepomis auritus*
Redfin pickerel	*Esox americanus*
White sucker	*Catostomus commersoni*
Yellow bullhead	*Ameiurus natalis*
Yellow perch	*Perca flavescens*

Source: DWM (2005)

Threatened and Endangered Species: According to the FWS's Federally Listed Endangered and Threatened Species in Massachusetts (FWS 2011), the small-whorled pagonia (*Isotria medeoloides*) is the only federally-listed species which occurs in Middlesex County, Massachusetts. However, this species is not known to occur within the City of Marlborough. As such, a "no species present" letter was obtained from the FWS (see Appendix E-2) and no further consultation is required. According to the NHESP database, there are no state-listed rare species or species of special concern in the area available through the Massachusetts Geographic Information Systems (MassGIS) (2008a). Figure 4 (Appendix C-1) depicts the NHESP estimated habitats of rare wildlife. In a letter dated October 20, 2011, the NHESP confirmed that there were no known occurrences of any threatened or endangered species in proximity to the dam (see Appendix E-2).

Floodplains and Floodplain Management: Floodplains are generally characterized as areas of land which are subject to flooding during a 100-year flood. Floodplains are typically considered to be hazardous to development activities. Usually, naturally vegetated floodplains provide

habitat for wildlife, floodflow reduction, sedimentation control, maintain water quality, and aid in the transport and deposition of sediment and nutrients within riverine systems.

The majority of the upstream portion of the site, and a portion of the downstream portion, are within the 100 year floodplain (Figure 7 in Appendix C-1). Downstream of the dam, the floodplain is approximately 2,610 acres. Temporary, short-term minor adverse impacts to the floodplain would occur during the installation of the ACBs within the auxiliary spillway. After construction, the ACBs should not have any permanent adverse impacts on the downstream floodplain.

Air Quality: Air quality is generally defined as how clean or polluted air in a specific area is, and what associated health effects may be of concern. The DEP monitors several air quality criteria pollutants subject to National Ambient Air Quality Standards (NAAQS) including sulfur dioxide (SO_2), ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), lead (Pb), and two categories of particulate matter (≤10 microns [PM10] and ≤ 2.5 microns [PM2.5]) (DEP 2011).

The City of Marlborough falls within the Boston-Lawrence-Worcester 8-hour ozone nonattainment area as defined by the EPA[23]. The area is in attainment for all other criteria pollutants (EPA 2009). The Clean Air Act (CAA) and Amendments of 1990[24] define a "nonattainment area" as a locality where air pollution levels persistently exceed NAAQS, or that contributes to ambient air quality in a nearby area that fails to meet standards. Air quality data for the Summer Street sampling location in Worcester (the closest location to the dam) for 2010 is presented in Table H (DEP 2011).

Table H: Summer Street Air Quality Data

Criteria Pollutant	Level[1/]	Standard
Sulfur dioxide (ppm)	0.002	0.03
Ozone (ppm)	0.083	0.075
Carbon monoxide (ppm)	1.55	9
Nitrogen dioxide (ppb)	13.99	53
Particulate Matter (PM10) (µg/m3)	15.5	150
Particulate Matter (PM2.5) (µg/m3)	8.7	15

Note: ppm=parts per million; ppb=parts per billion; µg/m³=micrograms per cubic meter
Source: DEP (2011)
[1/]Annual arithmetic mean

Recreation: Although "No Trespassing" signs have been posted, the dam area is used informally for hiking and biking (i.e., recreation is not one of the dam's purposes).

Hazardous Waste: Included in the SuAsCo Watershed are seven Superfund Sites. The following Superfund Sites are found on the National Priorities List (NPL) in the SuAsCo Watershed: Fort Devens-Sudbury Training Anex, Hocomono Pond, W.R. Grace & Company Acton Plant, Nuclear Metals, Natick Laboratory, Nyanza, and Silresim (EPA 2011). These sites

[23] http://www.epa.gov/ozonedesignations/1997standards/areamaps/BostonMA.pdf
[24] 42 U.S.C 7401 *et seq.*

are not within the vicinity of the proposed project, they will not be affected by rehabilitation of the dam.

Cultural and Historic Resources: The APE for the project is the access road into the site and the project construction area. The entire APE was previously disturbed for construction of the dam. Other than the dam itself there are no structures within the APE. No historic properties that are listed or eligible for listing on the National Register of Historic Places are present within the project's APE (NPS 2011). In a letter dated November 17, 2011, the SHPO stated that the project will not affect any historic properties (see Appendix E-2). No correspondence from THPO has been received. Consultation was initiated with the THPO of the Wampanoag Tribe of Gay Head (Aquinnah) with correspondence dated 28 October 2011. Consultation was determined completed as of 16 December 2012.

Land Use: In the 1958 watershed plan, the SuAsCo watershed is described as 10 percent developed and 90 percent cropland, grassland, forest, and open water. In the 50 years since, the area has developed as a residential area for Boston and Worcester commuters. At the time of the dam's design, land use in the dam's drainage area consisted of approximately 58 percent forest, 24 percent agriculture, and 5 percent urban. Current land use in the Tyler Dam drainage area is summarized in Table I; 23 percent of the area is residential, mostly low to medium density, while the majority of the watershed is forested (39 percent). Land in the drainage area is predominantly privately owned (80 percent), with the rest being state or local government and federally owned.

Table I also summarizes land use under ultimate build-out (H&S 2009). Residential and commercial/industrial development is projected to increase by about 126 and 115 percent respectively in the area, and will result in a similar loss of forested land cover and agricultural land. Figure 8 (Appendix C-1) depicts the current land use map of the Tyler Dam drainage area.

Table I: Land Use in the Tyler Dam Drainage Area

	Current		Ultimate Build-out	
Land Use	**Acres**	**Percent**	**Acres**	**Percent**
Residential	5,814	23	13,145	52
Forest	9,859	39	253	1
Agricultural	1,518	6	0	0
Commercial, industrial	3,286	13	7,079	28
Other (wetlands, open land, water, etc.)	4,803	19	4,803	19
Total	*25,280*	*100*	*25,280*	*100*

Source: H&S (2009) and MassGIS (2009a)

Land use in the Tyler Dam floodplain is summarized in Table J. Land in the floodplain is mostly privately (89 percent), with smaller proportions of state and local and federally owned. Future land use in the floodplain is not expected to change significantly because of zoning restrictions on floodplain development. Figure 9 (Appendix C-1) shows the current land-use in the downstream floodplain.

Table J: Land Use in the Tyler Dam Floodplain

Land Use	Acres	Percent
Forest	544	20
Residential	82	3
Commercial, industrial	59	2
Agricultural	49	2
Other (wetlands, open land, water, etc.)	1,876	72
Total	*2,610*	*100*

Source: MassGIS (2009a)

Natural Areas: Natural areas are generally defined as areas of open space that are preserved through some form of land protection mechanism (i.e., deed restriction, conservation easement, wildlife reserve, etc.) There are three natural areas in proximity to the Tyler Dam which include the Tyler Flood Control Site (which includes the area of the Tyler Dam as well as the land preserved as open space upstream and immediately adjacent to the dam), the Milham Reservoir Reservation to the east of the dam, and an area of preserved open space to the southeast of the dam. The Tyler Flood Control Site is approximately 263 acres in size and is owned by the DCR. The Milham Reservoir Reservation is approximately 344 acres and is owned by the City of Marlborough. A small site, approximately 30 acres, is owned by the Town of Northborough.

Scenic Beauty: Scenic beauty is typically defined as the aesthetic resources of a particular area and the quality of those resources. As such, the aesthetic quality of the area of the Tyler Dam is limited as a result of the dam itself, particularly the dam embankment and spillway, which can be seen from the surrounding landscapes; Interstate 290 1,500 feet to the northwest; and a residential development approximately 300 feet to the north. However, to the east and south of the dam, the land is preserved by natural areas and is relatively undeveloped. As such, the limited amount of work proposed as part of the dam rehabilitation (i.e., armoring a portion of the downstream slope) will no degrade the scenic beauty of the area.

Socioeconomic: The City of Marlborough, founded in 1660, has an estimated population of 38,499 (USCB 2011). The City of Marlborough is located in eastern Massachusetts and bordered on the north by the Town of Hudson, by the Towns of Berlin and Northborough on the west, by the Town of Southborough to the south, and by the Towns of Sudbury and Framingham to the east. The city primarily serves as a commercial hub in the area for high technology and specialized electronics. Table K summarizes the socioeconomic data for the City of Marlborough (the location of the dam) compared to Middlesex County, the Commonwealth of Massachusetts, and the United States. The Tyler Dam, as a flood control structure, provides an annual flood protection benefit of $179,100 to downstream communities.

Environmental Justice: Executive Order 12898 Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations[25] requires that "each federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental

[25] Executive Order 12898 of February 4, 1994. Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations. Federal Register 59:32.

effects of its programs, policies, and activities on minority populations" (Council on Environmental Quality 1997). Environmental Justice neighborhoods are defined as neighborhoods with minority, non-English speaking, low-income and/or foreign born populations. According to MassGIS data derived from the 2000 U.S. Census[26], there are environmental justice populations in the City of Marlborough (MassGIS 2008b). As shown in Table K, minority groups constitute approximately 19.4 percent of the population in Marlborough, and approximately 3.9 percent of all city families are families in poverty.

Figure 10 (Appendix C-1) depicts the Environmental Justice Zone in proximity to the dam. There would be no adverse effects to environmental justice communities downstream of Marlborough, because the project has no adverse effects downstream of the dam and only benefits downstream populations. Residents of Environmental Justice neighborhoods in the vicinity of the dam were provided the opportunity to participate in the planning process through a town meeting and a public invitation for public comment. The public planning process for the plan is discussed in greater detail in the Public Participation section.

Human Health and Safety: The human health and safety of the dam includes items of risk such as flood, drought, or other disasters affecting the security of life or health; potential loss of life, property, and essential public services due to structural failure; and other environmental effects such as changes in air or water quality. As previously discussed, since the dam does not meet current federal and state dam safety guidelines and standards, there is an increased risk of downstream flooding as a result from dam failure which could greatly impact the lives, health, and essential public services such as infrastructure and emergency assistance. Other factors, such as drought and air quality, would not be affected by a potential dam failure.

[26] Environmental Justice data based on the 2010 Census is not currently available at the time this Preliminary Draft Supplemental Plan – Environmental Evaluation was published.

Table K: Summary of Socioeconomic Characteristics								
	Marlborough		**Middlesex Co.**		**Massachusetts**		**United States**	
Population and Race	**38,499**		**1,503,085**		**6,547,629**		**308,745,538**	
White	32,286	83.9%	1,235,193	82.2%	5,400,458	82.5%	231,040,398	74.8%
Black/African American	1,504	3.9%	81,753	5.4%	508,413	7.8%	42,020,743	13.6%
Asian	2,184	5.7%	155,141	10.3%	394,211	6.0%	17,320,856	5.6%
Other	3,559	9.2%	61,840	4.1%	369,611	5.6%	21,748,084	7.0%
Native American	250	0.6%	7,942	0.5%	50,705	0.8%	5,220,579	1.7%
Hispanic or Latino of any race	4,174	10.8%	98,350	6.5%	627,654	9.6%	50,477,594	16.3%
Age								
Median age	38.5		38.5		39.1		37.2	
Over 18 years of age	30,174	78.4%	1,182,646	78.7%	5,128,706	78.3%	234,564,071	76.0%
Over 65 years of age	4,837	12.6%	197,015	13.1%	902,724	13.8%	40,267,984	13.0%
Language Spoken At Home								
English only	27,045	75.5%	1,065,202	75.0%	4,849,884	78.3%	229,673,150	79.4%
"less than very well"	3,626	10.1%	130,830	9.2%	546,663	8.8%	25,223,045	8.7%
Spanish	2,269	6.3%	77,393	5.4%	484,965	7.8%	36,995,602	12.8%
Indo-European	5,088	14.2%	168,784	11.9%	555,058	9.0%	10,666,771	3.7%
Asian-Pacific	1,128	3.2%	87,126	6.1%	230,616	3.7%	9,340,583	3.2%
Other languages	280	0.8%	22,008	1.5%	70,396	1.1%	2,539,640	0.9%
Disability Status								
Population five years of age and older	3,987	10.5%	125,006	8.4%	699,252	10.8%	36,354,712	11.9%
Education								
High school graduate or higher	90.5%		91.8%		89.1%		85.6%	
High school including GED	8,916	32.2%	234,564	22.5%	1,168,464	26.2%	58,225,602	28.5%
Associates degree	1,736	6.3%	60,906	5.8%	337,594	7.6%	15,553,106	7.6%
Bachelor's degree	5,985	21.6%	264,967	25.4%	992,307	22.3%	36,244,474	17.7%
Graduate or professional degree	4,257	15.4%	255,652	24.5%	746,592	16.7%	21,333,568	10.4%
Employment, Class of Worker and Commuter Status								
Labor force pool (population > age 16)	23,638	75.8%	1,223,441	81.4%	5,313,877	81.2%	243,832,923	79.0%
Employed	21,987	70.5%	789,816	64.6%	3,225,103	60.7%	139,033,928	57.0%
Unemployment	1,612	5.2%	69,109	5.6%	365,805	6.9%	16,883,085	6.9%
Private for profit workers	18,597	84.6%	642,342	81.3%	2,599,288	80.6%	108,824,974	78.3%
Self-employed workers	1,381	6.3%	53,265	6.7%	198,627	6.2%	8,740,557	6.3%
Unpaid family workers	0	0.0%	835	0.1%	2,192	0.1%	177,163	0.1%

Table K: Summary of Socioeconomic Characteristics								
	Marlborough		**Middlesex Co.**		**Massachusetts**		**United States**	
Government	3,041	7.9%	93,374	11.8%	424,996	13.2%	21,291,233	15.3%
Federal	231	0.6%	16,270	6.2%	64,128	1.0%	4,938,966	1.6%
State	269	0.7%	22,099	1.5%	116,608	1.2%	6,270,462	2.0%
Local	847	2.2%	52,504	3.5%	232,967	3.6%	10,453,506	3.4%
Occupation								
Management, professional and related occupations	9,430	42.9%	410,901	52.0%	1,402,769	43.5%	49,975,620	35.9%
Service occupations	3,975	18.1%	114,759	14.5%	559,683	17.4%	25,059,153	18.0%
Sales and office occupations	4,502	20.5%	168,333	21.3%	756,845	23.5%	34,711,455	25.0%
Production, transportation, and material moving occupations	2,153	9.8%	49,481	6.3%	285,760	8.9%	16,590,396	11.9%
Natural Resources, construction, extraction, and maintenance occupations	1,922	8.7%	46,342	5.9%	220,046	6.8%	12,697,304	9.1%
Commuting to Work								
Worked in county of residence	16,575	75.7%	536,285	67.9%	2,072,085	64.2%	99,361,852	72.6%
Worked outside county of residence	5,144	23.5%	235,365	29.8%	958,412	29.7%	32,364,811	23.6%
Worked outside the state of residence	184	0.8%	17,376	2.2%	121,049	3.8%	5,214,347	3.8%
Housing								
Number of households		15,395		580,688		2,547,075		116,716,292
Number of housing units		16,416		612,004		2,808,254		131,704,730
Occupied	15,395	93.8%	580,688	94.9%	2,547,075	90.7%	116,716,292	88.6%
Owner occupied	8,921	57.9%	361,089	62.2%	1,587,158	62.3%	75,982,306	65.1%
Income								
Median annual household income		$69,078		$75,534		$62,072		$50,046
Median family income		$92,718		$95,008		$78,653		$60,609
Per capita income		$37,130		$39,194		$33,203		$26,059
FT*, year-round male median income		$60,009		$65,454		$56,959		$46,500
FT*, year-round female median income		$46,564		$51,095		$46,213		$36,551
Poverty								
Number of families	359	3.9%	31,357	5.4%	208,860	8.2%	13,188,941	11.3%

Source: 2010 U.S. Census Bureau (USCB) data (USCB 2011) * FT = Full-time

STATUS OF OPERATION AND MAINTENANCE

The DCR is responsible for operation and maintenance of Tyler Dam. Site inspections of the dam occurred on May 5, 2008 by DCR and NRCS's consultants (H&S 2009). In general, the Tyler Dam was found to be in "Satisfactory" condition. The dam was generally found to have areas of thick grass and weeds at the time of inspection, areas of brush growth, possible subsidence of riprap, cracks within concrete, and other areas that would require maintenance.

The Tyler Dam embankment consists of the approximately 1,500-foot long upstream slope, top (crest) of the dam, and the downstream slope embankment section of the dam. In general, the crest of the dam is approximately 15 feet wide. The upstream embankment slope is approximately 3.5H:1V, while the downstream embankment slope is approximately 3.0H:1V. The upstream and downstream portions of the earthen embankment are generally covered in grass and weeds. The dam embankment is transected by Robin Hill Street, which crosses the dam from southwest to northeast, approximately 500 feet west of the spillway system. The roadway contains a paved surface with an elevation slightly above the dam itself. West of the roadway, the earthen embankment extends approximately 600 feet to the left abutment. Figure C-1 (Appendix C-2) depicts the existing conditions of the dam.

Upon inspection of the dam (H&S 2009), it was recommended that the top of the dam should be regraded to provide a uniform elevation along the length of the dam, at a minimum elevation that is equal to the original freeboard elevation. In addition, areas with thin grass cover should be overseeded to establish a healthy strand of grass, which provides an effective means of controlling erosion. Grass roots and stems can trap fine sand and soil particles, and form an erosion-resistant layer once the plants are well established.

The principal spillway consists of a reinforced concrete riser that leads to a 9-foot wide by 7-foot high reinforced concrete outlet conduit with four reinforced concrete anti-seep collars to control seepage. The outlet conduit discharges into a rock rip-rap lined stilling basin that extends from the base of the dam to the Robin Hill Street Bridge. Flow in the Assabet River enters the riser through a 6.375-foot by 6.75-foot rectangular opening that connects to the rectangular conduit.

The inspection of the Tyler Dam (H&S 2009) determined that voids within the rip-rap around the principal spillway riser and along the approach to the concrete drop inlet spillway should be filled. Deteriorated sealant from the joints in the spillway approach concrete slabs should be removed and replaced with appropriate materials. Gates and fencing along the spillway should also be repaired to limit unauthorized access to the dam and discharge features. Maintenance of gates and other access controls would limit damage to the dam and appurtenant structure and extend the life of the dam.

The auxiliary spillway is located in the right embankment section of the dam, directly downstream of the riser. The auxiliary spillway is a reinforced concrete drop spillway with concrete dividing walls, which separate sections of the spillway into 13 concrete lined chutes. The auxiliary spillway has a vegetated approach slope, with buttressed concrete head and wing (or training walls), with a concrete apron. The auxiliary spillway discharges into a stilling basin, which is approximately 300 feet long and extends to the Robin Hill Street Bridge.

SEDIMENTATION

There is no permanent pool at the Tyler Dam; therefore, sedimentation upstream of the dam is not a concern. Sediment accumulation has been minimal for the past 32 years and it is anticipated that it will continue to be minimal for the remainder of the design life.

BREACH ANALYSIS AND HAZARD CLASSIFICATION

As defined in Section 520.21(e) of the NRCS Title 210 National Engineering Manual, Tyler Dam is classified as a High Hazard dam "where failure may cause loss of life or serious damage to homes, industrial and commercial buildings, important public utilities, main highways, or railroads." The original NRCS hazard classification was also a high hazard structure. Under Commonwealth of Massachusetts Dam Safety Rules and Regulations, 302 CMR 10.00, the dam is classified as a Class I (High) hazard structure and a "Large" size structure because it has a storage capacity greater than 1,000 acre feet. The inundation map in the EAP (Haley & Aldrich 2007) indicates that failure of the dam would result in inundation of and damage to residences, major utilities, and infrastructure. Failure of the dam would likely lead to loss of life.

Failure of the dam at maximum pool will likely cause loss of life and serious damage to homes, commercial facilities, important public utilities, and roads. As discussed in the *Consequences of Dam Failure* section of this report, failure of the dam under wet weather conditions is anticipated to affect approximately 850 residential structures, 39 non-residential structures, 8 major roads, 1 school, 3 bridges, and public utilities in the City of Marlborough and the Towns of Berlin and Hudson.

A comprehensive hydrologic and hydraulic analysis was performed to evaluate the capacity of the Tyler Dam under current and future build-out conditions (see Appendix D). The analysis included development of several hydrologic and hydraulic models to predict maximum water surface elevations under a series of design storms. Design storms were established based on NRCS design criteria for earthen dams. The primary tools used for the evaluation of the existing capacity and rehabilitation alternatives were the NRCS's Site Analysis Integrated Development Environment (SITES), HEC-RAS, and WinDAM B computer models. Design storms were established based on NRCS and Massachusetts dam safety design criteria. The model applies user-specified rainfall, runoff, and watershed hydrologic data to develop inflow hydrographs. Hydrographs are then routed through the various control structures associated with the dam to predict maximum water level, potential embankment erosion, and other potential structure failures.

Results of the hydrologic and hydraulic analysis indicated that the Tyler Dam does not meet TR-60 NRCS design criteria for the principal spillway hydrograph (PSH) or the current Massachusetts design criteria for both current and build-out conditions. For current and ultimate build-out conditions, the dam is overtopped by as much as 4.52 feet during the routing of the TR-60 FBH.

Previous analyses have shown that tailwater conditions may contribute to overtopping of the Tyler Dam. Hydraulic modeling completed by AMEC (2012) also determined that tailwater

conditions at the dam impede the passage of flow through the spillway system and contribute to overtopping of the dam. The tailwater conditions appear to be caused by a series of low-profile bridge crossings, including Robin Hill Road located immediately downstream of the dam, and a relatively gentle channel slope.

Table L summarizes the hydrologic and hydraulic analyses for the original design and for current and build-out conditions.

Table L: Hydrologic and Hydraulic Analyses Summary (NAVD88)

	Original Design[1]	**Current Conditions**[2]	**Build-out Conditions**[2]
Comparison elevations			
Crest of principal spillway (elevation, feet)	226.24	226.24	226.24
Crest of auxiliary spillway (elevation, feet)	230.31	230.31	230.31
Top of dam low point (elevation, feet)	240.64	240.64	240.64
Bottom width of auxiliary spillway (feet)	275	275	275
PSH (principal spillway hydrograph)[1/]			
Maximum water elevation (feet)	N/A	236.09	236.55
Drawdown (days)	N/A	5.51	5.79
Starting pool elevation for SDH and FBH		219.59	219.63
SDH (stability design hydrograph)[2/ 3/]			
Maximum water elevation (feet)	N/A	238.25	238.65
FBH (freeboard design hydrograph)[2/]			
Maximum water elevation (feet)	233.31	244.06	245.16
Available freeboard (feet)	7.33	-3.42	-4.52

[1] Source: As-built Drawings "Tyler Floodwater Retarding Dam, Marlborough, MA"
[2] Source: WinDAM B Model for Tyler Dam developed by AMEC Earth & Environmental, Inc., January 2012.

Breach inundation maps are provided in Appendix C-3.

POTENTIAL MODES OF DAM FAILURE

Several potential modes of failure for dams were examined for the Tyler Dam:

Sedimentation: Excessive sedimentation can reduce flood storage volume and clog spillways, reducing the hydraulic efficiency of the dam. Sedimentation of the Tyler Dam over the past 32 years has been minimal, and failure due to sedimentation is not probable.

Hydrologic Capacity: Hydrologic failure of a dam can occur by breaching the auxiliary spillway or overtopping the dam during a storm event. The integrity and stability of the auxiliary spillway and embankment is dependent on depth, velocity, and duration of flow; vegetative cover; and resistance to erosion. As discussed in the previous section, the dam does not meet current dam safety design criteria for a high hazard dam. Therefore, the potential for failure due to a deficiency in hydrologic capacity at the dam is considered high.

Seepage: Embankment and foundation seepage can contribute to failure of an embankment by removing (piping) soil material through the embankment or foundation. As the soil material is removed, voids can be created, allowing ever increasing amounts of water to flow through the embankment or foundation until the dam collapses due to the internal erosion. Seepage that increases with an increase in pool elevation is an indication of a potential problem, as is stained or muddy water. Foundation and embankment drainage systems can alleviate the seepage problem by removing the water without allowing soil to be transported away from the dam. No visible signs of seepage were observed during the inspection conducted in 2009 (NRCS 2009b). The risk of failure as a result of seepage is low.

Seismic: The integrity and stability of an earthen embankment are dependent on the presence of a stable foundation. Foundation movement through consolidation, compression, or lateral movement can cause the creation of weak zones or voids within an embankment, separation of the principal spillway conduit joints, or in extreme cases, complete collapse of the embankment. Central Massachusetts is not an area of significant seismic risk, and there is low potential for seismic activity to cause the failure of the dam

Embankment Slope Failure: An embankment slope failure allows increased saturation, weakens the integrity of the dam during large storms, and could result in a catastrophic failure. Slope failure can also create slides and sloughing that lower the top of the dam elevation so that overtopping may occur during large storms.

The Tyler Dam shows no visible signs of slope failure, sloughing, or any other noticeable indications of instability on the embankments. The embankments of the dam are grass covered. Maintenance at the dam includes mowing and control and clearing of woody vegetation along the dam embankment and spillways (NRCS 2009b). Embankment slope failure presents a low potential mode of failure for Tyler Dam.

Material Deterioration: Materials used in the principal spillway system are common construction materials, but they are subject to weathering and chemical reaction due to natural elements within the soil, water, and atmosphere. As a result of this weathering, concrete components can deteriorate and crack, metal components can rust and corrode, and leaks can develop. Embankment failure can occur from internal erosion caused by these leaks.

Based on the results of the site inspection in 2009 (NRCS 2009b), the structure appears to be in satisfactory condition with no evidence of deterioration on any materials that would require structural repair at this time. Risk of failure as a result of material deterioration is low.

CONSEQUENCES OF DAM FAILURE

Modeling analysis of the Tyler Dam indicates that the 24-hour FBH would overtop the existing dam embankment by as much as 4.52 feet under the existing and future watershed buildout conditions. Failure of the Tyler Dam under more-extreme wet weather conditions is anticipated to impact approximately 850 residential structures, 39 non-residential structures, 1 school, 8 roads, 3 bridges, and public utilities, the majority of which are located in the City of Marlborough and the Towns of Berlin and Hudson. The structures are primarily private

residences but also include non-residential/commercial buildings, schools, and roadways. The population at risk in the breach inundation area for the Tyler Dam is 695.

Within the City of Marlborough, dam breach flooding of the Assabet River under wet weather conditions is expected to impact approximately 18 residential structures, six non-residential/commercial structures, and four major roadways, including Interstate-290 (and associated Interstate-290 Bridge), Interstate-495, Wheeler Hill Boulevard and Donald Lynch Boulevard.

Within the Town of Berlin, approximately 95 residential structures, seven non-residential/commercial structures, and two major roadways along the Assabet River (Whitney Road and River Road) are anticipated to experience flooding as a result of the wet weather dam breach.

Within the Town of Hudson, the wet weather dam breach flood is anticipated to impact approximately 737 residential structures 26 non-residential/commercial structures and one school (Hudson High) along the Assabet River. Approximately four major roadways are expected to flood, including Interstate-495 (and associated bridge), State Highway 85 (and associated bridge), State Highway 62 and River Road.

A catastrophic breach of the dam would affect an area larger than the 100-year floodplain, so the damages from a breach would far exceed the damages sustained from a 100-year flood event without the dam in place, and it would likely include the loss of lives.

ALTERNATIVES

FORMULATION PROCESS

The NRCS and DCR jointly developed a wide range of nonstructural and structural measures for flood protection downstream of Tyler Dam. Alternatives were developed that are ineligible for financial assistance under PL 83-566 as amended by PL 106-472 as well as alternatives that are eligible for federal funding. To be eligible for federal assistance, an alternative must meet the requirements of PL 106-472.

The following alternatives were considered:

- Future without Project (No Federal Action) – the most probable future conditions to be realized if the federally funded NED Alternative is not implemented.
- Rehabilitation of the Dam (NED Alternative).
- Decommissioning—controlled breaching of the dam so that it no longer stores floodwater.
- Relocation
- Floodproofing
- IDF evaluation of alternatives for FBH less than PMP
- Other dam rehabilitation alternatives.

Alternatives that would provide no additional benefits but would cost substantially more than the NED Alternative were eliminated from detailed analysis. The Future Without Project (No Federal Action) Alternative was used to evaluate the remaining feasible rehabilitation alternative, which is the NED Alternative.

ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED STUDY

Structural and nonstructural measures that were considered but eliminated from detailed study are described in the following paragraphs.

Decommissioning

Decommissioning would require taking the dam out of service through a full or partial breach of the dam. Decommissioning would eliminate flood storage behind the dam and eliminate the flood protection provided by the dam. Without further mitigation, downstream properties would be subject to increased flooding, increased property damage, and increased risk of loss of life. There would be construction costs and impacts related to the dam breach, but there would be no long-term dam maintenance and repair costs.
Decommissioning would not meet the sponsors' objective to maintain the downstream flood damage reductions provided by the existing project. To meet this objective, decommissioning would have to be supplemented by other measures such as floodproofing (approximately $7-$22 million) or relocation (approximately $14 million). The total estimated construction cost for this alternative is approximately $13.5-20.5 million.

Relocation

Land downstream of the dam that would be affected by failure of the dam would be purchased and the residences or businesses relocated out of the flood area. A major property that would be affected if the dam were to fail is The Shops at the Pond, which is valued at approximately $14 million. When costs for protecting roads and other infrastructure, other property purchases, and relocation are added to this cost, the cost of this nonstructural alternative far exceeds the cost of structural alternatives to rehabilitate.

Floodproofing

To protect areas that would be affected by failure of the dam, individual properties could be floodproofed or levees/floodwalls could be constructed along the Assabet River downstream of the dam. However, this alternative does not appear to be practical due to the density of residential and commercial/industrial development downstream of the dam. Protecting the residential and commercial/industrial properties within the breach inundation zone would require construction of levees/floodwalls of several miles in length along both banks of the Assabet River. It is estimated that the cost of constructing levees along the 5-mile reach of Assabet River would exceed $7 million, while the cost for floodwalls would likely exceed $13 million (the estimates are based on FEMA's approximate costs for construction of levees and floodwalls). In addition to significant construction costs, levees and/or floodwalls would likely have a greater environmental impact and, therefore, this alternative was not considered feasible.

IDF evaluation of alternatives for FBH less than PMP

An engineering analysis was conducted by AMEC (2012) to determine if the Tyler Dam qualifies for a reduction in the FBH storm, which is generated by the PMP storm. According to the NRCS criteria, the use of a storm smaller than the PMP is allowed if the reduction is justified by an incremental analysis of the IDF.

The results of the analysis indicate that the difference in water surface elevations between non-breach and breach conditions for both the PMP storm and the selected IDF (64% PMP) downstream of the Tyler Dam is less than the 2-foot maximum permitted by FEMA-94 and the NRCS to justify a reduction in the FBH. The NRCS criteria further requires that the incremental damages for the selected storm be the same as, or greater than, the incremental damages at the PMP storm. A comparison for both storms indicates that the incremental damages for the selected storm are higher than that for the PMP storm.

Consequently, the 64% PMP storm qualifies as the selected IDF provided that appropriate controls are put in place to ensure that no further development occurs in the entire PMP breach inundation zone. This requirement is strongly objected by the owner of the dam, the DCR. As a result, the design criteria set forth by the NRCS in TR-60 for a High Hazard Dam was applied when evaluating, developing, and designing rehabilitation measures for the Tyler Dam.

Armor the Crest and Entire Downstream Slope of the Dam

Armoring the crest and the entire downstream slope of the dam, as well as the Robin Hill Street approach using ACBs would provide erosion protection to the structural embankment from forces and stresses experienced during the overtopping of the dam. ACB systems are typically composed of a mattress of interconnected concrete block units, which are connected by a geometric interlock, cables, or ropes. Geotextile fabric is provided beneath the ACB mattress to provide a separation from sub-grade soil, preventing migration of sediment particles through the voids in the block. An aggregate base and geogrid may be provided to create an even base for the block and distribute loads and forces during the design event. Due to its specific design, the system conforms to changes in the subgrade while maintaining the protective cover. The system can also be designed to allow for vegetation to be re-established, which improves the overall visual appearance. Proper design and installation of the ACB system is required to prevent uplifting of the blocks and failure of the system during extreme flows. The construction of ACB systems involves removal of existing vegetation and topsoil up to 12 inches below the existing grade. Installation of geotextile and drain fill prior to placement of the ACBs is critical. During the final stages of installation, ACB cells or openings in the concrete blocks are backfilled and compacted using the proper material. A cutoff wall will also be constructed to provide a rigid boundary along the crest and upslope anchor for the block. Given the minimal head differential across the existing dam, armoring the entire downstream slope will not provide additional benefit and appears to be cost prohibitive. Thus, this alternative is not considered a viable alternative.

Raise the Dam

The dam would have to be raised by at least 6.4 feet, or possibly more, to allow the FBH to be routed through the existing spillway without overtopping. While increasing the height of the dam would provide additional protection against overtopping during the PMP event, the raised dam cannot be tied into natural high ground without directly affecting residential structures located along Robin Hill Street. Consequently, this alternative would likely require land acquisition and relocation of residences. Because of the costs associated with land acquisition and likely public opposition, this alternative is not considered to be feasible.

Widening the Auxiliary Spillway

Preliminary model results showed that increasing the width of the auxiliary spillway to 1,300 feet does not provide enough capacity to pass the FBH without overtopping the dam. The effectiveness of this alternative is affected by downstream tailwater conditions. Widening the auxiliary spillway alone would be insufficient in providing adequate capacity at the FBH without downstream conveyance improvements (increasing the width of the downstream channel, removal of the end sill at the stilling basin, and modification to the Robin Hill Street Bridge) to reduce tailwater. As a result, this alternative is impractical and cost prohibitive.

Labyrinth Spillway

As an alternative to providing a linear weir of 720 feet, a nonlinear system such as a labyrinth-type weir with a saw-tooth configuration could decrease the overall length of the structure and decrease impacts to the Robin Hill Street embankment. This approach would likely require the

demolition and replacement of the existing concrete structure, which would further increase the cost of this option. The installation of a labyrinth weir alone would be insufficient in providing adequate capacity at the FBH without downstream conveyance improvements (increasing the width of the downstream channel, removal of the end sill at the stilling basin, and modification to the Robin Hill Street Bridge) to reduce tailwater. As a result, this alternative is impractical and cost prohibitive.

Increase Downstream Conveyance

The overall goal of this alternative would be to reduce tailwater conditions at the dam and improve the ability of the spillway system to convey the FBH without overtopping the dam. This approach would likely require replacing the Robin Hill Street Bridge with a higher-profile structure and increasing the conveyance of downstream channel. This approach alone would likely not improve the hydraulic efficiency of the existing spillway enough and would need to be combined with spillway widening and/or raising of the dam. As a result, this alternative is impractical and cost prohibitive.

DESCRIPTION OF ALTERNATIVE PLANS

The following alternatives were developed in detail and are evaluated in this Supplemental Watershed Plan and Environmental Evaluation. Engineering Plans are provided in Appendix C-2.

Alternative 1 - Future Without Project (No Federal Action Alternative)

The Future Without Project Alternative or No Federal Action Alternative depicts the most probable future conditions to be realized in absence of any of the alternative plans studied. The DCR, the owner of the dam, and the agency under which the Commonwealth's dam regulations are implemented, has determined that it would rehabilitate the dam to meet current NRCS dam safety standards without federal funds. The DCR may use other alternative rehabilitation methods or develop its own plan to bring the dam into compliance with federal safety guidelines, but for the purposes of comparing this alternative to the NED Alternative, it is assumed that the DCR would implement the same plan as described in Alternative 2. This assumption was made because the recommended plan is the most cost-effective and least environmentally damaging of all plans considered.

Alternative 2 – Rehabilitation (NED Alternative):

Due to a low head differential when the dam is overtopped, armoring of the crest and a portion of the downstream slope with ACBs would provide sufficient erosion protection to the structural embankment during overtopping of the dam. The length of the partial downstream slope protection should be adjusted during final design based on a refined HEC-RAS unsteady flow model. Alternatively, the crest and the entire downstream face of the dam could be protected with ACBs to prevent erosion and potential breach during the FBH event; however, given the minimal head differential across the existing dam armoring the entire downstream slope will not provide additional benefit and appears to be cost prohibitive. A cutoff wall will also be

constructed to provide a rigid boundary along the crest and upslope anchor for the block. The potential confinement of flow resultant from Robin Hill Street will be addressed during final design. The dam embankment elevation will not be raised and the existing principal spillway and auxiliary spillways will not be altered.

ACB systems are typically composed of a mattress of interconnected concrete block units, which are connected by a geometric interlock, cables, or ropes. Geotextile fabric is provided beneath the ACB mattress to provide a separation from sub-grade soil, preventing migration of sediment particles through the voids in the block. An aggregate base and geogrid may be provided to create an even base for the block and distribute loads and forces during the design event. Due to its specific design, the system conforms to changes in the subgrade while maintaining the protective cover. The system can also be designed to allow for vegetation to be re-established, which improves the overall visual appearance. Proper design and installation of the ACB system is required to prevent uplifting of the blocks and failure of the system during extreme flows. The construction of ACB systems involves removal of existing vegetation and topsoil up to 12 inches below the existing grade. Installation of geotextile and drain fill prior to placement of the ACBs is critical. During the final stages of installation, ACB cells or openings in the concrete blocks are backfilled and compacted using the proper material.

This alternative differs in scope from the discarded Armor the Crest and Entire Downstream Slope of the Dam alternative by proposing to only armor a portion of the downstream slope. Drawing C-2 in Appendix C-2 provides the Engineering Plans for Alternative 2.

COMPARISON OF ALTERNATIVES

Table M summarizes and compares the two alternative plans. Refer to the NRCS-CPA-52 form provided in the Environmental Consequences section for additional information on the effects of each alternative.

Table M: Summary and Comparison of Candidate Plans

Effects	Alternative 1 Without Project	Alternative 2 (NED)
Measures	Armor the crest and a portion of the downstream slope of the dam.	Armor the crest and a portion of the downstream slope of the dam.
Project investment	$1,145,000	$1,145,000
National Economic Development Account[1/]		
Beneficial, annual	—	$179,100
Adverse, annual	—	$179,100
Net beneficial	—	$0
Environmental Quality Account		
Air Quality	Minimal, temporary impact due to construction activity.	Minimal, temporary impact due to construction activity.
Cultural Resources	No effect.	No effect.
Environmental Justice	No effect.	No effect.
Fish and wildlife habitat	Potential for loss of less than 1 acre of wildlife habitat; temporary disturbance near construction area (<1 acre).	Potential for loss of less than 1 acre of wildlife habitat; temporary disturbance near construction area (<1 acre).
Forest resources	Minimal (<1 acre), temporary clearing for construction access. Disturbed areas will be restored following construction.	Minimal (<1 acre), temporary clearing for construction access. Disturbed areas will be restored following construction.
Invasive species	Minimal impact. The site contains limited areas of invasive species. Disturbed areas will be restored with native vegetation. BMPs will be utilized during construction to reduce the risk of spreading invasive species to or from the site.	Minimal impact. The site contains limited areas of invasive species. Disturbed areas will be restored with native vegetation. BMPs will be utilized during construction to reduce the risk of spreading invasive species to or from the site.
Land use	No impact. The land use of the area will not change as a result of the dam rehabilitation.	No impact. The land use of the area will not change as a result of the dam rehabilitation.
Migratory birds	Minimal (<1 acre), temporary impact due to construction activity.	Minimal (<1 acre), temporary impact due to construction activity.
Natural areas	Minimal, temporary effect from construction. Vegetated areas will be restored.	Minimal, temporary effect from construction. Vegetated areas will be restored.

Table M: Summary and Comparison of Candidate Plans

Effects	Alternative 1 Without Project	Alternative 2 (NED)
Prime and unique farmland soils	No effect.	No effect.
Recreation	No impact. No trespassing signs are posted and recreation is not one of the dam's purposes.	No impact. No trespassing signs are posted and recreation is not one of the dam's purposes.
Riparian areas	Minimal (<1 acre) temporary impact from construction.	Minimal (<1 acre) temporary impact from construction.
Scenic beauty	No impact. The viewshed is not impacted by the project.	No impact. The viewshed is not impacted by the project.
Sedimentation and erosion	Minimal, temporary impact from construction. BMPs will be implemented during construction activities.	Minimal, temporary impact from construction. BMPs will be implemented during construction activities.
Social resources	No effect.	No effect.
Threatened and endangered species	No impact to federally or state protected habit or federally protected species. No habitat present.	No impact to federally or state protected habit or federally protected species. No habitat present.
Water quality	Minimal, temporary impacts from construction.	Minimal, temporary impacts from construction.
Water resources	Minimal, temporary impacts from construction.	Minimal, temporary impacts from construction.
Waters of the U.S.	Potential minimal (<1 acre), temporary impact.	Potential minimal (<1 acre), temporary impact.
Wetlands	0 acres of permanent impacts and potential temporary impacts to wetlands (< 1 acre); impacts will be avoided if possible and restored with native vegetation if affected by construction	0 acres of permanent impacts and potential temporary impacts to wetlands (< 1 acre); impacts will be avoided if possible and restored with native vegetation if affected by construction
Other Social Effects Account		
Dam safety	Reduced threat of dam failure	Reduced threat of dam failure
Human health and safety	Reduced threat to life from dam failure	Reduced threat to life from dam failure
Flood damages	Reduced threat of flood damages from dam failure	Reduced threat of flood damages from dam failure

[1/] Per sections 1.7.2(a)(4)(ii) and 2.1.1(b)(2) of the "Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies", U.S. Water Resources Council, March, 1983, allowing for abbreviated procedures, damage reduction benefits have not been estimated because they are the same for both alternatives, and no net change in benefits occurs when comparing the two candidate plans to each other. The federally assisted alternative (Alternative 2) is displayed within a zero-based accounting context that credits local costs avoided (Adverse, annual) as adverse beneficial costs (Beneficial, annual) consistent with P&G 1.7.2(b)(3). Net benefits are zero because the total project cost is equal to the claimed benefits and the resulting B/C ratio is 1.0:1.0.

ENVIRONMENTAL CONSEQUENCES

The proposed alternative includes armoring the crest of the dam as well as a portion of the downstream slope. Armoring of the dam requires the removal of the vegetation, rocks, clods, and other objects from the structure surface; excavation to the correct elevation; and installation of the ACBs. A description of the effects that the proposed alternative will have on the natural and human environment is documented within the NRCS-CPA-52 Form (see pages 45 – 49).

CUMULATIVE IMPACTS

Construction of the Tyler Dam in 1980 had long-term direct effects on the environment through the excavation and filling of the structure. Rehabilitation of the dam under either alternative would occur within the area disturbed for construction of the existing structure and, therefore, would have no cumulative impact on the environment other than the minor, temporary construction-related impacts described above.

Since construction, the dam has indirectly affected the natural environment by temporary inundation of the floodplain upstream of the dam during rain events, and by trapping sediment that would otherwise move downstream during rain events. The dam has also altered the hydrology of the Assabet River by reducing downstream peak flows during storm events, and consequently protecting property and people in otherwise floodprone areas. Rehabilitation of the dam under either alternative would not change the hydrology of the Assabet River except for protecting the downstream area from catastrophic flooding that could occur if the dam were to fail. There would be no long-term, cumulative effects from the rehabilitation project.

Future actions in the watershed not related to this project include continued changes to upstream and downstream land use as a result of residential, industrial, and commercial development. Rehabilitation of Tyler Dam would not affect future development, but it would allow the dam to safely pass storm flows under build-out conditions.

CONTROVERSY

There are no known areas of controversy.

RISK AND UNCERTAINTY

The areas of risk and uncertainty associated with this project lie in the accuracy of predicting flood flows and flood elevations, estimating costs associated with each alternative, estimating property values and damage costs and benefits. The uncertainty of flood flows and water surface elevations has the potential for increased damages as development of residential and commercial property alters land use. It is possible that these uncertainties could lead to increased risk to human life in the event of a dam breach regardless of rehabilitation or no federal action. Hydrologic methods and computer modeling used in this analysis are consistent with the standards of practice at this time. The potential impacts for each alternative are estimated using techniques that relate potential damage to lost opportunity. However, these methods are in part based on professional judgment and actual experiences could be different.

Uncertainties with the analysis of environmental impacts lie with the identification of wetland areas and the risk of invasive species colonizing areas of revegetation. Trained wetland specialists identified wetland areas using standard, well-accepted protocols. The sponsors will be responsible for verifying wetlands and consulting with DEP as required before construction. Native species will be used for planting to minimize introduction of invasive species, but introduction could occur from adjacent areas. The preferred alternative, Alternative 2 (Rehabilitation (NED Alternative)), does not change the top elevation of the dam; however, elevations based on the SDH and FBH peaks have increased. As such, properties which are not currently under DCR ownership that are between the top of dam elevation and existing DCR properties may be at risk. Additionally, the potential confinement of flow resultant from Robin Hill Street downstream of the dam will be addressed during final design.

Within the context of this study, all alternatives were considered on a comparable basis. There does not appear to be any area that would have resulted in a different decision by using different procedures or conducting more intensive studies.

CATEGORICAL EXCLUSION

Rehabilitation of the Tyler Dam is proposed to be completed under Categorical Exclusions (CE) 14[27] and 15[28]. A CE 14 may be used to repair or maintain principal spillways and appurtences in order to meet current safety standards. A CE 15 may be used to repair or improve existing auxiliary spillways in order to meet current safety standards. For both a CE 14 and 15, work must be confined to the existing footprint of the dam or abutment, and no major change in reservoir or downstream operations will result.

CE 14 provides for the maintenance of principal spillway appurtences. The NRCS has determined that the embankment should be considered an appurtence; thus, a CE 14 is appropriate. Armoring of the embankment will effectively transform the existing embankment into a pseudo auxiliary spillway in that the embankment will be able to withstand the velocity of flows that are expected to overtop it as a result of tailwater conditions. As such, a CE 15 is appropriate.

[27] 7 C.F.R. 650.6(d)(14)
[28] 7 C.F.R. 650.6(d)(15)

U.S. Department of Agriculture Natural Resources Conservation Service	NRCS-CPA-52 6/2010	**A. Client Name:**	**Massachusetts Department of Conservation and Recreation (DCR)**
ENVIRONMENTAL EVALUATION WORKSHEET		**B. Conservation Plan ID #** (as applicable)**:** **Program Authority** (optional)**:**	N/A
D. Client's Objective(s) (purpose): To rehabilitate the Tyler Dam by armoring the dam and a poriton of the downstream slope to protect agatinst the velocity of flood flows.		**C. Identification #** (farm, tract, field #, etc as required)**:** Tyler Floodwater Retarding Dam	

E. Need for Action:

The dam no longer provides the original protection planned for the watershed due to a greater-than-planned increase in development of the upstream drainage area. For current and future build-out development conditions the dam does not meet current federal design criteria for a high hazard dam. The local project sponsors have chosen to rehabilitate the dam to address the identified safety deficiencies. The purposes of the proposed rehabilitation of the dam are to maintain the present level of flood control benefits and comply with current performance and safety standards.

G. Alternatives

No Federal Action √ if RMS ☐	***Alternative 2 (NED Alternative*** √ if RMS ☐	***Alternative 3*** √ if RMS ☐
Federal funding would not be used to rehabilitate the dam. The DCR may use other alternative rehabilitation methods or develop its own plan to bring the dam into compliance with federal standards, but for the purposes of comparing this alternative to Alternative 2, it is assumed that DCR would implement the same plan as described in Alternative 2. This assumption was made because the recommended plan is the most cost-effective and least environmentally damaging of all plans considered.	The Tyler Dam would be rehabilitated with federal funding assistance being provided by the NRCS. Rehabilitation of the dam would include the installation of ACBs along the dam and a portion of the downstream slope. The increased protection of the dam would prevent scouring by the freeboard storm under current and future land use and watershed build-out conditions. The principal spillway, the elevation of the main dam crest and embankment, and the auxiliary spillway would not be affected by the project.	

Resource Concerns

In Section "F" below, analyze, record, and address concerns identified through the Resources Inventory process. (See FOTG Section III - Resource Quality Criteria for guidance).

F. Resource Concerns and Existing / Benchmark Conditions (Analyze and record the existing/benchmark conditions for each identified concern)	**H. Effects of Alternatives**					
	No Federal Action		***Alternative 2 (NED Alternative)***		***Alternative 3***	
	Amount, Status, Description (short and long term)	√ if does NOT meet QC	Amount, Status, Description (short and long term)	√ if does NOT meet QC	Amount, Status, Description (short and long term)	√ if does NOT meet QC
SOIL						
Erosion (Road/Roadside/Construction Site)	Short-term increase during the construction phase; erosion and sediment control measures will be employed during construction to mitigate impact.	NOT meet ☐ QC	Short-term increase during the construction phase; erosion and sediment control measures will be employed during construction to mitigate impact.	NOT meet ☐ QC		NOT meet ☐ QC
Erosion (Sheet and Rill)	Long-term decrease in erosion by high flow events by reducing floodflow velocities over the dam and through the downstream floodplain during the FBH.	NOT meet ☐ QC	Long-term decrease in erosion by high flow events by reducing floodflow velocities over the dam and through the downstream floodplain during the FBH.	NOT meet ☐ QC		NOT meet ☐ QC
WATER						
Quantity (Excessive Runoff, Flooding, or Ponding)	Floodwater velocities will be reduced before discharging downstream into the Asabet River, thereby reducing the downstream effects of floodwaters and reducing floodwater damages.	NOT meet ☐ QC	Floodwater velocities will be reduced before discharging downstream into the Asabet River, thereby reducing the downstream effects of floodwaters and reducing floodwater damages.	NOT meet ☐ QC		NOT meet ☐ QC
Quantity (Aquifer Overdraft)	There would be no effect on water supply because there is currently no permanent impoundment behind the dam and rehabilitatin of the dam would maintain this conditiion.	NOT meet ☐ QC	There would be no effect on water supply because there is currently no permanent impoundment behind the dam and rehabilitatin of the dam would maintain this conditiion.	NOT meet ☐ QC		NOT meet ☐ QC
Quality (Surface Water: Excessive Susp. Sedmt & Turbidity)	Negligible temporary impacts due to a potential increase in turbidity and suspended solids in the brook during construction. An erosion and sediment control plan and installation of BMPs to minimize sediment discharge to the river will be developed.	NOT meet ☐ QC	Negligible temporary impacts due to a potential increase in turbidity and suspended solids in the brook during construction. An erosion and sediment control plan and installation of BMPs to minimize sediment discharge to the river will be developed.	NOT meet ☐ QC		NOT meet ☐ QC

F. Resource Concerns and Existing / Benchmark Conditions (Analyze and record the existing/benchmark conditions for each identified concern)	H. (continued)					
	No Federal Action		*Alternative 2 (NED Alternative)*		*Alternative 3*	
	Amount, Status, Description (short and long term)	√ if does NOT meet QC	Amount, Status, Description (short and long term)	√ if does NOT meet QC	Amount, Status, Description (short and long term)	√ if does NOT meet QC
AIR						
Quality [Excessive Greenhouse Gas - Nitrogen Oxide (N20)]	Neglible, short-term increases in NO_x and VOC emmissions from construction equipment. Emissions from the project would be below General Conformity Rule thresholds; no further analysis is required. State requires diesel retrofitting for any construction equipment on projects funded at state level.	NOT meet ☐ QC	Neglible, short-term increases in NO_x and VOC emmissions from construction equipment. Emissions from the project would be below General Conformity Rule thresholds; no further analysis is required. State requires diesel retrofitting for any construction equipment on projects funded at state level.	NOT meet ☐ QC		NOT meet ☐ QC
PLANTS						
Adaptability (Plants Not Adapted or Suited to Site)	Existing vegetation will be temporarily stripped away to install the ACBs. After installation, the area will be replanted with native grass seed and restored to its original vegetative condition.	NOT meet ☐ QC	Existing vegetation will be temporarily stripped away to install the ACBs. After installation, the area will be replanted with native grass seed and restored to its original vegetative condition.	NOT meet ☐ QC		NOT meet ☐ QC
ANIMALS						
Fish and wildlife (Inadequate Cover/Shelter)	Neglibile short-term effect on local animal habitat by disturbance of site during construction; no long-term effect because site will be revegetated after construction.	NOT meet ☐ QC	Neglibile short-term effect on local animal habitat by disturbance of site during construction; no long-term effect because site will be revegetated after construction.	NOT meet ☐ QC		NOT meet ☐ QC
Fish and wildlife (Impacts to Endangered or Threatened Animals)	There are no federally- or state-listed threatened or endangered species in the project area.	NOT meet ☐ QC	There are no federally- or state-listed threatened or endangered species in the project area.	NOT meet ☐ QC		NOT meet ☐ QC
HUMAN - Economic and Social Considerations						
Land Use	No change in existing land use. Construction will occur within the existing footprint of the dam and will not result in a change of landuse within or in close proximity to the project.		No change in existing land use. Construction will occur within the existing footprint of the dam and will not result in a change of landuse within or in close proximity to the project.			
Dam Safety	Installation of the ACBs will reduce scouring and erosion of the dam if storm flows pass through and over the dam during the FBH. The rehabilitation would bring the dam into compliance with federal and state criteria, and the threat of the dam failing during large storms would be reduced.		Installation of the ACBs will reduce scouring and erosion of the dam if storm flows pass through and over the dam during the FBH. The rehabilitation would bring the dam into compliance with federal and state criteria, and the threat of the dam failing during large storms would be reduced.			
Human Health and Safety	The threat of loss of life or unsafe conditions from the dam failing would be reduced through rehabilitation designed to bring the dam into compliance with safety criteria. Flood protection would continue for residents, motorists, and other persons using downstream facilities.		The threat of loss of life or unsafe conditions from the dam failing would be reduced through rehabilitation designed to bring the dam into compliance with safety criteria. Flood protection would continue for residents, motorists, and other persons using downstream facilities.			

Special Environmental Concerns: Environmental Laws, Executive Orders, policies, etc.

In Section "I" complete and attach applicable Environmental Procedures Guide Sheets for documentation. Items with a "●" may require a federal permit or consultation/coordination between the lead agency and another government agency. In these cases, effects may need to be determined in consultation with another agency. Planning and practice implementation may proceed for practices not involved in consultation.

I. Special Environmental Concerns (Document compliance with Environmental Laws, Executive Orders, policies, etc.)	**J. Impacts to Special Environmental Concerns**					
	No Federal Action		***Alternative 2 (NED Alternative)***		***Alternative 3***	
	Status and progress of compliance. (Complete and attach Guide Sheets as applicable)	√ if needs further action	Status and progress of compliance. (Complete and attach Guide Sheets as applicable)	√ if needs further action	Status and progress of compliance. (Complete and attach Guide Sheets as applicable)	√ if needs further action
Clean Air Act	Upon Review, No Action Needed Emissions will be below General Conformity Rule thresholds and state requires diesel retrofitting for any construction equipment on projects funded at state level.	☐	Upon Review, No Action Needed Emissions will be below General Conformity Rule thresholds and state requires diesel retrofitting for any construction equipment on projects funded at state level.	☐		☐
Clean Water Act / Waters of the U.S.	Other Project may require a NPDES General Permit for disturbances greater than 1 acre. Project may require an Sec. 401 WQC and/or may require a Sec. 404 permit. Further planning is required to determine the potential for wetland impacts.	☑	Other Project may require a NPDES General Permit for disturbances greater than 1 acre. Project may require an Sec. 401 WQC and/or may require a Sec. 404 permit. Further planning is required to determine the potential for wetland impacts.	☑		☐
Coastal Zone Management	Upon Review, Not Applicable The dam is not located in any Coastal Zone Management areas.	☐	Upon Review, Not Applicable The dam is not located in any Coastal Zone Management areas.	☐		☐
Coral Reefs	Upon Review, Not Applicable There are no coral reefs or associated waterbodies in the project area.	☐	Upon Review, Not Applicable There are no coral reefs or associated waterbodies in the project area.	☐		☐
Cultural Resources / Historic Properties	Upon Review, No Effect SHPO concurs that the proposed project will not affect any historic properities	☐	Upon Review, No Effect SHPO concurs that the proposed project will not affect any historic properities	☐		☐
Endangered and Threatened Species	Upon Review, No Effect USFWS and NHESP have stated that no threatened or endangered species are present within the vacinity of the site.	☐	Upon Review, No Effect USFWS and NHESP have stated that no threatened or endangered species are present within the vacinity of the site.	☐		☐
Environmental Justice	Upon Review, Not Applicable Impacts are confined to the project footprint. There are no disproportionately adverse environmental or human health effects on low-income populations, minority populations, or Indian tribes.	☐	Upon Review, Not Applicable Impacts are confined to the project footprint. There are no disproportionately adverse environmental or human health effects on low-income populations, minority populations, or Indian tribes.	☐		☐
Essential Fish Habitat	Upon Review, Not Applicable There are no areas of Essential Fish Habitat indentified within the vacinity of the project. As such, further consultation with NOAA is not required.	☐	Upon Review, Not Applicable There are no areas of Essential Fish Habitat indentified within the vacinity of the project. As such, further consultation with NOAA is not required.	☐		☐
Floodplain Management	Upon Review, No Effect The project is located within the 100-year floodplain; however, the project will not result in any adverse effects to the floodplain.	☐	Upon Review, No Effect The project is located within the 100-year floodplain; however, the project will not result in any adverse effects to the floodplain.	☐		☐
Forest Resources	Other Minimal (<1 acre), temporary clearing for construction access. Disturbed areas will be restored following construction	☐	Other Minimal (<1 acre), temporary clearing for construction access. Disturbed areas will be restored following construction	☐		
Invasive Species	Upon Review, No Effect BMPs will be employed in project area. Site is not susceptible to prolific invasive species, but disturbed areas may experience an increase in volunerability to invasive species becoming established.	☐	Upon Review, No Effect BMPs will be employed in project area. Site is not susceptible to prolific invasive species, but disturbed areas may experience an increase in volunerability to invasive species becoming established.	☐		☐

Migratory Birds/Bald and Golden Eagle Protection Act	Other Minimal (<1 acre), temporary impact to migratory birds due to construction activity.The project will not have any permanent negative effect on any bald/golden eagles.	☐	Upon Review, No Effect Minimal (<1 acre), temporary impact to migratory birds due to construction activity.The project will not have any permanent negative effect on any bald/golden eagles.	☐		☐
Recreation	Upon Review, No Effect No impact. No trespassing signs are posted and recreation is not one of the dam's purposes.	☐	Upon Review, No Effect No impact. No trespassing signs are posted and recreation is not one of the dam's purposes.	☐		☐
Prime and Unique Farmlands	Upon Review, No Effect Prime farmland soils are located within the project site; however, the project will not result in the conversion of land in agricultural use to non-agricultural uses.	☐	Upon Review, No Effect Prime farmland soils are located within the project site; however, the project will not result in the conversion of land in agricultural use to non-agricultural uses.	☐		☐
Riparian Area	Other Minimal (<1 acre) temporary impact from construction.	☐	Upon Review, No Effect Minimal (<1 acre) temporary impact from construction.	☐		☐
Scenic Beauty	Upon Review, No Effect No impact. The viewshed is not impacted by the project.		Upon Review, No Effect No impact. The viewshed is not impacted by the project.			
Wetlands	Other Federal wetlands will likely not be affected. State wetland setbacks are located adjacent to the project site. Construction activities may require coordination with the MA Wetlands Proteciton Act; however, no Sec. 404 impacts are expected.	☑	Other Federal wetlands will likely not be affected. State wetland setbacks are located adjacent to the project site. Construction activities may require coordination with the MA Wetlands Proteciton Act; however, no Sec. 404 impacts are expected.	☑		☐
Wild and Scenic Rivers	Upon Review, Not Applicable There are no wild or scenic rivers located within the project site.	☐	Upon Review, Not Applicable There are no wild or scenic rivers located within the project site.	☐		☐

K. Other Agencies and Broad Public Concerns	***No Federal Action***	***Alternative 2 (NED Alternative)***	***Alternative 3***
Easements, Permissions, Public Review, or Permits Required and Agencies Consulted.	**Clean Water Act -** Possible Sec. 404 GP Cat. 1 and Sec. 401 WQC. **National Historic Preservation Act -** Sec. 106 Consultation **MA Env. Policy Act -** Env. Notification Form **MA Wetland Protection Act -** Notice of Intent/Order of Conditions **MA Endangered Species Act -** Project Review	**Clean Water Act -** Possible Sec. 404 GP Cat. 1 and Sec. 401 WQC. **National Historic Preservation Act -** Sec. 106 Consultation **MA Env. Policy Act -** Env. Notification Form **MA Wetland Protection Act -** Notice of Intent/Order of Conditions **MA Endangered Species Act -** Project Review	

K. (continued) Other Agencies and Broad Public Concerns	***No Federal Action***	***Alternative 2 (NED Alternative)***	***Alternative 3***
Cumulative Effects Narrative (Describe the cumulative impacts considered, including past, present and known future actions regardless of who performed the actions)	Construction of the dam in 1980 significantly altered the flow of the River and area of the dam. Rehabiltiation of the dam would occur within previously disturbed areas. Rehabilitation of the dam would not alter the existing flow of the River or the River's hydrology except protecting the downstream area from catastrophic flooding. Future development upstream and downstream of the dam will likely have a result on the greater watershed. Rehabilitation of Tyler Dam would not affect future development, but it would allow the dam to safely pass storm flows under build-out conditions.	Construction of the dam in 1980 significantly altered the flow of the River and area of the dam. Rehabiltiation of the dam would occur within previously disturbed areas. Rehabilitation of the dam would not alter the existing flow of the River or the River's hydrology except protecting the downstream area from catastrophic flooding. Future development upstream and downstream of the dam will likely have a result on the greater watershed. Rehabilitation of Tyler Dam would not affect future development, but it would allow the dam to safely pass storm flows under build-out conditions.	
L. Mitigation	Mitigation would include erosion and sediment controls during construction and the utilization of BMPs. Temporary weltands impacts will be restored to their previous condition.	Mitigation would include erosion and sediment controls during construction and the utilization of BMPs. Temporary weltands impacts will be restored to their previous condition.	

M. Preferred Alternative	√ preferred alternative	☐	☑	☐
	Supporting reason		Alternative 2 would provide federal funding support to the DCR for engineering and planning support; thereby, reducing the cost burden on the state.	

N. Context (Record context of alternatives analysis)	regional	regional	

The significance of an action must be analyzed in several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality.

O. Determination of Significance or Extraordinary Circumstances

Intensity: Refers to the severity of impact. Impacts may be both beneficial and adverse. A significant effect may exist even if the Federal agency believes that on balance the effect will be beneficial. Significance cannot be avoided by terming an action temporary or by breaking it down into small component parts.

If you answer ANY of the below questions "yes" then contact the State Environmental Liaison as there may be extraordinary circumstances and significance issues to consider and a site specific NEPA analysis may be required.

Yes	No	
☐	☑	• Is the preferred alternative expected to cause significant effects on public health or safety?
☐	☑	• Is the preferred alternative expected to significantly effect unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas?
☐	☑	• Are the effects of the preferred alternative on the quality of the human environment likely to be highly controversial?
☐	☑	• Does the preferred alternative have highly uncertain effects or involve unique or unknown risks on the human environment?
☐	☑	• Does the preferred alternative establish a precedent for future actions with significant impacts or represent a decision in principle about a future consideration?
☐	☑	• Is the preferred alternative known or reasonably expected to have potentially significant environment impacts to the quality of the human environment either individually or cumulatively over time?
☐	☑	• Will the preferred alternative likely have a significant adverse effect on ANY of the special environmental concerns? Use the Evaluation Procedure Guide Sheets to assist in this determination. This includes, but is not limited to, concerns such as cultural or historical resources, endangered and threatened species, environmental justice, wetlands, floodplains, coastal zones, coral reefs, essential fish habitat, wild and scenic rivers, clean air, riparian areas, natural areas, and invasive species.
☐	☑	• Will the preferred alternative threaten a violation of Federal, State, or local law or requirements for the protection of the environment?

P. The information recorded above is based on the best available information:

In the case where a non-NRCS person (i.e. a TSP) assists with planning they are to sign the first signature block and then NRCS is to sign the second block as the responsible federal agency for the planning action.

Signature (TSP if applicable)	**Title**	**Date**
	State Conservationist	
Signature (NRCS)	**Title**	**Date**

The following sections are to be completed by the Responsible Federal Official (RFO)		
Q. NEPA Compliance Finding (check one)		
The preferred alternative:		**Action required**
☐	1) is **not a federal action** where the agency has control or responsibility.	Document in "R.1" below. No additional analysis is required
☑	2) is a federal action that is **categorically excluded** from further environmental analysis **and** there are no extraordinary circumstances.	Document in "R.2" below. No additional analysis is required
☐	3) is a federal action that has been **sufficiently analyzed** in an existing Agency state, regional, or national NEPA document **and** there are no predicted significant adverse environmental effects or extraordinary circumstances.	Document in "R.1" below. No additional analysis is required.
☐	4) is a federal action that has been sufficiently analyzed in another Federal agency's NEPA document (EA or EIS) that addresses the proposed NRCS action and its' effects **and has been formally adopted by NRCS**. NRCS is required to prepare and publish the agency's own Finding of No Significant Impact for an EA or Record of Decision for an EIS when adopting another agency's EA or EIS document. **Note: This box is not applicable to FSA.**	Contact the State Environmental Liaison for list of NEPA documents formally adopted and available for tiering. Document in "R.1" below. No additional analysis is required
☐	5) is a federal action that has **NOT** been sufficiently analyzed or may involve predicted significant adverse environmental effects or extraordinary circumstances and may require an EA or EIS.	Contact the State Environmental Liaison. Further NEPA analysis required.

R. Rationale Supporting the Finding	
R.1 Findings Documentation	
R.2 Applicable Categorical Exclusion(s) (more than one may apply)	(14) Repairing or maintaining principal spillways and appurtenances associated with existing serviceable dams, originally constructed to NRCS standards, in order to meet current safety standards. Work will be confined to the existing footprint of the dam, and no major change in reservoir or downstream operations will result;
	(15) Repairing or improving (deepening/widening/armoring) existing auxiliary/emergency spillways associated with dams, originally constructed to NRCS standards, in order to meet current safety standards. Work will be confined to the dam or abutment areas, and no major change in reservoir or downstream operation will result;

I have considered the effects of the alternatives on the Resource Concerns, Economic and Social Considerations, Special Environmental Concerns, and Extraordinary Circumstances as defined by Agency regulation and policy.

S. Signature of Responsible Federal Official:

	State Conservationist	
Signature	**Title**	**Date**

Additional notes

CONSULTATION AND PUBLIC PARTICIPATION

PROJECT SPONSORS

Local sponsoring organizations of the SuAsCo Watershed Plan and Supplement No. 10 are the Middlesex Conservation District, DCR, and DFW.

PLANNING TEAM

An interdisciplinary planning team provided for the administration of this project through the NRCS nine-step planning process according to the procedures in the NRCS National Planning Procedures Handbook. Some of the tasks undertaken by the planning team include preliminary investigations, hydrologic and engineering analysis, economic analysis, formulation and evaluation of alternatives, and preparation of the Supplemental Watershed Plan and Environmental Evaluation. The planning team included representatives of the NRCS Massachusetts state office, the NRCS National Water Management Center, DCR, and technical consultants under contract to NRCS.

PUBLIC PARTICIPATION

A public meeting was held in the Town of Berlin on May 24, 2011, to explain the Watershed Rehabilitation Program, obtain public input on the project, and scope resource problems, issues, and concerns of local residents associated with the Tyler Dam project area. The meeting was widely advertised to reach everyone in the watershed including minorities. NRCS distributed a press release on May 6, 2011, that resulted in an article about the meeting in the MetroWest Daily News on May 25, 2011.

Potential alternative solutions to bring the Tyler Dam into compliance with current dam safety criteria were presented at the public meeting. A fact sheet summarizing the planned rehabilitation projects at six dams in the SuAsCo watershed was distributed at the meeting. Several members of the public attended the meeting. No verbal or written comments have been received in the intervening time to the publishing of this plan.

AGENCY CONSULTATION

As previously discussed, a review of the FWS's Federally Listed Endangered and Threatened Species in Massachusetts (FWS 2011) indicates that there are no federally-listed threatened or endangered species located in proximity to the site. As such, a "no species present" letter was obtained from the FWS (Appendix E-2). Additionally, the NHESP has confirmed that there is no habitat for any state-listed rare species in the vicinity of the site.

Consultations with SHPO and the THPO of the Wampanoag Tribe of Gay Head (Aquinnah) were conducted to determine the presence of any cultural or historic resources within the proposed project area. In a letter dated November 17, 2011, the SHPO indicated that no historic resources would be impacted as a result of the proposed project (see Appendix E-2). The THPO of the Wampanoag Tribe of Gay Head (Aquinnah) was sent a request for comment letter on 28

October 2011. No correspondence has been received from THPO. As such, coordination was considered complete as of 16 December 2012.

The U.S. Army Corps of Engineers (USACE) was contacted regarding potential permitting and mitigation requirements of the proposed project. A response from the USACE was not received. It is likely that the project will require a Section 404 permit under the CWA. As such, during the final design stages, when the level of potential impacts are better quantified, the USACE, State, and Local agencies will review the designs to determine the level of permitting required.

PROVISIONS OF THE PREFERRED ALTERNATIVE

PREFERRED ALTERNATIVE

Alternative 2, rehabilitation of the Tyler Dam with PL 83-566[29] funding, is the preferred alternative. The crest of the dam and a portion of the downstream slope would be modified to meet current safety guidelines for a high hazard dam and maintain the service life and flood prevention purpose of the dam. The rehabilitation will consist of armoring the crest of the dam and a portion of the downstream slope with ACBs to safely pass the SDH and FBH storm discharge flows. Estimated construction cost is $818,000 and total installation cost, including engineering and administration is $1,145,000.

The design criteria set forth by the NRCS in TR-60 for a High Hazard Dam was applied. Tyler Dam does not meet the TR-60 criteria for principal spillway capacity and the corresponding auxiliary spillway crest elevation. However, since the NRCS allows for variance from the principal spillway capacity criteria for structural auxiliary spillways, the main safety deficiency remains overtopping of the dam. The NRCS granted a waiver allowing for a variance from the TR-60 criteria which allowed the top-of-dam to be established at the current elevation of 240.64 NAVD88 (Appendix E-2).

The risk of dam failure will be reduced by armoring the crest of the dam and a portion of the downstream slope with ACBs. Although other potential modes of dam failure (e.g. sedimentation, seepage, seismic, and embankment slope failure) are considered to be low or minimal, a failure of the dam would endanger any development in the breach inundation zone. Based on existing land-use and development within the breach inundation zone, 850 residences, 39 non-residential properties, 8 major roads, 1 school, and 3 bridges, plus utilities in the floodplain downstream would be affected (Refer to the Breach Inundation Maps in Appendix C-3).

Table N compares structural data from the original as-built structure, the existing structure, and the planned rehabilitation.

Table N: Comparison of Structural Data

Tyler Floodwater Retarding Dam	Unit	As Built	Existing Conditions	Planned
Drainage area	acres	25,280	25,280	25,280
Elevation, top of-dam (effective)	feet	240.64	240.64	240.64
Length of dam	feet	1,500	1,500	1,500
Principal spillway	type	standard drop inlet	standard drop inlet	standard drop inlet
Elevation, principal spillway riser crest	feet	226.24	226.24	226.24
Pipe dimensions, principal spillway	feet	6.375 x 6.75	6.375 x 6.75	6.375 x 6.75
Auxiliary spillway	type	concrete drop spillway	concrete drop spillway	concrete drop spillway

[29] As amended by PL 106-427, November 9, 2000.

Table N: Comparison of Structural Data

Tyler Floodwater Retarding Dam	Unit	As Built	Existing Conditions	Planned
Elevation, auxiliary spillway crest	feet	230.31	230.31	230.31
Bottom width, auxiliary spillway	feet	275	275	275
Storage, permanent pool	acre-feet	0	0	0
Storage, floodwater retarding pool (Auxiliary Spillway Crest)	acre-feet	1,964	1,463[a/]	1,463[a/]
Storage, maximum pool (Top of Dam)	acre-feet	5,444	4,789	4,789

[a/]Based on stage-storage curve developed by AMEC using MassGIS data.

RATIONALE FOR ALTERNATIVE PREFERENCE

Alternative plans were formulated as required by NRCS policy, Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (U.S. Water Resources Council 1983) and the National Environmental Policy Act[30] (NEPA). According to P&G, an alternative that reasonably maximizes net national economic development benefits is to be formulated. This alternative (Alternative 2) is to be identified as the NED Plan.

Alternative plans were formulated in consideration of the purposes of the project and concerns expressed during the public scoping process. Formulation of the alternative plans gave consideration to four criteria: completeness, effectiveness, efficiency, and acceptability. Alternatives 1 and 2 are the same project, with the only difference being the use of federal funds for a portion of the project costs, and both alternatives meet all four of these criteria. Both alternatives maintain the present level of flood control benefits and comply with current performance and safety guidelines. Both alternatives produce the same monetary benefits, but the net average annual equivalent benefits between the Future with Federal Project (NED Alternative) and the Future without Federal Project (No Federal Action Alternative) is $0.

PERMITS, COMPLIANCE AND REQUIREMENTS PRIOR TO CONSTRUCTION

Potential Permits Needed

Specific permitting needs will be determined during the final design of the dam rehabilitation. The DCR is responsible for obtaining all permits. Federal and state permitting and consultation requirements that are likely to be required are summarized in Table O.

[30] 42 U.S.C. § *et seq*.

Table O: Summary of Federal and State Permit and Consultation Requirements

Permit/Consultation	Regulatory Authority	Status
NPDES General Permit for Construction	EPA	(Not yet acquired)
Section 404 CWA General Permit	USACE	(Not yet acquired)
Section 7 ESA consultation	USFWS	Completed
Section 106 NHPA consultation	SHPO/THPO	SHPO Completed THPO In Progress
Chapter 91 Waterways License	DEP	(Not yet acquired)
Chapter 253 Permit to Construct or Alter a Dam	DEP	(Not yet acquired)
Massachusetts WPA Order of Conditions	Conservation Commission/DEP	(Not yet acquired)
Section 401 Water Quality Certificate	DEP	(Not yet acquired)
MESA[31] consultation	NHESP	Completed

Compliance with Local, State and Federal Laws

The sponsors will comply with all applicable local, state, and federal laws in the installation of this project. Under the conditions of the NPDES general permit for construction, the sponsors or their contractor will prepare a stormwater pollution prevention plan, including an erosion and sediment control plan. In the event that cultural resources are discovered during project installation, construction will be halted in that area, and the resources will be evaluated in accordance with NRCS General Manual 420 part 401.

Mitigation

It is expected that most construction activities would be confined to existing disturbed and cleared areas. No permanent impacts to wetlands are expected, so no wetlands mitigation would be required. Removal of wetland vegetation may be required for temporary construction activities; these disturbed areas would be regraded to pre-construction contours and re-planted with native wetland vegetation. The sponsors would be responsible for preparing an approved sediment and erosion control plan to minimize erosion of disturbed soils and sediment runoff into the Assabet River. The sponsors would also be responsible for ensuring that the sediment and erosion control plan is implemented and maintained during construction and that the site is stabilized after construction. After construction, all temporarily disturbed areas will be regraded to pre-construction contours and reseeded with native species as per NRCS Critical Area Seeding Standard 342.

[31] Massachusetts Endangered Species Act

Operation, Maintenance and Replacement

The project will be operated and maintained by the owner. A new O&M Plan will be developed by both the DCR and NRCS for the remaining 68-year program life of the structure and signed by both parties after the final construction drawings and specification are prepared. O&M activities include but are not limited to inspection, maintenance, and repair of the principal spillway, dam, vegetation, ACBs, and the auxiliary spillway. Based on data from DCR, it is estimated that O&M activities and replacement costs will total about $18,640 per year.

The new O&M Plan will be based on the National Operation and Maintenance Manual. Although the sponsors' responsibility to the Federal Government for O&M ends when the O&M Plan expires upon completion of the evaluated life of measures covered by the agreement, the sponsors acknowledge that continued liabilities and responsibilities associated with works of improvement may exist beyond the evaluated life.

Project Agreement

DCR and NRCS will enter into a Project Agreement in accordance with the NRCS National Contract Grants and Agreement Manual before any work is initiated by either the owner or the NRCS.

Emergency Action Plan

The DCR has prepared an EAP for the Tyler Dam for the case where the dam is compromised and/or likely to fail. The EAP identifies areas at risk and dam conditions that would initiate emergency notification procedures. It outlines appropriate actions in the event of a potential failure of the dam and designates the parties responsible for those actions. The owner will review and update the EAP annually, in consultation with local and state emergency response officials. NRCS, if requested, may provide technical assistance in updating the EAP.

The EAP shall meet the minimum content specified in Part 500.52 of the NRCS Title 180, National Operation and Maintenance Manual (NOMM), Part 500, Subpart F, Section 500.52, and meet applicable State agency dam safety requirements. The NRCS State Conservationist will determine that a current EAP is prepared prior to the execution of fund obligating documents for construction of the structure.

COST, INSTALLATION AND FINANCING

The construction associated with the project will be financed jointly by DCR and NRCS. NRCS will use funds appropriated for this purpose. The eligible project costs including construction, engineering, and project administration to be paid by DCR and NRCS are as follows:

	DCR	NRCS	Estimated Total Cost
Rehabilitation of Tyler Floodwater Retarding Dam	$382,000	$763,000	$1,145,000

NRCS cost share shall be 65 percent of the total eligible project cost, not to exceed 100 percent of the actual construction costs. An amount up to the percentage rate specified may be satisfied by DCR through the cost of engineering and construction. Real property acquisition could also be used as a portion of DCR's cost-share, but is not expected to be required for this project. The decision on specific DCR-funded components will be negotiated between DCR and NRCS and will be included in the Project Agreement executed before implementation.

The NRCS is responsible for the engineering services and project administration costs it incurs. These costs are not used in the calculation of the federal cost share, but they are included in the estimated installation cost. Also, costs of federal, state, and local permits are the responsibility of DCR and are not counted toward the local cost share. See tables below for a complete description of the total rehabilitation cost.

The furnishing of financial and other assistance by the NRCS is contingent on the continuing availability of appropriations by Congress from which payment may be made and shall not obligate the NRCS if Congress fails to so appropriate. The sponsor has requested the NRCS to implement the project through the Federal contracting procedures.

The real property rights meet the minimum PL 83-566 requirements for the rehabilitation project. However, these easements are below the top-of-dam elevation. The sponsor has determined the land rights are adequate based on current local, state, and federal guidelines. The sponsors acknowledge the potential risk of flood damages for current or future upstream development between the flowage rights elevation and the top-of-dam elevation. The sponsor will inform the Town and the land owners.

ECONOMIC AND STRUCTURAL TABLES

Table 1: Estimated Installation Cost
SuAsCo Watershed, Massachusetts
(Dollars)[1/]

Installation Cost Item	Estimated Cost		
	PL 83-566 Funds	Other Funds	Total
Structural measures to rehabilitate Tyler Dam	$763,000	$382,000	$1,145,000
Total Project	**$763,000**	**$382,000**	**$1,145,000**

[1/] Price base: 2013 February 2013

Table 2: Estimated Cost Distribution – Structural and Nonstructural Measures

SuAsCo Watershed, Massachusetts

(Dollars) [1/]

	Installation Cost – PL 83-566 Funds [2/]				Installation Cost – Other Funds				Total Installation Cost
	Construction	Engineering	Project Administration	Total PL 83-566	Construction	Permitting	Project Administration	Total Other	
Structural measures: Tyler Dam	$532,000	$179,000	$52,000	$763,000	$258,000	$96,000	$28,000	$382,000	$1,145,000
Nonstructural measures	$0	$0	$0	$0	$0	$0	$0	$0	$0
Grand total	**$532,000**	**$179,000**	**$52,000**	**$763,000**	**$258,000**	**$96,000**	**$28,000**	**$382,000**	**$1,145,000**

[1/] Price base: 2013 February 2013

[2/] Federal Engineering and Project Administration costs and sponsors' Engineering (permitting) costs ($327,000) are not included when calculating eligible federal cost share. Therefore, federal cost share is based on Total Eligible Project Cost of $818,000.

Table 3: Structural Data – Dams with Planned Storage Capacity
SuAsCo Watershed, Massachusetts

Item	Unit	Tyler Dam
Class of structure		High Hazard
Seismic zone		2
Total drainage area	mi^2	39.5
Uncontrolled drainage area	mi^2	20.9
Runoff curve number (1-day) (ARC[1/])		73 existing development 78 future build-out
Time of concentration (T_c)	hr	14.20
Elevation top of dam	ft	240.64 NAVD88
Elevation crest of auxiliary spillway	ft	230.31 NAVD88
Elevation riser crest principal spillway	ft	226.24 NAVD88
Maximum height of dam	ft	38.5
Volume of fill	yd^3	130,500
Total capacity (auxiliary spillway crest)		
Sediment, submerged	ac-ft	0
Sediment, aerated[2/]	ac-ft	n/a
Flood[3/]	ac-ft	1,463
Surface area		
Sediment pool[4/]	ac-ft	n/a
Floodwater retarding pool	acre	200.5
Principal spillway		
Rainfall volume (1-day)[5/]	in	6.48
Rainfall volume (10-day)[5/]	in	11.51
Runoff volume (1-day)[6/]	In	3.5
Runoff volume (10-day)[6/]	in	7
Max. capacity, low stage	ft^3/s	833.7
Max. capacity, high stage (at top of dam)	ft^3/s	1,655.5
Max. capacity, high stage	ft^3/s	1,774.3
Type (standard drop inlet)		reinforced concrete
Outlet Conduit Dimension	ft	9 x 7
Auxiliary spillway		
Type		Reinforced concrete drop structure
Bottom width	ft	275
Frequency of operation[7/]	% chance	greater than 4
Auxiliary spillway hydrograph[8/]		
Rainfall volume	in	11.29
Runoff volume	in	8.49
Storm duration	hr	14.2
Max. reservoir water surface elevation	ft	238.65 NAVD88
Velocity of flow	ft/s	8.6

Item	Unit	Tyler Dam
Freeboard hydrograph[9/]		
Rainfall volume	in	27.72
Runoff volume	in	24.60
Storm duration	hr	24

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[1/] Antecedent Runoff Condition

[2/] The volume of aerated sediment needs to be based on original design documents; however, those documents were not available at the time of publication of this Final EE.

[3/] Based on stage-storage curve developed by AMEC using MassGIS data.

[4/] According to the SITES manual, "The portion of the reservoir allocated to the accumulation of submerged sediment during the design life of the dam." The Tyler Dam is a dry dam; therefore, this parameter does not apply.

[4/] Rainfall volume is based on the Northeast Regional Climate Center (NRCC) data.

[5/] Runoff volume is based on TR-60 criteria (Tables 2-1(a) and 2-1(b)).

[6/] Frequency of use is based on the 24-hour duration, NRCC distribution storm event. HEC-HMS model was used to estimate flood elevations for several recurrence intervals.

[7/] SDH is based on the 14.2-hr storm event.

[8/] FBH is based on the most critical condition from the 14.2-hr and 24-hr storm events.

Table 4: Estimated Average Annual NED Costs

SuAsCo Watershed, Massachusetts

(Dollars)[1/]

Evaluation Unit	Project Outlays		Total
	Amortization of Installation Cost [2/]	Operation, Maintenance and Replacement Cost	
Tyler Dam	$131,120	$18,640	$149,760
Grand Total	**$131,120**	**$18,640**	**$149,760**

[1/] Price base 2013 February 2013

[2/] Amortized over 68 years at 3.75%

Table 5: Estimated Average Annual Flood Damage Reduction Benefits
SuAsCo Watershed, Massachusetts
(Dollars)[1/]

Item	Estimated Average Annual Damage		Damage Reduction Benefit[3/]
	Without Project[2/]	With Project[2/]	
Floodwater			
Crop and Pasture	$0	$0	$0
Other Agricultural	$0	$0	$0
Nonagricultural (Road and Bridge)	$1,800	$1,800	$0
Nonagricultural (Urban)	$177,300	$177,300	$0
Subtotal	$179,100	$179,100	$0
Sediment			
Overbank Deposition	$0	$0	$0
Erosion			
Floodplain Scour	$0	$0	$0
Grand Total	**$179,100**	**$179,100**	**$0**

[1/] Price Base: 2013 February 2013

[2/] Original downstream damages updated using applicable indices and updated data.

[3/] Damage reduction benefits resulting from the recommended plan equal zero as compared to the No Federal Action (future without project) Alternative because they are the same in scope, cost, and effects, and therefore yield equivalent benefits. Positive benefits will accrue as a result of this project as compared to existing conditions, but no attempt was made to compute an estimate of the difference between the future with project and existing conditions because the existing conditions are not the most likely future conditions. The added details would not alter the recommended alternative and, therefore, would not justify the added planning costs. Sections 1.7.2(a)(4)(ii) and 2.1.1(b)(2) of the P&G allow for the abbreviated procedures.

Table 6: Comparison of NED Benefits and Costs
SuAsCo Watershed, Massachusetts
(Dollars)[1/]

Evaluation Unit	Benefits			Average Annual Costs[3/]	Benefit/Cost Ratio
	Average Annual Benefits		Average Annual Benefits		
	Agriculture-related[2/]	Nonagricultural[3/]			
Tyler Dam	$0	$143,910	$143,910	$143,910	1.0:1.0
Total	**$0**	**$143,910**	**$143,910**	**$143,910**	**1.0:1.0**

[1/] Price Base: 2013 February 2013

[2/] From Table 5

[3/] From Table 4. The costs and the benefits for the future with project plan are the same as those for the future without project plan. To maintain consistency with the display in Table 4, the costs associated with the No Federal Action Alternative (Future Without Project) are tracked as a benefit of the preferred alternative. Per sections 1.7.2(a)(4)(ii) and 2.1.1(b)(2) of the P&G allowing for abbreviated procedures, damage reduction benefits have not been estimated because they are the same for both alternatives, and no net change in benefits occurs when comparing the two candidate plans to each other. The federally assisted alternative is displayed within a zero-based accounting context that credits local costs avoided as "other" benefits consistent with P&G 1.7.2(b)(3). Net benefits are zero because the total project cost is equal to the claimed benefits and the resulting B/C ratio is 1.0:1.0.

FINDINGS OF THE ENVIRONMENTAL EVALUATION

Under NRCS regulations for implementing NEPA, the proposed action qualifies as a categorical exclusion (7 CFR 650.6(d)(14) and (15)):

> Exclusion No. 14 – Repairing or maintaining principal spillways and appurtences associated with existing serviceable dams, originally constructed to NRCS standards, in order to meet current safety standards. Work will be confined to the existing footprint of the dam, and no major change in reservoir or downstream operations will result.
>
> Exclusion No. 15 - Repairing or improving (deepening/widening/armoring) existing auxiliary/emergency spillways associated with dams, originally constructed to NRCS standards, in order to meet current safety standards. Work will be confined to the dam or abutment areas, and no major change in reservoir or downstream operation will result.

FINDINGS

I have considered the effects of this proposed action on resource, economic, and social considerations; special environmental concerns; and extraordinary circumstances criteria in the instructions for form NRCS-CPA-52. I find, for the reasons stated below, that the selected alternative is categorically excluded from further environmental analysis and there are no extraordinary circumstances. No additional environmental analysis is required.

_____	State Conservationist	_____
Signature	Title	Date

RATIONALE

The recommended action will protect human health and safety and the infrastructure and transportation system in the watershed by extending the life of the dam and bringing the structure up to current performance and safety standards. Existing flood control benefits will be maintained. The primary beneficiaries of the project are residential, industrial, and commercial property owners in the floodplain of the Assabet River; the City of Marlborough; the Towns of Berlin and Hudson; and the Commonwealth of Massachusetts.

The proposed action will not permanently affect wetlands. Construction may temporarily disturb less than one acre of wetlands, but disturbed areas will be restored if they cannot be avoided.

There are no historic properties in the project area, which was previously disturbed for construction of the dam. The SHPO has concurred with a determination of no effect on historic resources. A request of comment was sent to the THPO on 28 October 2011. No response from THPO has been received.

No federally protected threatened or endangered species or state-listed rare species will be affected by the project.

No impacts to floodplains, land use, prime farmland, park lands, wild and scenic rivers, or ecologically critical areas will result from the recommended action. Fish and wildlife habitats may be temporarily disturbed during construction, but will not be permanently affected by the project. Water quality and air quality may be temporarily affected by construction, but will not be permanently affected by the project. Best management practices will be employed to minimize soil erosion and stream sedimentation, and all disturbed areas will be restored and revegetated with native species after construction.

No significant adverse environmental impacts will result from the proposed action, and there are no extraordinary circumstances.

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Massachusetts Office of Dam Safety		
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AMEC Earth and Environment, Inc.		
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Petr Masopust, P.E., CFM	MS, Environmental Engineering	8

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APPENDIX A

COMMENTS AND RESPONSES

The following comments from intergovernmental agencies were received during the comment period for the Draft EE. As an EE, a public comment period was not required.

COMMENT [J. Palton; MHC]: [Forwarded a copy of the Notification form cover letter dated 27 October 2011 as well as a copy of the MHC response 17 November 2011.]

RESPONSE: Comment noted. The MHC stated in their 17 November 2011 letter that, "The MHC recommends that the [NRCS] make a finding of 'no historic properties affected' (36 CFR 800.4(d)(1)).

COMMENT [J. Sargent; USACE]: It appears that this project may involve activities that require a permit from the Corps of Engineers…You do not need to submit a formal application if your project meets all the terms and conditions of "Category 1" of the Massachusetts General Permit (GP) and appendices. However, you must ensure that your project complies with all of the terms and conditions of Category 1 of the GP and you must also complete and return the Appendix C Category 1 Form before any work or filing is done in areas subject to USACE jurisdiction. Performing such work or filling without first obtaining USACE authorization could result in substantial penalties.

An application to our office is required if your project is in Category 2 or in the Individual Permit Category…When preparing the plans, please ensure they are no larger than 11"x17". All plans must be drawn to scale and all pertinent features and labeling must be legible and reproducible in black and white/grayscale. Please do not use color; if you need to show details we suggest shading or hatch marks to identify specific areas.

Applications must include sufficient information for us to verify the extent of federal jurisdiction. This will include wetland delineation datasheets for work in wetlands. Wetlands must be identified and delineated in accordance with the USACE Wetland Delineation Manual and the Interim Regional Supplement to the USACE Wetland Delineation Manual: Northcentral and Northeast Region.

RESPONSE: Comment noted. At this time, the exact acreage of potential impact to regulated wetland resources is unknown. However, due to the limited work proposed as part of the dam rehabilitation, it is projected that there will be 0 acres of permanent impact to those regulated resources and less than 1 acre of temporary impact to those resources. Temporary impacts will mainly be the result of construction access and work in the immediate vicinity of the river and any adjacent wetlands. In order to reduce potential impacts to regulated wetlands, proper BMPs will be employed.

Moreover, this EE is serves as a planning document and, as part of the NEPA process, seeks to evaluate the potential impacts on natural and social resources of the area. As such, it is not

intended to serve as a permitting document. However, compliance with all terms and conditions of the GP will be ensured and a formal application to the USACE, if necessary, will be submitted prior to construction and after final design of the proposed rehabilitation.

APPENDIX B

PROJECT MAP

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H:\projects\SuAsCo Share Folder\Tyler\MXD\ProjectMap

SuAsCo: Tyler Dam

Project Map

Legend

- Stream
- 100yr Floodplain
- Tyler Dam Watershed
- NHESP Estimated Habitats of Rare Wildlife

DEP Wetlands

- Marsh/Bog
- Wooded marsh

NWI Wetlands

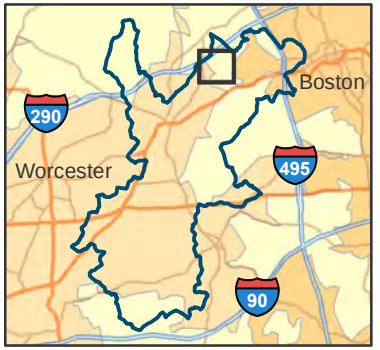
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond

N

0 400 800

Feet

NRCS Natural Resources Conservation Service



Sources: AMEC, 2011; esri, 2006; Microsoft (Bing Maps), 2010; Office of Geographic Information (MassGIS), Commonwealth of Massachusetts Information Technology Division; USFWS, 2010

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APPENDIX C

SUPPORT MAPS

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Sub-appendix C-1

Report Maps

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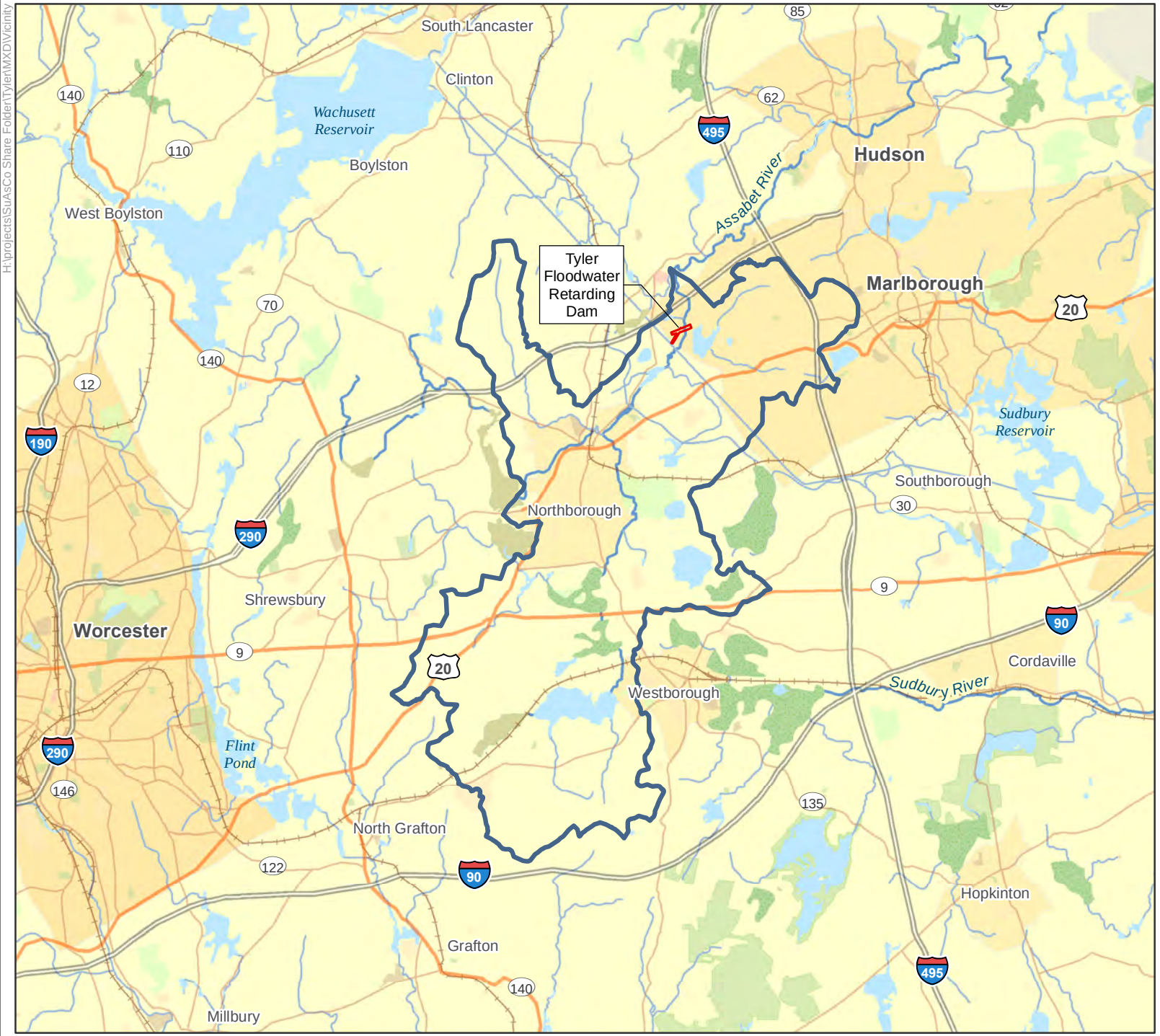

SuAsCo: Tyler Dam

Figure 1. Location Map

Legend

- Tyler Dam
- Tyler Dam Watershed

0 0.5 1 2

Miles

NRCS Natural Resources Conservation Service

Sources: AMEC, 2011; esri, 2006

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SuAsCo: Tyler Dam

Figure 2. Existing Conditions

Legend

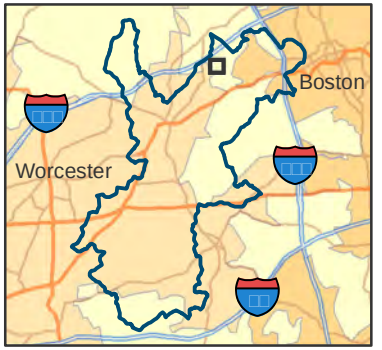
- Contour Line (Elevation in feet)
- Tyler Dam Watershed
- Stream

N

0 200 400

Feet

NRCS Natural Resources Conservation Service



Sources: AMEC, 2011; esri, 2006; Microsoft (Bing Maps), 2010; Office of Geographic Information (MassGIS), Commonwealth of Massachusetts Information Technology Division

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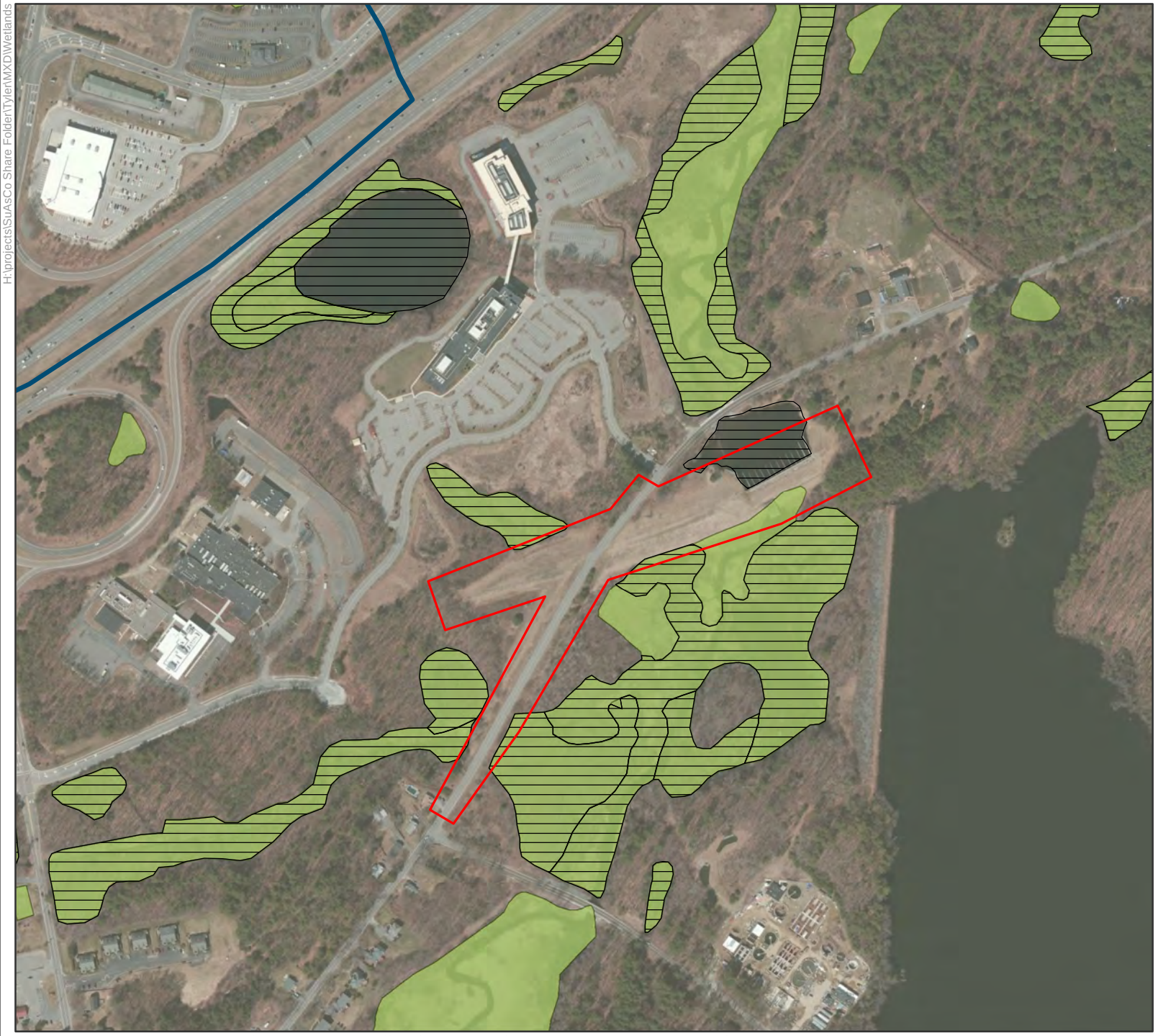


SuAsCo: Tyler Dam

Figure 3. DEP and NWI Wetlands

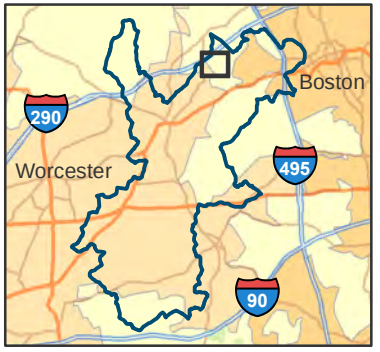
Legend

- DEP Wetlands
- NWI Wetlands
- Tyler Dam
- Tyler Dam Watershed

0 400 800

Feet

NRCS Natural Resources Conservation Service



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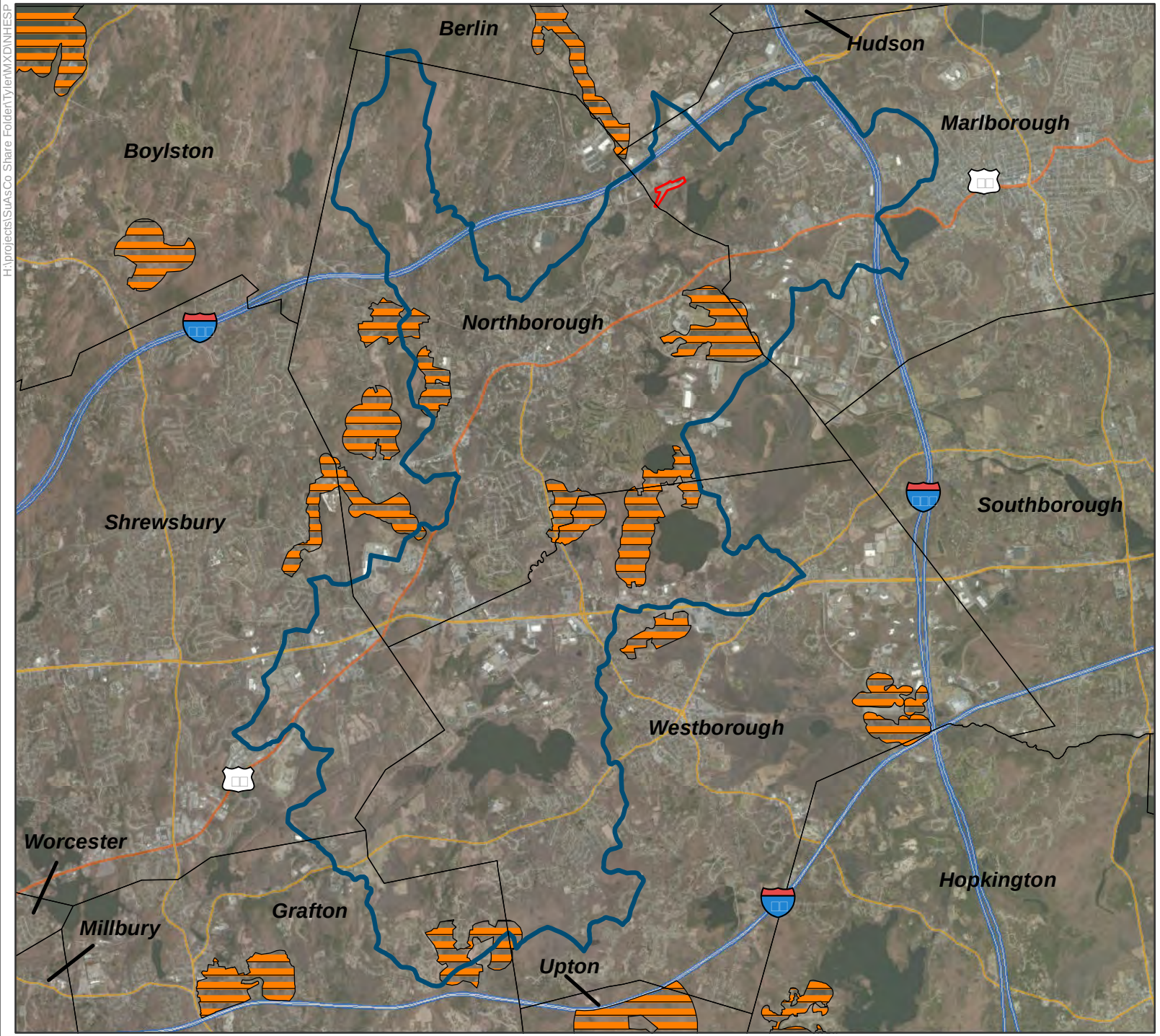

SuAsCo: Tyler Dam

Figure 4. NHESP Habitats of Rare Species

Legend

- NHESP Estimated Habitats of Rare Wildlife
- Tyler Dam
- Tyler Dam Watershed

0 1 2

Miles

NRCS Natural Resources Conservation Service

Sources: AMEC, 2011; esri, 2006; Microsoft (Bing Maps), 2010; Office of Geographic Information (MassGIS), Commonwealth of Massachusetts Information Technology Division; U.S. Census Bureau, 2010

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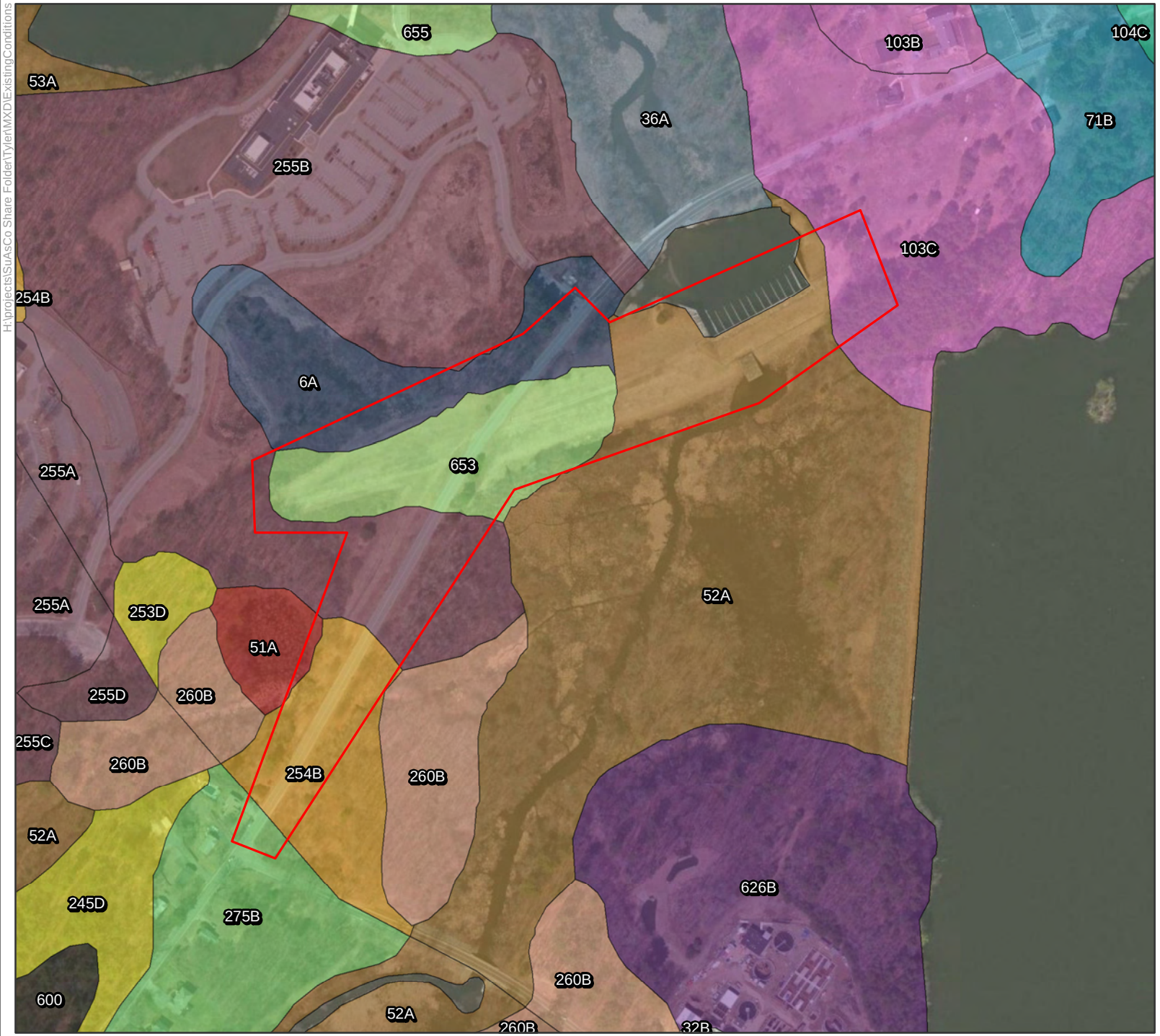


SuAsCo: Tyler Dam

Figure 5. Soils Map

Legend

Tyler Dam

Soils

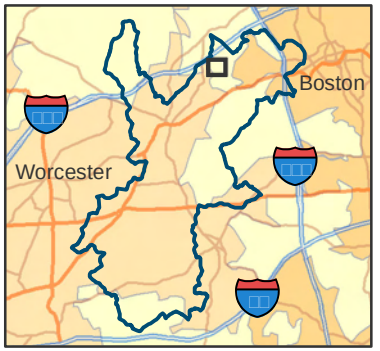
- Agawam fine sandy loam (275B)
- Charlton-Hollis-Rock outcrop complex (103B, 103C)
- Freetown muck (52A, 53A)
- Hinckley loamy sand (253D), Hinckley sandy loam (245D)
- Hollis-Rock outcrop-Charlton complex (104C)
- Merrimac fine sandy loam (254B)
- Merrimac-Urban land complex (626B)
- Pits, gravel (600)
- Ridgebury fine sandy loam (71B)
- Saco mucky silt loam (36A)
- Scarboro mucky fine sandy loam (6A)
- Sudbury fine sandy loam (260B)
- Swansea muck (51A)
- Udorthents (653, 655)
- Wareham loamy fine sand (32B)
- Windsor loamy sand (255A, 255B, 255C, 255D)

N

0 200 400

Feet

NRCS Natural Resources Conservation Service



Sources: AMEC, 2011; esri, 2006; Microsoft (Bing Maps), 2010; Office of Geographic Information (MassGIS), Commonwealth of Massachusetts Information Technology Division

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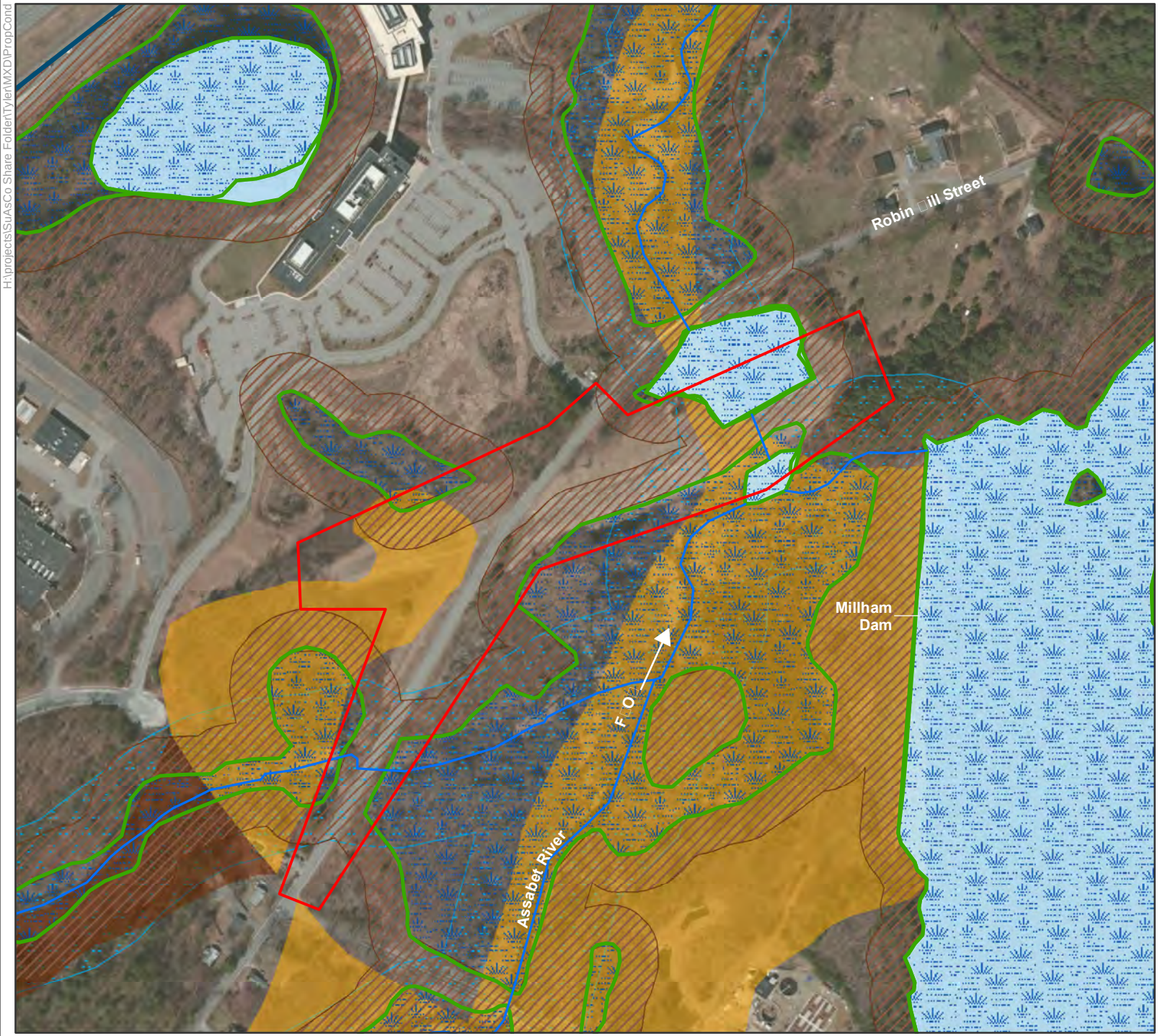
H:\projects\SuAsCo Share Folder\Tyler\MXD\PropCond

SuAsCo: Tyler Dam

Figure 6. Field Assessed Wetlands



Legend

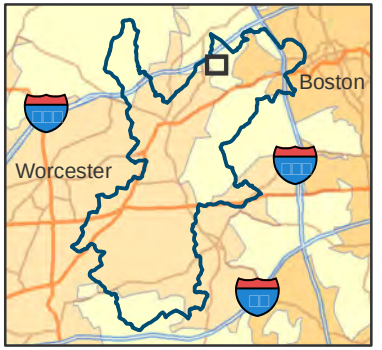
- Perennial Streams
- Tyler Dam
- 100yr Floodplain
- 500yr Floodplain
- Banks
- Buffer Zone
- Ponds
- Wetlands
- Tyler Dam Watershed
- River Front Area

N

0 200 400

Feet

NRCS Natural Resources Conservation Service



Sources: AMEC, 2011; esri, 2006; Microsoft (Bing Maps), 2010; Office of Geographic Information (MassGIS), Commonwealth of Massachusetts Information Technology Division

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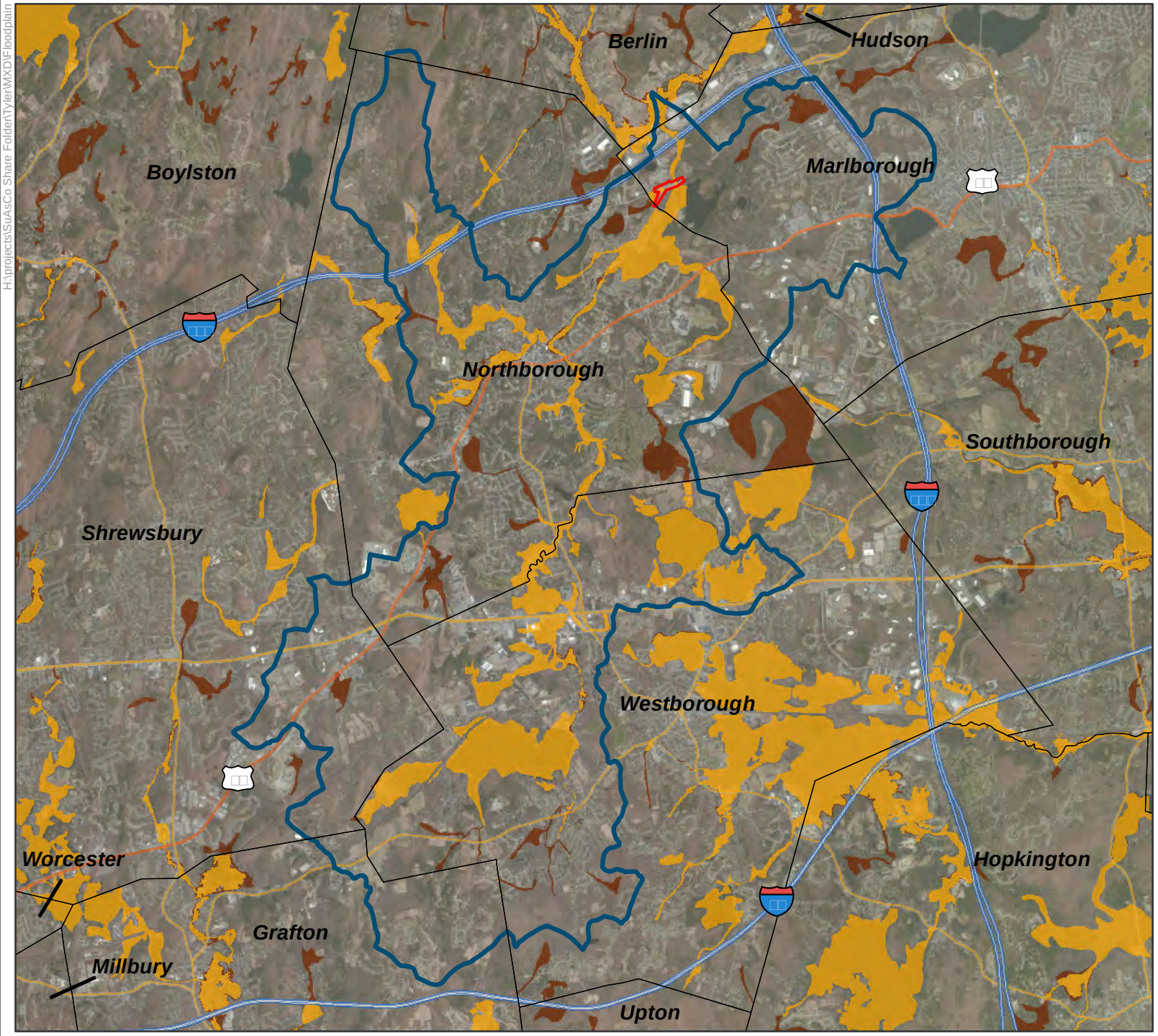
H:\projects\SuAsCo Share Folder\Tyler\MXD\Floodplain



SuAsCo: Tyler Dam

Figure 7. Floodplains

Legend

- 100yr Floodplain
- 500yr Floodplain
- Tyler Dam
- Tyler Dam Watershed

0 1 2

Miles

NRCS
Natural Resources Conservation Service

Sources: AMEC, 2011; esri, 2006; Microsoft (Bing Maps), 2010; Office of Geographic Information (MassGIS), Commonwealth of Massachusetts Information Technology Division; U.S. Census Bureau, 2010

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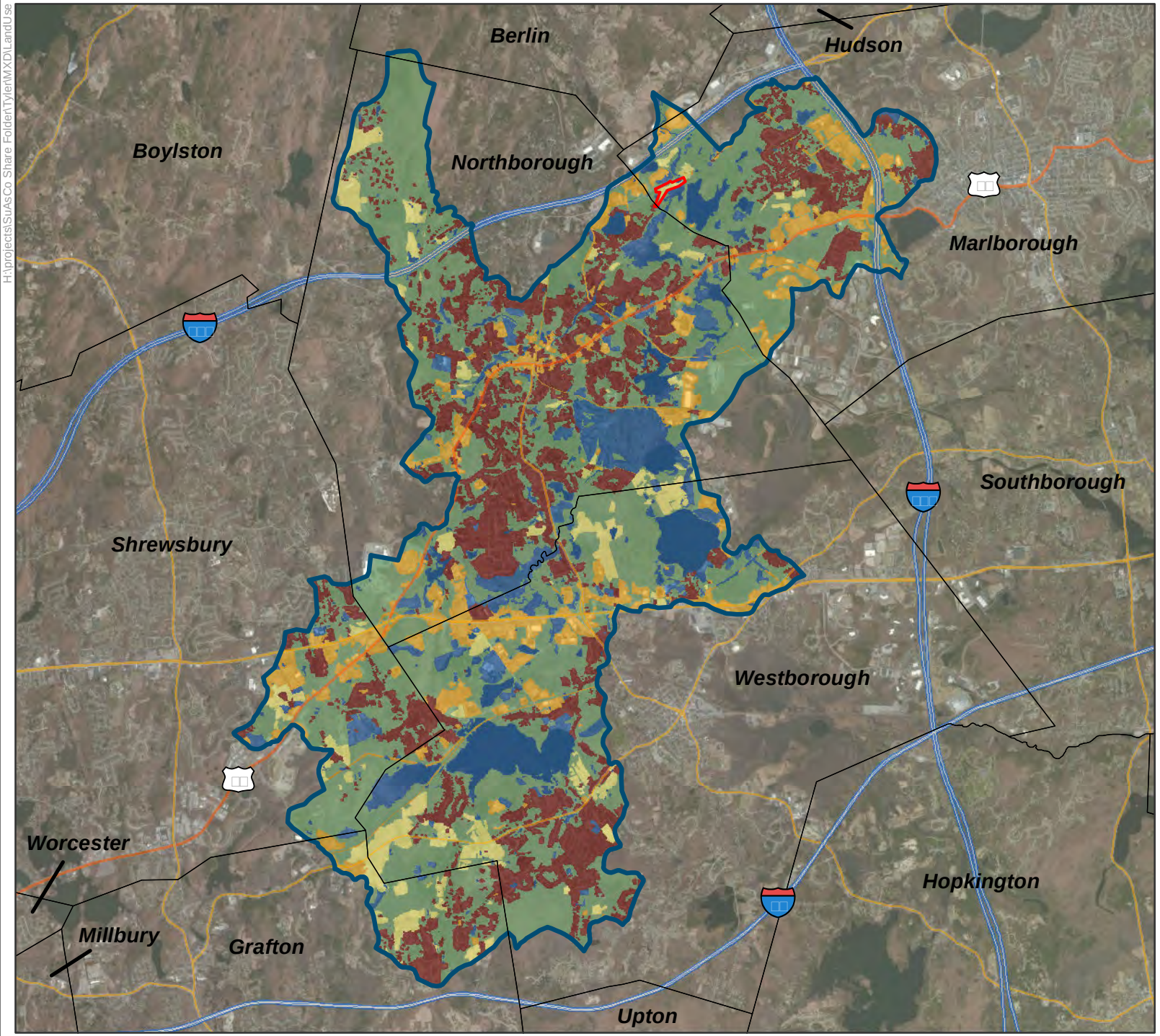
H:\projects\SuAsCo Share Folder\Tyler\MXD\LandUse



SuAsCo: Tyler Dam

Figure 8. Current Land Use in Drainage Area

Legend

- Tyler Dam
- Tyler Dam Watershed

Land Use Category

- Agriculture
- Developed Industrial/Commercial
- Developed Residential
- Forest
- Other

0 1 2

Miles

NRCS Natural Resources Conservation Service

Sources: AMEC, 2011; esri, 2006; Microsoft (Bing Maps), 2010; Office of Geographic Information (MassGIS), Commonwealth of Massachusetts Information Technology Division

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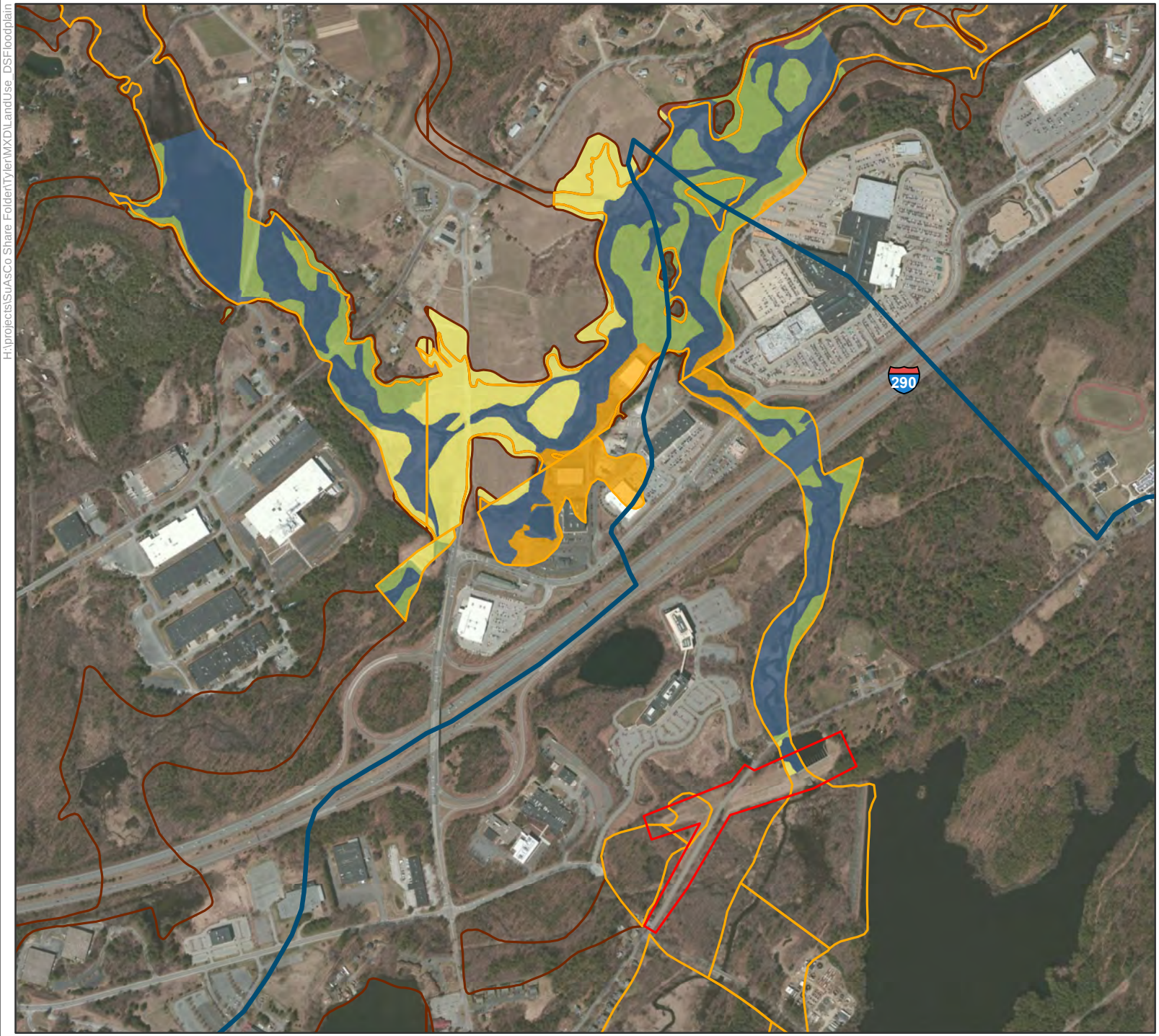
H:\projects\SuAsCo Share Folder\Tyler\MXD\LandUse_DSFloodplain

SuAsCo: Tyler Dam

Figure 9. Current Landuse in the Downstream Floodplain



Legend

- Tyler Dam
- Tyler Dam Watershed
- 100yr Floodplain
- 500yr Floodplain

Land Use Category

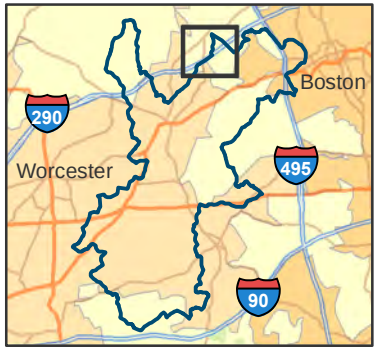
- Agriculture
- Developed Industrial/Commercial
- Developed Residential
- Forest
- Other

N

0 500 1,000

Feet

NRCS Natural Resources Conservation Service



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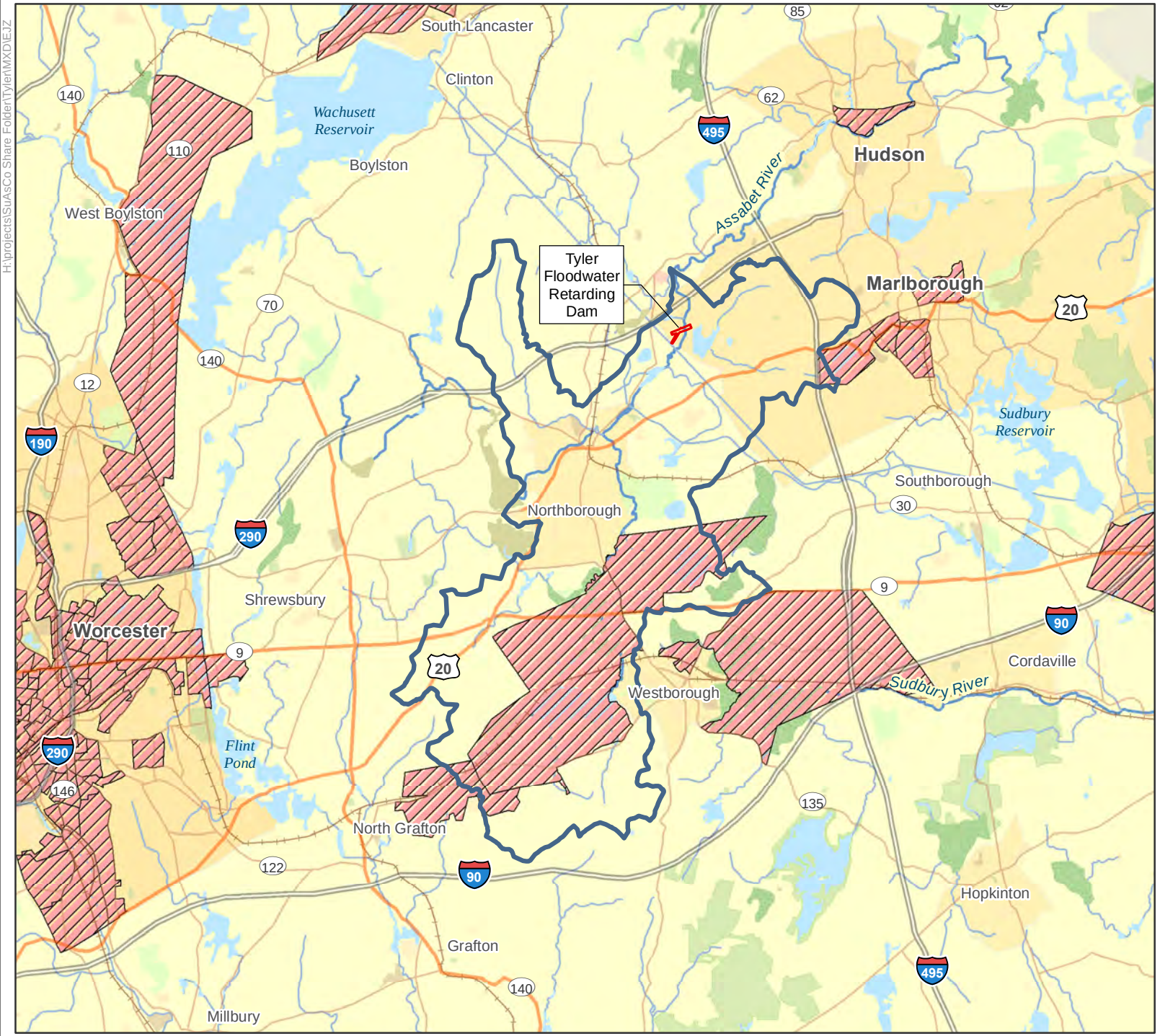

SuAsCo: Tyler Dam

Figure 10. Environmental Justice Zones

Legend

- Environmental Justice Zone
- Tyler Dam
- Tyler Dam Watershed

0 0.5 1 2

Miles

Sources: AMEC, 2011; esri, 2006; Office of Geographic Information (MassGIS), Commonwealth of Massachusetts Information Technology Division, 2003; U.S Census Bureau, 2000

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Sub-appendix C-2

Engineering Plans

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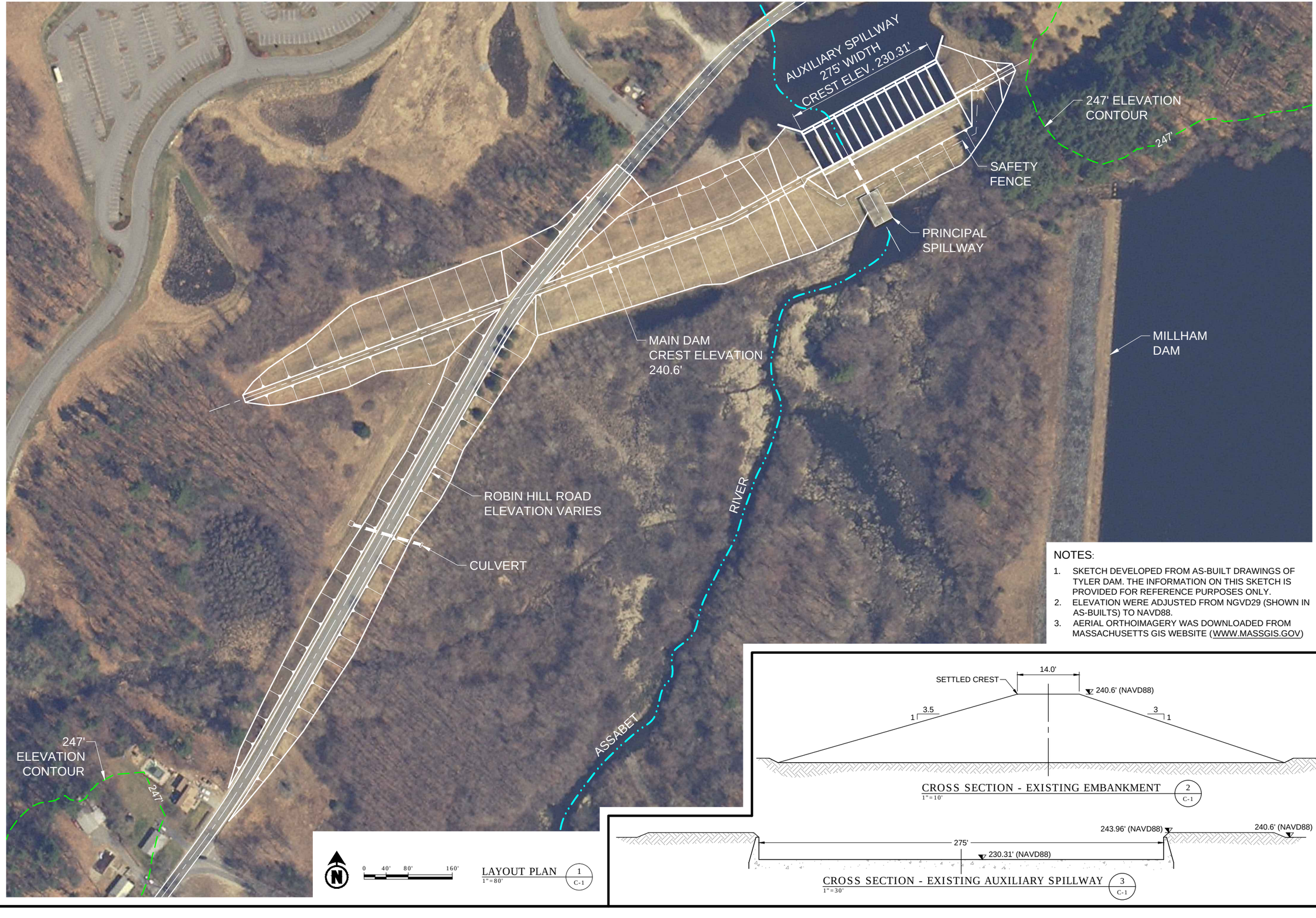

LAYOUT PLAN 1 / C-1
1"=80'

CROSS SECTION - EXISTING EMBANKMENT 2 / C-1
1"=10'

CROSS SECTION - EXISTING AUXILIARY SPILLWAY 3 / C-1
1"=30'

NOTES:

1. SKETCH DEVELOPED FROM AS-BUILT DRAWINGS OF TYLER DAM. THE INFORMATION ON THIS SKETCH IS PROVIDED FOR REFERENCE PURPOSES ONLY.
2. ELEVATION WERE ADJUSTED FROM NGVD29 (SHOWN IN AS-BUILTS) TO NAVD88.
3. AERIAL ORTHOIMAGERY WAS DOWNLOADED FROM MASSACHUSETTS GIS WEBSITE (WWW.MASSGIS.GOV)

Designed JVB
Drawn MA
Checked PM
Approved JVB

Rev.	Description	Date
0	Final Submission	01.10.12

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Environment & Infrastructure, Inc.
2 Robbins Road
Westford, Massachusetts 01886
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Web: www.amec.com

Tyler Floodwater Retarding Dam Rehabilitation Alternatives

EXISTING CONDITIONS

Assabet River, Marlborough, Middlesex County, Massachusetts

United States Department of Agriculture Natural Resources Conservation Service

Drawing No.
C-1

Sheet 1 of 2

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Save Time 10:58 AM
File Name 20120710-Tyler Alternatives.dwg

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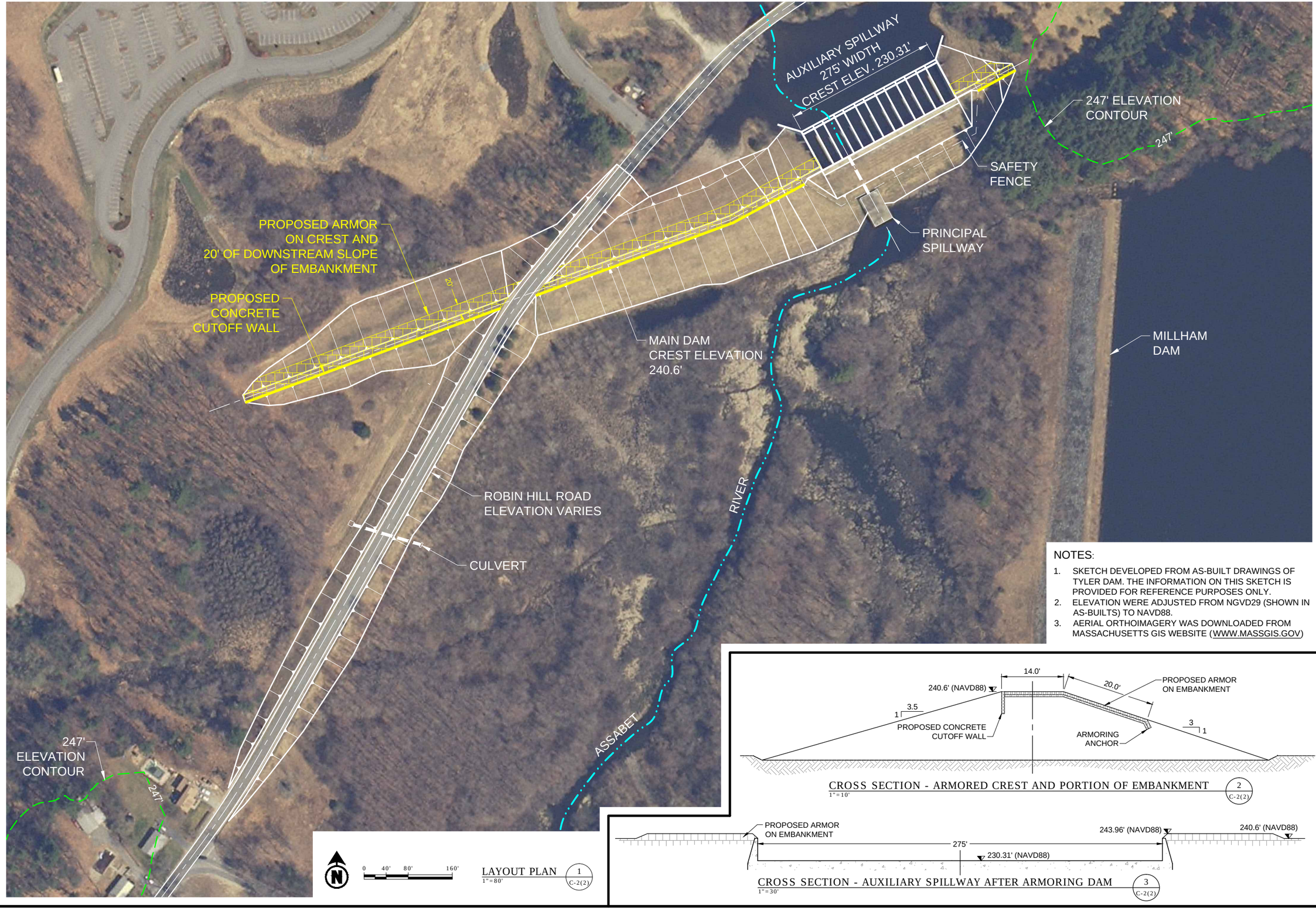

LAYOUT PLAN 1 (C-2(2)) 1"=80'

NOTES:

1. SKETCH DEVELOPED FROM AS-BUILT DRAWINGS OF TYLER DAM. THE INFORMATION ON THIS SKETCH IS PROVIDED FOR REFERENCE PURPOSES ONLY.
2. ELEVATION WERE ADJUSTED FROM NGVD29 (SHOWN IN AS-BUILTS) TO NAVD88.
3. AERIAL ORTHOIMAGERY WAS DOWNLOADED FROM MASSACHUSETTS GIS WEBSITE (WWW.MASSGIS.GOV)

CROSS SECTION - ARMORED CREST AND PORTION OF EMBANKMENT 2 (C-2(2)) 1"=10'

CROSS SECTION - AUXILIARY SPILLWAY AFTER ARMORING DAM 3 (C-2(2)) 1"=30'

Designed	JVB
Drawn	MA
Checked	PM
Approved	JVB

Rev.	Description	Date
0	Final Submission	01.10.12

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Tyler Floodwater Retarding Dam Rehabilitation Alternatives

ALTERNATIVE 2

ARMORED CREST AND PORTION OF D/S SLOPE

Assabet River, Marlborough, Middlesex County, Massachusetts

United States Department of Agriculture Natural Resources Conservation Service

Drawing No. C-2

Sheet 2 of 2

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File Name 20120710-Tyler Alternatives.dwg

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Sub-appendix C-3

Breach Inundation Maps

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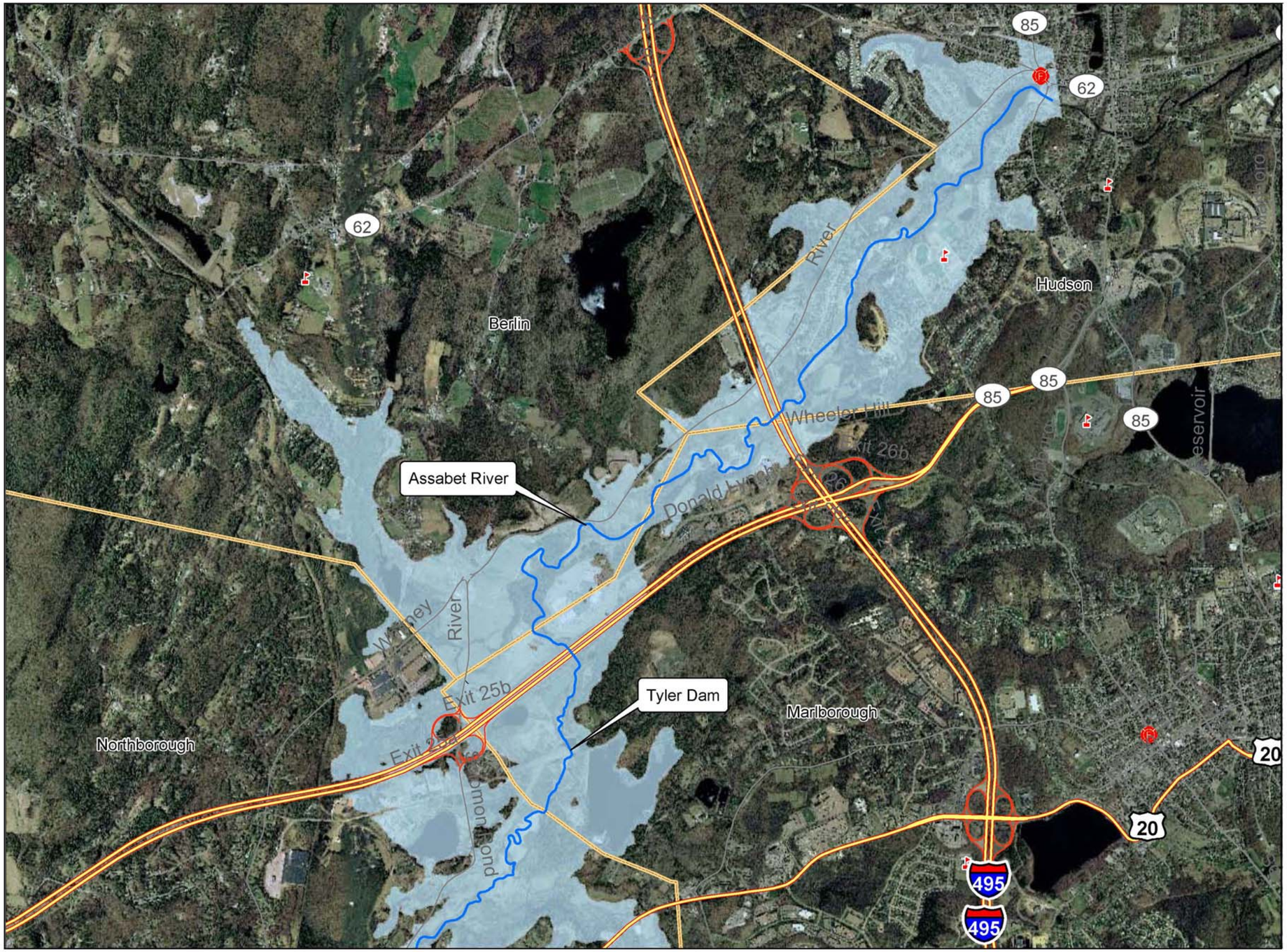
FIGURE 1-1

Structures Within the PMP Breach Inundation Zone

TYLER FLOODWATER RETARDING DAM



Legend

- Town Boundary
- Highways
- Main Roads
- Stream
- PMP Breach Inundation Zone
- Fire Station
- Public School

*There are no Hospitals, Colleges/Universities, or Police Stations located in the inundation zone.

Location of Project Site

Notes and Sources

Notes: Imagery provided by ESRI.

N

0 2,400 Feet

AMEC Earth & Environmental, Inc.
2 Robbins Road
Westford, MA 01886
(978) 692-9090

H:\NRCS\Northborough_MA\Task1\MXD\TylerDamBreach_Structures.mxd August 16, 2011 DWN: JDP CHKD: PM

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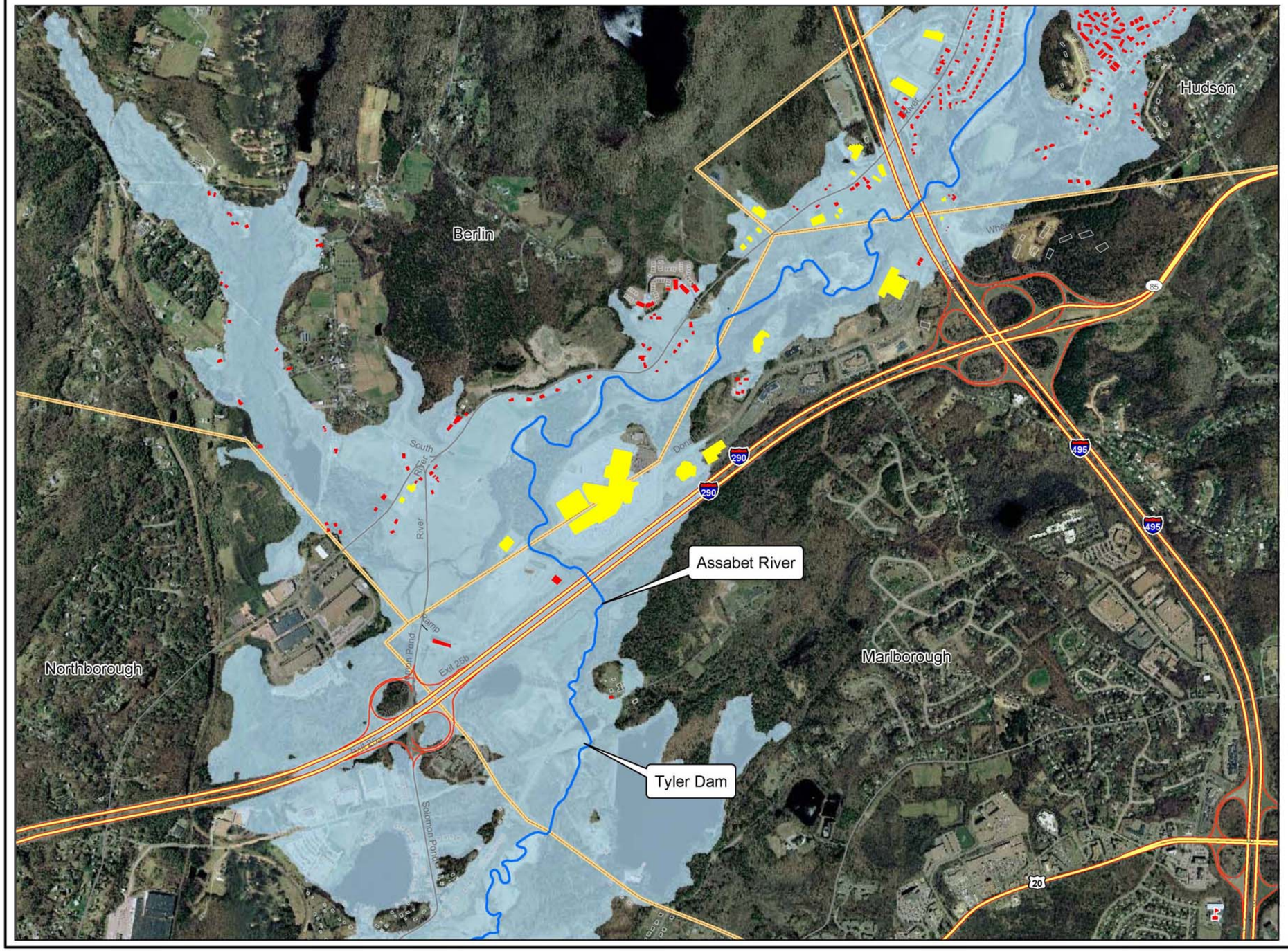
FIGURE 1-2

Structures Within the PMP Breach Inundation Zone

TYLER FLOODWATER RETARDING DAM



Legend

- Residential Buildings
- Non-Residential Buildings
- Buildings Outside of the PMP Breach Inundation Zone
- Town Boundary
- Highways
- Main Roads
- Stream
- PMP Breach Inundation Zone
- Fire Station
- Public School

*There are no Hospitals, Colleges/Universities, or Police Stations located in the inundation zone.

Location of Project Site

Notes and Sources

Notes: Imagery provided by ESRI.

N

0 1,500 Feet

AMEC Earth & Environmental, Inc.
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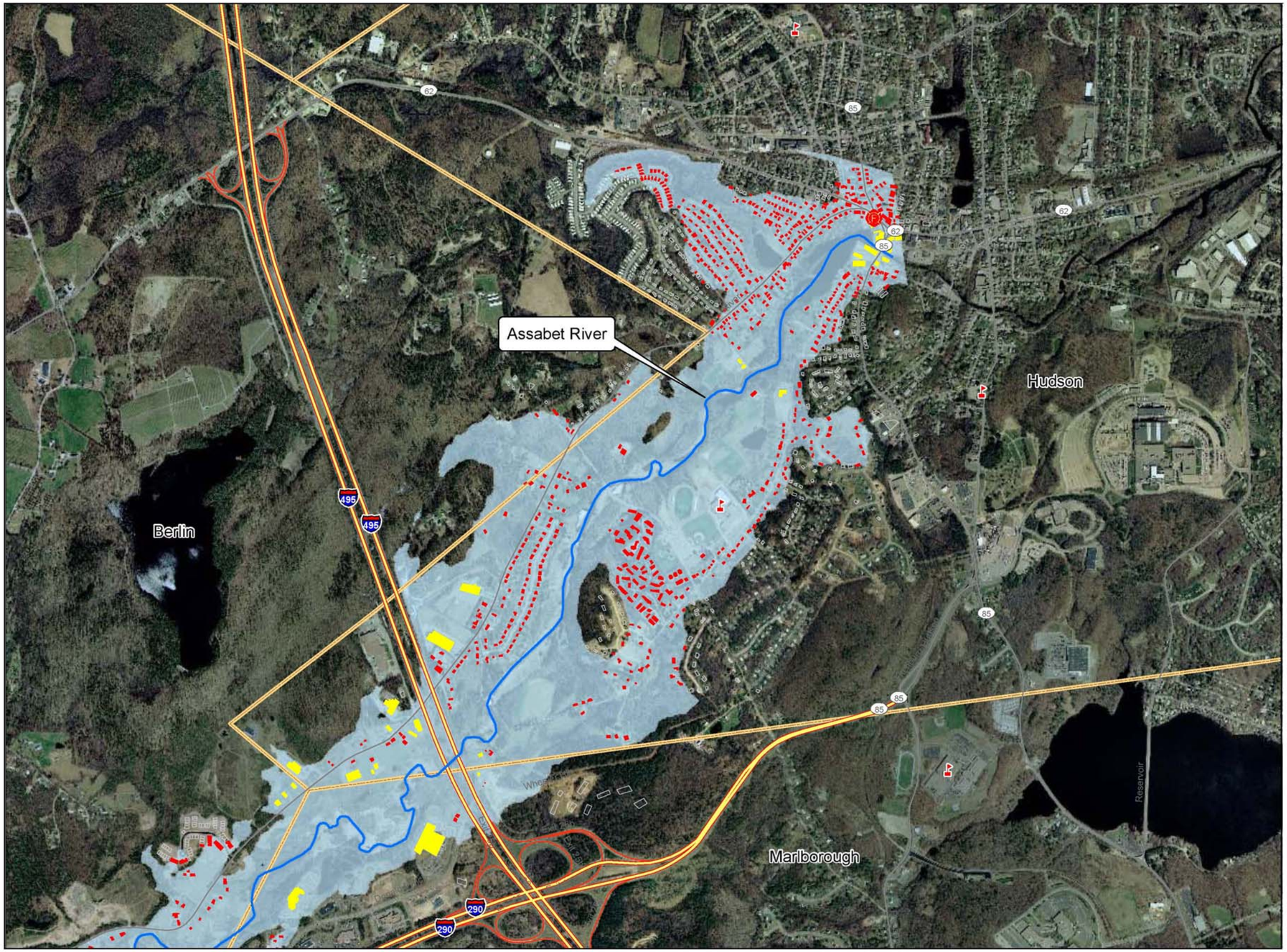
FIGURE 1-3

Structures Within the PMP Breach Inundation Zone

TYLER FLOODWATER RETARDING DAM



Legend

- Residential Buildings
- Non-Residential Buildings
- Buildings Outside of the PMP Breach Inundation Zone
- Town Boundary
- Highways
- Main Roads
- Stream
- PMP Breach Inundation Zone
- Fire Station
- Public School

*There are no Hospitals, Colleges/Universities, or Police Stations located in the inundation zone.

Location of Project Site

Notes and Sources

Notes: Imagery provided by ESRI.

N

0 1,500 Feet

AMEC Earth & Environmental, Inc.
2 Robbins Road
Westford, MA 01886
(978) 692-9090

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APPENDIX D

INVESTIGATION AND ANALYSIS REPORT

Clean Air Act: The Clean Air Act[32] regulates air pollutants at the national level. The 8-hour Ozone Nonattainment Area State/Area/County Report (EPA 2011) was reviewed to determine if the site was within any of the 8-hour nonattainment areas designated by the U.S. Environmental Protection Agency (EPA), which it is. Additionally, the Massachusetts 2010 Air Quality Report (DEP 2011) was reviewed to determine the existing conditions of the air quality in the vicinity of the site. Furthermore, the project was reviewed to analyze potential air quality impacts that may occur as a result of the dam rehabilitation. It was determined that only minor, temporary impacts related to construction-related activities would occur which would result in a limited decrease in air quality during construction. Once construction has been completed, it is expected that existing air quality will resume to the current existing conditions.

Clean Water Act / Waters of the U.S.: The Clean Water Act[33] (CWA) applies to waters of the U.S. which generally refers to waters (i.e., rivers, lakes, etc.) that are traditionally navigable and their adjacent and contributing waters (i.e., streams, wetlands, etc.). Typically, projects are most often affected by the CWA under Section 401 and Section 404. In summary, Section 401 prohibits the degradation of water quality by regulated activities; Section 404 regulates the discharge of dredged or fill material into waters of the U.S.

As part of the planning process for the rehabilitation of the dam, Massachusetts Geographic Information Systems (MassGIS) (MassGIS 2009) and National Wetlands Inventory (NWI) (FWS 2009) wetlands data was overlaid on the project area to determine if there were any mapped wetland habitats in the vicinity of the dam. An infield site assessment was completed to determine the presence of any wetlands or other waters of the U.S. within the proposed project area in order to "ground truth" the wetlands mapping. As a result, several wetlands and waters courses were identified within the vicinity of the site. These potentially regulated areas were overlaid onto the proposed engineering plans to determine if there would be any significant impacts to those resources as a result of the dam rehabilitation.

It was determined that rehabilitation of the dam will likely result in minor, temporary impacts likely less than 1 acre as a result of construction due to construction access and other construction-related activities. There are 0 permanent wetland impacts expected as a result of construction. The water quality of the Assabet River may be affected by temporary construction-related disturbance resulting in erosion and sedimentation. Compliance with state laws, application of best management practices (BMPs), and revegetation of the disturbed area would minimize these impacts. As such, it is likely that the project will require a Section 401 Water Quality Certificate from the Massachusetts Department of Environmental Protection (DEP) and a Section 404 General Permit (GP) Permit from the U.S. Army Corps of Engineers (USACE).

[32] 42 U.S.C. 7401 *et seq*
[33] 33 U.S.C. §1251 *et seq*.

Coastal Zone Management: Massachusetts's Coastal Management Program consists of enforceable programs and management principles which govern activities within a coastal zone. The Massachusetts coastal zone is generally restricted to land within 0.5 miles of coastal waters and salt marshes as well as all islands.

To evaluate the potential effects of dam rehabilitation on Coastal Zone Management areas, data from the Massachusetts Ocean Resources Information System (MORIS) was reviewed (MassGIS 2008a). The review indicated that the dam is not within any Coastal Zone Management areas.

Coral Reefs: The dam is located over 30 miles inland from the nearest coastal waters in Boston, Massachusetts. Since the dam is not in the vicinity of any coastal waters, it was determined that rehabilitation of the dam will not result in any impacts to coral reefs. Given the dam's inland locale, further consideration of impacts to coral reefs is not warranted.

Cultural Resources: The National Register of Historic Places (National Register) (NPS 2011a) was reviewed to determine the presence of any places listed or eligible for listing on the National Register. No places listed or eligible for listing in the vicinity of the dam were identified. Additionally, the Massachusetts State Historic Preservation Office (SHPO) and the Tribal Historic Preservation Office (THPO) were both consulted regarding the presence of known historic and cultural resources at the site. The SHPO indicated that there are no historic sites on the dam property, and no archeological sites would be affected by construction, which would be limited to the existing disturbed area with a determination of no effect on historic resources on November 17, 2011. THPO was sent a request for comment letter on 28 October 2011; a response has not received from the THPO. 36 CFR 800.3(c)(4) states that if THPO fails to respond within 30 days for a request of review, the project may move forward to the next step in the process.

Economic Analysis: The Natural Resources Conservation Service's (NRCS) National Watershed Program Manual (NRCS 2009a) and the National Watershed Program Handbook (NRCS 2010a) were used as references for the economic analysis along with two economic analysis guidance documents: Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (P&G) (WRC 1983) and the Economics Handbook, Part II for Water Resources (NRCS 1998). These guidance documents were used to evaluate potential flood damages, and estimate project benefits and associated costs. P&G was developed to define a consistent set of project formulation and evaluation instructions for all federal agencies that carry out water and related land resource implementation studies. The basic objective of P&G is to determine whether or not benefits from proposed actions exceed project costs. P&G also requires that the National Economic Development (NED) or NED Alternative, which maximizes monetary net benefits, be selected for implementation unless there is an overriding reason for selecting another alternative based on federal, state, local or international concerns related to the social and environmental accounts. The allowance for exceptions to the NED plan recognizes the fact that not all project considerations or benefits can be quantified and monetized when it comes to some ecological system and social effects.

Per sections 1.7.2(a)(4)(ii) and 2.1.1(b)(2) of the P&G allowing for abbreviated procedures, damage reduction benefits have not been estimated because they are the same for both

alternatives, and no net change in benefits occurs when comparing the two candidate plans to each other. The federally assisted alternative (Alternative 2) is displayed within a zero-based accounting context that credits local costs avoided (Adverse, annual) as beneficial costs (Beneficial, annual) consistent with P&G 1.7.2(b)(3). Net benefits are zero because the total project cost is equal to the claimed benefits and the resulting B/C ratio is 1.0:1.0.

Positive benefits would accrue as a result of this project as compared to existing conditions, but no attempt was made to compute an estimate of the difference between the future with project and existing conditions because the existing conditions are not the most likely future conditions. The added details would not alter the recommended alternative and, therefore, would not justify the added planning costs. Project flood-prevention benefit estimates were updated to 2012 dollars from the 1958 watershed plan. The Consumer Price Index (CPI) was used for updating reduction benefits for roads and bridges. Original downstream damage reduction benefits for residential and commercial properties were updated using the average increase in tax receipts. Values for selected commercial properties that constitute a major portion of the benefit calculations were updated to reflect current market values. These benefit estimates were not used to compare alternatives, because both alternatives provide the same benefit, but they show the ongoing value to the Commonwealth of Massachusetts and the local towns of the flood prevention provided by Tyler Dam.

All costs of installation and operation and maintenance were based on 2012 prices. One year was assumed for development, review, and approval of the final design and installation of the proposed rehabilitation project. Structural measures were assumed to have a 67-year useful life. Thus, a 68-year period of analysis was used along with the mandated 3.78 percent discount rate for all federal water resource projects for Fiscal Year 2012 (FY12) to discount and amortize the anticipated streams of costs and benefits.

Endangered and Threatened Species: Initial assessment of potential environmental impacts was based on review of natural resources information in MassGIS and consultations with U.S. Fish and Wildlife Service (FWS) and Massachusetts Natural Heritage and Endangered Species Program (NHESP). The FWS's list of Federally Listed Endangered and Threatened Species in Massachusetts (FWS 20011) was reviewed to determine the potential presence of any federally listed threatened or endangered (T&E) species in the vicinity of the site. As such, it was determined that there are no federally-protected threatened or endangered species in the project area. The NHESP's Priority Habitat for Rare Species (MassGIS 2008b) and Estimated Habitat for Rare Species (MassGIS 2008c) datasets were reviewed for the presence of rare species or their suitable habitats in the vicinity of the dam. As such, it was determined that there are no state-protected threatened or endangered species in the project area.

Engineering: NRCS contracted with AMEC Earth and Environmental in 2011 to complete an engineering report for the rehabilitation of the Tyler Floodwater Retarding Dam. Several alternatives (AMEC 2012) were screened out from further analysis because of cost, constructability, or environmental impacts, including:

- Decommissioning
- Relocation
- Floodproofing
- Widening the auxiliary spillway
- Labyrinth spillway
- Increase downstream conveyance
- Reduce PMP storm requirements for the FBH

Structural alternatives evaluated in detail were:

- Raise the height of the dam
- Armor the dam

The project team performed additional SITES modeling to determine the initial reservoir elevation for routing of the SDH and FBH. The results of the model confirmed that the principal spillway does not have enough capacity to pass the 1-day/10-day 100-year storm without overtopping the auxiliary spillway. However, AMEC also performed a WinDAM analysis that indicated that the 24-hour FBH would over top the dam by approximately 4.52 feet. Hydraulic modeling also determined that tailwater conditions at the dam impede the passage of flow through the spillway system and contribute to overtopping of the dam. The tailwater conditions appear to be caused by a series of low-profile bridge crossings, including Robin Hill Street located immediately downstream of the dam. It should also be noted that the time of concentration was determined to be shorter (14.2 hours) than the time of concentration used in the previous engineering studies (20.6 hours). The time of concentration, however, incorporates the most recent hydraulic modeling results and was calculated in accordance with NRCS guidelines.

Breach Analysis – An inundation analysis was conducted in 2007 by Kleinschmidt Energy & Water Resource Consultants (Kleinschmidt 2007) to calculate the peak modeled water surface that can be expected as a result of failure of the Tyler Dam. Only the IDF event failure was simulated for Tyler Dam due to the fact that there is no impoundment during normal operating conditions, and therefore no flooding would occur downstream as a result of a dam failure under sunny conditions.

Hydrologic and hydraulic data was obtained from the Tyler Dam Phase I Inspection Reports (Schoeneld 1981 and PARE 2006). All Geographic Information Systems (GIS) data used for mapping and the river terrain was obtained from the Massachusetts State GIS website, including the elevation data and the Manning's "n" values as developed from Land Cover data which was used in the HEC-RAS model. The hydrologic and hydraulic data was assembled using HEC-GeoRAS and modeled with HEC-RAS v3.1.3. Once the dam breach model was developed, it was calibrated to the FEMA Q3 100- and 500-year levels found in the 1982 Flood Insurance Study for the Town of Berlin (the closest available study that had data for Tyler Dam). In order to achieve the desired breach trigger conditions, the starting water level in the impoundment was set to elevation 239.4 feet, the IDF level noted in the 1981 Phase I Report for the PMF condition. For the breach and non-breach scenario, the peak inflow was set to be 19,500 cfs, which

corresponds to the given IDF level on the Tyler Dam rating curve found in the 1981 Phase I Report.

The results of the IDF failure condition indicated a peak breach flow of approximately 36,000 cfs and assuming limited inflow into the reservoir and a constant peak breach outflow, the impoundment volume would be depleted in just under two hours. Peak flow for the non-breach scenario was approximately 19,500 cfs.

The inundation maps of the downstream areas indicated that significant development would be inundated under the breach and non-breach scenario, including Robin Hill Street, Interstate-290, Pleasant Street, Bigelow Street, Chaplin Road and residential and commercial structures. These areas would be inundated by four to twelve feet of water under the non-breach scenario, and would be overtopped by an additional six inches to three feet under the breach scenario. However, Interstate-495 (located approximately 2.7 miles downstream) would not be overtopped under the breach or non-breach scenario.

However, it was assumed that the bridge openings would be completely unblocked and any blockages due to existing debris under the bridges carried downstream by floodwater would reduce the flow passing capacity of the bridges, thereby raising the water levels on the upstream side and potentially causing Interstate-495 to be overtopped. Backwater effects from this event would also cause the bridge on Whitney Street, River Road, and a small bridge northwest of Interstate-290 to be inundated.

The downstream limit of the model was the Washington Street Dam (approximately five miles downstream from Tyler Dam). In this area, the incremental rise would be approximately 0.37 feet.

Results from the dam breach analysis were used to update the EAP for the Tyler Dam. The EAP provides appropriate actions in the case of dam failure and is updated annually by DCR.

Population at Risk – The Population at Risk (PAR) was evaluated by the Pare Corporation (PARE) as part of the 2009 Engineering Assessment (NRCS 2009b). That report determined that the maximum PAR as a result of dam failure was 695. The PAR was defined as the persons exposed to flood waters if no action to evacuate was taken.

Environmental Justice: MassGIS data (2003) depicting Environmental Justice Zones was reviewed to determine if there were any zones within close proximity to the dam. The data shows that there are no Environmental Justice Zones in the vicinity of the project site.

Essential Fish Habitat: To analyze whether rehabilitation of the dam will impact essential fish habitat, National Oceanic and Atmospheric Administration's (NOAA) Essential Fish Habitat Mapper[34] was reviewed. The mapper shows that there is no essential fish habitat within close proximity to the dam. As such, further analysis regarding potential impacts to essential fish habitat is not warranted.

[34] NOAA Essential Fissh Habitat Mapper. Available [online]: http://sharpfin.nmfs.noaa.gov/website/EFH_Mapper/map.aspx. Accessed 21 March 2012.

Floodplain Management: The 100-year floodplain (MassGIS 1997) was reviewed to determine what, if any, impacts rehabilitation of the dam would have on the floodplain. As a result of the review, it was determined that rehabilitation of the dam will likely not impact the downstream floodplain. In fact, because the rehabilitation will bring the dam into federal and state dam safety guidelines and standards, the downstream floodplain will benefit from the rehabilitation. The rehabilitation will reduce the potential of the dam from failing. Failure of the dam would result in high velocity flows through the auxiliary spillway and downstream of the dam which would likely cause heavy erosion and sedimentation of the downstream floodplain.

Hydrology: NRCS prepared an assessment report on the Tyler Floodwater Retarding Dam in 2009 based on a comprehensive study of the hydrologic conditions of the dam for existing and future watershed build-out conditions. The study utilized the Site Analysis Integrated Development Environment (SITES) model to evaluate the hydrological parameters of the Assabet River watershed using NRCS TR-60 and Massachusetts dam safety design criteria.

Using the SITES model the Tyler Dam was evaluated with the SITES and WinDAM models using NRCS TR-60 design criteria for a Class C (High Hazard) structure in accordance with federal standards. The Principal Spillway Hydrograph (PSH) was the 100-year frequency with 1-day and 10-day storm durations. The Auxiliary Spillway Design Storm used a precipitation amount greater than the 100-year event and less than the Probable Maximum Precipitation (PMP) and a 6-hour design storm for developing the Auxiliary Spillway Hydrograph. The 2009 Dam Assessment Report indicated that the Tyler Floodwater Retarding Dam does not meet TR-60 design criteria or Massachusetts design criteria for the Principal Spillway Design Hydrograph (PSH) under existing or future build-out conditions.

The SITES model results indicated that under both the existing and future watershed build-out conditions, flow would pass over the auxiliary spillway at a depth of 1.1 feet and 4.5 feet respectively.

An engineering analysis was conducted by AMEC (2012) to determine if the Tyler Dam qualifies for a reduction in FBH storm. According to the NRCS criteria, the use of a storm smaller than the PMP is allowed if the reduction is justified by an incremental analysis of the IDF. A HEC-RAS unsteady-flow model was used to perform the incremental analysis, which included breach and non-breach conditions at the Tyler Dam. The results of the analysis indicate that the difference in water surface elevations between non-breach and breach conditions for both the PMP storm and the selected IDF (64% PMP) downstream of the Tyler Dam is less than the 2-foot maximum permitted by FEMA-94 and the NRCS to justify a reduction in the FBH. The NRCS criteria further requires that the incremental damages (i.e. difference in number of affected structures between breach and non-breach conditions) for the selected (64% PMP) storm be the same as, or greater than, the incremental damages at the PMP storm. A comparison for both storms indicates that the incremental damages for the selected storm are higher than that for the PMP storm. Consequently, the 64% PMP storm qualifies as the selected IDF provided that appropriate controls are put in place to ensure that no further development occurs in the entire PMP breach inundation zone. This requirement is strongly objected by the owner of the dam, the DCR. As a result, the design criteria was set forth by the NRCS in TR-60

for a "High Hazard Dam" (i.e. using the PMP to generate the FBH) will be applied when evaluating, developing, and designing rehabilitation measures for the Tyler Dam.

Invasive Species: During infield investigations, plant communities were identified throughout the site. In particular, the presence of invasive species was noted. As a result of the infield investigations, several invasive species including common reed (*Phragmites australis*), purple loosestrife (*Lythrum salicaria*), and reed canary grass (*Phalaris arundinacea*) were observed in the vicinity of the dam. Although the presence of invasive species was noted at the site, they were observed in only sporadic clusters.

In order to reduce the potential of construction activities transporting invasive species material to or from the site, best management practices will be employed to ensure that rehabilitation of dam does not spread invasive species material.

Migratory Birds / Bald and Golden Eagle Protection Act: The Migratory Birds Treaty Act[35] seeks to protect migratory birds. As such, the law makes it illegal to pursue, hunt, take, capture, kill or sell protected birds. The Bald and Golden Eagle Protection Act[36] prohibits the "taking" of bald and golden eagles.

During the infield investigations, numerous species of migratory birds where observed. However, it is likely that these species will not be harmed as a result of dam rehabilitation. The majority of the project impacts will occur on the dam itself (i.e., embankments, spillways, dikes, etc.). These areas are routinely mowed and do not provide suitable habitat for migratory species. It is likely that migratory species that may be affected by rehabilitation of the dam will relocate to other areas adjacent to the proposed project area during construction. Once construction has been completed, it is expected that those species will return to the area.

There is no suitable habitat for bald (*Haliaeetus leucocephalus*) or golden eagles (*Aquila chrysaetos*) at the site. Additionally, the bald eagle is a state-listed endangered species. If bald eagles were known to occur in the vicinity of the site, the NHESP would have identified such an occurrence during their project review. As such, it is highly unlikely that the project would affect any bald or golden eagles.

Plants: During the infield site investigation, vegetative communities were noted as they occurred throughout the site. Plant species in each vegetative community were noted. The majority of the site consists of upland forests and wetland habitats.

Construction activity would likely result in minor impacts affecting the vegetation due to the armoring of the dam. However, at the completion of construction, equipment would be removed and the disturbed area would be restored.

Prime and Unique Farmlands: The list of Prime and other Important Farmland Soils (NRCS 2010b) was reviewed to determine what soils are considered to be prime or unique farmland soils in Middlesex County, Massachusetts. Soil mapping data resources (NRCS 2010b) were reviewed

[35] 16 U.S.C. §§703-717
[36] 16 U.S.C. 668-668d

to determine the extent of any prime and/or unique farmland soil mapped on the site. In total, there are 9,127 acres of prime and unique farmland soils mapped in the drainage area of the dam. In the downstream floodplain, 1,321 acres of prime and unique farmland soils are mapped.

Riparian Areas: Riparian areas are generally described as habitats that exist in the vicinity of the interface between watercourses and land. In order to determine the extent of riparian areas in the vicinity of the dam, available watercourse mapping data (MassGIS 2000) was reviewed to identify areas on the site where riparian areas likely existed. During infield investigations, these areas were traversed to determine the condition of riparian habitat in the vicinity of the dam. Riparian areas were identified along the banks of the Assabet River. In general, these areas consisted of forested floodplain, forested wetland, and upland forest habitat.

Sedimentation: Excessive sedimentation can reduce flood storage volume and clog spillways, reducing the hydraulic efficiency of the dam. Sedimentation of the Tyler Dam has been minimal over the past 32 years.

Scoioeconomics: Sources for the data included in the social and economic conditions section of this supplement include the U.S. Census Bureau, Department of Commerce, 2000 and 2010 Census, and interviews conducted with local contacts.

Soil: NRCS (2101c) soil mapping data for Middlesex County, Massachusetts was reviewed to determine the soil types mapped in the vicinity of the dam. Review of the soils mapping for site shows that several major soil types are mapped in the area of dam. Upland soils in the drainage area are dominated by Charlton-Hollis-Rock outcrop complex, Windsor loamy sand, and Udorthents sandy. Hydric soils in the drainage area are dominated by Swansea muck, Sudbury fine sandy loam, and Udorthents wet substratum.

Wetlands: A field survey was conducted to identify and assess wetlands upstream and downstream of the dam in the potential construction area. Wetlands identified include Bordering Vegetated Wetlands, Land Under Water Bodies, Banks, and Rivers.

Based on the surveys and the conceptual project design, most of the construction for dam rehabilitation would occur within the existing area previously disturbed for construction of the dam and maintained as mowed grass. However, minimal wetland impacts are likely occur as a result of construction, access. There are 0 permanent wetland impacts proposed that would result from the armoring of the dam.

Wild and Scenic Rivers: The Wild and Scenic Rivers Act[37] established the National Wild and Scenic Rivers System. To determine if any Wild and Scenic Rivers were present in the vicinity of the dam, the River Mileage Classification for Components of the National Wild and Scenic Rivers System (NPS 2011b) was reviewed. According that list, the Assabet River is listed. The section of the Assabet River is located downstream of the dam from 1,000 feet downstream of the Damon Mill Dam to its Confluence with the Concord River. This section of the river, approximately 4.4 miles, is located completely within the Town of Concord, Massachusetts.

[37] 16 U.S.C. 1271-1287

The following table displays the effects of the recommended plan on particular types of resources that are recognized by certain Federal policies.

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APPENDIX E

OTHER SUPPORTING INFORMATION

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Sub-appendix E-1

Consultation and Public Scoping Process

Stakeholder agencies that were contacted concerning the proposed project are:

- Middlesex Conservation District
- Massachusetts Department of Conservation and Recreation
- Massachusetts Department of Fish & Game, Division of Fisheries and Wildlife
- Massachusetts Department of Fish & Game, Riverways Program
- Massachusetts Department of Environmental Protection
- City of Marlborough
- Organization for the Assabet, Sudbury, and Concord Rivers
- Massachusetts Executive Office of Energy and Environmental Affairs
- Massachusetts Executive Office of Energy and Environmental Affairs, MEPA
- EPA Region 1, Regulatory
- USACE, Regulatory Division
- Massachusetts Office of Dam Safety
- Massachusetts Historical Commission
- Massachusetts Tribe of Gay Head (Aquinnah)

In a letter dated November 17, 2011, SHPO agreed that the proposed project would not have any effect on historical properties. Coordination with the THPO of the Wampanoag Tribe of Gay Head (Aquinnah) was initiated on 28 October 2012 via a letter of inquiry. Coordination was deemed to be complete as of 17 December 2012.
A no species present letter was obtained from the FWS, which indicates that no federally listed threatened or endangered species are known to occur within the area. It was determined from MassGIS that there was no habitat for a state-protected species lies in the Assabet River floodplain. Consultation with NHESP is continuing; ultimately, DCR is responsible for completing the consultation and obtaining any permits that may be required.

A public meeting was held in the Town of Berlin on May 24, 2011, to explain the Watershed Rehabilitation Program, obtain public input on the project, and scope resource problems, issues, and concerns of local residents associated with the Tyler Dam project area. The meeting was widely advertised to reach everyone in the watershed including minorities. NRCS distributed a press release on May 6, 2011, that resulted in an article about the meeting in the Metro West Daily News on May 25, 2011.

Potential alternative solutions to bring the Tyler Dam into compliance with current dam safety criteria were presented at the public meeting. A fact sheet summarizing the planned rehabilitation projects at six dams in the SuAsCo watershed was distributed at the meeting. Members of the public attended the meeting. No verbal or written comments have been received in the intervening time to the publishing of this plan.

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Sub-appendix E-2

Regulatory Correspondence

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United States Department of the Interior

FISH AND WILDLIFE SERVICE

New England Field Office
70 Commercial Street, Suite 300
Concord, NH 03301-5087
http://www.fws.gov/newengland

January 17, 2012

To Whom It May Concern:

This project was reviewed for the presence of federally listed or proposed, threatened or endangered species or critical habitat per instructions provided on the U.S. Fish and Wildlife Service's New England Field Office website:

(http://www.fws.gov/newengland/EndangeredSpec-Consultation.htm)

Based on information currently available to us, no federally listed or proposed, threatened or endangered species or critical habitat under the jurisdiction of the U.S. Fish and Wildlife Service are known to occur in the project area(s). Preparation of a Biological Assessment or further consultation with us under section 7 of the Endangered Species Act is not required. No further Endangered Species Act coordination is necessary for a period of one year from the date of this letter, unless additional information on listed or proposed species becomes available.

Thank you for your cooperation. Please contact Mr. Anthony Tur of this office at 603-223-2541 if we can be of further assistance.

Sincerely yours,

Thomas R. Chapman
Supervisor
New England Field Office

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Commonwealth of Massachusetts

Division of Fisheries & Wildlife

MassWildlife

Wayne F. MacCallum, *Director*

October 20, 2011

P. Chase Bernier
EA Engineering, Science and Technology
2374 Post Road, Suite 102
Warwick RI 02886

RE: Project Location: Tyler Dam
Town: MARLBOROUGH
NHESP Tracking No.: 11-30193

To Whom It May Concern:

Thank you for contacting the Natural Heritage and Endangered Species Program ("NHESP") of the MA Division of Fisheries & Wildlife for information regarding state-listed rare species in the vicinity of the above referenced site.

Based on the information provided, the NHESP has determined that at this time the site is not mapped as Priority or Estimated Habitat. The NHESP database does not contain any state-listed species records in the immediate vicinity of this site.

This evaluation is based on the most recent information available in the NHESP database, which is constantly being expanded and updated through ongoing research and inventory. If you have any questions regarding this letter please contact Lauren Glorioso, Endangered Species Review Assistant, at (508) 389-6361.

Sincerely,

Thomas W. French

Thomas W. French, Ph.D.
Assistant Director

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The Commonwealth of Massachusetts
William Francis Galvin, Secretary of the Commonwealth
Massachusetts Historical Commission

November 17, 2011

P. Chase Bernier
Project Scientist
EA Engineering Science & Technology Inc.
2374 Post Road Suite 102
Warwick RI 02886

RE: Tyler Dam Rehabilitation, Robin Hill Road, Marlborough, MA. MHC #RC.51637

Dear Mr. Bernier:

Staff of the Massachusetts Historical Commission, office of the State Historic Preservation Officer, have reviewed the information that you submitted for the project referenced above, for raising the elevation of the dam embankment to prevent overtopping, and raising Robin Hill Road at its crossing with the dam at both approaches.

Review of the MHC's Inventory of Historic and Archaeological Assets of the Commonwealth indicates that the project is within or adjacent to three inventoried areas, West Marlborough (MRB.AL), Robin Hill (MRB.AM), and Hillside School (MRB.AN). The Robin Hill Street Bridge (MADOT #M-06-003) over the Assabet River (MRB.905) in the project area is not individually eligible for listing in the National Register of Historic Places. The bridge and its approaches were proposed for replacement and reconstruction in 2006.

The MHC does not recommend additional identification effort for the project.

The MHC recommends that the Natural Resource Conservation Service make a finding of "no historic properties affected" (36 CFR 800.4(d)(1)) for the undertaking.

These comments are offered to assist in compliance with Section 106 of the National Historic Preservation Act of 1966 as amended (36 CFR 800). Please contact Edward L. Bell of my staff if you have any questions.

Sincerely,

Brona Simon

Brona Simon
State Historic Preservation Officer
Executive Director
Massachusetts Historical Commission

xc:
Thomas Akin, NRCS
Marlborough Historical Commission

220 Morrissey Boulevard, Boston, Massachusetts 02125
(617) 727-8470 • Fax: (617) 727-5128
www.sec.state.ma.us/mhc

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United States Department of Agriculture

NRCS
Natural Resources Conservation Service
P.O. Box 2890
Washington, D.C. 20013

SUBJECT: ENG – Variance for Tyler Floodwater Retarding Dam
SuAsCo Watershed
Middlesex County, Massachusetts

JUN 18 2012

TO: Christine S. Clarke
State Conservationist
Amherst, Massachusetts

File Code: 210-7

The Massachusetts variance request submitted on December 21, 2011, to establish the Tyler Floodwater Retarding Dam top-of-dam at the current elevation of 240.64 feet is granted. This is lower than the required TR-60 freeboard hydrograph (FBH) storm elevation, but will be allowed by armoring the top of dam and the downstream slope, thus creating a structural spillway to prevent a dam breach.

If you have any further questions, please contact me at 202-720-2520.

Noller Herbert, P.E.
Director
Conservation Engineering Division

cc: Luis Laracuente, State Conservation Engineer, NRCS, Amherst, MA
James Moore, Civil Engineer, National Water Management Center (NWMC), NRCS, Little Rock, AR
Johnny Green, Co-Director, National Design, Construction, and Soil Mechanics Center (NDCSMC), NRCS, Fort Worth, TX
Ken Worster, P.E., Acting National Design Engineer, NDCSMC, NRCS, Fort Worth, Texas

The Natural Resources Conservation Service provides leadership in a partnership effort to help people conserve, maintain, and improve our natural resources and environment.

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