



CITY OF WATERTOWN

Conservation Commission

The Conservation Commission of the City of Watertown will hold a public meeting on April 6, 2022, at 7:00 p.m. The meeting will follow current State law/guidance and will be held remotely as follows:

CONSERVATION COMMISSION MEETING WEDNESDAY, APRIL 6, 2022 AT 7:00 PM AGENDA

ACCESS INFORMATION:

- A. The meeting will be televised through WCATV (Watertown Cable Access Television): <http://vodwcatv.org/CablecastPublicSite/?channel=1>
 - B. The Public may join the virtual meeting online: <https://watertown-ma.zoom.us/j/99597080710>
 - C. Public may join the virtual meeting audio only by phone: (877) 853-5257 or (888) 475-4499 (Toll Free) and enter Webinar ID: 995 9708 0710
 - D. Public may comment through email: lschwab@watertown-ma.gov
-

- 1. Informational Presentation and Discussion
 - A. Charles River Watershed Association will present regarding their advocacy of removing the Watertown Dam
- 2. Public Hearing-
 - A. **Notice of Intent- 93 California Street (continued from March meeting)-** For the construction of an addition to an existing single-family dwelling and associated site appurtenances at the above-referenced property. Christopher and Rose Zevitas, Applicants and Owners
- 3. Public Hearing-
 - A. **Notice of Intent- 0 Arlington St (Williams Pond Parcel) (Continuance had been requested to April 2022 meeting) -** to construct a 2-story commercial building and parking lot on property known as the Williams Pond parcel; Max Hatziliades, Applicant and Owner.
- 4. Public Hearing-
 - A. **Request for Determination of Applicability-** For the proposed parking lot

improvements and utility upgrades located at 10-30 Manley Way, Watertown, Massachusetts. PPF Industrial 20 Seyon LLC, Owner/Christopher M. Lucas Representative/Applicant

5. Agent Report

A.

1. CPA
2. Climate and Energy Plan
3. Pollinators
4. Ongoing Orders of Conditions
5. Arsenal Park

6. Acceptance of Minutes

- A. **Minutes**-review and approve minutes from March 2, 2022, meeting



Watertown Dam Removal Feasibility Study

On the Charles River
Dam No. MA00456
Watertown, Massachusetts
June 30, 2021
Final Draft

Prepared for:
The Commonwealth of
Massachusetts Department of Fish
and Game
Division of Ecological Restoration
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ABBREVIATIONS AND ACRONYMS

AHS.....	Archeological and Historical Services, Inc.
BVW	Bordering Vegetated Wetlands
CF	cubic foot
CFS.....	Cubic Feet per Second
CMGP.....	Coastal and Marine Geology Program
CMR.....	Code of Massachusetts Regulations
CRWA	Charles River Watershed Association
CY.....	Cubic yard
DCR	Department of Conservation & Recreation
DEM.....	Digital Elevation Model
DEP	Department of Environmental Protection
DER.....	Division of Ecological Restoration
EAP	Emergency Action Plan
EPA	Environmental Protection Agency
EPH.....	Extractable Petroleum Hydrocarbon
FEMA.....	Federal Emergency Management Agency
FIRM.....	Flood Insurance Rate Map
FIS	Flood Insurance Study
ft/ft	feet per foot
ft/sec.....	feet per second
GPS.....	Global Positioning System
HEC-RAS.....	Hydrologic Engineering Center – River Analysis System
HEC-SSP.....	Hydrologic Engineering Center – Statistical Software Package
lb/sq. ft.....	pounds per square foot
LiDAR.....	Light Detection and Ranging
MADCR	Massachusetts Department of Conservation & Recreation
MADER.....	Massachusetts Division of Ecological Restoration
MADFW	Massachusetts Division of Fisheries & Wildlife
MADMF.....	Massachusetts Division of Marine Fisheries
MCP.....	Massachusetts Contingency Plan
MCP S-1/GW-1	Massachusetts Contingency Plan Soil / Groundwater Standards
MDC.....	Metropolitan District Commission
MHC.....	Massachusetts Historical Commission
MMI.....	Milone & MacBroom, Inc.
NAD83.....	North American Datum of 1983
NAVD88.....	North American Vertical Datum of 1988
NOAA	National Oceanic and Atmospheric Administration
NRHP	National Register of Historic Places
NVS.....	Natural Valley Storage
NYSDOT.....	New York State Department of Transportation
ODS	Office of Dam Safety
O&M.....	Operation and Maintenance
PAH	Polyaromatic Hydrocarbons
PCB.....	Polychlorinated Biphenyl
UAS.....	Unmanned Aircraft System
USACE.....	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USFWS.....	United States Fish and Wildlife Service
USGS.....	United States Geological Survey
WSEL.....	Water Surface Elevation

EXECUTIVE SUMMARY

The Massachusetts Division of Ecological Restoration (MADER) accepted the Watertown Dam Removal on the Charles River as a Provisional Priority Project and retained Milone & MacBroom, Inc. (MMI, now a part of SLR International Corporation [SLR]) to perform a feasibility study for the removal of the dam. The Project Technical Team includes MADER, the Massachusetts Department of Conservation and Recreation, and the Charles River Watershed Association. The Project Technical Team includes staff from these agencies as well as those from the MA Division of Marine Fisheries (MADMF), the Massachusetts Division of Fisheries & Wildlife (MADFW), the National Oceanic and Atmospheric Administration (NOAA) Restoration Center, and the United States Fish and Wildlife Service (USFWS).

The subject study is intended to provide a multiparameter evaluation of the dam in its current state and identify the potential benefits and consequences of removal. Specific goals of dam removal would be to improve passage for anadromous fish species such as blueback herring, alewife, and American shad as well as to improve the ecological and recreational values of the corridor without incidental impacts on flood characteristics, stability, or public safety.

Table ES-1 presents the goals and objectives of the feasibility study as developed by the Project Technical Team and the degree to which those goals can be met based upon the analysis performed to date.

TABLE ES-1
Analysis of Project Goals and Objectives

Goal/Objective	Notes
Improve fish passage and water quality in the Charles River.	Removal of the dam could eliminate a significant barrier to fish passage and decrease the fragmentation of habitats within the Charles River. Minor channel modifications in the dewatered impoundment may be necessary to create deeper pools during severely low river flows and to create small areas of lower velocity where riffles existed before the construction of the dam.
Evaluate the effects on flood control upriver and downriver of the Watertown Dam.	Removal of the dam could lower the 100-year floodplain elevation upriver of the dam. Flood elevations could be expected to be approximately 6 feet lower at the dam itself, and the reduction in floodplain would diminish slowly upriver to a point approximately ½ mile upriver of the dam to where the floodplain would be unaffected by the dam removal. There are no changes anticipated for flooding downriver of the dam.
Evaluate the nature, composition, and stability of impounded sediment as well as the stability of the riverbed, banks, and nearby infrastructure.	Sediments are found to be fine-grained sediments with chemical constituents of concern. The post-dam-removal velocities are not expected to cause major erosion or scour after armoring is installed and vegetation of newly exposed banks is established. Chemical constituents found within the sediment exceed the requirements of Massachusetts Contingency Plan (MCP) guidance and will require additional testing to develop a formal sediment management plan. It is anticipated that up to 1,700 cubic yards (CY) of sediment will need to be removed surrounding the direct upriver vicinity of the dam, and additional sediment pockets found in the former impoundment would be tested, removed, and disposed of off-site, if necessary.

TABLE ES-1 (Cont.)
Analysis of Project Goals and Objectives

Goal/Objective	Notes
Evaluate impacts on archeologically sensitive resources.	The area is historically significant, and while the dam itself is not considered a cultural resource, the surrounding area and its ties to our industrial heritage are significant to the development of our modern civilization. The presence of historic artifacts in the impoundment and around the dam is possible. Archeological survey in the form of shovel pits is recommended in any area that requires ground disturbance as well as any areas exposed as a result of the drawdown due to the high archeological sensitivity of the Watertown Dam area. Also, informational signage could be developed and installed to memorialize the importance of the dam if it is removed.
Improve the visual and historic character, recreation, nature viewing, and boating along the Charles River Greenway for visitors.	The restoration of the river to a more natural, unaltered state will promote an increase in flora and fauna diversity, allow the Charles River corridor to form a more naturalized healthy riparian corridor, encourage fish passage, and improve nature-viewing opportunity, and the removal of the dam could make a longer segment of river available to paddling recreational use. However, dam removal would likely make the impounded section of the river upstream of the Watertown Dam inaccessible to powerboats during most lower-flow conditions.

Overall, this assessment found that removal of the Watertown Dam may be considered feasible and would provide overall improvement to ecological continuity, riparian health, anadromous fish passage, and flooding conditions. However, a final decision about whether it is feasible to remove the dam would require further analysis and addressing several factors.

Feasibility is a subjective opinion based upon many elements. This document is intended to factually present the findings of the analysis and to present as much data and conclusive analysis as possible for an initial review. This information may be used by interested parties and stakeholders in the Watertown Dam and Charles River to determine what benefits and negative impacts may result from removal of the dam and what other considerations and economic commitments may be required to mitigate those negative impacts.

In addition to the Recommendations described in Section 7.0 of this report, MADCR, the dam owner, has provided the following recommendations for future work:

The question of whether it is feasible to remove the Watertown dam has been asked for years. This report provides an initial outline of the areas that would need further analysis and review in order to make an informed decision about whether or not removal is appropriate. Central to this consideration is any potential impact removal would have on the operation of the entire Charles River system beyond the limits of effect identified by MMI. While this report reviews anticipated impacts of removal within the geographical area of the dam's influence according to standard engineering practice, additional modeling and analysis of the hydraulics and hydrology would be required for removal to be considered in the future.

Safe fish passage is a major driver of consideration of dam removal. Given that more detailed analyses are necessary to determine the feasibility question, including but not limited to hydraulics and hydrology of the entire system and removal and transport of contaminated sediments, proponents of dam removal may wish to consider improvement to fish passage with the existing dam while additional analyses are conducted.

1.0 INTRODUCTION

1.1 Overview

The Massachusetts Department of Fish and Game, Division of Ecological Restoration (MADER) selects and implements wetland, river, and flow restoration projects throughout the Commonwealth of Massachusetts through a statewide, competitive process, choosing high-priority projects that bring significant ecological and community benefits to the commonwealth. In 2016, the removal of the Watertown Dam was nominated by the Charles River Watershed Association (CRWA) as a potential project for the Division of Ecological Restoration's (DER) consideration. In June 2016, Massachusetts Department of Conservation and Recreation (MADCR) pledged support to the nomination of the project, as the owner and primary agency in charge of the operation and maintenance of the Watertown Dam. The Massachusetts Division of Marine Fisheries (MADMF) also pledged its support of the feasibility study based upon the potential benefits to anadromous fish species such as American shad, blueback herring, and alewife, with a particular focus on the American shad.

In 2016, MADER accepted the Watertown Dam Removal as a Provisional Priority Project. In order to investigate the potential benefits and negative impacts, MADER has retained Milone & MacBroom, Inc. (MMI) to perform a feasibility study for the removal of the dam.

The Project Technical Team includes DER, MADCR, and the CRWA. The Project Technical Team includes staff from these agencies as well as those from MADMF, the Massachusetts Division of Fisheries & Wildlife (MADFW), the National Oceanic and Atmospheric Administration (NOAA) Restoration Center, and the United States Fish and Wildlife Service (USFWS).

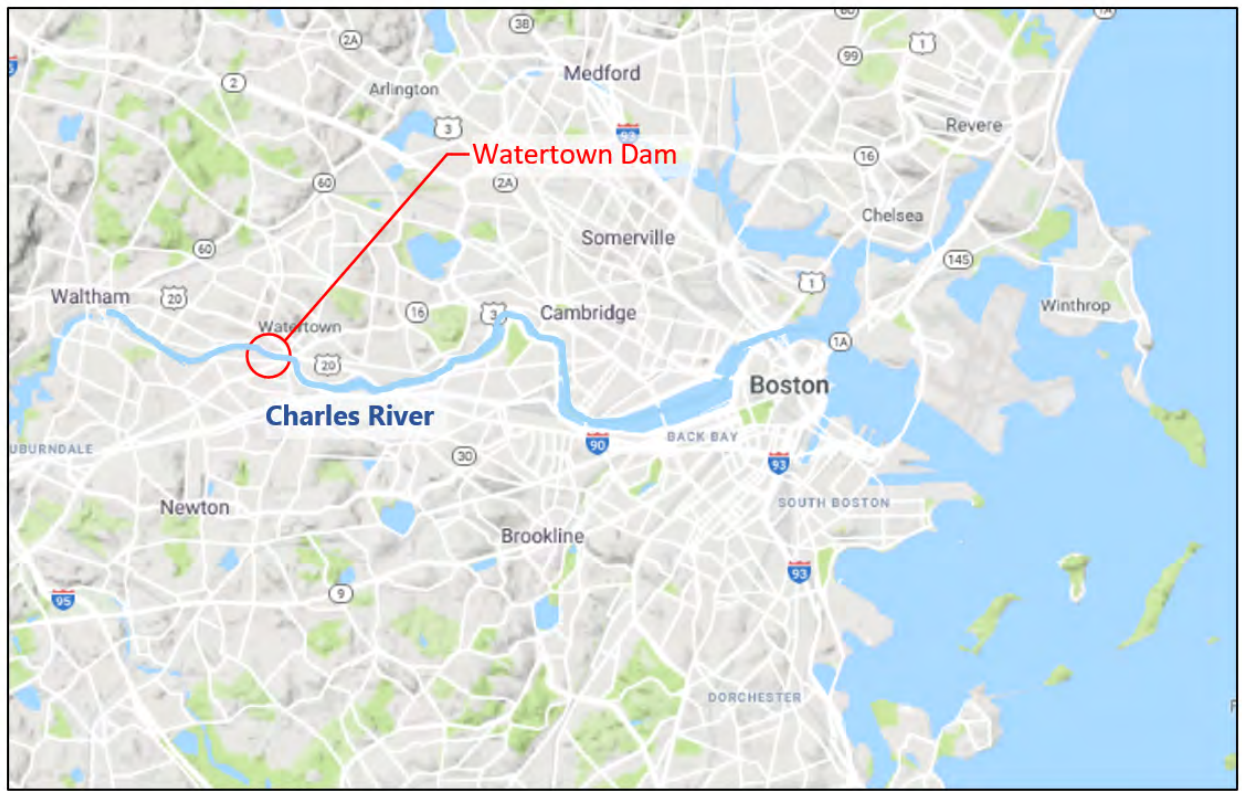
1.2 Background

The current site of the Watertown Dam has been host to a man-made hydraulic structure since before 1630, when Native Americans built a weir across the Charles River to block fish from passing upriver, to facilitate harvesting of the fish from the river. The first formal structure in the Charles River at this site was constructed in the 1630s. Over the generations to follow, many dams were constructed and reconstructed at this site until in 1966 the modern concrete spillway was designed and constructed soon thereafter. Despite the inclusion of a Denil-style fish ladder constructed in the 1970s, the dam still creates an impediment for anadromous fishes such as blueback herring, alewife, and American shad from passing upriver (MDMF, 2017, 2018).

The MADCR's Office of Dam Safety (ODS) classifies the Watertown Dam as a Small Size, Significant (Class II) Hazard Potential Structure in Fair condition. Based on the Watertown Dam's classification by the MADCR Office of Dam Safety, a failure of the dam has the potential to cause loss of life, significant property damage, and large-scale economic disruption. Although the dam is currently in fair condition, inspections must be performed at regular 3- to 5-year intervals in order to ensure that structural integrity is maintained.

Figure 1-1 provides a location map of the Watertown Dam.

FIGURE 1-1
Location Map of Watertown Dam



1.3 Feasibility Study Goals

This feasibility study is intended to provide an initial multiparameter evaluation of the anticipated benefits as well as incidental impacts caused by the removal of the Watertown Dam. This study provides an assessment of the Watertown Dam in its current condition and compares the current conditions with the anticipated potential changes from its removal.

Feasibility is a subjective opinion based upon many factors.. This document is intended to factually present the findings of the study and to present as much data and conclusive analysis as possible given the resources available for this phase. This information may be used by interested parties and stakeholders in the Watertown Dam and Charles River to determine what benefits and negative impacts may result from removal of the dam and what other considerations and economic commitments may be required to mitigate those negative impacts.

The following items were evaluated relative to the potential removal of the dam:

- Benefits to and impacts on fish passage, ecological habitat and the naturalized ecological processes, wetland resources, and water quality in the Charles River.
- The changes to hydrology, hydraulics, water velocities, sediment transport, flooding depths and extents, and the Charles River Flood Control System near the project site.

- The nature, composition, and stability of impounded sediment as well as the stability of the riverbed, banks, and nearby public and private infrastructure and facilities.
- Impacts on archeologically sensitive resources.
- The visual and historic character, channel depth and navigation, recreation, nature viewing, and boating along the Charles River Greenway for visitors.
- The predicted changes to bank widths and exposed sediments.

The subject report documents the data collected, the analyses performed, the results of the analyses, and recommendations regarding the potential dam removal. A photo log is included in Appendix A.

2.0 DATA COLLECTION

2.1 List Data Sources

Data, mapping, reports, and information have been collected and reviewed as available from CRWA, the MADER, the MADCR, the MADMF, the Town of Watertown Historical Society, the Federal Emergency Management Agency (FEMA), other project partners and stakeholders, and agencies within the commonwealth. This information includes the following:

- Dam inspection reports
- Bridge inspection reports
- Past historical studies
- Information regarding abutting property owners
- Information on historical diadromous fish runs and/or fisheries
- Existing archeological or historical reports
- Mapping of the project area, aerial photographs
- Geologic data and mapping
- Hydrologic data and analysis
- Fisheries data
- FEMA data, modeling, and reporting

A full and complete list of the reviewed references is located in Section 8.0 of this report.

2.2 The Watertown Dam

2.2.1 History

The Watertown Dam is located at the historical head of tide for the Charles River. The Charles River at this location and the area surrounding the Watertown Dam were important to Native American fording and fishing and were in proximity to an early (ca. 1632) English fish weir, dam, mill (ca. 1634), and footbridge (c. 1641). Historical maps depict a dam in this area from the 17th century through the present day, along with associated mills and a bridge in the location of the current Watertown Bridge. (Archeological and Historical Services, Inc. [AHS], 2018).

As the Watertown area became impacted by the Industrial Revolution in the late 18th and early 19th centuries, the dam was expanded, and the impoundment was enlarged in order to provide the hydraulic head required to power mills.

Portions of Watertown are protected by a larger flood control project constructed in the 1960s by the United States Army Corps of Engineers (USACE) and covering much of the Charles River. The project is known as the Charles River Natural Valley Storage (NVS) project and is sometimes referred to as the Charles River Flood Protection System. It is critical that the feasibility assessment serve to inform and facilitate discussions between the community, the Project Technical Team, and the USACE. Subsequent to deindustrialization in the 1960s, the dam was repurposed as a flood control structure (CRWA, 2016). However, the dam is not operated in a manner that could provide flood benefit. Ordinarily, the impoundment is completely full, with

water spilling over the entire width of the spillway and low-level outlet, rendering it ineffective for downriver flood control. Additional discussion of flood control is included in Section 6.1.

A dam known as the Bleachery Dam is located approximately 2 miles upriver of the Watertown Dam. The Bleachery Dam is partially breached on both the right and left sides to enhance fish passage. This low-head dam spans the river and does not possess any kind of fish passage structure. Located approximately 1 mile upriver of the Watertown Dam are the remnants of the Nonantum Dam. This stone masonry dam was also breached in the 1960s.

2.2.2 Technical Data

The Watertown Dam is located between Pleasant Street and California Street in Watertown, Massachusetts, located at 42° 21' 55.74" N, 71°11' 29.57" W. The dam is recognized by the Commonwealth of Massachusetts by the ID number 4-9-314-1 and on the National Inventory of Dams by ID number MA00456. According to the CRWA, the impoundment resulting from the dam extends approximately 1 mile upriver, with a total storage volume of 20 acre-feet (approximately 6.5 million gallons) (CRWA, 2016a). Below is an aerial photograph of the dam. The dam is classified under the Commonwealth of Massachusetts Dam Safety Program as a Small Size, Significant Hazard Potential (Class II) dam.

FIGURE 2-1
Aerial Photograph of the Watertown Dam



The Watertown Dam is a run-of-river dam with a concrete ogee spillway measuring 6 to 8 feet high and 200 feet wide. The spillway is constructed of concrete, with sloping earthen embankments upriver of the spillway. The spillway is flanked with concrete training walls on both ends. Behind the training walls, earthen embankments form the remainder of the dam. The river-left (northern) embankment is approximately 40 feet long, with a pedestrian walkway observation

deck constructed on top. The river-right (southern) embankment is approximately 80 feet long and is part of a public space park area along the river. Adjacent to the river-right (southern) training wall are both a concrete fishway and a 10-foot-wide low-level outlet controlled by stacked timber stop logs. The small fishway discharges just to the south of the low-level outlet.

2.2.3 Condition

In accordance with the Dam Safety Regulations in the Commonwealth of Massachusetts, formal inspections of the Watertown Dam are conducted every 5 years. The condition of the dam was listed as "poor" in the most recent Phase I inspection because of the trees on the left embankment, which could damage the integrity of the narrow embankment were they to topple. (GZA Inspection, 2016). It was later noted in a follow-up visit by GZA in 2017 that the aforementioned trees were cut down and removed, therefore upgrading the condition of the dam to "fair." The 2017 follow-up report also mentioned that no Emergency Action Plan (EAP) had been developed for the dam and listed this as a deficiency. Both the 2016 and 2017 inspection reports are included in Appendix B. It should be noted that such a plan was developed in June 2018 and is included in Appendix C. Table 2-1 provides a summary of the last four dam inspection report conditions and any deficiencies noted at the time of inspection.

TABLE 2-1
Stormwater Outfalls Located Upriver of Watertown Dam

Inspection Date	Inspection Contractor	Condition	Recommendations/Deficiencies
2006	Weston & Sampson	Fair	- Trees and brush should be removed from left embankment. - Wooden observation deck on left embankment should be removed and the embankment regraded to a uniform elevation and seeded/grassed. - Upriver slope of dam should be protected from erosion with riprap. - Granite curbstones on downriver slope should be removed and the area seeded/grassed.
2011	Fuss & O'Neill, Inc.	Fair	- Same as previous inspections (2006) plus the following: - Operation and Maintenance (O&M) manual should be developed. - Exposed soil area on right embankment should be regraded to a uniform elevation and seeded/grassed.
2016	GEI Consultants	Poor	- Same as previous inspections (2011) plus the following: - EAP should be developed.¹
2017	GZA GeoEnvironmental, Inc.	Fair	Same as previous inspections, however some vegetation was cut and removed from the left abutment, and the overall condition of the dam was upgraded from Poor back to Fair as a result.

Note: 1. EAP was developed in June 2018 (CDR Maguire, 2018).

2.2.4 Property Ownership

The Watertown Dam, the Charles River, and the surrounding open space on both banks of the impoundment are owned by MADCR, a division of the Commonwealth of Massachusetts Executive Office of Energy and Environmental Affairs. The northern abutment of the dam has a

walkway extending out on top of the dam training wall, behind which is a large former industrial building that currently hosts the offices of Sasaki Associates, Inc., an architectural and interior design firm. The building and grounds directly surrounding it are owned by Sasaki.

2.3 Fish Ladder

A 4-foot-wide concrete Denil-style fish ladder is installed on the southern abutment of the spillway. The walls of the fish ladder are 12" to 18" wide cast-in-place reinforced concrete. The inside of the channel is fitted with wooden baffles to slow water velocities sufficiently to allow fish passage through the structure, and the top of the channel is covered with steel and aluminum grating. The fish entrance to the ladder is in a pool with water depths of approximately 2 feet located near the spillway discharge. Figure 2-2 presents a photograph of the fish ladder. Attraction flow to the fish ladder entrance consists of flow through the fish ladder and flow from the stop log bay.

FIGURE 2-2
Photograph of the Fish Ladder



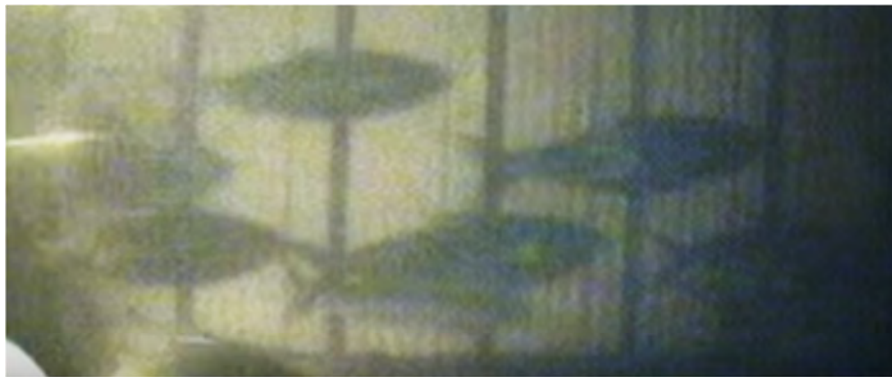
Assessment of the performance of the existing fish pass during a 2011 study determined that the fish ladder is functioning in a limited capacity due to a number of concerns including hydraulic conditions at the entrance and exit of the fish ladder, existing stop log boards located at the fishway entrance that are higher in elevation than the spillway, poor attraction flow through the fish ladder and at the fishway entrance, and shallow water depths at the downriver fish entrance (Stantec, 2011). The CRWA estimates that as many as 300,000 river herring attempt to migrate up the Charles River annually, not counting other species such as American shad, American eel, or smelt, which also utilize the ladder. This equates to approximately 15,000 fish per day utilizing the Watertown Dam fish ladder. MADMF video monitoring in 2013 and 2014 provided counts of individual species passing through the fish ladder as presented in Table 2-2. These counts were

obtained through the use of video footage and manual recording of the fish. Samples of that video footage from May 19, 2013, were posted online by the MADMF, which shows the abundance of river herring swimming past the underwater camera used to count the fish. Figure 2-3 presents a sample picture of that video footage.

TABLE 2-2
MADMF Fish Passage Video Monitoring at Watertown Dam, Charles River

	2013	2014
River Herring	353,174	312,359
American Shad	44	41

FIGURE 2-3
Underwater Camera of River Herring in the Watertown Dam Fish Ladder, May 19, 2013
(Courtesy of Massachusetts Division of Marine Fisheries)



A follow-up acoustic tag study by the MADMF (MADMF, 2017) found that of the nearly 100 American shad that were tagged none were able to ascend the Watertown Dam fish ladder. Personal correspondence with Ben Gahagan of MADMF indicates that the studies to date have conclusively shown that the Watertown Dam poses an impediment for anadromous fish, particularly spawning American shad. Fish have difficulty utilizing the fish ladder because it is located on the river-right bank of Charles River whereas the deepest waters flowing over the dam are located on the river-left bank (MADMF, 2018).

Fish mortality can also occur at the base of the dam for both river herring and American shad due to the shallow waters at the fish ladder entrance, especially during low flows of the Charles River. Shallow water depths make the fish ladder difficult to find and navigate, especially for American shad, and the stranded fish often die of predation by numerous bird species.

2.4 FEMA Flood Risk Information

The most recent detailed Flood Insurance Study (FIS) of Middlesex County, Massachusetts, performed by FEMA is dated July 6, 2016. The FIS describes that the underlying engineering analysis for the Charles River was performed by C.E. Maguire, Inc. in 1978. Typically, FEMA will provide the engineering data upon request such that it may be recreated with modern software and updated to reflect current conditions. Although a FIS Data Request was submitted to FEMA

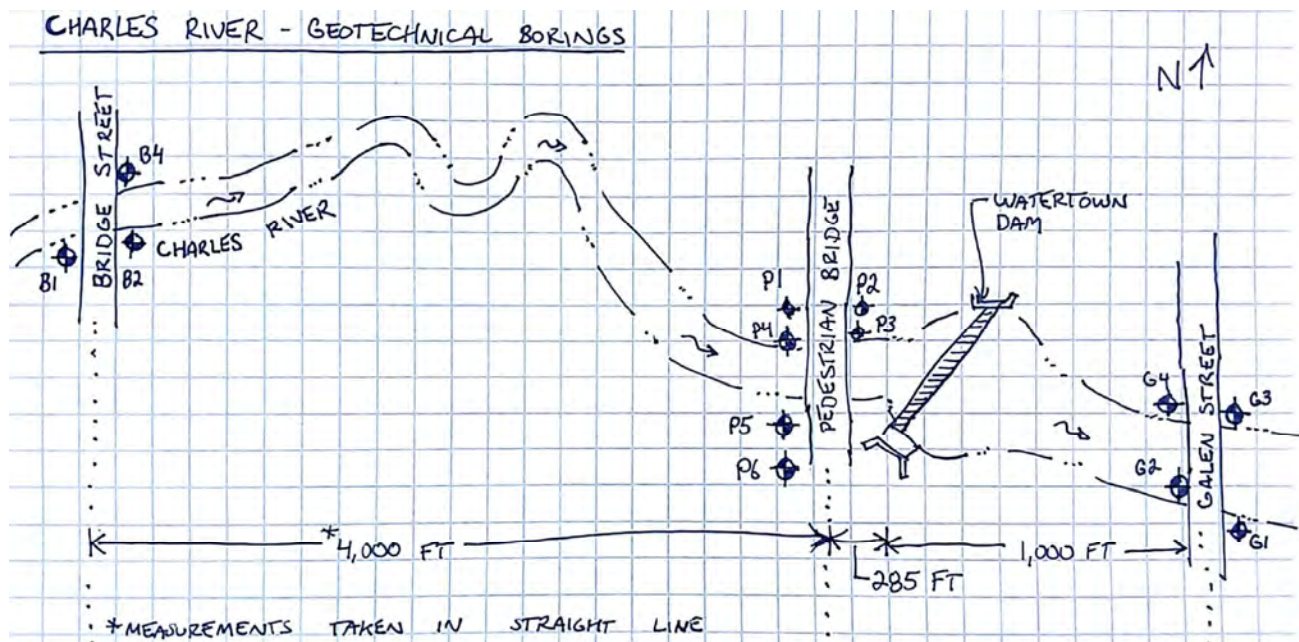
for that analysis, FEMA/USACE indicated that hydraulic modeling for the Charles River at the Watertown Dam does not exist (based upon correspondence with the agencies). Preliminary modeling is being developed by FEMA but is not currently available for release.

In addition to providing peak-flow rates (described in greater detail in Section 4), the FIS describes that extensive study and analysis were performed on the Charles River, especially relative to the Charles River Dam at Warren Avenue in downtown Boston and how the operation of flood control pumps affects the floodplain elevation upriver in the Charles River. These systems are described in greater detail in the following sections. The FEMA Flood Insurance Rate Mapping (FIRM) and relevant FIS data are included in Appendix D.

2.5 Geotechnical Boring Data

Geotechnical subsurface borings have been conducted in and around the Charles River in support of various bridge construction projects near the Watertown Dam. The three closest bridges to the dam all included subsurface exploration at their time of construction. The Galen Street bridge was most recently reconstructed in 1906, at which time subsurface borings were completed in order to inform the design of the footings. The pedestrian bridge upriver of the dam was constructed in 2018, but the design utilized boring data from a previous project at its location (1954). Bridge Street was most recently reconstructed in 1956, and subsurface borings were performed at that time. The original plans and boring records are included in Appendix E. Figure 2-4 presents a location plan of the borings.

FIGURE 2-4
Geotechnical Boring Location Plan



The results of the borings showed consistent strata between all three measured sites, with a layer of sandy gravel occupying the first 5' – 8' of depth below the channel bed, followed by another 7-

to 11-foot thick layer of compacted sand, gravel with some silty clay. Ledge was encountered at the bottom of all the borings at approximately 12 to 19 feet below the channel bottom.

The propensity for early colonial settlers to construct dams at the site of pre-existing ledge outcroppings means that many historic dam sites in New England were constructed on or near bedrock. The presence of these ledge outcroppings can create blockages to aquatic organism and fish passage even after the dam is removed. The borings show a consistent depth to bedrock that is below the elevation of any predicted scour depths and therefore outside of the range of probable exposure after removal of the dam.

Therefore, while the existing geotechnical borings were not comprehensive and only give a general idea of the soil conditions in the area, no evidence was seen of ledge outcroppings that may remain in the channel after the dam is removed.

3.0 FIELD INVESTIGATION

3.1 Site Investigation

MMI staff performed a visual observation of the Watertown Dam and its upriver impoundment on April 26 and July 13, 2018. The assessment included observation and measurement of the dam, training walls, and fish ladder, as well as observation of the riparian corridor in the impounded area. Utilities were located using a Global Positioning System (GPS), supplemented by measurement and documentation. Other tasks such as pebble counts, sediment sampling, and unmanned aircraft system (UAS) drone flight were also performed at this time and are described in detail in later sections of this report.

3.2 Pebble Count

In order to characterize the physical characteristics of the bed material downriver of the dam, a pebble count was performed (Wolman, 1954) in a free-flowing riffle starting at the downriver face of the Watertown Dam and extending approximately 200 linear feet downriver. The bed was well armored with coarse gravel and cobbles, with some boulders. The median particle diameter (D50) was found to be approximately 4 inches, or about the size of a softball. Figure 3-1 on the following page presents the results of the pebble count, and the full results are included in Appendix F.

3.3 UAS Drone Flight

MMI staff performed a UAS drone flight to capture imagery in a grid-style pattern over the project area on July 13, 2018, collecting photogrammetric data suitable for generation of a high-resolution aerial orthophoto of the dam and its impoundment. The photos were then compiled into one georeferenced, high-resolution orthophoto mosaic of the project site.

3.4 Survey

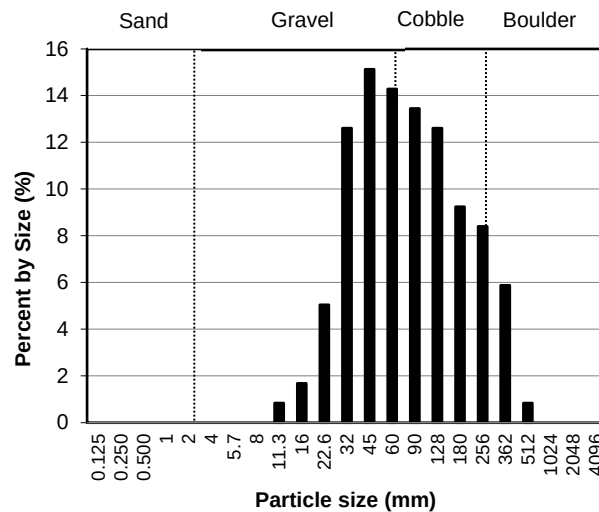
Ground and bathymetric survey was performed by MMI on May 31, 2018. The complete results of this survey are included in Appendix F but were used for developing mapping, figures, and for input to hydraulic modeling to accurately represent the hydraulics of the river system. This survey included measurements of the waterway openings, abutments, and bridge decks of both the Galen Street and Bridge Street bridges. It also included measurements of the Watertown Dam and the remnants of the Nonantum Dam. Bathymetric survey of the river bottom was conducted at 21 locations. Cross sections of the river channel were surveyed for use in developing the hydraulic model (described later in this report).

3.5 Base Mapping

Upland topography was generated from LIDAR (Light Detection and Ranging) data obtained from the United States Geological Survey (USGS) New England Coastal and Marine Geology Program (CMGP) Post Sandy LiDAR Processing Woolpert Project #73667 dated February 2015. A Digital Elevation Model (DEM) created from the LIDAR data was used to supplement ground survey to form the basis for updated hydraulic assessment. Horizontal mapping is referenced to the North

American Datum of 1983 (NAD83) in the Massachusetts Mainland zone. Elevation data is referenced to the North American Vertical Datum of 1988 (NAVD88). All contours are presented in feet at 1-foot intervals. Base mapping compiled from the various surveys is included in Appendix F.

FIGURE 3-1
Channel Bed Grain-Size Distribution
Pebble Count #1 – Downriver of Watertown Dam



Grain Size Distribution		
Grain Type	Grain Size	Percent
Sand	< 0.06 mm	1
Gravel	< 64 mm	26
Cobble	< 256 mm	60
Boulder	< 4096 mm	13
Bedrock	> 4096 mm	0

D16	D35	D50	D84	D95
43 mm	73 mm	96 mm	221 mm	385 mm

mm = millimeter

3.6 Impoundment Assessment

3.6.1 Sediment Sampling

When removing a dam, the quantification, characterization, and sometimes the active management of accumulated sediment is important to ensuring that downriver habitat and public safety are protected during and after the dam removal process. Due to the industrial past of the area surrounding the Watertown Dam, it is plausible that sediments that have accumulated behind the dam may contain harmful contaminants such as polychlorinated biphenyls (PCBs), heavy metals, petroleum hydrocarbons, chlorinated pesticides, and others. Sediment sampling

conducted by the USGS in 2005 within the Watertown Dam impoundment indicated the presence of cadmium, arsenic, copper, chromium, and zinc at concentrations above the Threshold Effects Concentration (Macdonald et al., 2000). Lead was found in concentrations above the probable effects concentration (USGS and Mass DER, 2012). Quantification and characterization of the sediment are necessary to ensure that any contaminants of concern can be disposed of or contained instead of released downriver if the dam is removed.

In order to estimate impounded sediment volumes at the Watertown Dam, sediment probing was performed at 10 transects. At each transect, the river was roughly divided into thirds. The left edge of water, center channel, and right edge of water were each probed several times to categorize the average sediment encountered in each third of the river. This method was selected because the high velocity of the water made probing across the river at higher resolution impossible. Sediment depths were measured by advancing steel rods until substrate was encountered and then again advancing under manual power until refusal. Refusal was determined to be the point at which the maximum steady application of force applied by the sampling scientist no longer advanced the sampler further into the sediment. The difference between the two depths was determined to be the depth of the accumulated sediment at that location. Care was taken to apply a consistent amount of pressure on the apparatus at each sample location. At the point of refusal, the depth of sediment observed was noted.

Each sediment sample was analyzed for the following constituents in accordance with 314 Code of Massachusetts Regulations (CMR) 9.07(2)(b)(6):

- Metals (Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, and Zinc) by the Environmental Protection Agency (EPA) Method 6010C
- Polyaromatic Hydrocarbons (PAHs) by EPA Method 8270D Modified
- PCBs by EPA Method 8082A with Soxhlet Extraction
- Extractable Petroleum Hydrocarbons (EPH) by Massachusetts Department of Environmental Protection (DEP) Methodology
- Organo-Chlorine Pesticides by EPA Method 8081B
- Total Organic Carbon by EPA Method 9060A

The results of that testing are summarized below while the full results are provided in the Sediment Sampling Report included herein as Appendix G. Figure 3-2 provides a location map of the sediment sampling locations.

3.6.2 Sediment Sampling Results

Native sandy and cobble riverbed material was found to be the dominant channel bed substrate in the area upriver of the dam. Samples located closer to the banks yielded more fine-grained sediments at up to depths of 3 feet. The amount of sediment in general decreased at the sample locations located in the upriver segments in the center of the channel. Typical sediment depths ranged between 0 and 1 foot. Sample S-9 exhibited larger sediment depths on the order of 2.5 feet. Based upon the probing transects as well as the profile data obtained during the assessment, the total volume of sediment in the channel from Nonantum Dam to Watertown Dam was estimated at 7,300 CY.

Preliminary sampling indicates that the sediment contains various chemical constituents and heavy metals consistent with urban runoff. The predominant constituents of concern are the various PAH compounds. Exceedances of the MCP S-1 soil standard were noted in the upriver, downriver, and impoundment sediments with no clear differentiation between the impoundment and the downriver sediment quality.

If the Watertown Dam is removed and the impoundment is drained, some land that was previously river bottom will be exposed as newly created floodplain, which could cause the sediments to be prone to human exposure. If the exposed sediments become regulated as "soil" due to the dam removal, measures will be necessary to address reportable conditions under the MCP. Sediment in some areas of newly exposed banks may need to be capped or removed to prevent exposure in a post-dam-removal scenario with receding water levels.

Additional sampling is required before a sediment management plan can be finalized; however, such a plan would likely include the removal of sediment from the area of sample S-8 and potentially rendering the sediment in the area of sample S-9 as soil classification S-2. This indicates that removal of any dredged sediments would require special handling and disposal considerations common to other recent Massachusetts dam removal projects.

Additional sampling should be performed to fully identify all areas that will be exposed and potentially require management under the regulatory requirements. Future investigations should calculate sediment quantities in greater detail so that a formal sediment management plan can be developed (**Recommendation No. SM-2**). However, it should be noted that upstream areas that will be unaffected by the contemplated work will continue to allow contaminated sediment to move through this area even if complete sediment removal were to be undertaken within the immediate project area. Because of this, it is impractical to expect that the sediment (exposed or otherwise) within the project area will meet the S-1 standards on a long-term basis. A larger watershed management program may help address some of these issues, but detailed solutions to this issue are beyond the scope of this feasibility study.

The full sediment sampling results are provided in the Sediment Sampling Report included herein as Appendix G.

3.6.3 River Corridor and Bank Vegetation

The Charles River forms much of the border between the cities of Boston and Cambridge. This area was one of the first areas to be settled and developed in the United States and has a long history of human manipulation of the river and its banks. Modern initiatives to promote a more natural riparian corridor for the river have succeeded in allowing the river to return to a more naturalized state with vegetated banks and some areas of forested floodplain.

The Charles River through Watertown consists of a narrow forested riparian corridor that lies adjacent to the densely settled community. Generally, the shallow profile banks are earthen. Overhanging canopy trees provide some shade adjacent to the bank though sunlight is abundant in the central portion of the watercourse and impoundment. Bordering vegetated wetlands are not extensive within this portion of the Charles River and are generally limited to bank vegetation with small areas of vegetated lateral bars upstream of the dam. Stormwater discharges enter the river via culverts along the length of the study area. Numerous green spaces parallel the river and allow for active and passive recreational opportunities.

Figure 3-3 shows an aerial image of the forested riparian corridor in the vicinity of the Watertown Dam from Galen Street to Farwell Street, which represents 2 miles of the Charles River.

FIGURE 3-3
Aerial Imagery from 2018 Depicting Vegetated Riparian Corridor
of the Charles River



Water flow in the Charles River upriver of the dam is characteristically deeper and slow-moving under normal flow conditions due to the presence of the dam. The vegetated banks and riparian corridor are protected by well-established and large floodplain trees. Generally, more fallen trees and debris were noted upriver of the dam than downriver. The photographs in Figure 3-4 on the following page represent typical channel sections both upriver and downriver of the Watertown Dam.

3.6.4 Ecological Functions and Condition

The impoundment behind the Watertown Dam does not differ dramatically in terms of width from areas downstream. However, the slow-moving energy regime of the impoundment produces a still-water environment as opposed to downstream of the dam, which is a lotic, or flowing, waterbody. The differing energy regimes are reflected in the ecology of each waterbody. Due to the transport-limited nature of the impoundment, the ecology of this area favors slower-moving, warmer-water aquatic species better adapted to the lentic environment as compared with a free-flowing perennial river. Morphological modifications have a direct connection to ecological health by affecting nutrient cycling and trophic-level connections in these aquatic systems.

3.6.5 Stormwater Outfalls

On July 13, 2018, MMI completed an inventory of culverts and outfalls from the area immediately downriver of Watertown Dam to the Bridge Street bridge. The locations of the culverts and outfalls were collected using a handheld GPS. Pipe inverts were measured by hand in relation to the water surface. The existing outfalls were often found to be impacted by sediment either due to historical road sand or aggraded silts from within the impoundment. The removal of the dam would require some of these outfalls to be extended down to the new water level after the impoundment was drained. Figure 3-5 shows the locations of the 11 outfalls and culverts that were found during the site investigation. Table 3-1 summarizes the results of the outfall survey. More information is provided in Appendix H.

FIGURE 3-4
Typical Riverbank Vegetation Upriver (Above) and Downriver (Below) of Watertown Dam



TABLE 3-1
Stormwater Outfalls Located Upriver of and Nearby to Watertown Dam

Outfall	Invert	Dimensions	Notes
ID No.	Invert at WSEL	W = 48 in H = 24 in	Culvert at the dam, concrete semicircle culvert
1	Height from bottom of culvert to the toe of riffle = 4-foot 10-inches	W = 10 ft H = 7 ft	Backwater from Charles River to bottom of riffle, concrete box culvert
2	15-inches below WSEL	Dia. = 42 in	Double circular concrete culvert, slightly filled with sediment
3	1-foot 9-inches above WSEL	Dia. = 12 in	Circular concrete culvert
4	7.5" below WSEL	Dia. = 24 in	Circular plastic pipe
5	1-foot 8-inches below WSEL	Dia. = 54 in	Outfall matches Watertown outfall sign #6; this is the left culvert facing the Charles River. circular concrete culvert
6	2-inches below WSEL	Dia. = 42 in	Outfall matches Watertown sign #5, right culvert facing the Charles River. circular concrete culvert
7	3-inches below WSEL	Dia. = 24 in	Outfall matches Watertown sign #7. circular concrete culvert, culvert slightly filled with sediment
8	3-foot 2-inches above WSEL	Dia. = 18 in	Circular plastic pipe
9	2-foot 10-inches above WSEL	Dia. = 12 in	Circular concrete culvert half full with sediment
10	N/A	Dia. = 18 in	At pool parking lot, culvert is disconnected, silted, and does not appear to be functioning.

1. Channel discharging from Bridge Street appears to be a side channel; no culverts were found.
2. Three inches of water were flowing over Watertown Dam at time of data collection.
The spillway elevation varies between 7.70 and 7.76 feet NAVD88 based on MMI survey completed in June 2018.
3. WSEL = water surface elevation; dia. = diameter

4.0 HYDROLOGIC ASSESSMENT

A river's flow fluctuates daily as environmental conditions change, increasing with precipitation and runoff and decreasing with dry weather. In order to develop flow data in the Charles River at the Watertown Dam, hydrologic assessment of the Charles River was performed at the site for low-flow and high-flow scenarios.

Various methods of hydrologic assessment are available, ranging in intensity from a basic estimation using regional regression data from other watercourses in the area to utilizing historical gauge data on the watercourse to extrapolate future flows. Advanced numerical rainfall-runoff models can also be developed and run over an entire watershed, in which the soil types and land use of the entire watershed are analyzed in an extremely complex model, and the various contributing runoff elements are predicted.

Given the preliminary scope of this feasibility assessment, regional estimates and historical gauge data (the first two methods described above) were used to develop flow estimates in the Charles River, and the results were subsequently compared with each other. Readily available flow information from USGS *StreamStats* and the effective FEMA FIS were also compiled for comparison.

4.1 Watershed

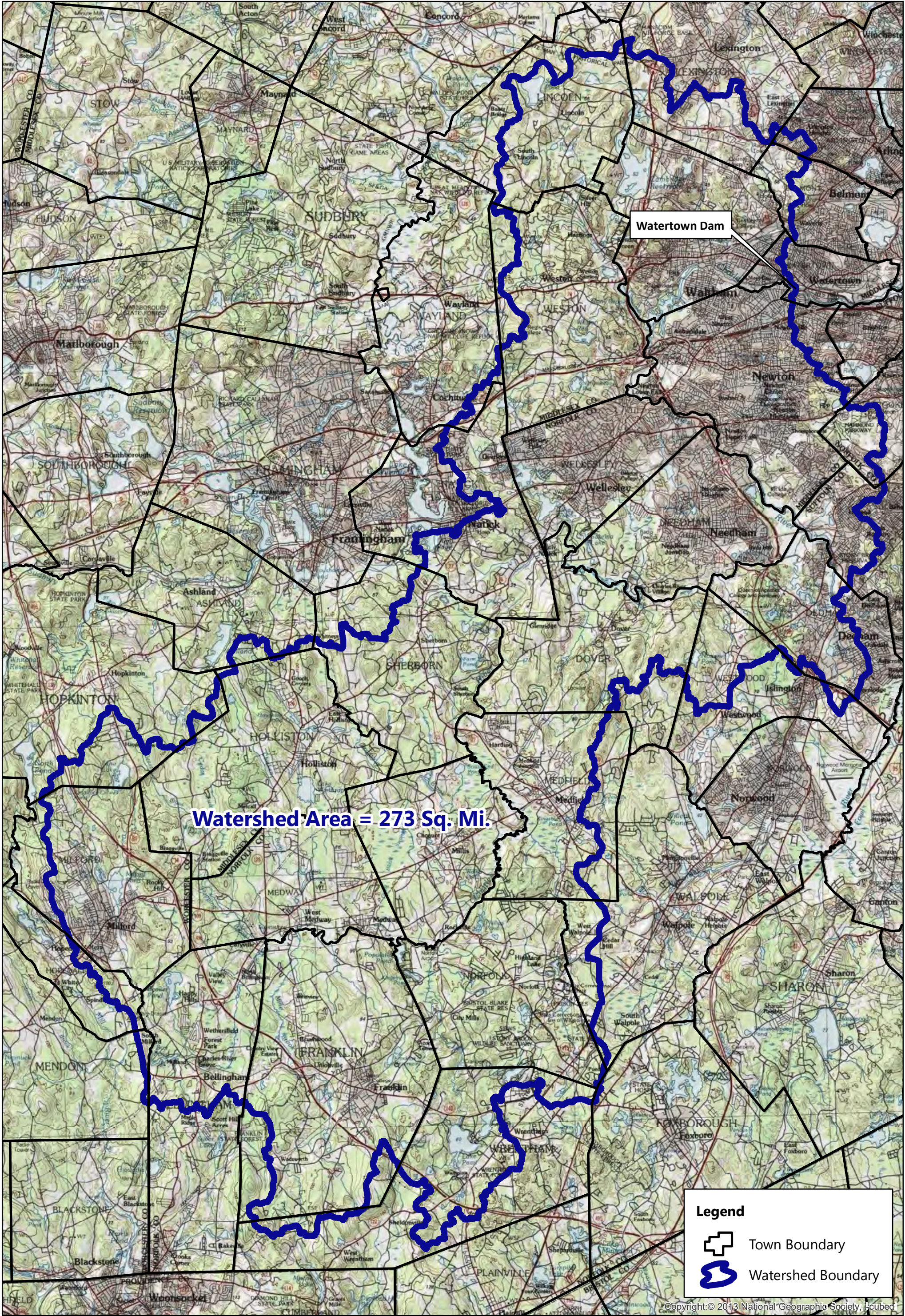
The contributing watershed of the Charles River at the Watertown Dam is approximately 273 square miles as delineated by the USGS *StreamStats* program. The watershed extends primarily south and west of the project site, covering the western side of Watertown and portions of more than 20 other towns. It extends west to the city of Milford, south to the town of Franklin, and north to the town of Lincoln.

Increasing amounts of urbanization in a watershed leads to "flashier" storm events as runoff from impervious surfaces such as pavement and rooftops reaches drainage systems and watercourses much more quickly than in natural, vegetated conditions. Approximately 30 percent of the Watertown Dam watershed is densely developed, with the majority of development located in the downstream-most portion of the watershed, near the project site. Figure 4-1 presents a graphic delineation of the watershed of the Charles River at the Watertown Dam.

4.2 Flood Flows

In order to assess the potential impacts of a dam removal on the flooding characteristics of the site, determination of riverine flows included the estimation of floods of varying severity and frequency. This included assessing the extents and depths of the floodplain to identify any infrastructure or buildings that may be flood prone as well as evaluating the velocities and shear stresses associated with these floods to assess the stability of the riverbanks, riverbed, and water-borne infrastructure such as bridges and dams.

For the purposes of this report, "flood flows" will be defined as flows that occur on a 2-year recurrence interval basis as well as more severe events.



Legend

Town Boundary

Watershed Boundary

Copyright © 2013 National Geographic Society, Inc.

FIG. 4-1

WATERSHED MAP

WATERTOWN DAM REMOVAL FEASIBILITY STUDY

CHARLES RIVER
WATERTOWN, MA

DESIGNED BY JCS

DRAWN BY JCM

CHECKED BY

DATE OCTOBER 16, 2018

PROJECT NO. 2688-44

DESCRIPTION	DATE	BY

MILONE & MACBROOM

99 Realty Drive
Cheshire, Connecticut 06410
(203) 271-1773
www.mminc.com

5,500 Feet

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Multiple sources of hydrologic data were compiled in researching the Watertown Dam site. Much of this data is applicable to various other locations along the Charles River but can be adjusted to the Watertown Dam site. Hydrologic data was adjusted to the Watertown Dam site using the following equation from 1983 USGS report "Estimating Peak Discharges of Small, Rural Streams in Massachusetts."

$$Q_u = (A_u/A_g)^{0.66} * Q_g \quad \text{Watershed Transfer Equation (USGS, 1983)}$$

The equation provides flow (Q_u) at the ungauged site in cubic feet per second (cfs), based upon flow (Q_g) at the gauged site in cfs, the drainage area (A_u) at the ungauged site in square miles (sq. mi.), and the drainage area at the gauged site (A_g).

4.2.1 FEMA

The most recent detailed FIS of Middlesex County, Massachusetts, is dated July 6, 2016. As part of that study, FEMA developed peak flood flows for the Charles River by using a log-Pearson Type III Bulletin 17b assessment of the records from multiple USGS gauging stations along the Charles River. Table 4-1 summarizes the flows utilized for the FEMA analysis.

**TABLE 4-1
FEMA Flood Flows**

Location	Drainage Area (sq. mi.)	10-Year (cfs)	50-Year (cfs)	100-Year (cfs)	500-Year (cfs)
Watertown/Newton Town Line near Farwell Street	250.6	2,200	3,200	3,700	5,200
Adjusted to Watertown Dam	273	2,485	3,614	4,179	5,873

4.2.2 USGS Gauge Data

The USGS maintains a network of stream gauges throughout the country. These gauges can provide valuable information on the flow conditions of the stream in which they are installed. USGS stream gauge No. 01104500 on the Charles River in Waltham, Massachusetts, is located approximately 2.7 miles upstream of the Watertown Dam. It is located 800 feet downstream of the Moody Street bridge and 800 feet downstream of the Moody Street dam. This gauge has been recording stream flow since 1931, which provides a period of record of 88 years at the time of writing and has a drainage area of 227 square miles. Peak flows were calculated by performing a Bulletin 17b analysis with the *Hydrologic Engineering Center – Statistical Software Package* (HEC-SSP) program and are presented in Table 4-2. Full computations are provided in Appendix I.

The FEMA flows match closely to the Charles River gauge data, which is expected because the FEMA data was originally based upon the Charles River gauges.

TABLE 4-2
Summary of Peak Flows Derived from USGS Gauge No 01104500, Charles River at Waltham, Massachusetts

Location	Drainage Area (sq. mi.)	10-Year (cfs)	50-Year (cfs)	100-Year (cfs)	500-Year (cfs)
Charles River at Waltham, Massachusetts	227	2,417	3,557	4,099	5,514
Adjusted to Watertown Dam	273	2,730	4,018	4,630	6,228

4.2.3 USGS *StreamStats*

StreamStats is a powerful hydrology tool developed by the USGS that predicts flow rates based upon drainage basin characteristics and stream gauge data, assuming natural runoff conditions. Estimated peak discharges for various frequency events at the Watertown Dam were calculated by MMI using *StreamStats*. The flows obtained from the USGS *StreamStats* application are presented in Table 4-3 below.

TABLE 4-3
Summary of Peak Flows Derived from USGS *StreamStats*

Location	Drainage Area (sq. mi.)	10-Year (cfs)	50-Year (cfs)	100-Year (cfs)	500-Year (cfs)
At Watertown Dam	273	5,830	9,030	10,500	14,400

4.2.4 Selection of Peak Flows

Substantial discrepancies exist between the peak discharges reported by FEMA, the USGS gauge, and those determined using *StreamStats*. It is common for hydrologic analyses to offer results that vary from one method of computation to another as they involve complex calculations that are functions of many factors.

While the *StreamStats* method of peak-flow approximation provides a regional average for stream behavior, there can be substantial variability between individual watersheds that can affect peak flows such as precipitation patterns, underlying geologic conditions, and urbanization. The USGS *StreamStats* flows are more than twice as large as the adjusted USGS gauge data flows and were determined to be unreasonably high. The USGS gauge data flows are slightly higher than the FEMA flows and therefore were chosen as the design flows in order to be more conservative.

4.2.5 Climate Change

In order to assess the feasibility of the Watertown Dam removal under future conditions, multiple guidelines regarding climate change's effect on flow and precipitation were considered. Watersheds with long-term flow records and little human influence have shown trends toward increasing stream flow over the past few decades (Collins, 2009). In a recent study, 25 of 28 flood series studied in New England showed upward flood trends, with evidence of an increase in flood

magnitudes around 1970 (Collins, 2009). Project design guidelines published by Collins through the NOAA Fisheries Service recommend the following (Collins, 2011):

- The most recent available data should be used to compute statistical flood frequency estimates.
- If the period of flood record allows, pre-1970 and post-1970 flood frequency curves should be computed, and the design team should consider using the larger estimated design flows.
- If little recent data is available, regional regression equations or other estimation strategies could be compared to older gauge data. The same strategy used to estimate more recent flows should also be applied to the older period of record to check for methodological bias.

Peak flow records for USGS Gauge 01104500 indicate that there were several large storms that registered 3,500 cfs or higher after the year 1970. Consistent with design guidance from Collins (2011), annual peak flow data from USGS Gauge 01104500 (period of record 1931 to present day) was analyzed using HEC-SSP for the periods from 1931 to 1969, 1970 to present day, and 1931 to present day. As shown in Figures 4-2 and 4-3, storm events in the post-1970 dataset had a larger discharge than in the pre-1970 dataset, especially for events with low annual exceedance probability.

FIGURE 4-2
USGS Gauge 01104500 Charles River, Waltham, Massachusetts
Annual Peak Flow Records

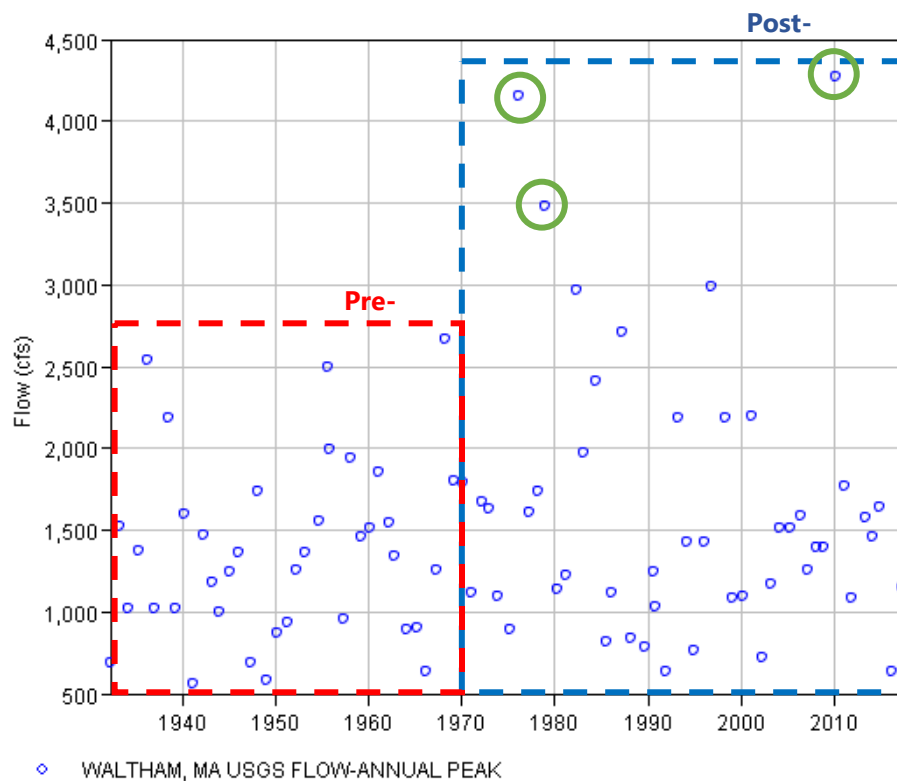
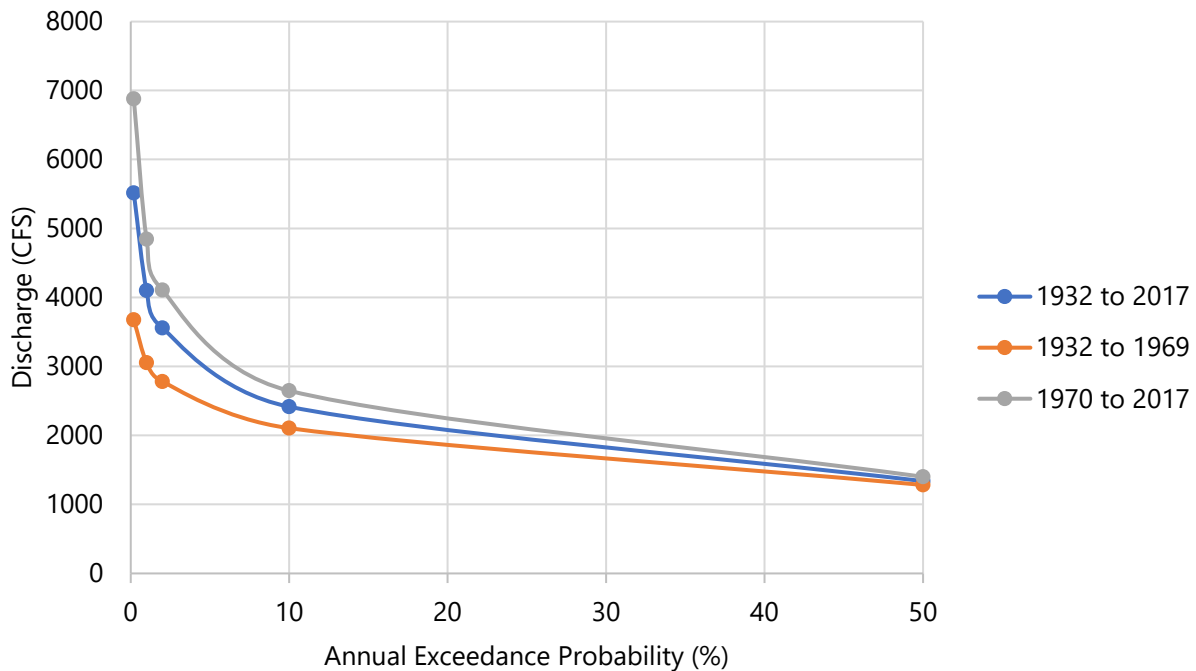


FIGURE 4-3
Bulletin 17B Analysis on Gauge 01104500 for
1932-2017, 1932-1969, and 1970-2017



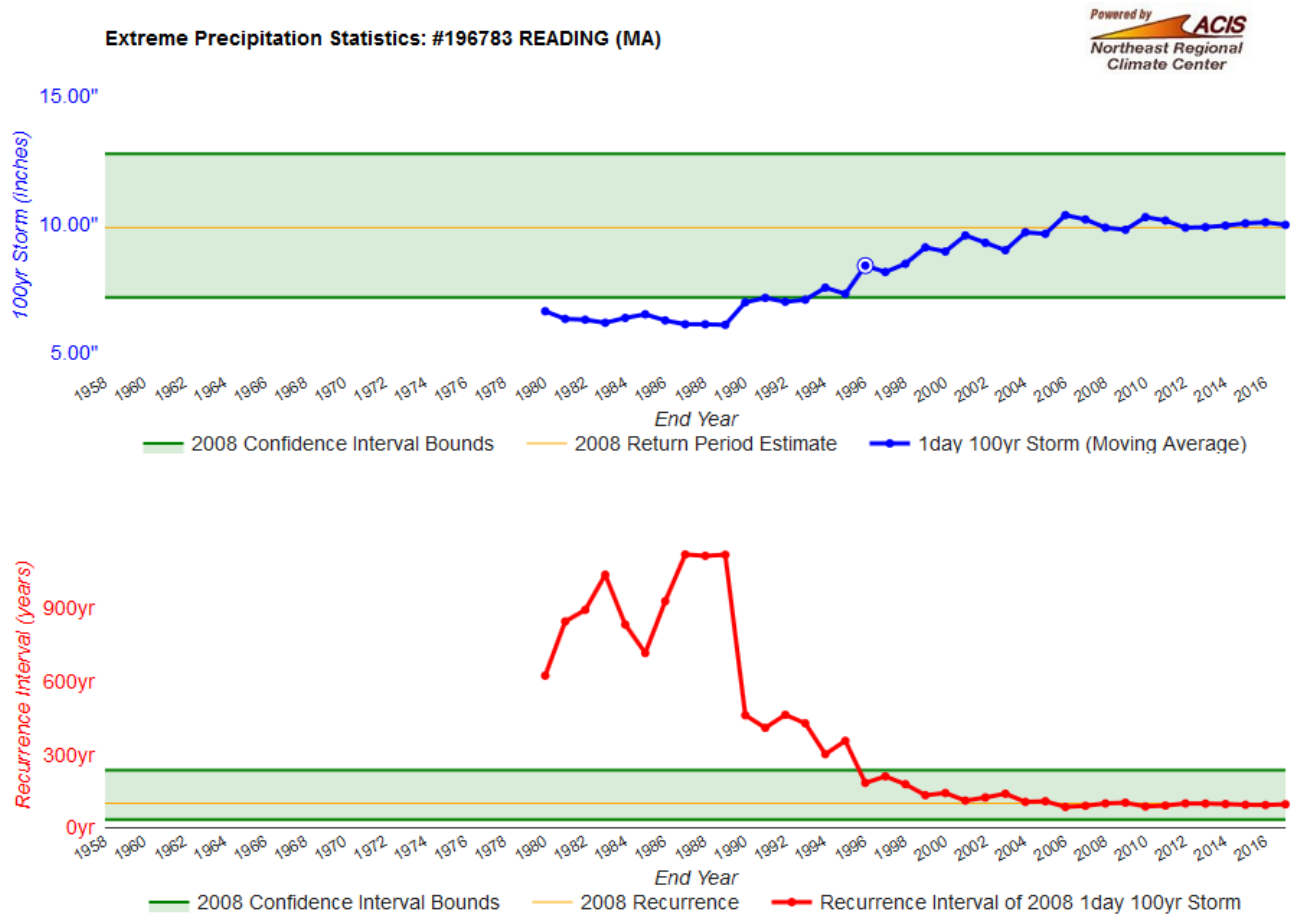
The Northeast Climate Adaptation Science Center at the University of Massachusetts Amherst published projected changes in precipitation for the Commonwealth of Massachusetts in its Massachusetts Climate Change Projections document (Northeast Climate Adaptation Science Center, 2018). The precipitation climate change projections are based on climate models from the International Panel on Climate Change and two greenhouse gas emission scenarios. The Massachusetts Climate Change Projections state that "the severity of flood-inducing weather events and storms will increase, with events that produce sufficient precipitation to present a risk of flooding likely increasing" (Northeast Climate Adaptation Science Center, 2018).

The Massachusetts Climate Change Projections include projections specific to the Charles River Basin. Within the Charles River Basin, the winter season is expected to have the largest change in precipitation, with an increase of 1 to 21 percent by the 2050s and an increase of 3 to 35 percent in the 2090s. An increase in precipitation is not directly proportional to an increase in channel flow due to infiltration, evaporation, transpiration, and interception within a watershed. However, given the high level of development within the Charles River watershed, the projected increase in precipitation may be similar to the projected increase in flow.

Guidelines from the state of New York were also considered. The New York State Department of Transportation (NYSDOT) *Bridge Manual* (2017) requires increasing the design flows by 20 percent in order to account for increasing projected future flows. The Extreme Precipitation website provided by Cornell indicates that precipitation for a 100-year storm event in Reading, Massachusetts, has increased from 8.39 inches to 10.08 inches over the period from 1996 to 2016,

as shown in Figure 4-4 below, which is a roughly 20 percent increase in precipitation over 20 years. As stated previously, increases in precipitation and flow are not directly proportional; however, the 20 percent increase in precipitation seen over the past 20 years in Reading, Massachusetts, lends support to the NYSDOT requirement of adding 20 percent to design flows.

FIGURE 4-4
Extreme Precipitation Statistics for the 100-Year Storm in Reading, Massachusetts, (Cornell, 2018)



In consideration of the multiple studies on climate change and multiple methods of accounting for it, DER requested that a 30 percent increase in flow be chosen as a middle ground between NYDOT guidance and Massachusetts precipitation projections. Table 4-4 below shows the peak design flows based on USGS gauge data and the projected 30 percent increase in peak flows.

TABLE 4-4
Summary of Peak Flows Derived from Nearby USGS Gauging Data and Climate Change Adjustment

Location	10-Year (cfs)	10-Year +30% (cfs)	50-Year (cfs)	50-Year +30% (cfs)	100-Year (cfs)	100-Year +30% (cfs)	500-Year (cfs)	500-Year +30% (cfs)
At Watertown Dam	2,730	3,549	4,018	5,223	4,630	6,019	6,228	8,097

4.3 Low Flows

Peak flows are useful in determining flooding extents, channel stability, and erosion potential during a flood event. In order to evaluate the channel characteristics during more common scenarios, low-flow estimates are also compiled. These flows are used to determine the size of the channel that may form in the former impoundment as well as to evaluate the ability of the channel to provide adequate fish passage. For the purposes of this report, "low flows" will be defined as the bankfull flow, the 1.5-year recurrence interval flow, and all flows lower than these values.

4.3.1 Monthly Exceedance Flows

Monthly exceedance flows were calculated using a HEC-SSP duration analysis at USGS Gauge 01104500. The flows were then adjusted to the project site. The 85 percent, 50 percent, and 15 percent monthly exceedance flows are shown in Table 4-5.

TABLE 4-5
Summary of Monthly Exceedance Flows

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
85% Exceedance Flow (cfs)	186	207	346	335	204	99	49	29	29	41	90	142
50% Exceedance Flow (cfs)	348	395	604	604	380	203	98	76	78	113	229	323
15% Exceedance Flow (cfs)	677	735	1,061	1,077	616	438	248	226	213	321	537	697

Note: Highlighted flows are utilized in fish passage and bank exposure analyses described later herein.

4.3.2 Bankfull Flow

In the case of the Charles River, heavy human manipulation of both the physical riverbanks as well as the upstream hydrology means that the concept of a "natural" bankfull flow and channel dimensions is very difficult to establish; therefore, multiple regional estimates were utilized and compared in an effort to estimate the bankfull conditions of the Charles River.

Bankfull flow was calculated using the regression equations from USGS Report 2013-5155, "Equations for Estimating Bankfull Channel Geometry and Discharge for Streams in Massachusetts." The USGS report provides two different regression equations for estimating bankfull flows. One equation is referred to as a "simple" equation with far less variables but less customization per site and therefore less potential accuracy. The multivariable regression equation allows for the customization of the equation with additional parameters, which provide better site-specific results.

The equilibrium concept of "bankfull" is often estimated as the 1.5-year flood in many watercourses. While such an estimation is an oversimplification of the bankfull concept and rarely aligns perfectly, it is a useful surrogate when attempting to estimate the bankfull flow of a stream or river when little other information is available. Therefore, the HEC-SSP Bulletin 17B analysis of

the Waltham USGS gauge was expanded to include an estimate of the 1.5-year flood. This data, as well as the estimates provided by the USGS regression equations, is compared in Table 4-6.

TABLE 4-6
Summary of Bankfull Flows

Calculation Method	Bankfull Flow (cfs)
Simple Regression Equation	3,294
Multiple Regression Equation	2,108
1.5-Year Flow, USGS Gauge, Waltham, Massachusetts	1,257

The calculated bankfull flows were entered into the *Hydrologic Engineering Center – River Analysis System* (HEC-RAS) existing conditions model and compared to existing bank height at cross sections that appeared to most closely resemble what may have been natural conditions before development and channel manipulation. The flow calculated using the multiple regression equation appeared to align with the heights of the existing banks better than the other two and was selected for use as the estimated bankfull flow in the Charles River.

4.3.3 7Q10 Flow

The 7Q10 flow is the lowest 7-day average flow in a 10-year period. USGS Report 88-4173 from 1992 titled "Water Resources and Aquifer Yields in the Charles River Basin, Massachusetts" includes a 7Q10 low flow of 14.3 cfs for the Charles River gauge at Waltham (Gauge #01104500). After adjusting for drainage area, the 7Q10 flow at the project site is estimated as 16.2 cfs.

4.4 Summary of Hydrology

The various sources for flow data described above were compiled and input into the HEC-RAS hydraulic modeling. Table 4-7 on the following page summarizes all of the flows that were modeled, the source of the data, and for what analysis they were used.

4.5 Post-dam-Removal Hydrology

Some dams are designed to provide flood control benefits for downstream areas. Such a dam often has a large, dry storage area within the floodplain on the upstream side that is able to fill with water during a severe flood, holding the water temporarily and releasing the water in a controlled fashion after the peak of the flooding has passed. This reduces the peak flow rate downstream of the dam and lessens the severity of the flood. The removal of a flood control dam would require the assessment of this effect and the resulting increases in downstream flood flows.

However, the Watertown Dam does not provide flood control benefits; it is a run-of-river dam and is not operated in a way that could provide flood flow attenuation at downstream locations. A more detailed assessment of the flood control effects of the Watertown Dam is provided in Section 6.1 of this report.

TABLE 4-7
Summary of Discharges Selected for Hydraulic Modeling

	Discharge Name	Discharge Value (cfs)	Analysis Provided	Source of Discharge Data
Flood Flows	500-year + 30%	8,097	Floodplain impacts	USGS Gauge Data + climate change projections
	100-year + 30%	6,019	Floodplain impacts	USGS Gauge Data + climate change projections
	50-year + 30%	5,223	Floodplain impacts	USGS Gauge Data + climate change projections
	10-year + 30%	3,549	Floodplain impacts	USGS Gauge Data + climate change projections
	Bankfull	2,108	Floodplain impacts	USGS Regression Equations for Massachusetts
	1.5-year	1,257	Floodplain impacts	USGS Gauge Data
Low Flows	15% Exceedance – April	1,077	Fish Passage (High) & Bank Exposure (High)	HEC-SSP Duration Analysis on USGS Gauge Data
	50% Exceedance – June	203	Bank Exposure (Med)	HEC-SSP Duration Analysis on USGS Gauge Data
	85% Exceedance – July	49	Fish Passage (Low)	HEC-SSP Duration Analysis on USGS Gauge Data
	85% Exceedance – Sept.	29	Bank Exposure (Low)	HEC-SSP Duration Analysis on USGS Gauge Data

5.0 HYDRAULIC ANALYSIS

Hydraulic analysis of the Charles River was utilized to determine the behavior of flowing water in the river as it relates to the Watertown Dam. This includes the analysis of flood flows as well as lower, daily flows, which can help with the prediction of floodplain elevations, depths, and extents, scour and erodibility of the channel and infrastructure, the assessment of sediment transport, and the assessment of fish passage through the site. Full hydraulic computations are Provided in Appendix J.

5.1 Downstream Boundary Conditions

In order to initialize the hydraulic model through the area of the Watertown Dam, water surface elevations downstream of the dam were established for each flow that was input into the hydraulic modeling. The downstream waters are manipulated and controlled by the New Charles River Dam at the mouth of the Charles River. According to conversations with DCR staff, this dam has a series of locks, pumps, and gates that are manipulated according to set operation and maintenance instructions.

As a result of the New Charles River Dam's daily operation, normal water levels in the Charles River Basin are intended to remain between the elevations of 0.05 feet NAVD and 2.05 feet NAVD regardless of the tidal, storm surge, or riverine flooding conditions. The active management of the New Charles River Dam as described in the operational guidance documentation (MMI, 2017) is effective at managing tidal influx into the Charles River Basin. In the summer, the Charles River Basin water surface elevation is maintained near the upper end of the safe operational range for recreational uses. Winter basin water surface elevation is usually near the lower end of the safe operational range to provide a larger water storage volume buffer for spring flooding.

New Charles River Dam operators look at predicted rain and stream gauges along the Charles River to anticipate basin flood water surface elevations and required operations at the New Charles River Dam to prevent flooding (MMI, 2017). When a large flood is predicted, the basin water surface elevation is typically lowered to 0.35 feet NAVD. A lock is opened during flooding when the tide is low enough to allow gravity flow through the lock to help drain the basin. When gravity flow alone cannot keep up with flow in the basin due to flooding or the required closing of gravity structures to prevent tidal intrusion, water is forced out of the basin and into the harbor by six pumps. The pumps are typically turned on when the basin water surface reaches 1.85 feet NAVD (MMI, 2017).

The results of the operations are observed in the data logged at the USGS Gauge No. 01104715 Charles River at the New Charles River Dam in Boston, Massachusetts. The gauge records both the incoming tide on the seaward side of the lock structure, as well as the water levels in the Charles River Basin. The two following figures, Figure 5-1 and 5-2, present 2018 data recorded by that gauge on the upriver Charles River Basin side. It includes the water levels for a 1-week period in December 2018 (Figure 5-1) and the May through September period of 2018 (Figure 5-2). In both, the water levels are presented in the Massachusetts Metropolitan District Commission (MDC) datum. The MDC datum is 106.45 feet higher than NAVD 88 (CE Maguire, Inc., 1973; NOAA, 2021). After converting the datum, the gauge data presented below show that the water elevation in the Charles River Basin never rose above 2.05 feet NAVD or fell below 0.05 feet NAVD for the entire summer of 2018.

FIGURE 5-1
USGS Gauge No. 01104715 Charles River at the New Charles River Dam in Boston
December 2018

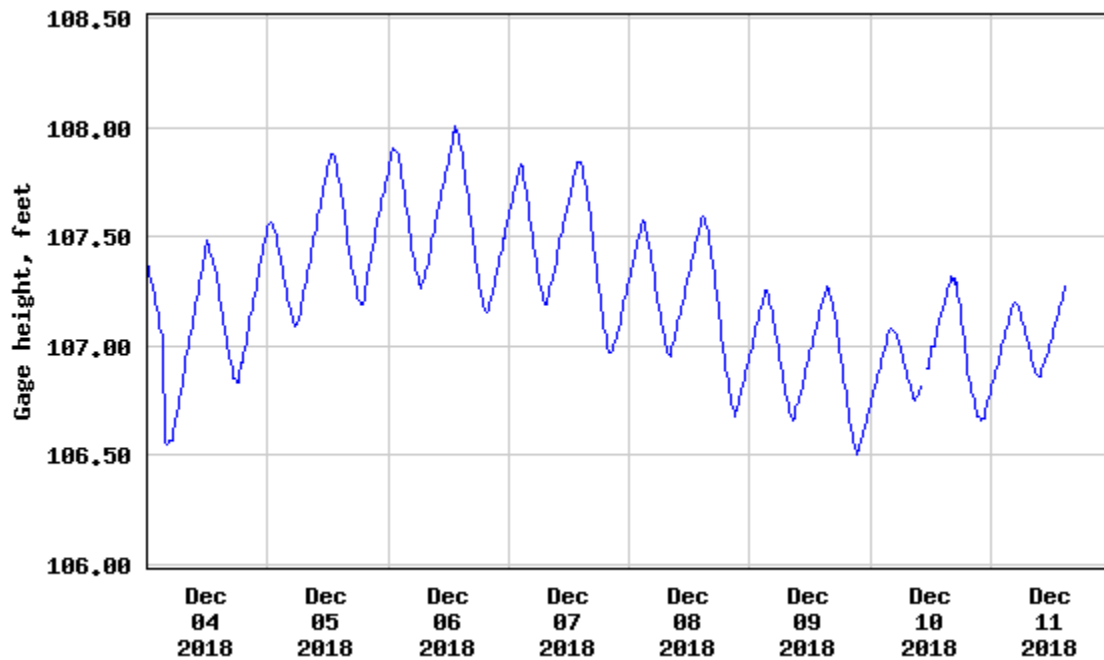
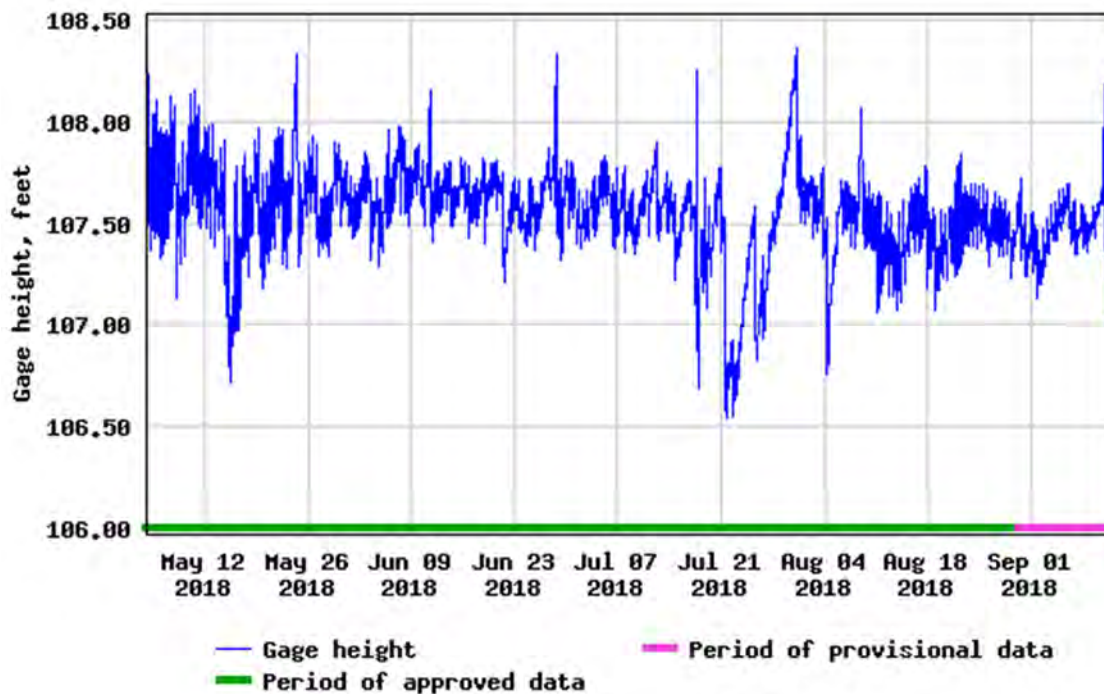


FIGURE 5-2
USGS Gauge No. 01104715 Charles River at the New Charles River Dam in Boston
May through September 2018



As a result of its daily operation, water levels in the Charles River Basin under most normal flow scenarios remain between those elevations of 0.05 feet NAVD and 2.05 feet NAVD; therefore, this elevation range was used as a downstream boundary condition for various low-flow conditions in the modeling and analysis. Although there may be outliers in other years, this was chosen as a good approximation for typical boundary conditions for low flows during the summer months. Specifically, the fish passage assessment and bank exposure assessments (described later) were performed with a range of flows in order to "bracket" the range of normally expected conditions. The higher flows used in those analyses utilize the higher boundary condition of 2.05 feet NAVD, and the lower flows utilize the lower boundary of 0.05 feet NAVD. The June 50 percent exceedance flow uses the average water surface elevation of 1.05 feet NAVD as a downstream boundary condition.

The downstream boundary conditions for the 10-, 50-, 100-, and 500-year flows were set using known water surface elevations taken from the FEMA FIS flood profile. Although design flows used in the HEC-RAS modeling have been adjusted by 30 percent based upon climate change projections, such an increase in flows may not directly correlate to an increase in downstream boundary conditions based upon the geometry and dynamics of the downstream floodplain area. Therefore, the water surface elevations from the FEMA FIS flood profile were used as downstream boundary conditions for the climate change projections as well. The downstream boundary condition for the bankfull and 1.5-year flows was set using the 10-year water surface elevation from the FEMA FIS flood profile. A summary of the boundary conditions and their sources is provided in Table 5-1.

TABLE 5-1
Downstream Boundary Conditions for Modeled Flows

	Discharge Name	Boundary Condition Description	Boundary Condition Value (Ft)	Source of Boundary Data
Flood Flows	500-year + 30%	Flood Elevation	5.2	FEMA
	100-year + 30%	Flood Elevation	3.6	FEMA
	50-year + 30%	Flood Elevation	3.2	FEMA
	10-year + 30%	Flood Elevation	3.0	FEMA
	Bankfull	Flood Elevation	3.0	FEMA
	1.5-year	Flood Elevation	3.0	FEMA
Low Flows	15% Exceedance – April	Higher Charles River Basin WSEL	2.05	MMI 2017, USGS
	50% Exceedance – June	Average Charles River WSEL	1.05	MMI 2017, USGS
	85% Exceedance – July	Lower Charles River Basin WSEL	0.05	MMI 2017, USGS
	85% Exceedance – Sept.	Lower Charles River Basin WSEL	0.05	MMI 2017, USGS

Note: WSEL = water surface elevation

5.2 Existing Conditions Hydraulics

The 2016 FEMA FIS for Middlesex County indicates that the engineering analysis for the Charles River used to develop the FIRM and FIS data was performed by C.E. Maguire, Inc. in 1978. FEMA typically provides backup hydraulic computations and modelling to anyone who requests it such that it may be used to recreate the modeling with modern software and updated to reflect current conditions. Although a FIS Data Request was submitted to FEMA for that analysis, it was determined after multiple attempts to correspond with FEMA that the data was unavailable. The effective FIRMette is included in Appendix D.

In lieu of the FEMA model, a brand new hydraulic model was created for the purposes of this analysis. The existing conditions HEC-RAS model channel geometry was created from survey collected by MMI on May 30-31 and June 11-14, 2018. The surveyed channel sections were supplemented with overbank data from the 2015 New England CMGP Sandy LiDAR dataset. The partially removed Nonantum Dam near Bridge Street, the Bridge Street bridge, the recently constructed Corporal Thompson Footbridge upriver of the Watertown Dam, the Watertown Dam, and the bridge at Galen Street were also surveyed by MMI. The elevations in the model are referenced to NAVD 1988.

The channel Manning's friction coefficients are based on field observations, and the overbank Manning's friction coefficients are based on a combination of field observations and aerial imagery. Manning's coefficient in the channel ranges between 0.03 and 0.038. Manning's coefficient values on the overbank vary from 0.02 to 0.10 depending on whether the overbank is paved, wooded, or grassy. Manning's N selection was based upon guidance from USGS (USGS, 2018), United States Department of Agriculture (USDA) (Guy B. Fasken, 1969), and USACE documentation. Normal depth using a slope of 0.09 feet per foot (ft/ft) was applied as the upstream boundary condition to represent the slope of the river bottom upstream of where the model begins.

The existing Watertown Dam was input into the HEC-RAS model as an ogee weir with a width of 2 feet. Based on the spillway approach height and design energy head, the weir coefficient was calculated in HEC-RAS as 3.91 based upon the program reference materials. The geometry of the wooden railings, fish ladder, retaining walls, and building on the left bank was entered as part of the inline structure geometry.

The model was run in a mixed-flow regime. The existing conditions geometry was used to evaluate water surface elevations and velocities for various design parameters including flood flows (10- through 500-year flows based on 17B analysis and adjusted by 30 percent to account for climate change) and low flows (17B analysis for monthly exceedance flows and calculated bankfull flow).

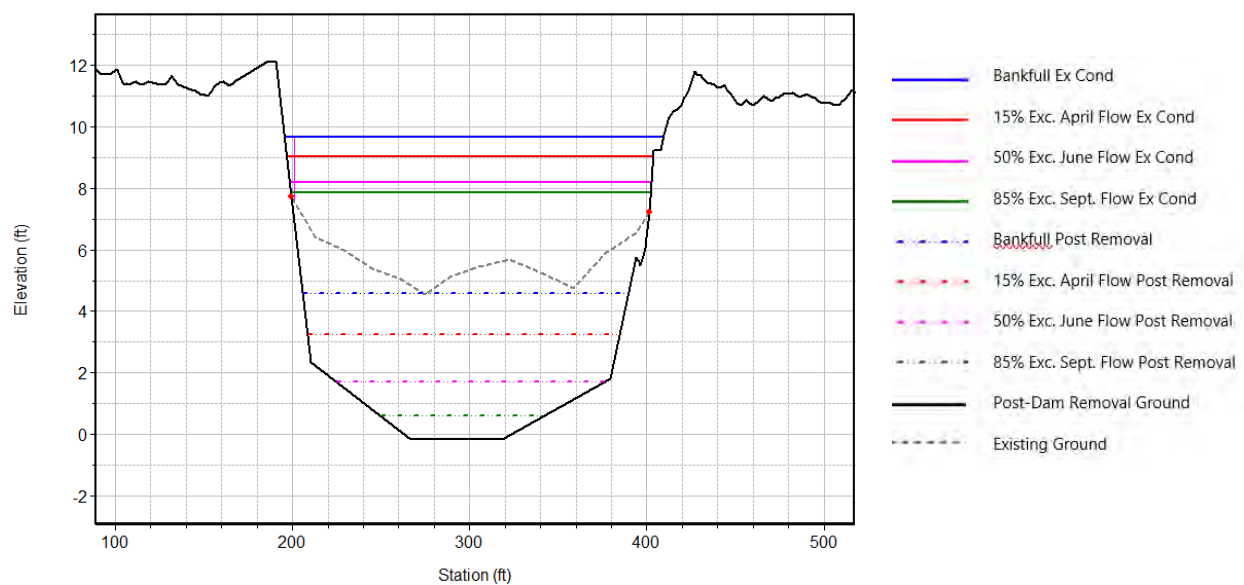
5.3 Post-dam-Removal Hydraulics

The proposed conditions model was created by copying the cross-section geometry and inputs from the existing conditions model and making revisions to reflect the removal of the Watertown Dam. The revisions included the removal of the existing dam, grading of approximately 130 linear

feet of channel at a slope of 1 percent upriver of the dam, and limited overbank grading in the vicinity of the dam. Manning's roughness coefficients were modified to reflect the proposed conditions.

Figure 5-3 presents a typical cross section of how the dam removal was modeled in HEC-RAS. It presents a cross section immediately upstream of the Watertown Dam from the HEC-RAS model, looking downstream. The gray dashed line represents the existing riverbed; the black line represents the limit of sediment removal if the dam is removed. Various flow regimes are represented as indicated in the legend.

FIGURE 5-3
Cross Section of Charles River Upstream of the Watertown Dam (Looking Downstream)
Showing Low-Flow Water Elevations



5.3.1 Dam Removal Sediment Management

Based upon the bathymetry of the Charles River collected by MMI, the removal of the dam would require regrading of the channel and sediment removal starting at the dam and extending upstream of the dam. This would create a mild slope for the Charles River through the former dam site of approximately 1 percent, which is similar to the slope of the existing channel downstream of the Corporal Thompson Footbridge.

Sediment removal will likely involve active management of up to 6 feet of sediment directly behind the dam in order to connect the channel upstream of the dam to the channel downstream. The 6-foot-deep trapezoidal channel would taper to zero feet deep approximately 100 feet upstream of the dam at the limits shown above. The channel would be approximately 200 feet wide at the top, with a 50-foot low-flow channel at the bottom. These are preliminary estimates and would be verified should more advanced dam removal plans be pursued.

Figure 5-4 below presents the limits of channel and sediment excavation necessary to create a channel through the site of the Watertown Dam if it was removed. The blue shaded area represents the limits of anticipated channel reconstruction, and the red line is the existing Watertown Dam. If the dam is removed, it is recommended that an estimated 1,700 CY of sediment in this area should be removed and disposed of off-site and a channel be reconstructed through this segment with armored banks and vegetation planted on exposed areas to ensure stability (**Recommendation No. SM-1**).

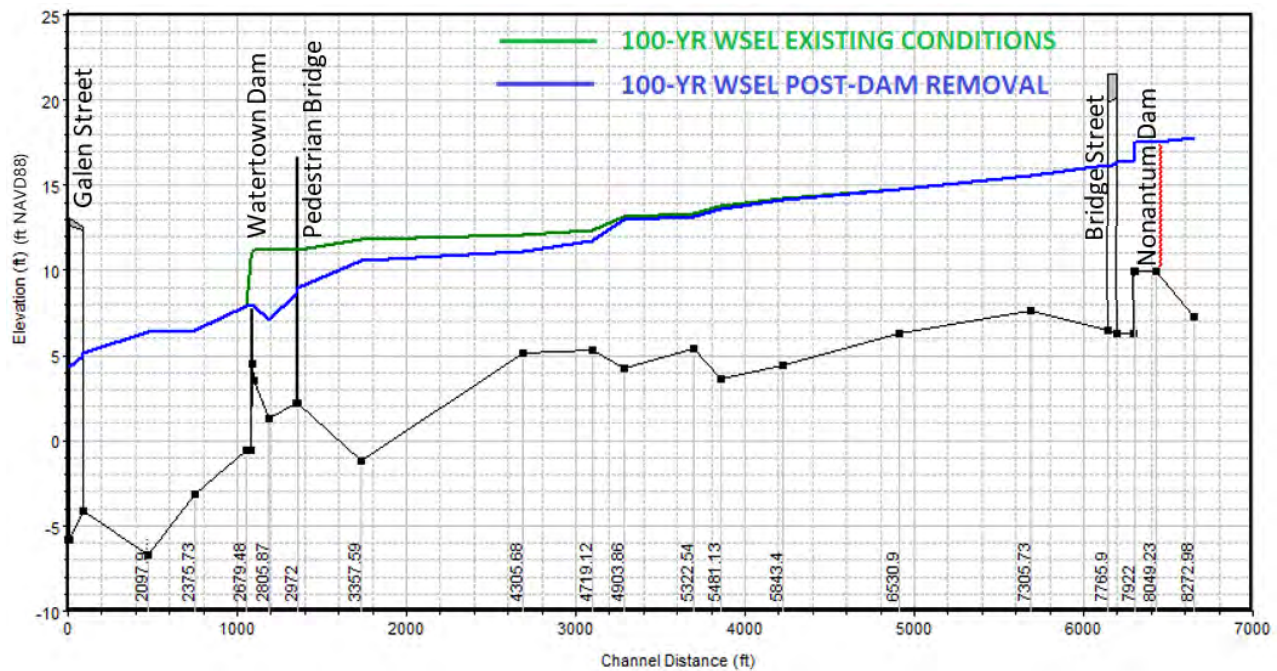
FIGURE 5-4
Aerial View of the Watertown Dam Removal and Sediment Removal Extents



5.3.2 Flood Assessment

Figure 5-5 presents a profile of the Charles River comparing the 100-year water surface elevation between existing conditions and post-dam-removal conditions. The green line indicates the existing conditions 100-year floodplain elevation (with 30 percent increase to account for climate change) at various locations along the river. The blue line represents the anticipated changes to the floodplain elevation if the Watertown Dam were removed. The limit of influence of the Watertown Dam on the flood flow water elevations in the Charles River appears to be approximately one-half mile upriver of the Watertown Dam.

FIGURE 5-5
Profile of the Charles River Showing 100-year + 30% Water Surface Elevations
Existing Conditions vs. Post-Dam-Removal Conditions



As is illustrated in Figure 5-5, the model predicts that the 100-year floodplain elevation will drop approximately 3 feet in the vicinity of the dam site, 2 feet in the vicinity of the Corporal Thompson Footbridge, and 1 foot upstream of the pedestrian bridge for a distance of approximately a half mile, or halfway between the Watertown Dam and Bridge Street (Station 4903 as shown in Figure 5-5). This is the limit of impact of water surface elevations, as locations farther upstream of this point are not expected to see any reduction in floodplain elevations or changes in hydraulics. The change in elevation correlates with a commensurate albeit modest change in the extents of the 100-year floodplain.

Figure 5-6 presents the limits of the 100-year floodplain (with 30 percent increase to account for climate change) as modeled by the HEC-RAS model. The red boundary represents the existing conditions floodplain limits while the yellow line and blue shaded area represent the post-dam removal limits of the floodplain. While flooding is expected to be reduced marginally, no buildings or infrastructure that currently flood are anticipated to be removed from the floodplain as a result of the dam removal.

FIGURE 5-6
Existing Conditions 100-Year +30% Floodplain Extents vs. Post-dam Removal



5.3.3 Channel Stability

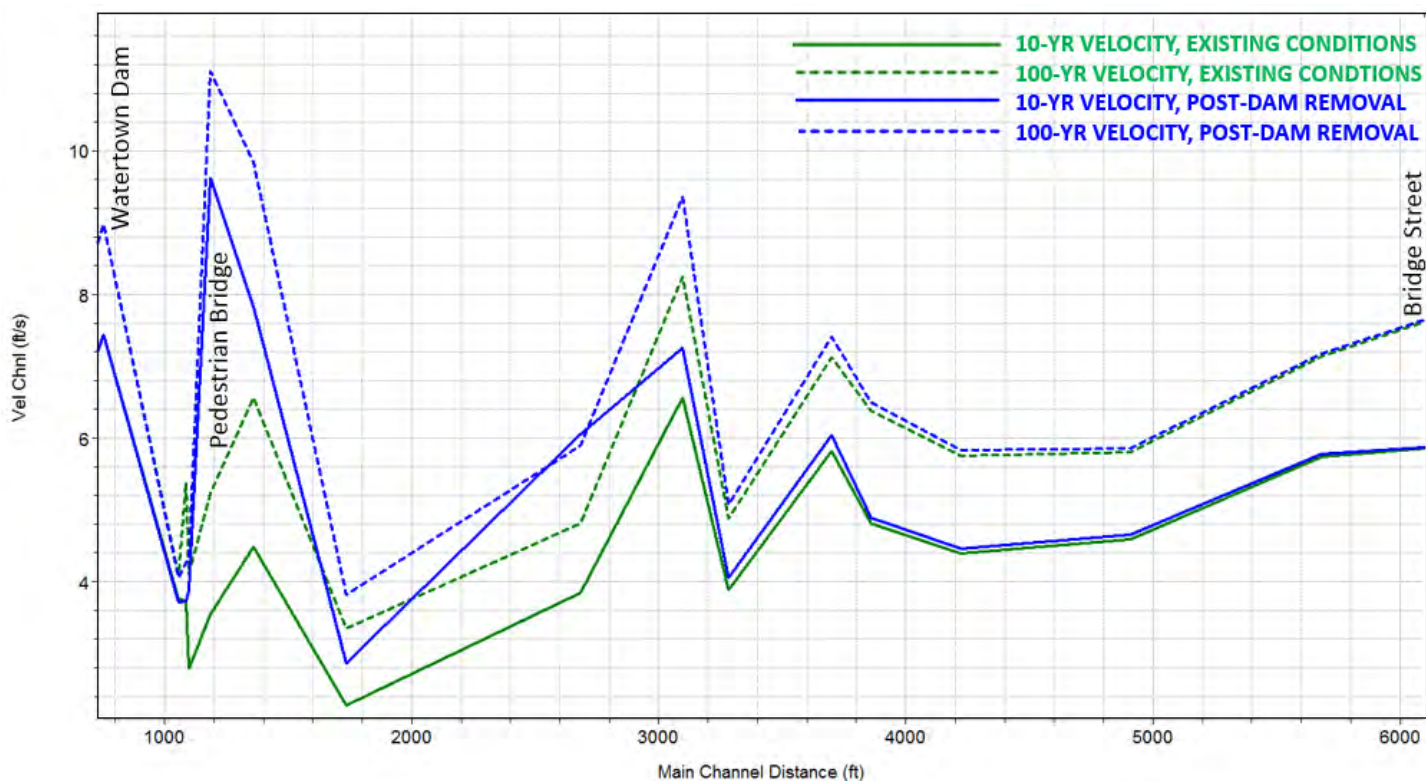
Many dam removals require the construction of a new channel upstream of the former dam to account for the vertical change in bed elevation held in place by that dam. In some cases, the vertical drop was formed by naturally occurring bedrock or other grade controls before the dam was constructed. Many dams are sited on natural grade controls to provide a solid foundation and to take advantage of the additional head available for energy-producing dams. In other cases, the drop in bed elevation is caused by the accumulation of sediment behind the dam. The latter situation requires the removal of sediment to allow flow through the former dam location. The placement of bed and bank armoring in the softer sediments to remain is often required to protect against elevated velocities if the historical bed and banks of the river are not found.

The Watertown Dam has very little coarse-grained sediment located directly behind the dam's spillway. Sediment has settled and accumulated within the impoundment, but it has done so sporadically throughout the impoundment in the eddy pools and deeper portions of meander bends rather than accumulating behind the spillway itself. A wedge of sediment has settled directly upriver of the dam, and it is expected that a channel will be constructed through this wedge (as shown in Figure 6-1). It is likely that the edges of excavation of this sediment will need to be stabilized to resist erosion unless the historical banks of the Charles River are discovered

and utilized. Because of the historical manipulation of this entire river reach, it is possible that the natural banks are not present behind the dam, and new banks will have to be constructed.

Velocity and shear stress within the project area were evaluated under the dam removal scenario. A comparison of the existing and proposed conditions velocities for both the 10-year and the 100-year flows is provided below in Figure 5-7. In the figure, the blue lines represent velocities in the post-dam-removal condition, and the green lines represent velocities in the current condition. The dashed lines represent the 100-year design flow while the solid lines are the 10-year flow.

FIGURE 5-7
Proposed Conditions Predicted Velocities Post-Dam Removal
100-YR +30% and 10-YR +30%



Modeling results indicate that the existing channel is subject to high velocities for larger storm events, especially downstream of Watertown Dam. A summary of velocities and shear stresses for various flows under existing conditions is provided in Table 5-2.

TABLE 5-2
Existing Conditions Predicted Flood Velocities and Shear Stress

	Station	Channel Velocity (ft/sec)			Shear Stress (lb/sq ft)			
		Bankfull	10-Year +30%	100-Year +30%	Bankfull	10-Year +30%	100-Year +30%	
UPSTREAM	8272.98	3.30	4.46	6.01	0.16	0.27	0.46	
	8049.23	3.54	4.65	6.15	0.20	0.31	0.51	
	7922	Nonantum Dam						
	7821.89	4.78	6.19	8.11	0.34	0.53	0.83	
	7795	Bridge Street Bridge						
	7765.9	4.55	5.87	7.67	0.32	0.48	0.76	
	7305.73	4.71	5.74	7.13	0.36	0.48	0.68	
	6530.9	3.74	4.59	5.81	0.22	0.31	0.45	
	5843.4	3.35	4.39	5.76	0.16	0.26	0.42	
	5481.13	3.52	4.81	6.37	0.18	0.32	0.52	
	5322.54	4.78	5.82	7.12	0.40	0.54	0.72	
	4903.86	2.98	3.89	4.87	0.13	0.21	0.31	
	4719.12	5.03	6.56	8.24	0.42	0.66	0.96	
	4305.68	3.04	3.85	4.81	0.16	0.24	0.34	
	3357.59	1.52	2.28	3.34	0.03	0.07	0.14	
	2982.99	3.03	4.48	6.57	0.14	0.28	0.58	
	DOWNSTREAM	2972	Corporal Thompson Footbridge					
		2805.87	2.36	3.54	5.23	0.08	0.17	0.36
2719.73		1.87	2.79	4.10	0.05	0.11	0.22	
2709.46		2.58	3.74	5.39	0.11	0.21	0.42	
2708		Watertown Dam						
2679.48		3.26	3.75	4.09	0.30	0.36	0.37	
2375.73		5.34	7.44	8.98	0.70	1.29	1.69	
2097.98		3.08	4.56	5.95	0.20	0.43	0.68	
1714.56		4.27	6.80	9.12	0.42	1.04	1.74	
1670		Galen Street Bridge						
1621.86		4.24	7.15	10.91	0.42	1.19	2.68	

ft/sec = feet per second

lb/sq ft = pounds per square foot

A summary of velocities and shear stresses for various flows under post-dam-removal conditions is provided in Table 5-3.

TABLE 5-3
Proposed Conditions Predicted Velocities and Shear Stress Post-dam Removal

	Station	Channel Velocity (ft/sec)			Shear Stress (lb/sq ft)		
		Bankfull	10-Year +30%	100-Year +30%	Bankfull	10-Year +30%	100-Year +30%
UPSTREAM	8272.98	3.30	4.46	6.01	0.16	0.27	0.46
	8049.23	3.54	4.65	6.15	0.20	0.31	0.51
	7922	Nonantum Dam					
	7821.89	4.78	6.21	8.13	0.35	0.53	0.84
	7795	Bridge Street Bridge					
	7765.9	4.56	5.88	7.69	0.32	0.49	0.76
	7305.73	4.73	5.78	7.18	0.36	0.49	0.69
	6530.9	3.76	4.65	5.86	0.23	0.32	0.46
	5843.4	3.37	4.46	5.83	0.17	0.27	0.44
	5481.13	3.54	4.89	6.49	0.18	0.33	0.54
	5322.54	4.87	6.04	7.41	0.42	0.58	0.79
	4903.86	3.03	4.05	5.07	0.14	0.23	0.34
	4719.12	5.19	7.25	9.36	0.45	0.83	1.29
	4305.68	7.33	6.05	5.89	1.15	0.68	0.54
	3357.59	2.13	2.86	3.82	0.07	0.12	0.20
	2982.99	6.48	7.83	9.84	0.78	1.04	1.50
	2972	Corporal Thompson Footbridge					
	2805.87	8.33	9.61	11.11	1.37	1.66	2.01
DOWNSTREAM	2719.73	3.27	3.87	4.30	0.18	0.23	0.25
	2709.46	3.04	3.73	4.26	0.15	0.21	0.24
	2708	Watertown Dam					
	2679.48	3.24	3.71	4.06	0.32	0.39	0.42
	2375.73	5.34	7.44	8.98	0.70	1.29	1.69
	2097.98	3.08	4.56	5.96	0.20	0.43	0.68
	1714.56	4.27	6.80	9.12	0.42	1.04	1.74
	1670	Galen Street Bridge					
	1621.86	4.24	7.15	10.91	0.42	1.19	2.68

ft/sec = feet per second

lb/sq ft = pounds per square foot

A summary of the changes to velocities and shear stresses for various flows that can be expected under post-dam-removal conditions is provided in Table 5-4.

TABLE 5-4
Differences Between Predicted Velocities and Shear Stress Post-dam Removal

	Station	Change in Channel Velocity (ft/sec)			Change in Shear Stress (lb/sq ft)		
		Bankfull	10-Year +30%	100-Year +30%	Bankfull	10-Year +30%	100-Year +30%
UPSTREAM	8272.98	--	--	--	--	--	--
	8049.23	--	--	--	--	--	--
	7922	Nonantum Dam					
	7821.89	--	+0.02	+0.02	+0.01	--	+0.01
	7795	Bridge Street Bridge					
	7765.9	+0.01	+0.01	+0.02	--	+0.01	--
	7305.73	+0.02	+0.04	+0.05	--	+0.01	+0.01
	6530.9	+0.02	+0.06	+0.05	+0.01	+0.01	+0.01
	5843.4	+0.02	+0.07	+0.07	+0.01	+0.01	+0.02
	5481.13	+0.02	+0.08	+0.12	--	+0.01	+0.02
	5322.54	+0.09	+0.22	+0.29	+0.02	+0.04	+0.07
	4903.86	+0.05	+0.16	+0.20	+0.01	+0.02	+0.03
	4719.12	+0.16	+0.69	+1.12	+0.03	+0.17	+0.33
	4305.68	+4.29	+2.20	+1.08	+0.99	+0.44	+0.20
	3357.59	+0.61	+0.58	+0.48	+0.04	+0.05	+0.06
	2982.99	+3.45	+3.35	+3.27	+0.64	+0.76	+0.92
	2972	Corporal Thompson Footbridge					
	2805.87	+5.97	+6.07	+5.88	+1.29	+1.49	+1.65
DOWNSTREAM	2719.73	+1.40	+1.08	+0.20	+0.13	+0.12	+0.03
	2709.46	+0.46	-0.01	-1.13	+0.04	--	-0.18
	2708	Watertown Dam					
	2679.48	-0.02	-0.04	-0.03	+0.02	+0.03	+0.05
	2375.73	--	--	--	--	--	--
	2097.98	--	--	+0.01	--	--	--
	1714.56	--	--	--	--	--	--
	1670	Galen Street Bridge					
	1621.86	--	--	--	--	--	--

ft/sec = feet per second

lb/sq ft = pounds per square foot

The post-dam removal modeling predicts that water velocities in the vicinity of the Watertown Dam will not be significantly altered following the dam removal, with average channel velocities predicted to be approximately 4 to 5 ft/sec. However, velocity and shear stress are predicted to increase in the vicinity of the Corporal Thompson Footbridge. This is typically the case when removing a dam that impounds water, since the removal of the impoundment allows water to flow freely through the formerly impounded area, and the energy-dissipating effects of the impoundment are lost. The modeling predicts an increase from 6 ft/sec under existing conditions to up to 11 ft/sec under the 100-year event. The possible effects of this increase in velocity are discussed in Section 6.3 of this report.

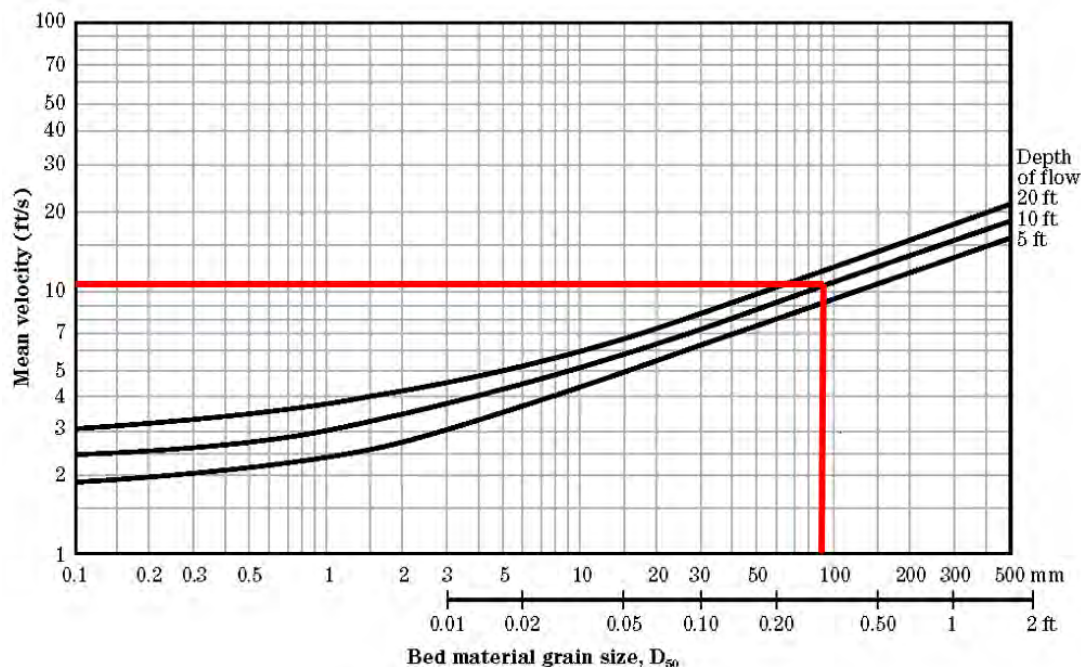
Erosion occurs when the hydraulic forces in the flow exceed the resisting forces of the channel boundary (Fischenich, USACE) or the proposed armoring. Permissible shear stress is defined as the maximum amount of shear sustainable by a certain material or armoring that will not cause particle movement or erosion. Table 5-5 is a summary of typical armoring types and permissible shear stresses as well as roughly corresponding velocities per the USACE Fischenich report. These values are useful in evaluating the stability of channel banks given estimated velocities and known bank material.

TABLE 5-5
Substrate Types and Permissible Velocities (Fischenich, 2001)

Substrate Type	Substrate Size	Permissible Shear Stress (lb/sq ft)	Permissible Velocity (ft/sec)
Bare Soil/Alluvium	-	0 - 2	0 – 0.25
Vegetation (Grasses, Shrubs, Trees)	-	1 - 4	0.1 – 4
Bioengineered Banks (Willows/Live Stakes)	-	2 – 8	0.25 - 8
Gravel/Cobble	2-in.	0.67	3-6
	6-in.	2.0	4-7.5
	12-in.	4.0	5.5-12
Riprap	6-in. d ₅₀	2.5	5-10
	9-in. d ₅₀	3.8	7-11
	12-in d ₅₀	5.1	10-13
	18-in d ₅₀	7.6	12-16
	24-in d ₅₀	10.1	14-18

The substrate downstream of the dam in the project area is characterized by coarse gravel and cobbles. Based upon the pebble counts described in Section 3.2, the D50 of the bed material was 96 millimeters (mm) (4 inches). Figure 5-8 presents a graph relating channel stability and flow velocity.

FIGURE 5-8
Permissible Velocity vs. Material Grain Size (D_{50}) – USACE, 1994

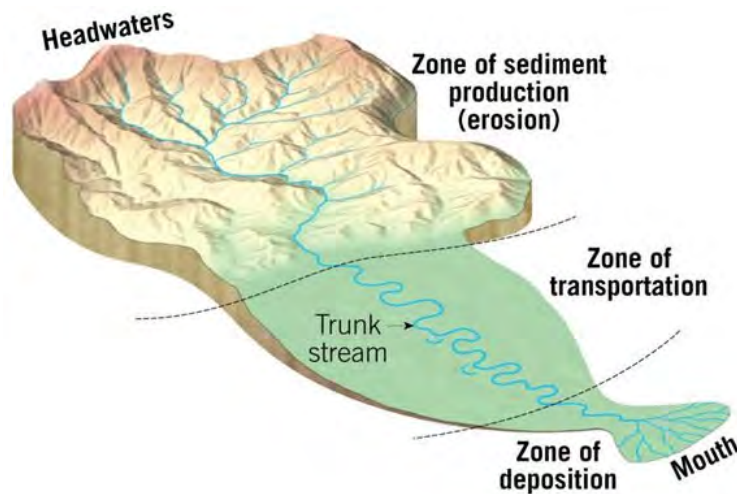


The exposed bank material of the Charles River after the removal of the dam will not be as coarse as the channel bed. Instead, the exposed banks are expected to be fine-grained silts and sands, which will be much more susceptible to erosion until they are vegetated and stable. In most reaches of the channel, post-dam-removal velocities are expected to be mild and well within the ability of fully vegetated banks to mitigate any potential erosion risk; however, in the vicinity of the Corporal Thompson Footbridge, the water surface elevation will be lowered by approximately 5 feet (under normal flow conditions). Localized high-velocity zones may develop that could erode material out from beneath the abutments at elevations below those that were armored during the construction of the bridge. This could be mitigated by conducting a detailed scour analysis of the bridge to determine the need for additional armoring.

5.3.4 Sediment Transport Assessment

The transportation of sediment, along with water, is a natural process of any river system. In the overall hydrologic cycle, water is transported from the inland-most regions of a land mass. This cycle begins as rainfall in the steeper headwaters of small tributaries, where sediment is typically produced in high-energy, erosive streams. The middle region of a watercourse is typically a transport reach where excessive aggradation or degradation is uncommon, and rivers flow with a balanced load of sediment and water in a dynamic equilibrium. At the mouth of a river as it enters the ocean, the low slope and slow-moving flows have less energy to carry the sediment, and these reaches become deposition zones. Figure 5-9 below presents the sediment transport zones of a typical watercourse.

FIGURE 5-9
Typical Sediment Transport Zones (2015, Mangan)



Cite: 2015, Earth Science, Fourteenth Edition, Running Water and Ground Water, Jennifer Mangan, James Madison University, Harrisonburg, VA

Dams interfere with the natural sediment transport process. They trap and detain sediment, creating a localized depositional zone and starving the downstream river reaches of sediment they used to receive. This can disrupt the natural equilibrium of the system and cause the river system to change in response through channel bed or bank instability or planform adjustment.

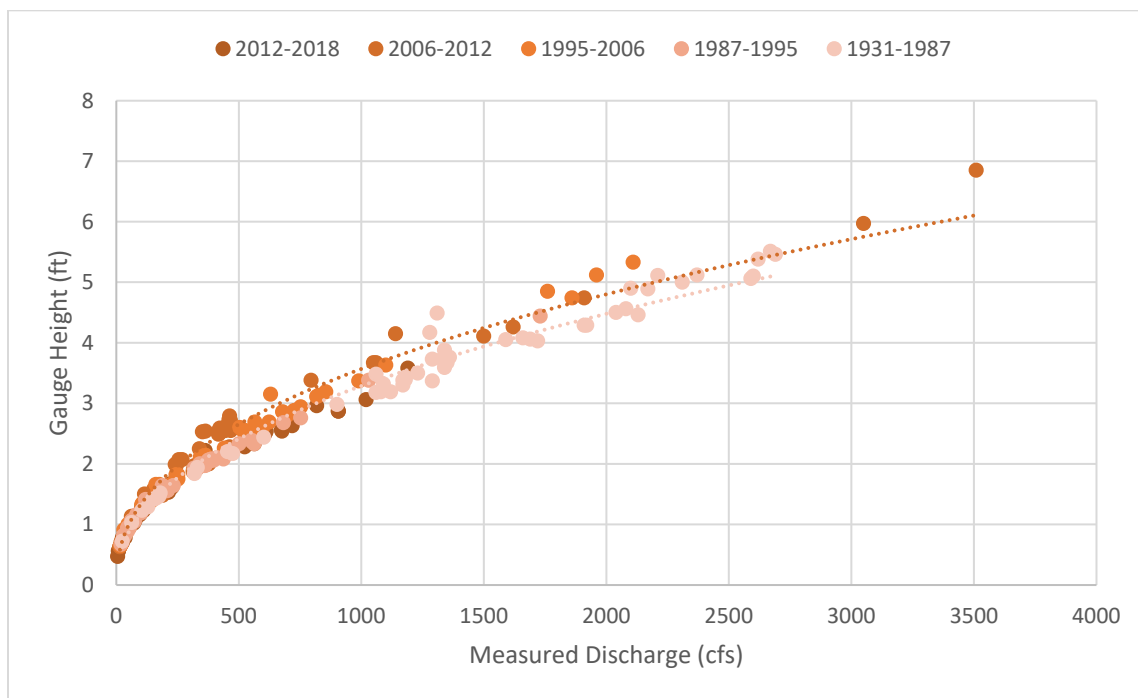
The Watertown Dam on the Charles River is approximately 8 miles upriver of Boston Harbor and only 5 miles upriver of the historic Back Bay. The Back Bay area was open tidal water before it was filled in to meet the needs of a rapidly expanding city. The Charles River downriver of the Watertown Dam (referred to as the Charles River Basin) is influenced by daily tides (as controlled by the New Charles River Dam, see Section 5.1). At higher tide elevations, flow in the Charles River Basin can stagnate or reverse upriver. If the transportation of sediment along a river corridor is compared to a conveyor belt, this tidally influenced basin is the end of that belt where sediment drops and settles.

In 2016, the Commonwealth of Massachusetts provided \$800,000 of funding to dredge a large sand bar that formed just downriver of the Watertown Yacht Club and the Highway 20 bridge (WGBH, 2016) that consisted of road sand and silts and chemical constituents consistent with urban runoff (Boston.com, 2011). Being this close to the mouth of the river, Watertown Dam is solidly located in the depositional zone of the Charles River. In order to confirm this, data from the Waltham USGS gauge was assessed to identify changes to the geometry of the river over time.

Figure 5-10 presents approximately 250 measurements performed by the USGS between 1931 and 2018 at the Charles River gauge in Waltham, Massachusetts. The measurements included the gauge height reading, as well as a measurement of discharge in the river. These measurements are performed periodically to establish the gauge rating curve, relating height and discharge. Changes to the rating curve over time are typically a result of changing geometry of the river,

such as from sediment aggradation or degradation. The darker trend line represents the more modern measurements while the lighter trend line represents older measurements.

FIGURE 5-10
Discharge vs. Height at USGS Gauge No. 01104500 Waltham, Massachusetts
Between 1931 and 2018



The Waltham gauge is located 2.7 miles upriver of the Watertown Dam and does seem to imply that sedimentation in the Charles River is occurring slowly. The trend lines appear to show that discharges of a similar magnitude were associated with slightly higher gauge heights, indicating that the bed of the river may have undergone minor aggradation over time. This implies that there likely is sediment being transported through the system and being deposited in this reach of the Charles River. The downstream-most third of the Charles River has a high level of urban and suburban development in the watershed, which limits how much sediment may be naturally entering the system and likely explains the relatively minor aggradation that seems to be occurring.

Sediment accumulation upriver of the Watertown Dam was found to be low as well due to both the low transport rates described above as well as the small impoundment and run-of-river configuration of the dam. The accumulated sediment was generally characterized as fine-grained sands and silts, as described in Section 3.6, which is consistent with the low energy and low gradient of the system through the subject reach.

The area directly upriver of the Watertown Dam appears to have reached its capacity to hold sediment, with no history of being dredged since its construction. With little to no more sediment storage available, the Charles River is allowed to continue transporting sediment downriver as if no dam were present.

The Watertown Dam is situated at the historical head of tide, which is where the free-flowing waters of the Charles River reach the fluctuating tides, and the areas downstream of the dam are a natural sediment deposit area. Also, within that area of the Charles River Basin, localized reaches of river that are overly wide will flow with even lower velocities than the narrower portions, encouraging a higher rate of sediment aggradation to occur. While sedimentation downriver of the dam is known to occur under current conditions, the condition is not expected to be worsened by the removal of the dam.

5.3.5 Anadromous Fish Passage Assessment

Anadromous fish are any type of fish that are born in fresh water, live in the sea, and return to fresh water to spawn. The oceans of New England are teeming with such fish species, and they all utilize the inland waterways of Massachusetts as their primary and sometimes only spawning habitat. The Charles River is one such habitat, offering hundreds of acres of watershed and tens of miles of riverine spawning grounds.

Over time, manipulation of the river has caused these prime spawning habitats to be difficult or impossible for these anadromous fishes to access. Obstructions in rivers and streams such as dams and culverts can impede the ability of fish to migrate upstream and prevent them from reaching suitable spawning habitat. Other barriers to fish migration and successful spawning can occur in a variety of ways, such as when water velocity, turbulence, and depth become impassible to the species that are native to the watercourse. Once the fish arrive at their spawning habitat, factors such as poor water quality, pollution, and temperature can have negative impacts on the success of a fish spawn season and affect the overall population health of the species.

Such reduction in the available habitat has a direct correlation to the health and size of fish populations. Many of the particular species being considered here serve as a staple in the entire marine food chain, and reductions in their populations have ripple effects throughout the entire marine environment.

In the past several decades, advocacy groups such as the CRWA and other nonprofit organizations have campaigned successfully to change harmful environmental policies allowing excessive and irresponsible development and manipulation of the Charles River, which has resulted in a substantial improvement in water quality in the Charles River. As a result, the Charles River anadromous fish populations have begun to return after centuries of human manipulation and pollution of the river. However, physical barriers such as dams still remain.

The Watertown Dam is a major impediment to several migratory fish species, but specific species of interest whose anadromous migrations from the sea are particularly impacted by the dam are the American shad, alewife, and blueback herring. Table 5-6 summarizes some relevant characteristics of these target species.

TABLE 5-6
Anadromous Fish Characteristics for Target Species at the Charles River

Common Name	American Shad	Alewife	Blueback Herring
<i>(Scientific Name)</i>	<i>(Alosa sapidissima)</i>	<i>(Alosa pseudoharengus)</i>	<i>(Alosa aestivalis)</i>
Life Stage of Concern	adult	adult	adult
Average Size (length in inches)	12 - 20	9 - 12	8 - 12
Upstream Migration ¹	April 1 - July 15	April 1 - May 15	April 1 - June 15
Minimum Water Depth (inches)	6 - 9	> 6	> 6
Swimming Speeds (ft/sec)			
Cruising Speed	2.8	2.8	2.8
Sustained Speed	7.6	4.8	4.8
Burst Speed	14.8	6.8	6.8
Swimming Characteristics	solitary	schooling	schooling
Notes: ¹ Dates are typical and may vary annually.			
Sources: 1. C. Katapodis. 1992. Introduction to Fishway Design, working document 2. EA Engineering, Science, and Technology. 1991. James River Instream Flow Study: Fish Passage Evaluations. Unpublished technical report 3. G. Kissil. 1974. Spawning of Anadromous Alewives, <i>Alosa pseudoharengus</i> , in Bride Lake, CT. TAFS 103: 312 - 317 4. K. Loftus. 1982. Proc. of the 1980 North American Eel Conference. Ontario Fish Tech. Report No. 4 5. J. Holsapple and L. Foster. 1975. Reproduction of White Perch in the Lower Hudson River. NY Fish and Game Journal 22: 122 - 127 6. W. Whitworth. 1996. Freshwater Fishes of Connecticut, Second Edition 7. Species Profiles: American Eel. USFWS Biol. Report 82 (11.74). August 1987 8. Fish Passageways and Diversion Structures; U.S. Fish & Wildlife Service 9. K. Reback and P. Brady, Massachusetts Department of Marine Fisheries, Pers. Comm., 2002			

Although there are dams both downstream and upstream of Watertown Dam, those dams have effective fish passages that minimize the disruptions to fish migration. According to a 2011 report by Stantec Consulting Services, the fish ladder at Watertown Dam is structurally and hydraulically deficient, with poor utilization and high mortality of the fish species described above.

The hydraulic characteristics of the river were predicted using the HEC-RAS hydraulic model described in the preceding sections in order to assess whether the removal of the Watertown Dam will allow for anadromous fish passage upstream. According to the data provided in Table 5-7, the period of importance for the target species when the primary upstream migration occurs is between April and July. Flow duration statistics were obtained from the USGS gauge (see Section 4.3). 85th percentile exceedance flow for the lowest flow month of July and the 15th percentile exceedance flow of the highest month of April were used as a dataset, which brackets the most common flow conditions and therefore reflects the variety of conditions that migrating fish are most likely to encounter. Table 5-7 presents the flows used in the analysis (green highlights represent the high and low boundaries used to represent most flow conditions).

TABLE 5-7
Summary of Monthly Exceedance Flows
During Period of Fish Passage

	Apr	May	Jun	Jul
85% Exceedance Flow (cfs)	335	204	99	<u>49</u>
50% Exceedance Flow (cfs)	604	380	203	98
15% Exceedance Flow (cfs)	<u>1,077</u>	616	438	248

The selected flows were input to the post-dam-removal hydraulic model. The results from this model were then used to assess the minimum depth and maximum velocity requirements of each of the target species and whether any segments of the river channel would be problematic for the fish with either water depths that were too shallow or velocities that were too high for successful migrations to occur. Figure 5-11 presents the results of this analysis.

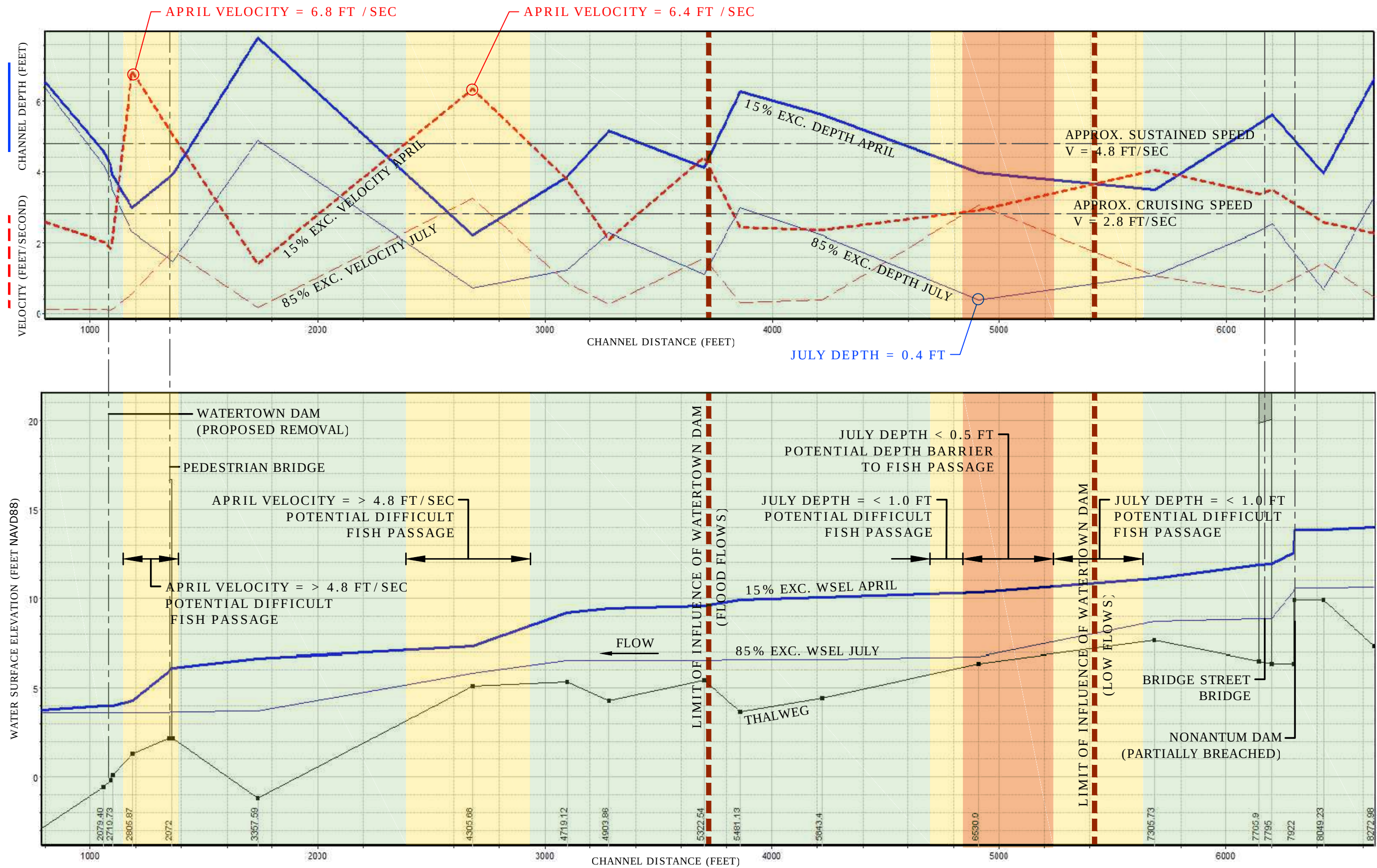
According to the modeling, two reaches may present elevated velocities greater than the sustained swimming speed of the target species. Both segments contain average channel velocities between 6.4 and 6.8 ft/sec, which is near the peak burst speed of both the alewife and the blueback herring. The first segment is located between the former dam and the Corporal Thompson Footbridge, and the second segment is 1,500 feet upstream of the dam where the river channel slope increases, and a natural riffle is expected to form if the Watertown Dam is removed. As has been done on several New England dam removal projects, both of these areas could be roughened with large stones to dissipate energy and slow velocities and to give fish resting areas in eddy pools behind the stone structures (**Recommendation No. FP-1**).

A third potential area where fish passage may be difficult is approximately 1,200 feet downstream of the Bridge Street bridge, where the water depths in very low flows may reach less than 6 inches and may prevent fish from passing through the area. Increased water depths through common treatment such as channel roughening, the installation of a fish-passable boulder riffle with fish-passable voids for low flows, or excavation of a low-flow channel in the deepest portion of the channel to concentrate flows during dry periods and provide sufficient depth for fish passage to occur (**Recommendation No. FP-2**).

In addition to fish passage being improved if the dam is removed, returning free-flowing conditions to the Charles River will increase oxygenation of the water and reduce the amount of time water is impounded and heated by the sun, thereby reducing water temperatures and further improving habitat through the reach.

C:\Users\JENMAN\APPDATA\LOCAL\TEMP\ACPIB\1888\FISH PASSAGE.DWG Layout 1: FISH PASSAGE

Plotted By: JENMAN On this date: Fri, 19 Feb 2016 11:44:30am



CHARLES RIVER - PROFILE VIEW
SCALE: N.T.S.

FISH PASSAGE LEGEND: (BLUEBACK HERRING, ALEWIFE, AMERICAN SHAD)

- | | | |
|---------------------------------|----------------------------------|-----------------------------------|
| HIGH POTENTIAL FOR FISH PASSAGE | POTENTIAL DIFFICULT FISH PASSAGE | POTENTIAL BARRIER TO FISH PASSAGE |
|---------------------------------|----------------------------------|-----------------------------------|

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REVISIONS

DAM REMOVAL FISH PASSAGE ANALYSIS

**WATERTOWN DAM
DAM REMOVAL FEASIBILITY STUDY**
CHARLES RIVER
WATERTOWN, MASSACHUSETTS

JCM DESIGNED	JCS DRAWN	WAG CHECKED
AS NOTED		
DECEMBER 2018		
DATE		
1967-27		
PROJECT NO.		

FIG. 5-11

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5.3.6 Bank Exposure

If the Watertown Dam is breached and the impoundment is drained, some land that was previously river bottom will be exposed as newly created floodplain due to the lower water level, exposing the sediments. Based on the preceding analysis, the limit of influence of the Watertown Dam on the flood flow water elevations in the Charles River is approximately one-half mile upriver. The extent of influence is greater during low flows, which extends to a point approximately 700 feet downriver of the Bridge Street bridge.

Figures 5-12, 5-13, and 5-14 compare the estimated edge of the river channel under existing conditions to the estimated edge of the channel if the dam were to be removed. The edge of water varies depending on the flow; therefore, the limits of current and post-dam-removal water levels were plotted for the April 15-percent exceedance flow, the June 50-percent exceedance flow, and the September 85-percent exceedance flow. Higher flow events will expose less land, and low-flow periods will expose more bank. However, in both cases, the banks under proposed conditions would be closer to those that existed before the dam was constructed.

During the April 15 percent exceedance flow (Figure 5-12), the banks would likely be exposed by an average of 10 feet within the 1,500 linear feet upstream of the dam. An exception shown on Figure 5-12 is an area near Myrtle Street where the channel extents would decrease by approximately 80 feet. However, this section of bank appears to be permanently vegetated under existing conditions and may not require sediment management. The total area of exposed banks in the project reach is approximately 2.19 acres for the April 15 percent exceedance flow.

During the June 50-percent exceedance flow (Figure 5-13), banks of the Charles River between 1,500 linear feet and 400 feet upriver of the dam are likely to be exposed by an average of approximately 15 feet. The amount of bank exposure will vary based upon the steepness of the bank at that location. The 400 linear feet directly upriver of the dam is where the water surface elevation is likely to drop the most if the dam is removed, and the most sediment is present. In this area, the low-flow channel is likely to narrow from a 150-foot-wide channel to an average of 80 feet wide, exposing a total of 70 feet of new bank between both the northern and southern edges of the river. The total area of exposed banks in the project reach is approximately 1.72 acres for the June 50-percent exceedance flow.

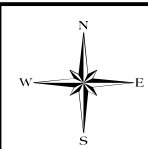
The September 85 percent exceedance flow (Figure 5-14) was the lowest flow used to estimate bank exposure. The level of bank exposure and the width of the channel under proposed conditions vary greatly depending on the channel geometry. In the 1,500 feet upstream of the dam, the September 85-percent exceedance flow is approximately 130 feet wide. In a post-dam-removal scenario, the channel width would range between 20 and 100 feet.

In order to more definitively predict what the bank extents may look like in a post-dam-removal scenario, it is recommended that a planned drawdown of the impoundment be pursued. Removal of the weir boards from the low-level outlet during a low-flow period would allow photos to be taken from various vantage points along the shore, from various infrastructure and bridges, and from the air to document the exact extents of where new banks of the Charles River can be expected to form (**Recommendation BE-1**).



Legend

- 15% Exceedance Apr Existing Conditions
- 15% Exceedance Apr Proposed Conditions



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WATERTOWN, MA

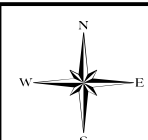
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SCALE	1"=250'	
DATE	DEC 31, 2018	
PROJECT NUMBER	2688-44	

FIG. 5-12
SHEET NAME



Legend

- 50% Exceedance Jun Existing Conditions
- 50% Exceedance Jun Proposed Conditions



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---	JCS	JCM
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1"=250'		
SCALE		
DEC 31, 2018		
DATE		
2688-44		
PROJECT NUMBER		

FIG. 5-13

SHEET NAME

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Based upon the results of preliminary sediment transport assessment described above in Section 5.3.4, it is likely that any sediment exposed by a lowering of the impoundment may need to be removed and disposed of off-site prior to revegetation of the banks. Therefore, it is recommended that additional chemical testing be performed on any sediments predicted to be exposed and that sediment removal quantities be calculated in greater detail so that a formal sediment management plan can be developed **(Recommendations No. SE-2 and BE-2)**.

Regardless of how the exposed sediments are managed, areas of natural channel bed substrate that are not chemically impacted will also be exposed if water levels were to be reduced. While many areas in dam impoundments can be allowed to naturally revegetate based upon the seed stock available in the sediments, it is possible that the seedstock available here would not allow for full vegetative stabilization of the exposed areas quickly enough to outcompete other invasive species such as phragmites, knotweed, or multiflora rose. It is recommended that these exposed areas be topsoiled, seeded with native seed, and planted with dense shrubby water-tolerant native vegetation to discourage pedestrian access and promote bank stability, increase shading on the water, and provide wildlife habitat **(Recommendation No. BE-3)**. If the dam removal project is pursued, a more comprehensive evaluation of the vegetative restoration of newly exposed bank areas should be pursued as well.

6.0 OTHER DAM REMOVAL CONSIDERATIONS

As described in the first section of this report, the goal of this feasibility study is to provide a multiparameter evaluation of the anticipated benefits as well as incidental impacts caused by the potential removal of the Watertown Dam. Hydrologic and hydraulic impacts have been assessed as described in the preceding section, but other incidental impacts such as the impact of the dam removal on the USACE Charles River flood control system, as well as lowered water surface levels upriver of the dam and their impacts on recreation in the open space areas surrounding the impoundment, the impacts to aesthetics of the former impoundment, and the probable cost for construction are discussed below.

6.1 Charles River Flood Control System

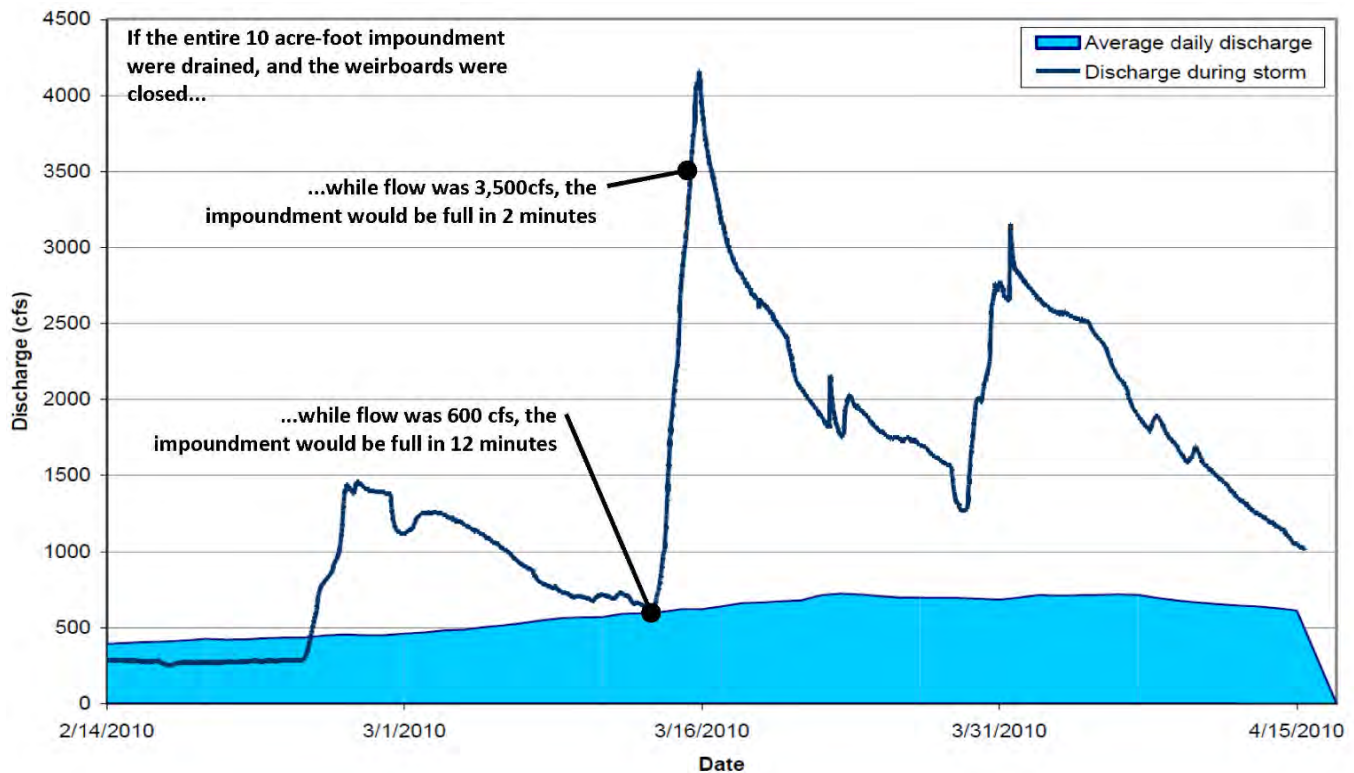
The Watertown Dam was repurposed in 1966 by the state to reduce flood impacts (CRWA, 2016a). The dam's ability to provide meaningful flood control is limited by the lack of an appreciably sized impoundment. In order to mitigate downriver flooding, the impoundment would have to be drained prior to an expected flood event and allowed to fill throughout the event, thus detaining flow and dampening the effects of a peak flow. The dam's ineffectiveness as a flood control structure would likely provide comparatively small benefits to downriver flooding when compared with the appreciable costs of continued and active management of the water levels in its impoundment.

A 10-foot-wide rectangular low-level outlet is located along the right edge (looking downriver) of the spillway. This outlet is typically shut with stop logs. If the dam were being operated in such a way as to utilize its available storage area (i.e., the impoundment was proactively drained before a storm by removing the stop logs and then replacing them as the storm began), it is estimated that the impoundment could provide up to approximately 10 acre-feet of available storage for flood control (2011, Stantec). This equates to roughly 435,600 cubic feet (CF) or 16,130 CY of available storage.

The Watertown Dam is not currently operated in a manner conducive to flood control, and no evidence was found that it has been operated in that way since it was built in 1966. The dam has historically been allowed to operate without interference or manipulation, behaving like a traditional run-of-river dam, which does not provide the benefit of increased storage during a flood. A traditional run-of-river dam will allow the same amount of flow to pass downstream as enters the impoundment from the upstream, providing no detention, but can conversely raise upriver flooding elevations as compared to pre-dam conditions, which is in fact the case with the Watertown Dam. This effect on upriver flooding is evaluated and described in further detail in Section 5.3.2.

If the Watertown Dam was operated as a flood control structure, its modest volume (10 acre-feet) of storage would fill quickly without appreciably reducing downriver flow rates. A severe flood occurred in the Charles River watershed in March 2010, where the cumulative effect of multiple rain events led to extremely high flows in the Charles River and its tributaries (CRWA, 2010). The following Figure 6-1 presents a hydrograph of that flood event as recorded by a USGS gauge on the Charles River in Waltham, Massachusetts (CRWA, 2010), approximately 2.75 miles upriver of the Watertown Dam.

FIGURE 6-1
Hydrograph of March 2010 Flood of the Charles River (CRWA, 2010)



Estimating the area beneath the hydrograph provides the total volume of runoff that flowed through the Charles River for the flood event. The most significant portion of the flood event (between March 13, 2010, and March 31, 2010) was computed, and flows below the average daily discharge of 600 cfs were disregarded. This method estimates a total of 65,200 acre-feet of flow. The storage available in the Watertown Dam impoundment (10 acre-feet) equates to 0.015 percent of the total volume of runoff. Reduction of the peak flow of 4,270 cfs (March 15, 2010) by 0.015 percent would provide a reduction in the peak flow of 0.65 cfs. Flood control structures are typically considered effective at reducing downriver flows by appreciable margins if their storage equates to approximately 10 percent of the design flood volume.

6.2 Municipal Infrastructure

In addition to bank exposure and erodibility, the reduction in water surface elevations may affect stormwater outfalls located upriver of the dam. Although the effects of the dam removal on reducing the 100-year floodplain only extend a half mile upriver of the dam, the water surface elevations during normal flows will be reduced by up to 1 foot almost all the way to Bridge Street. This implies that many of the stormwater outfalls that are currently above the water may need additional armoring. However, of greater concern are the two outfalls located upriver and very close to the Watertown Dam, outfalls ID No. 3 and ID No. 11.

Outfall ID No. 3 is a 42-inch twin concrete culvert located 15 inches below the water surface elevation at the time of inspection. The results of the hydraulic modeling indicate that the normal water surface elevation is expected to fall by approximately 3.5 feet (42 inches) at the location of this outfall. Because the outfall is currently 15 inches below water, the outfall would be exposed by 27 inches if the dam is removed. The banks are expected to recede approximately 25 feet at this location. Therefore, to prevent erosion if the dam is to be removed, it is recommended that a riprap channel outlet protection be designed/sized for the expected flows from this outfall and extended to the new edge of water **(Recommendation No. MI-1)**.

Outfall ID No. 11 was located directly upriver of the dam and is expected to undergo a 5.75-foot drop in normal water surface elevation, with newly exposed bank extending at least 40 feet. The outfall appeared to be completely silted, and joints of the pipe had separated. In its current condition, it is unlikely that this outfall is functioning as intended, but more exploration of this outfall may be necessary. If the outfall is to be repaired, then it would be recommended that a riprap channel outlet protection be designed/sized for the expected flows from this outfall and extended to the new edge of water **(Recommendation No. MI-2)**.

Based on the hydraulic modeling results discussed in Section 5, other bridges and dams surrounding the Watertown Dam such as the Bridge Street bridge, Galen Street bridge, and the Nonantum Dam were found to be outside the hydraulic influence of the dam removal and therefore will not be affected by the removal of the dam. Conditions at those locations will closely match the pre-dam conditions, and no further assessment is needed.

6.3 Department of Conservation & Recreation (DCR) Infrastructure

In 2018, a newly constructed pedestrian bridge (named the Corporal Thompson Footbridge) was installed approximately 250 feet upriver of the Watertown Dam. In a post-dam removal scenario, it is expected that water velocities upstream of the former dam site will be increased. Such elevated velocities in the Charles River during a flood may cause erosion to occur on exposed sediment and banks if they are not vegetated or otherwise protected. This erosion could compromise the abutments of the pedestrian bridge. Figure 6-2 presents a photo of the abutments under construction prior to installation of the bridge superstructure.

The design plans for the newly constructed pedestrian bridge were prepared by Gill Engineering. They indicate that the former pedestrian bridge had flat stone armoring placed to protect the abutment footings and that the armoring should be removed and replaced during construction of the new abutments but do not indicate the size, extents, or depths of placement (Gill Engineering, 2016). The photograph below shows that armoring was installed, but the extents, depths, thicknesses, and size are not clear. As presented in Table 5-3, the velocities in the vicinity of the Corporal Thompson Footbridge during a 100-year event range from 9 to 11 feet per second. Such velocities would be just at the threshold of the ability of the bed materials to withstand erosion in this area.

In a post-dam removal scenario, localized high-velocity zones may develop that could erode material out from beneath the abutments at elevations below the armoring that was installed during the construction of the bridge. This could be mitigated by conducting a detailed scour analysis of the bridge after final-design of the dam removal is complete, and determining whether

additional armoring is needed. It is therefore recommended that the existing stone armoring be surveyed and assessed for stability during a dam-removal scenario. A scour analysis should also be performed on the bridge abutments and riverbed. Stone armoring may need to be supplemented on the banks near and beneath the Corporal Thompson Footbridge to protect the footings from scour, and a grade control structure or riffle may need to be constructed beneath the Corporal Thompson Footbridge to ensure riverbed stability (**Recommendation No. DI-1**).

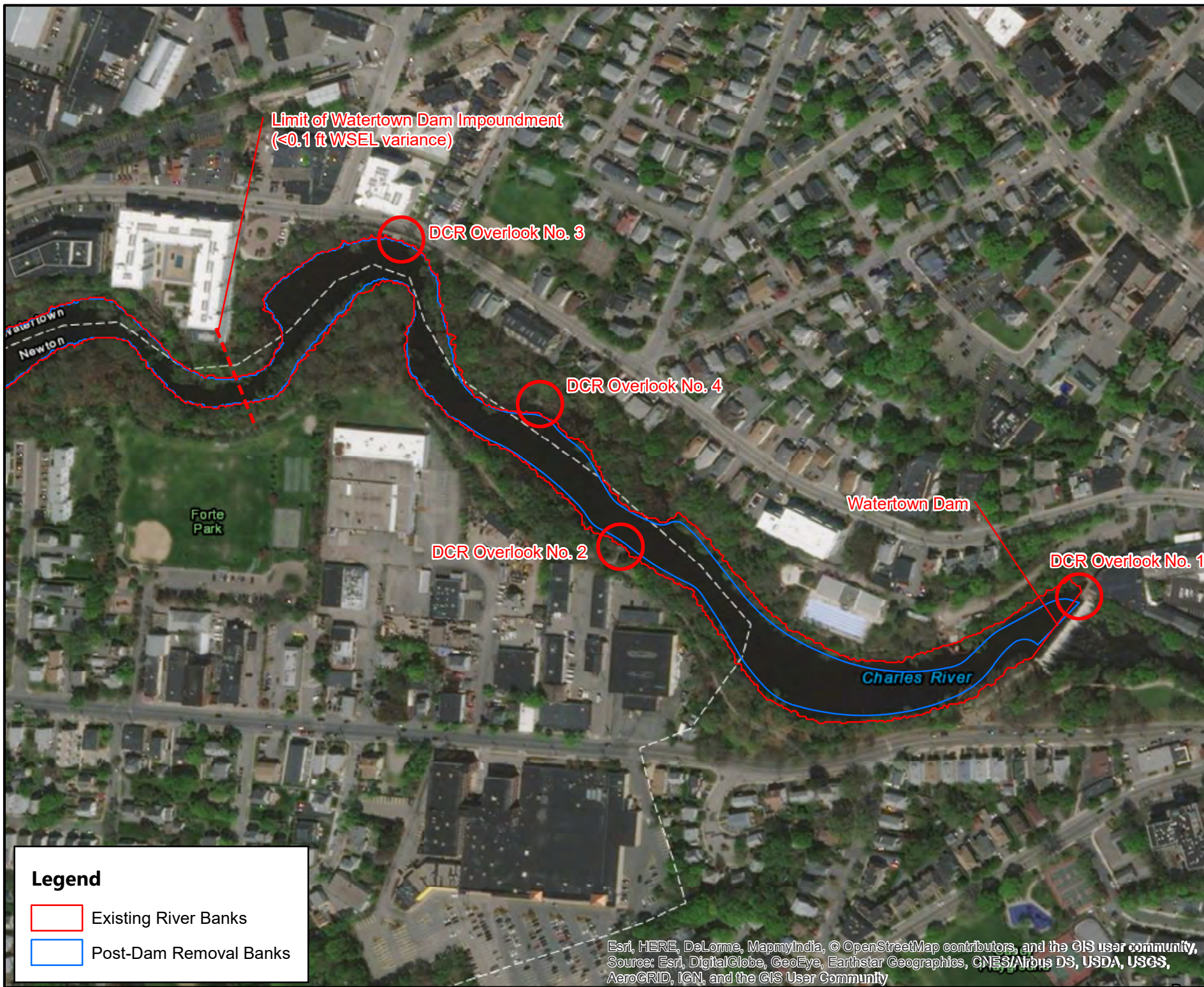
FIGURE 6-2

Photograph of Corporal Thompson Footbridge Abutments under Construction, April 26, 2018



Four timber overlooks upriver of the Watertown Dam and within the influence of the impoundment are also owned and maintained by the MADCR as part of the Charles River Greenway park system. Three of the overlooks were constructed along the impoundment and utilize raised wooden walkways that protrude into the river to provide views of the water. A fourth overlook is constructed on the eastern abutment of the Watertown Dam itself. Figure 6-3 presents a location plan of these overlooks.

The first overlook was constructed on the top of the eastern abutment and training wall of the dam itself. If the dam were to be removed, the abutment and overlook could remain. The water elevation would be lowered, but the stability and views associated with the overlook should not be affected. It would be expected that water levels during a median daily June flow would drop approximately 6.3 feet. Figure 6-4 presents a view of the overlook, looking upriver.



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DCR INFRASTRUCTURE PLAN
 WATERTOWN DAM REMOVAL FEASIBILITY STUDY
 WATERTOWN, MA

--- JCS JCM
 (unlabeled) (unlabeled)

1"=300'
 SCALE

OCTOBER 22, 2018
 DATE

2688-44
 PROJECT NUMBER

FIG. 6-3

Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community,
 Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,
 AeroGRID, IGN, and the GIS User Community

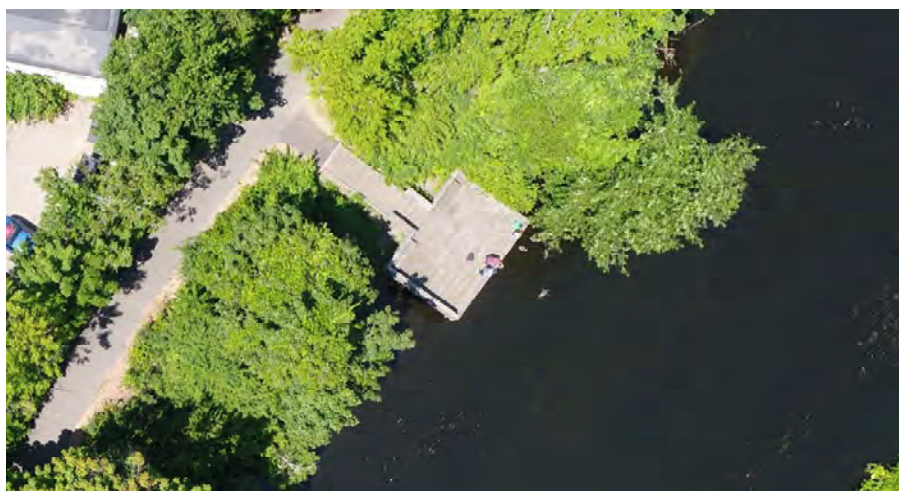
FIGURE 6-4
DCR Overlook No. 1 Near Sasaki Building at Eastern Abutment of Watertown Dam
Near 64 Pleasant Street, Watertown, Massachusetts



It is recommended that detailed survey of the four overlooks and boardwalks be performed to determine the extents of the reduced water levels and how they will impact the use of the recreational infrastructure **(Recommendation No. DI-2)**.

The second overlook is located approximately 1,200 feet upriver of the Watertown Dam on the western bank of the Charles River (Figure 6-5). It consists of a wooden platform with water currently beneath the platform. If the dam were to be removed, the water depths would be lowered by 2.5 to 3 feet in the center of the Charles River during median June flows.

FIGURE 6-5
DCR Overlook No. 2 Upriver of Watertown Dam
Near 145 California Street, Newton, Massachusetts



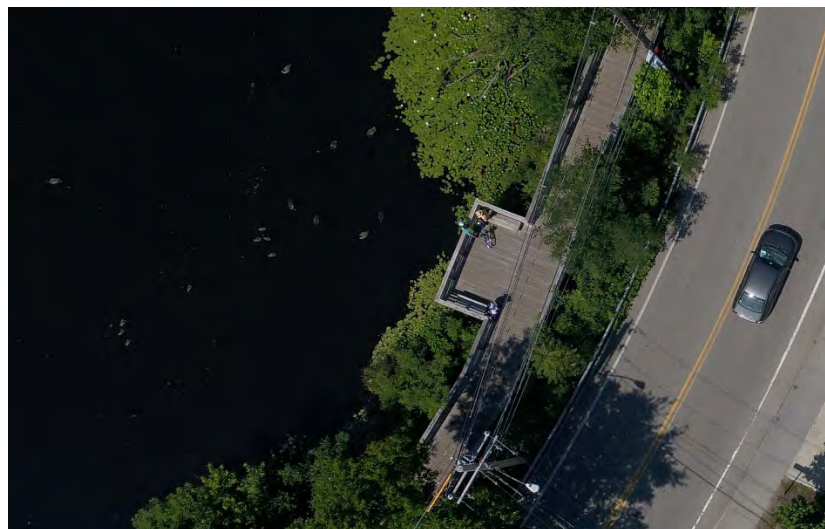
The third overlook is located approximately 1,600 feet upriver of the Watertown Dam on the eastern bank of the Charles River (Figure 6-6). It consists of a wooden platform currently set approximately 35 feet from the water's edge. If the dam were to be removed, the water depths at this location (in the center of the Charles River) would be lowered by 1.5 to 2 feet during median June flows.

FIGURE 6-6
DCR Overlook No. 3 Upriver of Watertown Dam
Near 184 Pleasant Street, Watertown, Massachusetts



The fourth overlook is located approximately 2,150 feet upriver of the Watertown Dam on the eastern bank of the Charles River (Figure 6-7). It consists of a wooden platform directly abutting the water's edge. If the dam were to be removed, the water depths at this location (in the center of the Charles River) would be lowered by 0.75 to 1 foot during median June flows.

FIGURE 6-7
DCR Overlook No. 4 Upriver of Watertown Dam
Near 219 Pleasant Street, Watertown, Massachusetts



6.4 Aesthetics and Recreation

The goals of removing the Watertown Dam include improving the visual and historic character of the Charles River and the opportunity for recreation, nature viewing, and boating along the Charles River Greenway, as discussed in Section 1.3.

The Charles River Greenway starts in downtown Boston at the Charles River Dam and Boston Museum of Science and extends upriver along the banks of the Charles to its terminus just east of Brandeis University in Waltham. The paved pathway creates a full loop with two parallel paths on each bank of the river and cross-river connections at each end for a total of 22 paved miles, connecting multiple parks, green spaces, and pedestrian bridges within the corridor.

The lowered water surface elevation upriver of the former Watertown Dam will expose larger areas of bank that were formerly under water and will reduce the overall depths of water. The widened bank areas will increase the width and diversity of the riparian buffer of the Charles River. The diversity of vegetation communities and the restoration of the naturalized flow characteristics of the river will promote and increase the diversity of aquatic and avian wildlife and create more opportunities for nature viewing within the parks.

No changes are expected to be seen downriver of the dam. An existing riffle downriver of the Watertown Dam prevents motorboats from accessing the base of the Watertown Dam under current conditions and will continue to be a barrier for boating under a dam-removal scenario. The former impounded section of the river will return to a free-flowing condition suitable for access by paddle boating but not for powered boating.

Downriver of Galen Street, a number of yacht clubs and boathouses are located on both banks of the Charles River. These boathouses support water-dependent recreation activities such as canoeing, kayaking, and rowing and are affiliated with universities including Boston University, Harvard University, Massachusetts Institute of Technology, and Northeastern University. Others belong to private clubs or nonprofit organizations, which provide public access for various types of boating. The removal of the dam will increase the connectivity of the river with upriver segments not only for fish and aquatic organisms but for paddlers and recreational users of the river as well.

6.5 Ecological and Aquatic Habitat

Dams located on the Charles River have varying degrees of fish passage capability. Removal of the Old Mill Dam, located on Pearl Street in Bellingham, was completed in 2017. This dam is located on the Charles River, far upriver of the Watertown Dam. The removal of the Old Mill Dam reconnected 9.2 miles of river habitat upstream of the dam with the 50 more miles of unobstructed river below it (2016b, CRWA). A fish ladder downriver of the Watertown Dam at the New Charles River Dam does not function correctly, and all fish passage occurs through the locks themselves (MADMF, 2018). Similarly, fish ladders at the Moody Street Dam and ladders upriver of Moody Street have varying levels of passage, but recent observations do not support them working at high efficiencies (2018, MADMF). The deficiencies of the Watertown Dam fish ladder are discussed in Sections 2.3 and 5.3.5.

Overall, the removal of the Watertown Dam is expected to result in ecological enhancement. The removal of the structure demonstrates the potential to improve the reproductive success of migrating fish species, as well as other wildlife usage. One such species of concern is the rainbow smelt, which has been documented as having laid eggs in the fast-moving riffle area just downriver of the Watertown Dam according to guidance from Brad Chase of the MADMF (Chase, 2019).

According to research done by MADMF, the optimal spawning and egg adherence for rainbow smelt occur between velocities of 1.6 to 2.6 ft/sec (Chase, 2006) and at channel slopes between 0.5 percent and 1.0 percent (Chase, 2010). If dam removal is pursued, a more formal proposed plan of the post-dam-removal channel will be developed. Hydraulic modeling of that channel will estimate a range of expected conditions given possible channel slopes, cross sections, and configurations. It would be a benefit to smelt and several other diadromous and freshwater fish species if the riffle habitat presently found downriver of the Watertown Dam is extended upriver and through the dam removal site, with target ranges of velocity between 1.6 and 2.6 ft/sec under low-flow conditions and slope between 0.5 and 1.0 percent (**Recommendation No. EAH-1**). This recommendation is consistent with the reconstruction of 130 linear feet of river channel upriver of the Watertown Dam at a slope of 1 percent as described in Section 5.3 based upon sediment and bank stability. If the Watertown Dam is not removed, future studies might consider improving efficiencies of the fish ladder.

This portion of the Charles River is a narrow riparian corridor flanked by intensive urbanized adjacent land uses. There are no significant areas of bordering vegetated wetlands (BVW) located along the banks of the Charles River within the impounded area. As such, if the river were to be lowered here through removal of the dam, significant loss of BVW is not anticipated. Rather, there is a potential for BVW creation. The areas previously under water or adjacent to the water's edge in the impounded condition will be ideal growing conditions for obligate and facultative plants. However, through this transition, monitoring the affected areas to ensure colonization of native plants rather than invasive species would be recommended.

6.6 Cultural Resource Assessment

Archeological and Historical Services, Inc (AHS) assessed the sensitivity of the Watertown Dam vicinity, including the areas on the north and south banks of the Charles River. After extensive research, it was the opinion of AHS that the role of the dam and this part of the Charles River in the settlement and industrial development of Watertown cannot be overstated. Later-period archeological resources, particularly those related to the industrial history of Watertown, are also likely present in the project area vicinity. AHS considers any area with intact soils to have high potential to contain archeological deposits.

Site file research and in-field inspection identified numerous historic resources in the project vicinity. Nonantum Road and Charles River Road are both listed on the National Register of Historic Places (NRHP) as contributing components of the Charles River Reservations Parkways. Within the Watertown Square Historic Area, three resources are immediately adjacent to the project: the 1907 Galen Street bridge, the former Hollingsworth & Whitney paper-products manufacturing complex, and the former Lewando Dyeing and Cleaning Company complex. The bridge is a contributing component of a potentially eligible historic district centered on Watertown

Square. The two factory complexes would be contributing components of a potentially eligible industrial-themed historic district on Pleasant and Brook Streets or as components of a multithemed Watertown Square historic district that embraced industry, commercial development, and City Beautiful planning, all of which occurred in close proximity to each other.

While any final recommendation related to historic or cultural resource mitigation will be finalized with the help of local, state, federal, and tribal agencies as part of the National Historic Preservation Act, Section 106 regulatory compliance process, three preliminary recommendations are offered.

Given the high archeological sensitivity of the overall project vicinity, archeological survey in the form of shovel tests is recommended in areas where ground disturbance or excavation is required if a dam removal plan is pursued **(Recommendation No. CR-1)**. A drop in water level from a dam removal may expose archeological sites or sensitive areas, and we would recommend that these areas, when exposed, be carefully walked over by an archaeologist and artifacts collected and that Massachusetts Historical Commission (MHC) site forms be completed with the site locations recorded **(Recommendation No. CR-2)**.

The current dam, constructed in 1966 and altered with the installation of a fish ladder in the 1970s, is not considered a NRHP-eligible resource. A product of our own time rather than a historical period, it appears to have no special engineering or historical significance. The removal of the dam, however, would have some impact on adjacent historical resources because it would remove the last link between the Charles River's waterpower and historical riverside industrial buildings.

It is also recommended that informative signage be added, or the dam training walls be allowed to remain in order to retain the link between the historical uses of the Charles River for waterpower in riverside industrial buildings **(Recommendation No. CR-3)**.

7.0 RECOMMENDATIONS

The Watertown Dam is a man-made structure on the Charles River. It, along with many other dams in the greater Boston area, helped provide energy to various industries and mills in the developing greater Boston area for centuries. In a post-industrial era, however, the dam's usefulness as an energy source has diminished. The most recent reconstruction of the dam was intended to be useful for flood control, but operating the dam for flood control would provide insignificant benefits and require additional resources.

Removal of the dam is seen as a step toward allowing the Charles River to return to a more naturalized ecological system, with the added benefits of flood reduction future cost benefits. The goals of this feasibility study were to evaluate the effects of the potential dam removal with respect to many facets of the riverine system. The following sections summarize the findings of this assessment, including the goals, benefits, and undesired effects of the potential removal of the Watertown Dam.

7.1 Assessment of Feasibility Study Goals and Objectives

As described in the first section of this report, the goal of the dam removal would be to improve the overall ecological health and connectivity of the Charles River, attempting to allow it to return to a more natural condition. Such action would improve fish passage for blueback herring, alewife, and American shad, as well as improve the ecological and recreational values of the corridor. Future plans for the removal of the dam, however, would be contingent upon the impacts to flood characteristics, stability, and public safety. Table 7-1 presents the goals and objectives of the potential Watertown Dam removal and the degree to which those goals can be met based upon the analysis performed to date.

TABLE 7-1
Analysis of Project Goals and Objectives

Goal/Objective	Notes
Improve fish passage and water quality in the Charles River.	Removal of the dam could eliminate a significant barrier to fish passage and decrease the fragmentation of habitats within the Charles River. Minor channel modifications in the dewatered impoundment may be necessary to create deeper pools during severely low river flows and to create small areas of lower velocity where riffles existed before the construction of the dam.
Evaluate the effects on flood control upriver and downriver of the Watertown Dam.	Removal of the dam could lower the 100-year floodplain elevation upriver of the dam. Flood elevations could be expected to be approximately 6 feet lower at the dam itself, and the reduction in floodplain would diminish slowly upriver to a point approximately ½ mile upriver of the dam to where the floodplain would be unaffected by the dam removal. There are no changes anticipated for flooding downriver of the dam.
Evaluate the nature, composition, and stability of impounded sediment as well as the stability of the riverbed, banks, and nearby infrastructure.	Sediments are found to be fine-grained sediments with chemical constituents of concern. The post-dam-removal velocities are not expected to cause major erosion or scour after armoring is installed and vegetation of newly exposed banks is established. Chemical constituents found within the sediment exceed human health thresholds and will require additional testing to develop a formal sediment management plan. It is anticipated that up to 1,700 cubic yards (CY) of sediment will need to be removed surrounding the direct upriver vicinity of the dam, and additional sediment pockets found in the former impoundment would be tested, removed, and disposed of off-site, if necessary.

TABLE 7-1 (Cont.)
Analysis of Project Goals and Objectives

Goal/Objective	Notes
Evaluate impacts on archeologically sensitive resources.	The area is historically significant, and while the dam itself is not considered a cultural resource, the surrounding area and its ties to our industrial heritage are significant to the development of our modern civilization. The presence of historic artifacts in the impoundment and around the dam is possible. Archeological survey in the form of shovel pits is recommended in any area that requires ground disturbance as well as any areas exposed as a result of the drawdown due to the high archeological sensitivity of the Watertown Dam area. Also, informational signage could be developed and installed to memorialize the importance of the dam if it is removed.
Improve the visual and historic character, recreation, nature viewing, and boating along the Charles River Greenway for visitors.	The restoration of the river to a more natural, unaltered state will promote an increase in flora and fauna diversity, allow the Charles River corridor to form a more naturalized healthy riparian corridor, encourage fish passage, and improve nature-viewing opportunity, and the removal of the dam could make a longer segment of river available to paddling recreational use. However, dam removal would make the impounded section of the river upstream of the Watertown Dam unnavigable to powerboats.

7.2 Summary of Dam Removal Effects and Mitigation

Just as the construction of the dam was disruptive to the natural processes and ecology of the Charles River, the removal of the dam will also change the newly adapted equilibrium that the system has known for almost 400 years. While many of the changes will be for the better, some changes will impart unintended effects that will require planning to mitigate such as the repositioning of sediments, the increase in water velocities in some locations, and effects on infrastructure. Possible unintended consequences of dam removal and their recommended mitigation efforts are summarized in Table 7-2 below. They are also presented graphically in Figure 7-1.

TABLE 7-2
List of Recommended Mitigations for Dam Removal

Section	ID No.	Recommendation
Sediment Management	SM-1	Remove sediment directly upriver of the dam and dispose of off-site, with an estimated volume of 1,700 CY. Reconstruct a channel through this reach, armor the banks, and establish vegetation on exposed areas to ensure stability.
	SM-2	Perform additional chemical testing of exposed sediments, quantify sediment removal volumes in greater detail, and develop sediment management plan.
Fish Passage	FP-1	Roughen areas of channel with large stones to dissipate energy, slow velocities, and give fish resting areas in eddy pools behind the stone structures at two locations where fish passage may be challenging. The first area is located between the former dam and the Corporal Thompson Footbridge, and the second area is 1,500 feet upriver of the dam where the river channel slope increases and a natural riffle is expected to form if the dam is removed.
	FP-2	Increase water depths through common treatment such as channel roughening, the installation of a fish-passable boulder riffle with fish-passable voids for low flows, or excavation of a low-flow channel in the deepest portion of the channel to concentrate flows during dry periods and provide sufficient depth for fish passage to occur.

TABLE 7-2 (Cont.)
List of Recommended Mitigations for Dam Removal

Section	ID No.	Recommendation
Bank Exposure	BE-1	In order to better predict what the bank extents may look like in a post-dam-removal scenario, it is recommended that a planned drawdown of the impoundment be pursued. Removal of the weir boards from the low-level outlet during a low-flow period would allow photos to be taken from various vantage points along the shore, from various infrastructure and bridges, and from the air, to document the exact extents of where new banks of the Charles River can be expected to form.
	BE-2	If the dam is removed and the upriver water levels drawn down, newly exposed areas should be seeded with native seed and planted with dense shrubby water-tolerant native vegetation to discourage pedestrian access and promote bank stability, increase shading on the water, and provide wildlife habitat.
Municipal Infrastructure	MI-1	To prevent erosion at Stormwater Outfall ID No. 3 if the dam is to be removed, it is recommended that a riprap channel outlet protection be designed/sized for the expected flows from this outfall and extended to the new edge of water.
	MI-2	To prevent erosion at Stormwater Outfall ID No. 11 if the dam is to be removed, it is recommended that a riprap channel outlet protection be designed/sized for the expected flows from this outfall and extended to the new edge of water.
DCR Infrastructure	DI-1	The existing stone armoring should be surveyed and assessed for stability during a dam-removal scenario, and a scour analysis should be performed on the bridge abutments and bed. Stone armoring may need to be supplemented on the banks near and beneath the Corporal Thompson Footbridge to protect the footings from scour, and a grade control structure or riffle may need to be constructed beneath the Corporal Thompson Footbridge to ensure riverbed stability.
	DI-2	It is recommended that detailed survey of four overlooks and boardwalks be performed to determine the extents of the reduced water levels and how they will impact the use of the recreational infrastructure.
Ecological and Aquatic Habitat	EAH-1	It would be a benefit to smelt and several other diadromous and freshwater fish species if the riffle habitat presently found downriver of the Charles River Dam is extended upriver and through the dam removal site, with target ranges of velocity between 1.6 and 2.6 ft/sec under low-flow conditions and slope between 0.5 and 1.0 percent. If the Watertown Dam is not removed, future studies might consider improving efficiencies of the fish ladder.
Cultural Resources	CR-1	Archeological survey in the form of shovel tests is recommended in areas where ground disturbance or excavation is required for dam removal.
	CR-2	A drop in water level may expose archeological sites or sensitive areas, and we would recommend that these areas, when exposed, be carefully walked over by an archaeologist and artifacts collected and that MHC site forms be completed with the site locations recorded.
	CR-3	Informative signage should be added at the site of the former dam, or the dam training walls should be allowed to remain in order to retain the link between the historical use of the Charles River for waterpower in riverside industrial buildings.

While none of the challenges identified as part of this study are considered insurmountable, they would require financial investment for the project to succeed. As such, the feasibility of the project would rely completely upon those providing the funding, their goals and priorities, and their subjective analysis of the costs as compared to the benefits of such a project.



7.3 Response to Community Priorities and Concerns

A series of questions were posed by MADER at the outset of the feasibility study, which represent concerns voiced by stakeholders and interested parties. A summary of what this feasibility assessment found as it relates to each question is also provided in green, italic font.

1. What is the geographic extent of change (hydrologic, hydraulic, other) that might result from removal of the Watertown Dam?
Removal of the dam will lower water surface elevations during both daily normal flows and severe flood flows. Those effects are most significant directly upriver of the dam and dissipate slowly for approximately a half-mile upriver of the dam, but the exact point where hydraulics match current conditions varies per flow event. More detail relating to hydrology can be found in Section 4.4, and information relating to flood extents can be found in Section 6.2.
2. What is the current relationship of the Watertown Dam to the overall function of the flood control system it is a part of and how would alteration of the dam impact the system's performance?
Removal of the dam was found to lower the elevation of the 100-year floodplain for approximately one-half mile upriver of the dam. The dam is not actively managed as a flood control structure, and removal of the dam was not found to impact the functionality of the Charles River Flood Control System. More detail relating to the impacts on the Charles River Flood Control System can be found in Section 6.3.
3. What are the current impacts that the dam has on the hydraulics of the Charles River and flooding patterns in the vicinity?
Currently, the dam impounds water and increases the depth of flood waters upriver for approximately one-half mile. This is described in greater detail in Section 6.2.
4. What are the benefits to hydrology and hydraulics from removing the dam?
While there is no appreciable change (benefit or impact) to hydrology from removing the dam, the hydraulics upriver will be improved such that the extents, depth, and severity of flooding upriver of the dam will be reduced. More detail relating to flood extents can be found in Section 6.5.
5. What is the character of the sediment impounded behind the dam, how does that compare to upriver and downriver sediment, and what are the options for managing that sediment in a dam removal?
The sediment is impacted by the presence of chemical constituents and heavy metals consistent with urban runoff at or above the MCP S-1/GW-1 standards at various locations. Sediment may have to be removed and disposed of from the site; however, more detailed testing in key areas is necessary before a formal sediment management plan can be developed. More detail relating to the character and composition of the sediment can be found in Section 4.1. More detail relating to the stability and management of the sediment can be found in Sections 5.3.4 and 6.5.

6. What will be the impact to public and private infrastructure, such as existing drainage structures and their alignment with the present river shoreline, and what are feasible treatments to address those impacts?
A small number of drainage outlets located in the impoundment area will require outlet protection to be installed in the newly exposed bank area to prevent erosion. The newly installed Corporal Thompson Footbridge will also require additional stone armoring to protect its abutments from elevated velocities that are predicted to occur during a post-dam-removal flood. More detail relating to municipal and DCR-owned infrastructure can be found in Sections 6.2 and 6.3.
7. What are the ramifications for restoring sediment transport through a potential dam removal?
Sediment transport in this reach of the Charles River is limited by a number of factors. The presence of upriver dams, the high urban development, and the low energy of the system lead to a comparatively low sediment transport. Fine-grained sediment carried by the Charles River has settled in the impoundment, but the Watertown Dam impoundment carries a low volume of total sediment and has no history of being dredged. The dam has filled to its capacity with as much sediment as the impoundment can support and is actively passing sediment downriver in the same manner and quantities as if no dam were present at the site. Therefore, removal of the dam is not expected to impart any change on the sediment transport characteristics of the Charles River. More detail relating to sediment transport can be found in Section 5.3.4.
8. What will be the changes to the shoreline upriver and downriver of the dam, particularly with respect to park improvements that have been made, and what are feasible treatments to address those changes?
No changes are expected to be seen downriver of the dam. Upriver of the dam, there will be more exposed areas of shoreline until vegetation is established. The greatest impact will be directly upriver of the dam, and the shoreline changes will gradually diminish in the upriver direction to a point one-half mile upriver of the dam, where there will be no change at all. More detail relating to changes to the riverbanks can be found in Sections 5.3.6 and 6.4.
9. What will be the impacts to channel depth, navigation, and recreational access points upriver and downriver of the dam?
No changes are expected to be seen downriver of the dam. Upriver of the dam, channel depths will be lowered. An existing riffle downriver of the Watertown Dam with low depths would still prevent boats from accessing the area upriver of the dam even if the dam were to be removed. The former impounded section of the river will return to a free-flowing condition suitable for access by paddle boating but not for powered boating. More detail relating to changes to the recreational use of the river can be found in Section 6.4.
10. What will be the visual impact to the upriver corridor from the river and abutting public properties?
The lowered water surface created by removal of the dam would create a more free-flowing segment of the Charles River, replacing the slow-moving deep impoundment. The exposed banks will be vegetated, which will increase the size and diversity of the riparian buffer. Visual renderings of what the dam removal will look are being developed. More detail relating to changes to the aesthetics of the river can be found in Section 6.4.

11. What will be the adverse effect, if any, to State-listed and Federally-listed historic and archaeological resources and what are feasible actions to address those effects?
Numerous historic resources were identified in the vicinity of the Watertown Dam. Nonantum Road and Charles River Road are both listed on the NRHP. The Galen Street bridge and two former industrial buildings are also eligible for the NRHP. The dam itself is not considered a NRHP-eligible resource. Shovel testing during excavation is recommended if dam removal is pursued. More information relating to cultural resources can be found in Section 6.6.
12. Will there be impacts to wetlands resources and their functions?
No significant BVWs are located along the banks of the Charles River within the impounded area. More detail relating to changes in the aesthetics of the river can be found in Section 6.5.

7.4 Opinion of Probable Construction Costs

Implementation of a dam removal project can have costs that vary significantly depending upon a number of factors. Time of year, economic conditions, site-specific design details, and special funding considerations can affect the cost of construction. At the feasibility stage, the following opinion of construction costs is for informational and comparative purposes, intending to guide discussions on the order of magnitude of the project and the potential financial commitment it represents. It is not intended to be a detailed/itemized cost estimate. The following Table 7-3 provides a conceptual-level order-of-magnitude breakdown of costs associated with the work needed to remove the Watertown Dam.

TABLE 7-3
Conceptual-Level Cost Opinion of Removal of the Watertown Dam

1. Design and permitting	\$ 175,000
2. Construction administration	\$ 125,000
3. Water control during construction	\$ 225,000
4. Archeological investigation during construction	\$ 75,000
5. Demolition and removal of Watertown Dam	\$ 250,000
6. Remove and dispose of sediment	\$ 350,000
7. Construction of roughened channel upriver of dam	\$ 75,000
8. Construction of boulder cross-vane for fish passability	\$ 100,000
9. Revegetate exposed banks of Charles River	\$ 125,000
10. Protect/armor exposed stormwater outfalls	\$ 75,000
11. Armor footing of pedestrian bridge	\$ 75,000
12. Extend boardwalks and overlooks to new water edge	\$ 150,000
Subtotal:	\$1,800,000
20% Contingency:	\$ 360,000
Total:	\$2,160,000

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APPENDIX A

PHOTO LOG

**WATERTOWN DAM REMOVAL
FEASIBILITY STUDY
ON THE CHARLES RIVER**

March 1, 2019
MMI #2688-44

Photo No. 1: Aerial photo of Watertown Dam showing 200-foot long concrete spillway, California Street, and the Corporal Thompson Footbridge under construction. *April 2018*



Photo No. 2: Aerial photo of river-right (southern) training wall, concrete fish ladder, and 10-foot wide low-level outlet with stacked timber stop logs. *April 2018*



Photo No. 3: River-right (southern) training wall, concrete fish ladder looking at upstream end (fish exit). *April 2018*



Photo No. 4: Aerial photo of river-left (northern) training wall, with a pedestrian walkway observation deck and former mill building. *April 2018*



Photo No. 5: Aerial photo of river-left (northern) training wall, with a pedestrian walkway observation deck and former mill building. *April 2018*



Photo No. 6: Aerial photo of the Charles River, looking downstream from the Watertown Dam, with Boston on the horizon. *April 2018*



Photo No. 7: Aerial photo of the Charles River, looking upstream from the Watertown Dam, with Waltham in the background. *April 2018*



APPENDIX B

DAM INSPECTION REPORTS

Watertown Dam Phase I Inspection Evaluation Report – GEI Consultants, June 2016

Watertown Dam Follow-Up Inspection/Evaluation Report – GZA GeoEnvironmental, Inc., March 13, 2017

-- WATERTOWN DAM --
PHASE I
INSPECTION / EVALUATION REPORT



Dam Name: Watertown Dam
NID ID#: MA00456
Owner: Commonwealth of Massachusetts DCR
Town: Watertown
Consultant: GEI Consultants, Inc.
Date of Inspection: June 28, 2016



EXECUTIVE SUMMARY

This Inspection/Evaluation Report details the inspection and evaluation of Watertown Dam located in Watertown, Massachusetts. The inspection was conducted on June 28, 2016 by GEI Consultants, Inc. of Woburn, Massachusetts. Watertown Dam is classified as a Small size, Significant Hazard Potential (Class II) Hazard Potential dam.

In general, the overall condition of Watertown Dam is **Poor** because of the trees on the left embankment, which could damage the integrity of the narrow embankment were they to topple. The dam was found to have the following deficiencies:

1. Trees and woody vegetation on embankments. – In general, embankment dams should not have woody vegetation, especially large trees, because of the potential for a breach if they are toppled during a flood event and because their roots can form seepage paths. We consider the trees on the left abutment to be a serious deficiency because of these issues and because that embankment is relatively narrow. However, because of the large width of the right embankment, we do not consider trees on that structure to be a significant deficiency.
2. No riprap on the upstream slope of the left embankment. – There is no riprap on the upstream slope of the left embankment.
3. No Operation & Maintenance (O&M) Manual or Emergency Action Plan (EAP). – We understand that there is no O&M Manual or EAP; however, we note that an EAP is not required for a Significant Hazard potential hazard dam, but can be useful.

The following table summarizes the operating and maintenance recommendations reported in the June 21, 2011 Phase I report and the status of those deficiencies.

<i>Previously Identified Recommendation</i>	<i>Resolution or Current Condition</i>
An operation and maintenance manual should be prepared for the dam.	There is still no operation and maintenance manual for the dam.
Remove trees and woody vegetation from the upstream slope of the right embankment and both upstream and downstream left embankments.	There are still trees and woody vegetation on the embankments.
Grade and seed sparsely vegetated (non-path areas at the right abutment).	The non-path areas are still not well vegetated.
Raise the grade of the right embankment to a uniform elevation at approximately 5 inches below the top of the right spillway/fishway training wall.	The right embankment grade is relatively level but not uniform and was probably not raised. This recommendation does not appear necessary because overtopping of the right embankment at its current level will probably not be a public safety threat.
Remove the wooden observation deck to make repairs to the left embankment.	The old deck was removed and reconstructed. It is not obvious that any repairs were made to the embankment underneath.
Place riprap on the upstream side of the left embankment	There is no riprap on the upstream side of the left embankment.

<i>Previously Identified Recommendation</i>	<i>Resolution or Current Condition</i>
Raise the crest of the left embankment to the same elevation as the right embankment.	It is unknown if the left embankment was raised. Details from the construction of the wooden observation deck should be reviewed.
Inspect the granite slabs and replace if necessary.	The granite slabs on the downstream slope of the left embankment appear to be in fair condition.
Replace the wooden observation deck following repairs.	The old deck was removed and reconstructed.

We recommend the following actions be taken to address the deficiencies observed at the dam during this inspection and evaluation:

Studies and Analyses - DCR may consider performing or contracting the following studies or analyses at their discretion; however, none of the listed studies are mandatory by regulation.

1. An Operations and Maintenance Manual, if one does not exist, should be prepared for the dam. The manual should include up-to-date drawings and manuals for all current structures and equipment, especially the bascule gate system.
2. An Emergency Action Plan (EAP) is always an asset to a dam owner and would be worthwhile but not mandatory for the dam. An EAP, if developed, should be prepared by a Registered Professional Engineer as defined in 302 CMR 10.03.

Recurrent Maintenance Recommendations - The activities presented below should be undertaken on a regular or yearly basis by the dam owner/caretaker to improve the safety, maintenance, and operation of the dam. Typically, these activities do not require engineering design.

1. Perform regular monitoring and inspection of the dam.
2. Remove woody vegetation from the left embankment on a regular basis.
3. Remove debris from the stop log channel and fishway as necessary. Because of the width of the spillway, debris need only be removed from the spillway if it appears that the debris forms a significant blockage and that rising floodwaters would not dislodge it.
4. Monitor the embankments for erosion caused by either water or recreational use. It is desirable to maintain a healthy vegetative cover (3 to 12 inches of grass) on the dam, but we recognize (1) that establishing grass across the right embankment is not feasible because of the heavy recreational use of the park area and (2) the overlying boardwalk shades the left embankment such that grass growth will be difficult. For this reason, we recommend regular monitoring for erosion that could increase the potential for a breach during flood conditions.

Remedial Modifications Recommendations - We recommend the following remedial modification:

Repair the left embankment by (a) removing trees and woody vegetation, (b) regrading the embankment to ensure a consistent profile and crest, and (c) placing riprap on the upstream side of the left embankment and possibly on other faces where grass cannot be grown because of the overlying boardwalk.

Dam Evaluation Summary Detail Sheet

1. NID ID:	MA00456	4. Inspection Date:	June 28, 2016
2. Dam Name:	Watertown Dam	5. Last Insp. Date:	June 21, 2011
3. Dam Location:	Watertown, MA	6. Next Inspection:	June 28, 2021
7. Inspector:	Lee Wooten, P.E.		
8. Consultant:	GEI Consultants, Inc.		
9. Hazard Code:	Significant	9a. Is Hazard Code Change Requested?:	No
10. Insp. Frequency:	5 Years	11. Overall Physical Condition of Dam:	POOR
12. Spillway Capacity (% SDF)	>100% SDF w/actions by Caretaker		
E1. Design Methodology:	3	E7. Low-Level Discharge Capacity:	3
E2. Level of Maintenance:	3	E8. Low-Level Outlet Physical Condition:	1
E3. Emergency Action Plan:	1	E9. Spillway Design Flood Capacity:	4
E4. Embankment Seepage:	5	E10. Overall Physical Condition of the Dam:	2
E5. Embankment Condition:	2	E11. Estimated Repair Cost:	\$ 35,200 - \$ 60,500
E6. Concrete Condition:	4		

Evaluation Description

E1: DESIGN METHODOLOGY

1. Unknown Design – no design records available
2. No design or post-design analyses
3. No analyses, but dam features appear suitable
4. Design or post design analysis show dam meets most criteria
5. State of the art design – design records available & dam meets all criteria

E2: LEVEL OF MAINTENANCE

1. Dam in disrepair, no evidence of maintenance, no O&M manual
2. Dam in poor level of upkeep, very little maintenance, no O&M manual
3. Dam in fair level of upkeep, some maintenance and standard procedures
4. Adequate level of maintenance and standard procedures
5. Dam well maintained, detailed maintenance plan that is executed

E3: EMERGENCY ACTION PLAN

1. No plan or idea of what to do in the event of an emergency
2. Some idea but no written plan
3. No formal plan but well thought out
4. Available written plan that needs updating
5. Detailed, updated written plan available and filed with MADCR, annual training

E4: SEEPAGE (Embankments, Foundations, & Abutments)

1. Severe piping and/or seepage with no monitoring
2. Evidence of monitored piping and seepage
3. No piping but uncontrolled seepage
4. Minor seepage or high volumes of seepage with filtered collection
5. No seepage or minor seepage with filtered collection

E5: EMBANKMENT CONDITION (See Note 1)

1. Severe erosion and/or large trees
2. Significant erosion or significant woody vegetation
3. Brush and exposed embankment soils, or moderate erosion
4. Unmaintained grass, rodent activity and maintainable erosion
5. Well maintained healthy uniform grass cover

E6: CONCRETE CONDITION (See Note 2)

1. Major cracks, misalignment, discontinuities causing leaks, seepage or stability concerns
2. Cracks with misalignment inclusive of transverse cracks with no misalignment but with potential for significant structural degradation
3. Significant longitudinal cracking and minor transverse cracking
4. Spalling and minor surface cracking
5. No apparent deficiencies

E7: LOW-LEVEL OUTLET DISCHARGE CAPACITY

1. No low level outlet, no provisions (e.g. pumps, siphons) for emptying pond
2. No operable outlet, plans for emptying pond, but no equipment
3. Outlet with insufficient drawdown capacity, pumping equipment available
4. Operable gate with sufficient drawdown capacity
5. Operable gate with capacity greater than necessary

E8: LOW-LEVEL OUTLET PHYSICAL CONDITION

1. Outlet inoperative needs replacement, non-existent or inaccessible
2. Outlet inoperative needs repair
3. Outlet operable but needs repair
4. Outlet operable but needs maintenance
5. Outlet and operator operable and well maintained

E9: SPILLWAY DESIGN FLOOD CAPACITY

1. 0 - 50% of the SDF or unknown
2. 50-90% of the SDF
3. 90 - 100% of the SDF
4. >100% of the SDF with actions required by caretaker (e.g. open outlet)
5. >100% of the SDF with no actions required by caretaker

E10: OVERALL PHYSICAL CONDITION OF DAM

1. UNSAFE – Major structural, operational, and maintenance deficiencies exist under normal operating conditions
2. POOR - Significant structural, operation and maintenance deficiencies are clearly recognized under normal loading conditions
3. FAIR - Significant operational and maintenance deficiencies, no structural deficiencies. Potential deficiencies exist under unusual loading conditions that may realistically occur. Can be used when uncertainties exist as to critical parameters
4. SATISFACTORY - Minor operational and maintenance deficiencies. Infrequent hydrologic events would probably result in deficiencies.
5. GOOD - No existing or potential deficiencies recognized. Safe performance is expected under all loading including SDF

E11: ESTIMATED REPAIR COST

Estimation of the total cost to address all identified structural, operational, maintenance deficiencies. Cost shall be developed utilizing standard estimating guides and procedures

Changes/Deviations to Database Information since Last Inspection

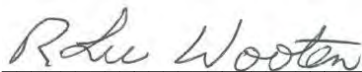
PREFACE

The assessment of the general condition of the dam reported herein was based upon available data and visual inspections. Detailed investigations and analyses involving topographic mapping, subsurface investigations, testing and detailed computational evaluations were beyond the scope of this report unless reported otherwise.

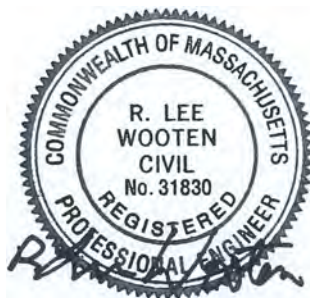
In reviewing this report, it should be realized that the reported condition of the dam was based on observations of field conditions at the time of inspection, along with data available to the inspection team.

It is critical to note that the condition of the dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the reported condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection, can there be any chance that unsafe conditions be detected.

Prepared by GEI CONSULTANTS, INC.



R. Lee Wooten, P.E.
Massachusetts License No. 31830
License Type: Civil



Design Division Manager
GEI Consultants, Inc.

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TABLES

1.1	Summary Data Table
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FIGURES

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Figure 2:	Aerial Photograph
Figure 3:	Drainage Basin
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APPENDICES

Appendix A:	Photographs
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Appendix C:	Previous Reports and References
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SECTION 1

1.0 DESCRIPTION OF PROJECT

1.1 General

1.1.1 Authority

The Massachusetts DCR has retained GEI Consultants, Inc. (GEI) to perform a visual inspection and develop a report of conditions for Watertown Dam along the Charles River in Watertown, Middlesex County, Massachusetts. This inspection and report were performed in accordance with MGL Chapter 253, Sections 44-50 of the Massachusetts General Laws as amended by Chapter 330 of the Acts of 2002.

1.1.2 Purpose of Work

The purpose of this investigation was to inspect and evaluate the present condition of the dam and appurtenant structures in accordance with 302 CMR10.07 to provide information that will assist in both prioritizing dam repair needs and planning/conducting maintenance and operation.

The investigation was divided into four parts: 1) obtain and review available reports, investigations, and data previously submitted to the owner pertaining to the dam and appurtenant structures; 2) perform a visual inspection of the site; 3) evaluate the status of an emergency action plan for the site and; 4) prepare and submit a final report presenting the evaluation of the structure, including recommendations and remedial actions, and opinion of probable costs.

1.1.3 Definitions

To provide the reader with a better understanding of the report, definitions of commonly used terms associated with dams are provided in Appendix D. Many of these terms may be included in this report. The terms are presented under common categories associated with dams, which include: 1) orientation; 2) dam components; 3) size classification; 4) hazard classification; and 5) miscellaneous.

1.2 Description of Project

1.2.1 Location

Watertown Dam is located on the Charles River in the Town of Watertown, Middlesex County, Massachusetts. The coordinates of the dam are 42.36532° North 71.18932° West, as estimated from Google Earth (WGS 84 Datum). The dam is located between California Street and Pleasant Street within the Charles River Greenway.

Take exit 17 on the Massachusetts Turnpike and turn left onto Centre Street. Continue 0.6 miles on Centre Street. Then turn left onto Route 16 for 0.1 miles and bear right onto California Street. The dam is immediately on the right within the Charles River Reservation. A locus map is provided as Figure 1.

1.2.2 Owner/Caretaker

The dam is owned and maintained by the Massachusetts Department of Conservation and Recreation. See Table 1.1 for current owner and caretaker data (names and contact information).

1.2.3 Purpose of the Dam

Watertown Dam is an earth embankment dam that was likely built for mill power decades ago. The current purpose of the dam is for recreation.

1.2.4 Description of the Dam and Appurtenances

The dam is a run-of-the-river dam consisting of a 182-ft-long concrete spillway, a stoplog outlet section, a fishway, and earthen embankment abutments with poorly defined lengths of about 50 ft on the left and 170 ft on the right. The structural and hydraulic heights of the dam are estimated to be approximately 10 ft and 6 ft respectively. The normal impoundment volume is estimated to be approximately 20 acre-ft. The maximum impoundment is reportedly 30 acre-ft.

The spillway consists of a concrete ogee structure across the Charles River. The training walls are concrete with the right training wall being formed by a Denil fishway. Between the ogee and the fishway, there is an outlet section of spillway with an approximately 9-ft weir length that can accommodate four stacked stop logs, which could be removed to a level of about half of the spillway height. Access to the stop logs is from the grate that covers the fishway.

The remainder of the dam consists of poorly defined earthen embankments with irregular slopes and crest. Both embankments are crossed by the recreational park paths. The right embankment is broad section of riverbank between the fishway and California Street. The upstream bound of the embankment is riverbank between the fish ladder and footbridge located about 170 ft upstream, with the top of the riverbank being the highest part of the embankment, generally about 5 ft above the spillway crest. The downstream bound of the embankment is the riverbank between the fishway and the higher adjacent ground from the park trails to California Street. Part of the downstream bank is covered with granite blocks and the headwall for a storm drain outlet. The distance from the upstream side of the embankment to the downstream side of the embankment is broad, with a minimum distance of about 50 ft. This area between California Street and the fishway could act as an emergency spillway during a flooding event.

The left embankment spans a short distance from the spillway concrete abutment wall to higher ground and has a height about 4 ft above the spillway crest. A recently constructed wooden walkway covers the embankment crest and an office building, likely a refurbished mill building, immediately abuts parts of the downstream side of the embankment. Between the building and the abutment wall, the embankment slopes appear to be about 3H:1V, and the crest width appears to be about 5 ft but is irregular and covered by the boardwalk.

1.2.5 Operations and Maintenance

MADCR is responsible for the operation and maintenance of the dam.

1.2.6 DCR Size Classification

Watertown Dam has a height of dam of approximately 10 feet to the top of the abutment embankments based on estimates of about 6 ft to the top of the run-of-the-river spillway crest and 4 ft from the spillway crest to the top of the left embankment. The dam has a maximum storage capacity of about 30 acre-feet. Refer to Appendix D for definitions of height of dam and storage. Therefore, in accordance with Department of Conservation and Recreation Office of Dam Safety classification, under Commonwealth of Massachusetts dam safety rules and regulations stated in 302 CMR 10.00 as amended by Chapter 330 of the Acts of 2002, Watertown Dam is a **Small** size structure.

1.2.7 DCR Hazard Potential Classification

An office building is located immediately downstream of the dam on the left bank and the Galen Street (Route 16) bridge is located 1,000 feet downstream. The office building, the bridge, and possibly other structures in this heavily developed area could be affected by a breach of the run-of-river dam during a flood. It appears that a failure of the dam at maximum pool “may cause loss of life and damage home(s), industrial or commercial facilities, secondary highway(s), or railroad(s), or cause interruption of use or service of relatively important facilities.” Therefore, in accordance with Department of Conservation and Recreation classification procedures, under Commonwealth of Massachusetts dam safety rules and regulations stated in 302 CMR 10.00 as amended by Chapter 330 of the Acts of 2002, Watertown Dam should be classified as a Hazard Potential Class II (**Significant**) hazard potential dam. The Hazard Potential Classification recommendation is consistent with the Hazard Potential Classification on record with the Office of Dam Safety for Watertown Dam.

1.3 Pertinent Engineering Data

1.3.1 Drainage Area

The drainage area of approximately 273 square miles for Watertown Dam was determined from USGS topographic mapping, and extends through the Towns of Watertown, Belmont, Arlington, Lexington, Waltham, Lincoln, Weston, Newton, Wellesley, Natick, Wayland, Brookline, Boston, Needham, Dedham, Westwood, Dover, Sherborn, Medfield, Ashland, Holliston, Millis, Norfolk, Walpole, Hopkinton, Medway, Milford, Hopedale, Mendon, Bellingham, Franklin, and Wrentham. The drainage area is a part of the Charles River drainage basin.

1.3.2 Reservoir

See Table 1.1 for data about normal, maximum, and spillway design flood (SDF) pools. These data were obtained from the previous Phase I Inspection report and checked with USGS topographic mapping. No bathymetric information was available for this inspection. The estimated storage volume at normal pool has been reported to be approximately 20 acre-ft, and approximately 30 acre-ft at maximum pool.

1.3.3 Discharges at the Dam Site

No records of discharges at the site are maintained.

1.3.4 General Elevations (ft)

The following elevations are approximated based on an assumed spillway crest elevation of 8.7 ft NGVD29 (from the previous Phase I inspection report).

A.	Top of Abutment Embankments (left embankment)	~El. 13
B.	Spillway Design Flood Pool	~El. 13
C.	Normal Pool	~El. 8.7
D.	Spillway Crest	~El. 8.7
E.	Upstream Water at Time of Inspection	~El. 8.8
F.	Downstream Water at Time of Inspection	~El. 4
G.	Stream bed at Low-Level Outlet (invert of outlet)	Not observed
H.	Low Point along Toe of Dam	~El. 2

1.3.5 Main Spillway Data

A.	Type	Concrete weir
B.	Length of Weir	182 ft (total)
C.	Crest Elevation	~El. 8.7
D.	Upstream Channel	~El. 2.5
E.	Downstream Channel	~El. 2
F.	Downstream Outlet Invert or Channel Bottom Elevation	~El. 2

1.3.6 Low-Level Outlet Sluiceway

A.	Type	Stop log sluiceway next to fishway
B.	Size	~9-ft weir length
C.	Length	~9 ft
D.	Intake Elevation (without stop logs)	~El. 6
D.	Discharge Elevation (just downstream of stop logs)	~El. 6
E.	Downstream Channel	~El. 2
F.	Downstream Outlet Invert or Channel Bottom Elevation	~El. 2

1.3.7 Design and Construction Records and History

There are no records available of the original construction of the dam.

1.3.8 Operating Records

There are no operating records for the dam.

1.4 Summary Data Table

Refer to Table 1.1, on the following page, for the DCR-formatted tabulation of the data required for the Watertown Dam.

1.1 Summary Data Table

Required Phase I Report Data	Data Provided by the Inspecting Engineer
National ID #	MA00456
Dam Name	Watertown Dam
Dam Name (Alternate)	Charles River Dam
River Name	Charles River
Impoundment Name	Charles River
Hazard Class	Significant
Size Class	Small
Dam Type	Earth Embankment
Dam Purpose	Recreation
Structural Height of Dam (feet)	10
Hydraulic Height of Dam (feet)	6
Drainage Area (sq. mi.)	273
Reservoir Surface Area (acres)	11
Normal Impoundment Volume (acre-feet)	20
Max Impoundment Volume ((top of dam) acre-feet)	30
SDF Impoundment Volume* (acre-feet)	No H&H
Spillway Type	Concrete Ogee
Spillway Length (feet)	182
Freeboard at Normal Pool (feet)	4
Principal Spillway Capacity* (cfs)	4370
Auxiliary Spillway Capacity* (cfs)	NA
Low-Level Outlet Capacity* (cfs)	250
Spillway Design Flood* (flow rate - cfs)	100 yr./4,600
Winter Drawdown (feet below normal pool)	N/A
Drawdown Impoundment Vol. (acre-feet)	N/A
Latitude	42.36532
Longitude	-71.18932
City/Town	Watertown
County Name	Middlesex
Public Road on Crest	No
Public Bridge over Spillway	No
EAP Date (if applicable)	N/A
Owner Name	Commonwealth of MA - DCR
Owner Address	251 Causeway Street-Suite 600
Owner Town	Boston, MA 02114
Owner Phone	617-626-1410
Owner Emergency Phone	617-626-1410
Owner Type	DCR - State Parks
Caretaker Name	William Gode von-Aesh
Caretaker Address	251 Causeway St
Caretaker Town	Boston, Ma
Caretaker Phone	617-727-0488 x200
Caretaker Emergency Phone	617-828-1629
Date of Field Inspection	6/28/2016
Consultant Firm Name	GEI Consultants, Inc.
Inspecting Engineer	Lee Wooten, P.E.
Engineer Phone Number	781-721-4034

*In the event a hydraulic and hydrologic analysis has not been completed for the dam, indicate "No H&H" in this table, recommendation section shall include specific recommendation to hire a qualified dam engineering consultant to conduct analysis to determine spillway adequacy in conformance with 302 CMR 10.00.

SECTION 2

2.0 INSPECTION

2.1 Visual Inspection

Watertown Dam was inspected on June 28, 2016. At the time of the inspection, the weather was overcast with some light rain and 71°F. It rained 0.24 inches on the day of the inspection, but there was no precipitation during the previous few days. Photographs to document the current condition of the dam were taken during the inspection and are included in Appendix A. The level of the impoundment was approximately 1 inch above the spillway elevation. Underwater areas were not inspected. A copy of the inspection checklist is included in Appendix B.

2.1.1 General Findings

In general, Watertown Dam was found to be in **Poor** condition because of the trees on the left embankment, which could damage the integrity of the narrow embankment, were they to topple. The specific concerns are identified in more detail in the sections below:

2.1.2 Dam (Embankment Sections)

- *Abutments* (Photographs 3, 6, 8)

Both embankments abut higher sections of the riverbank within park areas. Abutment contact was good on both ends of the dam.

- *Upstream Face* (Photographs 1, 2, 3)

The upstream left face was covered with trees and wetland vegetation. The upstream right face was covered with unmanaged vegetation and trees.

- *Crest* (Photographs 1, 3, 8)

The left embankment crest appeared to be bare earth beneath a wood observation deck / bike path extending from the left spillway training wall to a gravel pathway in the park; however, the deck hindered clear observation of the crest. The crest appeared to be fairly level.

The right embankment crest was a broad bank area spanning from the bank upstream of the fishway to the bank below the fishway. The upstream edge of the embankment crest abutted the upstream pedestrian bridge and continued along the riverbank until it met the concrete wall of the Denil fishway adjacent to the spillway.

- *Downstream Face* (Photograph 6)

The left embankment downstream slope was covered with unmanaged vegetation and trees. Slabs of granite were also observed on the downstream left slope, presumably to prevent bank erosion during high river flow.

The right embankment downstream slope consisted of sparsely vegetated areas with foot-worn pathways. There were stone steps and riprap along with the headwall of a storm drain outlet at the right side of the Denil fishway.

- *Access Roads and Gates* (Photographs 3, 8)

The dam is part of a park that was open to the public from both sides of the river, with an un-gated pedestrian bridge located just upstream of the dam.

2.1.3 Appurtenant Structures

- *Primary Spillway* (Photographs 1-7)

The primary spillway consisted of a concrete ogee structure with concrete training walls. There was a Denil fishway incorporated into the right end of the spillway, which also served as the training wall for the spillway. No debris was observed at the upstream entrance to the fishway during our visit. A few logs were observed at the base of the spillway, but were not obstructing flow. The concrete appeared to be in fair condition with minor erosion; although, water flow obscured visibility of the concrete. The training walls appeared to be in satisfactory condition, with no significant cracking evident.

- *Stop-Log Weir* (Photographs 5, 6)

At the right end of the primary spillway, left of the Denil fishway, there was a short weir section of the spillway with stop logs that could be used to provide some control over the impoundment level behind the spillway. At the time of our visit, the stop logs were installed to an elevation about two inches higher than the adjacent primary spillway. Two stop logs were removed from the weir section by DCR staff during our visit.

2.1.4 Downstream Area (Photographs 4-7)

The downstream river was rocky and shallow. No signs of erosion or instability downstream were observed. The general downstream area consisted of office, commercial, and industrial development. A road bridge across the Charles River was located approximately 1,000 ft downstream of the dam.

2.1.5 Reservoir Area (Photographs 1-5)

The impoundment consisted of the Charles River backwater upstream of the dam. The reservoir slopes were moderate to steep with trees on both sides. There was heavy commercial, industrial, and residential development along the riverbanks. A pedestrian bridge crossed the river about 170 ft upstream from the right end of the spillway. No erosion or signs of instability were noted around the impounded area during our inspection.

2.2 Caretaker Interview

We met Hugh Thigpen and Joe Parz of DCR on site. They indicated that the dam maintenance consists of clearing debris from around the dam, tightening bolts on the structures, and placing the stop logs into place at the end of the season. They indicated that the new wooden observation deck on the left abutment was completed around May 2016.

2.3 Operation and Maintenance Procedures

There are no written maintenance procedures for the dam itself.

2.3.1 Operational Procedures

There are no operational procedures for the dam.

2.3.2 Maintenance of Dam and Operating Facilities

There is no formal maintenance, operating procedures, or training for the dam.

2.4 Emergency Warning System

There is no EAP for this dam.

2.5 Hydrologic/Hydraulic Data

The Watertown Dam is currently classified as a **Small Size, Significant Hazard** potential dam. As such, in accordance with MGL 302 CMR 10, the required spillway design flood (SDF) for the dam is the 100-year flood event. GEI used the flood frequency data from a USGS Gage located a short distance upstream of Watertown Dam to estimate the 100 year flood for the Gage. We then adjusted the 100-year flood flow for the slightly larger drainage basin of the dam (273 sq. miles for the dam compared to 251 sq. miles for the Gage) to estimate a 100-year flood flow of 4,600 cubic feet per second (cfs). The spillway capacity was estimated to be 4,370 cfs with the stop logs in place and 4,620 cfs with the stop logs removed, based on a water depth of 4 ft above the spillway invert using a weir coefficient of 3.0. Consequently, the SDF will be likely to reach a level at or slightly above the embankment.

For comparison and using a different methodology, the 2016 FEMA Flood Insurance Study flood profile for this section of the Charles River shows a 100-year flood level at Watertown Dam about 3.2 ft above the spillway crest, which would not overtop the embankment.

Based on the current discharge capacity estimated by GEI, the spillway is determined to be hydraulically adequate with the stoplogs removed, but barely so.

2.6 Structural and Seepage Stability

2.6.1 Embankment Structural Stability

Because of its narrow width (upstream to downstream), the left embankment may be susceptible to breaching if any of the large trees on its upstream slope were to topple. Such a breach would have a limited width because of the adjacent building.

Because of its large width (upstream to downstream), the right embankment is obviously stable, even if the large trees on the embankment were to topple.

2.6.2 Structural Stability of Non-Embankment Structures

The concrete training walls appeared to be in satisfactory condition with no visual evidence of instability.

2.6.3 Seepage Stability

We did not see evidence of seepage on the downstream side of the left embankment, but seepage stability may be a concern at high pool levels because of the likelihood that the embankment does not have a seepage filter and collection system. Seepage is not a concern on the right embankment because of its width.

SECTION 3

3.0 ASSESSMENTS AND RECOMMENDATIONS

3.1 Assessments

In general, the overall condition of Watertown Dam is **Poor** because of the trees on the left embankment, which could damage the integrity of the narrow embankment were they to topple. The dam was found to have the following deficiencies:

1. Trees and woody vegetation on embankments. – In general, embankment dams should not have woody vegetation, especially large trees, because of the potential for a breach if they are toppled during a flood event and because their roots can form seepage paths. We consider the trees on the left abutment to be a serious deficiency because of these issues and because that embankment is relatively narrow. However, because of the large width of the right embankment, we do not consider trees on that structure to be a significant deficiency.
2. No riprap on the upstream slope of the left embankment. – There is no riprap on the upstream slope of the left embankment.
3. No Operation & Maintenance (O&M) Manual or Emergency Action Plan (EAP). – We understand that there is no O&M Manual or EAP; however, we note that an EAP is not required for a Significant Hazard potential dam, but can be useful.

The following table summarizes the operating and maintenance recommendations reported in the June 21, 2011 Phase I report and the status of those deficiencies.

<i>Previously Identified Recommendation</i>	<i>Resolution or Current Condition</i>
An operation and maintenance manual should be prepared for the dam.	There is still no operation and maintenance manual for the dam.
Remove trees and woody vegetation from the upstream slope of the right embankment and both upstream and downstream left embankments.	There are still trees and woody vegetation on the embankments.
Grade and seed sparsely vegetated (non-path areas at the right abutment).	The non-path areas are still not well vegetated.
Raise the grade of the right embankment to a uniform elevation at approximately 5 inches below the top of the right spillway/fishway training wall.	The right embankment grade is relatively level but not uniform and was probably not raised. This recommendation does not appear necessary because overtopping of the right embankment at its current level will probably not be a public safety threat.
Remove the wooden observation deck to make repairs to the left embankment.	The old deck was removed and reconstructed. It is not obvious that any repairs were made to the embankment underneath.
Place riprap on the upstream side of the left embankment	There is no riprap on the upstream side of the left embankment.

<i>Previously Identified Recommendation</i>	<i>Resolution or Current Condition</i>
Raise the crest of the left embankment to the same elevation as the right embankment.	It is unknown if the left embankment was raised. Details from the construction of the wooden observation deck should be reviewed.
Inspect the granite slabs and replace if necessary.	The granite slabs on the downstream slope of the left embankment appear to be in fair condition.
Replace the wooden observation deck following repairs.	The old deck was removed and reconstructed.

The following recommendations and remedial measures generally describe the recommended approach to address current deficiencies at the dam. Prior to undertaking recommended maintenance, repairs, or remedial measures, the applicability of environmental permits needs to be determined for activities that may occur within resource areas under the jurisdiction of local conservation commissions, MADEP, or other regulatory agencies.

3.2 Studies and Analyses

DCR may consider performing or contracting the following studies or analyses at their discretion; however, none of the listed studies are mandatory by regulation.

1. An Operations and Maintenance Manual, if one does not exist, should be prepared for the dam. The manual should include up to date drawings and manuals for all current structures and equipment.
2. An Emergency Action Plan (EAP) is always an asset to a dam owner and would be worthwhile but not mandatory for the dam. An EAP, if developed, should be prepared by a Registered Professional Engineer as defined in 302 CMR 10.03.

3.3 Recurrent Maintenance Recommendations

The activities presented below should be undertaken on a regular or yearly basis by the dam owner/caretaker to improve the safety, maintenance, and operation of the dam. Typically, these activities do not require engineering design.

1. Perform regular monitoring and inspection of the dam.
2. Remove woody vegetation from the left embankment on a regular basis.
3. Remove debris from the stop log channel and fishway as necessary. Because of the width of the spillway, debris need only be removed from the spillway if it appears that the debris forms a significant blockage and that rising floodwaters would not dislodge it.
4. Monitor the embankments for erosion caused by either water or recreational use. It is desirable to maintain a healthy vegetative cover (3 to 12 inches of grass) on the dam, but we recognize: (1) that establishing grass across the right embankment is not feasible because of the heavy recreational use of the park area, and (2) the overlying boardwalk shades the left embankment such that grass growth will be difficult. For this reason, we

recommend regular monitoring for erosion that could increase the potential for a breach during flood conditions.

3.4 Minor Repair Recommendations

We have no minor repair recommendations.

3.5 Remedial Modifications Recommendations

We recommend the following remedial modification:

1. Repair the left embankment by (a) removing trees and woody vegetation, (b) regrading the embankment to ensure a consistent profile and crest, and (c) placing riprap on the upstream side of the left embankment and possibly on other faces where grass cannot be grown because of the overlying boardwalk.

3.6 Alternatives

No alternatives have been considered for this dam.

3.7 Opinion of Probable Construction Costs

Studies, Analyses, Manuals:	\$10,000 - \$20,000
Maintenance, removal of trees and vegetation from slopes:	\$2,000 - \$5,000
Remedial modifications – left embankment repair	\$20,000 - \$30,000
Subtotal:	\$32,000 - \$55,000
10% Contingency:	\$3,200 - \$5,500

Total: \$35,200 - \$60,500

SECTION 4

4.0 LIMITATIONS

Our professional services for this project have been performed in accordance with generally accepted engineering practices; no other warranty, express or implied, is made. Limitations on our recommendations are contained in the attached “Important Information about your Geotechnical Engineering Report.”

Important Information about This Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a civil engineer may not fulfill the needs of a constructor — a construction contractor — or even another civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. No one except you should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you — should apply this report for any purpose or project except the one originally contemplated.*

Read the Full Report

Serious problems have occurred because those relying on a geotechnical-engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

Geotechnical Engineers Base Each Report on a Unique Set of Project-Specific Factors

Geotechnical engineers consider many unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk-management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical-engineering report that was:

- not prepared for you;
- not prepared for your project;
- not prepared for the specific site explored; or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical-engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an

assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical-engineering report is based on conditions that existed at the time the geotechnical engineer performed the study. *Do not rely on a geotechnical-engineering report whose adequacy may have been affected by:* the passage of time; man-made events, such as construction on or adjacent to the site; or natural events, such as floods, droughts, earthquakes, or groundwater fluctuations. *Contact the geotechnical engineer before applying this report to determine if it is still reliable.* A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ — sometimes significantly — from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide geotechnical-construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are Not Final

Do not overrely on the confirmation-dependent recommendations included in your report. *Confirmation-dependent recommendations are not final*, because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations *only* by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's confirmation-dependent recommendations if that engineer does not perform the geotechnical-construction observation required to confirm the recommendations' applicability.*

A Geotechnical-Engineering Report Is Subject to Misinterpretation

Other design-team members' misinterpretation of geotechnical-engineering reports has resulted in costly

problems. Confront that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Constructors can also misinterpret a geotechnical-engineering report. Confront that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing geotechnical construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical-engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make constructors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give constructors the complete geotechnical-engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise constructors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure constructors have sufficient time* to perform additional study. Only then might you be in a position to give constructors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and constructors fail to recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help

others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Environmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform an *environmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold-prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, many mold- prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical- engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; *none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.*

Rely, on Your GBC-Member Geotechnical Engineer for Additional Assistance

Membership in the Geotechnical Business Council of the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you GBC-Member geotechnical engineer for more information.



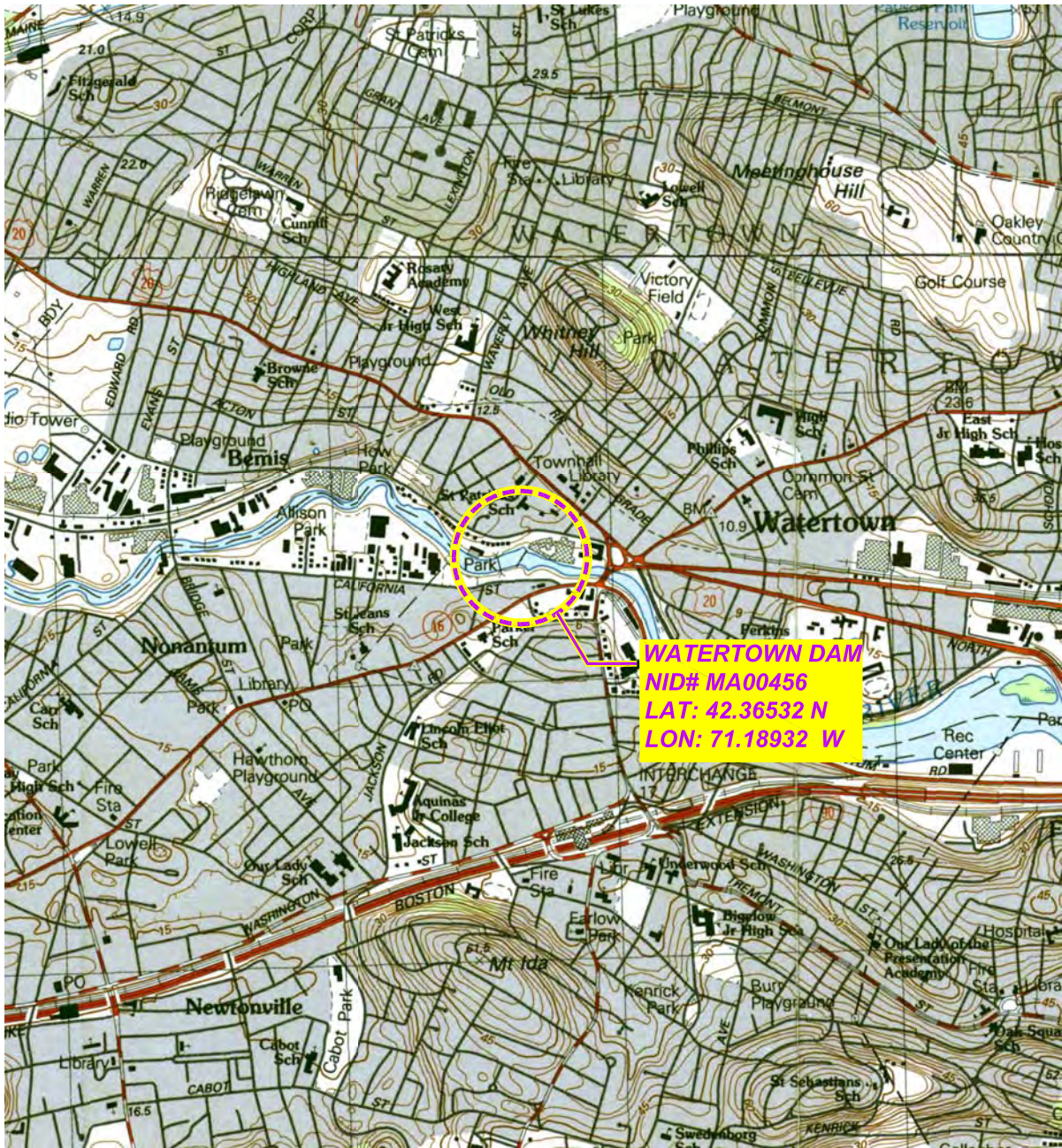
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FIGURES



This Image is based on scanned images of United States Geologic Survey (USGS) topographic maps, and is copyrighted by the National Geographic Society.



Watertown Dam
Watertown, Massachusetts

Mass Dept of Conservation and Recreation
Boston, Massachusetts



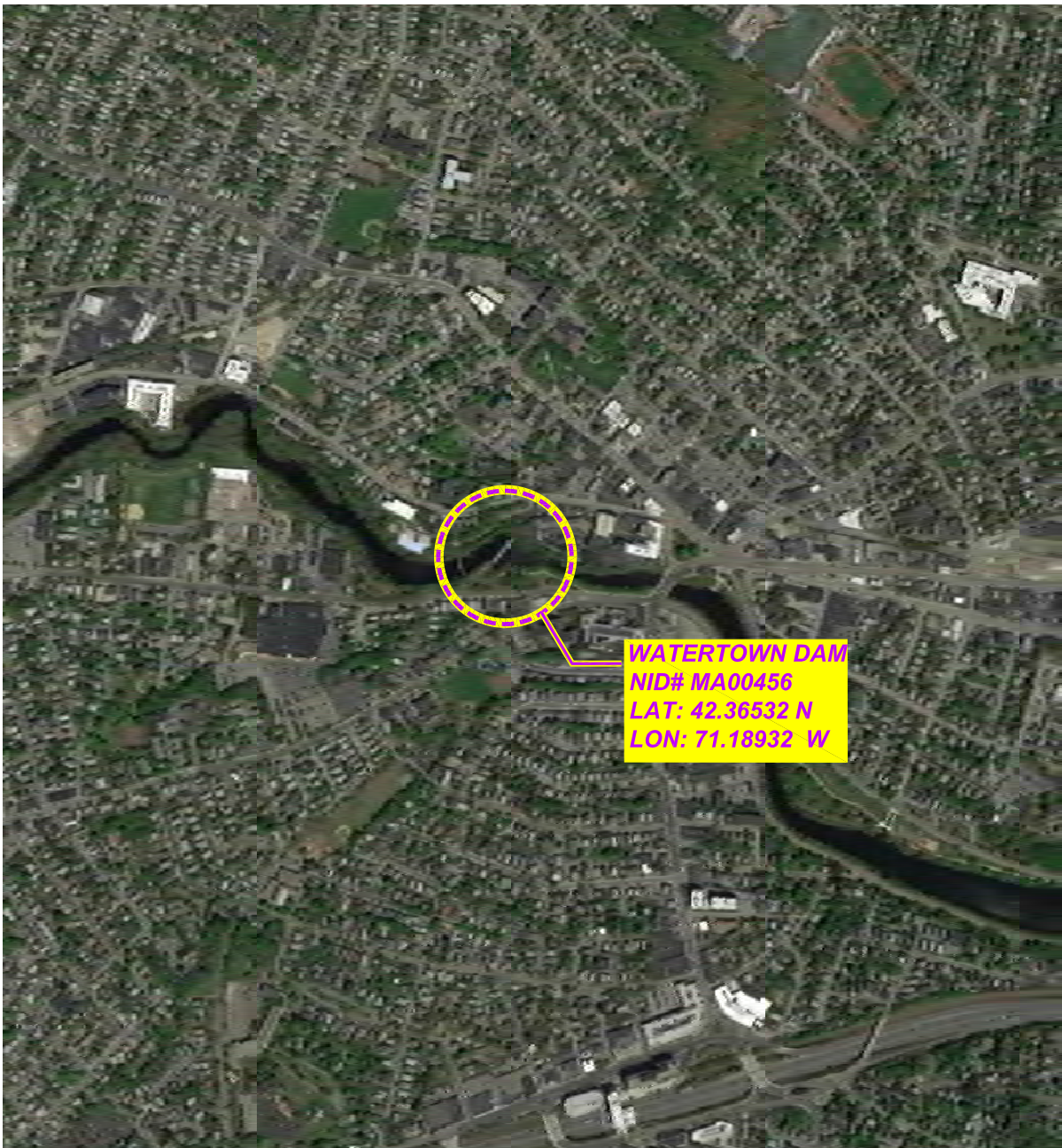
Project 1509030

SITE LOCUS MAP

August 2016

Fig. 1

B:\Working\DCR\1509030 Office of Dam Safety letters\Phase I Rpts\Watertown Dam\figures\Fig. 1 Proj Loc



This Image is based on images taken from Google Earth.



Watertown Dam
Watertown, Massachusetts

Mass Dept of Conservation and Recreation
Boston, Massachusetts



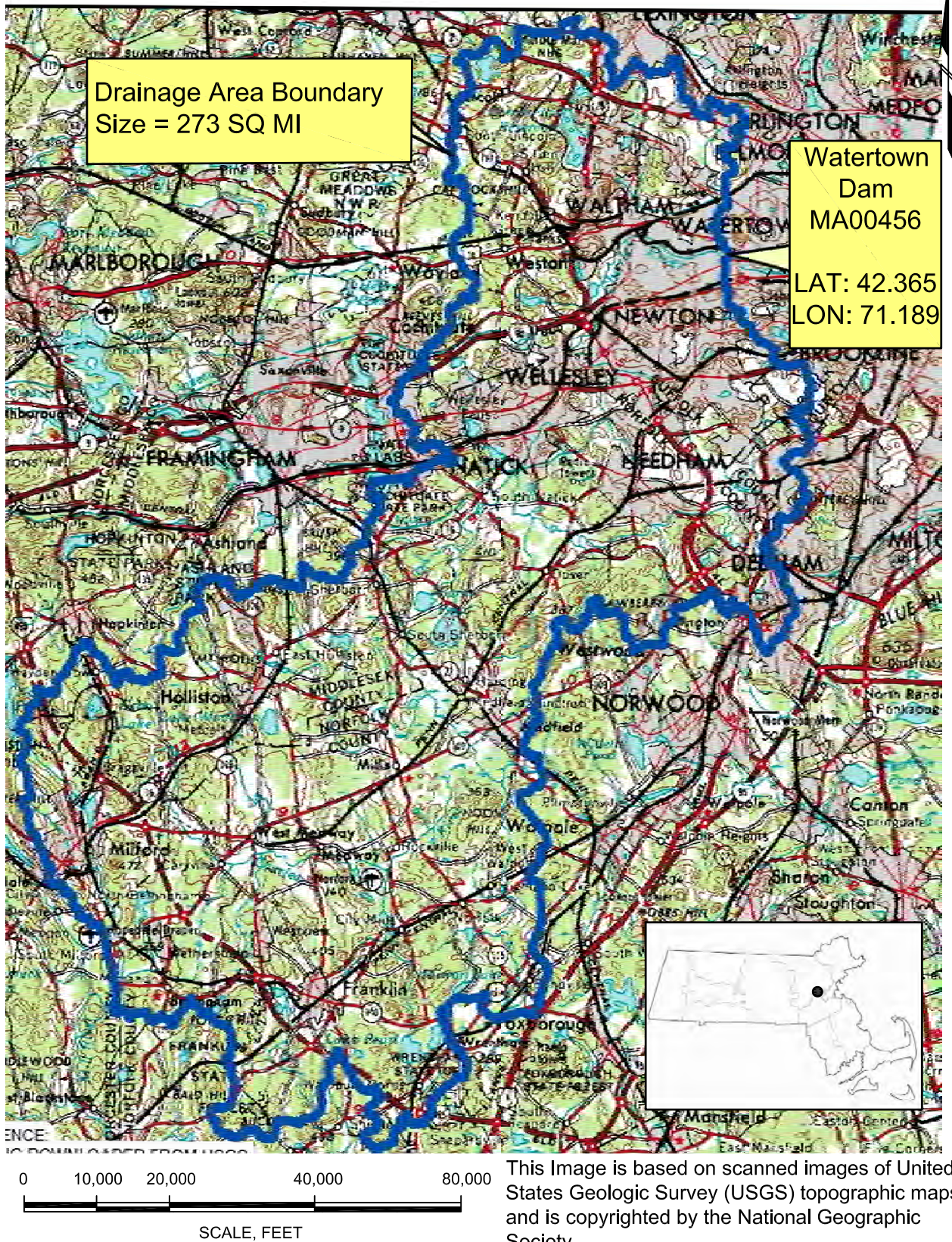
Project 1509030

AERIAL
PHOTOGRAPH

August 2016

Fig. 2

B:\Working\DCR\1509030 Office of Dam Safety letters\Phase I Rpts\Watertown Dam\figures\Fig. 1 Proj Loc



Watertown Dam
Watertown, Massachusetts

Mass Dept of Conservation and Recreation
Boston, Massachusetts

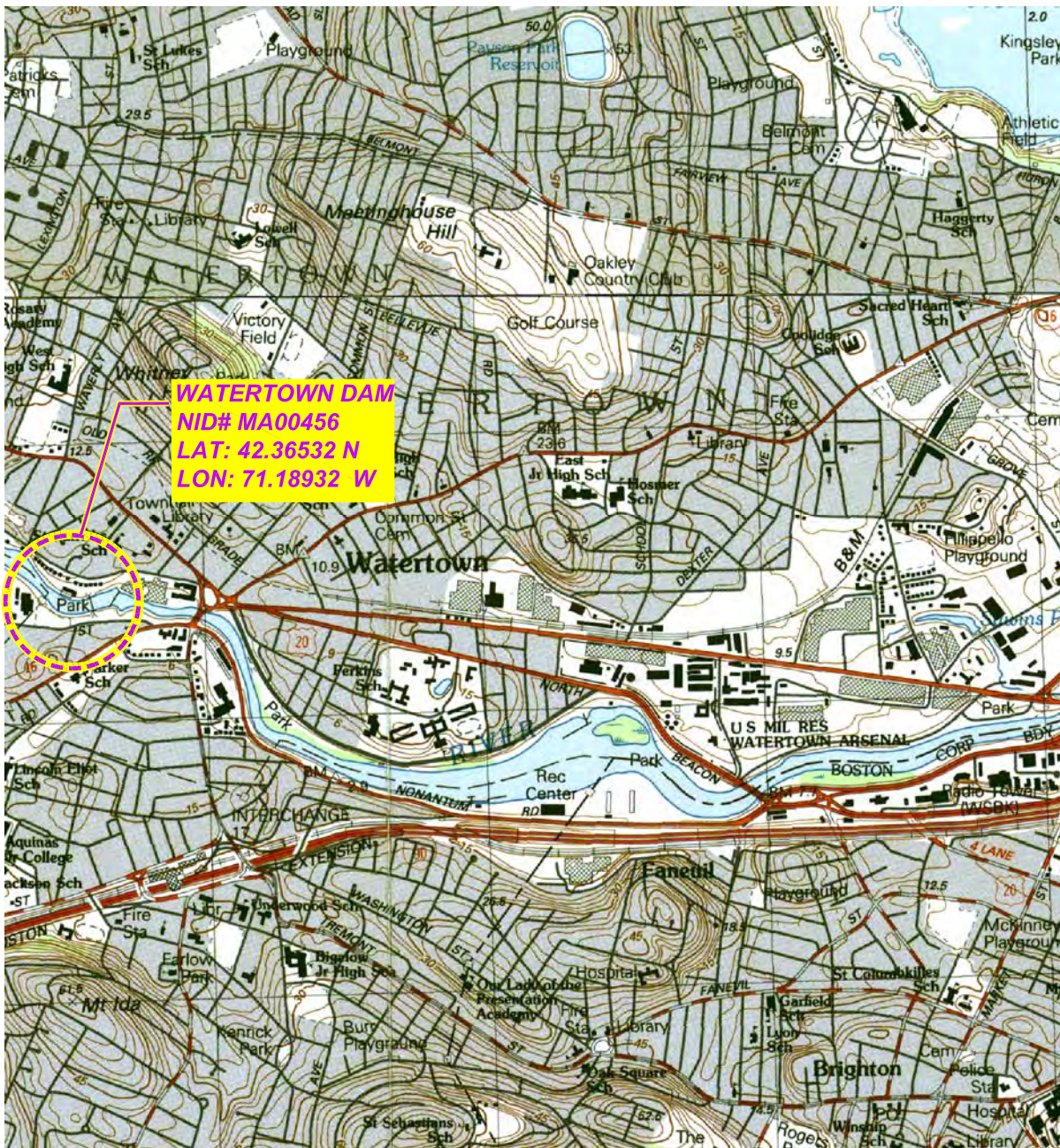


Project 1509030

DRAINAGE AREA

August 2016

Fig. 3



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Watertown Dam
Watertown, Massachusetts

Mass Dept of Conservation and Recreation
Boston, Massachusetts



Project 1509030

DOWNSTREAM
AREA

August 2016

Fig. 4

APPENDIX A
Photographs



LEGEND:

① PHOTO CAPTURE LOCATION

SOURCE:

1. PLAN BASED ON AERIAL MAP FROM GOOGLE EARTH.

Watertown Dam
Watertown, Massachusetts

Dept. of Conservation and Recreation
Boston Massachusetts



Project 1509030

PHOTO LOCATIONS

August 2016

Fig. A-1



Photo 1 – Dam weir and right bank from upstream footbridge*



Photo 2 – Dam weir and upstream end of fish ladder from upstream right riverbank*

*Note: Distortions and color or light irregularities in panoramic composite photos are due to discontinuities between individual photographic images used to create panoramic composites.



Photo 3 – Left abutment, spillway weir, and upstream channel from upstream left riverbank*



Photo 4 – Spillway weir / dam crest from left abutment walkway*



Photo 5 – Sluice / stop log gate and spillway weir / dam crest from right abutment fish ladder platform *



Photo 6 – Right abutment, fish ladder, sluice / stop log gate, and spillway / dam from downstream right riverbank*



Photo 7 – Dam / spillway from downstream left riverbank*



Photo 8 – Right abutment, looking toward the river*

APPENDIX B
Inspection Checklist

DAM SAFETY INSPECTION CHECKLIST INSTRUCTION PAGE

The checklist (Excel file) includes sections applicable to a variety of dam structure types. Carefully follow the instructions on the first tab of the checklist. Complete those pages pertaining to each structure and omit pages that are not relevant or mark them “Not Applicable.” The Checklist must be signed by the inspecting engineer and a clean, neat copy included in the final inspection report. Use the checklist to generate the Dam Evaluation Summary Detail Sheet (should immediately follow the Executive Summary) and Table 1.1 (should immediately follow Section 1.0).

E1: DESIGN METHODOLOGY

1. Unknown Design – no design records available
2. No design or post-design analyses
3. No analyses, but dam features appear suitable
4. Design or post-design analyses show dam meets most criteria
5. State of the art design – design records available & dam meets all criteria

E2: LEVEL OF MAINTENANCE

1. Dam in disrepair, no evidence of maintenance, no O&M manual
2. Dam in poor level of upkeep, very little maintenance, no O&M manual
3. Dam in fair level of upkeep, some maintenance and standard procedures
4. Adequate level of maintenance and standard procedures
5. Dam well maintained, detailed maintenance plan that is executed

E3: EMERGENCY ACTION PLAN

1. No plan or idea of what to do in the event of an emergency
2. Some idea but no written plan
3. No formal plan but well thought out
4. Available written plan that needs updating
5. Detailed, updated written plan available, filed with MADCR, annual training

E4: EMBANKMENT SEEPAGE (Embankment, Foundation & Abutments)

1. Severe piping and/or seepage with no monitoring
2. Evidence of monitored piping and seepage
3. No piping but monitored seepage
4. Minor seepage or high volumes of seepage with filtered collection
5. No seepage or minor seepage with filtered collection

E5: EMBANKMENT CONDITION (see Note 1)

1. Severe erosion and/or large trees
2. Significant erosion or significant woody vegetation
3. Brush and exposed embankment soils, or moderate erosion
4. Unmaintained grass, rodent activity and maintainable erosion
5. Well maintained, healthy uniform grass cover

E6: CONCRETE CONDITION (see Note 2)

1. Major cracks, misalignment, discontinuities causing leaks, seepage or stability concerns
2. Cracks with misalignment inclusive of transverse cracks with no misalignment but with potential for significant structural degradation
3. Significant longitudinal cracking and minor transverse cracking
4. Spalling and minor surface cracking
5. No apparent deficiencies

E7: LOW-LEVEL OUTLET DISCHARGE CAPACITY

1. No low-level outlet, no provisions (e.g., pumps, siphons) for emptying pond
2. No operable outlet, plans for emptying pond, but no equipment
3. Outlet with insufficient drawdown capacity, pumping equipment available
4. Operable gate with sufficient drawdown capacity
5. Operable gate with capacity greater than necessary

E8: LOW-LEVEL OUTLET PHYSICAL CONDITION

1. Outlet inoperative needs replacement, non-existent or inaccessible
2. Outlet inoperative needs repair
3. Outlet operable but needs repair
4. Outlet operable but needs maintenance
5. Outlet and operator operable and well maintained

E9: SPILLWAY DESIGN FLOOD CAPACITY

1. 0 - 50% of the SDF or unknown
2. 51- 90% of the SDF
3. 91- 100% of the SDF
4. >100% of the SDF with actions required by caretaker (e.g., open outlet)
5. >100% of the SDF with no actions required by caretaker

E10: OVERALL PHYSICAL CONDITION OF THE DAM

1. *UNSAFE* – Major structural, operational, and maintenance deficiencies exist under normal operating conditions
2. *POOR* - Significant structural, operation and maintenance deficiencies are clearly recognized for normal loading conditions
3. *FAIR* - Significant operational and maintenance deficiencies, no structural deficiencies. Potential deficiencies exist under unusual loading conditions that may realistically occur. Can be used when uncertainties exist as to critical parameters
4. *SATISFACTORY* - Minor operational and maintenance deficiencies. Infrequent hydrologic events would probably result in deficiencies.
5. *GOOD* - No existing or potential deficiencies recognized. Safe performance is expected under all loading including SDF

E11: ESTIMATED REPAIR COST

Estimation of the total cost to address all identified structural, operational, maintenance deficiencies. Cost shall be developed utilizing standard estimating guides and procedures

Guidelines and Notes for Evaluations

Each of the evaluation categories has 5 rating levels. In general, the rating levels in each category are intended to reflect the following conditions:

1. Unsafe
2. Poor
3. Fair
4. Satisfactory
5. Good

E10-Overall Safety Rating Guideline

Unless the inspecting engineer presents compelling data, analyses, and observations that justify a higher rating, E10-Overall Safety Rating of the Dam shall not be higher than the lowest ranking in these high importance categories:

- E4-Seepage,
- E5-Embankment Condition (for embankment dams), and
- E6-Concrete Condition (for dams where concrete structures retain water).

Note 1 - Embankment Condition Factor of Safety Criteria

In addition to the inspection conditions listed, the embankment condition rating should consider the slope stability Factor of Safety (FS) according to the following guidelines for downstream (D/S) and upstream slopes (U/S).

	Normal Pool	SDF	Seismic	Rapid Drawdown
Rating	D/S & U/S FS	D/S FS	D/S & U/S FS	U/S FS
1	<1.3	<1.1	<1.0	<1.0
2	<1.5	<1.4	<1.0	<1.1
3	>1.5	<1.5	<1.1	<1.2
4	>1.5	>1.5	>1.1	>1.2
5	>1.5	>1.5	>1.1	>1.2

In the absence of stability analyses, use the following factors to evaluate the stability component of the embankment rating. The inspecting engineer will need to consider all factors in combination as the exact combination of conditions listed will rarely occur. For slopes, > indicates “steeper than.”

Rating	Slopes	Seepage	Material	Compaction
1	>2H:1V	>5' above toe	SP, ML*, SM*	Loose or unknown
2	>2.5H:1V	>2' above toe	ML**, MH	Loose or unknown
3	>3H:1V	at toe	SM**, SW, CH	Likely compacted
4	<3H:1V	DS of toe	SC, CL	Compacted
5	<3H:1V	None	Suitably Zoned	Compacted

ML* - Non-plastic silt or any silt or clay susceptible to dispersion

ML** - Silt with some plasticity (non-dispersive)

SM* - Uniform silty fine sand

SM** - Widely graded silty sand

Note 2 - Concrete Condition Factor of Safety Criteria

In addition to the inspection conditions listed, ratings should consider the sliding stability Factors of Safety (FS) for any concrete structures that retain water according to the following guidelines.

FS Criteria for Dams with Limited Structure and Foundation Information and Testing

Rating	Normal Pool FS	SDF FS	Ice Loading FS	Seismic FS
1	<2.0	<1.3	<1.3	<1.0
2	<3.0	<2.0	<2.0	<1.3
3	>3.0	>2.0	>2.0	<1.5
4	>3.0	>2.0	>2.0	>1.5
5	>3.0	>2.0	>2.0	>1.5

FS Criteria for Dams with Well Defined Structure and Foundation Information and Testing

Rating	Normal Pool FS	SDF FS	Ice Loading FS	Seismic FS
1	<1.5	<1.3	<1.3	<1.0
2	<2.0	<1.7	<1.7	<1.0
3	<3.0	<2.0	<2.0	<1.1
4	>3.0	>2.0	>2.0	<1.3
5	>3.0	>2.0	>2.0	>1.3

See Appendix D for a complete listing of dam orientation and terminology definitions.

Upstream – Shall mean the side of the dam that borders the impoundment.

Downstream – Shall mean the high side of the dam, the side opposite the upstream side.

Right – Shall mean the area to the right when looking in the downstream direction.

Left – Shall mean the area to the left when looking in the downstream direction.

Height of Dam – Shall mean the vertical distance from the lowest portion of the natural ground, including any stream channel, along the downstream toe of the dam to the crest of the dam.

Embankment – Shall mean the fill material, usually earth or rock, placed with sloping sides, such that it forms a permanent barrier that impounds water.

Crest – Shall mean the top of the dam, usually provides a road or path across the dam.

Abutment – Shall mean that part of a valley side against which a dam is constructed. An artificial abutment is sometimes constructed as a concrete gravity section, to take the thrust of an arch dam where there is no suitable natural abutment.

Appurtenant Works – Shall mean structures, either in dams or separate therefrom, including but not be limited to, spillways; reservoirs and their rims; low-level outlet works; and water conduits including tunnels, pipelines, or penstocks, either through the dams or their abutments.

Spillway – Shall mean a structure over or through which water flows are discharged. If the flow is controlled by gates or boards, it is a controlled spillway; if the fixed elevation of the spillway crest controls the level of the impoundment, it is an uncontrolled spillway.

DAM SAFETY INSPECTION CHECKLIST

NAME OF DAM: <u>Watertown Dam</u>	STATE ID #: <u>4-9-314-1</u>
REGISTERED: ☒ YES ☐ NO	NID ID #: <u>MA00456</u>
STATE SIZE CLASSIFICATION: <u>Small</u>	STATE HAZARD CLASSIFICATION: <u>Significant</u>
	CHANGE IN HAZARD CLASSIFICATION REQUESTED?: <u>No</u>
<u>DAM LOCATION INFORMATION</u>	
CITY/TOWN: <u>Watertown</u>	COUNTY: <u>Middlesex</u>
DAM LOCATION: <u>California Street, Watertown</u> (street address if known)	ALTERNATE DAM NAME: <u>Charles River Dam</u>
USGS QUAD.: <u>Newton, Lexington</u>	LAT.: <u>42.36532</u> LONG.: <u>-71.18932</u>
DRAINAGE BASIN: <u>Charles</u>	RIVER: <u>Charles River</u>
IMPOUNDMENT NAME(S): <u>Charles River</u>	
<u>GENERAL DAM INFORMATION</u>	
TYPE OF DAM: <u>Earth Embankment</u>	OVERALL LENGTH (FT): <u>220</u>
PURPOSE OF DAM: <u>Recreation</u>	NORMAL POOL STORAGE (ACRE-FT): <u>20</u>
YEAR BUILT: <u>Unknown</u>	MAXIMUM POOL STORAGE (ACRE-FT): <u>30</u>
STRUCTURAL HEIGHT (FT): <u>10</u>	EL. NORMAL POOL (FT): <u>8.7</u>
HYDRAULIC HEIGHT (FT): <u>6</u>	EL. MAXIMUM POOL (FT): <u>13</u>
<u>FOR INTERNAL MADCR USE ONLY</u>	
FOLLOW-UP INSPECTION REQUIRED: ☐ YES ☐ NO	CONDITIONAL LETTER: ☐ YES ☐ NO

NAME OF DAM: <u>Watertown Dam</u>		STATE ID #: <u>4-9-314-1</u>	
INSPECTION DATE: <u>June 28, 2016</u>		NID ID #: <u>MA00456</u>	
<u>INSPECTION SUMMARY</u>			
DATE OF INSPECTION: <u>June 28, 2016</u>		DATE OF PREVIOUS INSPECTION: <u>June 21, 2011</u>	
TEMPERATURE/WEATHER: <u>71°F, overcast with light rain</u>		ARMY CORPS PHASE I: ☐ YES ☒ NO If YES, date _____	
CONSULTANT: <u>GEI Consultants, Inc.</u>		PREVIOUS DCR PHASE I: ☒ YES ☐ NO If YES, date <u>June 24, 2011</u>	
BENCHMARK/DATUM: <u>Assumed from 2011 Phase I Inspection, NGVD29</u>			
OVERALL PHYSICAL CONDITION OF DAM: <u>POOR</u> DATE OF LAST REHABILITATION: <u>1966. left abutment observation deck in 2016.</u>			
SPILLWAY CAPACITY: <u>>100% SDF w/actions by Caretaker</u>			
EL. POOL DURING INSP.: <u>8.8</u>		EL. TAILWATER DURING INSP.: <u>4</u>	
<u>PERSONS PRESENT AT INSPECTION</u>			
<u>NAME</u>	<u>TITLE/POSITION</u>	<u>REPRESENTING</u>	
<u>Lee Wooten, P.E.</u>	<u>Principal</u>	<u>GEI Consultants, Inc.</u>	
<u>Matthew Farren, P.E.</u>	<u>Project Engineer</u>	<u>GEI Consultants, Inc.</u>	
<u>Hugh Thigpen</u>	<u>Maintenance</u>	<u>Department of Conservation and Recreation</u>	
<u>Joe Parz</u>	<u>Maintenance</u>	<u>Department of Conservation and Recreation</u>	
<u>EVALUATION INFORMATION</u>			
Click on box to select E-code		Click on box to select E-code	
E1) TYPE OF DESIGN	<u>3</u>	E8) LOW-LEVEL OUTLET CONDITION	<u>1</u>
E2) LEVEL OF MAINTENANCE	<u>3</u>	E9) SPILLWAY DESIGN FLOOD CAPACITY	<u>4</u>
E3) EMERGENCY ACTION PLAN	<u>1</u>	E10) OVERALL PHYSICAL CONDITION	<u>2</u>
E4) EMBANKMENT SEEPAGE	<u>5</u>	E11) ESTIMATED REPAIR COST	<u>\$ 28,600 - \$ 45,100</u>
E5) EMBANKMENT CONDITION	<u>2</u>	ROADWAY OVER CREST	<u>NO</u>
E6) CONCRETE CONDITION	<u>4</u>	BRIDGE NEAR DAM	<u>NO</u>
E7) LOW-LEVEL OUTLET CAPACITY	<u>3</u>		
NAME OF INSPECTING ENGINEER: <u>Lee Wooten, P.E.</u>		SIGNATURE: <u>Lee Wooten</u>	

NAME OF DAM: <u>Watertown Dam</u>		STATE ID #: <u>4-9-314-1</u>	
INSPECTION DATE: <u>June 28, 2016</u>		NID ID #: <u>MA00456</u>	
OWNER: ORGANIZATION	<u>Commonwealth of MA - DCR</u>	CARETAKER: ORGANIZATION	<u>Mass DCR - Flood Control Operations</u>
NAME/TITLE	<u>William Salomaa</u>	NAME/TITLE	<u>William Gode von-Aesh</u>
STREET	<u>251 Causeway Street-Suite 600</u>	STREET	<u>251 Causeway St</u>
TOWN, STATE, ZIP	<u>Boston, MA 02114</u>	TOWN, STATE, ZIP	<u>Boston, Ma</u>
PHONE	<u>617-626-1410</u>	PHONE	<u>617-727-0488 x200</u>
EMERGENCY PH. #	<u>617-626-1410</u>	EMERGENCY PH. #	<u>617-828-1629</u>
FAX	<u>617-626-1349</u>	FAX	<u>617-523-1793</u>
EMAIL		EMAIL	
OWNER TYPE	<u>DCR - State Parks</u>		
PRIMARY SPILLWAY TYPE		<u>Concrete Ogee</u>	
SPILLWAY LENGTH (FT)	<u>182</u>	SPILLWAY CAPACITY (CFS)	<u>4,370</u>
AUXILIARY SPILLWAY TYPE	<u>NA</u>	AUX. SPILLWAY CAPACITY (CFS)	<u>NA</u>
NUMBER OF OUTLETS	<u>1</u>	OUTLET(S) CAPACITY (CFS)	<u>250</u>
TYPE OF OUTLETS	<u>Weir with Stop Logs</u>	TOTAL DISCHARGE CAPACITY (CFS)	<u>4,620</u>
DRAINAGE AREA (SQ MI)	<u>273</u>	SPILLWAY DESIGN FLOOD (PERIOD/CFS)	<u>100 yr./4,600</u>
HAS DAM BEEN BREACHED OR OVERTOPPED		☐ YES ☐ NO IF YES, PROVIDE DATE(S) <u>Not known if or when dam has overtopped.</u>	
FISH LADDER (LIST TYPE IF PRESENT)		<u>N/A</u>	
DOES CREST SUPPORT PUBLIC ROAD?		IF YES, ROAD NAME: _____	
☐ YES ☒ NO			
PUBLIC BRIDGE WITHIN 50' OF DAM?		IF YES, ROAD/BRIDGE NAME: _____	
☐ YES ☒ NO		MHD BRIDGE NO. (IF APPLICABLE) _____	

NAME OF DAM: <u>Watertown Dam</u>		STATE ID #: <u>4-9-314-1</u>			
INSPECTION DATE: <u>June 28, 2016</u>		NID ID #: <u>MA00456</u>			
EMBANKMENT (CREST)					
AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
CREST	1. SURFACE TYPE	Earth	X		
	2. SURFACE CRACKING	None Observed	X		
	3. SINKHOLES, ANIMAL BURROWS	None Observed	X		
	4. VERTICAL ALIGNMENT (DEPRESSIONS)	Satisfactory	X		
	5. HORIZONTAL ALIGNMENT	Satisfactory	X		
	6. RUTS AND/OR PUDDLES	Satisfactory	X		
	7. VEGETATION (PRESENCE/CONDITION)	Varied - left covered by wooden platform walkway; right varied vegetation cover.		X	X
	8. ABUTMENT CONTACT	Good	X		
ADDITIONAL COMMENTS: <u>The left embankment crest is covered by the wooden platform walkway and could not be inspected. Because the walkway limits the ability to grow a protective grass cover, we recommend that the crest be regraded and covered with erosion protection.</u> <u>The right embankment has bare ground, trees, and grass cover. Because of the width of the right embankment, erosion is not a concern.</u>					

NAME OF DAM: Watertown Dam

STATE ID #: 4-9-314-1

INSPECTION DATE: June 28, 2016

NID ID #: MA00456

EMBANKMENT (D/S SLOPE)

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
D/S SLOPE	1. WET AREAS (NO FLOW)	None Observed	X		
	2. SEEPAGE	None Observed	X		
	3. SLIDE, SLOUGH, SCARP	None Observed	X		
	4. EMB.-ABUTMENT CONTACT	Good	X		
	5. SINKHOLE/ANIMAL BURROWS	None Observed	X		
	6. EROSION	None Observed	X		
	7. UNUSUAL MOVEMENT	None Observed	X		
	8. VEGETATION (PRESENCE/CONDITION)	Varied - Left - paving stones; Right - trees, masonry steps, storm sewer	X		

ADDITIONAL COMMENTS:

NAME OF DAM: <u>Watertown Dam</u>		STATE ID #: <u>4-9-314-1</u>			
INSPECTION DATE: <u>June 28, 2016</u>		NID ID #: <u>MA00456</u>			
EMBANKMENT (U/S SLOPE)					
AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
U/S SLOPE	1. SLIDE, SLOUGH, SCARP	None Observed	X		
	2. SLOPE PROTECTION TYPE AND COND.	None Observed	X		
	3. SINKHOLE/ANIMAL BURROWS	None Observed	X		
	4. EMB.-ABUTMENT CONTACT	Good	X		
	5. EROSION	None Observed	X		
	6. UNUSUAL MOVEMENT	None Observed	X		
	7. VEGETATION (PRESENCE/CONDITION)	Left: Trees, Right: Trees (Embankment is wide enough at right side, where this is not an issue)			X
ADDITIONAL COMMENTS: The trees and vegetation need to be removed from the left embankment. Rip rap should be added to the left embankment upstream side.					

NAME OF DAM: Watertown Dam

STATE ID #: 4-9-314-1

INSPECTION DATE: June 28, 2016

NID ID #: MA00456

INSTRUMENTATION

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
INSTR.	1. PIEZOMETERS	None			
	2. OBSERVATION WELLS	None			
	3. STAFF GAGE AND RECORDER	None			
	4. WEIRS	None			
	5. INCLINOMETERS	None			
	6. SURVEY MONUMENTS	None			
	7. DRAINS	None			
	8. FREQUENCY OF READINGS	None			
	9. LOCATION OF READINGS	None			

ADDITIONAL COMMENTS:

NAME OF DAM: Watertown Dam

STATE ID #: 4-9-314-1

INSPECTION DATE: June 28, 2016

NID ID #: MA00456

DOWNSTREAM MASONRY WALLS

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
D/S WALLS	1. WALL TYPE	N/A			
	2. WALL ALIGNMENT				
	3. WALL CONDITION				
	4. HEIGHT: TOP OF WALL TO MUDLINE	min: max: avg:			
	5. SEEPAGE OR LEAKAGE				
	6. ABUTMENT CONTACT				
	7. EROSION/SINKHOLES BEHIND WALL				
	8. ANIMAL BURROWS				
	9. UNUSUAL MOVEMENT				
	10. WET AREAS AT TOE OF WALL				

ADDITIONAL COMMENTS:

NAME OF DAM: <u>Watertown Dam</u>		STATE ID #: <u>4-9-314-1</u>			
INSPECTION DATE: <u>June 28, 2016</u>		NID ID #: <u>MA00456</u>			
UPSTREAM MASONRY WALLS					
AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
U/S WALLS	1. WALL TYPE	N/A			
	2. WALL ALIGNMENT				
	3. WALL CONDITION				
	4. HEIGHT: TOP OF WALL TO MUDLINE	min: max: avg:			
	5. ABUTMENT CONTACT				
	6. EROSION/SINKHOLES BEHIND WALL				
	7. ANIMAL BURROWS				
	8. UNUSUAL MOVEMENT				
ADDITIONAL COMMENTS: _____ _____ _____ _____					

NAME OF DAM: Watertown DamSTATE ID #: 4-9-314-1INSPECTION DATE: June 28, 2016NID ID #: MA00456**DOWNSTREAM AREA**

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
D/S AREA	1. ABUTMENT LEAKAGE	None Observed			
	2. FOUNDATION SEEPAGE	None Observed			
	3. SLIDE, SLOUGH, SCARP	None Observed			
	4. WEIRS	NA			
	5. DRAINAGE SYSTEM	NA			
	6. INSTRUMENTATION	NA			
	7. VEGETATION	River bank is thickly vegetated. Inland is developed.			
	8. ACCESSIBILITY	By foot or boat.			
	9. DOWNSTREAM HAZARD DESCRIPTION	Galen St Bridge ~1,000 ft downstream. Buildings ~25 ft inland from the left embankment. Urban development along banks of the Charles River			
	10. DATE OF LAST EAP UPDATE	N/A			

ADDITIONAL COMMENTS:

NAME OF DAM: <u>Watertown Dam</u>		STATE ID #: <u>4-9-314-1</u>
INSPECTION DATE: <u>June 28, 2016</u>		NID ID #: <u>MA00456</u>
MISCELLANEOUS		
AREA INSPECTED	CONDITION	OBSERVATIONS
MISC.	1. RESERVOIR DEPTH (AVG)	Unkown
	2. RESERVOIR SHORELINE	Wooded
	3. RESERVOIR SLOPES	Moderate to Steep
	4. ACCESS ROADS	Paved roads inland and gravel access paths by river bank that are wide enough for car access.
	5. SECURITY DEVICES	
	6. VANDALISM OR TRESPASS	☐ YES ☒ NO WHAT: N/A
	7. AVAILABILITY OF PLANS	☐ YES ☒ NO DATE: N/A
	8. AVAILABILITY OF DESIGN CALCS	☐ YES ☒ NO DATE: N/A
	9. AVAILABILITY OF EAP/LAST UPDATE	☐ YES ☒ NO DATE: N/A
	10. AVAILABILITY OF O&M MANUAL	☐ YES ☒ NO DATE: N/A
	11. CARETAKER/OWNER AVAILABLE	☒ YES ☐ NO DATE: 6/28/2016
	12. CONFINED SPACE ENTRY REQUIRED	☐ YES ☒ NO PURPOSE: N/A
ADDITIONAL COMMENTS: _____ _____ _____ _____ _____		

NAME OF DAM: <u>Watertown Dam</u>		STATE ID #: <u>4-9-314-1</u>			
INSPECTION DATE: <u>June 28, 2016</u>		NID ID #: <u>MA00456</u>			
PRIMARY SPILLWAY					
AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
SPILLWAY	SPILLWAY TYPE	Broad Crest	X		
	WEIR TYPE	Concrete Ogee	X		
	SPILLWAY CONDITION	Satisfactory	X		
	TRAINING WALLS	Concrete Satisfactory Condition	X		
	SPILLWAY CONTROLS AND CONDITION	None Observed*	X		
	UNUSUAL MOVEMENT	None Observed*	X		
	APPROACH AREA	Clear	X		
	DISCHARGE AREA	Rocky river channel, stable.	X		
	DEBRIS	A few logs at base of spillway.	X		
	WATER LEVEL AT TIME OF INSPECTION	Approx. 1 inch above dam crest (assumed ~El. 8.8)	X		
ADDITIONAL COMMENTS: <u>* A short section of the spillway consists of a stop log channel that could increase the spillway capacity or provide flow in a drought condition.</u> 					

NAME OF DAM: <u>Watertown Dam</u>		STATE ID #: <u>4-9-314-1</u>			
INSPECTION DATE: <u>June 28, 2016</u>		NID ID #: <u>MA00456</u>			
AUXILIARY SPILLWAY					
AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
SPILLWAY	SPILLWAY TYPE	N/A			
	WEIR TYPE				
	SPILLWAY CONDITION				
	TRAINING WALLS				
	SPILLWAY CONTROLS AND CONDITION				
	UNUSUAL MOVEMENT				
	APPROACH AREA				
	DISCHARGE AREA				
	DEBRIS				
	WATER LEVEL AT TIME OF INSPECTION				
ADDITIONAL COMMENTS: _____ _____ _____ _____					

NAME OF DAM: <u>Watertown Dam</u>		STATE ID #: <u>4-9-314-1</u>			
INSPECTION DATE: <u>June 28, 2016</u>		NID ID #: <u>MA00456</u>			
OUTLET WORKS					
AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
OUTLET WORKS	TYPE	Stop log weir on right end of spillway	X		
	INTAKE STRUCTURE	Weir	X		
	TRASHRACK	None	X		
	PRIMARY CLOSURE	Stoplogs	X		
	SECONDARY CLOSURE	None	X		
	CONDUIT	Open channel	X		
	OUTLET STRUCTURE/HEADWALL	None	X		
	EROSION ALONG TOE OF DAM	None observed	X		
	SEEPAGE/LEAKAGE	Leakage between stoplogs as expected	X		
	DEBRIS/BLOCKAGE	None observed	X		
	UNUSUAL MOVEMENT	None observed	X		
	DOWNSTREAM AREA	Clear	X		
	MISCELLANEOUS				
ADDITIONAL COMMENTS: _____ _____ _____ _____ _____					

NAME OF DAM: <u>Watertown Dam</u>		STATE ID #: <u>4-9-314-1</u>			
INSPECTION DATE: <u>June 28, 2016</u>		NID ID #: <u>MA00456</u>			
CONCRETE/MASONRY DAMS					
AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
GENERAL	TYPE	See comments on primary spillway			
	AVAILABILITY OF PLANS				
	AVAILABILITY OF DESIGN CALCS				
	PIEZOMETERS				
	OBSERVATION WELLS				
	INCLINOMETERS				
	SEEPAGE GALLERY				
	UNUSUAL MOVEMENT				
ADDITIONAL COMMENTS: _____ _____ _____ _____					

NAME OF DAM: <u>Watertown Dam</u>		STATE ID #: <u>4-9-314-1</u>	
INSPECTION DATE: <u>June 28, 2016</u>		NID ID #: <u>MA00456</u>	
CONCRETE/MASONRY DAMS (CREST)			
AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION MONITOR REPAIR
CREST	TYPE	See comments on primary spillway	
	SURFACE CONDITIONS		
	CONDITIONS OF JOINTS		
	UNUSUAL MOVEMENT		
	HORIZONTAL ALIGNMENT		
	VERTICAL ALIGNMENT		
ADDITIONAL COMMENTS: <u>NA</u> 			

NAME OF DAM: <u>Watertown Dam</u>		STATE ID #: <u>4-9-314-1</u>	
INSPECTION DATE: <u>June 28, 2016</u>		NID ID #: <u>MA00456</u>	
CONCRETE/MASONRY DAMS (DOWNSTREAM FACE)			
AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION MONITOR REPAIR
D/S FACE	TYPE	See comments on primary spillway	
	SURFACE CONDITIONS		
	CONDITIONS OF JOINTS		
	UNUSUAL MOVEMENT		
	ABUTMENT CONTACT		
	LEAKAGE		
ADDITIONAL COMMENTS: _____ _____ _____ _____			

NAME OF DAM: <u>Watertown Dam</u>		STATE ID #: <u>4-9-314-1</u>	
INSPECTION DATE: <u>June 28, 2016</u>		NID ID #: <u>MA00456</u>	
CONCRETE/MASONRY DAMS (UPSTREAM FACE)			
AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION MONITOR REPAIR
U/S FACE	TYPE	See comments on primary spillway	
	SURFACE CONDITIONS		
	CONDITIONS OF JOINTS		
	UNUSUAL MOVEMENT		
	ABUTMENT CONTACTS		
ADDITIONAL COMMENTS: _____ _____ _____ _____			

APPENDIX C
Previous Reports and References

PREVIOUS REPORTS AND REFERENCES

The following is a list of reports that were located during the file review, or were referenced in previous reports.

Commonwealth of Massachusetts, Department of Conservation and Recreation (DCR) (2005). "Dam Safety," 302 CMR 10.00, November 4.

Federal Emergency Management Agency, "Flood Insurance Study, Middlesex County, Massachusetts (All Jurisidictions), July 6, 2016.

Fuss & O'Neill, Inc., "Watertown Dam Phase I Inspection / Evaluation Report," June 21, 2011.

Wandle, S. William, "Estimating Peak Discharges of Small Rural Stream in Massachusetts, USGS Water Supply Paper 2214," 1983.

Weston & Sampson, "Watertown Dam, Inspection/Evaluation Report," May 23, 2006

APPENDIX D

Definitions

COMMON DAM SAFETY DEFINITIONS

For a comprehensive list of dam engineering terminology and definitions refer to 302 CMR10.00 Dam Safety, or other reference published by FERC, Dept. of the Interior Bureau of Reclamation, or FEMA. Please note should discrepancies between definitions exist, those definitions included within 302 CMR 10.00 govern for dams located within the Commonwealth of Massachusetts.

Orientation

Upstream – Shall mean the side of the dam that borders the impoundment.

Downstream – Shall mean the high side of the dam, the side opposite the upstream side.

Right – Shall mean the area to the right when looking in the downstream direction.

Left – Shall mean the area to the left when looking in the downstream direction.

Dam Components

Dam – Shall mean any artificial barrier, including appurtenant works, which impounds or diverts water.

Embankment – Shall mean the fill material, usually earth or rock, placed with sloping sides, such that it forms a permanent barrier that impounds water.

Crest – Shall mean the top of the dam, usually provides a road or path across the dam.

Abutment – Shall mean that part of a valley side against which a dam is constructed. An artificial abutment is sometimes constructed as a concrete gravity section, to take the thrust of an arch dam where there is no suitable natural abutment.

Appurtenant Works – Shall mean structures, either in dams or separate therefrom, including but not be limited to, spillways; reservoirs and their rims; low-level outlet works; and water conduits including tunnels, pipelines, or penstocks, either through the dams or their abutments.

Spillway – Shall mean a structure over or through which water flows are discharged. If the flow is controlled by gates or boards, it is a controlled spillway; if the fixed elevation of the spillway crest controls the level of the impoundment, it is an uncontrolled spillway.

Size Classification

(as listed in Commonwealth of Massachusetts, 302 CMR 10.00 *Dam Safety*)

Large – structure with a height greater than 40 feet or a storage capacity greater than 1,000 acre-feet.

Intermediate – structure with a height between 15 and 40 feet or a storage capacity of 50 to 1,000 acre-feet.

Small – structure with a height between 6 and 15 feet and a storage capacity of 15 to 50 acre-feet.

Non-Jurisdictional – structure less than 6 feet in height or having a storage capacity of less than 15 acre-feet.

Hazard Classification

(as listed in Commonwealth of Massachusetts, 302 CMR 10.00 *Dam Safety*)

High Hazard (Class I) – Shall mean dams located where failure will likely cause loss of life and serious damage to home(s), industrial or commercial facilities, important public utilities, main highway(s) or railroad(s).

Significant Hazard (Class II) – Shall mean dams located where failure may cause loss of life and damage to home(s), industrial or commercial facilities, secondary highway(s) or railroad(s), or cause the interruption of the use or service of relatively important facilities.

Low Hazard (Class III) – Dams located where failure may cause minimal property damage to others. Loss of life is not expected.

General

EAP – Emergency Action Plan – Shall mean a predetermined (and properly documented) plan of action to be taken to reduce the potential for property damage and/or loss of life in an area affected by an impending dam failure.

O&M Manual – Operations and Maintenance Manual; Document identifying routine maintenance and operational procedures under normal and storm conditions.

Normal Pool – Shall mean the elevation of the impoundment during normal operating conditions.

Acre-foot – Shall mean a unit of volumetric measure that would cover one acre to a depth of one foot. It is equal to 43,560 cubic feet. One million U.S. gallons = 3.068 acre feet.

Height of Dam (Structural Height) – Shall mean the vertical distance from the lowest portion of the natural ground, including any stream channel, along the downstream toe of the dam to the lowest point on the crest of the dam.

Hydraulic Height – means the height to which water rises behind a dam and the difference between the lowest point in the original streambed at the axis of the dam and the maximum controllable water surface.

Maximum Water Storage Elevation – means the maximum elevation of water surface which can be contained by the dam without overtopping the embankment section.

Spillway Design Flood (SDF) – Shall mean the flood used in the design of a dam and its appurtenant works particularly for sizing the spillway and outlet works, and for determining maximum temporary storage and height of dam requirements.

Maximum Storage Capacity – The volume of water contained in the impoundment at maximum water storage elevation.

Normal Storage Capacity – The volume of water contained in the impoundment at normal water storage elevation.

Condition Rating

Unsafe – Major structural*, operational, and maintenance deficiencies exist under normal operating conditions.

Poor – Significant structural*, operation and maintenance deficiencies are clearly recognized for normal loading conditions.

Fair – Significant operational and maintenance deficiencies, no structural deficiencies. Potential deficiencies exist under unusual loading conditions that may realistically occur. Can be used when uncertainties exist as to critical parameters.

Satisfactory – Minor operational and maintenance deficiencies. Infrequent hydrologic events would probably result in deficiencies.

Good – No existing or potential deficiencies recognized. Safe performance is expected under all loading including SDF.

* Structural deficiencies include but are not limited to the following:

- Excessive uncontrolled seepage (e.g., upwelling of water, evidence of fines movement, flowing water, erosion, etc.)
- Missing riprap with resulting erosion of slope
- Sinkholes, particularly behind retaining walls and above outlet pipes, possibly indicating loss of soil due to piping, rather than animal burrows
- Excessive vegetation and tree growth, particularly if it obscures features of the dam and the dam cannot be fully inspected
- Deterioration of concrete structures (e.g., exposed rebar, tilted walls, large cracks with or without seepage, excessive spalling, etc.)
- Inoperable outlets (gates and valves that have not been operated for many years or are broken)

WATERTOWN DAM

Follow-Up

INSPECTION / EVALUATION REPORT



Dam Name: **Watertown Dam**
State Dam ID#: **4-9-314-1**
NID ID#: **MA 00456**
Owner: **Commonwealth of Massachusetts DCR**
Town: **Watertown, Massachusetts**
Consultant: **GZA GeoEnvironmental, Inc.**
Date of Inspection: **March 13, 2017**





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June 23, 2017
GZA File No. 01.0018802.47

William Salomaa, Director
Department of Conservation and Recreation
Office of Dam Safety
251 Causeway Street, Suite 800
Boston, MA 02114-2104

Re: Follow-Up Inspection/Evaluation Report
Watertown Dam, Watertown
NID # MA00456
Middlesex County

Dear Mr. Salomaa:

In accordance with your request, GZA has completed our follow-up inspection of the Watertown Dam, located in Watertown, Massachusetts. The visual follow-up inspection was performed under GZA's current task order agreement with the Department of Conservation and Recreation (DCR) from RFR No. DCR 395 and the Notice to Proceed (Assignment No. 3) dated January 13, 2017. The results and recommendations contained herein are subject to the Limitations attached as **Appendix A**. This follow-up inspection report is intended to corroborate the observations made during previous inspections and to document changes since the last inspection.

This follow-up inspection was completed on March 13, 2017. The most recent Phase I inspection of the dam was performed on June 28, 2016.

The condition of the dam was listed as "poor" in the most recent Phase I inspection "because of the trees on the left embankment, which could damage the integrity of the narrow embankment were they to topple." During our March 13, 2017 site visit, GZA observed that the trees on the left embankment had been cut. Therefore, although other deficiencies remain, GZA recommends the condition of the dam be upgraded to a rating of **FAIR**.

We are happy to have been able to assist you with this inspection and appreciate the opportunity to continue to provide the DCR with dam engineering consulting services. Please contact the undersigned if you have any questions or comments regarding this report.

Sincerely,
GZA GeoEnvironmental, Inc.

Chad W. Cox, P.E.
Principal-in-Charge

Matthew Taylor, P.E.
Consultant/Reviewer



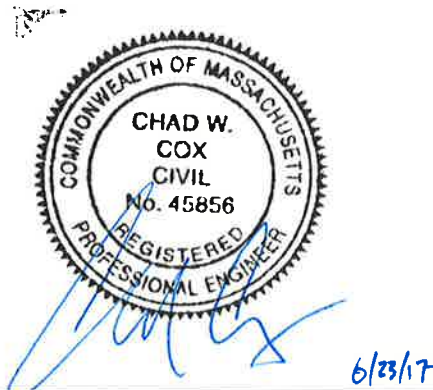
PREFACE

The assessment of the general condition of the dam is based upon available data and visual inspections. This follow-up inspection report is intended to corroborate the observations made during previous inspections and document changes since the last inspection. Detailed investigations and analyses involving topographic mapping, subsurface investigations, testing and detailed computational evaluations are beyond the scope of this report.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection, along with data available to the inspection team. In cases where an impoundment is lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions, which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is critical to note that the condition of the dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection, can there be any chance that unsafe conditions be detected.

Prepared by:
GZA GeoEnvironmental, Inc.



Chad W. Cox, P.E.
Massachusetts License No.: 45865
Principal
GZA GeoEnvironmental, Inc



**Commonwealth of Massachusetts
Department of Conservation and Recreation
Office of Dam Safety Follow-up Inspection Form**

Dam Name: Watertown Dam
Dam Owner: Commonwealth of Massachusetts DCR
Nat. ID Number: MA00456
Hazard Potential: Significant
Size Classification: Small
Structural Height (feet): 10
Hydraulic Height (feet): 6
Location of Dam (town): Watertown
Coordinate location (lat, long): 42° 21' 55.37"N, 71° 11' 21.25"W
Date of Inspection: May 13, 2017
Weather: Sunny, Mid 30s° Fahrenheit
State of Impoundment: Approx. 0.5 feet over spillway crest

Consultant Inspector(s): GZA GeoEnvironmental, Inc. – Chad W. Cox, P.E

Others in Attendance at Field Inspection: None

Attachments:

Figure 1:	Locus Map
Figure 2A:	Site Sketch
Figure 2B:	Site Sketch with Photo Locations
Appendix A:	Limitations
Appendix B:	Updated Photographs

I. Previous Inspection Date/Overall Condition:

- **Date of most recent formal Phase I Inspection Report:** June 28, 2016 (GEI)
- **Date of most recent formal Follow-Up Inspection Form:** None
- **List the overall condition reported in most recent Phase I Inspection Report:** POOR

II. Previous Inspection Deficiencies:

- **List identified deficiencies in the most recent Phase I Inspection Report:** (2016 by GEI)
 - **Trees and woody vegetation on embankments.** In general, embankment dams should not have woody vegetation, especially large trees, because of the potential for a breach if they are toppled during a flood event and because their roots can form seepage paths. We consider the trees on the left abutment to be a serious deficiency because of these issues and because that embankment is relatively narrow. However, because of the large width of the right embankment, we do not consider trees on that structure to be a significant deficiency.
 - **No riprap on the upstream slope of the left embankment.** There is no riprap on the upstream slope of the left embankment.
 - **No Operation & Maintenance (O&M) Manual or Emergency Action Plan (EAP).** We understand that there is no O&M Manual or EAP; however, we note that an EAP is [currently] not required for a Significant Hazard potential hazard dam, but can be useful.



Several other conditions were listed as having carried over from the June 21, 2011 Phase I inspection:

- Non-path areas of the right abutment are not well vegetated.
- The right embankment grade is relatively level but not uniform.
- Unclear as to condition and elevation of top of left embankment below deck.
- No riprap on the upstream side of the left embankment.

III. Overall Condition of Dam at the Time of the Current Follow-up Inspection:

a. State the current condition: FAIR

b. Have conditions changed since the previous inspection? Yes. The 2016 Phase I indicated a condition rating of Poor “because of the trees on the left embankment, which could damage the integrity of the narrow embankment were they to topple.” These trees, on upstream and downstream slopes, were observed to have been cut down with the stumps left close to flush to grade. The cutting of the trees on the left embankment justifies, in GZA’s opinion, an upgrade of the overall condition rating to Fair.

IV. Comparison of Current Conditions to Condition Listed in Previous Phase I Inspection Report:

a. Have any of the deficiencies listed in the previous Phase I Inspection Report worsened? No

b. If yes, list the changes. As noted above, removal of trees on the left embankment constitutes an improvement to a previously noted deficiency.

c. Are there any additional deficiencies that have been identified in the current inspection? Yes
If yes, list the deficiencies and describe.

- Stumps remain in upstream and downstream slopes of left embankment after trees have been removed. Remaining stumps represent a long-term problem as they and associated root systems begin to decay.
- The right riverbank upstream of the fish ladder structure is raised to form an embankment which acts essentially as a levee to address the potential for flow around the low area immediately adjacent to the fish ladder structure at the right abutment. This area was observed to be an active construction site during the follow-up inspection in 2017, presumably associated with the replacement of the Joseph Thompson Footbridge over the Charles River. The footbridge was found to have been removed. Ground cover vegetation on the right side upstream of the fish ladder was observed to have been cleared, but major trees in the area and vegetation along the immediate river bank (inboard face of “levee” embankment) remained.
- Multiple flow “fishtails” at downstream apron indicating some potential irregularities, potentially debris or protruding riprap.
- Heavy bank erosion on the shoreline which projects into the channel immediately downstream of the fish ladder structure.
- Minor spalling of vertical concrete joint at upstream corner of left training wall.

V. Dam Safety Orders: List dam safety orders that have been issued to the dam owner pertaining to this dam. None known.



VI. Maintenance:

- 1. Indicate if there exists an operation and maintenance plan for the dam.** No operation and maintenance manual is known to exist for the dam. DCR Navigation and Flood Control is responsible for the dam.
- 2. Indicate if it appears the dam is being maintained.** Yes. Removal of the trees on the left abutment demonstrates maintenance being performed on dam.

VII. Recommendations:

The 2016 Phase I Inspection Report contains the following recommendations:

- An Operations and Maintenance Manual, if one does not exist, should be prepared for the dam. The manual should include up-to-date [as built] drawings and manuals for all current structures and equipment.
- An Emergency Action Plan (EAP) is always an asset to a dam owner and would be worthwhile but not mandatory for the dam [at the time of the 2016 Phase I]. An EAP, if developed, should be prepared by a Registered Professional Engineer as defined in 302 CMR 10.03.
- Perform regular monitoring and inspection of the dam.
- Remove woody vegetation from the left embankment on a regular basis.
- Remove debris from the stop log channel and fishway as necessary. Because of the width of the spillway, debris need only be removed from the spillway if it appears that the debris forms a significant blockage and that rising floodwaters would not dislodge it.
- Monitor the embankments for erosion caused by either water or recreational use. It is desirable to maintain a healthy vegetative cover (3 to 12 inches of grass) on the dam, but we recognize (1) that establishing grass across the right embankment is not feasible because of the heavy recreational use of the park area and (2) the overlying boardwalk shades the left embankment such that grass growth will be difficult. For this reason, we recommend regular monitoring for erosion that could increase the potential for a breach during flood conditions.
- Repair the left embankment by (a) removing trees and woody vegetation [essentially completed as of March 2017], (b) regrading the embankment to ensure a consistent profile and crest, and (c) placing riprap on the upstream side of the left embankment and possibly on other faces where grass cannot be grown because of the overlying boardwalk.

GZA further suggests:

- Stumps remaining in the left embankment may be treated to reduce speed of decay, but ultimately these stumps should be removed along with associated major root systems. Voids left after removal of stumps and roots should be filled with appropriate compacted fill.
- Monitor condition of trees and vegetation on right side embankment “levee.” Remove inappropriate vegetation to the extent allowed, prevent additional trees from establishing, remove trees which appear to be at risk of toppling or show signs of unhealthiness.
- Monitor condition of riverbank immediately downstream of the fish ladder structure and stop log bay and assess erosion. In the event that erosion is judged to be unacceptable, repair bank and provide for erosion protection via riprap or other “hard” or “soft” materials.
- Observe “fishtail” flow areas at spillway apron during periods of low flow to ascertain reason for irregularities.
- Consideration should be given to safety issues such as the need to possibly add signage / boating safety measures upstream of the dam.



VIII. Other Comments or Observations:

GZA suggests that the DCR coordinate its efforts regarding the replacement of the upstream footbridge to verify that by design and in the final as-built condition, the interface between the two structures is appropriate, specifically on the right river bank between the bridge and dam. In this area, it is important that the top elevation of the levee be maintained and no flow paths for flow around the right abutment be created.

IX. Updated Site Sketch with Photo Locations: Attached

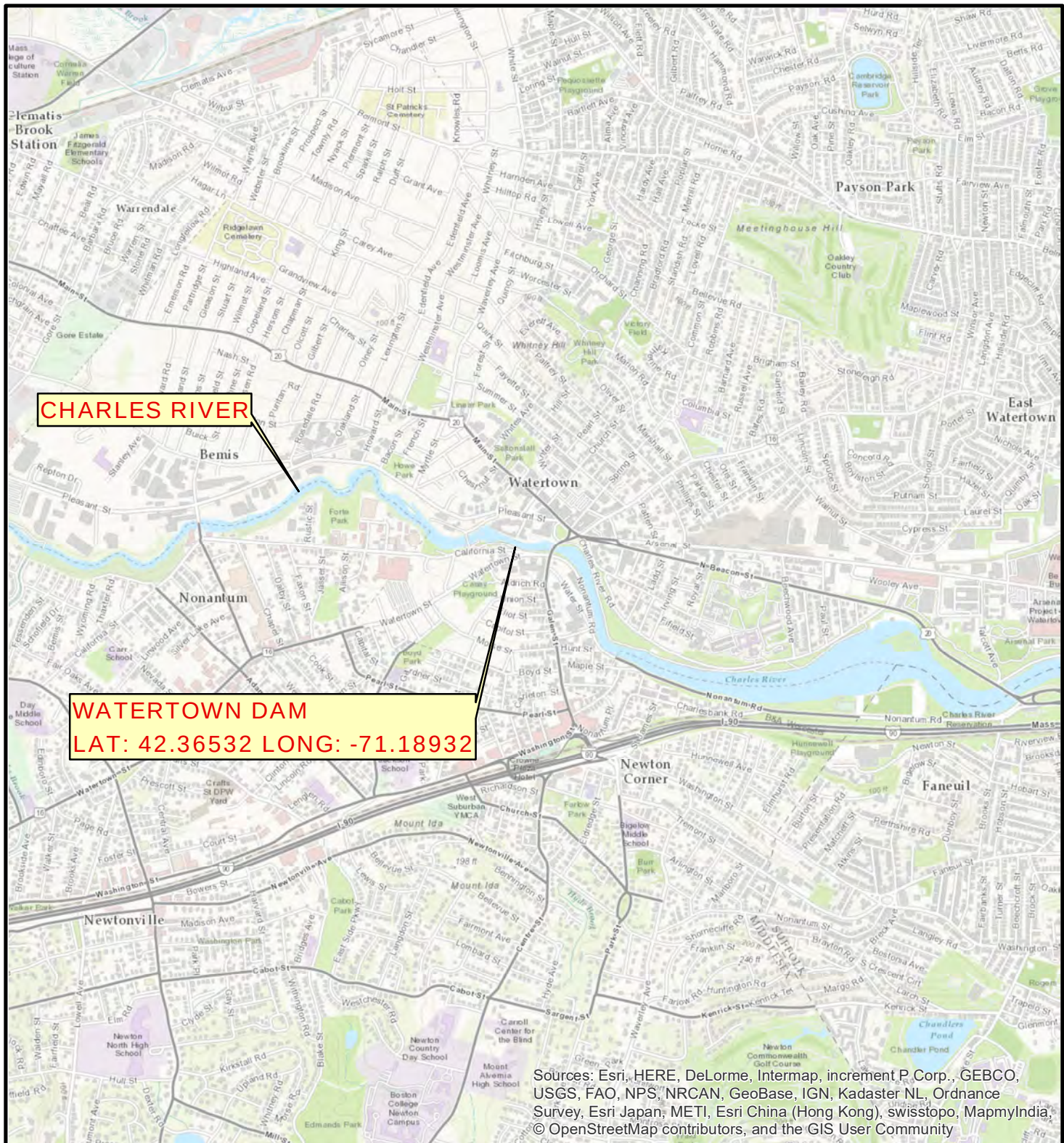
X. Updated Photos: Attached

XI. Locus Map: Attached

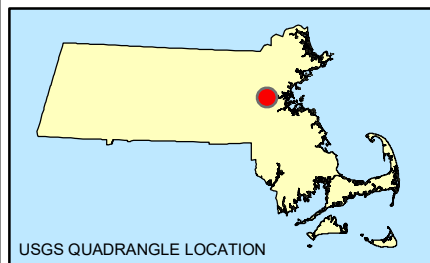
XII. Other applicable attachments: Preface and GZA Limitations



FIGURES



Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swiss topo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community



0 1,000 2,000 4,000 6,000 Feet



Data Supplied by :



PROJ. MGR.: DJS
DESIGNED BY: SMH
REVIEWED BY: DJS
OPERATOR: SMH
DATE: 06-22-2017

SITE LOCATION MAP WATERTOWN DAM CITY OF WATERTOWN WATERTOWN, MASSACHUSETTS

JOB NO.
18802.44

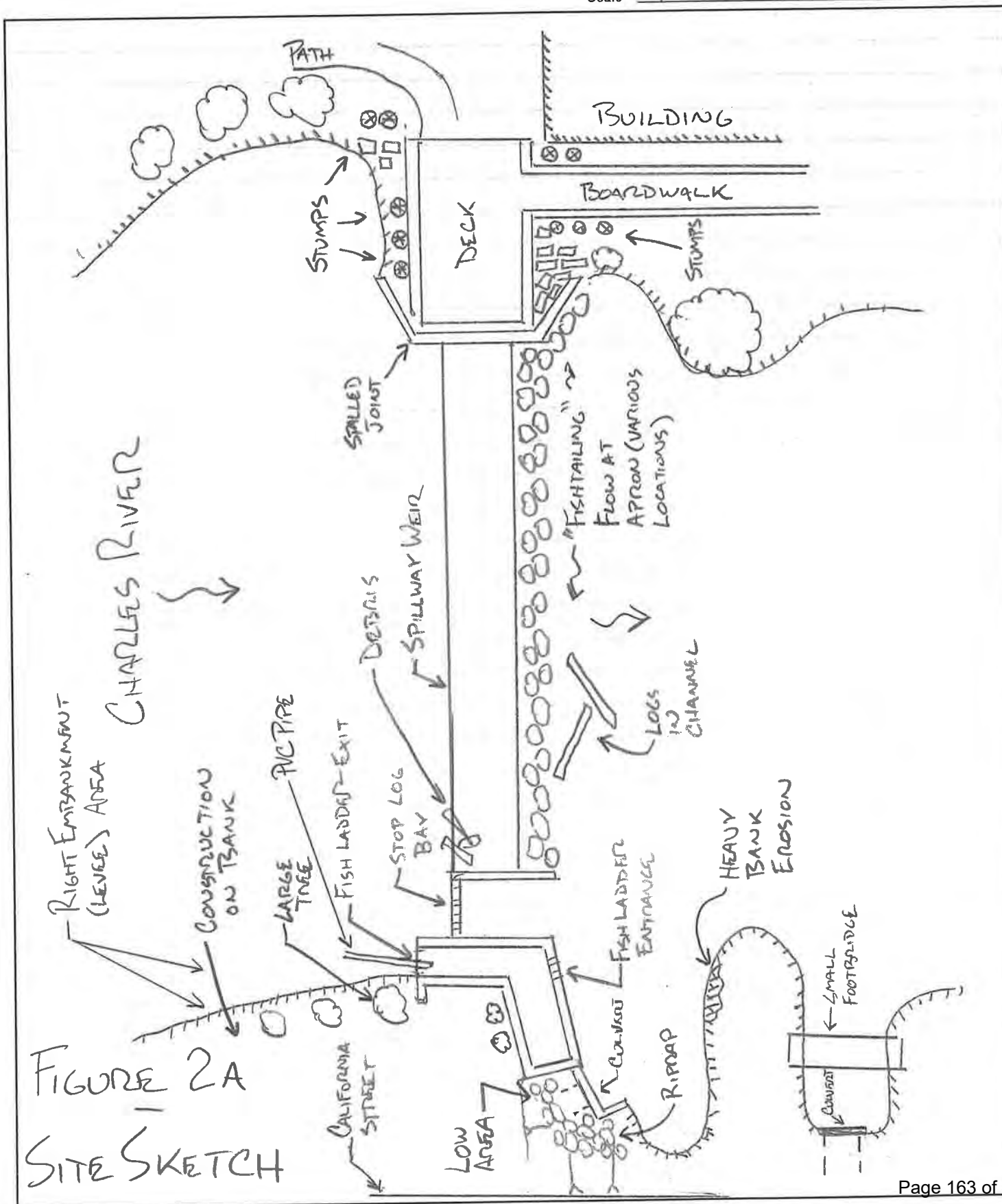
FIGURE NO.
1



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<http://www.gza.com>

Engineers and
Scientists

JOB WATERTOWN DAM
SHEET NO _____ OF _____
Calculated By C Cox Date 03/13/17
Checked By _____ Date _____
Scale NOT TO SCALE





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Engineers and
Scientists

JOB WATERTOWN DAM
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Scale NOT TO SCALE

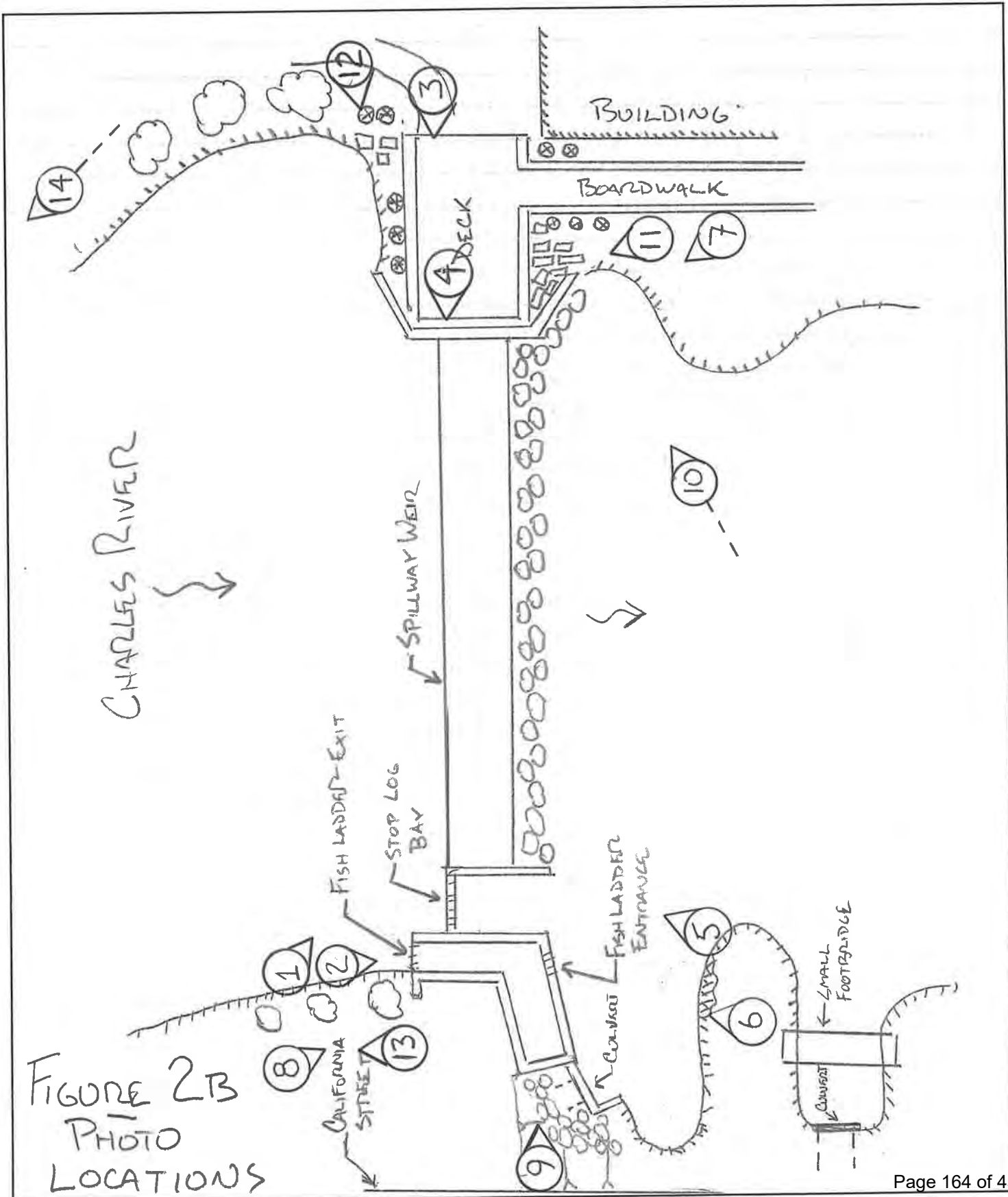


FIGURE 2B
PHOTO
LOCATIONS



APPENDIX A

LIMITATIONS



DAM ENGINEERING REPORT LIMITATIONS

Use of Report

1. GeoEnvironmental, Inc. (GZA) prepared this report on behalf of, and for the exclusive use of the Department of Conservation and Recreation (Client) for the stated purpose(s) and location(s) identified in the Report. Use of this report, in whole or in part, at other locations, or for other purposes, may lead to inappropriate conclusions; and we do not accept any responsibility for the consequences of such use(s). Further, reliance by any party not identified in the agreement, for any use, without our prior written permission, shall be at that party's sole risk, and without any liability to GZA.

Standard of Care

2. Our findings and conclusions are based on the work conducted as part of the Scope of Services set forth in the Report and/or proposal, and reflect our professional judgment. These findings and conclusions must be considered not as scientific or engineering certainties, but rather as our professional opinions concerning the limited data gathered during the course of our work. Conditions other than described in this report may be found at the subject location(s).
3. Our services were performed using the degree of skill and care ordinarily exercised by qualified professionals performing the same type of services at the same time, under similar conditions, at the same or a similar property. No warranty, expressed or implied, is made.

Subsurface Conditions

4. If presented, the generalized soil profile(s) and description, along with the conclusions and recommendations provided in our Report, are based in part on widely spaced subsurface explorations by GZA and/or others, with a limited number of soil and/or rock samples and groundwater /piezometers data and are intended only to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized, and were based on our assessment of subsurface conditions. The composition of strata, and the transitions between strata, may be more variable and more complex than indicated. For more specific information on soil conditions at a specific location refer to the exploration logs. The nature and extent of variations between these explorations may not become evident until further exploration or construction. If variations or other latent conditions then appear evident, it will be necessary to reevaluate the conclusions and recommendations of this report.
5. Water level readings have been made in test holes (as described in the Report), monitoring wells and piezometers, at the specified times and under the stated conditions. These data have been reviewed and interpretations have been made in this Report. Fluctuations in the groundwater and piezometer levels, however, occur due to temporal or spatial variations in areal recharge rates, soil heterogeneities, reservoir and tailwater levels, the presence of subsurface utilities, and/or natural or artificially induced perturbations.

General

6. The observations described in this report were made under the conditions stated therein. The conclusions presented were based solely upon the services described therein, and not on scientific tasks or procedures beyond the scope of described services or the time and budgetary constraints imposed by the Client.
7. In preparing this report, GZA relied on certain information provided by the Client, state and local officials, and other parties referenced therein available to GZA at the time of the evaluation. GZA did not attempt to independently verify the accuracy or completeness of all information reviewed or received during the course of this evaluation.



8. Any GZA hydrologic analysis presented herein is for the rainfall volumes and distributions stated herein. For storm conditions other than those analyzed, the response of the site's spillway, impoundment, and drainage network has not been evaluated.
9. Observations were made of the site and of structures on the site as indicated within the report. Where access to portions of the structure or site, or to structures on the site was unavailable or limited, GZA renders no opinion as to the condition of that portion of the site or structure. In particular, it is noted that water levels in the impoundment and elsewhere and/or flow over the spillway may have limited GZA's ability to make observations of underwater portions of the structure. Excessive vegetation, when present, also inhibits observations.
10. In reviewing this Report, it should be realized that the reported condition of the dam is based on observations of field conditions during the course of this study along with data made available to GZA. It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued inspection and care, can there be any chance that unsafe conditions be detected.

Compliance with Codes and Regulations

11. We used reasonable care in identifying and interpreting applicable codes and regulations. These codes and regulations are subject to various, and possibly contradictory, interpretations. Compliance with codes and regulations by other parties is beyond our control.
12. This scope of work does not include an assessment of the need for fences, gates, no-trespassing signs, repairs to existing fences and railings and other items, which may be needed to minimize trespass and provide greater security for the facility and safety to the public. An evaluation of the project for compliance with OSHA rules and regulations is also excluded.

Cost Estimates

13. Unless otherwise stated, our cost estimates are for comparative, or general planning purposes. These estimates may involve approximate quantity evaluations and may not be sufficiently accurate to develop construction bids, or to predict the actual cost of work addressed in this Report. Further, since we have no control over the labor and material costs required to plan and execute the anticipated work, our estimates were made using our experience and readily available information. Actual costs may vary over time and could be significantly more, or less, than stated in the Report.

Additional Services

14. It is recommended that GZA be retained to provide services during any future: site observations, explorations, evaluations, design, implementation activities, construction and/or implementation of remedial measures recommended in this Report. This will allow us the opportunity to: i) observe conditions and compliance with our design concepts and opinions; ii) allow for changes in the event that conditions are other than anticipated; iii) provide modifications to our design; and iv) assess the consequences of changes in technologies and/or regulations.



APPENDIX B
PHOTOGRAPHS



Photo 1. Dam / spillway weir and fish ladder exit from right abutment.



Photo 2. Fish ladder exit (upstream end) at right abutment.



Photo 3. Overview of left embankment and u/s slope from abutment.



Photo 4. Spillway weir from platform on left embankment.



Photo 5. Fish ladder entrance and stop log bay on right side.



Photo 6. Downstream face of fish ladder structure and culvert discharge.



Photo 7. Dam / spillway weir from downstream left bank.



Photo 8. Upstream "levee" on right bank.



Photo 9. Right Abutment with adjacent low area and u/s "levee".



Photo 10. Downstream face of left embankment.



Photo 11. Downstream slope of left embankment.



Photo 12. Upstream slope of left embankment / abutment (note stumps).



Photo 13. Right upstream embankment “levee” (note construction).



Photo 13. Construction sign for the upstream bridge replacement project.

APPENDIX C

EMERGENCY ACTION PLAN

EMERGENCY ACTION PLAN

for

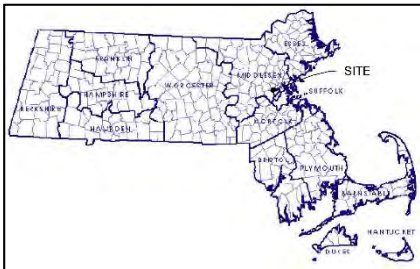
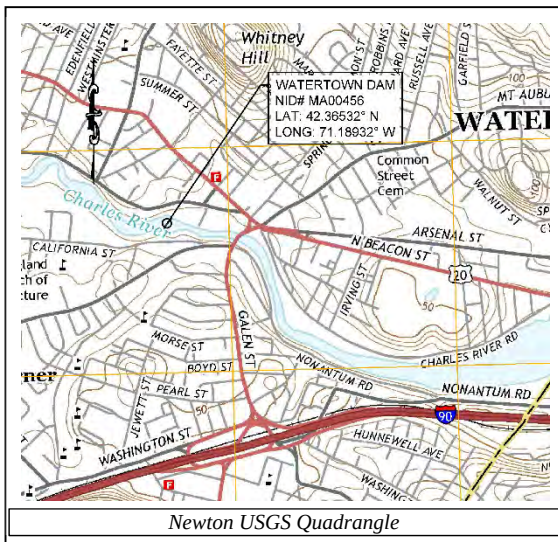
WATERTOWN DAM

Watertown, Middlesex County, Massachusetts

National I.D. Number: MA00456

State ID Number: 4-9-314-1

Dam Location: 42.36532° N / 71.18932° W



Dam Owner:
Owner: Massachusetts DCR
Owner Address:
251 Causeway Street Suite 600
Boston, MA 02114
Owner Daytime Phone: 617-626-1410
Owner Emergency Phone: 617-626-1410

Dam Caretaker:
Mass DCR – Flood Control Operations
William Gode von-Aesch
251 Causeway Street
Boston, MA 02114
617-757-0488 x200
617-828-1629

Plan Developed 2018-06
Revision Number _____

WATERTOWN DAM
EMERGENCY ACTION PLAN
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Figure 2	USGS Quad Map
Figure 3	Impact Mapping

APPENDICES

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Appendix B	Emergency Detection, Evaluation, and Classification
Appendix C	Termination & Recovery
Appendix D	Materials & Equipment
Appendix E	Sign Off Sheets
Appendix F	Common Dam Safety Definitions

REFERENCES

PREAMBLE

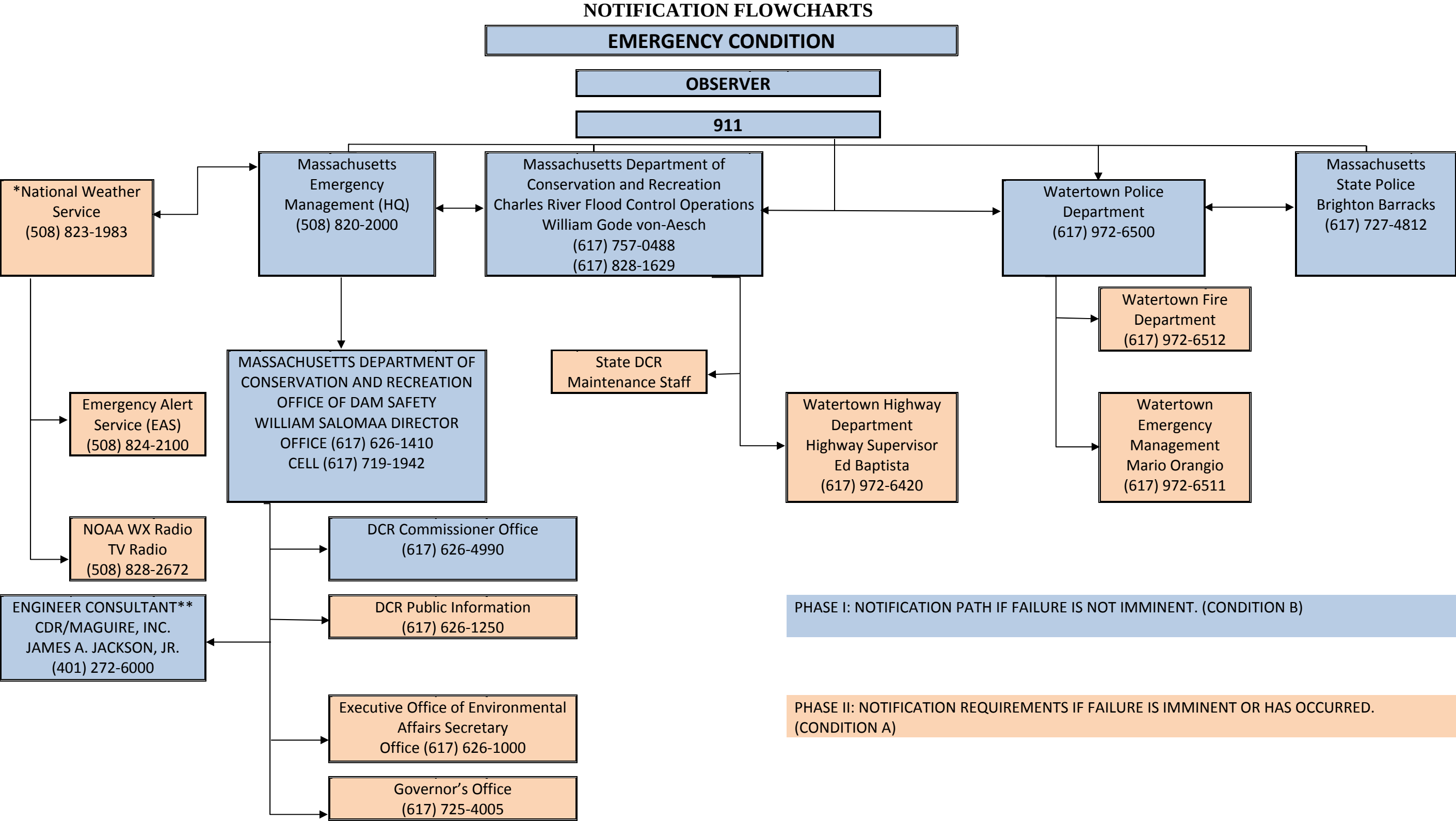
This Emergency Action Plan was prepared for the Owner of the WATERTOWN DAM in accordance with the Commonwealth of Massachusetts General Laws, M.G.L. 253, Section 44, Chapter 302 C.M.R. 10.00, “Dam Safety, dated February 10, 2017” to establish a basic plan of action if conditions at the dam indicate the potential for dam failure or if any individual observes and reports that a dangerous condition is developing at the dam. The development of this EAP has been primarily based on the Federal Emergency Management Agency (FEMA) “Federal Guidelines for Dam Safety: Emergency Action Planning for Dam Owners,” dated October 1998, the Federal Energy Regulatory Commission (FERC) “Emergency Action Plan Guidelines,” dated November 1998, 2006 NRCS recommendations for developing EAPs, and other publicly available EAP templates from state dam safety programs.

The purpose of this plan is to define responsibilities and provide procedures for identifying unusual and unlikely conditions, which may endanger the WATERTOWN DAM and infrastructure downstream of the dam, in time to take mitigated action and to notify the appropriate emergency management officials of possible, impending, or actual failure of the dam in order to minimize property damage and loss of life.

This Emergency Action Plan should not be viewed as a substitute for implementing standard dam maintenance, inspections and repairs in accordance with good dam operations.

It is important to note that the condition of the dam depends on numerous and constantly changing internal conditions and is evolutionary in nature. It would be incorrect to assume that the condition of the dam will remain the same over time. Only through continued care and inspection can there be any chance of detecting unsafe conditions before they result in an emergency condition.

The EAP is housed in a three ring binder to easily facilitate updates to the plan. The EAP should be updated and exercised annually to ensure that the information is current. Most importantly, the names and telephone numbers of emergency response personnel listed in the Notification Flowchart shall be updated periodically. The general layout of an emergency response is as follows:



* CALL THE EMERGENCY ALERT SYSTEM IF IT IS NECESSARY TO BROADCAST THE EVACUATION ON TELEVISION AND RADIO. THE NATIONAL WEATHER SERVICE WILL CALL THE FIRE DEPARTMENT TO VERIFY THE EMERGENCY.
** CDR/MAGUIRE, INCL SHOULD BE CONTACTED IMMEDIATELY TO ASSESS THE SITUATION.

1.0 NOTIFICATION PROCEDURES

1.1 Notification Flowchart

The Notification Flowchart (located at the front of this report, before the table of contents) indicates the chain of communication to be followed in the event of an Emergency. The Notification Flowchart indicates a Phase I and Phase II type of notification to be implemented depending on the emergency classification level (Emergency Condition Watch or Dam Failure Warning) as determined necessary based upon the judgment of the personnel monitoring the emergency condition at the dam (see Section 4 for additional descriptions).

- **Dam Safety Watch: “Potential failure is developing”**: This is a situation where a failure may eventually occur if left unattended. This situation will require a Phase I response with continuous monitoring of the situation.
- **Dam Failure Warning: “Failure is Imminent or has occurred”**: This is a situation where a failure either has occurred, is occurring, or is just about to occur. This situation will require Phase I and II responses that will proceed with evacuation procedures.

During the highest emergency level (Dam Failure Warning), procedures are to evacuate the downstream residents using a combination of the telephone, augmented by police cruising the area broadcasting the evacuation message and going door to door to homes that cannot be reached by telephone. To ease this burden somewhat, the National Weather Service can be alerted at (508) 823-1983 and they will make a general broadcast about the evacuation over the airways. ***The National Weather Service will call the Fire Department to verify the emergency. Therefore, the Fire Department should be called before the National Weather Service is contacted. MEMA can also be contacted to activate the Emergency Alert Service.***

The flowchart should be updated yearly to account for local or state personnel changes. Any new personnel should be informed and trained to perform their responsibilities under this plan.

This Notification Flowchart is contained within the opening pages of this report.

1.2 Emergency Notification Template

Once the emergency condition has been identified, and the appropriate response level has been determined, the following template can be used as a guide for notification announcements:

“This is (your name, title, affiliation)

You are being contacted per the Emergency Action Plan for the WATERTOWN DAM.

Please be advised: A Dam (Dam Safety / Warning / Watch) condition has been identified at the WATERTOWN DAM.

The observation was made at (time and date)

The situation is (provide brief description)

It is recommended that (Remain on alert; Prepare for Evacuation; Evacuate the area and move to higher ground)”

1.3 Impact Summary / Road Closures

USGS maps and aerial photos were evaluated to determine potential impacts from a dam breach. The downstream area consists of the Charles River and contains greenway and park areas that will absorb the impacts of a dam breach. Due to the limited impacts to roadways and properties it was determined that inundation map modeling and analysis were not required for this dam.

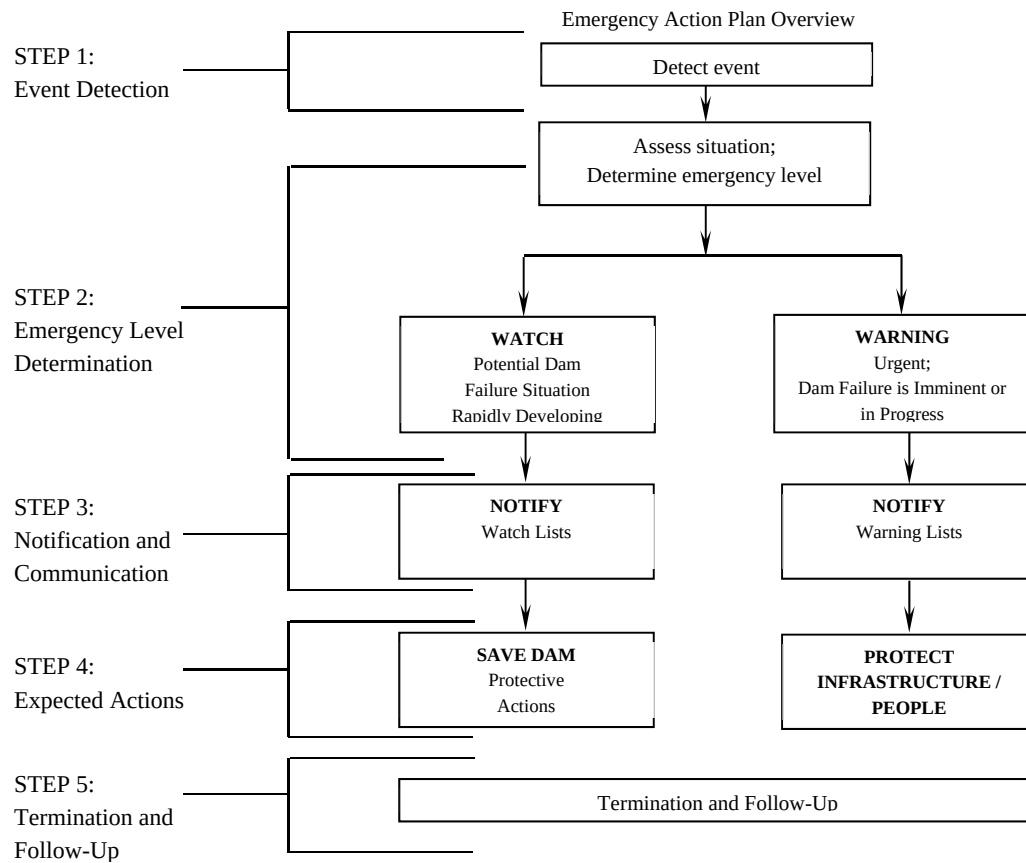
A dam breach could impact an office complex immediately downstream of the dam along its north bank as well as the Galen Street Bridge approximately 1,000 feet downstream. Portions of Charles River Road along the north bank and Nonantum Road along the south bank may also experience flooding. Flooding may impact the Charles River Greenway and the Watertown Riverfront Park and Braille Trail as well as recreational complexes close to the riverbank downstream of the dam.

Note that portions of the impact area lie within Newton and Brighton municipal boundaries.

Areas impacted by a breach of the dam as described above would include:

- The Galen Street Bridge should be closed to thru traffic.
- Charles River Road should be closed to thru traffic from its intersection with Main Street/Mt Auburn Street/Arsenal Street/N Beacon Street to Wheeler Lane. No homes or businesses lie along this route.
- Charles River Road should be closed to thru traffic from Pequossette Street east to N Beacon Street. One property along this route should be evacuated – the Watertown Yacht Club (a marina).
- Nonantum Road should be closed from Galen Street to Brooks Street. Thru traffic can be detoured thru Brooks Street, Faneuil Street, Washington Street, and Centre Street. Four properties along this route should be evacuated: Newton Yacht Club (a marina), Daly Rink, Daly Field Athletics Complex, and Community Rowing, Inc.. The latter two properties are within
- Portions of the Charles River Greenway and Watertown Riverfront Park and Braille Trail downstream of the dam should be closed.
- The office complex immediately downstream of the dam on Brook Street should be evacuated.

1.4 General Response Flowchart



2.0 PROJECT DESCRIPTION

Dam Name:	<u>Watertown Dam</u>	Hazard Classification:	<u>Significant Hazard</u>
STATE-ID #:	<u>4-9-314-1</u>	Federal ID (NID):	<u>MA00456</u>
City/Town:	<u>Watertown</u>	County:	<u>Middlesex</u>
Size Classification:	<u>Small</u>		

Location & Access (provide a location map & directions to the dam from a major highway): Watertown Dam is located on the Charles River in Watertown, between California Street and Pleasant Street within the Charles River Greenway. Take exit 17 on the Massachusetts Turnpike and turn left onto Centre Street. Continue 0.6 miles on Centre Street. Then turn left onto Route 16 for 0.1 miles and bear right onto California Street. The dam is immediately on the right within the Charles River Reservation. A locus map is provided as Figure 1.

Lot No:	<u>--</u>	Block No	<u>--</u>
Latitude:	<u>42.36532° N</u>	Longitude:	<u>71.18932° W</u>
River/Stream/River Basin:	<u>Charles River</u>		
Quad Sheet:	<u>Newton</u>	Nearest City/Town:	<u>Watertown</u>
Hydraulic/Structural Height (ft):	<u>10 / 6</u>	Normal Surface Area (ac):	<u>11</u>
Embankment Length (ft):	<u></u>	Normal Storage (ac-ft):	<u>20</u>
Dam Type:	<u>Earth</u>	Maximum Storage (ac-ft):	<u>30</u>
Spillway Type:	<u>Concrete Ogee</u>	Spillway Capacity (cfs):	<u>4,370</u>
Type Dike:	<u>--</u>	Drainage Area (sq. mi.):	<u>273</u>
Outlet Type (other than spillway):	<u>Stop log weir on right end of spillway</u>		
Year Built:	<u>Unknown</u>	Last Rehabilitation:	<u>1966</u>

Purpose/Operation of Dam (attach additional sheets if necessary): The dam was likely built as a power source decades ago; it is currently purposed for recreation. MADCR is responsible for operation of the dam. There are no formal written operation and maintenance procedures or records for the dam.

Instrumentation (if any): None observed

Upstream Dams: Bleachery Dam, Moody Street Dam, Newton Lower Falls Dam, Cordingly Dam, Metro Circ Dam Hemlock Gorge Spillway, Silk Mill Dam, Cochran Dam, Willow St. By-pass Dam, Charles River Dam at South Natick, Stanford Mill Pond Dam, West Medway Dam, Old Mill Dam, North Bellingham Dam, Box Pond Dam, Cedar Swamp Pond Dam, Echo Lake Dam

Downstream Dams: New Charles River Dam

Description of Inundation Area and Downstream Hazards: Buildings approx.. 25ft inland from left embankment; urban development along banks of Charles River; Galen Street Bridge approx.. 1,000ft d/s

Method of emergency drawdown: Stop log weir allows for adjustment of impoundment level

Sketches of the Dam have been provided within the Figures section.

3.0 GENERAL RESPONSIBILITIES

3.1 Summary of Responsibilities

Entity	Responsibilities
Dam Owner: Massachusetts DCR Phone 617-626-1410 Emergency 617-626-1410	1. Notify local authorities. Upon receiving report of an incident, contact the Emergency Management Director (EMD) and identify the report. 2. Evaluate the extent/nature/severity of the incident. Update the EMD as to the need to implement the EAP. 3. Monitor the situation at the dam for the duration of the emergency. Update the EMD and other local and state authorities of developing conditions at the dam for the duration of the emergency situation.
Local Emergency Management: Taunton Emergency Management Richard E. Ferreira Phone 508-821-1026 Emergency 508-821-1026	1. Contact and warn population in area of potential impacts; Coordinate efforts with other parties involved in the EAP as necessary. 2. The EMD/Incident Commander will serve as the contact point for disseminating all updates concerning the condition of the emergency.
Local Police Department: Taunton Police Department Phone Number 508-824-7522 Emergency Phone 508-823-5000 or 9-1-1	1. Assist in securing the site and implementing evacuation if necessary (i.e. coordinating barricades, street closures, traffic flow). 2. Utilize appropriate and/or necessary evacuation procedures, which may include but are not limited to, multilingual broadcasts, slow-speed broadcasts, and coordinated efforts with other emergency responders..
Local Fire Department Taunton Fire Department Phone Number 508-821-1000 Emergency Phone 508-821-1000 or 9-1-1	1. Assist in the evacuation of special needs and/or elderly citizens. 2. Provide additional evacuation support as needed. 3. Assist EMD as needed.
Massachusetts Emergency Management Agency (MEMA) 24 hrs: 508.820.2000	1. Coordinate broadcast notification as <u>requested</u> by the local Fire/Police/EMD. 2. Mobilize necessary equipment as <u>requested</u> by the local Police/Fire/EMD.
Massachusetts State Police Middleboro Barracks 24hrs: 508-947-2222 Local Phone No. 508-947-2222	1. Assist in securing the site, implementing evacuation, and controlling traffic flow in and out of the impacted area as <u>requested</u> by the local Police Department.

3.2 Emergency Response Coordination

During an emergency situation, **Emergency Management Director [Incident Commander]** will be responsible for the proper organization and operation of the Emergency Action Plan. He/she will coordinate all activities with state and local authorities.

FIGURES

Latitude: 42.36532° N
Longitude: 71.18932° W

PLEASANT ST

CHARLES RIVER

DAM LOCATION

CALIFORNIA ST

WATERTOWN ST



CDR MAGUIRE

225 Chapman Street, 4th Floor
Providence, RI 02905
TEL. (401) 272-6000
www.cdrmaguire.com



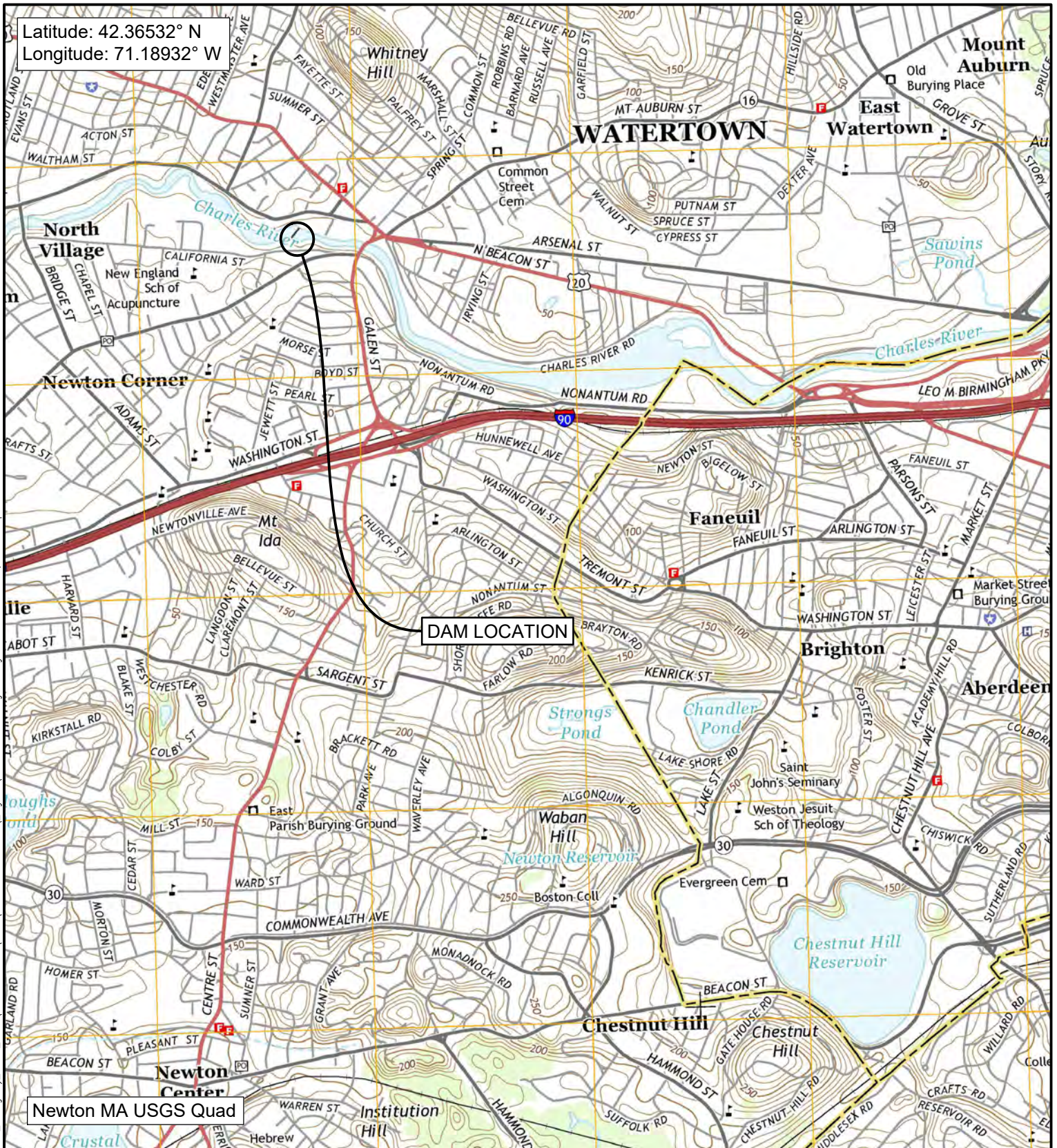
50' 0 100'
SCALE: 1" = 100'

FIGURE 1 AERIAL PHOTOGRAPH

Watertown Dam
Watertown, Massachusetts
NID MA00456

May 2018

Latitude: 42.36532° N
Longitude: 71.18932° W



DAM LOCATION

Newton MA USGS Quad



CDR MAGUIRE

225 Chapman Street, 4th Floor
Providence, RI 02905
TEL: (401) 272-6000
www.cdrmaguire.com



1000' 0 2000'
SCALE: 1" = 2000'

FIGURE 2 USGS QUAD MAP

Watertown Dam
Watertown, Massachusetts
NID MA00456

June 2018

Latitude: 42.36532° N
Longitude: 71.18932° W

DAM BREACH IMPACT AREA
GALEN ST BRIDGE
CHARLES RIVER RD (1 PROPERTY)
NONANTUM RD (4 PROPERTIES)
1 PROPERTY ON BROOK ST
CHARLES RIVER GREENWAY
WATERTOWN RIVERFRONT PARK AND BRAILLE TRAIL



CDR MAGUIRE

225 Chapman Street, 4th Floor
Providence, RI 02905
TEL. (401) 272-6000
www.cdrrmaguire.com



5000' 0 1000'
SCALE: 1" = 1000'

FIGURE 3 IMPACT MAPPING

Watertown Dam
Watertown, Massachusetts
NID MA00456

June 2018

Appendix A

Preparedness

PREPAREDNESS

Preparedness actions are taken to prevent an emergency situation from developing or to minimize the extent of damage caused from a developed emergency situation. The preparedness actions may be by providing response procedures to emergency situations and/or arranging for equipment, labor, and materials for use in emergency situations.

3.3 Surveillance

The most important part of the EAP is the identification of a problem at the dam. If a problem is not identified, the plan cannot be implemented. Problem identification will be much easier if knowledgeable personnel regularly monitor the dam closely.

The dam owner and dam operator must continue to monitor the dam on a regular basis. This is especially important during high rainfall events and during spring runoff conditions when large amounts of snow melting occur. Appendix B identifies some potential hazards that could lead to dam failure.

It is impossible to predict when an emergency situation will develop, therefore it is important that emergency contact information be posted at the site so that a casual observer can contact emergency personnel if they observe an unusual condition.

3.4 Access to Site

Lake Rico Dam falls within Massasoit State Park, owned by the Commonwealth of Massachusetts. Emergency personnel require no special authorization to access the property. Access to the Lake Rico Dam is from Middleboro Avenue.

3.5 Operations and Maintenance Manual

Operation and maintenance of the dam and associated spillway, culvert and fish ladder are the responsibility of the Department of Conservation and Recreation Office of Dam Safety. At times problems arise that require further corrective action. The following is a breakdown of the minimum requirements for the above listed components.

Inspection: Inspections of the dam and the associated structures shall be completed on an annual basis. If no imminent danger is apparent, inspection of the general condition of the dam shall be assessed.

Maintenance: The grass along the dam shall be maintained with a maximum height of 4" to 6" with mandatory cutting being required if the grass exceeds 10" in height. Obstructions of the inlet to the culvert or the slide and sluice gates shall be cleared. Any signs of erosion or rilling within the banks of the dam shall be noted. Any cracking of the concrete spillway shall be noted.

Corrective Action: Corrective actions shall start immediately (within 48 hours) of the discovery of a problem. Soil erosion gullies shall be repaired upon discovery. Cracks within the concrete shall be repaired with hydraulic cement, epoxy injection or an approved methodology.

3.6 Response during Periods of Darkness

If the information provided indicates that failure of the dam is imminent, the Commonwealth of Massachusetts Department of Conservation and Recreation Office of Dam Safety shall be contacted immediately. The DCR ODS staff will perform an inspection and assess the threat. Proper notification will be made accordingly and necessary repairs will be completed immediately. Should the information provided indicate that the problem with the dam is not likely to be an immediate threat, the DCR ODS staff will assess the condition of the dam at first light.

3.7 Response during Evenings, Weekends, and Holidays

The DCR ODS staff will assess any notification of damage or potential failure of the dam. Should the staff feel there is potential for the issue with the dam to result in failure, they shall immediately make a site visit to assess and inspect the dam. If there is a potential of failure, the emergency condition notification procedure will be implemented.

3.8 Response during Periods of Adverse Weather

The DCR ODS staff will assess any notification of damage or potential failure of the dam. Should the staff feel there is potential for the issue with the dam to result in failure, they shall immediately make a site visit to assess and inspect the dam. If there is a potential of failure, the emergency condition notification procedure will be implemented.

3.9 Training and Testing

Training and testing of the EAP is the responsibility of the dam owner. The dam owner should coordinate training and testing with local responders and emergency personnel within the municipalities impacted by a dam failure. Training seminars should be held for all operators, attendants and other personnel (i.e. police and fire) responsible for the implementation of the plan. After the initial training seminar it is recommended that a special meeting be held to explain the plan to the downstream residents and elected officials. The meeting with downstream residents will be extremely beneficial at a time of emergency.

It is recommended that EAP or components of the plan be tested periodically. The testing should be conducted through the use of drills and exercises. Testing should include operators, attendants, police, fire and other personnel responsible for the implementation of the plan. Downstream residents shall not be included in the test.

Below is a list of suggested training exercises, the frequencies they should be conducted, and the topics they should cover:

Seminars with Emergency Personnel

- Frequency: As needed
- Topics:
 - New hires should be briefed on their duties during an emergency response
 - At a minimum a read through of the EAP and a brief assessment should be conducted.

Emergency Management Workshop

- Frequency: Annually
- Attendees: Kathryne Garcia, DCR District Manager
William Salomaa, DCR ODS Director
Ed Baptista, Watertown Highway Supervisor
Mario Orangio, Watertown Emergency Management Coordinator
DCR Maintenance Staff
- Topics:
 - Authorities responsible for executing the EAP should gather to discuss the EAP.
 - Review and updating of the Notification Flowchart, Emergency Contracts, and Emergency Warning systems should be conducted at this time.
 - Parties should discuss the response effort specifically the Notification Flowchart and the corrective actions to be taken at the dam during various scenarios.
 - Lines of communication should be streamlined such that a developing condition at the dam can be assessed and handled

Public Meetings

- Frequency: Every 2 Years
- Topics:
 - The public should be educated on the EAP and how they can facilitate the rapid and safe execution of the EAP during an emergency.
 - Evacuation routes should be discussed.
 - Emergency Warning systems (i.e. Connect-CTY) should be discussed and updated.
 - Preparation and situational awareness techniques during an emergency situation. (i.e. Areas of high ground within the town, keeping a cell phone charged, supplies needed for an extended evacuation, navigation of flooded roads, etc.)

Table Top Exercise

- Frequency: Every 3-4 Years
- Topics:
 - Emergency management personnel should gather and discuss different emergency scenarios to assess plans, policies, and procedures.

Functional Exercise

- Frequency: Every 5 Years
- Topics:
 - A functional exercise is conducted to test and validate the coordination, command, and control between the EOC, EMD, and all agencies involved with carrying out the EAP.
 - This type of exercise does not include any “boots on the ground”

After each of the tests mentioned above, a “lessons learned” discussion and evaluation should be conducted. The discussions should highlight procedures that work well and those that did not; as well as inaccurate information (within the flowchart, inundation maps, resident contacts, assigned responsibilities, equipment, etc.). Results should be written down and distributed to the associated parties and any corrections and updates should be made.

The training and testing activities should be fully documented.

3.10 Updating and Posting

All aspects of the EAP should be reviewed and updated once per year in accordance with the applicable guidelines. During the review, a determination of any new developments or other changes downstream or elsewhere should be made to determine whether any revisions to the current EAP are necessary. It is imperative that all other holders of the EAP receive updates to the EAP immediately upon becoming aware of necessary changes to keep the EAP workable. This includes revisions when phone numbers and/or names change for notification flow chart personnel and downstream residents.

An up-to-date copy of the flowchart and notification list should be in prominent locations in the offices of the personnel responsible for the EAP Implementation.

A copy of the complete up-to-date EAP should also be available to all operators and personnel responsible for the implementation of the EAP. At a minimum, a full copy of the EAP should be located at the following locations:

- Owner: *Commonwealth of Massachusetts*
- Local Emergency Management Agency: *Taunton Emergency Management, Richard Ferriera (508) 821-1026*
- Massachusetts Emergency Management Agency (MEMA); *Massachusetts Emergency Management – Ben Hiltunen; Office (508) 820-2043*
- Massachusetts Department of Conservation and Recreation, Office of Dam Safety: *William Salomaa, Director, 251 Causeway Street, Boston, MA 02114*
- Local Highway Department: *Watertown Highway Supervisor, Fred Comaglia (508) 821-1431*

3.11 Emergency Response Coordination

During an emergency situation, the **Incident Commander** will be responsible for the proper organization and operation of the Emergency Action Plan. He/she will coordinate all activities with state and local authorities.

3.12 Contact Lists

Contact lists should be maintained for facilities, structures, and other properties that may be impacted by a flood wave. Dependent upon the nature of the inundated area, the contact lists may include residents to be evacuated due to shallow flooding, facilities requiring special considerations, and other facilities. Contact lists should also consider special needs in the impacted area such as multilingual communications.

Hard copies of the list should be kept at the EOC and within each EAP binder. At a minimum, annual reviews and updating of the contact list should be completed to keep the list current.

3.13 Alternative Systems of Communication

If there is an interruption in telephone service during an emergency condition, emergency response personnel should broadcast over their radio communications system and cellular phones as

necessary. Cell phone/telephone numbers for the emergency responders should be maintained and updated in the notification flowchart on a regular basis.

3.14 Emergency Labor, Supplies and Equipment

Once an emergency condition has been identified, mobilization of the appropriate equipment is key to addressing the situation. The following lists provide partial equipment lists for the conditions described above. This list should be modified as required to address actual conditions at the time of the emergency. Additional equipment, not listed below may be necessary. Actual condition and estimated response time versus the rate of deterioration of the dam may preclude the repair of the structure and necessitate full evacuation. The primary goal is to protect human life and minimize property damage.

- Emergency lights and generators for dam work or evacuation.
- Construction equipment if the dam is repairable:
- Loaders
- Excavators
- Gravel hauling trucks
- High wheel trucks
- Sandbags
- Shovels
- Tree removal equipment
- Barriers, barricades and personnel transportation to facilitate evacuation

The provision of labor, equipment and materials is the responsibility of the dam owner. As such the following sections provide recommendations for establishing relationships and agreements with local contractors, vendors, and suppliers.

3.14.1 Subcontractors

The dam owner should develop/maintain open-ended contracts with a number of general contractors and/or suppliers. These contracts allow the dam owner to hire equipment as needed at a set hourly rate. Materials could be purchased from any of the contractors.

3.14.2 Potential Borrow Areas Around the Town

Potential borrow areas should be identified that could be utilized as sources of fill material in the event of an emergency condition at the dam requiring extra material. The owners of these and any other gravel pits that may be utilized during an emergency should be contacted.

APPENDIX B

Emergency Detection, Evaluation, & Classification

EMERGENCY DETECTION, EVALUATION & CLASSIFICATION

The detection, evaluation and classification of a potential emergency situation are crucial in determining the level of response and notification required in order to minimize the response time.

The following emergency classification system is proposed for this site:

- **Dam Safety WATCH: “Potential failure is developing”**: This is a situation where a failure may eventually occur if left unattended. This situation will require a Phase I response with continuous monitoring of the situation. This emergency classification level was formerly titled “Condition I”.
- **Dam Failure WARNING: “Failure is Imminent or has occurred”**: This is a situation where a failure either has occurred, is occurring, or is just about to occur. This situation will require Phase I and II responses that will proceed with evacuation procedures. This emergency classification level was formerly titled “Condition II”.

Examples of the preplanned procedures and notification that should be followed based on the various conditions observed during either storm or fair weather conditions are outlined below. These are examples and are not intended to describe all possible conditions, nor are they intended to limit the actions taken during a given event.

B.1 Dam Safety WATCH Examples

Notify: Dam Owner, Local EMD, Engineer, and MADCR ODS

- Any seismic event regardless of how slight
- Other situations which may lead to damage at the structure
 - Evidence of vandalism
 - Bomb threat
 - A civil disorder near the reservoir
 - Any aircraft accident near the reservoir
- Water level of the impoundment is at an unsafe level and is rising threatening to overtop the dam
- Discharges resulting in significant erosion and/or scour
- Any developing erosion, settlement, or upheaval occurring on the downstream slope or at the toe of the dam that is considered to be controllable
- Any undocumented leakage through any dam structure considered to be controllable

B.2 Dam Safety WARNING Examples

Notify: ALL PARTIES LISTED ON THE NOTIFICATION FLOWCHART

- Water has overtopped or will overtop the dam
- Any uncontrollable erosion, settlement, or upheaval occurring on the downstream slope or at the toe of the dam
- Any uncontrollable leakage through any dam structure resulting in degradation to the structural integrity of the dam
- A dislocation or failure of any structure which allows for an expanding, uncontrollable discharge of water through the spillway or dam indicating a breach is occurring
- Dam is failing, is about to fail, or has failed

An Emergency Condition Watch may be declared initially with gradual transition into a Dam Failure Warning or a Dam Failure Warning may be declared immediately, depending on the actual conditions.

While these actions attempt to generalize responses to the observed conditions, the judgment of the primary observer and/or knowledgeable person(s) must be utilized. While some conditions such as breaching, overtopping and severe piping can dictate an immediate evacuation; others will require the observer to determine the extent of the concern and the probability of the concern being addressed within a timely fashion.

B.3 Additional Guidance for Determining the Emergency Level¹

TABLE B.1: Possible Failure Modes

Event	Situation	Emergency Level
Structural Cracking	New cracking along the concrete structure with radial, transverse, or vertical displacement	--
	New cracks in the concrete with seepage	Watch
	New cracks/old cracks with actively progressing displacements	Warning
Foundation Weakness	New cracks at the abutment greater than ¼-inch wide without seepage	Watch
	Cracks in the abutment with seepage	Watch
	Visual movement/slippage of the embankment slope	Warning
Construction Joint Cracking	Cracking at the construction joint	--
	Cracked construction joint with displacement and seepage	Watch
Sinkholes	Rapidly enlarging sinkhole	Warning
Embankment Cracking	New cracks in the embankment greater than ¼-inch wide without seepage	--
	Cracks in the embankment with seepage	Watch / Warning
Earthquake	Earthquake resulting in visible damage to the dam or appurtenances	Watch
	Earthquake resulting in uncontrolled release of water from the dam	Warning
Security Threat	Verified bomb threat that, if carried out, could result in damage to the dam	Warning
	Detonated bomb that has resulted in damage to the dam or appurtenances	Warning
Sabotage/Vandalism	Damage to dam or appurtenances with no impacts to the functioning of the dam	--
	Damage to dam or appurtenances that has resulted in seepage flow	Watch
	Damage to dam or appurtenances that has resulted in uncontrolled water release	Warning

¹ Based upon the NRCS Recommendations for Developing EAPs, 2006.

B.4 Potential Hazards That Can Lead to Dam Failure

The purpose of the section is to educate the user of the EAP as to some of the common causes of dam instability and possible failure. A short definition of each hazard is listed along with typical causes. This is not intended to be an exhaustive list of all failure mechanisms as each dam has a unique set of conditions which will influence the development of conditions and concerns.

1. Flow Erosion

- Wash out of spillways, embankment sections
- Causes: poor compaction of silt backfill; lack of riprap or concrete protection at interface between soil embankment and concrete structure; erosion by flow over embankment, spillway, or through outlet.

2. Embankment Leakage, Piping

- Excessive seepage resulting in internal erosion followed by formation of a "pipe" through the embankment which once formed causes rapid flow erosion and wash out of the embankment.
- Causes: poor compaction of soil along interface with concrete structures; lack of seepage control collars around pipe; root and rodent holes; inadequate or nonexistent filters between fine and coarse soils; cracks or voids within the concrete structure.

3. Foundation Leakage, Piping

- Wash-out of foundation material below dam causing undermining.
- Causes: poor interface with bedrock and concrete structures; excessive seepage at dam toe carrying soil with it.

4. Sliding

- Serious movement in foundation or concrete structure which either result in dam failure or significantly weaken the dam structure.
- Causes: Foundation material weak; excessive water pressure in structure or foundation

5. Deformation

- Gross deformation of dam or outlet structures resulting in immediate failure or cracking of the dam, and subsequent washouts.
- Causes: excessive settlement in foundation, ice jacking (Pressure exerted by expending/contracting ice structures).

6. Blowing of Trees from Embankment

- Blowing of trees on and near the embankment would result in substantial cracks and scour of the embankment and subsequent washout of the embankments.
- Causes: Heavy rain associated with gusty winds and natural aging and poor root system of the trees on and near the embankments.

7. Reduction of Crest Elevation

- Deterioration or washout of Dam crest
- Causes: Poor concrete condition; heavy rain runoff.

8. Dam Overtopping

- Water flows over the crest of the dam causing erosion and subsequent reduced dam height with time. If overtopping continues for any length of time it may lead to a total failure of the dam.
- Causes: Heavy rain; blocked or inadequately sized spillway.

9. Cracking

- Longitudinal cracking can be due to movements and/or settlements of the dam and can allow water to infiltrate the concrete.
- Transverse cracking can be due to horizontal and/or vertical movement and can result in a flow path across the concrete structure.
- Thin cracks can be very deep and intersect the phreatic surface.

APPENDIX C

Termination & Recovery

APPENDIX C

TERMINATION & RECOVERY

If the EAP has been placed into action and the event has been deemed to not be an emergency, or the threat has been mitigated, termination of the emergency response under the EAP will be the sole responsibility of the incident commander. Termination process should include, but not be limited to, the following steps:

- Notify all agencies and parties contacted during the response of the situation termination
- Issue public notification
- Complete post-situation dam inspection

Implement post-situation recovery including restoring impacted areas such that they are safe for public use and repairing or otherwise addressing damaged infrastructure

APPENDIX D
Materials & Equipment

APPENDIX D
AVAILABLE MATERIALS & EQUIPMENT

DPW & DCR – Construction Equipment including:

- Backhoes
- Dump Trucks
- Pickups
- Barriers
- Emergency Signage

Fire Department – Pumps

Police Department – Flaggers

APPENDIX E
Signoff Sheets

**APPENDIX E
SIGNOFF SHEETS**

RECORD OF EAP TRAINING

INSTRUCTIONS: All employees who may be called on to during an emergency shall receive training with regards to the Emergency Action Plan. New hires will be trained within 60 days of starting. Periodic training will be provided annually.

Date: _____

Attendees:

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Subjects and Issues:

Recommendations and Suggestions:

RECORD OF EAP REVISIONS

INSTRUCTIONS: All revisions to the Emergency Action Plan shall be documented. The Emergency Management and DPW supervisors shall sign off on the revisions.

Date	Description of Revision	Signatures

APPENDIX F

Common Dam Safety Definitions

APPENDIX F

COMMON DAM SAFETY DEFINITIONS

For a comprehensive list of dam engineering terminology and definitions refer to 302 CMR10.00 Dam Safety, or other reference published by FERC, Dept. of the Interior Bureau of Reclamation, or FEMA. Please note should discrepancies between definitions exist, those definitions included within 302 CMR 10.00 govern for dams located within the Commonwealth of Massachusetts.

Orientation

Upstream – Shall mean the side of the dam that borders the impoundment.

Downstream – Shall mean the high side of the dam, the side opposite the upstream side.

Right – Shall mean the area to the right when looking in the downstream direction.

Left – Shall mean the area to the left when looking in the downstream direction.

Dam Components

Dam – Shall mean any artificial barrier, including appurtenant works, which impounds or diverts water.

Embankment – Shall mean the fill material, usually earth or rock, placed with sloping sides, such that it forms a permanent barrier that impounds water.

Crest – Shall mean the top of the dam, usually provides a road or path across the dam.

Abutment – Shall mean that part of a valley side against which a dam is constructed. An artificial abutment is sometimes constructed as a concrete gravity section, to take the thrust of an arch dam where there is no suitable natural abutment.

Appurtenant Works – Shall mean structures, either in dams or separate therefrom, including but not be limited to, spillways; reservoirs and their rims; low level outlet works; and water conduits including tunnels, pipelines, or penstocks, either through the dams or their abutments.

Spillway – Shall mean a structure over or through which water flows are discharged. If the flow is controlled by gates or boards, it is a controlled spillway; if the fixed elevation of the spillway crest controls the level of the impoundment, it is an uncontrolled spillway.

Size Classification

(as listed in Commonwealth of Massachusetts, 302 CMR 10.00 *Dam Safety*)

Large – structure with a height greater than 40 feet or a storage capacity greater than 1,000 acre-feet.

Intermediate – structure with a height between 15 and 40 feet or a storage capacity of 50 to 1,000 acre-feet.

Small – structure with a height between 6 and 15 feet and a storage capacity of 15 to 50 acre-feet.

Non-Jurisdictional – structure less than 6 feet in height or having a storage capacity of less than 15 acre-feet.

Hazard Classification

(as listed in Commonwealth of Massachusetts, 302 CMR 10.00 *Dam Safety*)

High Hazard (Class I) – Shall mean dams located where failure will likely cause loss of life and serious damage to home(s), industrial or commercial facilities, important public utilities, main highway(s) or railroad(s).

Significant Hazard (Class II) – Shall mean dams located where failure may cause loss of life and damage to home(s), industrial or commercial facilities, secondary highway(s) or railroad(s), or cause the interruption of the use or service of relatively important facilities.

Low Hazard (Class III) – Dams located where failure may cause minimal property damage to others. Loss of life is not expected.

General

EAP – Emergency Action Plan - Shall mean a predetermined plan of action to be taken to reduce the potential for property damage and/or loss of life in an area affected by an impending dam break.

O&M Manual – Operations and Maintenance Manual; Document identifying routine maintenance and operational procedures under normal and storm conditions.

Normal Pool – Shall mean the elevation of the impoundment during normal operating conditions.

Acre-foot – Shall mean a unit of volumetric measure that would cover one acre to a depth of one foot. It is equal to 43,560 cubic feet. One million U.S. gallons = 3.068 acre feet

Height of Dam – Shall mean the vertical distance from the lowest portion of the natural ground, including any stream channel, along the downstream toe of the dam to the crest of the dam.

Spillway Design Flood (SDF) – Shall mean the flood used in the design of a dam and its appurtenant works particularly for sizing the spillway and outlet works, and for determining maximum temporary storage and height of dam requirements.

Condition Rating

Unsafe - Major structural, operational, and maintenance deficiencies exist under normal operating conditions.

Poor - Significant structural, operation and maintenance deficiencies are clearly recognized for normal loading conditions.

Fair - Significant operational and maintenance deficiencies, no structural deficiencies. Potential deficiencies exist under unusual loading conditions that may realistically occur. Can be used when uncertainties exist as to critical parameters.

Satisfactory - Minor operational and maintenance deficiencies. Infrequent hydrologic events would probably result in deficiencies.

Good - No existing or potential deficiencies recognized. Safe performance is expected under all loading including SDF.

REFERENCES

REFERENCES

Provide a list of available reports, design, drawings, or other information relating to the dam and its construction. Copies of critical information may also be provided within this Appendix.

The following references were utilized during the preparation of this report and the development of the recommendations presented herein:

1. “Design of Small Dams”, United States Department of the Interior Bureau of Reclamation, 1987
2. “ER 110-2-106 - Recommended Guidelines for Safety Inspection of Dams”, Department of the Army, September 26, 1979.
3. “Guidelines for Reporting the Performance of Dams” National Performance of Dams Program, August 1994.
4. Commonwealth of Massachusetts General Laws, M.G.L. 253, Section 44, Chapter 302 CMR 10.00, Dam Safety, February 10, 2017.
5. “Watertown Dam Phase I Inspection / Evaluation Report”, GEI Consultants, Inc., June 28, 2016

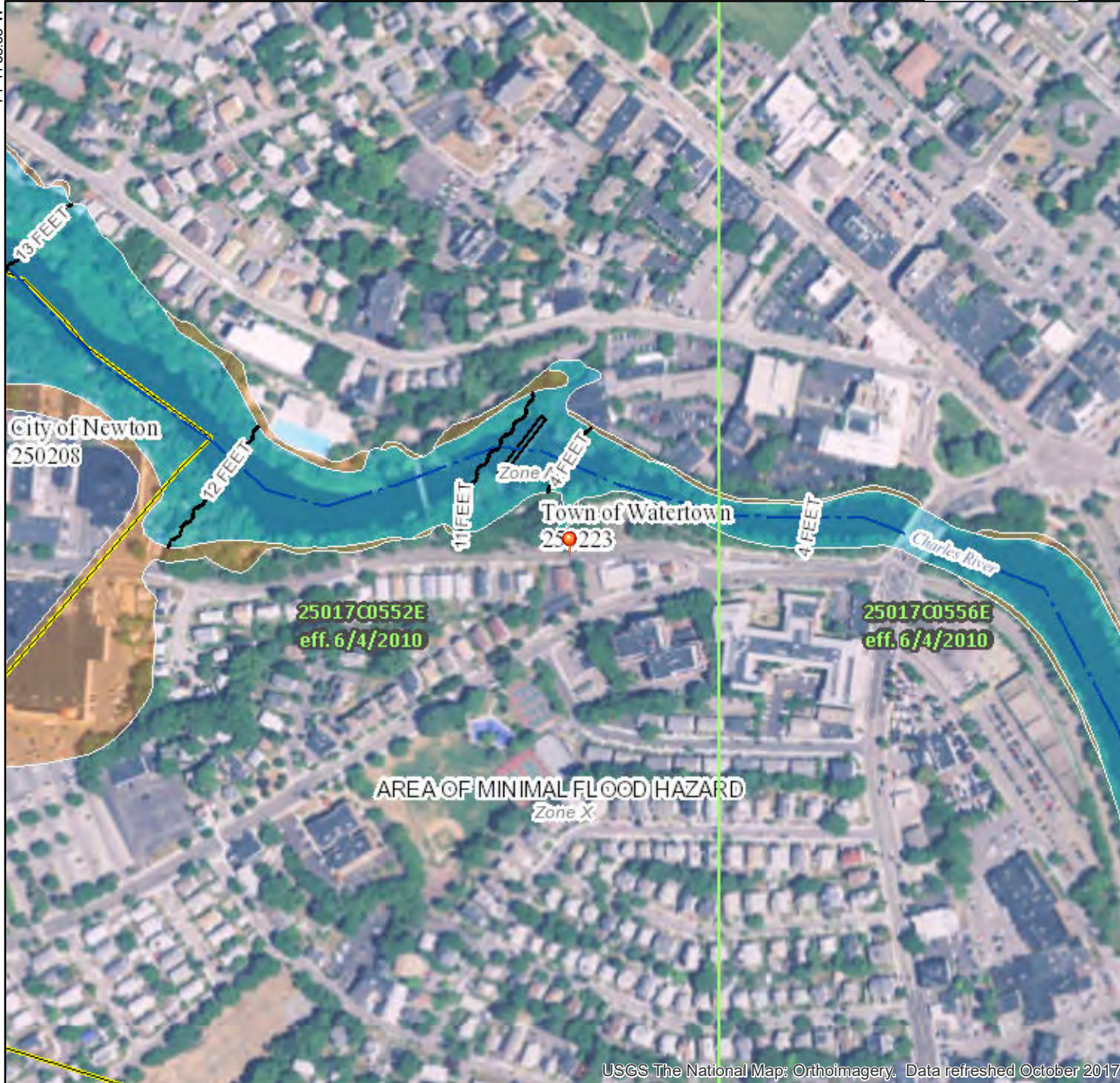
APPENDIX D

FEMA INFORMATION

National Flood Hazard Layer FIRMette



42°22'6.14"N



0 250 500 1,000 1,500 2,000 Feet

1:6,000

42°21'39.56"N

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS		Without Base Flood Elevation (BFE) Zone A, V, A99
		With BFE or Depth Zone AE, AO, AH, VE, AR
		Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD		0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
		Future Conditions 1% Annual Chance Flood Hazard Zone X
		Area with Reduced Flood Risk due to Levee. See Notes. Zone X
		Area with Flood Risk due to Levee Zone D
OTHER AREAS		Area of Minimal Flood Hazard Zone X
		Effective LOMRs
GENERAL STRUCTURES		Area of Undetermined Flood Hazard Zone D
		Channel, Culvert, or Storm Sewer
		Levee, Dike, or Floodwall
OTHER FEATURES		Cross Sections with 1% Annual Chance Water Surface Elevation
		Coastal Transect
		Base Flood Elevation Line (BFE)
		Limit of Study
		Jurisdiction Boundary
		Coastal Transect Baseline
MAP PANELS		Digital Data Available
		No Digital Data Available
		Unmapped



The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on **8/22/2018 at 11:40:53 AM** and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

Pond Brook and Nashoba Brook. The Merriam, Cement, and Erikson Dams affect flooding on Fort Pond Brook. The Concord Road and Wheeler Lane Dams affect flooding on Nashoba Brook. The Amelia Earhart Dam in Arlington affects flood elevations on the Mystic River, Lower Mystic Lake, and Alewife Brook (Little River). The Cooke's Hollow Dam affects flooding on Mill Brook 3. The Charles River Dam at Warren Avenue in Boston controls the level of the Charles River within the City of Cambridge. This dam was designed to maintain the basin at a level of 4.35 feet during the 1-percent-annual-chance flood. It is estimated that damage to properties along the basin will not occur until the basin level reaches an elevation of 4.6 feet. With water being pumped at a rate of 8,400 cubic feet per second (cfs) at the dam, a basin level of 4.6 feet can be expected to be exceeded approximately once in 175 years. The Talbot Mills Dam in Billerica affects flooding on the Concord and Sudbury Rivers. The Newton Lower Falls Dam, the Cordingly Dam, and the Metropolitan Dam affect flood elevations on the lower Charles River. The Cochrane Dam, which is located in Needham and Dover, affects flood elevations on the upper Charles River. The significance of the combination of the upstream control structures and natural valley storage can be explained when analyzing the March 1968 flood. Runoff within the lower basin crested at the old Charles River Dam within hours. The upper basin peak flow took four days to reach the dam. All storm runoff was drained from the watershed in about a month's time.

The following tabulation, taken from a USACE Flood Plain Information report, presents the relative flood heights at the Carlisle Road bridge (State Route 225) from Bedford to Carlisle for the 10 major floods in the Concord River basin in order of magnitude.

<u>Date of Crest¹</u>	<u>Estimated Elevation (feet NAVD88)</u>	<u>Peak Discharge at Lowell² (cfs)</u>
August 23, 1955	118.6	4,540
January 26, 1979	118.5	5,400
March 20, 1936	118.4	6,000
March 27, 1968	117.9	4,900
July 29, 1938	117.3	3,790
September 15, 1954	116.7	3,340
September 24, 1938	116.5	3,210
March 24, 1948	116.5	3,200
January 30, 1958	116.4	3,120
April 18, 1956	116.2	2,970

¹ The Carlisle Road bridge is located one mile upstream of the Bedford/ Billerica/Carlisle corporate limits.

² The Lowell gage is located 9.15 miles downstream of the Bedford/Billerica/Carlisle corporate limits.

Velocities of water during a 1-percent-annual-chance flood on the Concord River would be approximately 2.0 feet per second (fps) in the main channel and approximately 0.4 fps over the floodplain. For the Shawsheen River, velocities would be somewhat greater than 4 fps in the main channel and approximately 0.5

In the Town of Stoneham, open parklands operated by the DCR surround Spot Pond Reservoir, Doleful Pond, Fells Reservoir, North Reservoir, and South Reservoir in Stoneham. This prevents floodplain encroachment, provides floodplain storage, and provides a buffer between the ponds and reservoirs and the developed areas.

In the Town of Stow, on the upper Assabet River basin, nine flood control structures have been completed and one is under construction by the NRCS. One such structure, the Delaney Dam, is located on Elizabeth Brook in Stow. These structures are designed to lower flood peaks on the Assabet River and on their respective tributaries such as Elizabeth Brook. Several floodplain management measures have been undertaken by town officials, including zoning controls to protect fringe areas along the Assabet River from encroachment, ongoing land management, and maintenance programs by the town conservation commission.

In the Towns of Sudbury and Wayland, Cedar Swamp provides a natural storage area for the Sudbury River. The storage area helps to mitigate peak flows and the severity of flooding along the Sudbury River as it passes through the towns. The Sudbury Reservoir and the Framingham Reservoir system, which are an integral part of the DCR water-supply system, also provide significant storage volume which reduces peak flood flows on the Sudbury River.

In the Town of Tewksbury, above the study area there are five dams designed for flood control on the Merrimack River. They were constructed and are operated by the New England Division of the USACE. These structures are the Franklin Falls Dam on the Pemigewasset River, the Edward McDowell Dam on Nubanusit Brook, the Blackwater Dam on the Blackwater River (flood control), and two dams, the Everett Dam on the Piscataguog River and the Hopkinton Dam on the Contoocook River that control Hopkinton Lake. These reservoirs have the capacity to reduce flood stages on the Merrimack River in the Tewksbury area about 8 feet for a recurrence interval of the March 1936 event.

In the Town of Watertown, natural storage that exists in the many swamps and ponds in the upper Charles River is an important factor in dampening the potentially hazardous effects of the floodwaters. A program is presently underway to acquire extensive natural valley storage areas in the upper watershed in order to ensure preservation of these areas and allow for natural storage of floodwaters. This program is being administered by the USACE.

The reach of the Charles River downstream of the Watertown Dam is called the Charles River basin. The flood elevations in this area are controlled by the Charles River Dam located approximately eight miles downstream from Watertown.

Natural storage that exists in the many swamps and ponds throughout the Town of Weston is an important factor in dampening the potentially hazardous effects of the floodwaters. A program is presently underway to acquire extensive natural valley storage areas in the upper Charles River watershed in order to ensure preservation of these areas and allow for the natural storage of floodwaters. This program is being administered by the USACE.

Bridge and the confluence of Mulpus Brook with the Nashua River. The storage areas cause discharges on Mulpus Brook to increase going upstream.

In Weston, the hydrology for Bogle Brook, Tributary 3 to Bogle Brook 2, Tributary 4 to Bogle Brook 2, Cherry Brook and Stony Brook was calculated using unit hydrograph theory. This technique was selected because the watershed is ungaged and has natural storage flow regulation. Synthetic triangular unit hydrographs were developed representing the watershed, utilizing the data available in USGS Water Resources Investigation 77-39 (U.S. Department of the Interior, 1977), and making appropriate adjustments for slopes and local inflows. The results of this study was compared to results obtained by using the peak discharge equations found in Estimating the Magnitude and Frequency of Floods on Natural Flow Stream in Massachusetts (USGS, 1977). In Natick, discharge-frequency data for Bogle Brook and Stony Brook were defined using regional equations (U.S. Department of the Interior, 1974). These equations, which relate basin characteristics to stream flow, provided the method for which the 10-, 2-, and 1-percent-annual-chance peak discharges were obtained. The 0.2-percent-annual-chance peak discharge estimates were determined by linear extrapolation of a log-Pearson Type III probability distribution on the 10-, 2-, and 1-percent-annual-chance floods (U.S. Water Resources Council, 1976).

Peak discharge-frequency estimates for the Charles River were developed by the USACE using the log-Pearson Type III method (U.S. Water Resources Council, 1976), from records of the USGS gaging stations on the Charles River at the Village of Charles River and at Waltham (U.S. Department of Agriculture, 1972). The gage on the Charles River (no. 01103500) has been in effect since October 1937, and the gage at Waltham (no. 01104500) has been in effect since October 1909. A discharge-frequency-drainage area relationship was developed from this data. Watertown is located downstream of the gages. Approximately one-third of the Charles River flow is diverted from the basin via Mother Brook in Dedham, which is located midway between the two gaging stations.

For the Ipswich River in Reading and North Reading, flood-flow frequency data were based on statistical analyses of stage-discharge records covering a 35-year period at the South Middleton gage operated by the USGS. This analysis followed the standard log-Pearson Type III method as outlined by the Water Resources Council (Water Resources Council, 1967). Based on a previous study of the Ipswich River basin, a skew coefficient of 0.5 was adopted (USGS, 1971). Discharges at various locations on the Ipswich River were derived by multiplying the given discharge by a factor equal to the ratio of the drainage areas to the 0.7 exponential power.

Peak discharges for the 10-, 2-, 1-, and 0.2-percent-annual-chance floods on Lubbers Brook and Ipswich River in Wilmington were initially determined using the regional frequency-discharge formulas in Water Resources Investigation 77-39 (U.S. Department of the Interior, 1977). The formulas used drainage area, main channel slope, and storage to develop the calculated discharges. The percentage of impervious land in each drainage basin was considered in determining the regional discharge values.

TABLE 8 - SUMMARY OF DISCHARGES – continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs)			
		10-PERCENT	2-PERCENT	1-PERCENT	0.2-PERCENT
BRANCH OF ASSABET RIVER					
Approximately 1,380 feet downstream of Hudson Road/Walcott-Randall Road	4.2	186	294	347	505
At Hudson Road/Walcott-Randall Road	1.5	78	118	135	188
At Goshen Lane	1.1	60	91	104	145
At Athens Street	1.0	57	78	98	136
BRANCH OF ELIZABETH BROOK 1					
At confluence of Ministers Pond	1.1	84	113	125	175
BROAD MEADOW BROOK					
At confluence with Sudbury Reservoir	1.1	70	100	110	150
BROOK A OF SHAWSHEEN RIVER					
At confluence with Shawsheen River	0.7	65	120	150	255
BROOK FROM WAUSHAKUM POND					
At confluence with Beaver Dam Brook	2.9	30	40	50	60
BUTTER BROOK					
At confluence with Nashoba Brook	3.1	105	180	225	440
At Acton/Westford corporate limits	1.4	65	110	140	275
At Concord Road	1.0	60	120	160	270
At Griffin Road	0.4	30	50	70	110
CATACONAMUG BROOK					
At confluence with the Nashua River	20.3	670	1,150	1,400	2,080
CHARLES RIVER					
At the Waltham/Newton/ Watertown corporate limits	250.6	2,200	3,200	3,700	5,200
At Moody Street Dam	250.6	2,200	3,200	3,700	5,200
At Waltham Gaging Station	227.0	2,200	2,900	3,500	4,500
At diversion from Mother Brook	200.0	1,780	2,480	3,200	4,270
At confluence of Mother Brook	200.0	2,650	3,610	4,680	6,210
At the Charles River Village/ Dover Gage (No. 01103500)	184.0	2,500	3,500	4,500	6,000
At Natick/Sherborn corporate limits	176.0	2,500	3,500	4,500	6,000

computer program, FLOW2D computer simulation model, storage-discharge relationships, and normal bridge option.

Starting water surface elevations for the streams studied by detailed methods within Middlesex County involved the following techniques: use of the slope/area method, use of backwater computations, use of the HEC-2 program, use of normal depth analysis, use of a discharge rating curve, using the USACE report in Littleton, use of profiles of the main streams, use of various previously printed FISs for several communities within Middlesex County, developing a stage-discharge curve and then computing a backwater profile to this cross section, developing a stage-discharge relationship for the Wamesit Power Company Dam, use of critical depth, use of the NRCS TR-20 computer program, and analyzing the effects of the tide gates.

For the Middlesex County countywide FIS, revised hydraulic analyses were prepared for the following streams: Aberjona River, Aberjona River North Spur, Alewife Brook (Little River), Cummings Brook, Halls Brook, Horn Pond Brook/Fowle Brook, Little Brook, Mill Brook 3, Mystic River, Schneider Brook, Shakers Glen Brook, Sweetwater Brook, and Wellington Brook. Cross sections for the hydraulic model were developed using GIS-based automated modeling techniques from a digital terrain model of the study area. The floodplain digital terrain model developed from LiDAR survey of the water areas and boat-based bathymetric/field transect survey of the underwater areas. Dimensions of the hydraulic structures were determined by field survey and/or from available plan information.

Flood levels along the Charles River downstream of the Watertown Dam are controlled by the operation of the Charles River Dam located 6 miles downstream in the City of Boston. The DCR operates the 8,400 cfs capacity pumps at the dam so as to prevent the 1-percent-annual-chance flood from achieving 4.6 feet (beginning of damages). Stages for the 10-, 2-, 1-, and 0.2-percent-annual-chance flood events along this reach of the Charles River are presented on the Flood Profiles.

June 4, 2010 Countywide Analyses

Cross-sections for the hydraulic model were developed using GIS-based automated modeling techniques from a digital terrain model of the study area. The floodplain digital terrain model developed from LiDAR survey of the above water areas and boat-based bathymetric/field transect survey of the underwater areas.

Dimensions of the hydraulic structures were determined by field survey and/or from available plan information.

July 7, 2014 Countywide Analyses

Floodplain cross sections were placed at representative locations, approximately 500 feet apart along the stream centerline. Cross sections may be spaced at closer intervals, such as locations of sudden changes in stream geometry or direction. The

APPENDIX E

GEOTECHNICAL BORING DATA

+GENERAL NOTES+

FOUNDATIONS:

MAY BE ALTERED, IF NECESSARY, TO SUIT CONDITIONS ENCOUNTERED IN CONSTRUCTION.

REINFORCEMENT:

ALL REINFORCING STEEL BAR DEFORMATIONS SHALL CONFORM TO A.S.T.M. SPECIFICATION A-305. UNLESS OTHERWISE SHOWN ON THE PLANS, REINFORCING BARS SHALL BE LAPPED 20 DIAMETERS TO MAKE A SPLICE, EXCEPT THAT MAIN REINFORCING BARS NEAR THE TOP OF SLABS AND BEAMS HAVING MORE THAN 12 INCHES OF CONCRETE UNDER THE BARS SHALL BE LAPPED 35 DIAMETERS TO MAKE A SPLICE.

BORING NOTES:

LOCATIONS OF BORINGS SHOWN ON KEY PLAN THUS: No. 3. BORINGS ARE TAKEN FOR PURPOSE OF DESIGN AND SHOW CONDITIONS AT BORING POINTS ONLY, BUT DO NOT NECESSARILY SHOW NATURE OF MATERIALS TO BE ENCOUNTERED DURING CONSTRUCTION. FIGURES IN COLUMNS INDICATE NUMBER OF BLOWS REQUIRED TO DRIVE A 1 1/2" I.D. SAMPLING SPOON ONE FOOT USING A 140 POUND HAMMER FALLING 30 INCHES. BORING SAMPLES MAY BE SEEN AT THE RESEARCH AND MATERIALS DIVISION, MASS. D.P.W. MAINTENANCE DEPOT, ROUTE 9, WELLESLEY.

DESIGN:

IN ACCORDANCE WITH THE CURRENT SPECIFICATIONS OF THE A.A.S.H.O. FOR H20-44

SCALES:

SCALES NOTED ON PLANS ARE NOT APPLICABLE TO REDUCED SIZE PRINTS. DIVIDE SCALES BY 2 FOR 1/2 SIZE PRINTS (11"x18")

HYDRAULICS (M.D.C.):

SIZE OF DRAINAGE AREA = 264 ± SQ. MILES.
BRIDGE DESIGNED FOR A 100 YEAR FLOOD
ANTICIPATED DISCHARGE = 5500 CFS
VELOCITY OF FLOOD FLOW = 7 ± FT. PER SEC.

DATE:

TO BE PLACED ON THE INSIDE FACE OF THE NORTHWESTERLY AND SOUTHEASTERLY END POSTS. SHEET SHOWING SIZE AND CHARACTER OF THE NUMERALS WILL BE FURNISHED.

UNSUITABLE MATERIAL:

ALL UNSUITABLE MATERIAL SHALL BE REMOVED WITHIN THE LIMITS OF THE FOUNDATIONS OF THE STRUCTURE.

BENCH MARK

CHISEL SQUARE CUT IN STONE PARAPET AT STA. 2+36 14.3' LT. EL. = 22.13.

BRIDGE RAILINGS:

SEE DEPARTMENT STANDARD PLANS, DATED OCT. 1966 FOR DETAILS OF BRIDGE RAILINGS.

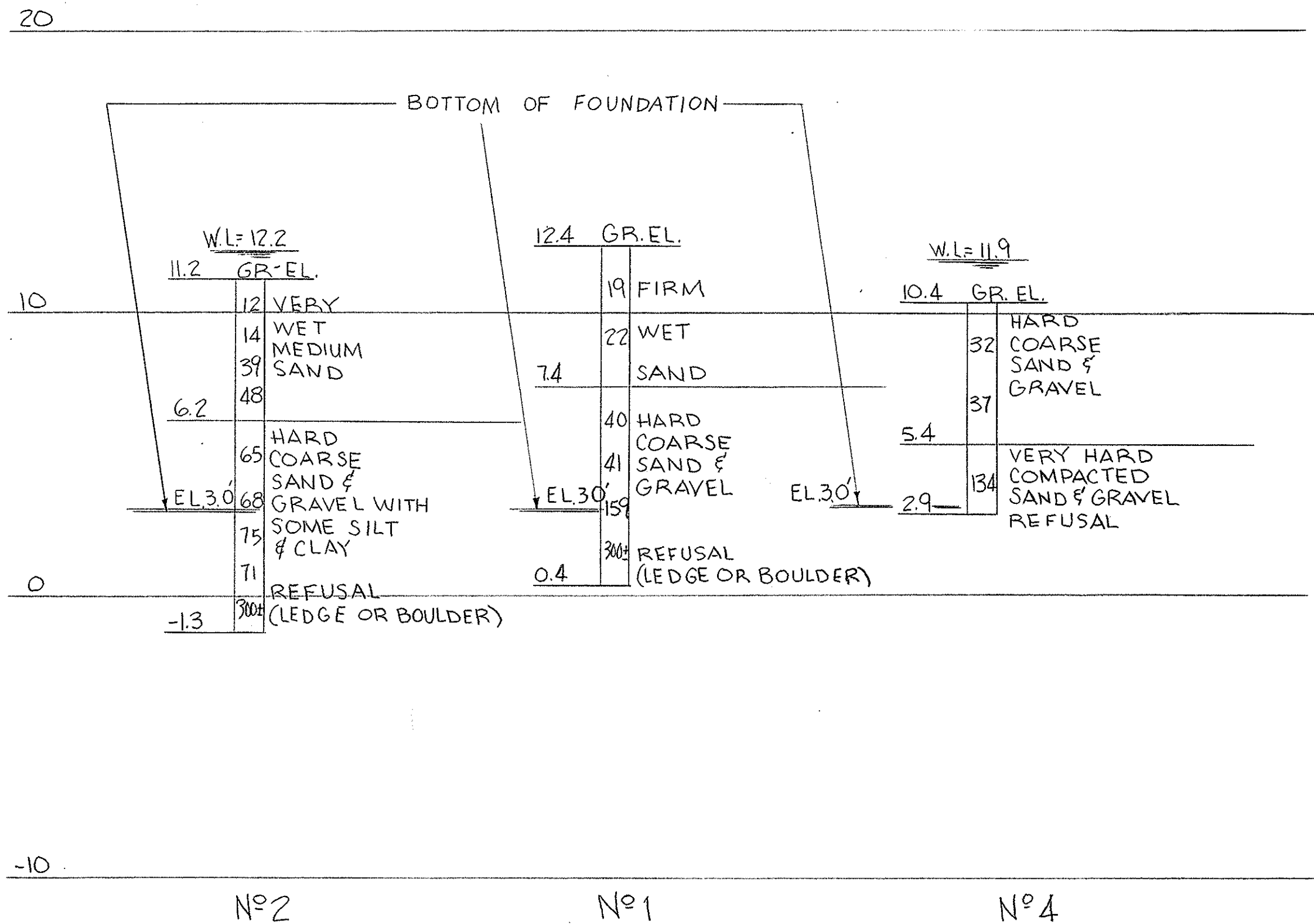
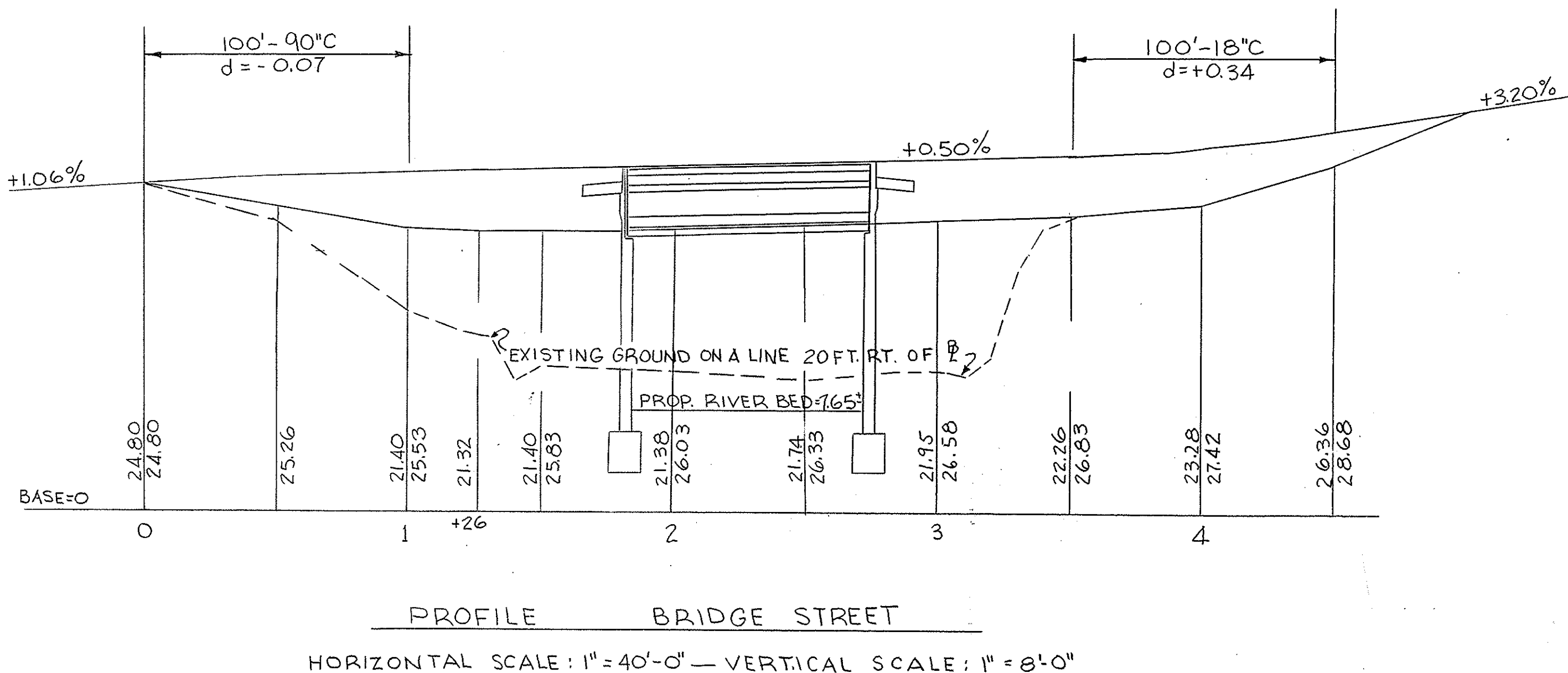
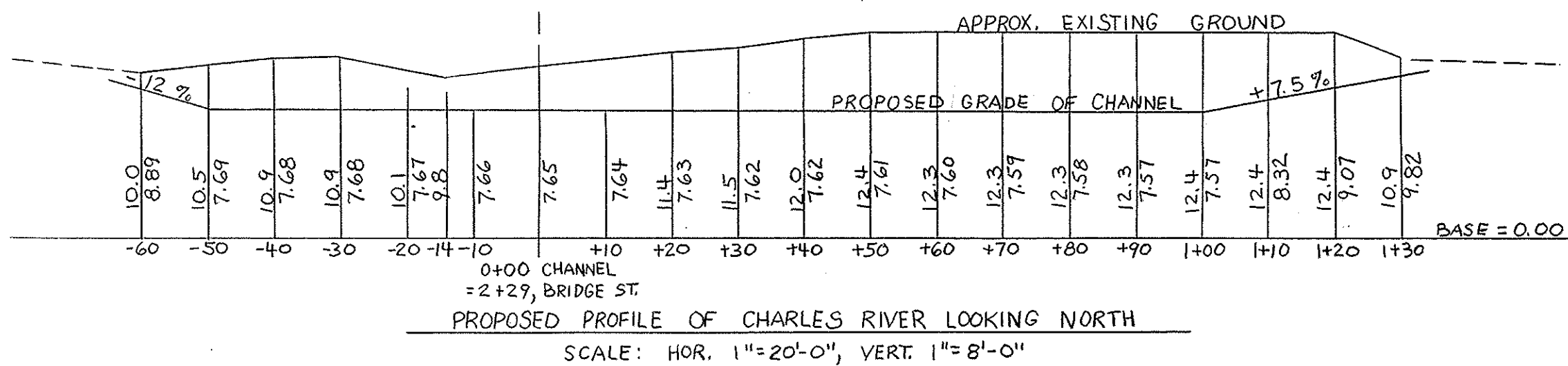
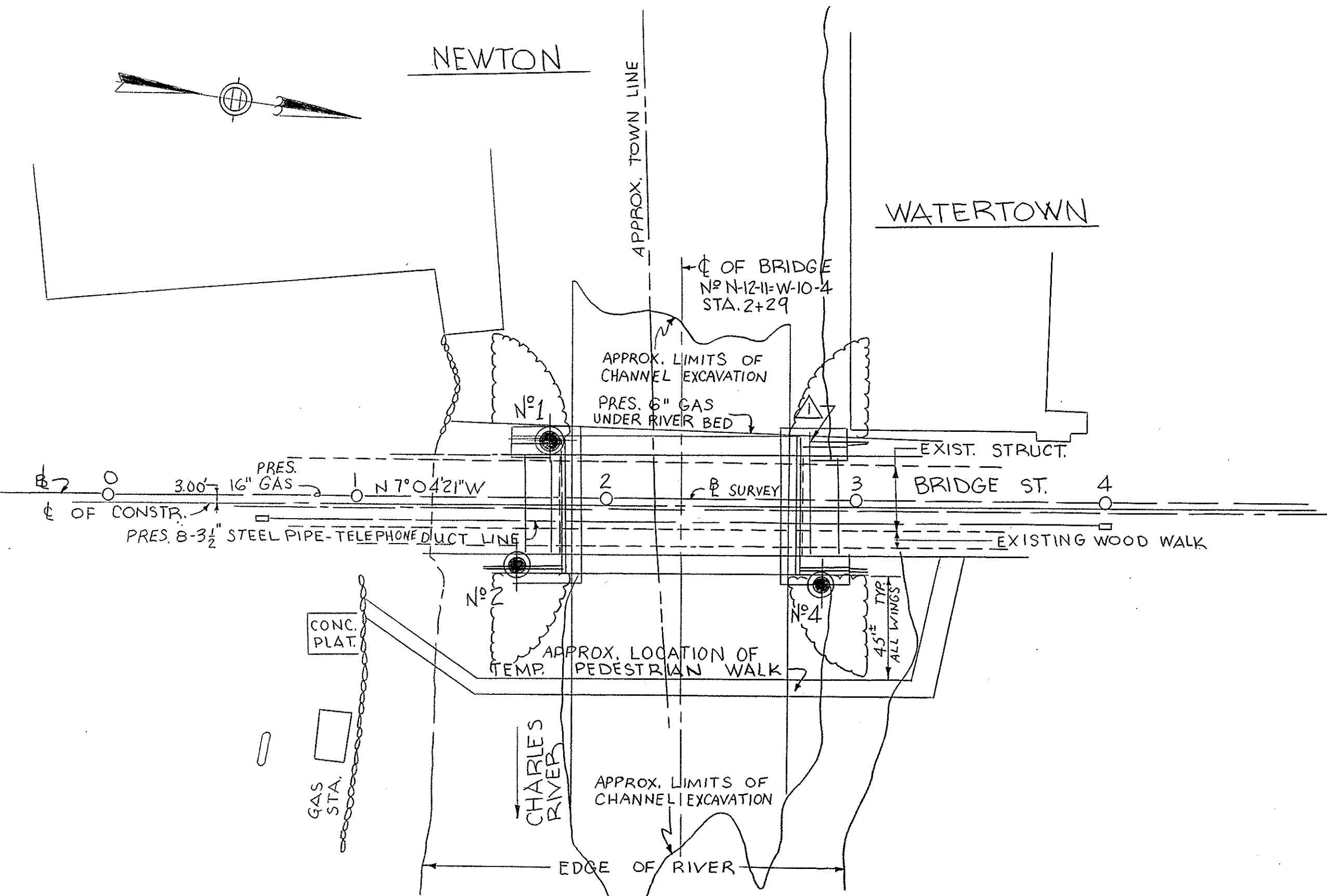
NOTEBOOKS:

9943, 2052 & 27859

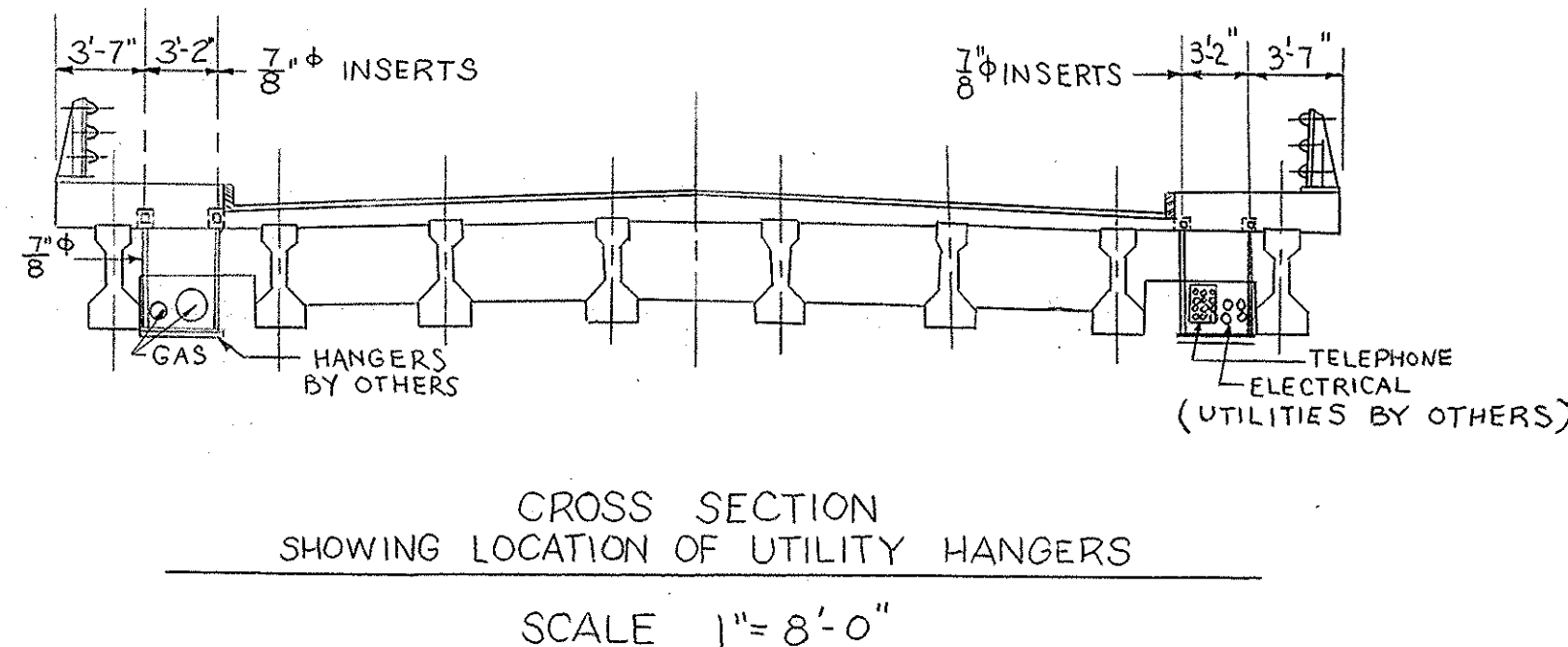
ANCHOR BOLTS:

ALL ANCHOR BOLTS SHALL BE SET BY TEMPLATE BEFORE THE CONCRETE IS PLACED.

ESTIMATED QUANTITIES SEE SHEET 2.



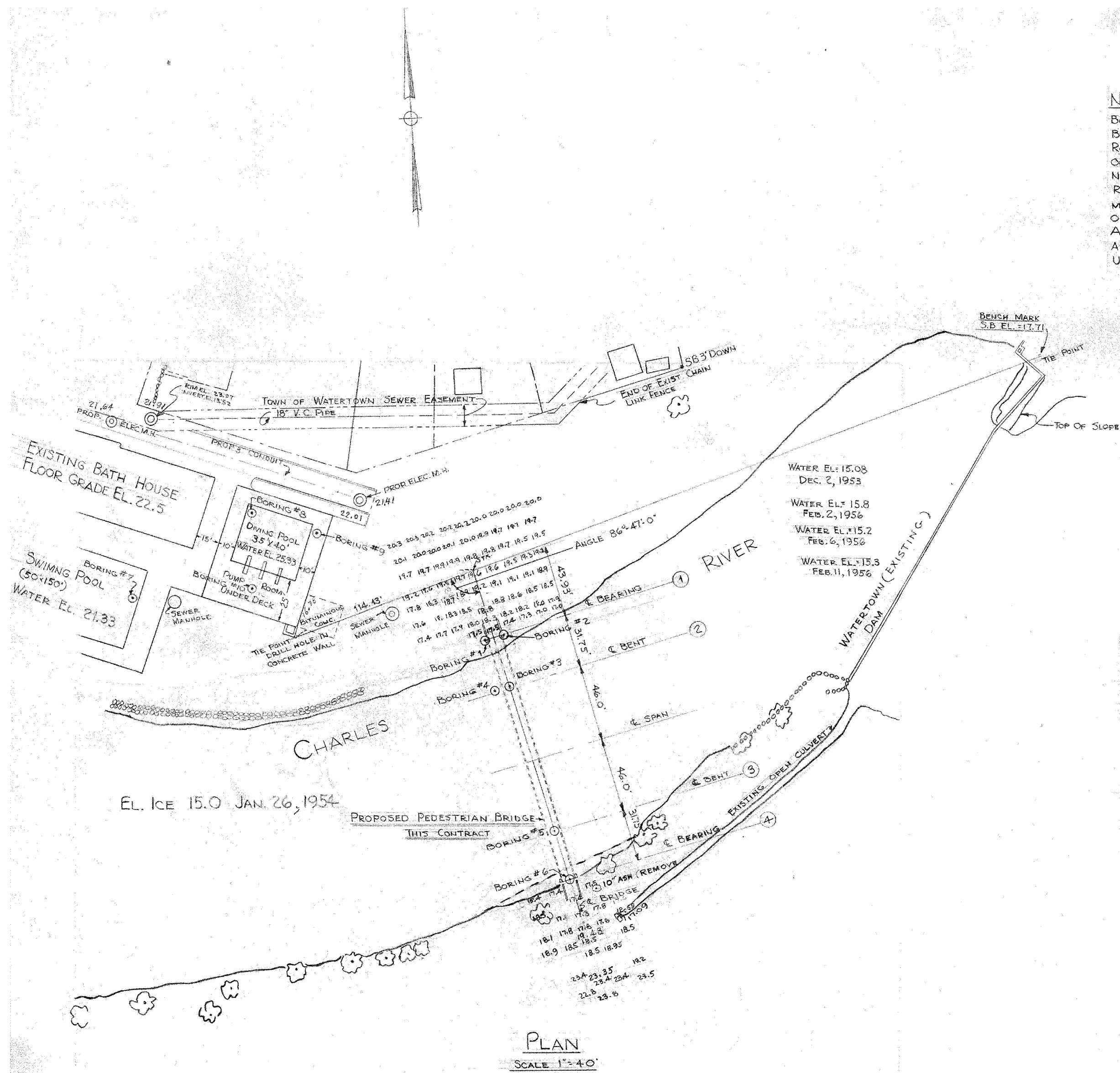
WATER LEVELS SHOWN ON THE BORING LOGS WERE OBSERVED AT THE TIME OF TAKING BORINGS AND DO NOT NECESSARILY SHOW THE TRUE GROUND WATER LEVELS. BORING 5 TAKEN APRIL, 1965 BY MASS. DEPT. OF PUBLIC WORKS DIV. OF RESEARCH AND MATERIALS, WELLESLEY, MASS. THERE IS NO BORING NO. 3.



COPIED FROM ORIGINAL TRACING BY S. PALAZZOLO, JAN. 5, 1973.
(ORIGINAL TRACING BEYOND REPAIR)

DESIGNED BY MIHALJAN	AUG. 12, 1967	△ N.W. WINGWALL FOOTING REVISED
DRAWN BY KALLOCH SIMON (C)	AUG. 12, 1967	△ REVISION SHEETS 1, 2, 3
CHECKED BY MULLEN	DEC. 3, 1966	ISSUED FOR CONSTRUCTION
APPROVED FOR DESIGN AHERNE	THE COMMONWEALTH OF MASSACHUSETTS PROPOSED BRIDGE NEWTON-WATERTOWN BRIDGE STREET OVER CHARLES RIVER SCALES AS NOTED OFFICE OF DEPARTMENT OF PUBLIC WORKS 100 NASHUA ST., BOSTON, MASS. DEC. 1966	
SPECS. COLLAZZO	S/R.J. Mc Donagh BRIDGE ENGINEER	S/John Hannon CHIEF ENGINEER

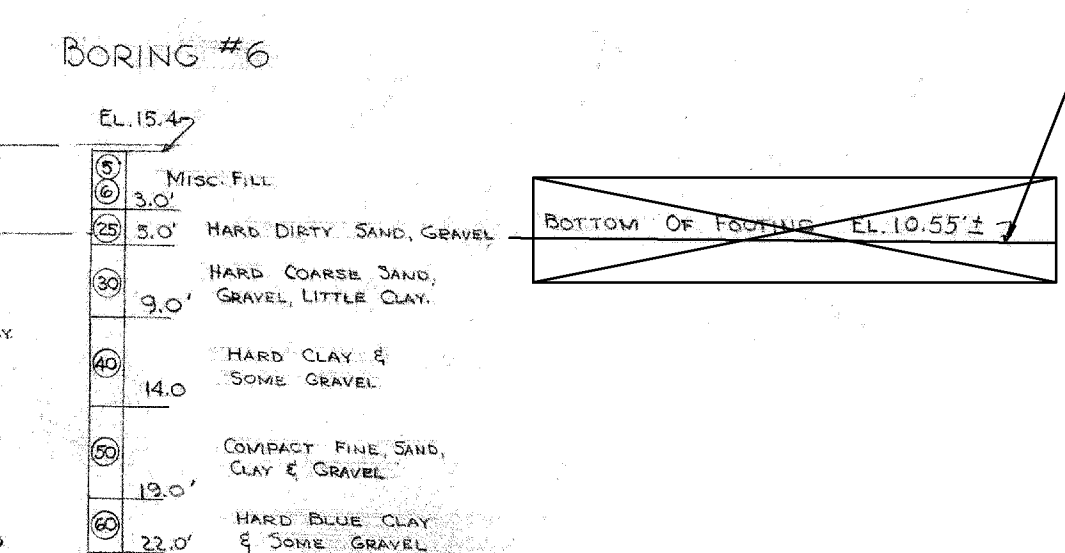
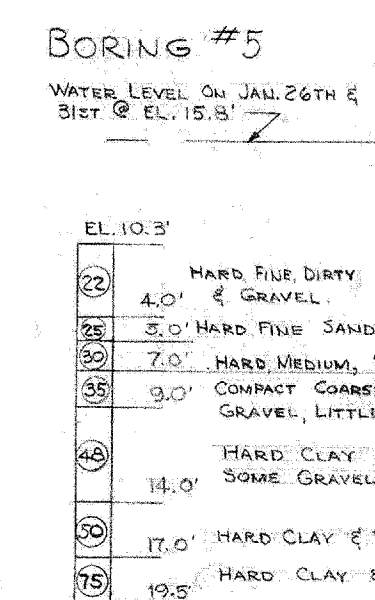
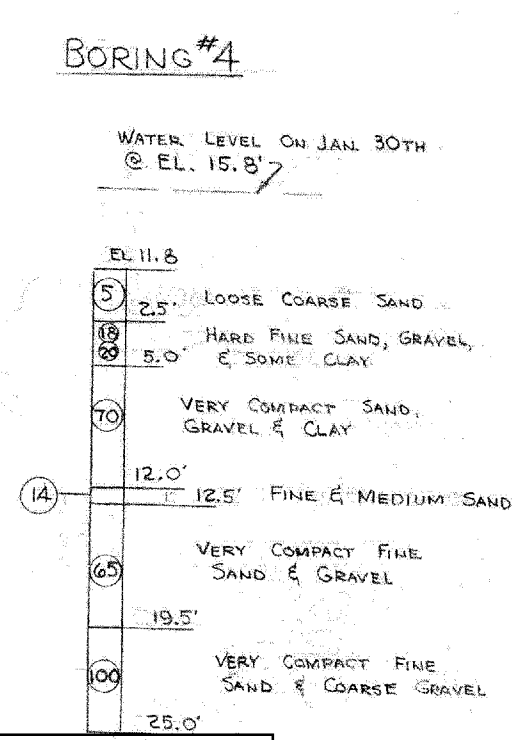
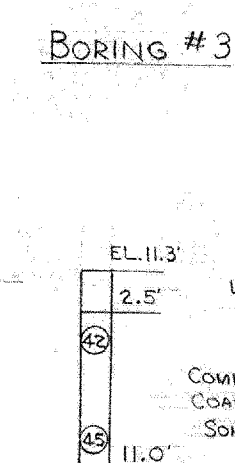
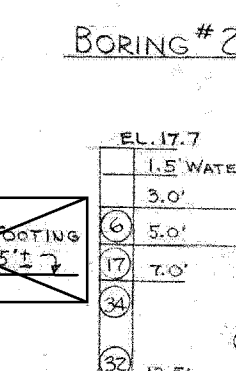
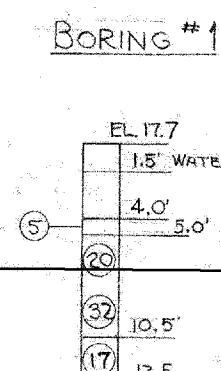
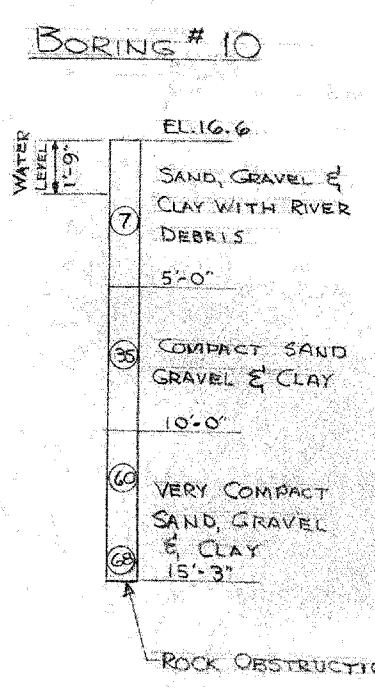
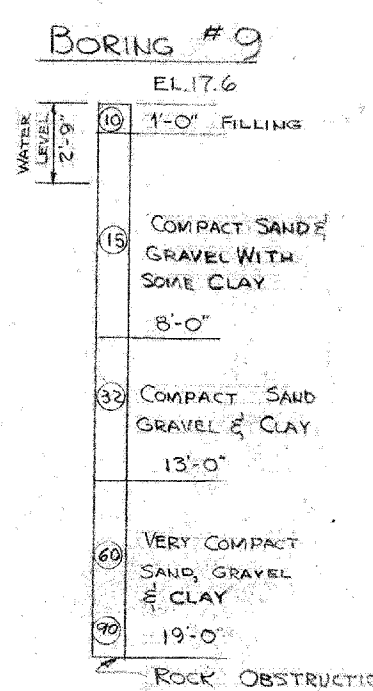
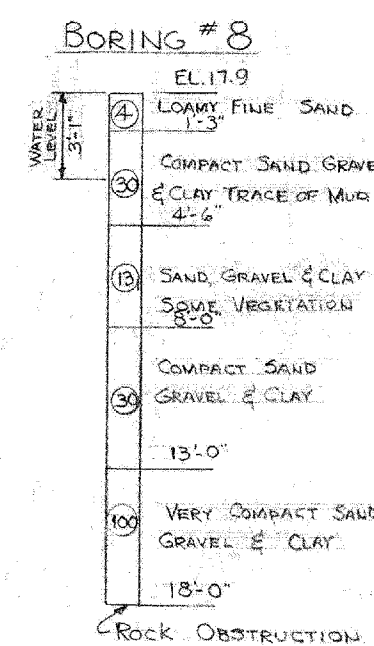
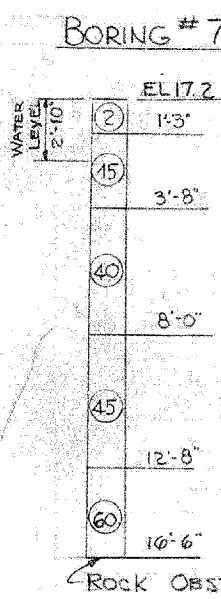
SHEET 1 OF 6 SHEETS BRIDGE No. W-10-4



NOTE: BORINGS 7, 8, 9, 10
BORINGS 8 & 9 TAKEN JAN. 7, 1954;
BORINGS 7 & 10 TAKEN JAN. 8, 1954.
ROCK OBSTRUCTION COULD BE EITHER BOULDER
OR LEDGE.
NUMBERS IN CIRCLES ARE NUMBER OF BLOWS
REQUIRED TO DRIVE AN OPEN-END 1-INCH DIA-
METER PIPE INTO THE MATERIAL A DISTANCE
OF 1-FOOT.
A 140-POUND WRIGHT FALLING THROUGH AN
APPROXIMATE DISTANCE OF 30-INCHES WAS
USED.

BORING NOTES
LOCATION OF BORINGS SHOWN ON PLAN
THUS ① B1.
BORINGS TAKEN FOR PURPOSE OF DESIGN
AND SHOW CONDITIONS AT BORING POINTS
ONLY, BUT DO NOT NECESSARILY SHOW
NATURE OF MATERIALS TO BE ENCOUNTERED
DURING THE CONSTRUCTION OF THE
BRIDGE.

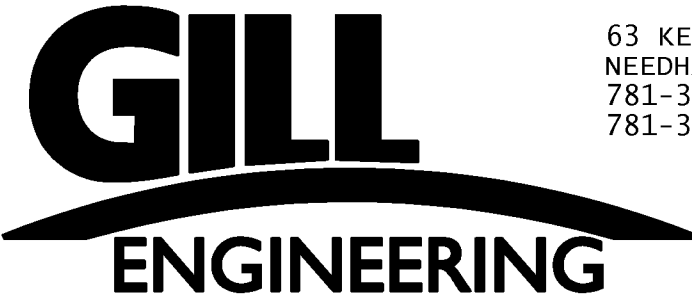
BORING DATA
SIZE 2" SAMPLING PIPE.
FIGURES IN LEFT HAND COLUMN INDICATE
NUMBER OF BLOWS REQUIRED TO DRIVE
2" SAMPLING PIPE ONE FOOT, USING 140-LB.
WEIGHT FALLING 30 INCHES.
BORINGS MADE BY RAYMOND CONCRETE
PILE CO. FEBRUARY 2, 1956.



NOTES:

1. LOCATION OF BORINGS SHOWN ON PLAN THUS ① B1.
2. BORINGS SHOW CONDITIONS AT BORING POINTS ONLY AND DO NOT NECESSARILY SHOW THE NATURE OF MATERIALS TO BE ENCOUNTERED DURING CONSTRUCTION.
3. RECORD BORING DATA IS FROM THE CONTRACT PLANS DATED FEBRUARY 1956.
4. NOTES FOR THIS PROJECT DENOTED BY

REV.	DATE	DESCRIPTION	BY



63 KENDRICK ST.
NEEDHAM, MA 02494
781-355-7100
781-355-7101 (FAX)

COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF CONSERVATION & RECREATION
DIVISION OF ENGINEERING

TOWN OF WATERTOWN
PEDESTRIAN BRIDGE REPLACEMENT
PEDESTRIAN BRIDGE
OVER CHARLES RIVER

DESIGNED: CJK
CHECKED: GRK

DATE: 9/23/16

CONT. P17-3139-C1A
ACC. 103473X

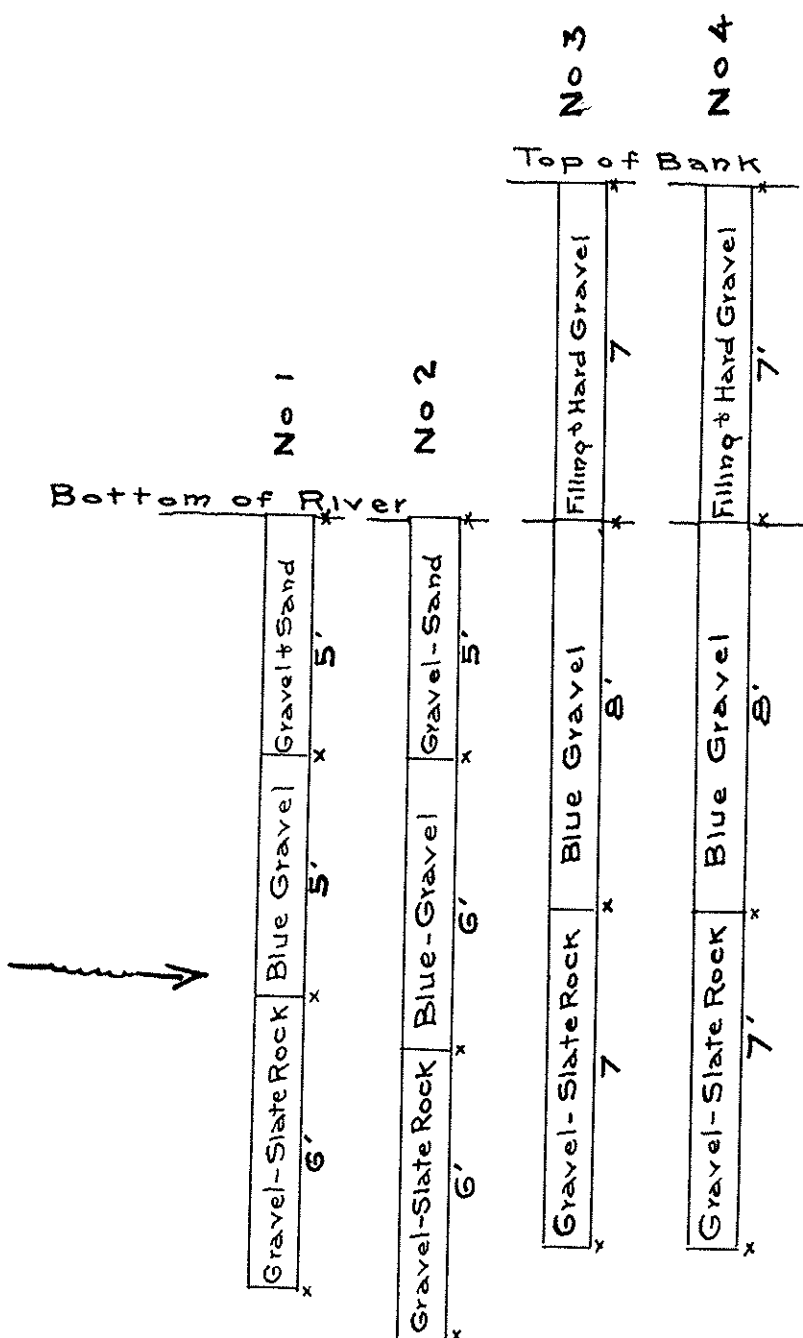
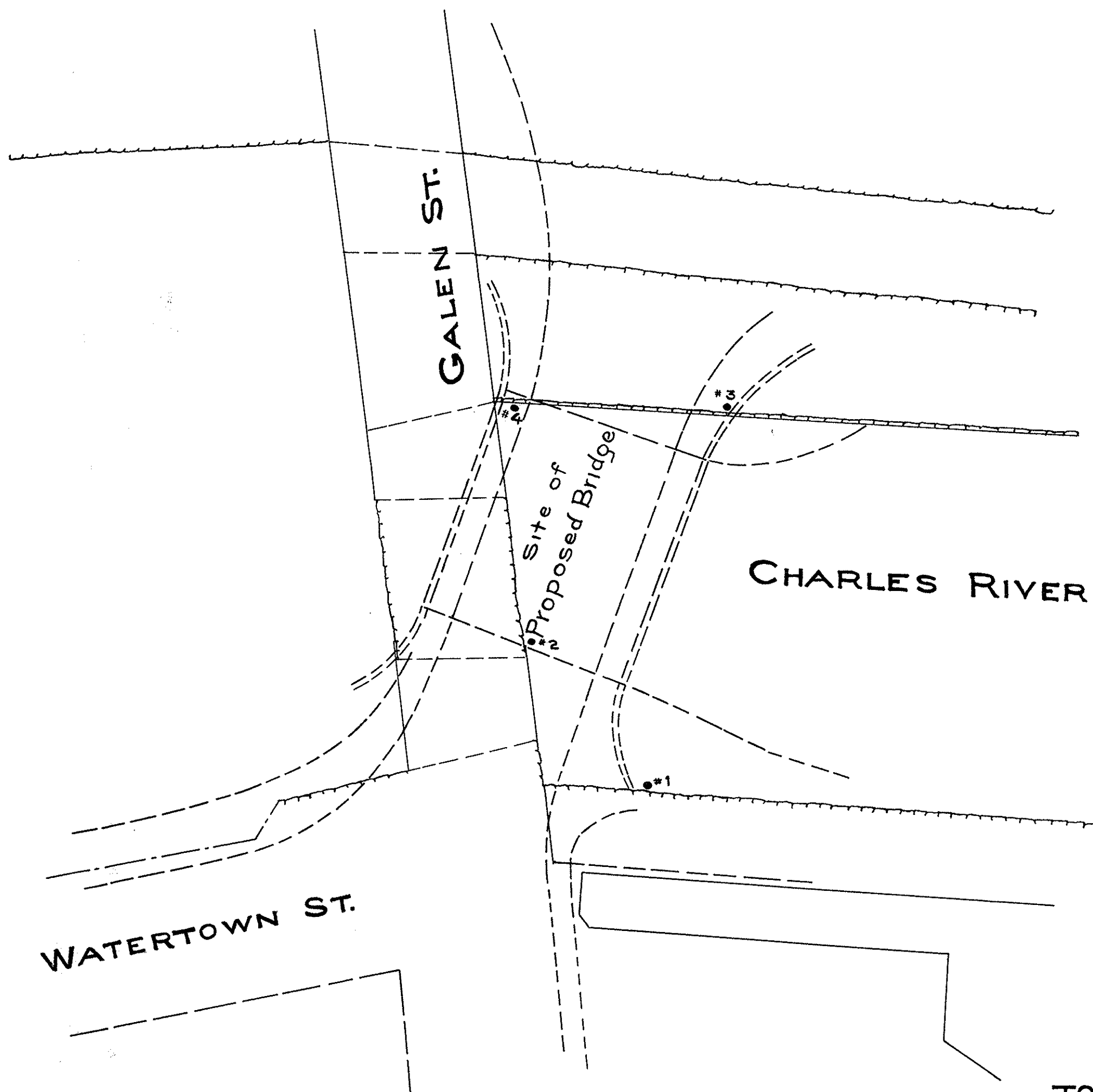
SCALE: AS NOTED

DRAWING NO.
B3

26 OF 34

2/4

2/4



TOWN-OF-WATERTOWN
GALEN-ST-IMPROVEMENT
PLAN SHOWING BORINGS AT SITE OF
PROPOSED BRIDGE
Scale Hor. 40 Ft. Ver. 4 Ft. = 1-INCH.
May 5-1906

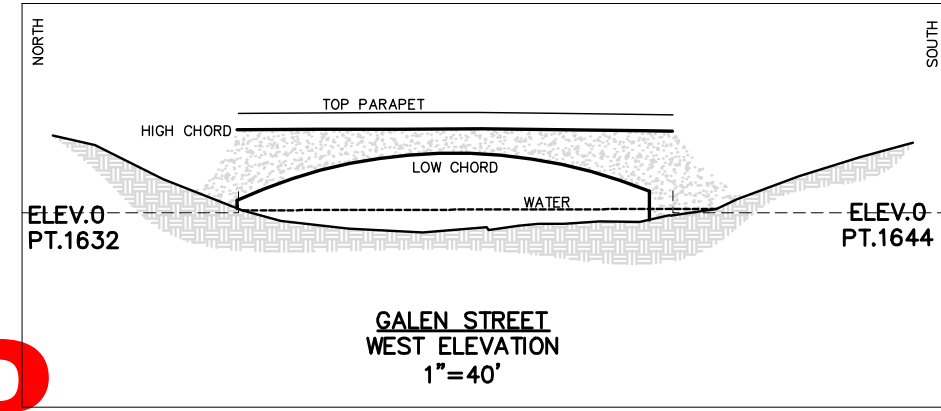
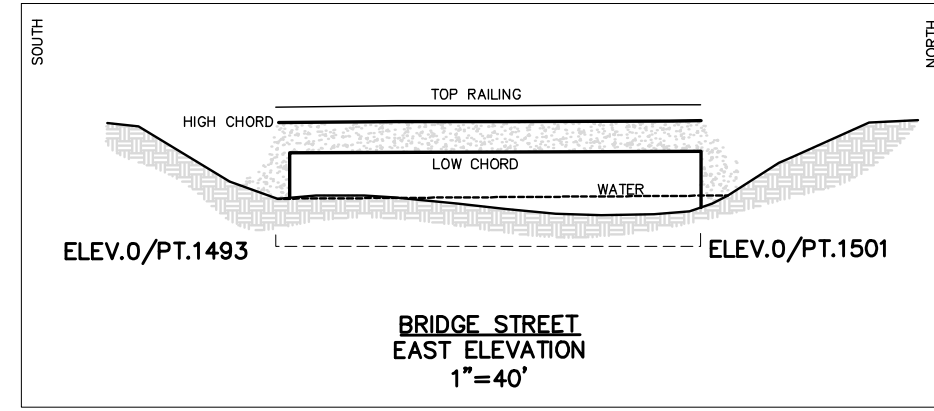
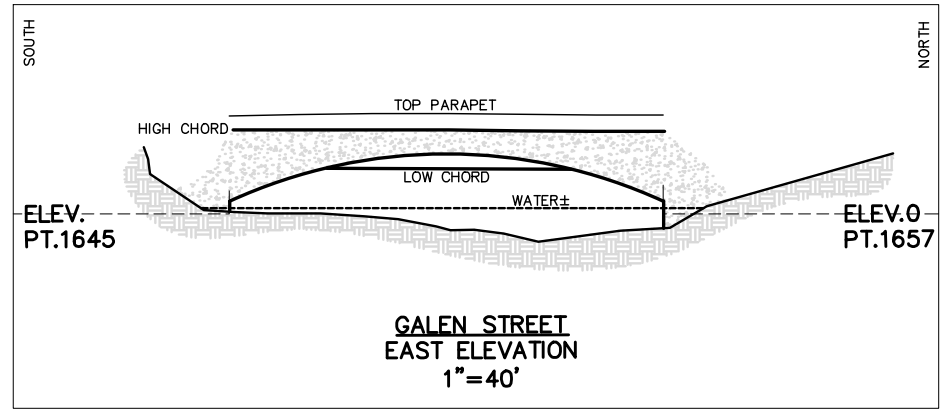
2/4

2/4

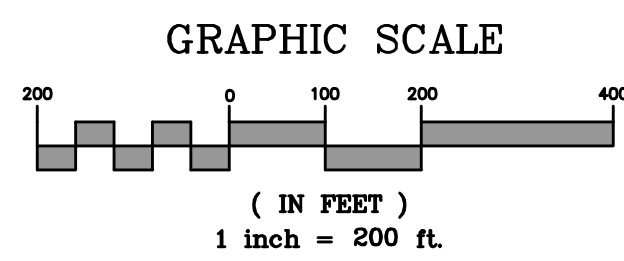
APPENDIX F

SURVEY AND FIELD DATA

-
- Diagram illustrating the elevation view of Bridge Street West. The drawing shows the bridge structure, including the top railing, high chord, and low chord. The water level is indicated. The elevation is marked as ELEV.0/PT.1483 on the left and ELEV.0/PT.1491 on the right. The drawing is labeled "BRIDGE STREET WEST ELEVATION" and "1"=40". A north arrow is present in the top left corner.



PRELIMINARY 06-18-2018



DATE	REVISION

CHARLES RIVER WORKSHEET			
Division of Ecological Restoration (DER) & Department of Conservation and Recreation (DCR) River Sections BRIDGE STREET to GALEN STREET Watertown, Massachusetts			
RH/JC	**	**	 MILONE & MACBROOM 99 Realty Drive Chelsea, CT 06410 203-273-1373 www.mmncinc.com
FIELD CREW	DRAWN	CHECKED	
SCALE:	1"=200'		
DATE:	MAY 2018		2688-44 PROJECT NO.
			1 OF 1 SHEET NO.

APPENDIX G

SEDIMENT SAMPLING REPORT

SEDIMENT SAMPLING REPORT

Watertown Dam | Watertown, Massachusetts

August 27, 2018
MMI #2688-44-04

INTRODUCTION

The Watertown Dam is located between Pleasant Street and California Street in Watertown, Massachusetts, at 42° 21' 55.74" N, 71°11' 29.57" W. The dam is recognized by state ID number 4-9-314-1 and at the federal level by ID number MA00456. The face of the dam is approximately 6 to 8 feet high and 200 feet wide, with a 10-foot-wide adjustable low-level outlet with stacked timber stop logs in the southeast corner of the dam. The entirety of the 200-foot cross width is constructed of concrete, with a sloping earthen embankment upstream of the spillway. Adjacent to the low-level outlet is a small fish ladder, which discharges just to the south of the low-level outlet. According to the Charles River Watershed Association (CRWA), the impoundment resulting from the dam extends approximately 1 mile upstream, with a total storage volume of 20 acre-feet (approximately 6.5 million gallons).

According to the CRWA, the origins of the dam can be traced to 1634 when Native Americans constructed a small fish weir. As the Watertown area became impacted by the Industrial Revolution in the late 18th and early 19th centuries, the dam was expanded and the impoundment enlarged in order to provide the hydraulic head required to power mills. Subsequent to the postwar deindustrialization in the 1960s, the dam was revitalized, and a repurposing of the dam as a flood control structure was proposed. However, the dam has not been utilized as such. Ordinarily, the impoundment is completely full, with water spilling over the entire width of the spillway and low-level outlet, rendering it ineffective for downstream flood control.

Despite its longstanding presence in the Watertown community, the dam has been targeted for removal for several reasons. Most pressingly, the dam is a major impediment to several migratory fish species, including blueback herring, alewife, American shad, and others. Although there are dams both downstream and upstream of Watertown Dam, those dams have effective fish passages that minimize the disruption of fish migration. According to a 2011 report by Stantec Consulting Services, the fish ladder at Watertown Dam is structurally and hydraulically deficient, with poor utilization and high mortality of the target fish species. Watertown Dam is also listed as a "Significant Hazard Potential" dam. According to the Massachusetts Department of Conservation & Recreation (DCR), a failure of Watertown Dam has the potential to cause loss of life, significant property damage, and large-scale economic disruption. Although the dam is currently in fair condition, inspections must be performed at regular 3- to 5-year intervals in order to ensure that structural integrity is maintained. Lastly, Watertown Dam has no functional purpose at this time. Although it could theoretically be used to supplement flood control measures downstream, the relatively small storage volume and lack of historical need make this use unnecessary. It is even thought that the deeper conveyance channel after dam removal could reduce flooding concerns along the area of the present impoundment.

When the concept of removing a dam is proposed, management of accumulated sediment is crucial to ensuring that downstream habitat and public safety are protected during the dam removal process. Due to its industrial past, it is plausible that any sediments that have accumulated behind the dam may contain harmful contaminants such as polychlorinated biphenyls (PCBs), heavy metals, petroleum hydrocarbons, chlorinated pesticides, and others. The amount of accumulated sediment should also be roughly quantified before the dam removal process commences. This ensures that any concerning substances can be disposed of or contained instead of released downstream once the dam has been breached.

Milone & MacBroom, Inc. worked closely with the DCR, the Massachusetts Division of Ecological Restoration (DER), and the CRWA to develop a sediment sampling and benthic probing plan to adequately characterize the quantity and chemical constituents of the accumulated sediments behind Watertown Dam. The methodology and results of the study are summarized below.

METHODOLOGY

Personnel from Milone & MacBroom, Inc. were present at the Charles River on May 23, 2018. The purpose of the visit was to collect sediment samples for chemical and physical analysis and to probe the river bottom to determine sediment depths throughout the impoundment and surrounding river reaches. The sediment was studied at 10 transects along the Charles River. One location was positioned upstream of the former Nonantum Dam, six locations were located between the breached Nonantum Dam and the Watertown Dam, and three areas were sampled downstream of the Watertown Dam. Although 10 sampling locations were planned, one location between Nonantum Dam and Watertown Dam, labeled S-10 on the appended map, was found to be unsuitable for gathering samples due to lack of sediment accumulation in the area. All 10 areas were probed for sediment, however. At each sampling point, probing was performed in three locations along a perpendicular transect in order to determine sediment depth and composition.

The probing and sampling were performed with a 36-inch Wildco Hand Core Sediment Sampler. When water depth permitted, probing and sampling were performed by wading through the river while deeper areas required a boat-mounted approach to sampling. The soil sampler houses a 2.5-inch-diameter plastic sleeve and is outfitted with a specialized tip and backflow preventer in order to maximize sediment containment within the sleeve. Multiple sample collections were executed and composited at each transect in order to gather a sufficient quantity of sediment such that sampling could be performed. When possible, samples were taken in the center of the transect; however, much of the river did not exhibit extractable quantities of sediment within the center channel. In such cases, samples were concentrated toward the banks. Samples were well mixed in a steel mixing bowl before being deposited into laboratory-provided glass jars. The sampling unit was cleaned between each sampling location to prevent cross contamination of samples.

Sediment probing was performed at 10 transects. At each transect, the river was roughly divided into thirds. The left edge of water, center channel, and right edge of water were each probed several times to categorize the average sediment encountered in each third of the river. This method was chosen because the high velocity of the water made probing across the river at higher resolution impossible. Sediment depths were collected by advancing steel rods until substrate was encountered and then again advancing under manual power until refusal. Refusal was determined to be the point at which the maximum steady application of force applied by the sampling scientist no longer advanced the sampler further into the sediment. The difference between the two depths was determined to be the depth of the accumulated

sediment at that location. Care was taken to apply a consistent amount of pressure on the apparatus at each sample location. At the point of refusal, the depth of sediment observed was noted.

The samples were transported in refrigerated containment units until delivery to a Massachusetts-certified environmental testing laboratory, Complete Environmental Testing, Inc. (CET) on May 15, 2017. Each sediment sample was analyzed for the following constituents in accordance with 314 Code of Massachusetts Regulations (CMR) 9.07(2)(b)(6):

- Metals (Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, and Zinc) by the Environmental Protection Agency (EPA) Method 6010C
- Polyaromatic Hydrocarbons (PAHs) by EPA Method 8270D Modified
- Polychlorinated Biphenyls (PCBs) by EPA Method 8082A with Soxhlet Extraction
- Extractable Petroleum Hydrocarbons (EPH) by Massachusetts Department of Environmental Protection (DEP) Methodology
- Organo-Chlorine Pesticides by EPA Method 8081B
- Total Organic Carbon by EPA Method 9060A

Laboratory detection limits were requested to meet those found in 314 CMR 9.07, and results were compared to soil category "S-1/GW-1" criteria listed in 310 CMR 40.

Upon receipt of the laboratory results, the data was entered into a spreadsheet provided by Massachusetts Department of Fish and Game and the DER. For results that fall below the laboratory detection limit, the spreadsheet prescribes an input of one-half the detection limit into the cell, with green color coding of the text to indicate that it was out of range. This sheet also contains regulatory standards for many of the parameters for which sampling was done.

The full spreadsheet with sampling results is attached as Appendix A while site maps of the sampling locations are attached as Appendix B. Within Appendix B, Figure 1 shows the sampling locations, Figure 2 shows the observed depth of water at each sampling location, Figure 3 shows the depth of sediment at each sampling location, and Figure 4 shows locations classified by the type of elevated contaminant observed.

RESULTS AND ANALYSIS

Sample 1

The downstreammost sample location is located near Water Street, downstream of the Watertown Dam and the Galen Street bridge. The land use surrounding the sample location is fairly urbanized, with old manufacturing buildings adjacent to the left bank and a small grass area of open space adjacent to the right bank. The water is deep and slow moving in this area. Upon inserting the sampling apparatus into the sediment, a strong petroleum odor was noted, and a visible oily sheen was observed on the surface of the water. When agitated, the sheen maintained its form, potentially indicating petroleum origins as opposed to natural mineral sheen.

Physical Characteristics

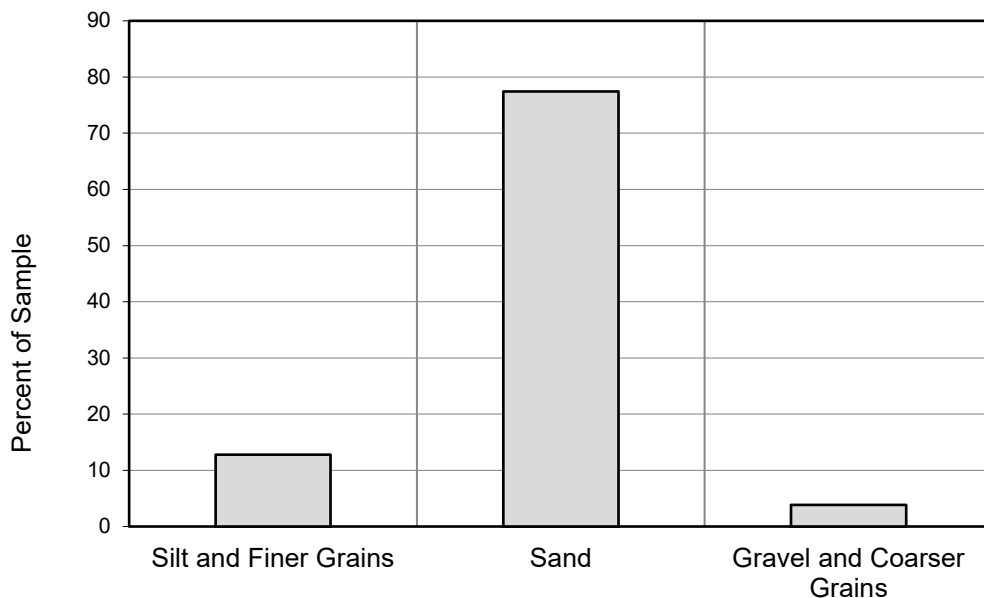
The sediment was characterized as fine to medium sand with a dark gray color. Some gravel and silt were present. Sieve analysis is shown in Table 1-1 and Graph 1-1 below.

TABLE 1-1
S-1 Grain Size Distribution

Sieve No.	Size (mm*)	Percent	Material Description
4	4.75	3.85	Fine Gravel
10	2	5.94	Coarse Sand
40	0.42	19.7	Medium Sand
60	0.25	27.7	Medium Sand
200	0.074	30	Fine Sand

*mm = millimeter

GRAPH 1-1
S-1 Grain Size Distribution



Total organic carbon was found to be 3.1 percent, with 56 percent total water.

Sediment was probed throughout the river. There was no extractable sediment in the center channel. The sample was collected approximately 5' from the riverbank, where the sediment was approximately 1.75' deep.

Chemical Characteristics

Of the heavy metals sampled, the only element that exceeded the Massachusetts Contingency Plan (MCP) S-1/GW-1 Human Health Standards was lead, at 240 milligrams per kilogram (mg/kg). Chemical analysis results appear to confirm field observations of petroleum sheen and odor. Multiple PAH compounds exceeded MCP S-1/GW-1 standards. EPH was detected at a concentration of 512.5 mg/kg. There were no chlorinated pesticides detected in Sample 1. PCBs, specifically Aroclor 1260, were detected at a concentration of 0.26 micrograms per kilogram (µg/kg).

Sample 2

Sample S-2 was gathered within the vicinity of the Watertown Founders Monument, again located downstream of both the Watertown Dam and the Galen Street bridge. The area around the sample is similarly urbanized as that of Sample 1, with deep slow-moving water. Just as with Sample 1, a petroleum odor was noted and a visible sheen on the water when inserting the sampler into the sediment.

Physical Characteristics

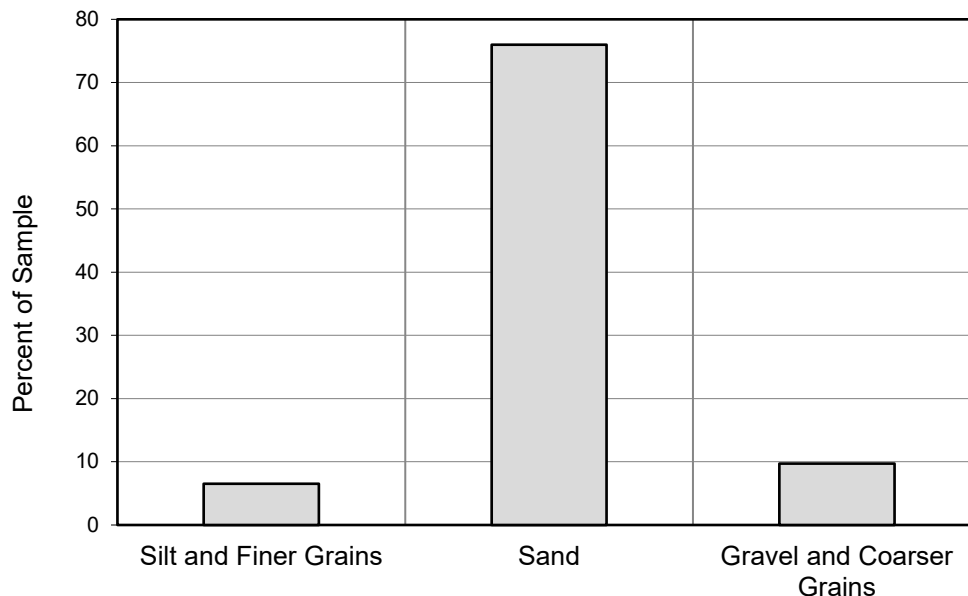
The sediments were described as ranging from fine to coarse and grey brown in color, with gravel, silt, and organic matter present. Sieve analysis is depicted below in Table 1-2 and Graph 1-2.

TABLE 1-2
S-2 Grain Size Distribution

Sieve No.	Size (mm*)	Percent	Material Description
4	4.75	9.77	Fine Gravel
10	2	7.75	Coarse Sand
40	0.42	19.6	Medium Sand
60	0.25	20.9	Medium Sand
200	0.074	35.5	Fine Sand

*mm = millimeter

GRAPH 1-2
S-2 Grain Size Distribution



Total organic carbon was found to be 4.1 percent, with 56 percent total water.

Sediment was probed throughout the river. As with Sample 1, there was no extractable sediment in the center channel. The sample was collected from several locations close to the riverbank where the sediment was approximately 1.5' to 3' deep.

Chemical Characteristics

Of the heavy metals analyzed, none exceeded the MCP GW-1 Human Health Standards. Chemical analysis results again confirmed the observed petroleum sheen and odor. Of the 17 PAH compounds analyzed, 16 were detected in the sample. Some of the detected PAH compounds exceeded MCP S-1/GW-1 standards. EPH was detected at a concentration of 462 mg/kg. There were no chlorinated pesticides or PCBs detected in Sample S-2.

Sample 3

Sample S-3 was gathered just downstream of Watertown Dam, upstream of the Galen Street bridge. The river is much shallower in this area, with large cobbles and substrate generating rapids. Due to the shallow water and coarse substrate, this sample was gathered by wading into the water and collecting samples by hand. A slight petroleum odor was noted when harvesting the sample although not nearly as strong as with S-1 and S-2. The immediate area around the sample is less urbanized than sample 1 although the study reach is located within an urbanized area. The right bank borders a small park while the left bank borders several old factory buildings that have been converted into mixed residential and commercial use buildings.

Physical Characteristics

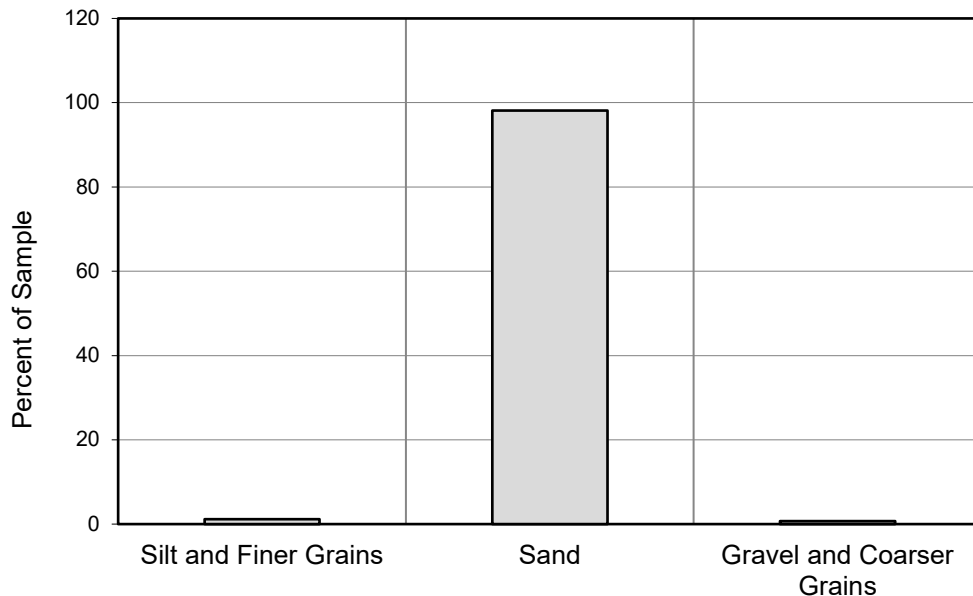
The sediment was described as medium to coarse sand and brown grey in color, with some gravel and trace silt. Sieve analysis is shown in Table 1-3 and Graph 1-3 below.

TABLE 1-3
S-3 Grain Size Distribution

Sieve No.	Size (mm*)	Percent	Material Description
4	4.75	0.713	Fine Gravel
10	2	ND	Coarse Sand
40	0.42	69.9	Medium Sand
60	0.25	21.6	Medium Sand
200	0.074	6.64	Fine Sand

*mm = millimeter

GRAPH 1-3
S-3 Grain Size Distribution



Total organic carbon was found to be 0.7 percent, with 18 percent total water.

Due to the rushing water associated with the dam outflow, there is minimal accumulated sediment in the river channel. This was due to the effects of the high velocity of water from the dam discharge spillway. The sample was collected approximately 5 feet from the south bank adjacent to the stone staircase access to the river from the park. The sample was collected from several locations close to the riverbank. Due to the rocky substrate, refusal was met immediately.

Chemical Characteristics

Of the heavy metals sampled, none exceeded the MCP GW-1 Human Health Standards. In the PAH suite, 10 compounds were found in the sample. One PAH, Benzo[a]pyrene, equaled the MCP S-1/GW-1 standards in this sample. There was a detection of the chlorinated pesticide Dieldrin at a level of 3.4 ug/kg. There were no PCBs detected in S-3.

Sample 4

Sample S-4 was gathered upstream of the breached Nonantum Dam, which is upstream of the Watertown Dam impoundment, in Newton, Massachusetts. The banks are bordered by old factory buildings, which have since been converted into mixed-use retail and light industrial space.

Physical Characteristics

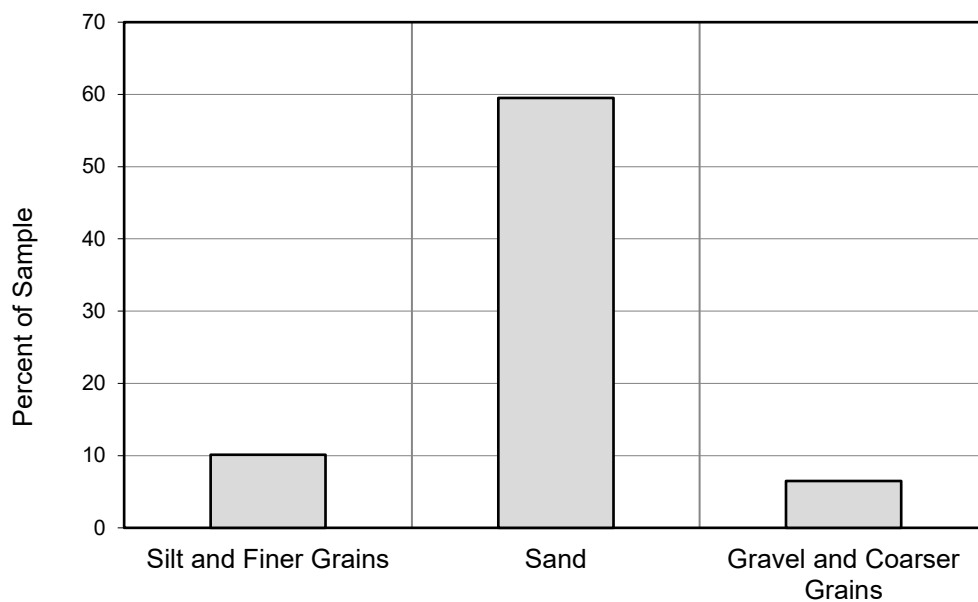
The sediment was described as brown/grey fine to medium sand, with organics and leaf matter present. Sieve analysis is shown in Table 1-4 and Graph 1-4 below.

TABLE 1-4
S-4 Grain Size Distribution

Sieve No.	Size (mm*)	Percent	Material Description
4	4.75	6.48	Fine Gravel
10	2	23.9	Coarse Sand
40	0.42	31.3	Medium Sand
60	0.25	9.14	Medium Sand
200	0.074	19.1	Fine Sand

*mm = millimeter

GRAPH 1-4
S-4 Grain Size Distribution



Total organic carbon was found to be 8 percent, with 83 percent total water. The sediment depth at the sampling location on the southern bank was approximately 6 inches.

Chemical Characteristics

Of the heavy metals sampled, none exceeded the MCP GW-1 Human Health Standard. Of the 17 PAHs sampled, 10 were found in the sample. One PAH, Benzo[a]pyrene, equaled the MCP S-1/GW-1 standards in this sample. EPH measured 590 mg/kg. There were no chlorinated pesticides or PCBs detected in S-4.

Sample 5

Sample S-5 was gathered within the Watertown Dam impoundment in the area of Chapel Street in Newton, Massachusetts. This area is just downstream of the former Nonantum Dam, which was recently breached. There is a wooded perimeter on both banks, with the bike path flanking the left bank of the river. A large industrial area lies just north of the bike path. The right bank of the river features residential and light commercial buildings.

Physical Characteristics

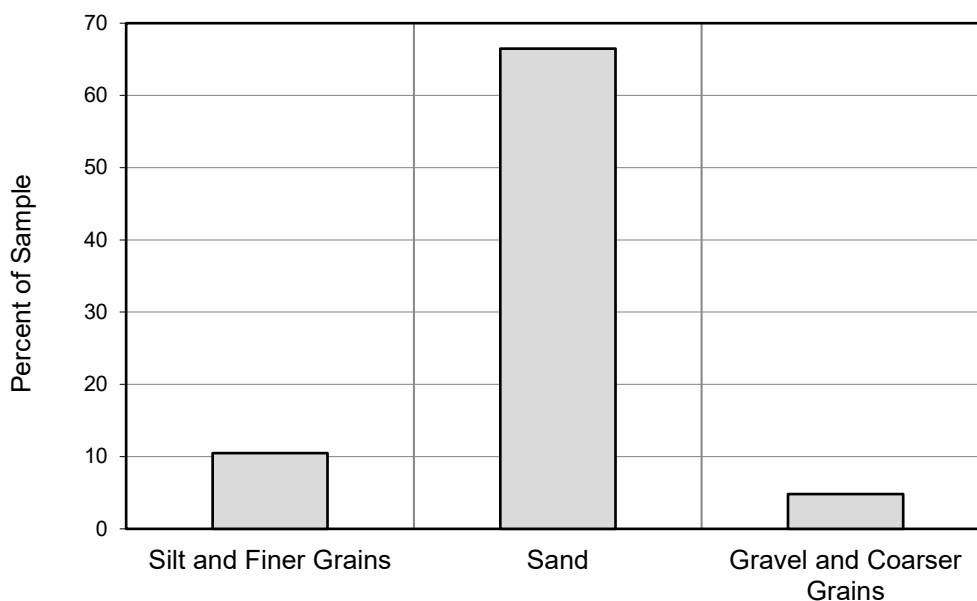
The sediment was described as fine to medium sand with organics and leaf matter present. Sieve analysis is shown in Table 1-5 and Graph 1-5 below.

TABLE 1-5
S-5 Grain Size Distribution

Sieve No.	Size (mm*)	Percent	Material Description
4	4.75	4.82	Fine Gravel
10	2	18.2	Coarse Sand
40	0.42	31.4	Medium Sand
60	0.25	10.3	Medium Sand
200	0.074	24.8	Fine Sand

*mm = millimeter

TABLE 1-5
S-5 Grain Size Distribution



Total organic carbon was found to be 7.2 percent, with 87 percent total water. There was no significant sediment accumulation in the channel. The sample was collected near the right edge of water.

Chemical Characteristics

Of the heavy metals sampled, none exceeded the MCP GW-1 Human Health Standard. In the PAH suite, four compounds were detected in the sample. One PAH, Benzo[a]pyrene, exceeded the MCP S-1/GW-1 standards. EPH measured 680 mg/kg. There were no chlorinated pesticides or PCBs detected in Sample 5.

Sample 6

Sample S-6 was gathered within the Watertown Dam impoundment adjacent to Forte Memorial Park. Land use around the sampling location is wooded on both banks, with the town bike path running on both sides of the river. Beyond the wooded areas, a large town park is adjacent to the right bank while a large apartment complex lies near the left bank.

Physical Characteristics

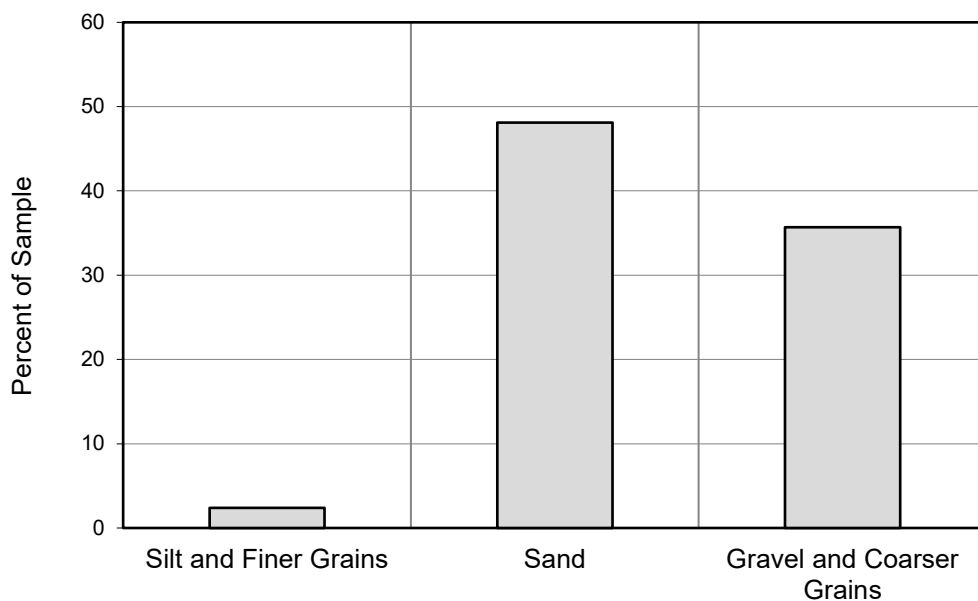
Sediments found in this area were described as predominantly gravel. Sieve analysis is shown in Table 1-6 and Graph 1-6 below.

TABLE 1-6
S-6 Grain Size Distribution

Sieve No.	Size (mm*)	Percent	Material Description
4	4.75	35.7	Fine Gravel
10	2	13.8	Coarse Sand
40	0.42	29.9	Medium Sand
60	0.25	8.17	Medium Sand
200	0.074	9.99	Fine Sand

*mm = millimeter

GRAPH 1-6
S-6 Grain Size Distribution



Total organic carbon was found to be 8.7 percent, with 87 percent total water. There was no significant sediment accumulation aside from a light gravelly accumulation in the center channel.

Chemical Characteristics

Of the heavy metals sampled, none exceeded the MCP GW-1 Human Health Standard. One PAH, Benzo[a]pyrene, exceeded the MCP S-1/GW-1 standards. EPH measured 340 mg/kg. Two chlorinated pesticides were detected in the sample. 4,4'-DDD was detected at 19 ug/kg while Dieldrin was detected at 12 ug/kg. There were no PCBs detected in Sample 6.

Sample 7

Sample S-7 was gathered within the Watertown Dam impoundment in the area of Los Angeles Street in Newton, Massachusetts. This location is very similar to the Sample 6 location. Land use around the sampling location is wooded on both banks; however, an industrial area is located a short distance from the banks on Riverdale Avenue and Los Angeles Street. The river is bordered by the bike path on both sides.

Physical Characteristics

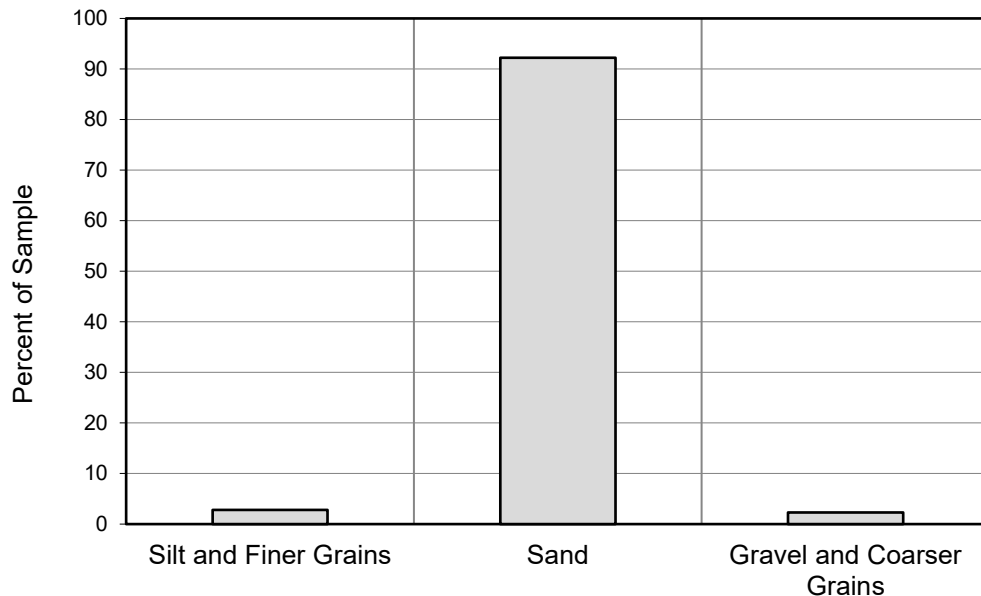
Sediment was described as fine to medium sand. Sieve analysis is shown in Table 1-7 and Graph 1-7 below.

TABLE 1-7
S-7 Grain Size Distribution

Sieve No.	Size (mm*)	Percent	Material Description
4	4.75	2.31	Fine Gravel
10	2	2.64	Coarse Sand
40	0.42	24.3	Medium Sand
60	0.25	35.8	Medium Sand
200	0.074	32.1	Fine Sand

*mm = millimeter

GRAPH 1-7
S-7 Grain Size Distribution



Total organic carbon was found to be 2.2 percent, with 35 percent total water. The sediment depth was approximately 6 inches near the right edge of water where the sample was collected.

Chemical Characteristics

Of the heavy metals sampled, none exceeded the MCP GW-1 Human Health Standard. Of the 17 PAHs sampled, 12 were found in the sample. One PAH, Benzo[a]pyrene, exceeded the MCP S-1/GW-1 standards. EPH measured 173.5 mg/kg. One chlorinated pesticide, Dieldrin, was detected in the sample at 5.8 ug/kg. There was one detection of PCBs in Sample 7. Aroclor 1260 was detected at a concentration of 0.39 ug/kg. This value is well below MCP S-1/GW-1 standards.

Sample 8

Sample 8 was gathered within the Watertown Dam impoundment adjacent to the west end of the old town pool. Land use around the sampling location is wooded on both banks, and the river is bordered by the bike path on both sides. Beyond the wooded area along the banks is a town pool and recreation area on the left bank and a dense single-family residential area on the right bank.

Physical Characteristics

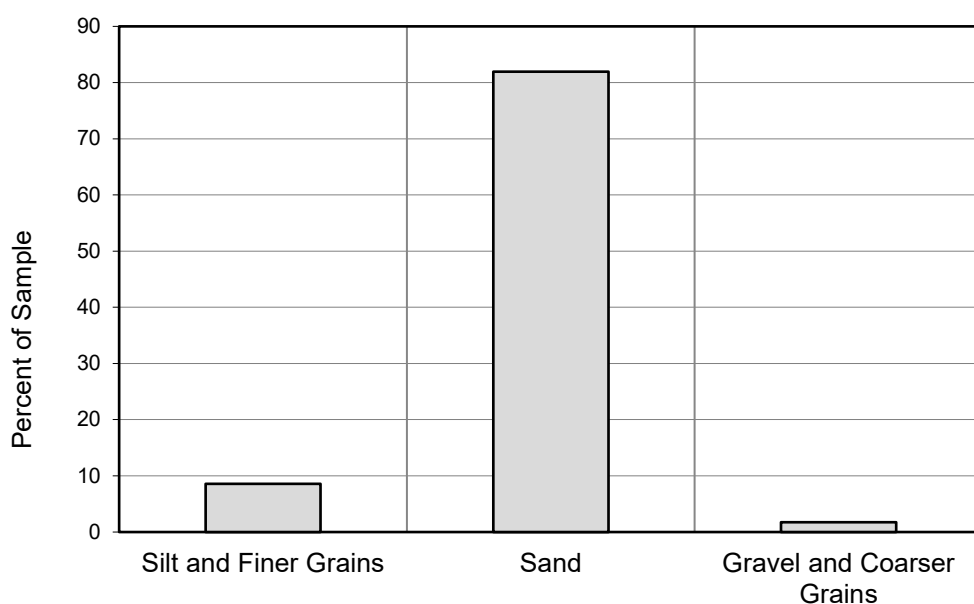
Sediment was described as grey fine to medium sand, with a slight petroleum or organic odor. An oily sheen was noted on the water surface when the sampler was removed from the sediment. Sieve analysis is shown in Table 1-8 and Graph 1-8 below.

TABLE 1-8
S-8 Grain Size Distribution

Sieve No.	Size (mm*)	Percent	Material Description
4	4.75	1.75	Fine Gravel
10	2	7.72	Coarse Sand
40	0.42	34.3	Medium Sand
60	0.25	23.6	Medium Sand
200	0.074	24	Fine Sand

*mm = millimeter

GRAPH 1-8
S-8 Grain Size Distribution



Total organic carbon was found to be 2.2 percent, with 35 percent total water. There was approximately 3 feet of sediment near the right edge of water where the sample was gathered.

Chemical Characteristics

Of the heavy metals sampled, three elements exceeded the MCP GW-1 Human Health Standard. Lead, total chromium, and arsenic all exceeded the standard. Some of the detected PAHs exceeded MCP S-1/GW-1 standards. EPH measured 173.5 mg/kg. One chlorinated pesticide, Dieldrin, was detected in the sample at 5.8 ug/kg. One PCB, Aroclor 1260, was detected at a concentration of 0.39 ug/kg.

Sample 9

Sample 9 was gathered within the Watertown Dam impoundment adjacent to the east end of the old town pool. The adjacent land use is very similar to that of Sample 8.

Physical Characteristics

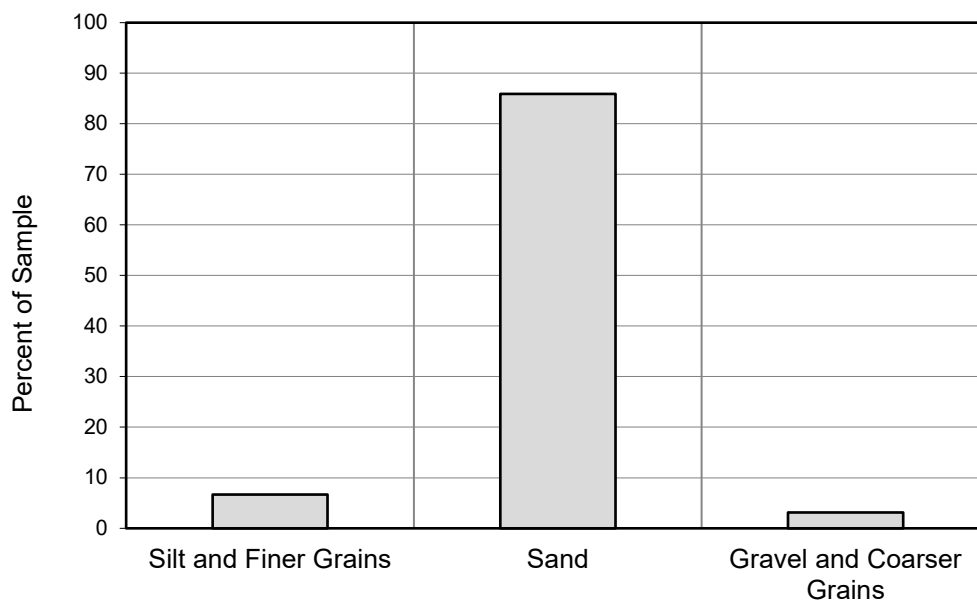
Sediment was described as grey fine to medium sand and silt, with a petroleum odor. An oily sheen was noted on the water surface when the sampler was removed from the sediment. Sieve analysis is shown in Table 1-9 and Graph 1-9 below.

TABLE 1-9
S-9 Grain Size Distribution

Sieve No.	Size (mm*)	Percent	Material Description
4	4.75	3.14	Fine Gravel
10	2	4.25	Coarse Sand
40	0.42	28.6	Medium Sand
60	0.25	29.7	Medium Sand
200	0.074	27.6	Fine Sand

*mm = millimeter

GRAPH 1-9
S-9 Grain Size Distribution



Total organic carbon was found to be 2.3 percent, with 51 percent total water. There was approximately 2.5 feet of sandy sediment in the center channel in this area where sampling occurred.

Chemical Characteristics

Of the heavy metals sampled, arsenic and lead exceeded the MCP GW-1 Human Health Standard. Of the 17 PAHs sampled, 12 were found in the sample. Some of the detected PAHs exceeded MCP S-1/GW-1 standards. EPH total hydrocarbons measured 513 mg/kg. One chlorinated pesticide, Endrin, was detected in the sample at 48 ug/kg. There were no detections of PCBs in the sample.

Sample 10

An attempt to gather sample 10 was made just upstream of Watertown Dam. Unfortunately, even at the closest possible safe distance from the dam, it was impossible to retrieve an adequate quantity of sample due to lack of accumulated sediment. Milone & MacBroom, Inc. performed probing approximately 50 feet from the dam but hit rocky refusal each time with minimal sediment encountered. The only exception was a small area near the left edge of water, which contained up to 0.5 feet of sediment. Unfortunately, the water depth and lack of cohesiveness made gathering a sample impossible. On a later site visit, a survey team member was able to walk behind the face of the dam during significantly lower flows. The depth of water was reported to be approximately 3.5 feet in this area but increased rapidly behind the dam. This means that there was approximately 3 to 5 feet of accumulated sediment directly behind the dam, which dropped off quickly with distance upstream. It is not clear, however, whether this sediment is part of an earthen dam structure or whether it is truly accumulated sediment. Regardless, it can be concluded that significant sediment accumulations, if any, most likely do not extend further than 50 feet from the face of the dam.

SUMMARY TABLE

The table below summarizes the physical and chemical analysis results. The maximum water and sediment depths represent the observed value across the sampling transect. Often, the deepest water coincided with the center channel, which tended to have the least amount of sediment. Conversely, the deepest sediment was found by the banks, where the water level was shallow. The sediment depths of the left edge and center channel were not recorded at S-1 and S-2 as the water depth was greater than the 8-foot-long sediment sampler.

Sample	Maximum Water Depth across Transect (feet)	Sediment Depth (feet)			Sediment Type	Compounds at or Above MCP S-1/GW-1 Standard
		Left Edge of Water	Center Channel	Right Edge of Water		
S-1	>8	N/A	N/A	1.75	Fine to medium sand, some coarse sand, some silt, trace gravel	Lead, Multiple PAHs
S-2	>8	N/A	N/A	3	Fine to coarse sand, some silt, some gravel	Multiple PAHs
S-3	7.3	<0.25	<0.25	<0.25	Medium to coarse sand, trace silt, trace gravel	Benzo[a]pyrene (PAH)
S-4	2	<0.25	<0.25	0.5	Medium to coarse sand, some fine sand, some silt, some gravel	Benzo[a]pyrene (PAH)
S-5	2.5	<0.25	<0.25	<0.25	Fine to coarse sand, some silt, some gravel	Benzo[a]pyrene (PAH)
S-6	7.3	<0.25	<0.25	<0.25	Gravel to medium sand, some fine sand, trace silt	Benzo[a]pyrene (PAH)
S-7	6	<0.25	<0.25	0.5	Medium to fine sand, some coarse sand, some silt, trace gravel	Benzo[a]pyrene (PAH)
S-8	>8	<0.25	0.25	3	Medium to fine sand, some silt, trace gravel	Lead, Chromium, Arsenic, Multiple PAHs
S-9	>8	0.75	2.5	<0.25	Fine to coarse sand, some silt, trace gravel	Lead, Arsenic, Multiple PAHs
S-10	7	0.5	<0.25	<0.25	N/A	N/A

CONCLUSION

Based on the probing analysis of the Charles River, there appears to be a relatively small quantity of sediment that has accumulated in the impounded area behind Watertown Dam. Probing throughout the reach encountered immediate refusal in nearly all sample locations in or near the center of the river. This indicates that native sandy and cobble riverbed material is the dominant channel bed substrate found in the area upstream of the dam. Samples located closer to the banks yielded more fine-grained sediments at up to depths of 3 feet. The amount of sediment in general decreased at the sample locations located

in the upstream segments in the center of the channel. Typical values ranged between 0 and 1 foot deep. Sample S-9 exhibited larger sediment quantities on the order of 2.5 feet.

Sediment depth probing was performed upstream of the Watertown Dam to within a 50-foot safe operating distance. Visual observation of the area directly upstream of the dam suggests that sediment depths may be greater, but direct measurement could not confirm the exact depths or limits of that sediment. Visual observation also suggested that the accumulated sediment behind the dam was composed mostly of coarse sands. According to a study from Breault et al. (2012), 1.58 meters of sediment were estimated directly behind the dam. A 2017 study from Boston College estimated similar values and that the bulk of the sediment was concentrated immediately behind the dam. Careful consideration should be paid to determining whether such sediment is truly accumulated from upstream or whether it is part of the original dam construction. It is likely that if it is part of the dam construction it contains less soft sediments and more coarse sands and gravels.

Based upon the probing transects as well as the profile data obtained during the assessment, the total volume of sediment in the channel from Nonantum Dam to Watertown Dam was estimated at 7,300 cubic yards. This is less than the 35,185 cubic yards of sediment estimated by Breault et al. (2012). Part of this discrepancy could be related to the definition of "accumulated sediments." Milone & MacBroom, Inc. does not consider large gravel and cobbles as "sediment" as pertaining to dam removal projects such as this as these materials have limited mobility and do not accumulate contaminants as is the case with fine sediments. In the case of Watertown Dam, the majority of the center channel sediments were encountered in the area of S-9. Some sediment accumulation was also present behind the dam. If the dam was going to be removed, the excavatable quantities of sediment would be found in these areas. The quantity of sediment from the area of S-9 to the face of the dam is estimated at approximately 2,800 cubic yards.

A dam removal plan should prepare to account for the possible migration of this volume of sediment. Sediments upstream of S-9 were of minimal depth (<0.5 feet) and could not feasibly be excavated. Note that the accumulated sediments were calculated based on a linear grade between probing transects.

Chemical analysis determined that any sediment that is present likely has concerning levels of PAHs and select heavy metals. While there were other contaminants that were detected including PCBs and chlorinated pesticides, only heavy metals and PAHs exceeded MCP S-1/GW-1 standards. This indicates that removal of any dredged sediments would require special handling and disposal considerations.

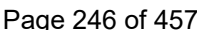
The sediment samples taken close to the banks indicate that contamination is most likely present in the bank substrate. Sediment in the exposed banks may need to be capped or removed to prevent exposure once water levels have dropped.

After the dam is breached and the impoundment is drained, land that was previously river bottom will be exposed as newly created floodplain due to the lower water level, exposing the sediments found there to human exposure. Figure 5-1 shows the estimated edge of the river channel at June 50-percent flow duration before and after the removal of Watertown Dam. The limits of current and postdam removal water levels were plotted using the 50-percent median daily flows for the month of June in the hydraulic modeling. Based on the analysis, the limit of influence of the dam removal on the low-flow water elevations in the Charles River appears to be approximately 1,500 linear feet upstream of the Watertown Dam. The banks of the river between 1,500 linear feet and 400 feet upstream of the dam are likely to be exposed by an average of approximately 15 feet. The 400 linear feet directly upstream of the dam is

where the water surface elevation is likely to drop the most after the dam is removed, and the most sediment is present. In this area, the low-flow channel is likely to narrow from an average of 150 feet wide to an average of 80 feet wide, exposing a total of 70 feet of new banks split between both the northern and southern edges of the river. The total area of exposed banks in the project reach is approximately 1.72 acres.

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Prepared by:
Massachusetts Department of Fish and Game
Division of Ecological Restoration (DER)
Updated August 2014
This table is prepared and offered by DER for the benefit of all parties pursuing river restoration projects within Massachusetts.
Special thanks to Stantec Consulting Services for peer review and QA/QC (2014).



APPENDIX H

OUTFALL DATA

Project/Sample Information

Project	2688-44 Watertown Outfall Data
Stream	Charles River
Sample Date	7/13/2018
Sampled By	JCS and FRM



Outfall #	Invert	Dimensions	Notes
1	Invert is at WSEL	W = 48", H = 24"	Culvert at the dam, concrete semi-circle culvert
2	Height from bottom of culvert to the tow of riffle = 4' 10"	W = 10 ft H = 7 ft	Backwater from Charles River to bottom of riffle, concrete box culvert
3	15" below WSEL	Dia. = 42"	Double circular concrete culvert, slightly filled with sediment
4	1' 9" above WSEL	Dia. = 12"	Circular concrete culvert
5	7.5" below WSEL	Dia. = 2"	Circular plastic pipe
6	1' 8" below WSEL	Dia. = 4'6"	Outfall matches Watertown outfall sign #6, this is the left culvert facing Charles River. Circular concrete culvert
7	2" below WSEL	Dia. = 3' 6"	Outfall matches Watertown sign #5, right culvert facing Charles River. Circular concrete culvert
8	3" below WSEL	Dia. = 2'	Outfall matches Watertown sign #7, circular concrete culvert, culvert slightly filled with sediment
9	3' 2" above WSEL	Dia. = 1' 6"	Circular plastic pipe
10	2' 10" above WSEL	Dia. = 1'	Circular concrete culvert half full with sediment
11	N/A	N/A	At pool parking lot, culvert is disconnected and does not appear to be functioning

Notes: Channel discharging from Bridge St appears to be side channel, no culverts found. 3" water flowing over dam at time of data collection.

APPENDIX I

HYDROLOGY

Charles River Restoration Project

MMI No 2688-44

Summary of Peak Flow Data

6/20/2018

Drainage Areas

Drainage area at USGS Gage 01104500 Charles River Waltham	227	Sq Mi
Watertown Dam (From StreamStats)	273	Sq Mi
Bridge Street (From StreamStats)	266	Sq Mi

Flows were adjusted for drainage area based on the USGS report "Estimating Peak Discharges of Small, Rural Streams in Massachusetts," 1983 using the equation below.

$$Q_{R(u)} = \left(\frac{A_u}{A_g} \right)^x Q_{R(g)}$$

Where
 $Q_{R(u)}$ = peak discharge at ungaged site
 $Q_{R(g)}$ = peak discharge at gaged site
 $A(u)$ = drainage area of the ungaged site
 $A(g)$ = drainage area of the gaged site
 x = exponent for each flood region, which is 0.66 for eastern Massachusetts

Discharges from 2016 County FIS

Flooding Source and Location	Drainage Area (SM)	Peak Discharges (CFS)							
		10%	10% Adjusted for DA	2%	2% Adjusted for DA	1%	1% Adjusted for DA	0.20%	0.2% Adjusted for DA
At Waltham Gaging Station	227	2200	2485	2900	3276	3500	3953	4500	5083
At Moody Street Dam	250.6	2200	2485	3200	3614	3700	4179	5200	5873
At the Waltham/Newton/Watertown Corporate Limits	250.6	2200	2485	3200	3614	3700	4179	5200	5873

Discharges from StreamStats

Flooding Source and Location	Drainage Area (SM)	Peak Discharges (CFS)			
		10%	2%	1%	0.20%
Watertown Dam	273	5830	9030	10500	14400

Stream Gages - Bulletin 17B

Location	Gage Number	Drainage Area (SM)	Years of Record	Peak Discharges (CFS) from HEC-SSP 17B Analysis											
				66.67% (1.5 year)	66.67% (1.5 year) Adjusted for DA	50%	50% Adjusted for DA	10%	10% Adjusted for DA	2%	2% Adjusted for DA	1%	1% Adjusted for DA	0.20%	0.20% Adjusted for DA
Charles River at Waltham MA	1104500	227	1931-Current	1113	1257	1338	1511	2417	2730	3557	4018	4099	4630	5514	6228

Bankfull Flow - USGS Report 2013-5155

Simple Regression Equation at Watertown Dam

$$Q \text{ (ft}^3\text{/s)} = 37.1364 \times [\text{Drainage Area (mi}^2\text{)}]^{0.7996}$$

Q= 3294 ft³/s

Multiple Regression Equation at Watertown Dam

$$Q \text{ (ft}^3\text{/s)} = 8.2490 \times [\text{Drainage Area (mi}^2\text{)}]^{0.7545} \times [\text{Mean basin slope (\%)}]^{0.7659}$$

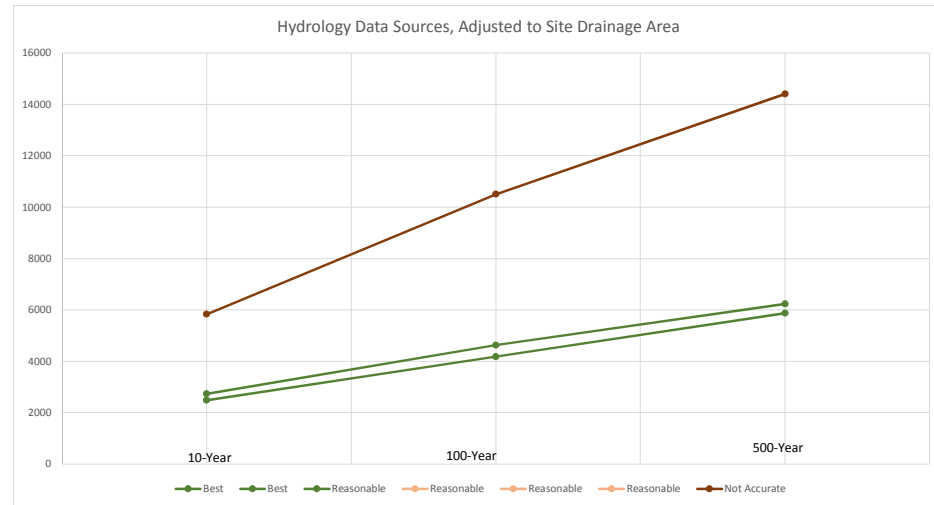
Mean Basin Slope (from StreamStats 10m DEM

calculation) = 5.538 %

Q= 2108 ft³/s

Summary Table

	10-Yr	100-Yr	500-Yr
Best	Best		
FEMA FIS at Moody Street Dam (Adjusted to Watertown Dam)	2485	4179	5873
Bulletin 17B at Gage 01104500 (Adjusted to Watertown Dam)	2730	4630	6228
Reasonable	Reasonable		
Not Accurate	Not Accurate		
StreamStats at Watertown Dam	5830	10500	14400



Future Projected Peak Flows

Bulletin 17B Peak Flows adjusted by 30% based on Massachusetts Climate Change Projections

Location	Drainage Area (SM)	10% Annual Chance Adjusted for DA	10% Annual Chance Adjusted for DA +30%	2% Annual Chance Adjusted for DA	2% Annual Chance Adjusted for DA +30%	1% Annual Chance Adjusted for DA	1% Annual Chance Adjusted for DA +30%	0.2% Annual Chance Adjusted for DA	0.20 % Annual Chance Adjusted for DA +30%
Adjusted to Watertown Dam	227	2,730	3,549	4,018	5,223	4,630	6,019	6,228	8,097

Flows were adjusted for drainage area based on the USGS report "Estimating Peak Discharges of Small, Rural Streams in Massachusetts," 1983 as described in the Summary of Peak Flow Data.

Charles River Restoration Project

MMI No 2688-44

Summary of Low Flow Hydrology Data

7/5/2018

Drainage Areas

Drainage area at USGS Gage 01104500

Charles River Waltham 227 Sq Mi

Watertown Dam (From StreamStats) 273 Sq Mi

Bridge Street (From StreamStats) 266 Sq Mi

Stream Gages - Gage 01104500

Monthly Exceedance Flows (CFS) from HEC-SSP Duration Analysis

		85%		50%		15%
		Adjusted		Adjusted		Adjusted
Month	85%	for DA	50%	for DA	15%	for DA
January	165	186	308	348	599.3	677
February	183	207	350	395	651	735
March	306.7	346	535	604	939	1061
April	297	335	535	604	953.4	1077
May	181	204	336	380	545	616
June	88	99	180	203	388	438
July	43	49	87.2	98	220	248
August	25.7	29	67	76	200	226
September	26	29	69	78	189	213
October	36	41	100	113	284	321
November	80	90	202.5	229	475	537
December	126	142	286	323	617.3	697

Flows were adjusted for drainage area based on the USGS report "Estimating Peak Discharges of Small, Rural Streams in Massachusetts," 1983 as described in the Summary of Peak Flow Data.

Charles River Restoration Project

Summary of Low Flow Hydrology Data

7/5/2018

MMI No 2688-44

7Q10 Flow - USGS

From the article "Water Resources and Aquifer Yields in the Charles River Basin, Massachusetts", Charles F. Myette and Alison C. Simcox, U.S. Geological Survey Water Resources Investigations Report 88-4173, 1992 Revised 1991

Table 2.--Low-flow statistics and flow duration of the Charles River and Mother Brook at streamflow-gaging stations near Millis, Dover, Dedham, Wellesley, and Waltham, Mass.

[From Wandle, 1984, p. 39-40; streamflow is given in Mgal/d, million gallons per day; drainage area is given in mi², square miles; a dash indicates no computation]

Station name and number	Charles River near Millis (01103305)	Charles River at Dover (01103500)	Mother Brook at Dedham (01104000)	Charles River at Wellesley (01104200)	Charles River at Waltham (01104500)
Period of record	1975-80	1938-81	1932-81	1960-81	1932-81
Drainage	84.0	183	-	211	¹ 227
7-day, 2-year low flow (7Q2)	-	21.0	-	17.3	22.0
7-day, 10-year low flow (7Q10)	-	8.34	-	6.66	9.24
Flow duration (percent)					
99	11.0	10.3	0.03	8.72	3.75
95	14.8	19.1	0.31	17.6	16.4
90	19.6	26.4	1.16	25.0	25.9
75	32.1	53.2	5.69	54.9	52.2
70	37.0	65.3	8.14	67.9	69.8
50	69.1	133	26.6	128	136
25	132	273	76.3	242	267
10	215	447	136	397	432

¹ Excludes 23.7 mi² drained by Stony Brook.

Gage Number	Flows from USGS Report 88-4173		Units
	7Q10	7Q10 Adjusted for DA	
1104500	9.24	10.44	MGD
1104500	14.30	16.15	CFS

Flows were adjusted for drainage area based on the USGS report "Estimating Peak Discharges of Small, Rural Streams in Massachusetts," 1983 as described in the Summary of Peak Flow Data.

Charles River HEC SSP

Bulletin 17B Frequency Analysis
17 Aug 2018 10:27 AM

--- Input Data ---

Analysis Name: Charles River Gauge 01104500
Description:

Data Set Name: Charles River 01104500-WALTHAM, MA-FLOW-ANNUAL PEAK
DSS File Name:
W:\Design\2688-44-DE\Comps\Hydrology\HEC-SSP\Watertown_Dam_-_Charles_River\Watertown_Dam_-_Charles_River.dss
DSS Pathname: /CHARLES RIVER/WALTHAM, MA/FLOW-ANNUAL PEAK/01jan1900/IR-CENTURY/USGS/

Report File Name:
W:\Design\2688-44-DE\Comps\Hydrology\HEC-SSP\Watertown_Dam_-_Charles_River\Bulletin17Results\Charles_River_Gauge_01104500\Charles_River_Gauge_01104500.rpt
XML File Name:
W:\Design\2688-44-DE\Comps\Hydrology\HEC-SSP\Watertown_Dam_-_Charles_River\Bulletin17Results\Charles_River_Gauge_01104500\Charles_River_Gauge_01104500.xml

Start Date:
End Date:

Skew Option: Use Station Skew
Regional Skew: -Infinity
Regional Skew MSE: -Infinity

Plotting Position Type: Weibull

Upper Confidence Level: 0.05
Lower Confidence Level: 0.95

Display ordinate values using 1 digits in fraction part of value

--- End of Input Data ---

<< Low Outlier Test >>

Based on 86 events, 10 percent outlier test deviate $K(N) = 2.966$
Computed low outlier test value = 371.74

0 low outlier(s) identified below test value of 371.74

<< High Outlier Test >>

Based on 86 events, 10 percent outlier test deviate $K(N) = 2.966$
Computed high outlier test value = 5,003.68

0 high outlier(s) identified above test value of 5,003.68

--- Final Results ---

Untitled

<< Plotting Positions >>

Charles River 01104500-WALTHAM, MA-FLOW-ANNUAL PEAK

Events Analyzed				Ordered Events			
Day	Mon	Year	FLOW CFS	Rank	Water Year	FLOW CFS	Weibull Plot Pos
01	Apr	1932	690.0	1	2010	4,270.0	1.15
19	Apr	1933	1,520.0	2	1976	4,150.0	2.30
10	Mar	1934	1,020.0	3	1979	3,480.0	3.45
14	Apr	1935	1,370.0	4	1997	2,990.0	4.60
19	Mar	1936	2,540.0	5	1982	2,960.0	5.75
20	Dec	1936	1,020.0	6	1987	2,710.0	6.90
26	Jul	1938	2,180.0	7	1968	2,670.0	8.05
03	Apr	1939	1,020.0	8	1936	2,540.0	9.20
22	Apr	1940	1,600.0	9	1955	2,490.0	10.34
15	Feb	1941	555.0	10	1984	2,410.0	11.49
23	Mar	1942	1,470.0	11	2001	2,190.0	12.64
12	Mar	1943	1,180.0	12	1998	2,180.0	13.79
14	Jan	1944	1,000.0	13	1993	2,180.0	14.94
12	Mar	1945	1,240.0	14	1938	2,180.0	16.09
14	Jan	1946	1,360.0	15	1956	1,990.0	17.24
07	May	1947	692.0	16	1983	1,970.0	18.39
22	Mar	1948	1,730.0	17	1958	1,940.0	19.54
20	Feb	1949	575.0	18	1961	1,850.0	20.69
28	Mar	1950	869.0	19	1969	1,800.0	21.84
07	Apr	1951	933.0	20	1970	1,790.0	22.99
17	Mar	1952	1,250.0	21	2011	1,770.0	24.14
03	Apr	1953	1,360.0	22	1978	1,740.0	25.29
22	Sep	1954	1,550.0	23	1948	1,730.0	26.44
19	Aug	1955	2,490.0	24	1972	1,670.0	27.59
11	Nov	1955	1,990.0	25	2015	1,640.0	28.74
11	Apr	1957	957.0	26	1973	1,630.0	29.89
26	Jan	1958	1,940.0	27	1977	1,610.0	31.03
06	Mar	1959	1,460.0	28	1940	1,600.0	32.18
04	Apr	1960	1,510.0	29	2006	1,590.0	33.33
27	Feb	1961	1,850.0	30	2013	1,570.0	34.48
02	Apr	1962	1,540.0	31	1954	1,550.0	35.63
07	Oct	1962	1,340.0	32	1962	1,540.0	36.78
27	Jan	1964	890.0	33	1933	1,520.0	37.93
02	Mar	1965	904.0	34	2005	1,510.0	39.08
06	Mar	1966	637.0	35	2004	1,510.0	40.23
21	Apr	1967	1,250.0	36	1960	1,510.0	41.38
22	Mar	1968	2,670.0	37	1942	1,470.0	42.53
30	Mar	1969	1,800.0	38	2014	1,460.0	43.68
11	Feb	1970	1,790.0	39	1959	1,460.0	44.83
03	Mar	1971	1,110.0	40	1996	1,430.0	45.98
22	Mar	1972	1,670.0	41	1994	1,430.0	47.13
07	Jan	1973	1,630.0	42	2009	1,390.0	48.28
21	Dec	1973	1,090.0	43	2008	1,390.0	49.43
03	Apr	1975	895.0	44	1935	1,370.0	50.57
03	Feb	1976	4,150.0	45	1953	1,360.0	51.72
23	Mar	1977	1,610.0	46	1946	1,360.0	52.87
31	Mar	1978	1,740.0	47	1963	1,340.0	54.02
25	Jan	1979	3,480.0	48	2007	1,250.0	55.17
11	Apr	1980	1,140.0	49	1967	1,250.0	56.32
27	Feb	1981	1,220.0	50	1952	1,250.0	57.47
07	Jun	1982	2,960.0	51	1990	1,240.0	58.62
12	Mar	1983	1,970.0	52	1945	1,240.0	59.77
02	Jun	1984	2,410.0	53	1981	1,220.0	60.92
01	Aug	1985	811.0	54	1943	1,180.0	62.07
15	Mar	1986	1,110.0	55	2003	1,170.0	63.22

Untitled

07 Apr 1987	2,710.0	56	2017	1,150.0	64.37
21 Feb 1988	837.0	57	1980	1,140.0	65.52
17 Aug 1989	779.0	58	1986	1,110.0	66.67
11 Aug 1990	1,240.0	59	1971	1,110.0	67.82
19 Oct 1990	1,030.0	60	2000	1,090.0	68.97
15 Nov 1991	637.0	61	1974	1,090.0	70.11
02 Apr 1993	2,180.0	62	2012	1,080.0	71.26
29 Mar 1994	1,430.0	63	1999	1,080.0	72.41
25 Dec 1994	757.0	64	1991	1,030.0	73.56
27 Jan 1996	1,430.0	65	1939	1,020.0	74.71
21 Oct 1996	2,990.0	66	1937	1,020.0	75.86
14 Jun 1998	2,180.0	67	1934	1,020.0	77.01
03 Feb 1999	1,080.0	68	1944	1,000.0	78.16
26 Apr 2000	1,090.0	69	1957	957.0	79.31
23 Mar 2001	2,190.0	70	1951	933.0	80.46
18 May 2002	721.0	71	1965	904.0	81.61
30 Mar 2003	1,170.0	72	1975	895.0	82.76
02 Apr 2004	1,510.0	73	1964	890.0	83.91
03 Apr 2005	1,510.0	74	1950	869.0	85.06
10 Jun 2006	1,590.0	75	1988	837.0	86.21
17 Apr 2007	1,250.0	76	1985	811.0	87.36
08 Mar 2008	1,390.0	77	1989	779.0	88.51
12 Dec 2008	1,390.0	78	1995	757.0	89.66
15 Mar 2010	4,270.0	79	2002	721.0	90.80
09 Mar 2011	1,770.0	80	1947	692.0	91.95
08 Dec 2011	1,080.0	81	1932	690.0	93.10
14 Jun 2013	1,570.0	82	1992	637.0	94.25
02 Apr 2014	1,460.0	83	1966	637.0	95.40
10 Dec 2014	1,640.0	84	2016	634.0	96.55
08 Apr 2016	634.0	85	1949	575.0	97.70
06 Apr 2017	1,150.0	86	1941	555.0	98.85

<< Skew Weighting >>

Based on 86 events, mean-square error of station skew = 0.075
Mean-square error of regional skew = -?

<< Frequency Curve >>

Charles River 01104500-WALTHAM, MA-FLOW-ANNUAL PEAK

Computed Curve FLOW, CFS	Expected Probability	Percent Chance Exceedance	Confidence Limits 0.05 0.95 FLOW, CFS	
5,514.1	---	0.2	6,857.8	4,638.6
4,680.3	---	0.5	5,695.8	4,002.3
4,099.4	---	1.0	4,903.8	3,551.1
3,556.7	---	2.0	4,179.0	3,122.4
2,890.3	---	5.0	3,312.3	2,584.1
2,416.9	---	10.0	2,715.7	2,191.1
1,959.5	---	20.0	2,159.0	1,799.4
1,338.8	---	50.0	1,447.6	1,237.5
939.1	---	80.0	1,023.2	851.6
788.2	---	90.0	868.0	703.2
685.6	---	95.0	762.9	602.6
534.3	---	99.0	607.5	456.0

Untitled

<< Systematic Statistics >>

Charles River 01104500-WALTHAM, MA-FLOW-ANNUAL PEAK

Log Transform: FLOW, CFS		Number of Events	
Mean	3.135	Historic Events	0
Standard Dev	0.190	High Outliers	0
Station Skew	0.254	Low Outliers	0
Regional Skew	---	Zero Events	0
Weighted Skew	---	Missing Events	0
Adopted Skew	0.254	Systematic Events	86

--- End of Analytical Frequency Curve ---

Untitled

Duration Analysis

05 Jul 2018 09:49 AM

--- Input Data ---

Analysis Name: Charles River Gauge 01104500
Description:

DSS File Name:

W:\Design\2688-44-DE\Comps\Hydrology\HEC-SSP\Watertown_Dam_-_Charles_River\Watertown_Dam_-_Charles_River.dss

DSS Pathname: /CHARLES RIVER/WALTHAM, MA/FLOW//1DAY/USGS/

Project Path:

W:\Design\2688-44-DE\Comps\Hydrology\HEC-SSP\Watertown_Dam_-_Charles_River

Report File Name:

W:\Design\2688-44-DE\Comps\Hydrology\HEC-SSP\Watertown_Dam_-_Charles_River\DurationAnalysisResults\Charles_River_Gauge_01104500\Charles_River_Gauge_01104500.rpt

Result File Name:

W:\Design\2688-44-DE\Comps\Hydrology\HEC-SSP\Watertown_Dam_-_Charles_River\DurationAnalysisResults\Charles_River_Gauge_01104500\Charles_River_Gauge_01104500.xml

Duration Analysis Method: Standard

Duration Plot Position Method: Rank/(N+1)

X-Axis Scale: Linear

Y-Axis Scale: Linear

Duration Period: Monthly

Use Standard Percent Exceedance

Display ordinate values using 1 digits in fraction part of value

--- End of Input Data ---

January Duration Analysis

Time Period: 01Jan - 31Jan

Number Valid Values: 2697

Number Missing Values: 0

Minimum Value: 3.1

Maximum Value: 2,940.0

Percent of Time Exceeded	FLOW CFS
99.0	54.0
95.0	99.0
90.0	137.0

Untitled

80.0	190.0
50.0	308.0
25.0	491.5
15.0	599.3
10.0	684.0
5.0	802.1
2.0	1,030.0
1.0	1,340.0
0.1	2,749.5

February Duration Analysis

Time Period: 01Feb - 29Feb

Number Valid Values: 2458
Number Missing Values: 0

Minimum Value: 14.0
Maximum Value: 1,870.0

Percent of Time Exceeded	FLOW CFS
99.0	72.0
95.0	121.0
90.0	159.0
80.0	209.8
50.0	350.0
25.0	530.0
15.0	651.0
10.0	734.1
5.0	891.1
2.0	1,120.0
1.0	1,250.0
0.1	1,600.8

March Duration Analysis

Time Period: 01Mar - 31Mar

Number Valid Values: 2697
Number Missing Values: 0

Minimum Value: 96.0
Maximum Value: 3,640.0

Percent of Time Exceeded	FLOW CFS
99.0	131.0
95.0	210.0
90.0	262.0
80.0	339.0

Untitled

50.0	535.0
25.0	776.0
15.0	939.0
10.0	1,060.0
5.0	1,340.0
2.0	1,720.0
1.0	1,971.0
0.1	3,126.2

April Duration Analysis

Time Period: 01Apr - 30Apr

Number Valid Values: 2610

Number Missing Values: 0

Minimum Value: 75.7

Maximum Value: 2,860.0

Percent of Time Exceeded	FLOW CFS
99.0	155.0
95.0	208.5
90.0	255.0
80.0	330.0
50.0	535.0
25.0	808.5
15.0	953.4
10.0	1,060.0
5.0	1,220.0
2.0	1,493.4
1.0	1,700.0
0.1	2,683.3

May Duration Analysis

Time Period: 01May - 31May

Number Valid Values: 2697

Number Missing Values: 0

Minimum Value: 4.5

Maximum Value: 1,450.0

Percent of Time Exceeded	FLOW CFS
99.0	70.9
95.0	123.0
90.0	157.0
80.0	201.0
50.0	336.0

Untitled

25.0	465.0
15.0	545.0
10.0	603.0
5.0	724.1
2.0	888.4
1.0	1,040.0
0.1	1,399.1

June Duration Analysis

Time Period: 01Jun - 30Jun

Number Valid Values: 2610
Number Missing Values: 0

Minimum Value: 1.0
Maximum Value: 2,910.0

Percent of Time Exceeded	FLOW CFS
99.0	29.1
95.0	54.5
90.0	73.0
80.0	101.0
50.0	180.0
25.0	299.2
15.0	388.0
10.0	490.0
5.0	699.0
2.0	1,221.2
1.0	1,586.7
0.1	2,640.0

July Duration Analysis

Time Period: 01Jul - 31Jul

Number Valid Values: 2668
Number Missing Values: 0

Minimum Value: 1.0
Maximum Value: 2,170.0

Percent of Time Exceeded	FLOW CFS
99.0	5.4
95.0	22.9
90.0	35.0
80.0	48.0
50.0	87.2
25.0	157.0

Untitled

15.0	220.0
10.0	277.0
5.0	419.1
2.0	553.9
1.0	668.8
0.1	2,086.6
-----	-----

August Duration Analysis

Time Period: 01Aug - 31Aug

Number Valid Values: 2694
Number Missing Values: 0

Minimum Value: 0.9
Maximum Value: 2,330.0

Percent of Time Exceeded	FLOW CFS
99.0	3.0
95.0	10.6
90.0	19.0
80.0	31.0
50.0	67.0
25.0	138.0
15.0	200.0
10.0	254.5
5.0	374.0
2.0	590.2
1.0	828.3
0.1	2,273.1
-----	-----

September Duration Analysis

Time Period: 01Sep - 30Sep

Number Valid Values: 2610
Number Missing Values: 0

Minimum Value: 1.0
Maximum Value: 1,290.0

Percent of Time Exceeded	FLOW CFS
99.0	5.0
95.0	13.0
90.0	20.0
80.0	31.0
50.0	69.0
25.0	129.0
15.0	189.0
-----	-----

Untitled

10.0	260.0
5.0	417.3
2.0	624.7
1.0	804.9
0.1	1,161.7

October Duration Analysis

Time Period: 01Oct - 31Oct

Number Valid Values: 2697
Number Missing Values: 0

Minimum Value: 0.2
Maximum Value: 2,620.0

Percent of Time Exceeded	FLOW CFS
99.0	5.1
95.0	19.0
90.0	29.0
80.0	40.2
50.0	100.0
25.0	200.0
15.0	284.0
10.0	358.0
5.0	574.0
2.0	822.1
1.0	1,060.2
0.1	2,055.0

November Duration Analysis

Time Period: 01Nov - 30Nov

Number Valid Values: 2610
Number Missing Values: 0

Minimum Value: 3.1
Maximum Value: 1,640.0

Percent of Time Exceeded	FLOW CFS
99.0	8.5
95.0	41.0
90.0	62.0
80.0	98.0
50.0	202.5
25.0	355.0
15.0	475.0
10.0	538.8

Untitled

5.0	655.0
2.0	764.6
1.0	854.2
0.1	1,513.9

December Duration Analysis

Time Period: 01Dec - 31Dec

Number Valid Values: 2697
Number Missing Values: 0

Minimum Value: 3.8
Maximum Value: 1,430.0

Percent of Time Exceeded	FLOW CFS
99.0	38.0
95.0	75.0
90.0	107.0
80.0	146.0
50.0	286.0
25.0	490.5
15.0	617.3
10.0	706.2
5.0	862.0
2.0	1,030.0
1.0	1,100.0
0.1	1,388.1

Untitled

Duration Analysis

17 Aug 2018 11:12 AM

--- Input Data ---

Analysis Name: Charles 01104500 15%, 50%, 85%
Description:

Data Set Name: Charles River 01104500 Daily Flows-WALTHAM, MA-FLOW

DSS File Name:

W:\Design\2688-44-DE\Comps\Hydrology\HEC-SSP\Watertown_Dam_-_Charles_River\Watertown_Dam_-_Charles_River.dss

DSS Pathname: /CHARLES RIVER/WALTHAM, MA/FLOW//1DAY/USGS/

Project Path:

W:\Design\2688-44-DE\Comps\Hydrology\HEC-SSP\Watertown_Dam_-_Charles_River

Report File Name:

W:\Design\2688-44-DE\Comps\Hydrology\HEC-SSP\Watertown_Dam_-_Charles_River\DurationAnalysisResults\Charles_01104500_15_,_50_,_85_\Charles_01104500_15_,_50_,_85_.rpt

Result File Name:

W:\Design\2688-44-DE\Comps\Hydrology\HEC-SSP\Watertown_Dam_-_Charles_River\DurationAnalysisResults\Charles_01104500_15_50_85_\Charles_01104500_15_50_85_.xml

Duration Analysis Method: Standard

Duration Plot Position Method: Rank/(N+1)

X-Axis Scale: Linear

Y-Axis Scale: Linear

Duration Period: Monthly

Use User-Specified Percent Exceedance

Percent Exceedance: 85.0

Percent Exceedance: 50.0

Percent Exceedance: 15.0

Display ordinate values using 1 digits in fraction part of value

--- End of Input Data ---

January Duration Analysis

Charles River 01104500 Daily Flows-WALTHAM, MA-FLOW

Time Period: 01Jan - 31Jan

Number Valid Values: 2697

Number Missing Values: 0

Minimum Value: 3.1

Maximum Value: 2,940.0

| Percent of | FLOW |

Untitled

Time Exceeded	CFS
85.0	165.0
50.0	308.0
15.0	599.3

February Duration Analysis Charles River 01104500 Daily Flows-WALTHAM, MA-FLOW

Time Period: 01Feb - 29Feb

Number Valid Values: 2458
Number Missing Values: 0

Minimum Value: 14.0
Maximum Value: 1,870.0

Percent of Time Exceeded	FLOW CFS
85.0	183.0
50.0	350.0
15.0	651.0

March Duration Analysis Charles River 01104500 Daily Flows-WALTHAM, MA-FLOW

Time Period: 01Mar - 31Mar

Number Valid Values: 2697
Number Missing Values: 0

Minimum Value: 96.0
Maximum Value: 3,640.0

Percent of Time Exceeded	FLOW CFS
85.0	306.7
50.0	535.0
15.0	939.0

April Duration Analysis Charles River 01104500 Daily Flows-WALTHAM, MA-FLOW

Time Period: 01Apr - 30Apr

Number Valid Values: 2610
Number Missing Values: 0

Untitled

Minimum Value: 75.7
Maximum Value: 2,860.0

Percent of Time Exceeded	FLOW CFS
85.0	297.0
50.0	535.0
15.0	953.4

May Duration Analysis Charles River 01104500 Daily Flows-WALTHAM, MA-FLOW

Time Period: 01May - 31May

Number Valid Values: 2697
Number Missing Values: 0

Minimum Value: 4.5
Maximum Value: 1,450.0

Percent of Time Exceeded	FLOW CFS
85.0	181.0
50.0	336.0
15.0	545.0

June Duration Analysis Charles River 01104500 Daily Flows-WALTHAM, MA-FLOW

Time Period: 01Jun - 30Jun

Number Valid Values: 2610
Number Missing Values: 0

Minimum Value: 1.0
Maximum Value: 2,910.0

Percent of Time Exceeded	FLOW CFS
85.0	88.0
50.0	180.0
15.0	388.0

July Duration Analysis Charles River 01104500 Daily Flows-WALTHAM, MA-FLOW

Untitled

Time Period: 01Jul - 31Jul

Number Valid Values: 2668
Number Missing Values: 0

Minimum Value: 1.0
Maximum Value: 2,170.0

Percent of Time Exceeded	FLOW CFS
85.0	43.0
50.0	87.2
15.0	220.0

August Duration Analysis

Charles River 01104500 Daily Flows-WALTHAM, MA-FLOW

Time Period: 01Aug - 31Aug

Number Valid Values: 2694
Number Missing Values: 0

Minimum Value: 0.9
Maximum Value: 2,330.0

Percent of Time Exceeded	FLOW CFS
85.0	25.7
50.0	67.0
15.0	200.0

September Duration Analysis

Charles River 01104500 Daily Flows-WALTHAM, MA-FLOW

Time Period: 01Sep - 30Sep

Number Valid Values: 2610
Number Missing Values: 0

Minimum Value: 1.0
Maximum Value: 1,290.0

Percent of Time Exceeded	FLOW CFS
85.0	26.0
50.0	69.0
15.0	189.0

October Duration Analysis
Charles River 01104500 Daily Flows-WALTHAM, MA-FLOW

Time Period: 01Oct - 31Oct

Number Valid Values: 2697
Number Missing Values: 0

Minimum Value: 0.2
Maximum Value: 2,620.0

Percent of Time Exceeded	FLOW CFS
85.0	36.0
50.0	100.0
15.0	284.0

November Duration Analysis
Charles River 01104500 Daily Flows-WALTHAM, MA-FLOW

Time Period: 01Nov - 30Nov

Number Valid Values: 2610
Number Missing Values: 0

Minimum Value: 3.1
Maximum Value: 1,640.0

Percent of Time Exceeded	FLOW CFS
85.0	80.0
50.0	202.5
15.0	475.0

December Duration Analysis
Charles River 01104500 Daily Flows-WALTHAM, MA-FLOW

Time Period: 01Dec - 31Dec

Number Valid Values: 2697
Number Missing Values: 0

Minimum Value: 3.8
Maximum Value: 1,430.0

Untitled

Percent of Time Exceeded	FLOW CFS
85.0	126.0
50.0	286.0
15.0	617.3

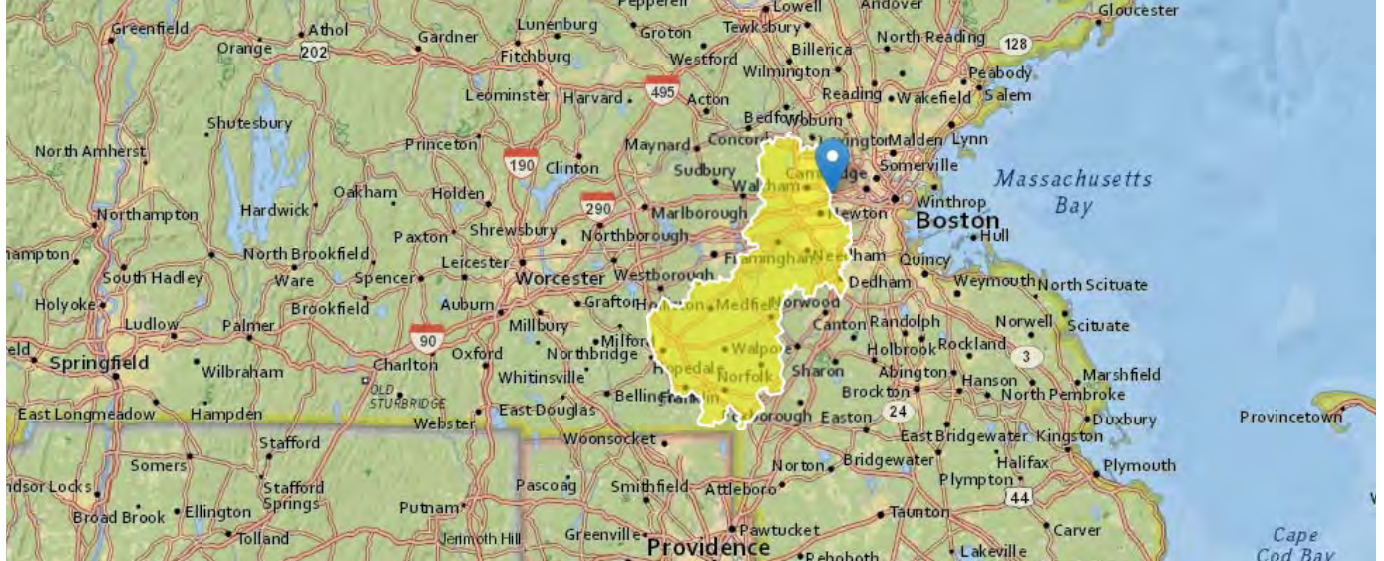
StreamStats Report

Region ID: MA

Workspace ID: MA20180619191309212000

Clicked Point (Latitude, Longitude): 42.36536, -71.18924

Time: 2018-06-19 15:13:23 -0400



Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	273	square miles
ELEV	Mean Basin Elevation	205	feet
LC06STOR	Percentage of water bodies and wetlands determined from the NLCD 2006	13.43	percent
DRFTPERSTR	Area of stratified drift per unit of stream length	0.23	square mile per mile
MAREGION	Region of Massachusetts 0 for Eastern 1 for Western	0	dimensionless
BSLDEM250	Mean basin slope computed from 1:250K DEM	2.325	percent
BSLDEM10M	Mean basin slope computed from 10 m DEM	5.538	percent
PCTSDNGRV	Percentage of land surface underlain by sand and gravel deposits	47.17	percent
FOREST	Percentage of area covered by forest	43.46	percent

Peak-Flow Statistics Parameters [Peak Statewide 2016 5156]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	273	square miles	0.16	512
ELEV	Mean Basin Elevation	205	feet	80.6	1948
LC06STOR	Percent Storage from NLCD2006	13.43	percent	0	32.3

Peak-Flow Statistics Flow Report [Peak Statewide 2016 5156]

PII: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	PII	PIu	SEp
2 Year Peak Flood	2930	ft^3/s	1500	5730	42.3

Statistic	Value	Unit	PII	Plu	SEp
5 Year Peak Flood	4580	ft ³ /s	2310	9090	43.4
10 Year Peak Flood	5830	ft ³ /s	2870	11800	44.7
25 Year Peak Flood	7580	ft ³ /s	3610	15900	47.1
50 Year Peak Flood	9030	ft ³ /s	4170	19500	49.4
100 Year Peak Flood	10500	ft ³ /s	4700	23400	51.8
200 Year Peak Flood	12100	ft ³ /s	5260	27800	54.1
500 Year Peak Flood	14400	ft ³ /s	6060	34000	57.6

Peak-Flow Statistics Citations

Zarriello, P.J., 2017, Magnitude of flood flows at selected annual exceedance probabilities for streams in Massachusetts: U.S. Geological Survey Scientific Investigations Report 2016–5156, 99 p. (<https://dx.doi.org/10.3133/sir20165156>)

Flow-Duration Statistics Parameters [Statewide Low Flow WRIR00 4135]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	273	square miles	1.61	149
DRFTPERSTR	Stratified Drift per Stream Length	0.23	square mile per mile	0	1.29
MAREGION	Massachusetts Region	0	dimensionless	0	1
BSLDEM250	Mean Basin Slope from 250K DEM	2.325	percent	0.32	24.6

Flow-Duration Statistics Disclaimers [Statewide Low Flow WRIR00 4135]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errorsOne or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors

Flow-Duration Statistics Flow Report [Statewide Low Flow WRIR00 4135]

Statistic	Value	Unit
50 Percent Duration	292	ft ³ /s
60 Percent Duration	241	ft ³ /s
70 Percent Duration	165	ft ³ /s
75 Percent Duration	135	ft ³ /s
80 Percent Duration	106	ft ³ /s
85 Percent Duration	84.6	ft ³ /s
90 Percent Duration	65.9	ft ³ /s
95 Percent Duration	44.5	ft ³ /s
98 Percent Duration	29.7	ft ³ /s
99 Percent Duration	24.6	ft ³ /s

Flow-Duration Statistics Citations

Ries, K.G., III, 2000, Methods for estimating low-flow statistics for Massachusetts streams: U.S. Geological Survey Water Resources Investigations Report 00-4135, 81 p. (<http://pubs.usgs.gov/wri/wri004135/>)

Low-Flow Statistics Parameters [Statewide Low Flow WRIR00 4135]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	273	square miles	1.61	149

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
BSLDEM250	Mean Basin Slope from 250K DEM	2.325	percent	0.32	24.6
DRFTPERSTR	Stratified Drift per Stream Length	0.23	square mile per mile	0	1.29
MAREGION	Massachusetts Region	0	dimensionless	0	1

Low-Flow Statistics Disclaimers [Statewide Low Flow WRIR00 4135]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errorsOne or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors

Low-Flow Statistics Flow Report [Statewide Low Flow WRIR00 4135]

Statistic	Value	Unit
7 Day 2 Year Low Flow	47.6	ft ³ /s
7 Day 10 Year Low Flow	23.6	ft ³ /s

Low-Flow Statistics Citations

Ries, K.G., III,2000, Methods for estimating low-flow statistics for Massachusetts streams: U.S. Geological Survey Water Resources Investigations Report 00-4135, 81 p. (<http://pubs.usgs.gov/wri/wri004135/>)

August Flow-Duration Statistics Parameters [Statewide Low Flow WRIR00 4135]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	273	square miles	1.61	149
BSLDEM250	Mean Basin Slope from 250K DEM	2.325	percent	0.32	24.6
DRFTPERSTR	Stratified Drift per Stream Length	0.23	square mile per mile	0	1.29
MAREGION	Massachusetts Region	0	dimensionless	0	1

August Flow-Duration Statistics Disclaimers [Statewide Low Flow WRIR00 4135]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errorsOne or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors

August Flow-Duration Statistics Flow Report [Statewide Low Flow WRIR00 4135]

Statistic	Value	Unit
August 50 Percent Duration	90.7	ft ³ /s

August Flow-Duration Statistics Citations

Ries, K.G., III,2000, Methods for estimating low-flow statistics for Massachusetts streams: U.S. Geological Survey Water Resources Investigations Report 00-4135, 81 p. (<http://pubs.usgs.gov/wri/wri004135/>)

Bankfull Statistics Parameters [Bankfull Statewide SIR2013 5155]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	273	square miles	0.6	329
BSLDEM10M	Mean Basin Slope from 10m DEM	5.538	percent	2.2	23.9

Bankfull Statistics Flow Report [Bankfull Statewide SIR2013 5155]

PII: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	SEp
Bankfull Width	131	ft	21.3

Statistic	Value	Unit	SEp
Bankfull Depth	4.62	ft	19.8
Bankfull Area	606	ft^2	29
Bankfull Streamflow	2110	ft^3/s	55

Bankfull Statistics Citations

Bent, G.C., and Waite, A.M., 2013, Equations for estimating bankfull channel geometry and discharge for streams in Massachusetts: U.S. Geological Survey Scientific Investigations Report 2013–5155, 62 p., (<http://pubs.usgs.gov/sir/2013/5155/>)

Probability Statistics Parameters [Perennial Flow Probability]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	273	square miles	0.01	1.99
PCTSNDGRV	Percent Underlain By Sand And Gravel	47.17	percent	0	100
FOREST	Percent Forest	43.46	percent	0	100
MAREGION	Massachusetts Region	0	dimensionless	0	1

Probability Statistics Disclaimers [Perennial Flow Probability]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errorsOne or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors

Probability Statistics Flow Report [Perennial Flow Probability]

Statistic	Value	Unit
Probability Stream Flowing Perennially	1	dim

Probability Statistics Citations

Bent, G.C., and Steeves, P.A., 2006, A revised logistic regression equation and an automated procedure for mapping the probability of a stream flowing perennially in Massachusetts: U.S. Geological Survey Scientific Investigations Report 2006–5031, 107 p. (http://pubs.usgs.gov/sir/2006/5031/pdfs/SIR_2006-5031rev.pdf)

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Application Version: 4.2.1



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Data Category:
Site Information

Geographic Area:
United States

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- [Full News](#) 

USGS 01104500 CHARLES RIVER AT WALTHAM, MA

Available data for this site SUMMARY OF ALL AVAILABLE DATA

GO

Stream Site

DESCRIPTION:

Latitude 42°22'20", Longitude 71°14'03" NAD27
Middlesex County, Massachusetts, Hydrologic Unit 01090001
Drainage area: 251 square miles
Contributing drainage area: 227 square miles,
Datum of gage: 20.02 feet above NGVD29.

AVAILABLE DATA:

Data Type	Begin Date	End Date	Count
Current / Historical Observations (availability statement)	1976-02-01	2019-03-05	
Daily Data			
Discharge, cubic feet per second	1931-08-04	2019-03-04	31990
Daily Statistics			
Discharge, cubic feet per second	1931-08-04	2018-10-02	31837
Monthly Statistics			
Discharge, cubic feet per second	1931-08	2018-10	
Annual Statistics			
Discharge, cubic feet per second	1931	2019	
Peak streamflow	1932-04-01	2017-04-06	86
Field measurements	1931-06-18	2019-02-08	258
Field/Lab water-quality samples	1952-10-21	2006-07-12	209
Water-Year Summary	2005	2018	14
Revisions	Available (site:1) (timeseries:0)		

OPERATION:

Record for this site is maintained by the USGS Massachusetts Water Science Center

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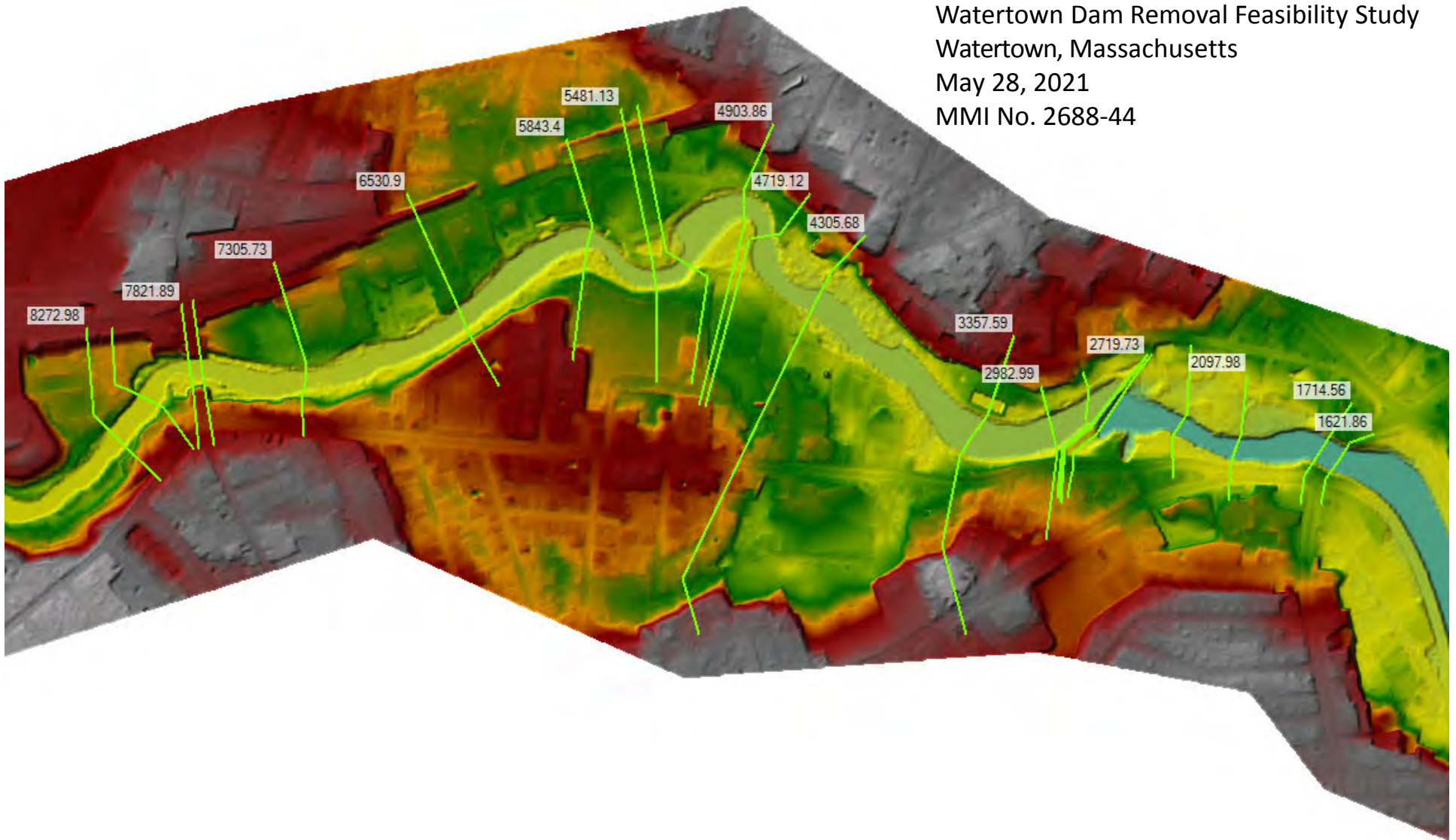
TABLE 8 - SUMMARY OF DISCHARGES – continued

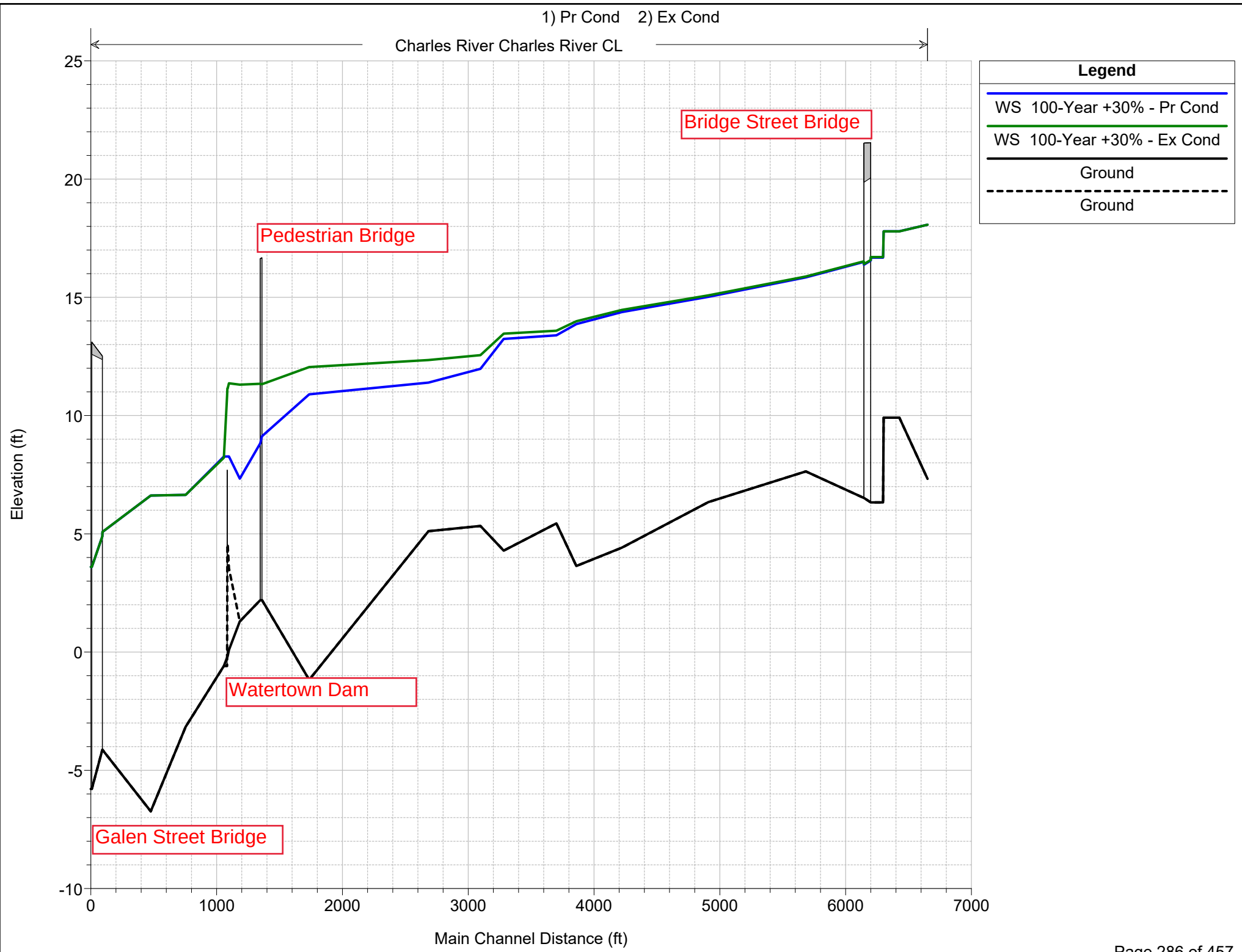
FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs)			
		10-PERCENT	2-PERCENT	1-PERCENT	0.2-PERCENT
BRANCH OF ASSABET RIVER					
Approximately 1,380 feet downstream of Hudson Road/Walcott-Randall Road	4.2	186	294	347	505
At Hudson Road/Walcott-Randall Road	1.5	78	118	135	188
At Goshen Lane	1.1	60	91	104	145
At Athens Street	1.0	57	78	98	136
BRANCH OF ELIZABETH BROOK 1					
At confluence of Ministers Pond	1.1	84	113	125	175
BROAD MEADOW BROOK					
At confluence with Sudbury Reservoir	1.1	70	100	110	150
BROOK A OF SHAWSHEEN RIVER					
At confluence with Shawsheen River	0.7	65	120	150	255
BROOK FROM WAUSHAKUM POND					
At confluence with Beaver Dam Brook	2.9	30	40	50	60
BUTTER BROOK					
At confluence with Nashoba Brook	3.1	105	180	225	440
At Acton/Westford corporate limits	1.4	65	110	140	275
At Concord Road	1.0	60	120	160	270
At Griffin Road	0.4	30	50	70	110
CATACONAMUG BROOK					
At confluence with the Nashua River	20.3	670	1,150	1,400	2,080
CHARLES RIVER					
At the Waltham/Newton/ Watertown corporate limits	250.6	2,200	3,200	3,700	5,200
At Moody Street Dam	250.6	2,200	3,200	3,700	5,200
At Waltham Gaging Station	227.0	2,200	2,900	3,500	4,500
At diversion from Mother Brook	200.0	1,780	2,480	3,200	4,270
At confluence of Mother Brook	200.0	2,650	3,610	4,680	6,210
At the Charles River Village/ Dover Gage (No. 01103500)	184.0	2,500	3,500	4,500	6,000
At Natick/Sherborn corporate limits	176.0	2,500	3,500	4,500	6,000

APPENDIX J

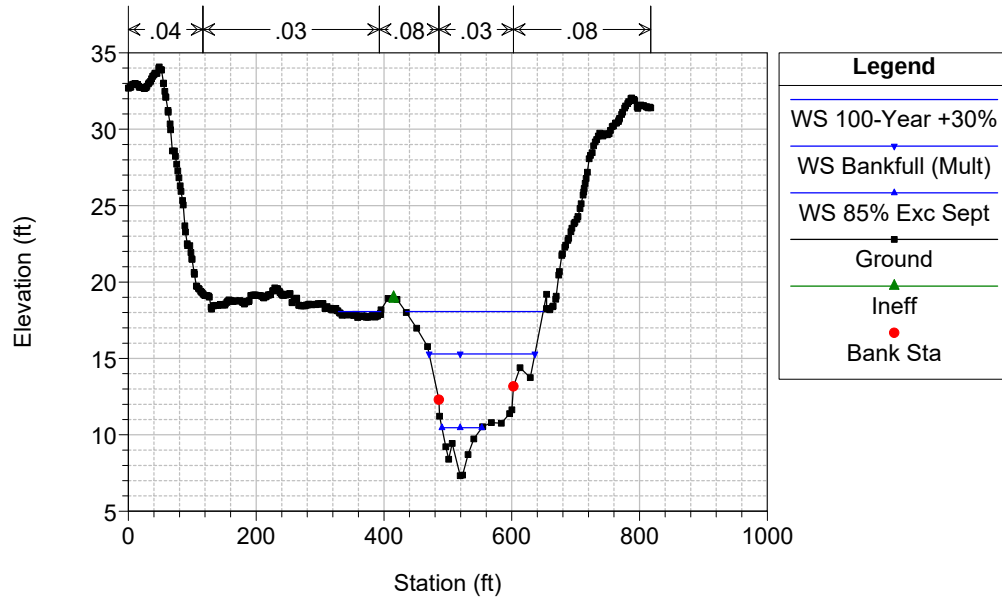
HYDRAULICS

HEC-RAS Hydraulic Model, v5.0.5
Charles River
Watertown Dam Removal Feasibility Study
Watertown, Massachusetts
May 28, 2021
MMI No. 2688-44

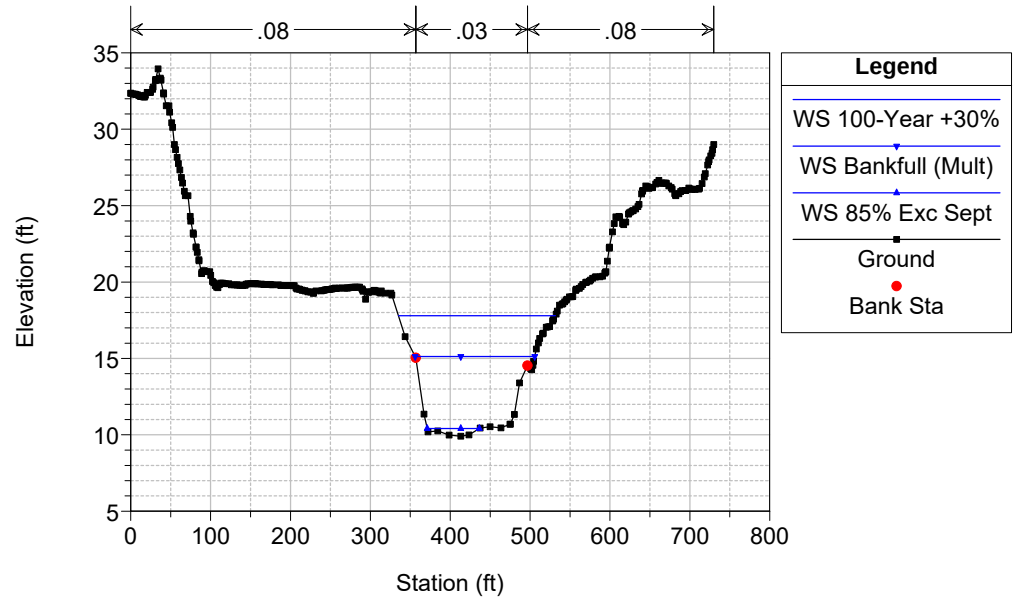




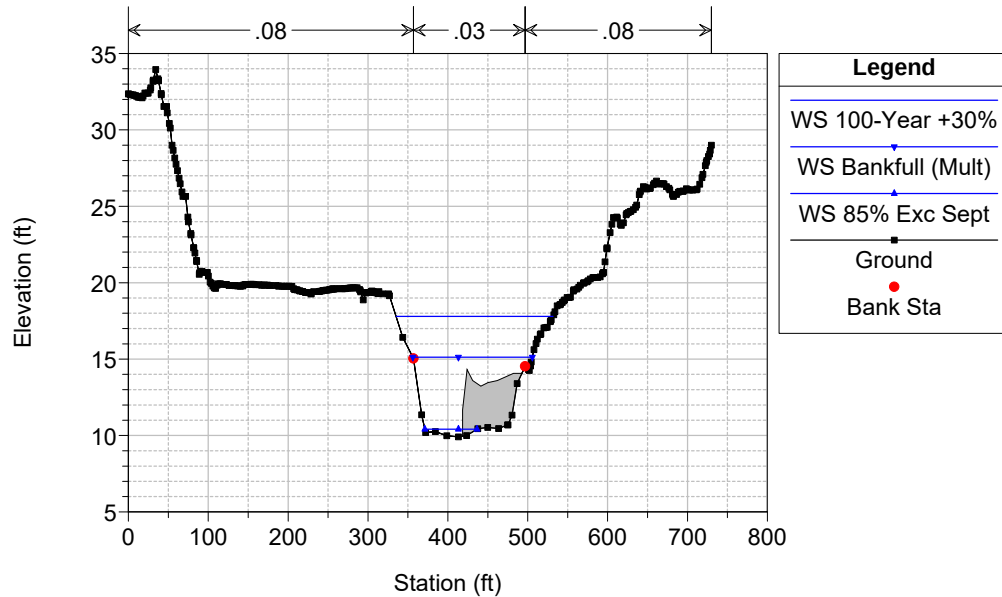
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 RS = 8272.98



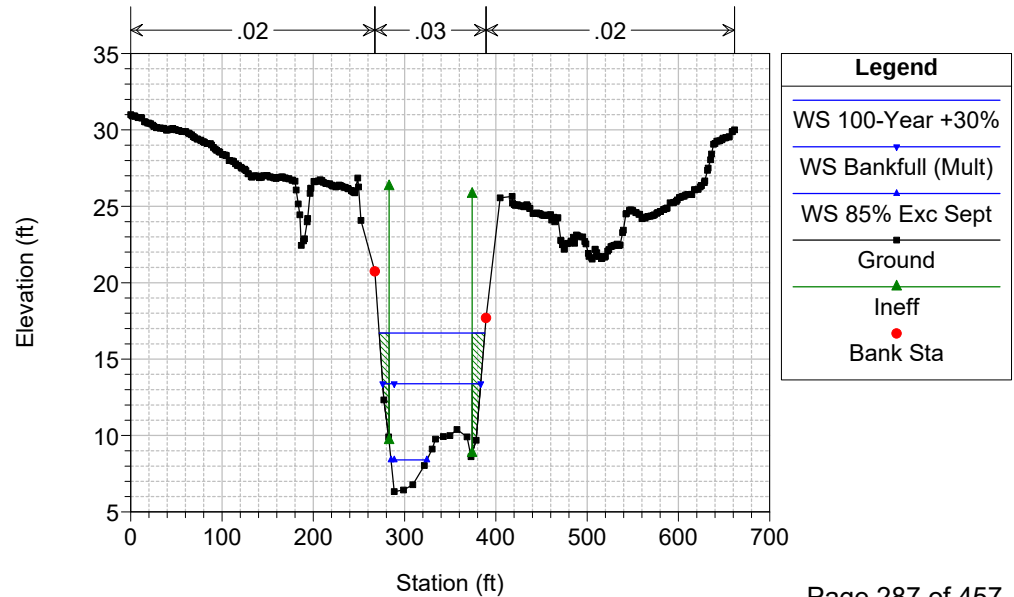
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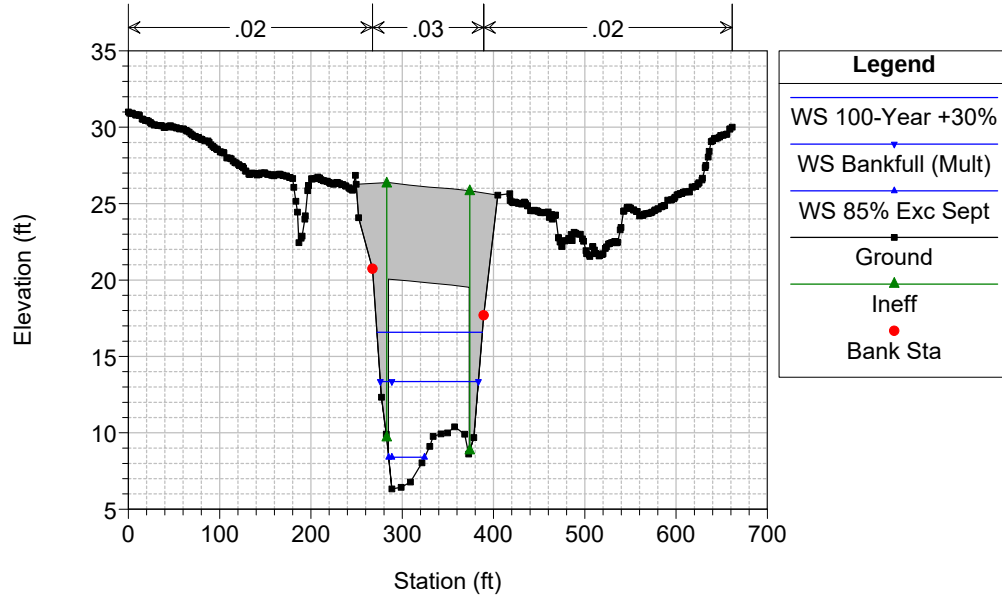
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 RS = 7922 IS Nonantum Dam - Partial



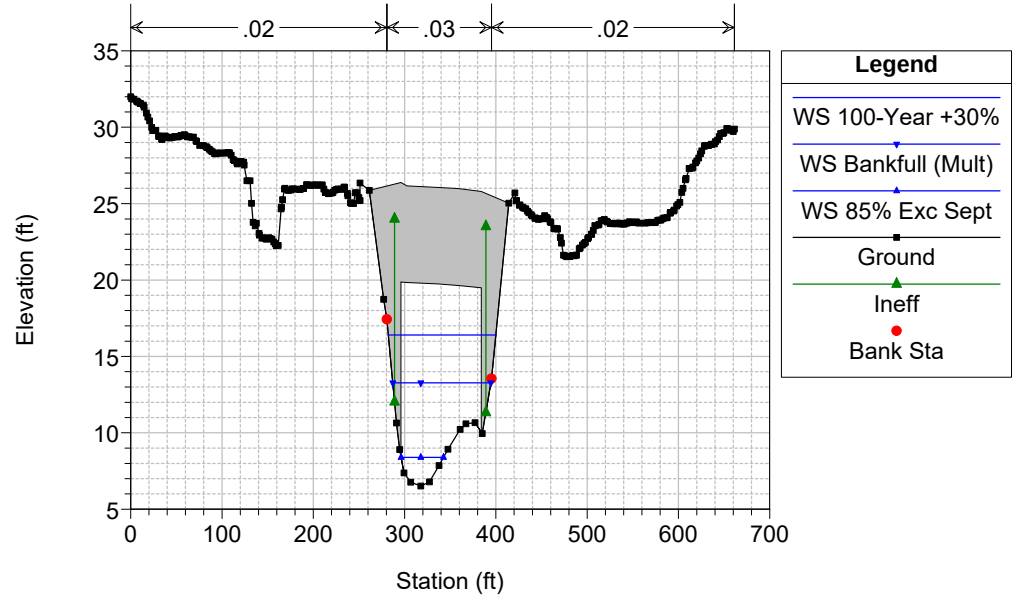
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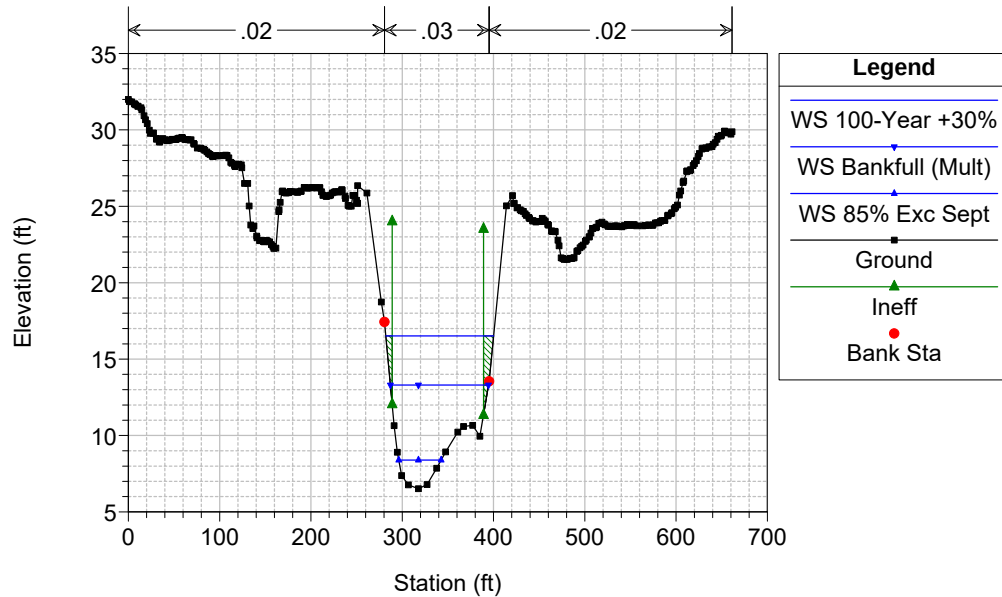
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 Geom: Existing Conditions Flow: Stream Flows_Revised
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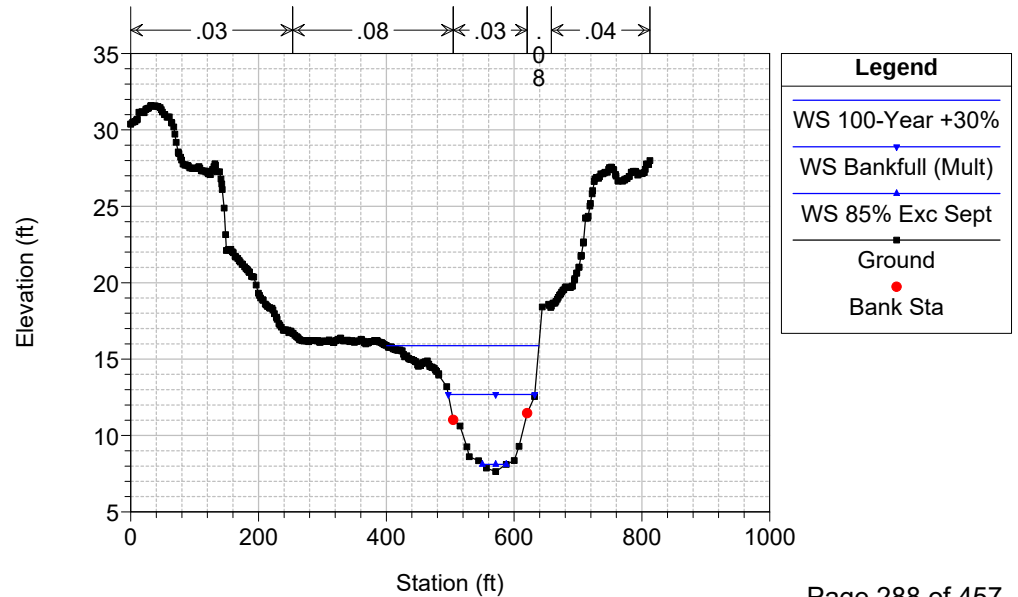
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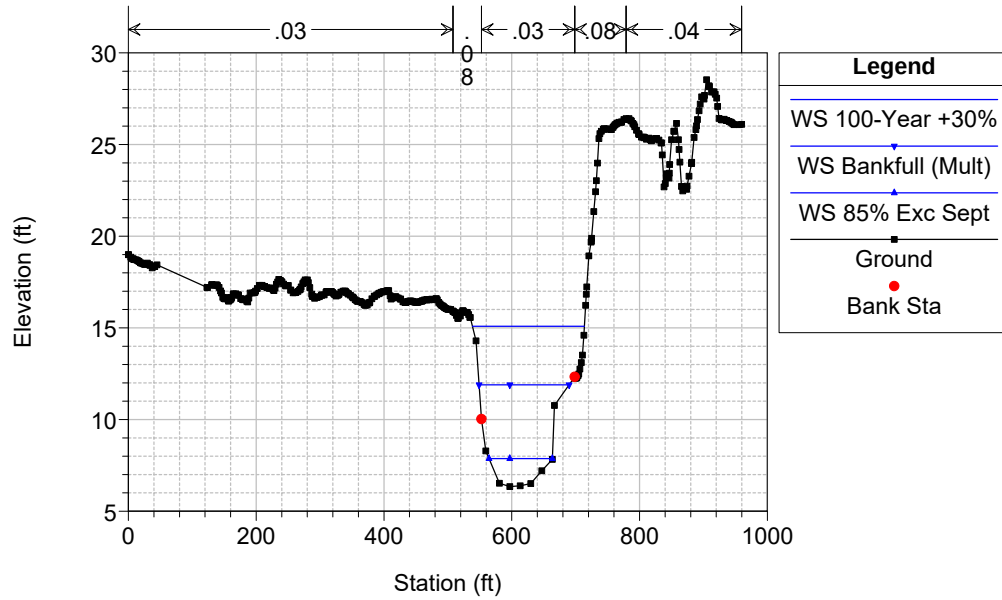
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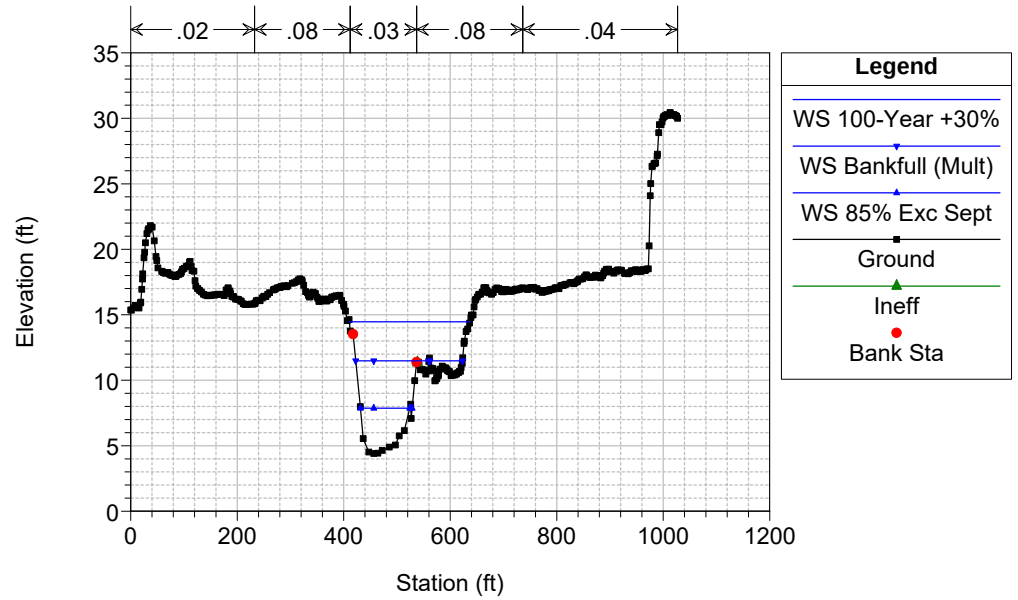
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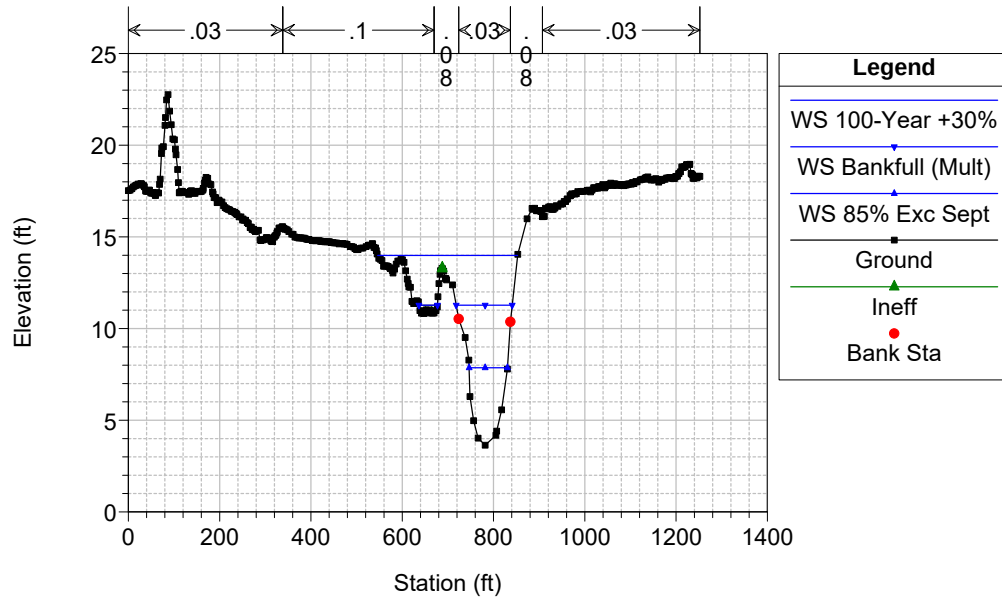
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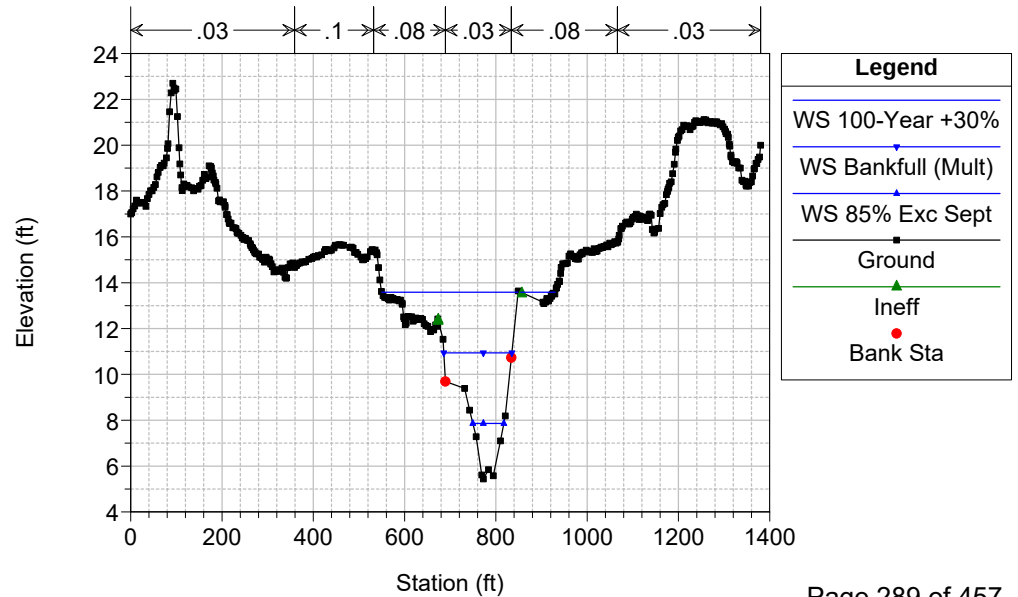
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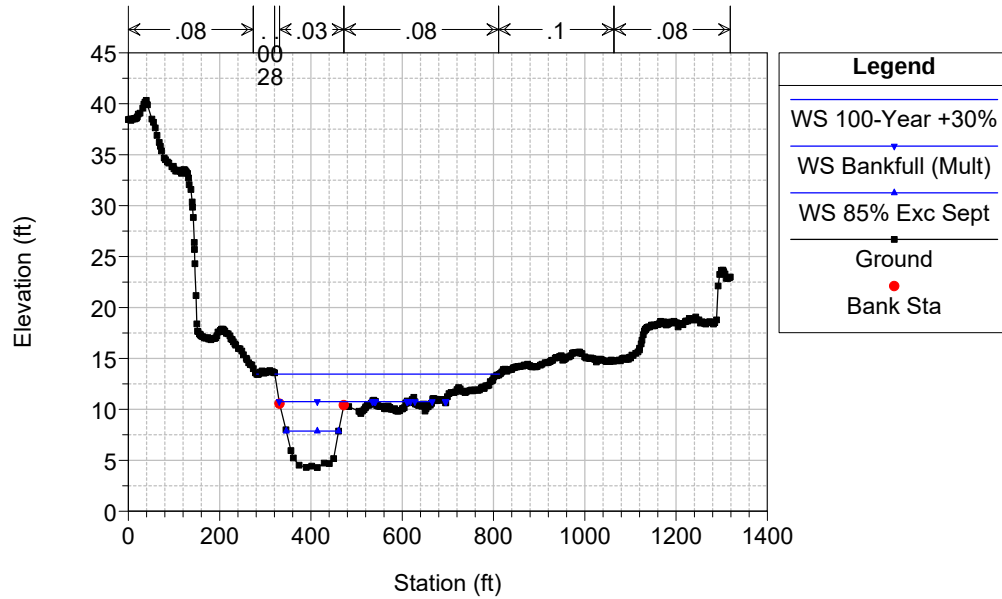
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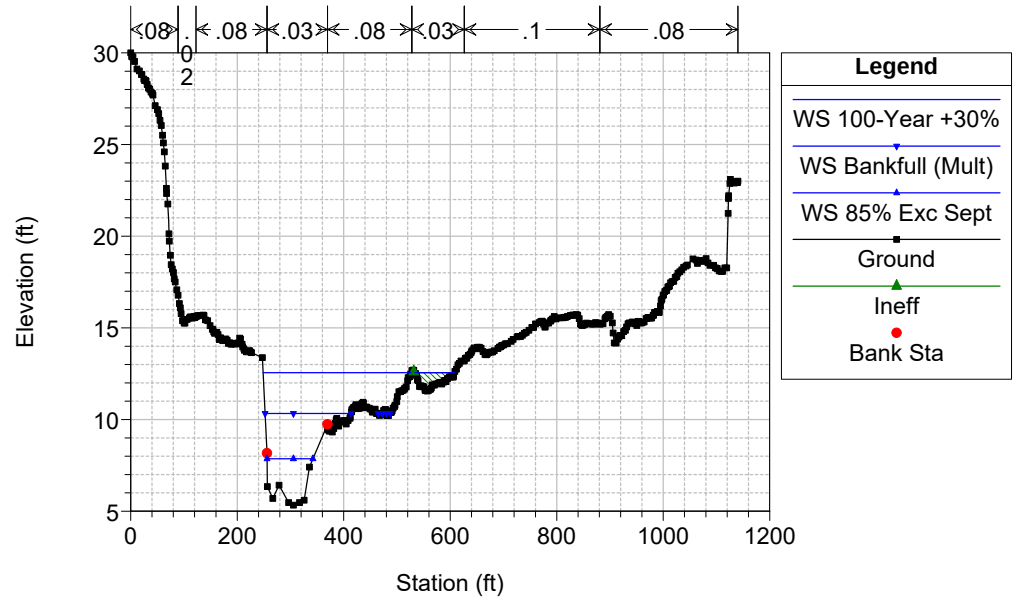
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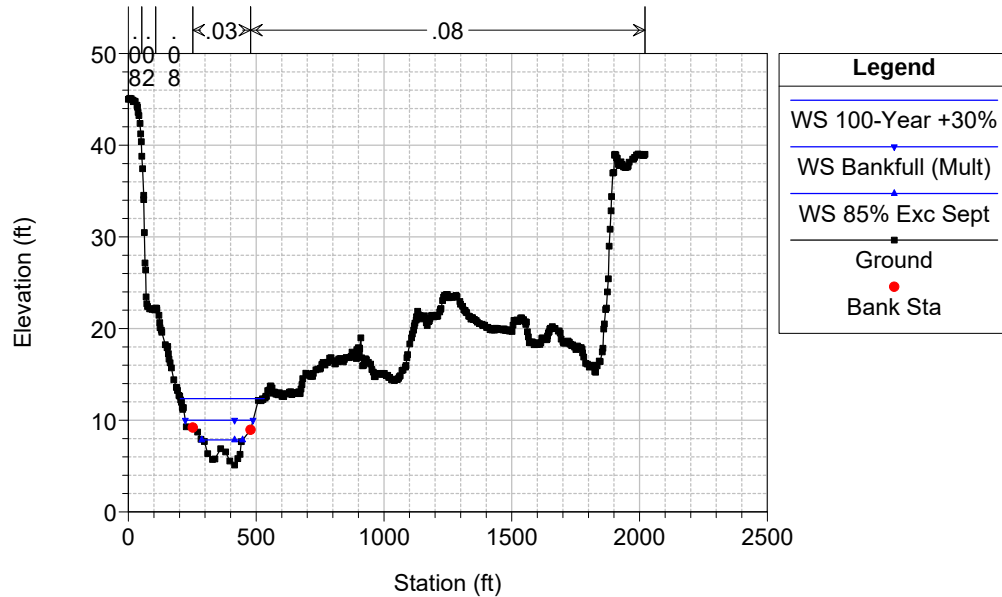
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 Geom: Existing Conditions Flow: Stream Flows_Revised
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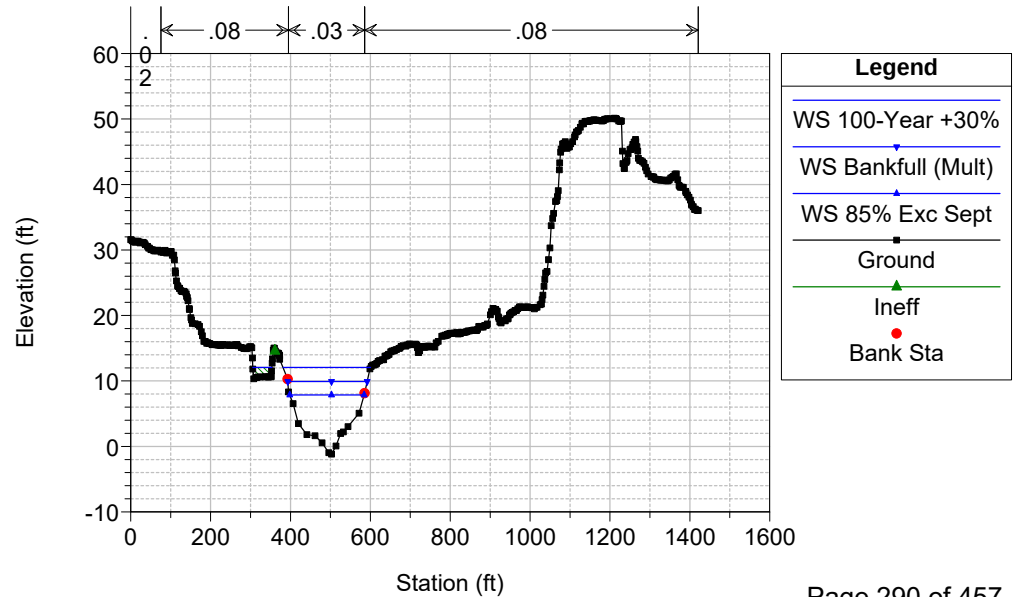
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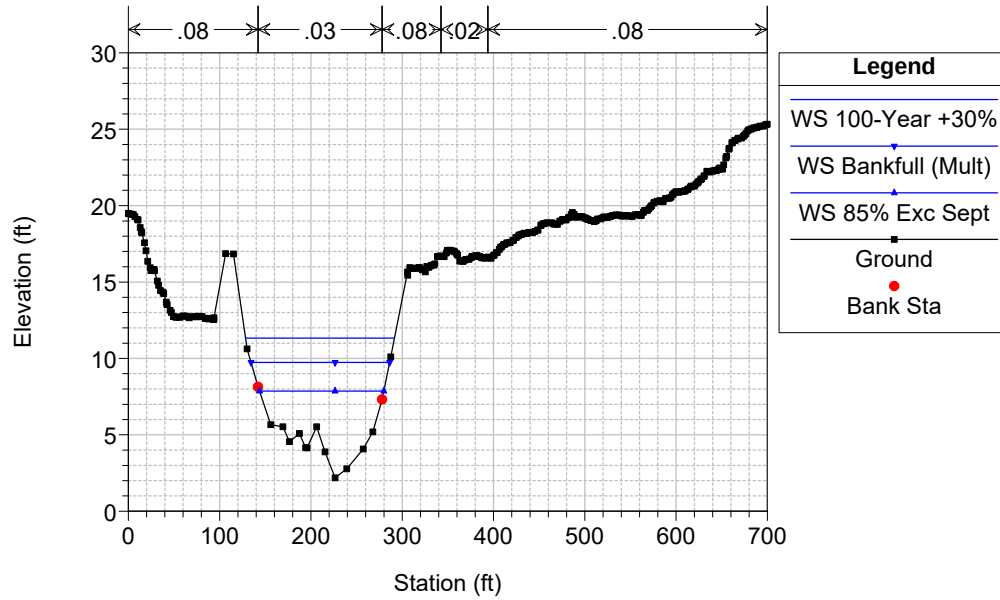
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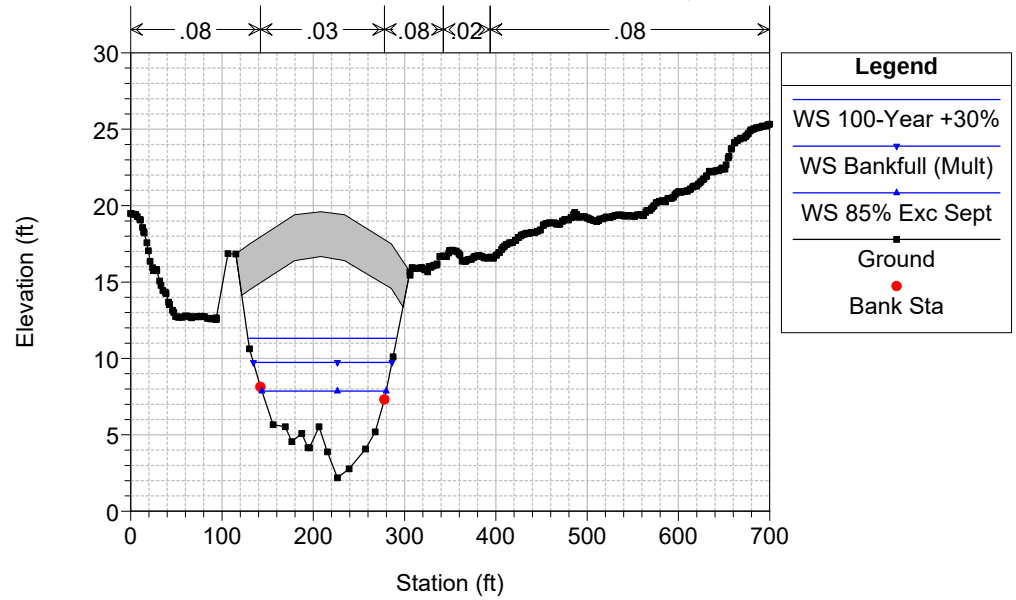
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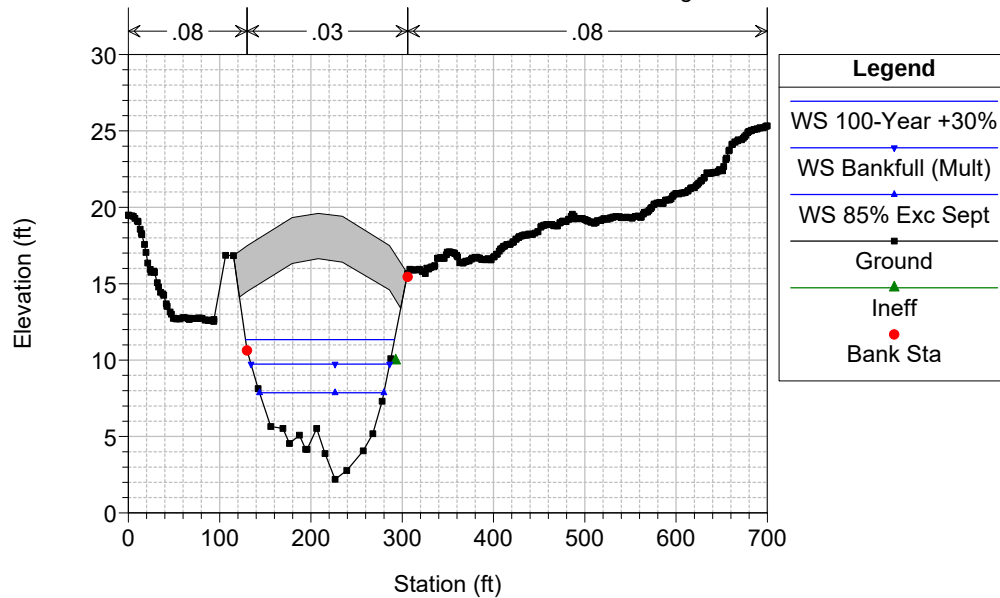
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 Geom: Existing Conditions Flow: Stream Flows_Revised
 RS = 2982.99



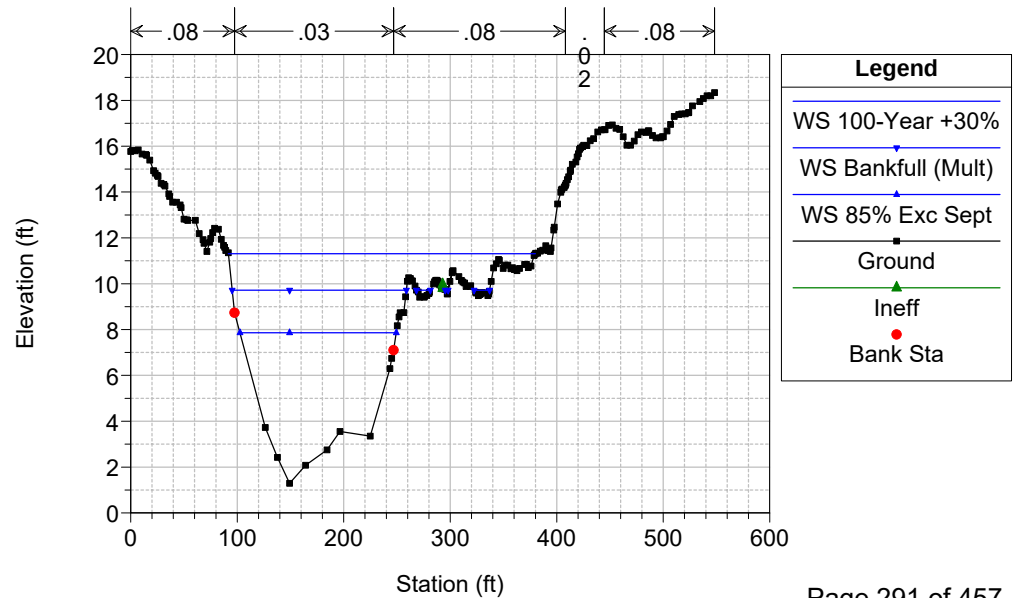
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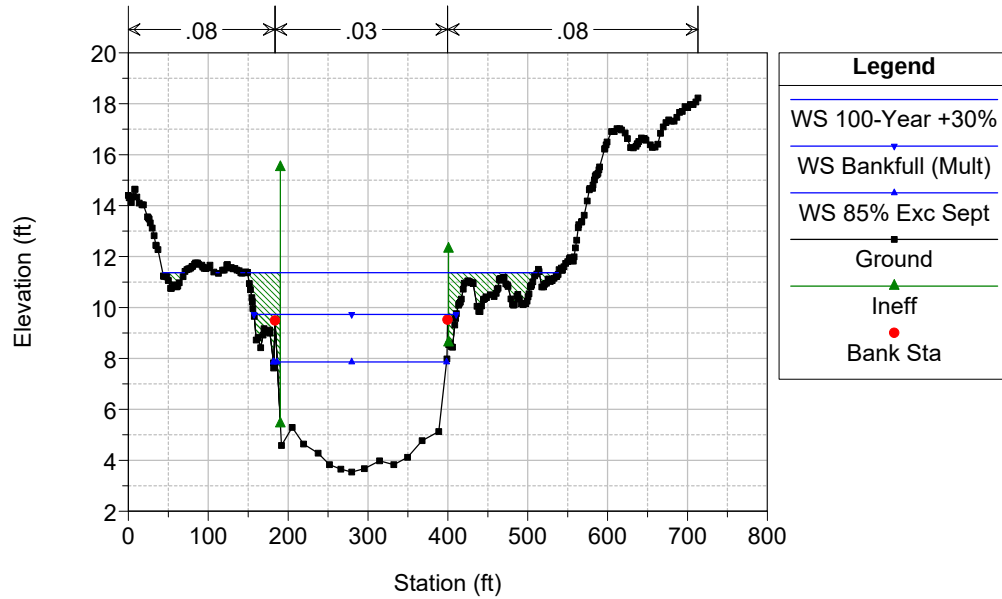
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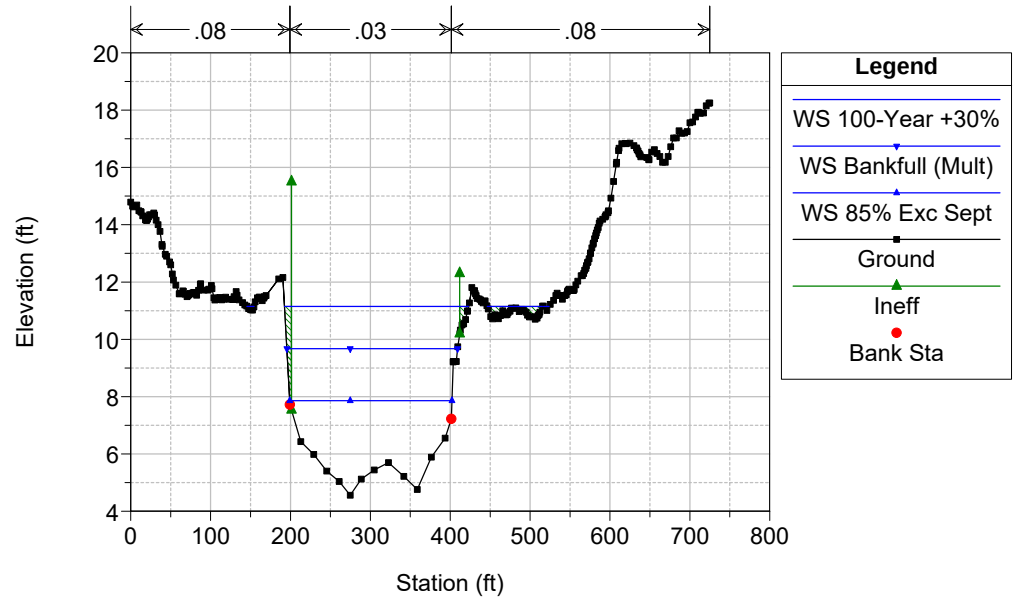
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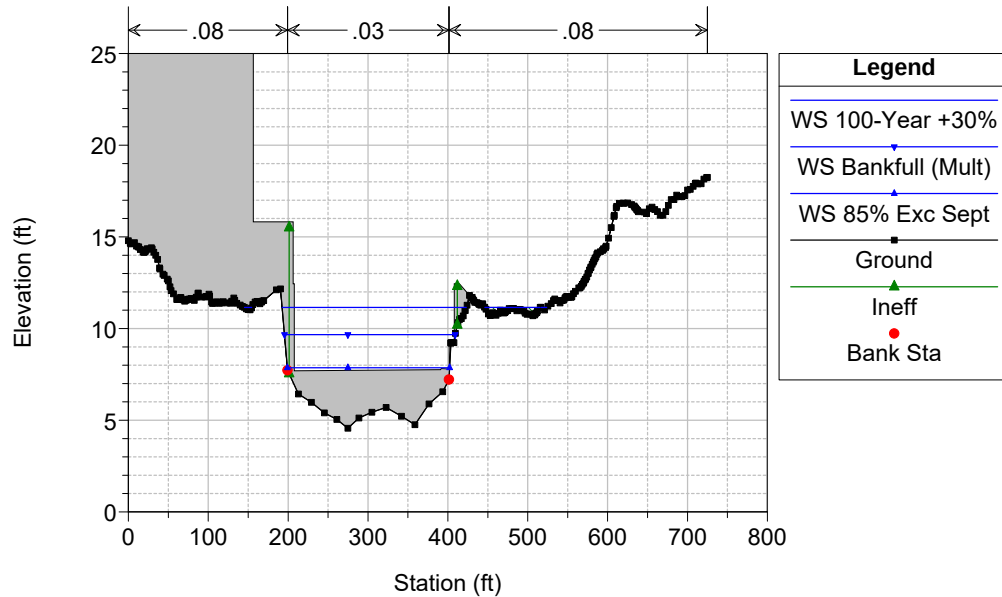
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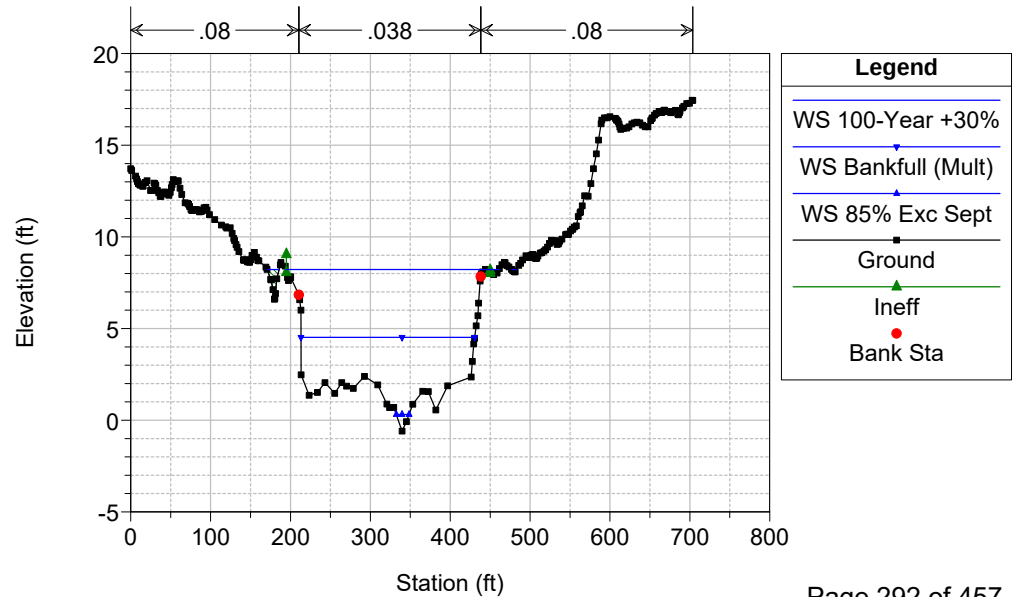
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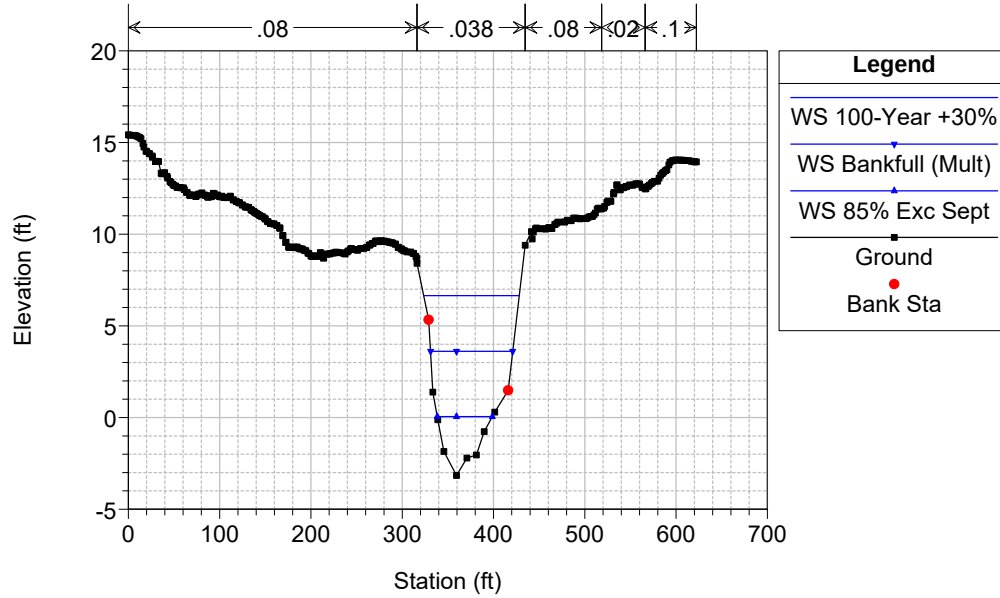
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 RS = 2708 IS Watertown Dam



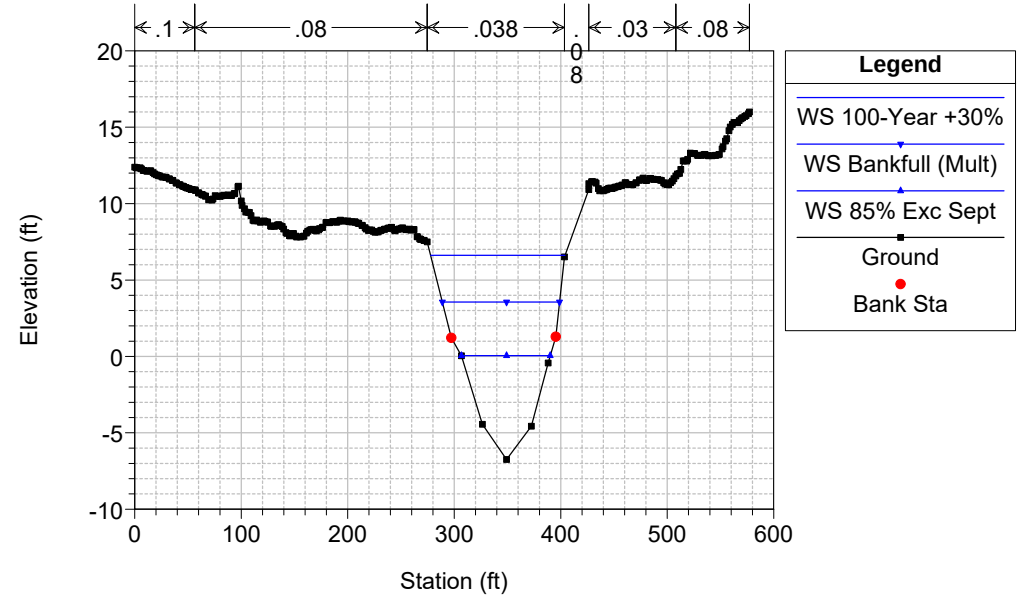
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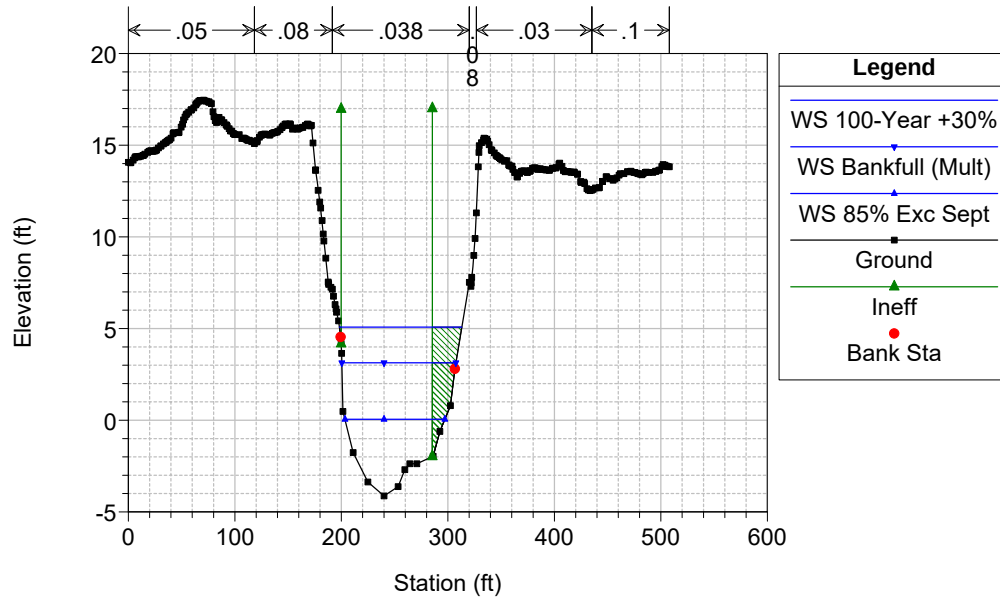
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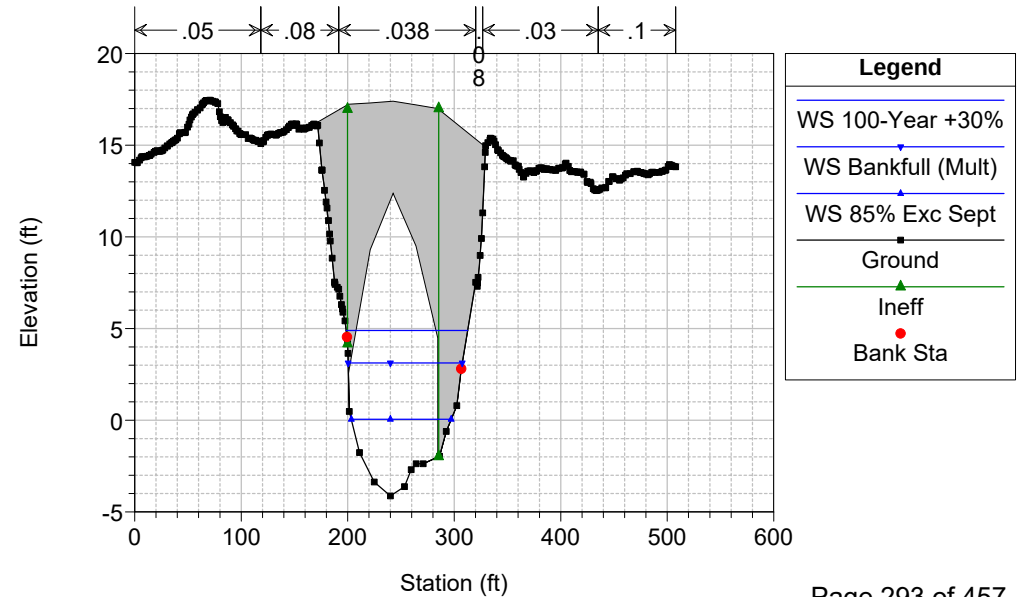
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 Geom: Existing Conditions Flow: Stream Flows_Revised
 RS = 2097.98



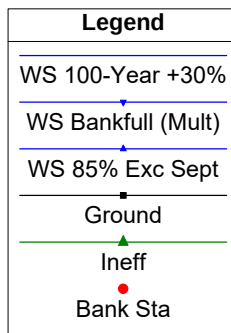
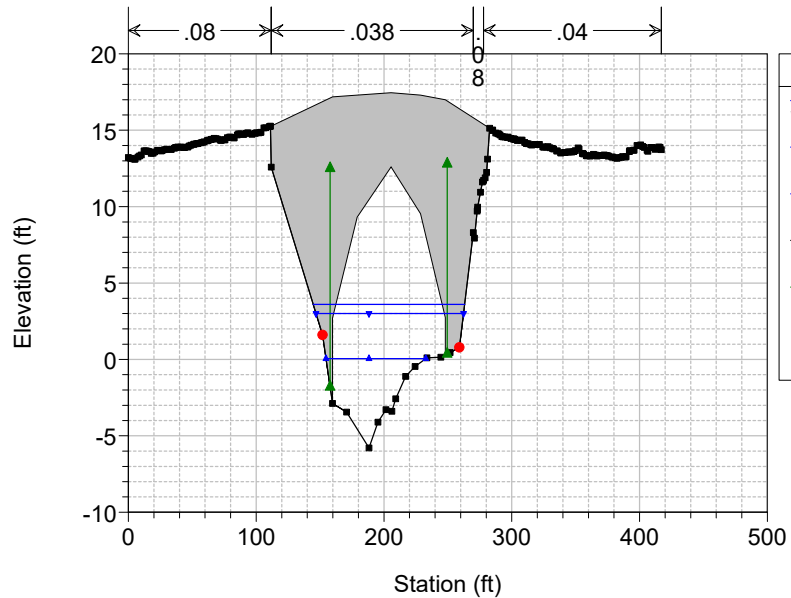
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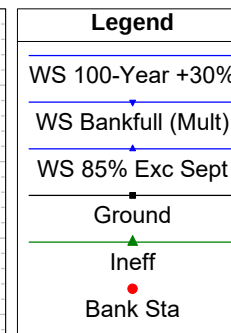
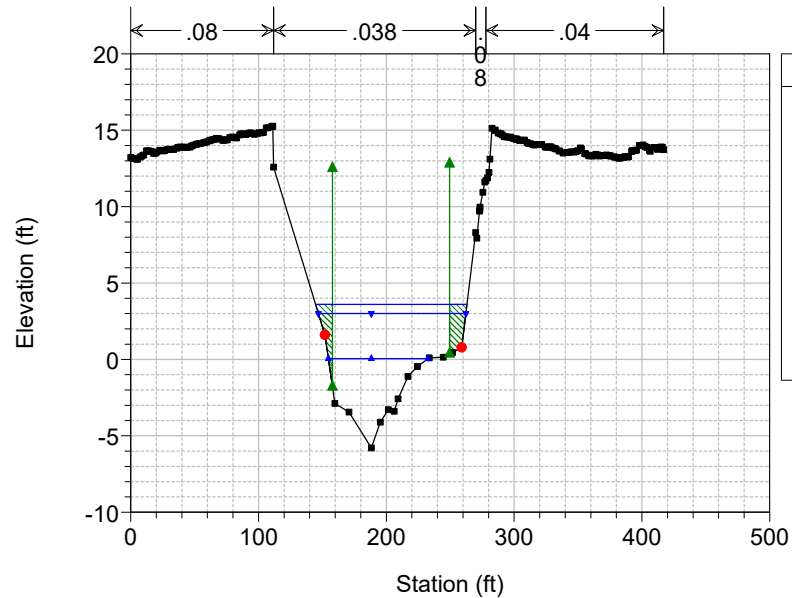
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 Geom: Existing Conditions Flow: Stream Flows_Revised
 RS = 1670 BR Galen Street



Existing Cond_CorrectedBC for Low Flow
 Geom: Existing Conditions Flow: Stream Flows_Revised
 RS = 1670 BR Galen Street



Existing Cond_CorrectedBC for Low Flow
 Geom: Existing Conditions Flow: Stream Flows_Revised
 RS = 1621.86



Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Charles River CL	8272.98	10-year +30%	ExCond	3549.00	7.32	16.53	12.95	16.83	0.00066	4.46	908.01	184.26	0.30
Charles River CL	8272.98	10-year +30%	PrCond	3549.00	7.32	16.53	12.95	16.83	0.00066	4.46	907.83	184.24	0.30
Charles River CL	8272.98	50-Year +30%	ExCond	5223.00	7.32	17.62	13.87	18.08	0.00084	5.55	1121.78	206.03	0.35
Charles River CL	8272.98	50-Year +30%	PrCond	5223.00	7.32	17.63	13.87	18.09	0.00083	5.55	1122.76	206.07	0.35
Charles River CL	8272.98	100-Year +30%	ExCond	6019.00	7.32	18.07	14.28	18.61	0.00091	6.01	1216.27	281.54	0.37
Charles River CL	8272.98	100-Year +30%	PrCond	6019.00	7.32	18.07	14.29	18.61	0.00091	6.01	1216.38	281.53	0.37
Charles River CL	8272.98	500-Year +30%	ExCond	8097.00	7.32	19.21	15.29	19.86	0.00098	6.79	1687.53	534.19	0.39
Charles River CL	8272.98	500-Year +30%	PrCond	8097.00	7.32	19.20	15.29	19.85	0.00097	6.77	1682.91	532.91	0.39
Charles River CL	8272.98	15% Exc April	ExCond	1077.00	7.32	13.98	11.18	14.06	0.00032	2.25	487.98	139.02	0.20
Charles River CL	8272.98	15% Exc April	PrCond	1077.00	7.32	13.98	11.18	14.06	0.00032	2.25	487.82	138.90	0.20
Charles River CL	8272.98	85% Exc Jul	ExCond	49.00	7.32	10.65	8.39	10.65	0.00005	0.46	106.24	70.43	0.07
Charles River CL	8272.98	85% Exc Jul	PrCond	49.00	7.32	10.65	8.40	10.65	0.00005	0.46	106.16	70.49	0.07
Charles River CL	8272.98	85% Exc Sept	ExCond	29.00	7.32	10.46	8.15	10.47	0.00002	0.31	94.22	62.51	0.04
Charles River CL	8272.98	85% Exc Sept	PrCond	29.00	7.32	10.46	8.15	10.46	0.00002	0.31	94.13	62.50	0.04
Charles River CL	8272.98	50% Exc-June	ExCond	203.00	7.32	11.52	9.33	11.54	0.00022	1.05	193.37	111.72	0.14
Charles River CL	8272.98	50% Exc-June	PrCond	203.00	7.32	11.52	9.34	11.54	0.00022	1.05	193.29	111.73	0.14
Charles River CL	8272.98	1.5-year	ExCond	1257.00	7.32	14.28	11.36	14.37	0.00035	2.45	531.04	151.74	0.21
Charles River CL	8272.98	1.5-year	PrCond	1257.00	7.32	14.28	11.35	14.37	0.00035	2.45	531.05	151.65	0.21
Charles River CL	8272.98	Bankfull (Mult)	ExCond	2108.00	7.32	15.29	12.03	15.46	0.00048	3.30	694.02	165.51	0.25
Charles River CL	8272.98	Bankfull (Mult)	PrCond	2108.00	7.32	15.29	12.03	15.46	0.00048	3.30	693.88	165.51	0.25
Charles River CL	8049.23	10-year +30%	ExCond	3549.00	9.91	16.31	13.43	16.65	0.00093	4.65	787.47	167.36	0.35
Charles River CL	8049.23	10-year +30%	PrCond	3549.00	9.91	16.31	13.43	16.65	0.00093	4.65	787.44	167.33	0.35
Charles River CL	8049.23	50-Year +30%	ExCond	5223.00	9.91	17.36	14.35	17.86	0.00111	5.71	974.17	189.43	0.39
Charles River CL	8049.23	50-Year +30%	PrCond	5223.00	9.91	17.37	14.35	17.87	0.00111	5.70	975.45	189.54	0.39
Charles River CL	8049.23	100-Year +30%	ExCond	6019.00	9.91	17.79	14.72	18.37	0.00118	6.15	1056.89	196.37	0.41
Charles River CL	8049.23	100-Year +30%	PrCond	6019.00	9.91	17.79	14.72	18.37	0.00118	6.15	1057.28	196.41	0.41
Charles River CL	8049.23	500-Year +30%	ExCond	8097.00	9.91	18.83	15.58	19.60	0.00132	7.14	1268.81	216.48	0.45
Charles River CL	8049.23	500-Year +30%	PrCond	8097.00	9.91	18.81	15.58	19.59	0.00133	7.15	1265.46	216.19	0.45
Charles River CL	8049.23	15% Exc April	ExCond	1077.00	9.91	13.86	11.72	13.96	0.00056	2.56	421.13	130.53	0.25
Charles River CL	8049.23	15% Exc April	PrCond	1077.00	9.91	13.86	11.72	13.96	0.00056	2.56	421.08	130.52	0.25
Charles River CL	8049.23	85% Exc Jul	ExCond	49.00	9.91	10.58	10.35	10.61	0.00329	1.41	34.65	98.68	0.42
Charles River CL	8049.23	85% Exc Jul	PrCond	49.00	9.91	10.58	10.35	10.61	0.00331	1.42	34.60	98.66	0.42
Charles River CL	8049.23	85% Exc Sept	ExCond	29.00	9.91	10.42	10.26	10.44	0.00349	1.38	21.08	65.33	0.43
Charles River CL	8049.23	85% Exc Sept	PrCond	29.00	9.91	10.42	10.26	10.44	0.00352	1.38	21.02	65.28	0.43
Charles River CL	8049.23	50% Exc-June	ExCond	203.00	9.91	11.41	10.74	11.45	0.00097	1.63	124.23	113.45	0.28
Charles River CL	8049.23	50% Exc-June	PrCond	203.00	9.91	11.41	10.74	11.45	0.00097	1.63	124.16	113.45	0.28
Charles River CL	8049.23	1.5-year	ExCond	1257.00	9.91	14.15	11.87	14.27	0.00060	2.74	459.35	133.88	0.26
Charles River CL	8049.23	1.5-year	PrCond	1257.00	9.91	14.15	11.87	14.27	0.00060	2.74	459.52	133.88	0.26
Charles River CL	8049.23	Bankfull (Mult)	ExCond	2108.00	9.91	15.13	12.51	15.32	0.00075	3.54	600.12	149.63	0.30
Charles River CL	8049.23	Bankfull (Mult)	PrCond	2108.00	9.91	15.13	12.51	15.32	0.00075	3.54	600.14	149.64	0.30
Charles River CL	7922			Inl Struct									
Charles River CL	7821.89	10-year +30%	ExCond	3549.00	6.33	14.84	12.16	15.44	0.00137	6.19	573.23	111.05	0.43
Charles River CL	7821.89	10-year +30%	PrCond	3549.00	6.33	14.82	12.16	15.42	0.00138	6.21	571.60	111.00	0.44
Charles River CL	7821.89	50-Year +30%	ExCond	5223.00	6.33	16.16	13.22	17.04	0.00158	7.54	693.13	114.38	0.48
Charles River CL	7821.89	50-Year +30%	PrCond	5223.00	6.33	16.14	13.22	17.02	0.00159	7.56	691.13	114.32	0.48
Charles River CL	7821.89	100-Year +30%	ExCond	6019.00	6.33	16.70	13.69	17.72	0.00166	8.11	742.61	115.75	0.50
Charles River CL	7821.89	100-Year +30%	PrCond	6019.00	6.33	16.68	13.68	17.71	0.00168	8.13	740.67	115.70	0.50
Charles River CL	7821.89	500-Year +30%	ExCond	8097.00	6.33	17.92	14.81	19.32	0.00189	9.49	853.30	118.96	0.55
Charles River CL	7821.89	500-Year +30%	PrCond	8097.00	6.33	17.90	14.81	19.31	0.00190	9.50	852.06	118.92	0.55
Charles River CL	7821.89	15% Exc April	ExCond	1077.00	6.33	11.96	10.06	12.14	0.00097	3.47	310.80	103.38	0.33
Charles River CL	7821.89	15% Exc April	PrCond	1077.00	6.33	11.95	10.06	12.13	0.00098	3.47	310.03	103.34	0.33
Charles River CL	7821.89	85% Exc Jul	ExCond	49.00	6.33	8.64	7.05	8.65	0.00013	0.75	65.03	41.84	0.11
Charles River CL	7821.89	85% Exc Jul	PrCond	49.00	6.33	8.83	7.05	8.84	0.00010	0.67	73.58	45.40	0.09
Charles River CL	7821.89	85% Exc Sept	ExCond	29.00	6.33	8.40	6.89	8.40	0.00007	0.52	55.41	39.30	0.08
Charles River CL	7821.89	85% Exc Sept	PrCond	29.00	6.33	8.61	6.89	8.62	0.00005	0.45	63.98	41.37	0.06
Charles River CL	7821.89	50% Exc-June	ExCond	203.00	6.33	9.62	7.84	9.67	0.00051	1.80	113.01	58.56	0.22
Charles River CL	7821.89	50% Exc-June	PrCond	203.00	6.33	9.68	7.84	9.73	0.00047	1.74	116.44	59.57	0.21
Charles River CL	7821.89	1.5-year	ExCond	1257.00	6.33	12.24	10.34	12.46	0.00101	3.73	336.67	104.39	0.34
Charles River CL	7821.89	1.5-year	PrCond	1257.00	6.33	12.23	10.33	12.45	0.00102	3.74	335.95	104.35	0.34
Charles River CL	7821.89	Bankfull (Mult)	ExCond	2108.00	6.33	13.39	11.10	13.75	0.00116	4.78	441.29	107.38	0.38
Charles River CL	7821.89	Bankfull (Mult)	PrCond	2108.00	6.33	13.38	11.10	13.74	0.00116	4.78	440.84	107.37	0.38
Charles River CL	7795			Bridge									
Charles River CL	7765.9	10-year +30%	ExCond	3549.00	6.52	14.72	12.07	15.26	0.00130	5.87	605.09	112.36	0.42
Charles River CL	7765.9	10-year +30%	PrCond	3549.00	6.52	14.70	12.06	15.24	0.00131	5.88	603.14	112.30	0.42
Charles River CL	7765.9	50-Year +30%	ExCond	5223.00	6.52	16.00	13.06	16.79	0.00149	7.13	732.77	116.46	0.46
Charles River CL	7765.9	50-Year +30%	PrCond	5223.00	6.52	15.97	13.06	16.77	0.00150	7.15	730.33	116.38	0.47
Charles River CL	7765.9	100-Year +30%	ExCond	6019.00	6.52	16.52	13.50	17.44	0.00157	7.67	784.89	118.13	0.48
Charles River CL	7765.9	100-Year +30%	PrCond	6019.00	6.52	16.50	13.50	17.42	0.00158	7.69	782.47	118.05	0.48
Charles River CL	7765.9	500-Year +30%	ExCond	8097.00	6.52	17.66	14.55	18.92	0.00181	9.01	898.47	122.02	0.53
Charles River CL	7765.9	500-Year +30%	PrCond	8097.00	6.52	17.64	14.56	18.91	0.00182	9.03	896.85	121.95	0.53
Charles River CL	7765.9	15% Exc April	ExCond	1077.00	6.52	11.89	9.70	12.07	0.00098	3.35	321.88	107.33	0.29

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Charles River CL	7765.9	15% Exc April	PrCond	1077.00	6.52	11.88	9.70	12.06	0.00099	3.36	320.98	101.32	0.33
Charles River CL	7765.9	85% Exc Jul	ExCond	49.00	6.52	8.63	7.19	8.64	0.00012	0.69	71.05	49.41	0.10
Charles River CL	7765.9	85% Exc Jul	PrCond	49.00	6.52	8.83	7.19	8.84	0.00008	0.60	81.14	51.88	0.09
Charles River CL	7765.9	85% Exc Sept	ExCond	29.00	6.52	8.40	7.04	8.40	0.00007	0.49	59.77	46.52	0.08
Charles River CL	7765.9	85% Exc Sept	PrCond	29.00	6.52	8.61	7.04	8.61	0.00004	0.41	70.06	49.18	0.06
Charles River CL	7765.9	50% Exc-June	ExCond	203.00	6.52	9.60	7.87	9.64	0.00043	1.63	124.42	61.19	0.20
Charles River CL	7765.9	50% Exc-June	PrCond	203.00	6.52	9.66	7.87	9.70	0.00039	1.58	128.49	62.02	0.19
Charles River CL	7765.9	1.5-year	ExCond	1257.00	6.52	12.17	9.97	12.37	0.00101	3.59	349.91	102.59	0.34
Charles River CL	7765.9	1.5-year	PrCond	1257.00	6.52	12.16	9.96	12.36	0.00102	3.60	349.06	102.54	0.34
Charles River CL	7765.9	Bankfull (Mult)	ExCond	2108.00	6.52	13.31	11.05	13.63	0.00112	4.55	463.27	107.54	0.37
Charles River CL	7765.9	Bankfull (Mult)	PrCond	2108.00	6.52	13.30	11.04	13.62	0.00112	4.56	462.74	107.51	0.37
Charles River CL	7305.73	10-year +30%	ExCond	3549.00	7.64	14.10		14.61	0.00147	5.74	663.35	154.49	0.44
Charles River CL	7305.73	10-year +30%	PrCond	3549.00	7.64	14.07		14.58	0.00150	5.78	658.28	153.66	0.45
Charles River CL	7305.73	50-Year +30%	ExCond	5223.00	7.64	15.36		16.05	0.00152	6.74	891.97	211.17	0.46
Charles River CL	7305.73	50-Year +30%	PrCond	5223.00	7.64	15.32		16.02	0.00156	6.78	883.57	210.75	0.47
Charles River CL	7305.73	100-Year +30%	ExCond	6019.00	7.64	15.88		16.64	0.00154	7.13	1007.98	238.27	0.47
Charles River CL	7305.73	100-Year +30%	PrCond	6019.00	7.64	15.84		16.62	0.00157	7.18	998.74	237.09	0.48
Charles River CL	7305.73	500-Year +30%	ExCond	8097.00	7.64	17.05		17.98	0.00157	7.97	1417.02	404.97	0.49
Charles River CL	7305.73	500-Year +30%	PrCond	8097.00	7.64	17.02		17.96	0.00159	8.01	1405.61	404.44	0.49
Charles River CL	7305.73	15% Exc April	ExCond	1077.00	7.64	11.17		11.41	0.00206	3.99	270.16	114.70	0.46
Charles River CL	7305.73	15% Exc April	PrCond	1077.00	7.64	11.13		11.39	0.00216	4.04	266.34	114.31	0.47
Charles River CL	7305.73	85% Exc Jul	ExCond	49.00	7.64	8.24	8.24	8.40	0.01960	3.26	15.04	46.70	1.01
Charles River CL	7305.73	85% Exc Jul	PrCond	49.00	7.64	8.73	8.23	8.74	0.00087	1.07	46.00	73.88	0.24
Charles River CL	7305.73	85% Exc Sept	ExCond	29.00	7.64	8.11	8.11	8.25	0.02091	2.95	9.85	37.33	1.01
Charles River CL	7305.73	85% Exc Sept	PrCond	29.00	7.64	8.55	8.11	8.56	0.00083	0.88	33.01	68.06	0.22
Charles River CL	7305.73	50% Exc-June	ExCond	203.00	7.64	9.02		9.16	0.00429	2.97	68.38	78.00	0.56
Charles River CL	7305.73	50% Exc-June	PrCond	203.00	7.64	9.26		9.34	0.00202	2.33	87.09	81.25	0.40
Charles River CL	7305.73	1.5-year	ExCond	1257.00	7.64	11.46		11.73	0.00193	4.13	304.50	117.84	0.45
Charles River CL	7305.73	1.5-year	PrCond	1257.00	7.64	11.43		11.70	0.00200	4.18	301.20	117.50	0.46
Charles River CL	7305.73	Bankfull (Mult)	ExCond	2108.00	7.64	12.68		13.03	0.00151	4.71	459.85	135.26	0.42
Charles River CL	7305.73	Bankfull (Mult)	PrCond	2108.00	7.64	12.67		13.02	0.00153	4.73	458.01	135.16	0.43
Charles River CL	6530.9	10-year +30%	ExCond	3549.00	6.34	13.32		13.65	0.00095	4.59	788.91	163.68	0.35
Charles River CL	6530.9	10-year +30%	PrCond	3549.00	6.34	13.26		13.59	0.00099	4.65	778.48	163.28	0.36
Charles River CL	6530.9	50-Year +30%	ExCond	5223.00	6.34	14.57		15.03	0.00100	5.44	997.36	170.55	0.38
Charles River CL	6530.9	50-Year +30%	PrCond	5223.00	6.34	14.50		14.97	0.00104	5.50	985.68	169.91	0.38
Charles River CL	6530.9	100-Year +30%	ExCond	6019.00	6.34	15.08		15.60	0.00103	5.81	1085.86	175.14	0.39
Charles River CL	6530.9	100-Year +30%	PrCond	6019.00	6.34	15.02		15.55	0.00107	5.86	1074.49	174.55	0.39
Charles River CL	6530.9	500-Year +30%	ExCond	8097.00	6.34	16.18		16.87	0.00115	6.73	1295.25	223.12	0.42
Charles River CL	6530.9	500-Year +30%	PrCond	8097.00	6.34	16.13		16.84	0.00117	6.77	1285.13	221.45	0.42
Charles River CL	6530.9	15% Exc April	ExCond	1077.00	6.34	10.43		10.55	0.00065	2.81	382.85	114.59	0.27
Charles River CL	6530.9	15% Exc April	PrCond	1077.00	6.34	10.32		10.45	0.00072	2.91	370.52	114.26	0.28
Charles River CL	6530.9	85% Exc Jul	ExCond	49.00	6.34	7.93		7.94	0.00007	0.44	111.71	99.89	0.07
Charles River CL	6530.9	85% Exc Jul	PrCond	49.00	6.34	6.73	6.73	6.87	0.02024	3.04	16.12	56.89	1.01
Charles River CL	6530.9	85% Exc Sept	ExCond	29.00	6.34	7.87		7.87	0.00003	0.28	105.08	99.01	0.05
Charles River CL	6530.9	85% Exc Sept	PrCond	29.00	6.34	6.64	6.64	6.75	0.02193	2.58	11.22	53.63	1.00
Charles River CL	6530.9	50% Exc-June	ExCond	203.00	6.34	8.40		8.42	0.00038	1.28	159.20	105.13	0.18
Charles River CL	6530.9	50% Exc-June	PrCond	203.00	6.34	7.77		7.84	0.00185	2.12	95.68	96.35	0.38
Charles River CL	6530.9	1.5-year	ExCond	1257.00	6.34	10.73		10.87	0.00067	3.02	417.33	115.51	0.28
Charles River CL	6530.9	1.5-year	PrCond	1257.00	6.34	10.65		10.80	0.00072	3.08	408.57	115.28	0.29
Charles River CL	6530.9	Bankfull (Mult)	ExCond	2108.00	6.34	11.90		12.11	0.00088	3.74	567.05	140.92	0.33
Charles River CL	6530.9	Bankfull (Mult)	PrCond	2108.00	6.34	11.87		12.09	0.00089	3.76	563.11	140.35	0.33
Charles River CL	5843.4	10-year +30%	ExCond	3549.00	4.41	12.81		13.10	0.00066	4.39	956.64	206.67	0.30
Charles River CL	5843.4	10-year +30%	PrCond	3549.00	4.42	12.72		13.02	0.00069	4.46	938.34	206.27	0.31
Charles River CL	5843.4	50-Year +30%	ExCond	5223.00	4.41	13.98		14.40	0.00080	5.36	1205.54	221.54	0.34
Charles River CL	5843.4	50-Year +30%	PrCond	5223.00	4.42	13.89		14.32	0.00084	5.44	1184.39	220.35	0.35
Charles River CL	5843.4	100-Year +30%	ExCond	6019.00	4.41	14.47		14.95	0.00085	5.76	1314.09	226.22	0.36
Charles River CL	5843.4	100-Year +30%	PrCond	6019.00	4.42	14.38		14.87	0.00089	5.83	1293.48	225.50	0.36
Charles River CL	5843.4	500-Year +30%	ExCond	8097.00	4.41	15.47		16.13	0.00101	6.78	1550.53	246.28	0.39
Charles River CL	5843.4	500-Year +30%	PrCond	8097.00	4.42	15.41		16.07	0.00104	6.83	1534.66	244.29	0.40
Charles River CL	5843.4	15% Exc April	ExCond	1077.00	4.41	10.17		10.24	0.00030	2.26	476.58	112.96	0.19
Charles River CL	5843.4	15% Exc April	PrCond	1077.00	4.42	10.03		10.12	0.00033	2.33	461.95	109.29	0.20
Charles River CL	5843.4	85% Exc Jul	ExCond	49.00	4.41	7.93		7.93	0.00000	0.20	247.11	95.59	0.02
Charles River CL	5843.4	85% Exc Jul	PrCond	49.00	4.42	6.61		6.62	0.00003	0.37	130.70	82.38	0.05
Charles River CL	5843.4	85% Exc Sept	ExCond	29.00	4.41	7.86		7.87	0.00000	0.12	241.14	94.89	0.01
Charles River CL	5843.4	85% Exc Sept	PrCond	29.00	4.42	6.38		6.38	0.00002	0.26	111.87	80.51	0.04
Charles River CL	5843.4	50% Exc-June	ExCond	203.00	4.41	8.33		8.34	0.00005	0.71	286.71	99.16	0.07
Charles River CL	5843.4	50% Exc-June	PrCond	203.00	4.42	7.61		7.62	0.00012	0.94	217.11	92.02	0.11
Charles River CL	5843.4	1.5-year	ExCond	1257.00	4.41	10.44		10.54	0.00034	2.48	506.45	126.01	0.20
Charles River CL	5843.4	1.5-year	PrCond	1257.00	4.42	10.35		10.45	0.00036	2.53	496.05	116.48	0.21
Charles River CL	5843.4	Bankfull (Mult)	ExCond	2108.00	4.41	11.49		11.66	0.00049	3.35	687.27	198.46	0.25
Charles River CL	5843.4	Bankfull (Mult)	PrCond	2108.00	4.42	11.45		11.63	0.00050	3.37	680.04	197.96	0.26
Charles River CL	5481.13	10-year +30%	ExCond	3549.00	3.64	12.47		12.83	0.00080	4.81	758.44	206.27	0.33

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Charles River CL	5481.13	10-year +30%	PrCond	3549.00	3.64	12.37	8.64	12.74	0.00084	4.89	744.23	201.75	0.34
Charles River CL	5481.13	50-Year +30%	ExCond	5223.00	3.64	13.56	9.87	14.08	0.00097	5.88	1099.46	276.74	0.38
Charles River CL	5481.13	50-Year +30%	PrCond	5223.00	3.64	13.43	9.87	13.98	0.00103	6.00	1066.09	272.08	0.39
Charles River CL	5481.13	100-Year +30%	ExCond	6019.00	3.64	13.99	10.41	14.60	0.00106	6.37	1226.73	306.52	0.40
Charles River CL	5481.13	100-Year +30%	PrCond	6019.00	3.64	13.87	10.41	14.50	0.00112	6.49	1189.95	304.26	0.41
Charles River CL	5481.13	500-Year +30%	ExCond	8097.00	3.64	14.83	11.42	15.69	0.00133	7.64	1524.67	471.65	0.45
Charles River CL	5481.13	500-Year +30%	PrCond	8097.00	3.64	14.74	11.42	15.62	0.00138	7.73	1484.67	432.58	0.46
Charles River CL	5481.13	15% Exc April	ExCond	1077.00	3.64	10.05	6.33	10.13	0.00032	2.33	462.04	105.92	0.20
Charles River CL	5481.13	15% Exc April	PrCond	1077.00	3.64	9.90	6.33	9.99	0.00034	2.41	446.83	103.54	0.20
Charles River CL	5481.13	85% Exc Jul	ExCond	49.00	3.64	7.93	4.25	7.93	0.00000	0.18	264.96	84.26	0.02
Charles River CL	5481.13	85% Exc Jul	PrCond	49.00	3.64	6.61	4.25	6.61	0.00001	0.31	159.31	75.58	0.04
Charles River CL	5481.13	85% Exc Sept	ExCond	29.00	3.64	7.86	4.13	7.86	0.00000	0.11	259.75	84.02	0.01
Charles River CL	5481.13	85% Exc Sept	PrCond	29.00	3.64	6.38	4.13	6.38	0.00001	0.20	142.26	74.01	0.03
Charles River CL	5481.13	50% Exc-June	ExCond	203.00	3.64	8.32	4.81	8.33	0.00004	0.68	298.26	86.00	0.06
Charles River CL	5481.13	50% Exc-June	PrCond	203.00	3.64	7.58	4.80	7.59	0.00008	0.86	235.89	82.27	0.09
Charles River CL	5481.13	1.5-year	ExCond	1257.00	3.64	10.30	6.55	10.41	0.00038	2.57	489.64	110.14	0.21
Charles River CL	5481.13	1.5-year	PrCond	1257.00	3.64	10.20	6.55	10.31	0.00040	2.63	478.46	108.47	0.22
Charles River CL	5481.13	Bankfull (Mult)	ExCond	2108.00	3.64	11.27	7.43	11.47	0.00056	3.52	603.11	163.23	0.27
Charles River CL	5481.13	Bankfull (Mult)	PrCond	2108.00	3.64	11.23	7.43	11.43	0.00057	3.54	598.22	162.36	0.27
Charles River CL	5322.54	10-year +30%	ExCond	3549.00	5.44	12.10	10.55	12.62	0.00204	5.82	622.57	179.96	0.50
Charles River CL	5322.54	10-year +30%	PrCond	3549.00	5.44	11.95	10.54	12.51	0.00231	6.04	598.13	167.33	0.53
Charles River CL	5322.54	50-Year +30%	ExCond	5223.00	5.44	13.15	11.33	13.84	0.00205	6.76	868.62	258.17	0.52
Charles River CL	5322.54	50-Year +30%	PrCond	5223.00	5.44	12.96	11.33	13.72	0.00232	7.03	822.88	249.98	0.55
Charles River CL	5322.54	100-Year +30%	ExCond	6019.00	5.44	13.59	11.67	14.36	0.00204	7.12	1010.37	373.85	0.53
Charles River CL	5322.54	100-Year +30%	PrCond	6019.00	5.44	13.40	11.67	14.23	0.00232	7.41	936.03	337.17	0.56
Charles River CL	5322.54	500-Year +30%	ExCond	8097.00	5.44	14.50	12.65	15.42	0.00210	7.97	1366.92	412.83	0.55
Charles River CL	5322.54	500-Year +30%	PrCond	8097.00	5.44	14.35	12.65	15.34	0.00229	8.21	1306.59	402.77	0.57
Charles River CL	5322.54	15% Exc April	ExCond	1077.00	5.44	9.77	8.40	10.01	0.00258	3.93	273.77	139.59	0.49
Charles River CL	5322.54	15% Exc April	PrCond	1077.00	5.44	9.55	8.40	9.85	0.00300	4.39	245.23	118.72	0.54
Charles River CL	5322.54	85% Exc Jul	ExCond	49.00	5.44	7.92	6.10	7.93	0.00005	0.46	106.13	69.23	0.07
Charles River CL	5322.54	85% Exc Jul	PrCond	49.00	5.44	6.56	6.10	6.60	0.00154	1.58	31.09	42.37	0.32
Charles River CL	5322.54	85% Exc Sept	ExCond	29.00	5.44	7.86	5.97	7.86	0.00002	0.28	102.06	67.92	0.04
Charles River CL	5322.54	85% Exc Sept	PrCond	29.00	5.44	6.35	5.98	6.37	0.00139	1.29	22.54	38.64	0.30
Charles River CL	5322.54	50% Exc-June	ExCond	203.00	5.44	8.27	6.74	8.31	0.00047	1.54	131.62	76.60	0.21
Charles River CL	5322.54	50% Exc-June	PrCond	203.00	5.44	7.43	6.73	7.54	0.00217	2.72	74.73	58.34	0.42
Charles River CL	5322.54	1.5-year	ExCond	1257.00	5.44	10.01	8.62	10.27	0.00241	4.08	307.86	141.54	0.49
Charles River CL	5322.54	1.5-year	PrCond	1257.00	5.44	9.85	8.62	10.15	0.00305	4.40	285.90	140.31	0.54
Charles River CL	5322.54	Bankfull (Mult)	ExCond	2108.00	5.44	10.94	9.73	11.30	0.00211	4.78	443.33	149.06	0.48
Charles River CL	5322.54	Bankfull (Mult)	PrCond	2108.00	5.44	10.88	9.72	11.25	0.00225	4.87	434.72	148.61	0.50
Charles River CL	4903.86	10-year +30%	ExCond	3549.00	4.29	11.91		12.13	0.00055	3.89	1222.89	433.73	0.28
Charles River CL	4903.86	10-year +30%	PrCond	3549.00	4.29	11.72		11.96	0.00063	4.05	1145.05	393.78	0.29
Charles River CL	4903.86	50-Year +30%	ExCond	5223.00	4.29	13.00		13.30	0.00063	4.61	1724.76	476.67	0.30
Charles River CL	4903.86	50-Year +30%	PrCond	5223.00	4.29	12.78		13.11	0.00071	4.81	1620.00	472.47	0.32
Charles River CL	4903.86	100-Year +30%	ExCond	6019.00	4.29	13.46		13.79	0.00065	4.87	1948.96	496.24	0.31
Charles River CL	4903.86	100-Year +30%	PrCond	6019.00	4.29	13.24		13.60	0.00073	5.07	1841.11	481.89	0.33
Charles River CL	4903.86	500-Year +30%	ExCond	8097.00	4.29	14.41		14.80	0.00071	5.51	2478.04	634.95	0.33
Charles River CL	4903.86	500-Year +30%	PrCond	8097.00	4.29	14.24		14.66	0.00077	5.68	2372.76	604.30	0.34
Charles River CL	4903.86	15% Exc April	ExCond	1077.00	4.29	9.66		9.72	0.00024	1.96	549.04	134.18	0.17
Charles River CL	4903.86	15% Exc April	PrCond	1077.00	4.29	9.44		9.51	0.00028	2.07	519.96	130.36	0.18
Charles River CL	4903.86	85% Exc Jul	ExCond	49.00	4.29	7.92		7.92	0.00000	0.15	333.68	115.32	0.02
Charles River CL	4903.86	85% Exc Jul	PrCond	49.00	4.29	6.57		6.57	0.00001	0.26	186.03	102.52	0.03
Charles River CL	4903.86	85% Exc Sept	ExCond	29.00	4.29	7.86		7.86	0.00000	0.09	326.89	114.74	0.01
Charles River CL	4903.86	85% Exc Sept	PrCond	29.00	4.29	6.36		6.36	0.00001	0.18	164.57	100.53	0.02
Charles River CL	4903.86	50% Exc-June	ExCond	203.00	4.29	8.26		8.27	0.00003	0.54	373.82	118.71	0.05
Charles River CL	4903.86	50% Exc-June	PrCond	203.00	4.29	7.43		7.43	0.00006	0.73	277.58	110.61	0.08
Charles River CL	4903.86	1.5-year	ExCond	1257.00	4.29	9.88		9.95	0.00028	2.17	580.13	155.96	0.18
Charles River CL	4903.86	1.5-year	PrCond	1257.00	4.29	9.71		9.79	0.00031	2.26	555.29	135.78	0.20
Charles River CL	4903.86	Bankfull (Mult)	ExCond	2108.00	4.29	10.75		10.89	0.00043	2.98	792.96	319.42	0.24
Charles River CL	4903.86	Bankfull (Mult)	PrCond	2108.00	4.29	10.68		10.82	0.00045	3.03	770.02	308.70	0.24
Charles River CL	4719.12	10-year +30%	ExCond	3549.00	5.33	11.26		9.82	0.00235	6.56	659.47	250.13	0.54
Charles River CL	4719.12	10-year +30%	PrCond	3549.00	5.33	10.89		9.82	0.00321	7.25	566.01	244.58	0.62
Charles River CL	4719.12	50-Year +30%	ExCond	5223.00	5.33	12.16		10.78	0.00260	7.78	895.44	326.09	0.59
Charles River CL	4719.12	50-Year +30%	PrCond	5223.00	5.33	11.61		10.78	0.00388	8.87	747.27	269.48	0.70
Charles River CL	4719.12	100-Year +30%	ExCond	6019.00	5.33	12.55		11.33	0.00266	8.24	1002.65	352.62	0.60
Charles River CL	4719.12	100-Year +30%	PrCond	6019.00	5.33	11.98		11.33	0.00394	9.36	844.85	308.94	0.72
Charles River CL	4719.12	500-Year +30%	ExCond	8097.00	5.33	13.55		12.23	0.00239	8.68	1416.39	406.37	0.58
Charles River CL	4719.12	500-Year +30%	PrCond	8097.00	5.33	13.03		12.23	0.00338	9.78	1216.30	368.41	0.68
Charles River CL	4719.12	15% Exc April	ExCond	1077.00	5.33	9.44		7.67	0.00118	3.41	317.51	121.62	0.35
Charles River CL	4719.12	15% Exc April	PrCond	1077.00	5.33	9.17		7.67	0.00156	3.77	286.59	107.01	0.40
Charles River CL	4719.12	85% Exc Jul	ExCond	49.00	5.33	7.92		5.88	0.00002	0.30	165.76	87.16	0.04
Charles River CL	4719.12	85% Exc Jul	PrCond	49.00	5.33	6.55		5.87	0.00044	0.86	56.68	74.57	0.17
Charles River CL	4719.12	85% Exc Sept	ExCond	29.00	5.33	7.86		5.75	0.00001	0.18	160.75	86.30	0.02
Charles River CL	4719.12	85% Exc Sept	PrCond	29.00	5.33	6.34		5.75	0.00040	0.70	41.65	74.57	0.16

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Charles River CL	4719.12	50% Exc-June	ExCond	203.00	5.33	8.24	6.39	8.26	0.00017	1.04	194.55	92.02	0.13
Charles River CL	4719.12	50% Exc-June	PrCond	203.00	5.33	7.36	6.39	7.40	0.00070	1.71	118.91	79.28	0.25
Charles River CL	4719.12	1.5-year	ExCond	1257.00	5.33	9.62	7.88	9.84	0.00135	3.74	340.29	127.15	0.38
Charles River CL	4719.12	1.5-year	PrCond	1257.00	5.33	9.40	7.88	9.65	0.00168	4.04	312.44	119.13	0.42
Charles River CL	4719.12	Bankfull (Mult)	ExCond	2108.00	5.33	10.33	8.71	10.72	0.00187	5.03	446.46	176.68	0.46
Charles River CL	4719.12	Bankfull (Mult)	PrCond	2108.00	5.33	10.22	8.71	10.64	0.00207	5.19	428.11	160.71	0.49
Charles River CL	4305.68	10-year +30%	ExCond	3549.00	5.11	10.97		11.20	0.00094	3.85	980.61	279.56	0.34
Charles River CL	4305.68	10-year +30%	PrCond	3549.00	5.11	9.54		10.11	0.00420	6.05	595.05	258.15	0.66
Charles River CL	4305.68	50-Year +30%	ExCond	5223.00	5.11	11.94		12.25	0.00098	4.53	1259.53	298.26	0.36
Charles River CL	4305.68	50-Year +30%	PrCond	5223.00	5.11	10.86		11.38	0.00225	5.83	949.40	277.90	0.52
Charles River CL	4305.68	100-Year +30%	ExCond	6019.00	5.11	12.35		12.70	0.00100	4.81	1387.92	328.11	0.36
Charles River CL	4305.68	100-Year +30%	PrCond	6019.00	5.11	11.39		11.92	0.00194	5.89	1100.12	290.28	0.49
Charles River CL	4305.68	500-Year +30%	ExCond	8097.00	5.11	13.32		13.76	0.00101	5.41	1768.64	470.95	0.38
Charles River CL	4305.68	500-Year +30%	PrCond	8097.00	5.11	12.65		13.22	0.00149	6.11	1490.12	350.50	0.45
Charles River CL	4305.68	15% Exc April	ExCond	1077.00	5.11	9.17		9.24	0.00065	2.15	501.44	226.41	0.25
Charles River CL	4305.68	15% Exc April	PrCond	1077.00	5.11	7.31	7.31	7.93	0.01262	6.34	170.01	139.63	1.01
Charles River CL	4305.68	85% Exc Jul	ExCond	49.00	5.11	7.92		7.92	0.00001	0.19	259.00	164.63	0.03
Charles River CL	4305.68	85% Exc Jul	PrCond	49.00	5.11	5.82	5.82	5.99	0.02044	3.24	15.13	48.86	1.03
Charles River CL	4305.68	85% Exc Sept	ExCond	29.00	5.11	7.86		7.86	0.00000	0.12	250.00	160.06	0.02
Charles River CL	4305.68	85% Exc Sept	PrCond	29.00	5.11	5.67	5.67	5.82	0.01983	3.15	9.22	30.39	1.01
Charles River CL	4305.68	50% Exc-June	ExCond	203.00	5.11	8.20		8.21	0.00009	0.66	307.67	177.39	0.09
Charles River CL	4305.68	50% Exc-June	PrCond	203.00	5.11	6.30	6.30	6.58	0.01672	4.23	48.03	89.51	1.02
Charles River CL	4305.68	1.5-year	ExCond	1257.00	5.11	9.33		9.41	0.00070	2.34	540.12	254.99	0.27
Charles River CL	4305.68	1.5-year	PrCond	1257.00	5.11	7.45	7.45	8.13	0.01229	6.65	189.00	141.48	1.01
Charles River CL	4305.68	Bankfull (Mult)	ExCond	2108.00	5.11	10.00		10.14	0.00085	3.04	715.44	265.04	0.31
Charles River CL	4305.68	Bankfull (Mult)	PrCond	2108.00	5.11	8.08	8.08	8.92	0.01111	7.33	287.46	172.28	1.00
Charles River CL	3357.59	10-year +30%	ExCond	3549.00	-1.17	10.80	4.20	10.88	0.00014	2.28	1567.56	249.78	0.14
Charles River CL	3357.59	10-year +30%	PrCond	3549.00	-1.18	9.16	4.20	9.29	0.00029	2.86	1241.63	195.23	0.20
Charles River CL	3357.59	50-Year +30%	ExCond	5223.00	-1.17	11.67	5.07	11.82	0.00022	3.02	1751.86	261.12	0.18
Charles River CL	3357.59	50-Year +30%	PrCond	5223.00	-1.18	10.38	5.06	10.58	0.00037	3.54	1483.90	202.52	0.23
Charles River CL	3357.59	100-Year +30%	ExCond	6019.00	-1.17	12.05	5.40	12.23	0.00025	3.34	1833.99	266.93	0.19
Charles River CL	3357.59	100-Year +30%	PrCond	6019.00	-1.18	10.90	5.40	11.13	0.00039	3.82	1589.18	251.09	0.24
Charles River CL	3357.59	500-Year +30%	ExCond	8097.00	-1.17	12.94	6.22	13.20	0.00034	4.10	2038.59	292.73	0.23
Charles River CL	3357.59	500-Year +30%	PrCond	8097.00	-1.18	12.13	6.21	12.44	0.00044	4.46	1851.24	268.25	0.26
Charles River CL	3357.59	15% Exc April	ExCond	1077.00	-1.17	9.14	2.34	9.15	0.00003	0.87	1236.81	195.12	0.06
Charles River CL	3357.59	15% Exc April	PrCond	1077.00	-1.18	6.63	2.35	6.66	0.00011	1.40	770.57	172.70	0.12
Charles River CL	3357.59	85% Exc Jul	ExCond	49.00	-1.17	7.92	-0.27	7.92	0.00000	0.05	1002.44	187.05	0.00
Charles River CL	3357.59	85% Exc Jul	PrCond	49.00	-1.18	3.61	-0.27	3.61	0.00000	0.16	301.43	132.34	0.02
Charles River CL	3357.59	85% Exc Sept	ExCond	29.00	-1.17	7.86	-0.46	7.86	0.00000	0.03	992.09	186.43	0.00
Charles River CL	3357.59	85% Exc Sept	PrCond	29.00	-1.18	3.36	-0.46	3.36	0.00000	0.11	268.16	126.77	0.01
Charles River CL	3357.59	50% Exc-June	ExCond	203.00	-1.17	8.20	0.54	8.20	0.00000	0.19	1056.05	190.11	0.01
Charles River CL	3357.59	50% Exc-June	PrCond	203.00	-1.18	4.65	0.53	4.65	0.00002	0.45	448.38	150.86	0.05
Charles River CL	3357.59	1.5-year	ExCond	1257.00	-1.17	9.29	2.54	9.30	0.00003	0.99	1266.15	195.82	0.07
Charles River CL	3357.59	1.5-year	PrCond	1257.00	-1.18	6.87	2.54	6.90	0.00013	1.55	812.78	175.40	0.13
Charles River CL	3357.59	Bankfull (Mult)	ExCond	2108.00	-1.17	9.91	3.28	9.94	0.00007	1.52	1388.81	198.69	0.10
Charles River CL	3357.59	Bankfull (Mult)	PrCond	2108.00	-1.18	7.85	3.28	7.92	0.00020	2.13	990.71	186.33	0.16
Charles River CL	2982.99	10-year +30%	ExCond	3549.00	2.19	10.44	7.34	10.75	0.00079	4.48	817.54	157.59	0.33
Charles River CL	2982.99	10-year +30%	PrCond	3549.00	2.19	7.97	7.34	8.92	0.00502	7.83	453.99	137.11	0.75
Charles River CL	2982.99	50-Year +30%	ExCond	5223.00	2.19	11.07	8.20	11.61	0.00121	5.93	918.89	161.68	0.41
Charles River CL	2982.99	50-Year +30%	PrCond	5223.00	2.19	8.80	8.20	10.12	0.00523	9.22	570.57	144.07	0.80
Charles River CL	2982.99	100-Year +30%	ExCond	6019.00	2.19	11.33	8.57	11.99	0.00141	6.57	960.12	163.12	0.45
Charles River CL	2982.99	100-Year +30%	PrCond	6019.00	2.19	9.13	8.57	10.63	0.00538	9.84	618.50	146.79	0.82
Charles River CL	2982.99	500-Year +30%	ExCond	8097.00	2.19	11.84	9.43	12.87	0.00199	8.19	1044.06	166.02	0.54
Charles River CL	2982.99	500-Year +30%	PrCond	8097.00	2.19	9.81	9.43	11.85	0.00606	11.48	720.64	152.44	0.89
Charles River CL	2982.99	15% Exc April	ExCond	1077.00	2.19	9.07	5.61	9.12	0.00018	1.78	610.34	146.33	0.15
Charles River CL	2982.99	15% Exc April	PrCond	1077.00	2.19	6.10	5.62	6.50	0.00471	5.02	214.52	118.82	0.66
Charles River CL	2982.99	85% Exc Jul	ExCond	49.00	2.19	7.92	3.13	7.92	0.00000	0.11	446.29	136.59	0.01
Charles River CL	2982.99	85% Exc Jul	PrCond	49.00	2.19	3.53	3.13	3.60	0.00279	2.10	23.28	32.15	0.44
Charles River CL	2982.99	85% Exc Sept	ExCond	29.00	2.19	7.86	2.94	7.86	0.00000	0.07	438.76	136.10	0.01
Charles River CL	2982.99	85% Exc Sept	PrCond	29.00	2.19	3.30	2.95	3.35	0.00255	1.77	16.38	27.38	0.40
Charles River CL	2982.99	50% Exc-June	ExCond	203.00	2.19	8.20	3.91	8.20	0.00001	0.42	485.00	139.05	0.04
Charles River CL	2982.99	50% Exc-June	PrCond	203.00	2.19	4.44	3.91	4.61	0.00377	3.29	61.67	54.48	0.55
Charles River CL	2982.99	1.5-year	ExCond	1257.00	2.19	9.21	5.79	9.27	0.00022	2.02	629.90	147.43	0.17
Charles River CL	2982.99	1.5-year	PrCond	1257.00	2.19	6.28	5.79	6.72	0.00479	5.33	235.74	120.64	0.67
Charles River CL	2982.99	Bankfull (Mult)	ExCond	2108.00	2.19	9.74	6.45	9.88	0.00043	3.03	709.04	151.81	0.24
Charles River CL	2982.99	Bankfull (Mult)	PrCond	2108.00	2.19	7.00	6.43	7.65	0.00498	6.48	325.37	128.05	0.72
Charles River CL	2972			Bridge									
Charles River CL	2805.87	10-year +30%	ExCond	3549.00	1.29	10.41	6.06	10.61	0.00041	3.54	1067.52	241.51	0.24
Charles River CL	2805.87	10-year +30%	PrCond	3549.00	1.30	6.06	6.06	7.49	0.00932	9.61	369.15	128.92	1.00
Charles River CL	2805.87	50-Year +30%	ExCond	5223.00	1.29	11.05	6.96	11.39	0.00064	4.72	1234.86	285.05	0.31
Charles River CL	2805.87	50-Year +30%	PrCond	5223.00	1.30	6.96	6.96	8.73	0.00865	10.66	489.88	158.65	0.99

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Charles River CL	2805.87	100-Year +30%	ExCond	6019.00	1.29	11.31	7.33	11.73	0.00076	5.23	1309.16	288.22	0.34
Charles River CL	2805.87	100-Year +30%	PrCond	6019.00	1.30	7.33	7.33	9.25	0.00843	11.11	542.02	141.94	1.00
Charles River CL	2805.87	500-Year +30%	ExCond	8097.00	1.29	11.84	8.21	12.48	0.00107	6.51	1471.96	315.81	0.40
Charles River CL	2805.87	500-Year +30%	PrCond	8097.00	1.30	9.46	8.21	10.85	0.00359	9.46	867.63	168.03	0.70
Charles River CL	2805.87	15% Exc April	ExCond	1077.00	1.29	9.07	4.26	9.10	0.00008	1.35	803.25	160.38	0.10
Charles River CL	2805.87	15% Exc April	PrCond	1077.00	1.30	4.26	4.26	4.99	0.01153	6.85	157.27	107.36	1.00
Charles River CL	2805.87	85% Exc Jul	ExCond	49.00	1.29	7.92	2.22	7.92	0.00000	0.08	626.31	147.23	0.01
Charles River CL	2805.87	85% Exc Jul	PrCond	49.00	1.30	2.23	2.23	2.45	0.01701	3.77	13.01	29.15	0.99
Charles River CL	2805.87	85% Exc Sept	ExCond	29.00	1.29	7.86	2.04	7.86	0.00000	0.05	618.20	146.73	0.00
Charles River CL	2805.87	85% Exc Sept	PrCond	29.00	1.30	2.05	2.05	2.24	0.01838	3.49	8.31	22.11	1.00
Charles River CL	2805.87	50% Exc-June	ExCond	203.00	1.29	8.20	2.89	8.20	0.00001	0.30	667.94	149.80	0.03
Charles River CL	2805.87	50% Exc-June	PrCond	203.00	1.30	2.89	2.89	3.28	0.01456	5.00	40.56	52.80	1.01
Charles River CL	2805.87	1.5-year	ExCond	1257.00	1.29	9.20	4.42	9.24	0.00010	1.54	824.40	161.00	0.12
Charles River CL	2805.87	1.5-year	PrCond	1257.00	1.30	4.43	4.43	5.23	0.01131	7.19	174.82	109.31	1.00
Charles River CL	2805.87	Bankfull (Mult)	ExCond	2108.00	1.29	9.72	5.12	9.81	0.00021	2.36	911.80	193.86	0.17
Charles River CL	2805.87	Bankfull (Mult)	PrCond	2108.00	1.30	5.12	5.12	6.19	0.01019	8.32	253.41	117.63	1.00
Charles River CL	2719.73	10-year +30%	ExCond	3549.00	3.54	10.43	6.38	10.56	0.00029	2.79	1275.09	299.89	0.20
Charles River CL	2719.73	10-year +30%	PrCond	3549.00	0.09	5.95	3.29	6.19	0.00082	3.87	916.63	202.10	0.32
Charles River CL	2719.73	50-Year +30%	ExCond	5223.00	3.54	11.09	7.00	11.31	0.00044	3.70	1413.72	381.35	0.25
Charles River CL	2719.73	50-Year +30%	PrCond	5223.00	0.09	7.53	4.02	7.80	0.00068	4.21	1240.68	210.34	0.31
Charles River CL	2719.73	100-Year +30%	ExCond	6019.00	3.54	11.37	7.28	11.63	0.00052	4.10	1470.97	422.61	0.27
Charles River CL	2719.73	100-Year +30%	PrCond	6019.00	0.09	8.27	4.33	8.56	0.00062	4.30	1399.32	215.89	0.30
Charles River CL	2719.73	500-Year +30%	ExCond	8097.00	3.54	11.93	7.94	12.34	0.00072	5.10	1590.82	517.77	0.33
Charles River CL	2719.73	500-Year +30%	PrCond	8097.00	0.09	10.12	5.06	10.44	0.00050	4.49	1846.97	268.91	0.27
Charles River CL	2719.73	15% Exc April	ExCond	1077.00	3.54	9.07	5.19	9.09	0.00006	1.09	987.46	242.88	0.09
Charles River CL	2719.73	15% Exc April	PrCond	1077.00	0.09	3.25	1.86	3.36	0.00097	2.69	400.03	173.15	0.31
Charles River CL	2719.73	85% Exc Jul	ExCond	49.00	3.54	7.92	3.97	7.92	0.00000	0.07	746.61	213.29	0.01
Charles River CL	2719.73	85% Exc Jul	PrCond	49.00	0.09	0.86	0.38	0.88	0.00064	0.89	55.28	93.11	0.20
Charles River CL	2719.73	85% Exc Sept	ExCond	29.00	3.54	7.86	3.88	7.86	0.00000	0.04	735.11	212.74	0.00
Charles River CL	2719.73	85% Exc Sept	PrCond	29.00	0.09	0.59	0.30	0.60	0.00111	0.91	31.85	77.79	0.25
Charles River CL	2719.73	50% Exc-June	ExCond	203.00	3.54	8.20	4.29	8.20	0.00000	0.25	805.06	215.38	0.02
Charles River CL	2719.73	50% Exc-June	PrCond	203.00	0.09	1.71	0.79	1.73	0.00063	1.33	152.99	138.27	0.22
Charles River CL	2719.73	1.5-year	ExCond	1257.00	3.54	9.20	5.30	9.22	0.00008	1.24	1015.21	248.07	0.10
Charles River CL	2719.73	1.5-year	PrCond	1257.00	0.09	3.78	2.00	3.88	0.00069	2.54	495.17	181.11	0.27
Charles River CL	2719.73	Bankfull (Mult)	ExCond	2108.00	3.54	9.73	5.74	9.78	0.00015	1.87	1126.05	253.27	0.14
Charles River CL	2719.73	Bankfull (Mult)	PrCond	2108.00	0.09	4.58	2.55	4.75	0.00087	3.27	645.15	192.93	0.32
Charles River CL	2709.46	10-year +30%	ExCond	3549.00	4.56	10.33	7.72	10.54	0.00072	3.74	960.08	218.63	0.30
Charles River CL	2709.46	10-year +30%	PrCond	3549.00	-0.17	5.96	3.01	6.18	0.00070	3.73	951.03	195.75	0.30
Charles River CL	2709.46	50-Year +30%	ExCond	5223.00	4.56	10.91	8.35	11.28	0.00105	4.89	1084.05	263.10	0.37
Charles River CL	2709.46	50-Year +30%	PrCond	5223.00	-0.17	7.53	3.71	7.79	0.00061	4.14	1262.94	201.98	0.29
Charles River CL	2709.46	100-Year +30%	ExCond	6019.00	4.56	11.15	8.63	11.60	0.00120	5.39	1133.73	315.51	0.40
Charles River CL	2709.46	100-Year +30%	PrCond	6019.00	-0.17	8.27	4.02	8.55	0.00056	4.26	1413.76	204.38	0.28
Charles River CL	2709.46	500-Year +30%	ExCond	8097.00	4.56	11.60	9.30	12.30	0.00167	6.70	1229.45	429.04	0.48
Charles River CL	2709.46	500-Year +30%	PrCond	8097.00	-0.17	10.11	4.75	10.43	0.00046	4.53	1800.49	216.92	0.27
Charles River CL	2709.46	15% Exc April	ExCond	1077.00	4.56	9.05	6.47	9.08	0.00019	1.55	694.49	206.88	0.15
Charles River CL	2709.46	15% Exc April	PrCond	1077.00	-0.17	3.25	1.59	3.34	0.00066	2.38	451.94	176.24	0.26
Charles River CL	2709.46	85% Exc Jul	ExCond	49.00	4.56	7.92	5.21	7.92	0.00000	0.11	466.50	203.24	0.01
Charles River CL	2709.46	85% Exc Jul	PrCond	49.00	-0.17	0.86	0.12	0.87	0.00021	0.60	81.94	106.58	0.12
Charles River CL	2709.46	85% Exc Sept	ExCond	29.00	4.56	7.86	5.10	7.86	0.00000	0.06	455.42	203.06	0.01
Charles River CL	2709.46	85% Exc Sept	PrCond	29.00	-0.17	0.59	0.03	0.59	0.00023	0.53	54.73	92.09	0.12
Charles River CL	2709.46	50% Exc-June	ExCond	203.00	4.56	8.19	5.61	8.20	0.00002	0.39	522.55	204.13	0.04
Charles River CL	2709.46	50% Exc-June	PrCond	203.00	-0.17	1.71	0.52	1.73	0.00034	1.06	190.68	151.20	0.17
Charles River CL	2709.46	1.5-year	ExCond	1257.00	4.56	9.17	6.59	9.22	0.00023	1.75	720.16	207.29	0.16
Charles River CL	2709.46	1.5-year	PrCond	1257.00	-0.17	3.79	1.74	3.87	0.00049	2.30	547.06	179.35	0.23
Charles River CL	2709.46	Bankfull (Mult)	ExCond	2108.00	4.56	9.67	7.07	9.77	0.00041	2.58	823.14	213.82	0.22
Charles River CL	2709.46	Bankfull (Mult)	PrCond	2108.00	-0.17	4.59	2.30	4.74	0.00065	3.04	692.92	184.00	0.28
Charles River CL	2708			Inl Struct									
Charles River CL	2679.48	10-year +30%	ExCond	3549.00	-0.59	5.89	3.56	6.11	0.00136	3.75	947.28	221.81	0.32
Charles River CL	2679.48	10-year +30%	PrCond	3549.00	-0.59	5.93	3.56	6.15	0.00147	3.71	955.72	221.86	0.32
Charles River CL	2679.48	50-Year +30%	ExCond	5223.00	-0.59	7.47	4.16	7.72	0.00106	4.01	1303.31	239.36	0.30
Charles River CL	2679.48	50-Year +30%	PrCond	5223.00	-0.59	7.52	4.16	7.76	0.00118	3.98	1314.19	240.24	0.29
Charles River CL	2679.48	100-Year +30%	ExCond	6019.00	-0.59	8.22	4.42	8.48	0.00093	4.09	1487.02	286.85	0.28
Charles River CL	2679.48	100-Year +30%	PrCond	6019.00	-0.59	8.26	4.42	8.52	0.00106	4.06	1499.92	290.93	0.28
Charles River CL	2679.48	500-Year +30%	ExCond	8097.00	-0.59	10.10	5.06	10.36	0.00069	4.17	2183.34	416.30	0.25
Charles River CL	2679.48	500-Year +30%	PrCond	8097.00	-0.59	10.14	5.07	10.40	0.00079	4.14	2199.91	418.57	0.25
Charles River CL	2679.48	15% Exc April	ExCond	1077.00	-0.59	3.15	2.43	3.30	0.00325	3.08	349.84	214.20	0.42
Charles River CL	2679.48	15% Exc April	PrCond	1077.00	-0.59	3.15	2.43	3.30	0.00329	3.07	350.75	214.21	0.42
Charles River CL	2679.48	85% Exc Jul	ExCond	49.00	-0.59	0.53	0.53	0.82	0.02538	4.31	11.38	19.68	1.00
Charles River CL	2679.48	85% Exc Jul	PrCond	49.00	-0.59	0.54	0.54	0.82	0.02500	4.28	11.45	19.76	0.99
Charles River CL	2679.48	85% Exc Sept	ExCond	29.00	-0.59	0.32	0.32	0.55	0.02720	3.86	7.51	16.09	1.00
Charles River CL	2679.48	85% Exc Sept	PrCond	29.00	-0.59	0.31	0.31	0.55	0.02766	3.88	7.47	16.07	1.00
Charles River CL	2679.48	50% Exc-June	ExCond	203.00	-0.59	1.30	1.30	1.66	0.02402	4.80	42.33	56.85	1.01

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Charles River CL	2679.48	50% Exc-June	PrCond	203.00	-0.59	1.31	1.31	1.66	0.02349	4.75	42.71	60.22	0.99
Charles River CL	2679.48	1.5-year	ExCond	1257.00	-0.59	3.73	2.53	3.84	0.00162	2.65	474.83	215.37	0.31
Charles River CL	2679.48	1.5-year	PrCond	1257.00	-0.59	3.74	2.53	3.84	0.00166	2.64	476.04	215.38	0.31
Charles River CL	2679.48	Bankfull (Mult)	ExCond	2108.00	-0.59	4.52	2.96	4.69	0.00165	3.26	646.56	217.47	0.33
Charles River CL	2679.48	Bankfull (Mult)	PrCond	2108.00	-0.59	4.54	2.95	4.70	0.00173	3.24	650.18	217.52	0.33
Charles River CL	2375.73	10-year +30%	ExCond	3549.00	-3.16	4.54		5.40	0.00386	7.44	483.31	93.29	0.56
Charles River CL	2375.73	10-year +30%	PrCond	3549.00	-3.16	4.54		5.40	0.00386	7.44	483.33	93.30	0.56
Charles River CL	2375.73	50-Year +30%	ExCond	5223.00	-3.16	5.92		7.07	0.00395	8.67	615.52	99.90	0.59
Charles River CL	2375.73	50-Year +30%	PrCond	5223.00	-3.16	5.92		7.07	0.00395	8.67	615.55	99.91	0.59
Charles River CL	2375.73	100-Year +30%	ExCond	6019.00	-3.16	6.65		7.88	0.00369	8.98	690.01	104.65	0.58
Charles River CL	2375.73	100-Year +30%	PrCond	6019.00	-3.16	6.65		7.88	0.00369	8.98	690.05	104.67	0.58
Charles River CL	2375.73	500-Year +30%	ExCond	8097.00	-3.16	8.51		9.86	0.00308	9.50	895.87	116.45	0.55
Charles River CL	2375.73	500-Year +30%	PrCond	8097.00	-3.16	8.51		9.86	0.00308	9.50	895.93	116.46	0.55
Charles River CL	2375.73	15% Exc April	ExCond	1077.00	-3.16	2.34		2.56	0.00184	3.77	286.40	85.56	0.36
Charles River CL	2375.73	15% Exc April	PrCond	1077.00	-3.16	2.34		2.56	0.00184	3.77	286.39	85.57	0.36
Charles River CL	2375.73	85% Exc Jul	ExCond	49.00	-3.16	0.05		0.06	0.00006	0.44	112.23	60.29	0.06
Charles River CL	2375.73	85% Exc Jul	PrCond	49.00	-3.16	0.05		0.06	0.00006	0.44	112.19	60.30	0.06
Charles River CL	2375.73	85% Exc Sept	ExCond	29.00	-3.16	0.05		0.05	0.00002	0.26	112.15	60.27	0.03
Charles River CL	2375.73	85% Exc Sept	PrCond	29.00	-3.16	0.05		0.05	0.00002	0.26	112.11	60.28	0.03
Charles River CL	2375.73	50% Exc-June	ExCond	203.00	-3.16	1.07		1.09	0.00026	1.12	181.61	76.21	0.13
Charles River CL	2375.73	50% Exc-June	PrCond	203.00	-3.16	1.07		1.09	0.00026	1.12	181.59	76.22	0.13
Charles River CL	2375.73	1.5-year	ExCond	1257.00	-3.16	3.23		3.42	0.00117	3.48	363.78	88.68	0.30
Charles River CL	2375.73	1.5-year	PrCond	1257.00	-3.16	3.23		3.42	0.00117	3.48	363.77	88.68	0.30
Charles River CL	2375.73	Bankfull (Mult)	ExCond	2108.00	-3.16	3.61		4.05	0.00249	5.34	397.83	90.02	0.44
Charles River CL	2375.73	Bankfull (Mult)	PrCond	2108.00	-3.16	3.61		4.05	0.00249	5.34	397.83	90.02	0.44
Charles River CL	2097.98	10-year +30%	ExCond	3549.00	-6.74	4.46		4.78	0.00089	4.56	796.49	114.66	0.29
Charles River CL	2097.98	10-year +30%	PrCond	3549.00	-6.74	4.46		4.78	0.00089	4.56	796.33	114.66	0.29
Charles River CL	2097.98	50-Year +30%	ExCond	5223.00	-6.74	5.87		6.35	0.00109	5.63	962.21	121.89	0.33
Charles River CL	2097.98	50-Year +30%	PrCond	5223.00	-6.74	5.87		6.35	0.00109	5.63	962.06	121.90	0.33
Charles River CL	2097.98	100-Year +30%	ExCond	6019.00	-6.74	6.62		7.16	0.00110	5.95	1055.54	126.17	0.33
Charles River CL	2097.98	100-Year +30%	PrCond	6019.00	-6.74	6.62		7.16	0.00110	5.96	1055.39	126.19	0.33
Charles River CL	2097.98	500-Year +30%	ExCond	8097.00	-6.74	8.55		9.18	0.00105	6.54	1351.81	244.89	0.33
Charles River CL	2097.98	500-Year +30%	PrCond	8097.00	-6.74	8.55		9.18	0.00105	6.55	1351.70	244.90	0.33
Charles River CL	2097.98	15% Exc April	ExCond	1077.00	-6.74	2.31		2.37	0.00024	1.93	561.28	103.53	0.14
Charles River CL	2097.98	15% Exc April	PrCond	1077.00	-6.74	2.31		2.37	0.00024	1.93	561.14	103.52	0.14
Charles River CL	2097.98	85% Exc Jul	ExCond	49.00	-6.74	0.05		0.05	0.00000	0.14	345.80	83.49	0.01
Charles River CL	2097.98	85% Exc Jul	PrCond	49.00	-6.74	0.05		0.05	0.00000	0.14	345.71	83.48	0.01
Charles River CL	2097.98	85% Exc Sept	ExCond	29.00	-6.74	0.05		0.05	0.00000	0.08	345.67	83.47	0.01
Charles River CL	2097.98	85% Exc Sept	PrCond	29.00	-6.74	0.05		0.05	0.00000	0.08	345.57	83.46	0.01
Charles River CL	2097.98	50% Exc-June	ExCond	203.00	-6.74	1.07		1.07	0.00002	0.46	437.02	95.94	0.04
Charles River CL	2097.98	50% Exc-June	PrCond	203.00	-6.74	1.07		1.07	0.00002	0.46	436.90	95.89	0.04
Charles River CL	2097.98	1.5-year	ExCond	1257.00	-6.74	3.21		3.26	0.00020	1.94	656.33	108.17	0.13
Charles River CL	2097.98	1.5-year	PrCond	1257.00	-6.74	3.21		3.26	0.00020	1.94	656.17	108.16	0.13
Charles River CL	2097.98	Bankfull (Mult)	ExCond	2108.00	-6.74	3.56		3.71	0.00048	3.08	694.85	109.99	0.21
Charles River CL	2097.98	Bankfull (Mult)	PrCond	2108.00	-6.74	3.56		3.71	0.00048	3.08	694.69	109.98	0.21
Charles River CL	1714.56	10-year +30%	ExCond	3549.00	-4.13	3.47	1.10	4.19	0.00280	6.80	521.84	108.16	0.48
Charles River CL	1714.56	10-year +30%	PrCond	3549.00	-4.13	3.47	1.10	4.19	0.00280	6.80	521.83	108.15	0.48
Charles River CL	1714.56	50-Year +30%	ExCond	5223.00	-4.13	4.40	2.22	5.57	0.00384	8.69	601.15	111.60	0.58
Charles River CL	1714.56	50-Year +30%	PrCond	5223.00	-4.13	4.40	2.22	5.57	0.00384	8.69	601.14	111.59	0.58
Charles River CL	1714.56	100-Year +30%	ExCond	6019.00	-4.13	5.08	2.71	6.37	0.00374	9.12	659.80	114.97	0.58
Charles River CL	1714.56	100-Year +30%	PrCond	6019.00	-4.13	5.08	2.71	6.37	0.00374	9.12	659.79	114.96	0.58
Charles River CL	1714.56	500-Year +30%	ExCond	8097.00	-4.13	6.90	3.89	8.43	0.00334	9.92	815.95	126.19	0.57
Charles River CL	1714.56	500-Year +30%	PrCond	8097.00	-4.13	6.90	3.90	8.43	0.00334	9.92	815.94	126.17	0.57
Charles River CL	1714.56	15% Exc April	ExCond	1077.00	-4.13	2.12	-1.12	2.22	0.00058	2.65	406.99	104.29	0.21
Charles River CL	1714.56	15% Exc April	PrCond	1077.00	-4.13	2.12	-1.12	2.22	0.00058	2.65	406.99	104.29	0.21
Charles River CL	1714.56	85% Exc Jul	ExCond	49.00	-4.13	0.05	-3.35	0.05	0.00001	0.21	233.47	93.85	0.02
Charles River CL	1714.56	85% Exc Jul	PrCond	49.00	-4.13	0.05	-3.36	0.05	0.00001	0.21	233.47	93.86	0.02
Charles River CL	1714.56	85% Exc Sept	ExCond	29.00	-4.13	0.05	-3.51	0.05	0.00000	0.12	233.43	93.85	0.01
Charles River CL	1714.56	85% Exc Sept	PrCond	29.00	-4.13	0.05	-3.51	0.05	0.00000	0.12	233.43	93.85	0.01
Charles River CL	1714.56	50% Exc-June	ExCond	203.00	-4.13	1.06	-2.67	1.06	0.00005	0.64	317.50	101.69	0.06
Charles River CL	1714.56	50% Exc-June	PrCond	203.00	-4.13	1.06	-2.67	1.06	0.00005	0.64	317.49	101.70	0.06
Charles River CL	1714.56	1.5-year	ExCond	1257.00	-4.13	3.05	-0.91	3.15	0.00044	2.59	485.94	106.78	0.19
Charles River CL	1714.56	1.5-year	PrCond	1257.00	-4.13	3.05	-0.91	3.15	0.00044	2.59	485.93	106.77	0.19
Charles River CL	1714.56	Bankfull (Mult)	ExCond	2108.00	-4.13	3.14	-0.06	3.42	0.00118	4.27	493.54	107.07	0.31
Charles River CL	1714.56	Bankfull (Mult)	PrCond	2108.00	-4.13	3.14	-0.06	3.42	0.00118	4.27	493.54	107.06	0.31
Charles River CL	1670			Bridge									
Charles River CL	1621.86	10-year +30%	ExCond	3549.00	-5.79	3.00	1.18	3.79	0.00356	7.15	496.63	115.38	0.54
Charles River CL	1621.86	10-year +30%	PrCond	3549.00	-5.79	3.00	1.18	3.79	0.00356	7.15	496.64	115.37	0.54
Charles River CL	1621.86	50-Year +30%	ExCond	5223.00	-5.79	3.20	2.24	4.80	0.00683	10.14	514.95	116.40	0.75
Charles River CL	1621.86	50-Year +30%	PrCond	5223.00	-5.79	3.20	2.23	4.80	0.00683	10.14	514.96	116.40	0.75
Charles River CL	1621.86	100-Year +30%	ExCond	6019.00	-5.79	3.60	2.70	5.45	0.00721	10.91	551.59	117.45	0.78

HEC-RAS River: Charles River Reach: Charles River CL (Continued)

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Charles River CL	1621.86	100-Year +30%	PrCond	6019.00	-5.79	3.60	2.70	5.45	0.00721	10.91	551.60	118.44	0.78
Charles River CL	1621.86	500-Year +30%	ExCond	8097.00	-5.79	5.20	3.82	7.29	0.00595	11.60	698.13	126.63	0.74
Charles River CL	1621.86	500-Year +30%	PrCond	8097.00	-5.79	5.20	3.82	7.29	0.00595	11.60	698.14	126.63	0.74
Charles River CL	1621.86	15% Exc April	ExCond	1077.00	-5.79	2.05	-1.52	2.16	0.00062	2.63	409.62	110.52	0.22
Charles River CL	1621.86	15% Exc April	PrCond	1077.00	-5.79	2.05	-1.53	2.16	0.00062	2.63	409.63	110.51	0.22
Charles River CL	1621.86	85% Exc Jul	ExCond	49.00	-5.79	0.05	-4.44	0.05	0.00001	0.21	228.29	78.13	0.02
Charles River CL	1621.86	85% Exc Jul	PrCond	49.00	-5.79	0.05	-4.45	0.05	0.00001	0.21	228.30	78.06	0.02
Charles River CL	1621.86	85% Exc Sept	ExCond	29.00	-5.79	0.05	-4.70	0.05	0.00000	0.13	228.29	78.13	0.01
Charles River CL	1621.86	85% Exc Sept	PrCond	29.00	-5.79	0.05	-4.71	0.05	0.00000	0.13	228.30	78.06	0.01
Charles River CL	1621.86	50% Exc-June	ExCond	203.00	-5.79	1.05	-3.40	1.06	0.00005	0.64	318.03	106.47	0.06
Charles River CL	1621.86	50% Exc-June	PrCond	203.00	-5.79	1.05	-3.41	1.06	0.00005	0.64	318.04	106.46	0.06
Charles River CL	1621.86	1.5-year	ExCond	1257.00	-5.79	3.00	-1.27	3.10	0.00045	2.53	496.63	115.38	0.19
Charles River CL	1621.86	1.5-year	PrCond	1257.00	-5.79	3.00	-1.27	3.10	0.00045	2.53	496.64	115.37	0.19
Charles River CL	1621.86	Bankfull (Mult)	ExCond	2108.00	-5.79	3.00	-0.13	3.28	0.00126	4.24	496.63	115.38	0.32
Charles River CL	1621.86	Bankfull (Mult)	PrCond	2108.00	-5.79	3.00	-0.13	3.28	0.00126	4.24	496.64	115.37	0.32

Watertown Dam

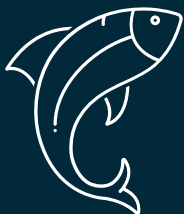
A Case for Removal.

The Watertown Dam is a 180-foot long, 8-foot high concrete weir structure in the Charles River in Watertown, MA. Created in the 1600s to power grist and paper mills, the Watertown Dam served active mill power and passive electricity power into the 1900s, but today serves no purpose for power or flood control. The Charles River Watershed Association, the Watertown Conservation Commission, and others have long expressed interest in evaluating the potential to remove the Watertown Dam.

In 2016, an inspection report found that Watertown Dam is in "poor" condition and Charles River Watershed Association applied to the Department of Ecological Restoration for support in conducting a feasibility study to investigate the removal of Watertown Dam. Dam removal is becoming increasingly favorable in Massachusetts as our aging dams impede migratory fish passage, degrade river ecosystems, and are susceptible to failure as climate change brings more frequent extreme weather events.

In June 2021, the Watertown Dam Feasibility Study was finally completed.

- Pre-1600s Indigenous use as fish weir
- 1634 Stone dam constructed
- 1700-1800s Used as active mill power
- Early 1900s Passive dam for electricity
- 1966 Rebuilt with current spillway
- 1972 Fish ladder constructed
- 2015 DMF finds fish unable to pass
- 2016 Inspection reports "poor" condition
- 2017 Feasibility Study accepted by DER
- 2021 DER Completes Feasibility Study



Impedes Fish Passage

The Watertown Dam is a major barrier to fish and eel passage during critical migrations. Migratory fish such as blueback herring, alewife, rainbow smelt, and American shad migrate to and spawn in the Charles River each year. According to a study from DMF, the fish ladder is not effective at passing female American shad and rainbow smelt.



Degrades River Ecosystem

When dams are constructed, they raise the water level upstream, creating an impoundment and submerging the natural floodplain around the river. Water quality in the impoundment degrades because slow flows allow for temperatures to rise, harmful pollutants to accumulate, and oxygen levels to decrease. These threats lead to invasive species growth, cyanobacteria blooms, and habitat destruction.



Susceptible to Failure

The dam is a significant hazard to because of the densely populated area downstream. If the spillway failed during a storm, downstream flooding would damage homes, businesses, and infrastructure, or could lead to potential injuries or deaths. With increasingly intense storms due to climate change, dam failure is an even greater concern.

Watertown Dam

Feasibility Study Findings.

Hydrologic Assessment

Dam removal would restore the floodplain upstream of the dam. This would increase the area's resilience to flooding, as more water could be stored within the restored floodplain area, reducing flood elevations up to 6 feet. Flooding risks downstream of the dam would also be reduced without the hazard of potential failure.

Sediment Assessment

Dam removal has the potential to release contaminated sediments downstream. The sediment assessment found that there are contaminated sediments behind the dam, and that further testing will need to be done to create a sediment management plan. Initial testing found that about 170 truckloads of sediment may need to be removed for proper disposal offsite. Removing this contaminated sediment from the Charles River system will ultimately improve the ecosystem.

Design Considerations

Designing the look and feel of the river corridor after dam removal can be tailored to the needs of the site and the community. Since the dam is located at a natural elevation change, a rocky riffle with rushing water sounds would be appropriate to replace the location of the current spillway. Upstream, the water level will be drawn down, and native vegetation would be planted on the newly uncovered land to restore a healthy river bank. In this area, the Charles River Greenway trails and overlooks could be extended and repositioned closer to the water for all to enjoy.

Removing the Watertown Dam is feasible and would improve the area for both people and nature. With support from residents and elected officials, we can remove this derelict dam and restore a natural, free-flowing Charles River.

The Numerous Benefits of Dam Removal

- *Improved habitat connectivity for fish and wildlife*
- *Improved river ecosystem water quality and habitat quality*
- *Restored floodplain and floodwater storage*
- *Removal of contaminated sediments*
- *Elimination of hazard of dam failure*
- *Improved opportunities for wildlife observation, recreational fishing, and boating*
- *Eliminated dam maintenance and liability for the owner*
- *A free-flowing, uninhibited Charles River*

Notice of Intent Application and Wetland Resource Area Analysis



February 9, 2022

Subject Property

93 California Street

Parcel ID: 125-2-0

Watertown, Massachusetts

Applicants and Property Owners

Christopher and Rose Zevitas

93 California Street

Watertown, MA 02472

LEC Environmental Consultants, Inc.

380 Lowell Street

Suite 101

Wakefield, MA 01880

781-245-2500

www.lecenvironmental.com

February 9, 2022

Hand Delivery

Watertown Conservation Commission
 Watertown Administration Building
 149 Main Street, 3rd Floor
 Watertown, MA 02472

**Re: Notice of Intent Application and
 Wetland Resource Area Analysis
 93 California Street
 Parcel ID: 125-2-0
 Watertown, Massachusetts**

[LEC File #: PLA\12-260.02]

Dear Members of the Conservation Commission:

On behalf of the Applicants and Property Owners, Christopher and Rose Zevitas, LEC Environmental Consultants, Inc., (LEC) is filing the enclosed Notice of Intent (NOI) Application and *Wetland Resource Area Analysis* with the Watertown Conservation Commission for the construction of an addition to an existing single-family dwelling and associated site appurtenances at the above-referenced property. Portions of the proposed activities are located within Riverfront Area and Bordering Land Subject to Flooding (BLSF) associated with the Charles River. The Applicants propose a reduction of impervious area, compensatory flood storage, and erosion controls to minimize the potential for impacts to the resource areas and improve site conditions.

LEC was retained to identify Wetland Resource Areas protectable under the *Massachusetts Wetlands Protection Act* (M.G.L. c. 131, s. 40), its implementing Regulations (310 CMR 10.00), and the *Watertown Wetlands Ordinance* (Chapter XV), and its *Rules and Regulations*, and to prepare this NOI Application. Everett M. Brooks Co. has prepared the enclosed *Plan of Land in Watertown, MA* dated September 15, 2021 and revised through October 4, 2021 (Appendix B).

Enclosed please find two checks payable to the City of Watertown for Ninety-Five Dollars (\$95.00) and One Hundred Dollars (\$100.00), for the purpose of filing this NOI Application under the State and Local Statutes (respectively). A check payable to the Commonwealth of Massachusetts for Seventy Dollars (\$70.00) has been sent to the DEP Lockbox along with the Wetland Fee Transmittal Form.

LEC Environmental Consultants, Inc.				www.lecenvironmental.com
12 Resnik Road Suite 1 Plymouth, MA 02360 508.746.9491	380 Lowell Street Suite 101 Wakefield, MA 01880 781.245.2500	100 Grove Street Suite 302 Worcester, MA 01605 508.753.3077	P.O. Box 590 Rindge, NH 03461 603.899.6726	680 Warren Avenue Suite 3 East Providence, RI 02914 401.685.3109
PLYMOUTH, MA	WAKEFIELD, MA	WORCESTER, MA	RINDGE, NH	EAST PROVIDENCE, RI



Thank you for your consideration of this Application. We look forward to meeting with you at the March, 2, 2022 Public Hearing. Should you have any questions, please do not hesitate to contact me in our Wakefield office at 781-245-2500 or at rkirby@lecenvironmental.com.

Sincerely,

LEC Environmental Consultants, Inc.

A handwritten signature in black ink, appearing to read "Richard A. Kirby", written over a horizontal line.

Richard A. Kirby

Senior Wetland Scientist

cc: DEP, Northeast Region
 Pierce Lamb Architects
 Everett M. Brooks Co.
 Christopher and Rose Zevitas

i.	WPA Form 3 – Notice of Intent
ii.	WPA Appendix B – Wetland Fee Transmittal Form
iii.	Watertown Wetlands Ordinance Fee Calculation and Transmittal Form
iv.	Watertown Wetlands Ordinance Application for Permit/Determination
v.	Affidavit of Service
vi.	Letter to Abutters
vii.	Abutter Notification Form
viii.	Certified List of Abutters

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Appendix A

Figure 1: USGS Topographic Quadrangle & NHESP Estimated Habitat Map

Figure 2: FEMA Flood Insurance Rate Map

Figure 3: MassGIS Orthophoto

Appendix B

Site Plan of Land in Watertown, MA dated September 15, 2021, revised through October 4, 2021 and February 3, 2022 prepared by Everett M. Brooks Co.



Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40
Watertown Wetlands Ordinance (Chapter XV)

Provided by MassDEP:

MassDEP File Number

Document Transaction Number

Watertown

City/Town

Important:

When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



Note:
Before completing this form consult your local Conservation Commission regarding any municipal bylaw or ordinance.

A. General Information

1. Project Location (**Note:** electronic filers will click on button to locate project site):

93 California Street

a. Street Address

Watertown

b. City/Town

02472

c. Zip Code

Latitude and Longitude:

42.364706 N

d. Latitude

-70.192543 W

e. Longitude

Parcel ID: 125-2-0

f. Assessors Map/Plat Number

g. Parcel /Lot Number

2. Applicant:

Christopher and Rose

a. First Name

Zevitas

b. Last Name

Home Owners

c. Organization

93 California Street

d. Street Address

Watertown

e. City/Town

MA

f. State

02472

g. Zip Code

617-744-0028

h. Phone Number

N/A

i. Fax Number

christopher.d.zevitas@dot.gov

j. Email Address

3. Property owner (required if different from applicant): ☐ Check if more than one owner

Same as Applicant

a. First Name

b. Last Name

c. Organization

d. Street Address

e. City/Town

f. State

g. Zip Code

h. Phone Number

i. Fax Number

j. Email address

4. Representative (if any):

Richard

a. First Name

Kirby

b. Last Name

LEC Environmental Consultants, Inc.

c. Company

380 Lowell Street, Suite 101

d. Street Address

Wakefield

e. City/Town

MA

f. State

01880

g. Zip Code

781-245-2500

h. Phone Number

781-245-6677

i. Fax Number

rkirby@lecenvironmental.com

j. Email address

5. Total WPA Fee Paid (from NOI Wetland Fee Transmittal Form):

\$165.00

a. Total Fee Paid

\$95.00

b. State Fee Paid

\$70.00 (+ \$100.00 Ordinance Fee)

c. City/Town Fee Paid



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A. General Information (continued)

6. General Project Description:

The Applicants propose to construct an addition and associated site appurtenances to a single-family dwelling. The activities will be located within the outer portion of the Riverfront Area and within BLSF. No change in flood storage is proposed. Erosion controls and a reduction of impervious surface are proposed.

7a. Project Type Checklist: (Limited Project Types see Section A. 7b.)

- | | |
|---|---|
| 1. ☒ Single Family Home | 2. ☐ Residential Subdivision |
| 3. ☐ Commercial/Industrial | 4. ☐ Dock/Pier |
| 5. ☐ Utilities | 6. ☐ Coastal engineering Structure |
| 7. ☐ Agriculture (e.g., cranberries, forestry) | 8. ☐ Transportation |
| 9. ☐ Other | |

7b. Is any portion of the proposed activity eligible to be treated as a limited project (including Ecological Restoration Limited Project) subject to 310 CMR 10.24 (coastal) or 310 CMR 10.53 (inland)?

1. ☐ Yes ☒ No If yes, describe which limited project applies to this project. (See 310 CMR 10.24 and 10.53 for a complete list and description of limited project types)

2. Limited Project Type

If the proposed activity is eligible to be treated as an Ecological Restoration Limited Project (310 CMR 10.24(8), 310 CMR 10.53(4)), complete and attach Appendix A: Ecological Restoration Limited Project Checklist and Signed Certification.

8. Property recorded at the Registry of Deeds for:

Middlesex

a. County

49573

c. Book

N/A

b. Certificate # (if registered land)

475

d. Page Number

B. Buffer Zone & Resource Area Impacts (temporary & permanent)

- ☐ Buffer Zone Only – Check if the project is located only in the Buffer Zone of a Bordering Vegetated Wetland, Inland Bank, or Coastal Resource Area.
- ☒ Inland Resource Areas (see 310 CMR 10.54-10.58; if not applicable, go to Section B.3, Coastal Resource Areas).

Check all that apply below. Attach narrative and any supporting documentation describing how the project will meet all performance standards for each of the resource areas altered, including standards requiring consideration of alternative project design or location.



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B. Buffer Zone & Resource Area Impacts (temporary & permanent) (cont'd)

For all projects affecting other Resource Areas, please attach a narrative explaining how the resource area was delineated.

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
a. ☐ Bank	1. linear feet	2. linear feet
b. ☐ Bordering Vegetated Wetland	1. square feet	2. square feet
c. ☐ Land Under Waterbodies and Waterways	1. square feet 3. cubic yards dredged	2. square feet

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
d. ☒ Bordering Land Subject to Flooding	362 (Lawn to pervious pavers and shed) 1. square feet <u>1±</u> 3. cubic feet of flood storage lost	362 (Lawn to pervious pavers and shed) 2. square feet <u>3±</u> 4. cubic feet replaced
e. ☐ Isolated Land Subject to Flooding	1. square feet 2. cubic feet of flood storage lost	3. cubic feet replaced
f. ☐ Riverfront Area	Charles River 1. Name of Waterway (if available) - specify coastal or inland	

2. Width of Riverfront Area (check one):

- ☐ 25 ft. - Designated Densely Developed Areas only
- ☐ 100 ft. - New agricultural projects only
- ☒ 200 ft. - All other projects

3. Total area of Riverfront Area on the site of the proposed project:

5,959
square feet

4. Proposed alteration of the Riverfront Area:

a. total square feet	b. square feet within 100 ft.	c. square feet between 100 ft. and 200 ft.
----------------------	-------------------------------	--

5. Has an alternatives analysis been done and is it attached to this NOI? ☐ Yes ☒ No

6. Was the lot where the activity is proposed created prior to August 1, 1996? ☒ Yes ☐ No

3. ☐ Coastal Resource Areas: (See 310 CMR 10.25-10.35)

Note: for coastal riverfront areas, please complete **Section B.2.f.** above.



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B. Buffer Zone & Resource Area Impacts (temporary & permanent) (cont'd)

Check all that apply below. Attach narrative and supporting documentation describing how the project will meet all performance standards for each of the resource areas altered, including standards requiring consideration of alternative project design or location.

Online Users:
Include your document transaction number (provided on your receipt page) with all supplementary information you submit to the Department.

<u>Resource Area</u>	<u>Size of Proposed Alteration</u>	<u>Proposed Replacement (if any)</u>
a. ☐ Designated Port Areas	Indicate size under Land Under the Ocean, below	
b. ☐ Land Under the Ocean	1. square feet	
	2. cubic yards dredged	
c. ☐ Barrier Beach	Indicate size under Coastal Beaches and/or Coastal Dunes below	
d. ☐ Coastal Beaches	1. square feet	2. cubic yards beach nourishment
e. ☐ Coastal Dunes	1. square feet	2. cubic yards dune nourishment
	<u>Size of Proposed Alteration</u>	<u>Proposed Replacement (if any)</u>
f. ☐ Coastal Banks	1. linear feet	
g. ☐ Rocky Intertidal Shores	1. square feet	
h. ☐ Salt Marshes	1. square feet	2. sq ft restoration, rehab., creation
i. ☐ Land Under Salt Ponds	1. square feet	
	2. cubic yards dredged	
j. ☐ Land Containing Shellfish	1. square feet	
k. ☐ Fish Runs	Indicate size under Coastal Banks, inland Bank, Land Under the Ocean, and/or inland Land Under Waterbodies and Waterways, above	
	1. cubic yards dredged	
l. ☐ Land Subject to Coastal Storm Flowage	1. square feet	
4. ☐ Restoration/Enhancement	If the project is for the purpose of restoring or enhancing a wetland resource area in addition to the square footage that has been entered in Section B.2.b or B.3.h above, please enter the additional amount here.	
	a. square feet of BVW	b. square feet of Salt Marsh

5. ☐ Project Involves Stream Crossings

a. number of new stream crossings

b. number of replacement stream crossings



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C. Other Applicable Standards and Requirements

- ☐ This is a proposal for an Ecological Restoration Limited Project. Skip Section C and complete Appendix A: Ecological Restoration Limited Project Checklists – Required Actions (310 CMR 10.11).

Streamlined Massachusetts Endangered Species Act/Wetlands Protection Act Review

1. Is any portion of the proposed project located in **Estimated Habitat of Rare Wildlife** as indicated on the most recent Estimated Habitat Map of State-Listed Rare Wetland Wildlife published by the Natural Heritage and Endangered Species Program (NHESP)? To view habitat maps, see the *Massachusetts Natural Heritage Atlas* or go to http://maps.massgis.state.ma.us/PRI_EST_HAB/viewer.htm.

a. ☐ Yes ☒ No

If yes, include proof of mailing or hand delivery of NOI to:

**Natural Heritage and Endangered Species Program
Division of Fisheries and Wildlife
1 Rabbit Hill Road
Westborough, MA 01581**

2021

b. Date of map

If yes, the project is also subject to Massachusetts Endangered Species Act (MESA) review (321 CMR 10.18). To qualify for a streamlined, 30-day, MESA/Wetlands Protection Act review, please complete Section C.1.c, and include requested materials with this Notice of Intent (NOI); *OR* complete Section C.2.f, if applicable. *If MESA supplemental information is not included with the NOI, by completing Section 1 of this form, the NHESP will require a separate MESA filing which may take up to 90 days to review (unless noted exceptions in Section 2 apply, see below).*

- c. Submit Supplemental Information for Endangered Species Review*

1. ☐ Percentage/acreage of property to be altered:

(a) within wetland Resource Area

percentage/acreage

(b) outside Resource Area

percentage/acreage

2. ☐ Assessor's Map or right-of-way plan of site

2. ☐ Project plans for entire project site, including wetland resource areas and areas outside of wetlands jurisdiction, showing existing and proposed conditions, existing and proposed tree/vegetation clearing line, and clearly demarcated limits of work **

(a) ☐ Project description (including description of impacts outside of wetland resource area & buffer zone)

(b) ☐ Photographs representative of the site

* Some projects **not** in Estimated Habitat may be located in Priority Habitat, and require NHESP review (see <http://www.mass.gov/eea/agencies/dfg/dfw/natural-heritage/regulatory-review/>). Priority Habitat includes habitat for state-listed plants and strictly upland species not protected by the Wetlands Protection Act.

** MESA projects may not be segmented (321 CMR 10.16). The applicant must disclose full development plans even if such plans are not required as part of the Notice of Intent process.



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C. Other Applicable Standards and Requirements (cont'd)

- (c) ☐ MESA filing fee (fee information available at http://www.mass.gov/dfwele/dfw/nhosp/regulatory_review/ mesa/ mesa_fee_schedule.htm).
Make check payable to "Commonwealth of Massachusetts - NHESP" and **mail to NHESP** at above address

Projects altering 10 or more acres of land, also submit:

- (d) ☐ Vegetation cover type map of site
- (e) ☐ Project plans showing Priority & Estimated Habitat boundaries
- (f) OR Check One of the Following
1. ☐ Project is exempt from MESA review.
Attach applicant letter indicating which MESA exemption applies. (See 321 CMR 10.14, http://www.mass.gov/dfwele/dfw/nhosp/regulatory_review/ mesa/ mesa_exemptions.htm; the NOI must still be sent to NHESP if the project is within estimated habitat pursuant to 310 CMR 10.37 and 10.59.)
 2. ☐ Separate MESA review ongoing. a. NHESP Tracking # _____ b. Date submitted to NHESP _____
 3. ☐ Separate MESA review completed.
Include copy of NHESP "no Take" determination or valid Conservation & Management Permit with approved plan.
3. For coastal projects only, is any portion of the proposed project located below the mean high water line or in a fish run?
- a. ☐ Not applicable – project is in inland resource area only b. ☐ Yes ☐ No

If yes, include proof of mailing, hand delivery, or electronic delivery of NOI to either:

South Shore - Cohasset to Rhode Island border, and the Cape & Islands:

Division of Marine Fisheries -
Southeast Marine Fisheries Station
Attn: Environmental Reviewer
836 South Rodney French Blvd.
New Bedford, MA 02744
Email: DMF.EnvReview-South@state.ma.us

North Shore - Hull to New Hampshire border:

Division of Marine Fisheries -
North Shore Office
Attn: Environmental Reviewer
30 Emerson Avenue
Gloucester, MA 01930
Email: DMF.EnvReview-North@state.ma.us

Also if yes, the project may require a Chapter 91 license. For coastal towns in the Northeast Region, please contact MassDEP's Boston Office. For coastal towns in the Southeast Region, please contact MassDEP's Southeast Regional Office.



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C. Other Applicable Standards and Requirements (cont'd)

Online Users:

Include your document transaction number (provided on your receipt page) with all supplementary information you submit to the Department.

4. Is any portion of the proposed project within an Area of Critical Environmental Concern (ACEC)?
 a. ☐ Yes ☒ No If yes, provide name of ACEC (see instructions to WPA Form 3 or MassDEP Website for ACEC locations). **Note:** electronic filers click on Website.
 b. ACEC
5. Is any portion of the proposed project within an area designated as an Outstanding Resource Water (ORW) as designated in the Massachusetts Surface Water Quality Standards, 314 CMR 4.00?
 a. ☐ Yes ☒ No
6. Is any portion of the site subject to a Wetlands Restriction Order under the Inland Wetlands Restriction Act (M.G.L. c. 131, § 40A) or the Coastal Wetlands Restriction Act (M.G.L. c. 130, § 105)?
 a. ☐ Yes ☒ No
7. Is this project subject to provisions of the MassDEP Stormwater Management Standards?
 a. ☐ Yes. Attach a copy of the Stormwater Report as required by the Stormwater Management Standards per 310 CMR 10.05(6)(k)-(q) and check if:
 1. ☐ Applying for Low Impact Development (LID) site design credits (as described in Stormwater Management Handbook Vol. 2, Chapter 3)
 2. ☐ A portion of the site constitutes redevelopment
 3. ☐ Proprietary BMPs are included in the Stormwater Management System.
- b. ☒ No. Check why the project is exempt:
 1. ☒ Single-family house
 2. ☐ Emergency road repair
 3. ☐ Small Residential Subdivision (less than or equal to 4 single-family houses or less than or equal to 4 units in multi-family housing project) with no discharge to Critical Areas.

D. Additional Information

- ☐ This is a proposal for an Ecological Restoration Limited Project. Skip Section D and complete Appendix A: Ecological Restoration Notice of Intent – Minimum Required Documents (310 CMR 10.12).

Applicants must include the following with this Notice of Intent (NOI). See instructions for details.

Online Users: Attach the document transaction number (provided on your receipt page) for any of the following information you submit to the Department.

1. ☒ USGS or other map of the area (along with a narrative description, if necessary) containing sufficient information for the Conservation Commission and the Department to locate the site. (Electronic filers may omit this item.)
2. ☒ Plans identifying the location of proposed activities (including activities proposed to serve as a Bordering Vegetated Wetland [BVW] replication area or other mitigating measure) relative to the boundaries of each affected resource area.



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D. Additional Information (cont'd)

3. ☒ Identify the method for BVW and other resource area boundary delineations (MassDEP BVW Field Data Form(s), Determination of Applicability, Order of Resource Area Delineation, etc.), and attach documentation of the methodology.

4. ☒ List the titles and dates for all plans and other materials submitted with this NOI.

Plan of Land in Watertown, MA (3 Sheets)

a. Plan Title

Everett M. Brooks Co.

Bruce Bradford, PLS

b. Prepared By

c. Signed and Stamped by

Dated 9/15/21; Revised 10/4/21 and 2/3/21

1" = 20'

d. Final Revision Date

e. Scale

N/A

f. Additional Plan or Document Title

g. Date

5. ☐ If there is more than one property owner, please attach a list of these property owners not listed on this form.
6. ☐ Attach proof of mailing for Natural Heritage and Endangered Species Program, if needed.
7. ☐ Attach proof of mailing for Massachusetts Division of Marine Fisheries, if needed.
8. ☒ Attach NOI Wetland Fee Transmittal Form
9. ☐ Attach Stormwater Report, if needed.

E. Fees

1. ☐ Fee Exempt: No filing fee shall be assessed for projects of any city, town, county, or district of the Commonwealth, federally recognized Indian tribe housing authority, municipal housing authority, or the Massachusetts Bay Transportation Authority.

Applicants must submit the following information (in addition to pages 1 and 2 of the NOI Wetland Fee Transmittal Form) to confirm fee payment:

1143

2. Municipal Check Number

2/4/2022

3. Check date

1144

4. State Check Number

2/4/2022

5. Check date

Christopher D.

Zevitas

6. Payor name on check: First Name

7. Payor name on check: Last Name



Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

Provided by MassDEP:

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F. Signatures and Submittal Requirements

I hereby certify under the penalties of perjury that the foregoing Notice of Intent and accompanying plans, documents, and supporting data are true and complete to the best of my knowledge. I understand that the Conservation Commission will place notification of this Notice in a local newspaper at the expense of the applicant in accordance with the wetlands regulations, 310 CMR 10.05(5)(a).

I further certify under penalties of perjury that all abutters were notified of this application, pursuant to the requirements of M.G.L. c. 131, § 40. Notice must be made by Certificate of Mailing or in writing by hand delivery or certified mail (return receipt requested) to all abutters within 100 feet of the property line of the project location.

1. Signature of Applicant

2/3/2022

2. Date

3. Signature of Property Owner (if different)

4. Date

2/8/2022

5. Signature of Representative (if any)

6. Date

For Conservation Commission:

Two copies of the completed Notice of Intent (Form 3), including supporting plans and documents, two copies of the NOI Wetland Fee Transmittal Form, and the city/town fee payment, to the Conservation Commission by certified mail or hand delivery.

For MassDEP:

One copy of the completed Notice of Intent (Form 3), including supporting plans and documents, one copy of the NOI Wetland Fee Transmittal Form, and a **copy** of the state fee payment to the MassDEP Regional Office (see Instructions) by certified mail or hand delivery.

Other:

If the applicant has checked the "yes" box in any part of Section C, Item 3, above, refer to that section and the Instructions for additional submittal requirements.

The original and copies must be sent simultaneously. Failure by the applicant to send copies in a timely manner may result in dismissal of the Notice of Intent.



Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands
NOI Wetland Fee Transmittal Form
Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A. Applicant Information

1. Location of Project:

93 California Street

a. Street Address

1144

c. Check number

Watertown

b. City/Town

\$70.00

d. Fee amount

2. Applicant Mailing Address:

Christopher and Rose

a. First Name

Zevitas

b. Last Name

Home Owners

c. Organization

93 California Street

d. Mailing Address

Watertown

e. City/Town

MA

f. State

02472

g. Zip Code

617-744-0028

h. Phone Number

N/A

i. Fax Number

christopher.d.zevitas@dot.gov

j. Email Address

3. Property Owner (if different):

Same as Applicant

a. First Name

b. Last Name

c. Organization

d. Mailing Address

e. City/Town

f. State

g. Zip Code

h. Phone Number

i. Fax Number

j. Email Address

B. Fees

Fee should be calculated using the following process & worksheet. **Please see Instructions before filling out worksheet.**

Step 1/Type of Activity: Describe each type of activity that will occur in wetland resource area and buffer zone.

Step 2/Number of Activities: Identify the number of each type of activity.

Step 3/Individual Activity Fee: Identify each activity fee from the six project categories listed in the instructions.

Step 4/Subtotal Activity Fee: Multiply the number of activities (identified in Step 2) times the fee per category (identified in Step 3) to reach a subtotal fee amount. Note: If any of these activities are in a Riverfront Area in addition to another Resource Area or the Buffer Zone, the fee per activity should be multiplied by 1.5 and then added to the subtotal amount.

Step 5/Total Project Fee: Determine the total project fee by adding the subtotal amounts from Step 4.

Step 6/Fee Payments: To calculate the state share of the fee, divide the total fee in half and subtract \$12.50. To calculate the city/town share of the fee, divide the total fee in half and add \$12.50.

To calculate filing fees, refer to the category fee list and examples in the instructions for filling out WPA Form 3 (Notice of Intent).



Massachusetts Department of Environmental Protection

Bureau of Resource Protection - Wetlands

NOI Wetland Fee Transmittal Form

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

B. Fees (continued)

Step 1/Type of Activity	Step 2/Number of Activities	Step 3/Individual Activity Fee	Step 4/Subtotal Activity Fee
Category 1a: work associated with a single-family dwelling	1.5 (Riverfront Area)	\$110.00	\$165.00
Step 5/Total Project Fee:			\$165.00

Step 6/Fee Payments:

Total Project Fee:	<u>\$165.00</u>
	a. Total Fee from Step 5
State share of filing Fee:	<u>\$70.00</u>
	b. 1/2 Total Fee less \$12.50
City/Town share of filling Fee:	<u>\$95.00</u>
	c. 1/2 Total Fee plus \$12.50

C. Submittal Requirements

- a.) Complete pages 1 and 2 and send with a check or money order for the state share of the fee, payable to the Commonwealth of Massachusetts.

Department of Environmental Protection
Box 4062
Boston, MA 02211

- b.) **To the Conservation Commission:** Send the Notice of Intent or Abbreviated Notice of Intent; a **copy** of this form; and the city/town fee payment.

To MassDEP Regional Office (see Instructions): Send a copy of the Notice of Intent or Abbreviated Notice of Intent; a **copy** of this form; and a **copy** of the state fee payment. (E-filers of Notices of Intent may submit these electronically.)



Town of Watertown
 Administration Building
 149 Main Street
 Watertown, Massachusetts 02472
Conservation Commission
 Tel: (617) 972-6426 • Fax: (617) 972-6484

WATERTOWN WETLANDS ORDINANCE

Fee Calculation and Transmittal Form

Owner		Applicant	
Name	Christopher and Rose Zevitas	Name	Same as Owner
Street	93 California Street	Street	
City	Watertown	City	
State	MA	State	
Zip	02472	Zip	
Phone	617-744-0028	Phone	
e-mail	Chris.zevitas@dot.gov	e-mail	

Project Location:

93 California Street, Watertown, MA

Any person filing an Application for Permit/RDA/NOI pursuant to the Ordinance shall, at the same time, pay a filing fee in accordance with the Filing Fee Schedule contained in the *Rules and Regulations for the Administration of the Watertown Wetlands Ordinance of 2008*. Municipal agencies are exempt from this requirement.

A. Fee Schedule:

Project Size	Fees
Less than 1,000 sq. ft.	\$50.00
1,000 sq. ft. to less than 2,000 sq. ft.	\$100.00
2,000 sq. ft. to less than 3,000 sq. ft.	\$150.00
3,000 sq. ft. to less than 4,000 sq. ft.	\$200.00
4,000 sq. ft. to less than 5,000 sq. ft.	\$250.00
5,000 sq. ft. to less than 6,000 sq. ft.	\$300.00
6,000 sq. ft. to less than 10,000 sq. ft.	\$400.00
10,000 sq. ft. to less than 15,000 sq. ft.	\$500.00
15,000 sq. ft. to less than 20,000 sq. ft.	\$650.00
20,000 sq. ft. to less than 30,000 sq. ft.	\$750.00
30,000 sq. ft. to less than 50,000 sq. ft.	\$850.00

50,000 sq. ft. or greater	\$1000.00
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Project Fee

\$100.00

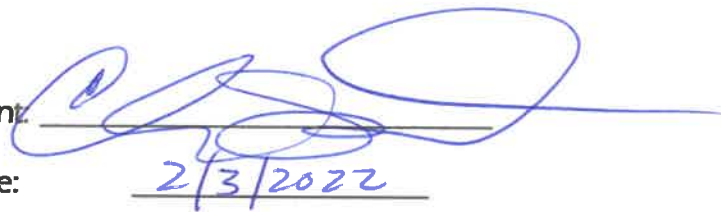
B. Fee Exemption

The Commission may waive the filing fee for an Application or Request for Determination filed by a government agency, for an RDA filed by a person having no financial connection with the subject property, for any projects whose sole effect is to substantially enhance a Resource Area, or for other reasonable grounds as determined by the Commission at its discretion.

Grounds for Exemption (to be filled out by CC staff)

Signature of Owner or Applicant: _____

Date: _____



2/3/2022

Enclose this form with a check or money order for the calculated amount payable to the Town of Watertown with the Application for Permit or Request for Determination of Applicability. These fees are non-refundable.

Please note this payment does not relieve the Applicant from the further fee requirements as stated in the Wetlands Protection Act Regulations MGL Chapter 44, Section 53G.



Town of Watertown
Administration Building
149 Main Street
Watertown, Massachusetts 02472
Conservation Commission
Tel: (617) 972-6426 • Fax: (617) 972-6484

WATERTOWN WETLANDS ORDINANCE

Application for Permit/Determination

Application for: ☐ Request for Determination of Applicability ☐ Notice of Intent
☐ Other

Owner*		Applicant	
Name	Christopher and Rose Zevitas	Name	Same as Owner
Street	93 California Street	Street	
City	Watertown	City	
State	MA	State	
Zip	02472	Zip	
Phone	617-744-0028	Phone	
e-mail	Chris.zevitas@dot.gov	e-mail	

**Name(s) and address(s) under which title of property is recorded at Registry of Deeds.*

1. Location of site where work is proposed:
93 California Street, Watertown, MA

Town of Watertown Assessor's Information:

Map: 125 Lot: 2 Block: 0 (Assessors Parcel ID: 125-2-0)

2. Briefly describe the proposed work:

The Applicants propose to construct an addition and associated site appurtenances to a single-family dwelling. Erosion controls and stormwater management are proposed. The activities will be located within the 200-foot Riverfront Area and within Bordering Land Subject to Flooding

3. Are there any impediments to accessing the site? No

If yes, what are they (fence, dog, topography, etc.):

N/A _____

If yes, what arrangements have been or will be made to ensure that the Conservation Commission members and designated representatives have safe and easy access to the site?

N/A _____

6. Do you understand that notification of this application and the Public Hearing will be published in a newspaper of local circulation at your expense? Please check-off appropriate box: Yes

7. How much is the filing fee, for this project, under the local ordinance? And under the Wetlands Protection Act?

\$100.00

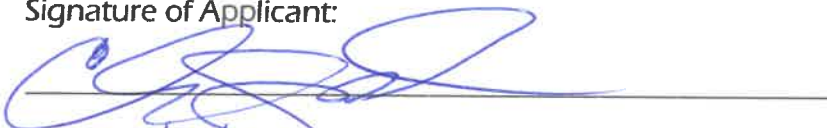
(See Fee Schedule). Make check payable to the Town of Watertown.

\$165.00 (City portion is \$95.00)

(See NOI Wetland Fee Transmittal Form wpaform3.doc) Make check payable to the Watertown Conservation Commission)

I hereby certify, under the pains and penalties of perjury, that the contents of this application are true and complete.

Signature of Applicant:



Date: 2/3/2022

By signing this application the owner grants permission to the Conservation Commission for its members and designated representative to enter upon the premises of the site.

Signature of Owner:



Date: 2/3/2022

Waiver

If the next regular meeting of the Conservation Commission is not within 21 days of submission of this filing, or if the agenda for the next regular meeting is full, I waive the 21 day requirement and agree to a later date for this Hearing no later than the next regular scheduled meeting or 30 days from the date of the filing a complete application (whichever is less).

Signature of Applicant:



Date: 2/3/2022

AFFIDAVIT OF SERVICE

Under the *Massachusetts Wetlands Protection Act*
and the
Watertown Wetlands Ordinance (Chapter XV)

I, Sharon A. Sullivan, on behalf of Christopher and Rose Zevitas, hereby certify under the pains and penalties of perjury that on February 9, 2022 I gave notification to abutters in compliance with the second paragraph of Massachusetts General Laws Chapter 131, Section 40, and 310 CMR 10.05 (4) (a), in connection with the following matter:

A Notice of Intent filed under the *Massachusetts Wetlands Protection Act* and the *Watertown Wetlands Ordinance* by LEC Environmental Consultants, Inc., on behalf of Christopher and Rose Zevitas, with the Watertown Conservation Commission on February 9, 2022 for property located at 93 California Street (Assessor's Parcel ID: 125-2-0) in Watertown, Massachusetts.

The form of notification, and a list of the abutters to whom it was given and their addresses, are attached to this Affidavit of Service.

Sharon A. Sullivan
Sharon A. Sullivan
Permitting Technician

2/9/2022
Date

February 9, 2022

CERTIFIED MAIL

«Name»

«Name2»

«Name3»

«Address»

«City», «State» «Zip»

Re: Notice of Intent Application
93 California Street
Assessor's Parcel ID: 125-2-0
Watertown, Massachusetts

[LEC File #: PLA\12-260.02]

Dear Abutter:

On behalf of the Applicants, Christopher and Rose Zevitas, LEC Environmental Consultants, Inc. (LEC) has filed a Notice of Intent (NOI) Application with the Watertown Conservation Commission for the proposed construction of an addition to an existing single-family dwelling and associated site appurtenances at the above-referenced property. The proposed activities are located within Riverfront Area and Bordering Land Subject to Flooding associated with the Charles River. The Applicants propose a reduction of impervious area, compensatory flood storage, and erosion controls to minimize the potential for impacts to the resource areas and improve site conditions.

The report entitled *Notice of Intent Application and Wetland Resource Area Analysis* and accompanying site plans are available for review by the public by contacting the Watertown Conservation Commission. A remote Public Hearing will be held on March 2, 2022 at 7:00 p.m., in accordance with the provisions of the *Massachusetts Wetlands Protection Act* (M.G.L. Ch. 131, s. 40, as amended), its implementing Regulations (310 CMR 10.00), and the *Watertown Wetlands Ordinance*. Notice of the Public Hearing, including its date, time, and place, will also be published at least five (5) days in advance in the *Watertown Tab*. Notice of the Public Hearing will also be posted at the Watertown Administration Building at least 48 hours in advance. Please check the Town's website and the Board/Committee's page for any updated information on the meeting.

Please do not hesitate to review the materials and/or attend the public hearing should you have questions or concerns about the proposed project.

Sincerely,

LEC Environmental Consultants, Inc.

Richard A. Kirby, Manager
 Senior Wetland Scientist

LEC Environmental Consultants, Inc.

www.lecenvironmental.com

12 Resnik Road
 Suite 1
 Plymouth, MA 02360
 508.746.9491

380 Lowell Street
 Suite 101
 Wakefield, MA 01880
 781.245.2500

100 Grove Street
 Suite 302
 Worcester, MA 01605
 508.753.3077

P.O. Box 590
 Rindge, NH 03461
 603.899.6726

680 Warren Avenue
 Suite 3
 East Providence, RI 02914
 401.685.3109

PLYMOUTH, MA

WAKEFIELD, MA

WORCESTER, MA

RINDGE, NH

EAST PROVIDENCE, RI

Notification to Abutters Under the
Massachusetts Wetlands Protection Act
and the
Watertown Wetlands Ordinance

In accordance with the second paragraph of Massachusetts General Laws Chapter 131, Section 40 and the *Watertown Wetlands Ordinance*, you are hereby notified of the following:

- A. The names of the Applicants are Christopher and Rose Zevitas, 93 California Street, Watertown, Massachusetts.
- B. The Applicants have filed a Notice of Intent with the Conservation Commission for the municipality of Watertown, Massachusetts seeking permission to remove, fill, dredge or alter an area subject to protection under the *Massachusetts Wetlands Protection Act* (General Laws Chapter 131, Section 40) and the *Watertown Wetlands Ordinance*.
- C. The address of the lot where the activity is proposed is 93 California Street (Assessor's Parcel ID: 125-2-0), Watertown, Massachusetts.
- D. Copies of the Notice of Intent may be examined by contacting the Watertown Conservation Commission at (617) 972-6426, between the hours of 8:30 a.m. and 5:00 p.m., Monday through Friday.
- E. Copies of the Notice of Intent may be obtained from LEC Environmental Consultants, Inc. (the applicants' representative) by calling (781) 245-2500 between the hours of 8:00 a.m. and 5:00 p.m., Monday through Friday. A fee may be charged for each copy requested.
- F. Information regarding the Public Hearing may be obtained from the Watertown Conservation Commission (the regulatory agency) by calling (617) 972-6426, between the hours of 8:30 a.m. and 5:00 p.m., Monday through Friday.

NOTE: Notice of the Public Hearing, including its date, time, and place, will be published at least five (5) days in advance in the Watertown Tab.

NOTE: Notice of the Public Hearing will also be posted at the Watertown Town Hall not less than 48 hours in advance.

NOTE: You also may contact the nearest Department of Environmental Protection Regional Office for more information about this application or the Wetlands Protection Act. To contact DEP, call:

Northeast Region: 978-694-3200

Parcel ID: 125 2 0
ZEVITAS CHRISTOPHER
93 CALIFORNIA ST
WATERTOWN, MA 02472

Parcel ID: 122 12 0
KF REALTY ASSOCIATES
C/O THE STOP + SHOP CO
c/o AHOLD FINANCIAL SERVICES
P O BOX 6500
CARLISLE, PA 17013

Parcel ID: 123 102 10
FISHER-BOWMAN JENNIFER H
FISHER-BOWMAN JENNIFER J
10 CALIFORNIA PK, UNIT 2
WATERTOWN, MA 02472

Parcel ID: 123 102 8
HAKIMI PARVIN
8 CALIFORNIA PK
WATERTOWN, MA 02472

Parcel ID: 123 11 3
MOOK KEVIN
16 CALIFORNIA PK
WATERTOWN, MA 02472

Parcel ID: 123 12 4
RAZ REGINA
18 CALIFORNIA PK
WATERTOWN, MA 02472

Parcel ID: 123 13 5
BLACKWOOD CLIFTON M
BLACKWOOD ANTOINETTE E
20 CALIFORNIA PARK
WATERTOWN, MA 02472

Parcel ID: 123 14 6
MAMONOV ARTEM
SHEMIRANI ATENA IRANL
19 CALIFORNIA PARK
WATERTOWN, MA 02472

Parcel ID: 123 15 7
HUANG GUO QIU
HUANG YU YUN
15 CALIFORNIA PARK
WATERTOWN, MA 02472

Parcel ID: 123 16 8
SLAMIN JR LEO F
11 CALIFORNIA PK
WATERTOWN, MA 02472

Parcel ID: 123 17 9
ANDREWS RACHEL L
KIRK JAMAL K
7 CALIFORNIA PK
WATERTOWN, MA 02472

Parcel ID: 123 18 10
MAI THANH
3 CALIFORNIA PK
WATERTOWN, MA 02472

Parcel ID: 123 19 11
KENNEY NORMAN
KENNEY PATRICIA
104 CALIFORNIA ST
WATERTOWN, MA 02472

Parcel ID: 123 20 12
PURI BIREN KUMAR
PURI NEETA
108 CALIFORNIA STREET
WATERTOWN, MA 02472

Parcel ID: 123 3E 0
DICIENZO ROSINA MONACO
MAZZOLA MARIA, SANDRA &
92 CALIFORNIA ST
WATERTOWN, MA 02472

Parcel ID: 123 4D 0
TIBERIO ADELE L/E
TIBERIO LAWRENCE M R/M
120 PINE KNOLL DR
LUDLOW, MA 01056

Parcel ID: 123 5C 0
LEONOR ESDRAS R
LEONOR JUSSARA V
74 CALIFORNIA ST
WATERTOWN, MA 02472

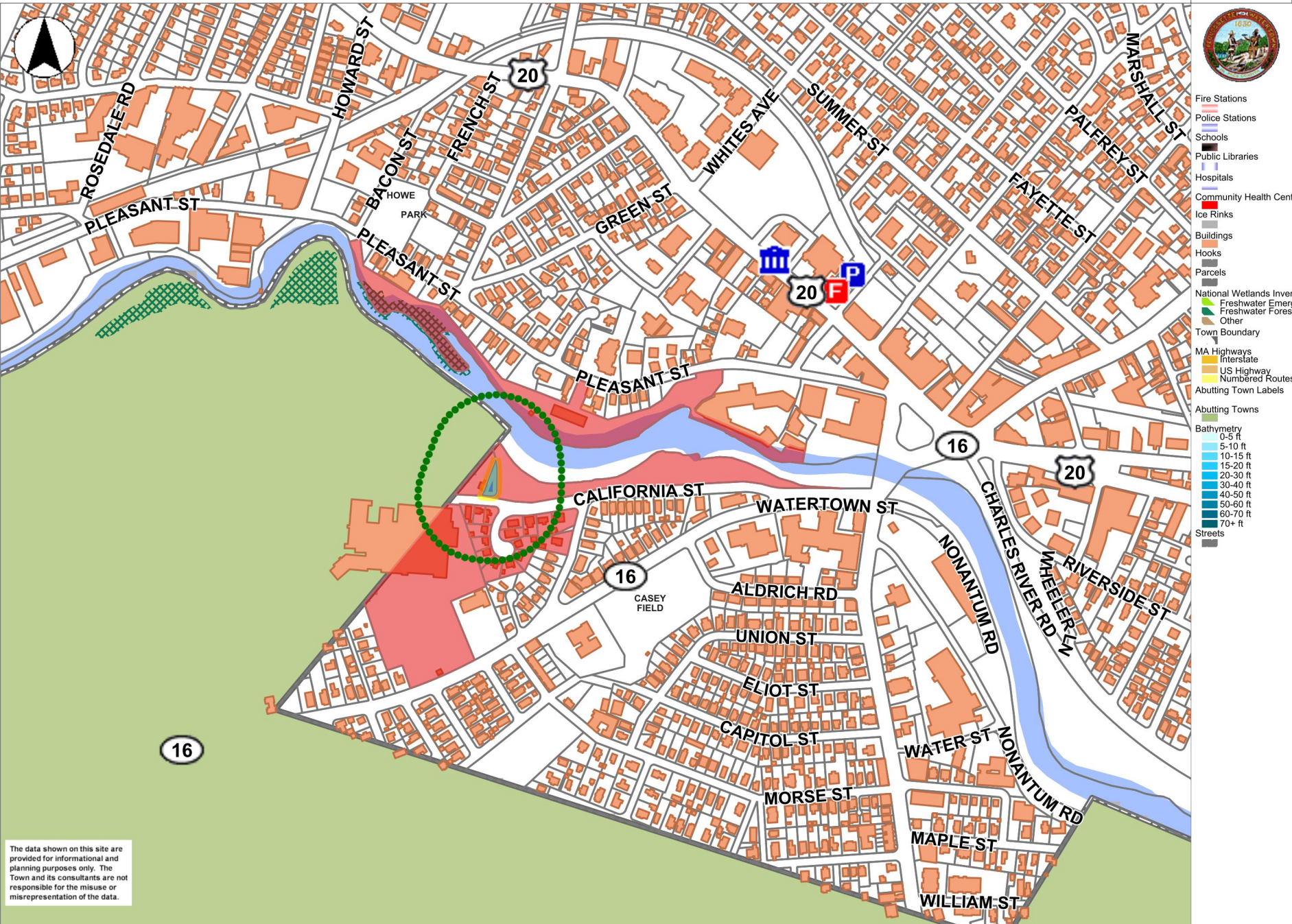
Parcel ID: 123 6B 1
TAYLOR JEFFREY E.
TAYLOR JULIE A.
13 FIFTH AVE
WATERTOWN, MA 02472

Parcel ID: 123 9 1
MAZZOLA EMILIO
MAZZOLA MARIA
92 CALIFORNIA ST
WATERTOWN, MA 02472

Parcel ID: 125 3 0
COMMONWEALTH OF
DEPT OF CONSER. &
251 CAUSEWAY ST. STE 600
BOSTON, MA 02114

Parcel ID: 125 4A 1P
PHILIP A RAND CO., INC
139 CALIFORNIA ST
NEWTON, MA 02458

Parcel ID: 201 1 1136
COMMONWEALTH OF
DEPT OF CONSER. &
251 CAUSEWAY ST. STE 600
BOSTON, MA 02114



The data shown on this site are provided for informational and planning purposes only. The Town and its consultants are not responsible for the misuse or misrepresentation of the data.



**Notice of Intent Application and
Wetland Resource Area Analysis**

93 California Street
Assessor's Parcel ID: 125-2-0
Watertown, Massachusetts

February 9, 2022

1. Introduction

On behalf of the Applicants, Christopher and Rose Zevitas, LEC Environmental Consultants, Inc., (LEC) is filing the enclosed Notice of Intent (NOI) Application and *Wetland Resource Area Analysis* with the Watertown Conservation Commission for the construction of an addition to an existing single-family dwelling and associated site appurtenances at 93 California Street in Watertown, Massachusetts. Portions of the proposed activities will occur within the Riverfront Area and Bordering Land Subject to Flooding (BLSF) associated with the Charles River. As part of this filing, the Applicants propose to implement mitigating measures, including a reduction of impervious surface, compensatory flood storage, and the installation of erosion controls. The existing conditions and proposed activities are depicted on the enclosed *Plan of Land in Watertown, MA* dated September 15, 2021 and revised through October 4, 2021 prepared by Everett M. Brooks Co., (*Site Plan*, Appendix B).

The Applicants filed a NOI Application for a similar project on July 1, 2013 (DEP File #: 321-0154), but the addition was never constructed. More recently, the Applicants filed with the Watertown Zoning Board of Appeals (ZBA) for relief from several zoning requirements related to conformity, use, dimensions, and parking, and the ZBA granted the requested relief at the January 25, 2022 hearing. The purpose of the relief sought was in part to position the proposed work as far from the Wetland Resource Areas as possible.

2. General Site Description

The 6,473+/- square-foot property is located along the north side of California Street and south of the Charles River walkway, near the Newton/Watertown town boundary in Watertown, Massachusetts. Residential development associated with the southern side of California Street and commercial development west of the site generally surround the property, while DCR land occurs immediately to the east.



Northwesterly view of dwelling from California Street



Southerly view of rear of dwelling

The southern portion of the property contains an existing single-family dwelling with attached garage and paved driveway providing site access from California Street. A wooden deck is situated off the rear of the existing dwelling, and a flagstone patio is located off the rear of the garage. The dwelling and site appurtenances are surrounded by

lawn and landscape plants, including a grove of native grape located within the northern portion of the site. The site's topography gently descends northerly toward the Charles River walkway.

Forested uplands occur on surrounding DCR land. The canopy contains scattered individuals of red maple (*Acer rubrum*), poplar (*Populus* sp.), birch (*Betula* sp.), weeping willow (*Salix babylonica*), larch (*Larix laricina*), and eastern white pine (*Pinus strobus*). The understory contains saplings from the canopy, with clusters of silky dogwood (*Cornus amomum*), European buckthorn (*Frangula alnus*), multiflora rose (*Rosa multiflora*), tartarian honeysuckle (*Lonicera tartarica*), witch hazel (*Hamamelis virginiana*), false indigo bush (*Amorpha fruticosa*), and Japanese knotweed (*Polygonum cuspidatum*). Scattered entanglements of wild grape (*Vitis* sp.) were also observed. The groundcover contains patches of poison ivy (*Toxicodendron radicans*), jewelweed (*Impatiens capensis*), violet (*Viola* sp.), day lilies (*Hemerocallis*), and sensitive fern (*Onoclea sensibilis*).

LEC inspected soil conditions throughout the upland areas up-gradient of the BVW boundary, and generally observed 2 to 3 feet of historic fill material (sandy loam) over sapric organic soils.

2.1

Natural Heritage and Endangered Species Program Designation

According to the 2021 edition of the *Massachusetts Natural Heritage Atlas*, no areas of Estimated Habitat for Rare Wildlife or Certified Vernal Pools exist on the site (Appendix A, Figure 3).

3. **Wetland Boundary Determination Methodology**

LEC conducted a site evaluation on September 17, 2012 to identify and characterize existing protectable Wetland Resource Areas located on or immediately adjacent to the site, and to demarcate the Bordering Vegetated Wetland (BVW) and Bank-Mean Annual High Water (MAHW) Line associated with pertinent portions of the Charles River. A more recent site evaluation was conducted on August 24, 2021. The extent of Wetland Resource Areas was determined through observations of existing plant communities, hydrologic indicators, and bankfull indicators in accordance with the *Massachusetts Wetlands Protection Act* (M.G.L. c. 131, s. 40), its implementing Regulations (310 CMR 10.00), and the *Watertown Wetlands Ordinance* (Chapter XV), and its *Rules and Regulations*.

Based on these methods, LEC determined that the Wetland Resource Areas associated with this site include: BVW, Bank, Riverfront Area (extending from the Bank-MAHW Line associated with the Charles River), and Bordering Land Subject to Flooding (BLSF). The BVW boundary was delineated with sequentially-numbered, blaze orange surveyor's tape, with the words "LEC Resource Area" printed in black (LEC flagging stations BVW-1 through BVW-3). The Bank-MAHW boundary was delineated with sequentially-numbered, safety blue surveyor's tape (LEC flagging stations MAHW-1 through MAHW-5). The BVW and Bank-MAHW flags were re-established in the field via survey by Everett M. Brooks Co., and are shown on the enclosed *Site Plan* (Appendix B).

3.1 **Plant Species Identification**

LEC identified plant species comprising 5% or more of the vegetative cover along the BVW boundary. Identifications were made to the species level when morphologically possible and were used along with other hydrologic indicators to determine the extent of BVW on site in accordance with definitions and criteria in 310 CMR 10.55(2).

3.1.1 **Identification of Wetland Indicator Species**

The regional wetland indicator status for all identified plant species was obtained from the classification system described in the *National List of Plant Species that Occur in Wetlands: Massachusetts* (Reed, 1988). This classification system divides plant species into ten categories and identifies the wetland indicator status based on the frequency of

their occurrence in wetland habitat. These include, in order of lowest to highest frequency within wetlands:

Facultative Upland Minus (FACU-),
Facultative Upland (FACU),
Facultative Upland Plus (FACU+),
Facultative Minus (FAC-),
Facultative (FAC),
Facultative Plus (FAC+),
Facultative Wetland Minus (FACW-),
Facultative Wetland (FACW),
Facultative Wetland Plus (FACW+), and
Obligate (OBL).

Plant species with a FAC, FAC+, FACW-, FACW, FACW+, or OBL wetland indicator status occur in wetlands more than 50% of the time and are considered “wetland indicator plants.” Plant species with a FAC-, FACU+, FACU, FACU- wetland indicator status, and those not contained within the list occur in wetlands less than 50% of the time, are not considered “wetland indicator plants.” This system of classification has been adopted by the Department of Environmental Protection (DEP) as the definitive source regarding the indicator status of wetland plants.

3.1.2 **Measurement of Relative Abundance**

The relative abundance or percent cover of each plant species occurring along the BVW boundary was determined visually. When completing DEP BVW (310 CMR 10.55) Delineation Field Data Forms, midpoints were utilized to determine the percent cover of each plant species according to the following classification system: 3% = 1-5%; 10.5% = 6-15%; 20.5 = 16-25%; 38% = 26-50%; 63% = 51-75%; 85.5% = 76-95%; and 98% = 96-100%. The purpose of using midpoints is to reduce variability between wetland scientists when visually determining percent cover. Utilizing midpoints does not affect whether a given species within a sample layer will be a dominant plant and is recommended in DEP’s handbook, *Delineating Bordering Vegetated Wetlands Under the Massachusetts Wetlands Protection Act*.

3.1.3 **Measurement of Vegetative Distribution and Density**

The relative pattern of plant distribution within each vegetative layer (canopy, sapling, shrub, lianas, and groundcover) was visually determined. Plant species within each layer

were determined to occur as single plants, patches or clusters, entanglements, or as the dominant plant species. In addition, LEC observed the relative plant density between each vegetation layer, noting whether the sample layer is densely vegetated, contains moderately dense vegetation, is variably dense within the sample layer, or is sparsely vegetated.

3.2 **Evaluation of Edaphic (Soil) Characteristics**

3.2.1 **General Soil Analysis**

Prior to conducting the site evaluation, LEC reviewed United States Geologic Survey (USGS) Topographic Maps and United States Natural Resources Conservation Service (NRCS) Soil Survey Maps. The purpose of this review was to become familiar with the site's general soil characteristics. Using a Dutch-style, hand-held auger and/or spade, LEC investigated soil conditions within these representative areas by digging a test pit to a depth of at least 20 inches, or refusal. The purpose of this investigation was to confirm and document the difference in soil conditions along the BVW boundary. Specifically, LEC analyzed soil horizon thickness and depth, soil texture, and soil color, noting the presence or absence of redoximorphic features in accordance with *Delineating Bordering Vegetated Wetlands Under the Massachusetts Wetlands Protection Act* (March 1995) and *Field Indicators for Identifying Hydric Soils in New England* (2019).

3.2.2 **Soil Horizon Thickness and Depth**

LEC noted the presence of all soil layers and horizons (e.g. O, A, E, B, and/or C) and their relative thickness and depth within the test pit. The thickness of the O soil layer may be directly related to wetness, and is critical to the identification of a hydric soil. Specifically, histosols (organic soil layers measuring greater than 16 inches thick) and soils with a histic epipedon (an organic layer between 8 and 16 inches thick) always qualify as hydric soils, provided the hydrology that created these soil conditions still exists and has not been altered. Although not directly related to wetness, the thickness of the A or A_p horizons is a function of the depth of plowing (many of New England's forests today were historically agricultural fields) and/or a function of erosion and deposition of organic matter. Interpreting redoximorphic features within the A or A_p horizons can be difficult given their relatively dark color. Redoximorphic features are best observed in the soil layers beneath the A or A_p horizons.

3.2.3

Soil Texture

Soil texture refers to the relative proportions of sand, silt, and clay particles in the soil. Although there are several standard systems for determining soil texture, LEC utilized the United States Department of Agriculture (USDA) system, because it is widely accepted and referred to in the *Field Indicators* guide referenced above. Specifically, LEC identified whether the soil is classified as sand, loamy sand, sandy loam, loam, silt loam, silty clay loam, or clay. LEC also estimated the relative proportion of organic matter within the topsoil to determine if the soil is classified as an organic soil. Differences in soil texture affect how water moves through the soil and the type of hydrologic indicators that form when hydric conditions are present during the growing season.

3.2.4

Soil Color

Using the Munsell® Soil Color Charts, LEC examined the hue, value, and chroma of the different soil horizon matrixes (dominant soil color) and redoximorphic features present within the test pits. The purpose of examining the soil color within the A or A_p horizon is to determine whether these horizons are rich in organic material and meet the criteria for dark or very dark. This distinction refers to the relative amount of organic matter within the soil horizon and may indicate the presence of saturated conditions during the growing season.

Within the B and/or C horizons, the soil color and color patterns may indicate the movement of iron and/or other minerals within the soil. The movement and/or concentration of iron and other minerals, such as manganese, may indicate hydric conditions persist during the growing season. Specifically, a soil matrix color with a relatively low chroma (chroma 2 or less) and high value (value 4 or more) due to wetness is often defined as a depleted matrix - the iron and/or other minerals have been removed or depleted from the soil due to groundwater fluctuations, soil saturation, and reduction. A soil with a depleted matrix due to wetness within the upper 20 inches will likely constitute a hydric soil.

3.2.5

Redoximorphic Features

During the soil evaluation, LEC documented the presence or absence of redoximorphic features within the soil sample. Redoximorphic features are changes in soil color and/or texture that contrast from the matrix color and dominant soil texture and include redox depletions (formerly referred to as “low-chroma mottles”), redox concentrations (formerly referred to as “high-chroma mottles”), nodules, concretions, pore linings, and

oxidized rhizospheres. Redoximorphic features form through the processes of reduction, translocation, and oxidation of Fe and Mn oxides when groundwater levels fluctuate near the soil surface. Commonly observed redoximorphic features include redox depletions, occurring when minerals in the soil are reduced or removed, and redox concentrations or soil masses, occurring when minerals accumulate. Less commonly observed redoximorphic features include nodules and concretions, which are hardened, cemented soil masses. Pore linings are localized areas of brightly colored soils located adjacent to a pore within the soil. Oxidized rhizospheres are a form of pore lining that occurs on the surface of live roots of certain plants.

4. Wetland Resource Areas

The Wetland Resource Areas associated with the site include BVW, Bank, Riverfront Area, and Bordering Land Subject to Flooding (BLSF) associated with the Charles River. A description of each of these resource areas is provided below.

4.1 Bordering Vegetated Wetlands

BVW is defined at 310 CMR 10.55(2) as: *freshwater wetlands which border on creeks, rivers, streams, ponds, and lakes...Bordering Vegetated Wetlands are areas where the soils are saturated and/or inundated such that they support a predominance of wetland indicator plants...The boundary of Bordering Vegetated Wetlands is the line within which 50% or more of the vegetational community consists of wetland indicator plants and saturated or inundated conditions exist.*

A narrow band of forested wetlands occurs up-gradient of a portion of the Charles River north of the property. The canopy contains scattered silver maple (*Acer sacharinum*) and American elm (*Ulmus americana*), while the understory contains clusters of arrowwood (*Viburnum dentatum*), European buckthorn, and saplings from the canopy. The groundcover is sparsely vegetated with scattered patches of poison ivy.

LEC inspected soil conditions within the BVW area and generally observed a deep, dark, mucky topsoil (A horizon) with a soil matrix color of 10YR 2/1 to a depth of up to 20 inches. This topsoil is underlain by sapric organic soils. Redoximorphic concentrations were observed within 10 inches of the soil surface.

LEC flagging stations BVW-1 through BVW-3 demarcate the BVW boundary as it relates to the subject property.

4.2

Bank-Mean Annual High Water

The Mean Annual High Water Line of a river is the line that is apparent from visible markings or changes in the character of soils or vegetation due to the prolonged presence of water and that distinguishes between predominantly aquatic and predominantly terrestrial land. Field indicators of bankfull conditions shall be used to determine the mean annual high-water line. Bankfull field indicators include but are not limited to: changes in slope, changes in vegetation, stain lines, top of point bars, changes in bank materials, or bank undercuts [310 CMR 10.58 (2) (a) 2].



Northeasterly view of Charles River and Bank

The Charles River is contained within relatively steep embankments measuring 1-2 feet high. The Bank-MAHW line was determined based on LEC's observation of multiple corroborating Bankfull Indicators, including moss lines, bank undercuts, and an abrupt transition between predominantly aquatic and terrestrial land, and is

generally coincident with the top-of-Bank. LEC flagging stations MAHW-1 through MAHW-5 demarcate the Bank-MAHW boundary as it relates to the subject property.

4.3

Riverfront Area

According to 310 CMR 10.58 2(a), *Riverfront Area is defined as the area of land between a river's mean annual high water line and a parallel line measured horizontally 200 feet away.*

Riverfront Area includes land within 200 feet of the MAHW line. The site's Riverfront Area is comprised of forested upland, lawn and landscaped areas, as well as the dwelling, deck, patio, and a portion of the driveway. Riverfront Area containing structure, pavement, and/or lacking topsoil is considered 'Degraded' in accordance with 310 CMR 10.58 (5).

4.4

Bordering Land Subject to Flooding

Bordering Land Subject to Flooding (BLSF) is an area with low, flat topography adjacent to and inundated by flood waters rising from creeks, rivers, streams, ponds or lakes [310 CMR 10.57(2)(a)1].

According to the June 4, 2010 Federal Emergency Management Agency Flood Insurance Rate Map for Middlesex County, Massachusetts (Map Number: 25017C0552E), the northern half+/- of the property is located within Zone AE: *Special Flood Hazard Areas Subject to Inundation by the 1% Annual Chance Flood...Base Flood Elevations determined*. The 1% Annual Chance Floodplain elevation occurs at elevation 12 (Datum NAVD 88), and approaches the flagstone patio and deck off the rear of the dwelling. The land occurring between the Charles River and elevation 12 is considered Bordering Land Subject to Flooding (Appendix A, Figure 2). The remainder of the property appears to be located within Zone X (shaded): *Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees by the 1% annual chance flood*.

5.

Proposed Construction Activities

5.1

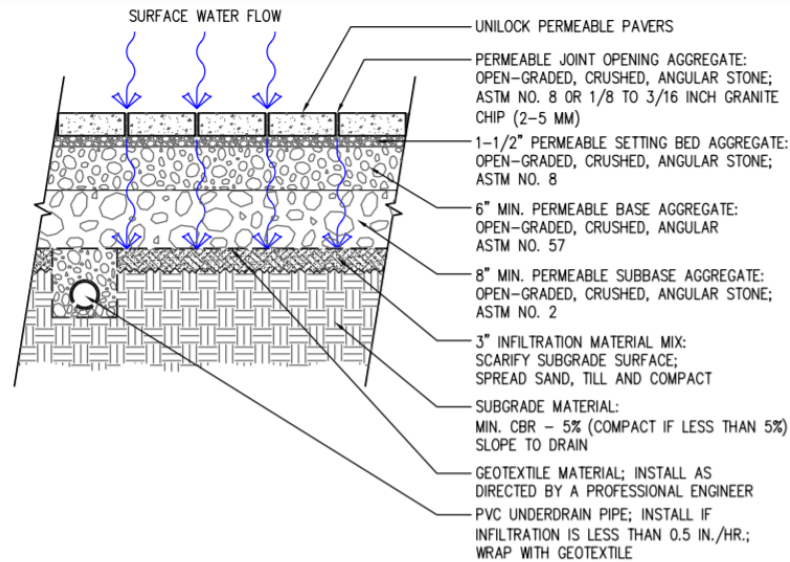
Addition and Site Appurtenances

The Applicants propose to demolish the existing 430± square-foot garage, and construct a 426± square-foot, 2-story addition in its place. The addition footprint will coincide with the existing garage. The proposed addition will be constructed atop a crawl space foundation, and a deck and pervious paver patio will be constructed off the rear of the addition, within the footprint of a flagstone patio (to be removed) and existing lawn.

The existing deck off the rear of the dwelling will be removed and replaced with a second pervious paver patio, and walkways and stairs will be reconfigured to provide access to the backyard from the patios. Further, the existing concrete walkway located along the eastern side of the dwelling will be removed. An attached storage shed measuring 32+/- square feet will be constructed between the existing dwelling and the pervious paver patio proposed behind the addition. This shed will displace roughly 1 cubic foot of flood storage within the BLSF.

The paved driveway will be removed and replaced with a pervious paver driveway. Block-style pervious pavers are proposed for the driveway and two patios, and will be underlain by a permeable base (representative detail provided below) to promote

infiltration of stormwater. The base will be comprised of 12 inches of crushed stone, 4 inches of clean gravel, and 2 inches of grit settling bed for the pavers.



9 LD—Low Infiltration Permeable Paver Section
CS—COM—PERM—T3

6. Mitigation Measures

The Applicants intend to implement erosion controls, reduce impervious area, and provide compensatory flood storage to mitigate for the proposed work in the Riverfront Area and BLSF. A description of each of these mitigating measures is provided below.

6.1 Erosion and Sedimentation Control

The Applicants propose to implement an erosion control program to protect adjacent resource areas from sedimentation during construction activities. The plan for the control of potential impacts to the adjacent Wetland Resource Areas is based on DEP guidelines, and will be comprised of a staked, 12-inch diameter, filtermitt. The erosion controls will be installed along the Limit of Work line to minimize any sedimentation that may occur during construction. All barriers will remain in place until disturbed areas are stabilized by vegetation. The location of the proposed erosion controls is shown on the *Site Plan* (Appendix B).

6.2

Impervious Area Reduction

The project design reduces impervious area by 501± square feet. This is largely accomplished by replacing the existing pavement and impervious patio with permeable pavers, and by eliminating the existing concrete walkway located along the eastern side of the dwelling. A table further detailing the impervious reduction is provided on the *Site Plan*.

6.3

Compensatory Flood Storage

In order to mitigate for the 1 square foot of floodplain displacement resulting from the proposed shed, the Applicants are removing the deck stairs (along with the deck) located off the rear of the dwelling. Removing these stairs will result in roughly 3 cubic feet of compensatory flood storage, resulting in a 3:1 ratio of compensatory flood storage to floodplain displacement.

7.

Regulatory Implications

7.1

Bordering Land Subject to Flooding

The Regulations at 310 CMR 10.57 (4) state that *work within BLSF shall conform to the following criteria:*

(a) *Bordering Land Subject to Flooding*

- (1) Compensatory storage shall be provided for all flood storage volume that will be lost as a result of the proposed work.*

The proposed shed will result in 1± cubic foot of flood storage displacement, while removal of the deck stairs will result in 3± cubic feet of compensatory flood storage. The *Site Plan* contains a table showing the proposed cut and fill within the 100-year floodplain.

- (2) Work within BLSF...shall not restrict flows so as to cause an increase in flood stage or velocity.*

Proposed work in the floodplain will not restrict flows or cause an increase in flood stage.

- (3) Work within BLSF shall not impair its capacity to provide important wildlife habitat functions.*

According to 310 CMR 10.57 (4) (a) 3, alteration of less than 10% or 5,000 square feet of BLSF shall *not* be deemed to impair its capacity to provide important wildlife habitat functions. The proposed work will alter approximately 362 square feet of BLSF, thereby not exceed the above threshold.

(b) Protection of Rare Wildlife Species

(1) Notwithstanding the provisions of 310 CMR 10.57(4)(a) or (b), no project may be permitted which will have any adverse effect on specified wildlife habitat sites of rare vertebrate or invertebrate species.

There are no specified wildlife habitat sites of rare vertebrate or invertebrate species located on the project site; therefore, the proposed project will have no adverse effect on any such sites.

7.2

Riverfront Area

The majority of the proposed work, including the addition, deck, patios, and a portion of the driveway, etc., will be conducted within 'Previously Developed' Riverfront Area in accordance with 310 CMR 10.58 (5). The performance standards outlined therein and the project's compliance with those standards are provided below.

The proposed patios, deck, and shed are considered exempt or grandfathered activities in accordance with 310 CMR 10.58 (6) (b) (which refers the reader to 310 CMR 10.02 (2) (b) 1.).

Redevelopment Within Previously Developed Riverfront Areas: Restoration and Mitigation. *Notwithstanding the provisions of 310 CMR 10.58 (4) (c) and (d), the issuing authority may allow work to redevelop a previously developed riverfront area, provided the proposed work improves existing conditions. Redevelopment means replacement, rehabilitation, or expansion of existing structures...A previously developed riverfront area contains areas degraded prior to August 7, 1996 by impervious surfaces from existing structures or pavement, absence of topsoil...Work to redevelop previously developed riverfront area shall conform to the following criteria:*

- (a) *At a minimum, proposed work shall result in an improvement over existing conditions of the capacity of the riverfront area to protect the interests identified in M.G.L. c. 131, s. 40. When a lot is previously developed but no portion of the riverfront area is degraded, the requirements of 310 CMR 10.58 (4) shall be met.*

The proposed activities will improve the Riverfront Area function and value by reducing impervious area by 501± square feet.

- (b) *Stormwater management is provided according to standards established by the Department.*

DEP has no stormwater management standards for single-family dwellings, and the Applicants propose to reduce impervious area by 501± square feet.

- (c) *Within 200-foot riverfront areas, proposed work shall not be located closer to the river than existing conditions or 100 feet, whichever is less....*

The proposed addition will be located greater than 100 feet from the Bank-MAHW Line and further from the Charles River compared to the existing dwelling and deck.

- (d) *Proposed work, including expansion of structures, shall be located outside the riverfront area or toward the riverfront area boundary and away from the river, except in accordance with 310 CMR 10.58 (5) (f) or (g).*

The addition footprint is contained completely within the footprint of the existing garage, and located farther from the Charles River compared to the remainder of the dwelling and deck.

- (e) *The area of proposed work shall not exceed the amount of the degraded area, provided that the proposed work may alter up to 10% if the degraded area is less than 10% of the riverfront area, except in accordance with 310 CMR 10.58 (5) (f) or (g).*

The entire footprint of the proposed addition is contained within a degraded area.

- (f) *When an applicant proposes restoration on-site of degraded riverfront area, alteration may be allowed notwithstanding the criteria of 310 CMR 10.58 (5) (c), (d), and (e) at a ratio in square feet of at least 1:1 of restored area to area of alteration not conforming to the criteria. Areas immediately along the river shall be selected for restoration. Alteration not conforming to the criteria shall begin at the riverfront area boundary...*

No restoration in accordance with 310 CMR 10.58 (f) or (g) is proposed.

8. Summary

On behalf of the Applicants, Christopher and Rose Zevitas, LEC is filing this NOI Application and *Wetland Resource Area Analysis* with the Watertown Conservation

Commission for the construction of an addition to an existing single-family dwelling and associated site appurtenances at 93 California Street in Watertown, Massachusetts. Portions of the proposed activities will occur within the Riverfront Area and BLSF associated with the Charles River. As part of this filing, the Applicants propose to implement mitigating measures, including a reduction of impervious surface, compensatory flood storage, and the installation of erosion controls. The existing conditions and proposed activities are depicted on the enclosed *Site Plan of Land in Watertown, MA* dated September 15, 2021, revised through October 4, 2021 and February 3, 2022 prepared by Everett M. Brooks Co., (*Site Plan*, Appendix B).

The proposed activities conform to the performance standards enumerated in the *Massachusetts Wetlands Protection Act* (M.G.L., c.131, s.40), its implementing Regulations (310 CMR 10.00), and the *Watertown Wetlands Ordinance* (Chapter XV), and its *Rules and Regulations*. The Applicants request that the Watertown Conservation Commission issue an Order of Conditions approving the activities proposed herein.

Massachusetts Wetlands Protection Act (M.G.L. c. 131, §. 40), www.state.ma.us/dep

Massachusetts Wetlands Protection Act Regulations (310 CMR 10.00),
www.state.ma.us/dep

Massachusetts Natural Heritage and Endangered Species Program Atlas of Estimated Habitat of State-listed Rare Wetlands Wildlife. Natural Heritage & Endangered Species Program, Massachusetts Division of Fisheries & Wildlife, Route 135, Westborough, MA 01581, www.state.ma.us/dfwele/dfw

Massachusetts Department of Environmental Protection, Division of Wetlands and Waterways 1995. *Delineating Bordering Vegetated Wetlands Under the Massachusetts Wetlands Protection Act, A Handbook*. 89 pp.

National Flood Insurance Program, Federal Emergency Management Agency Flood Insurance Rate Map, Middlesex County, Massachusetts, Middlesex County, June 4, 2010.

New England Hydric Soils Technical Committee. 2019, 4th ed., *Field Indicators for Identifying Hydric Soils in New England*, New England Interstate Water Pollution Control Commission, Wilmington, MA. P. 76

Reed, P.B. 1988. *National List of Plant Species that Occur in Wetlands: 1988 Massachusetts*. U.S. Department of the Interior, Fish and Wildlife Service. NERC-88/18.21

Watertown Conservation Commission, *Watertown Wetlands Ordinance* (Chapter XV). City of Watertown, Massachusetts, February 1987, Revised through September 2008.

Watertown Conservation Commission, *Rules and Regulations for the Administration of the Watertown Wetlands Ordinance*.

Appendix A

Figure 1: USGS Topographic Quadrangle & NHESP Estimated Habitat Map

Figure 2: FEMA Flood Insurance Rate Map

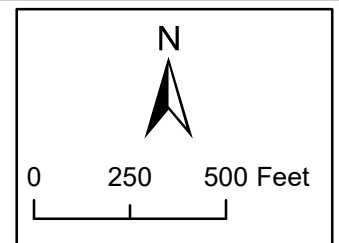
Figure 3: MassGIS Orthophoto

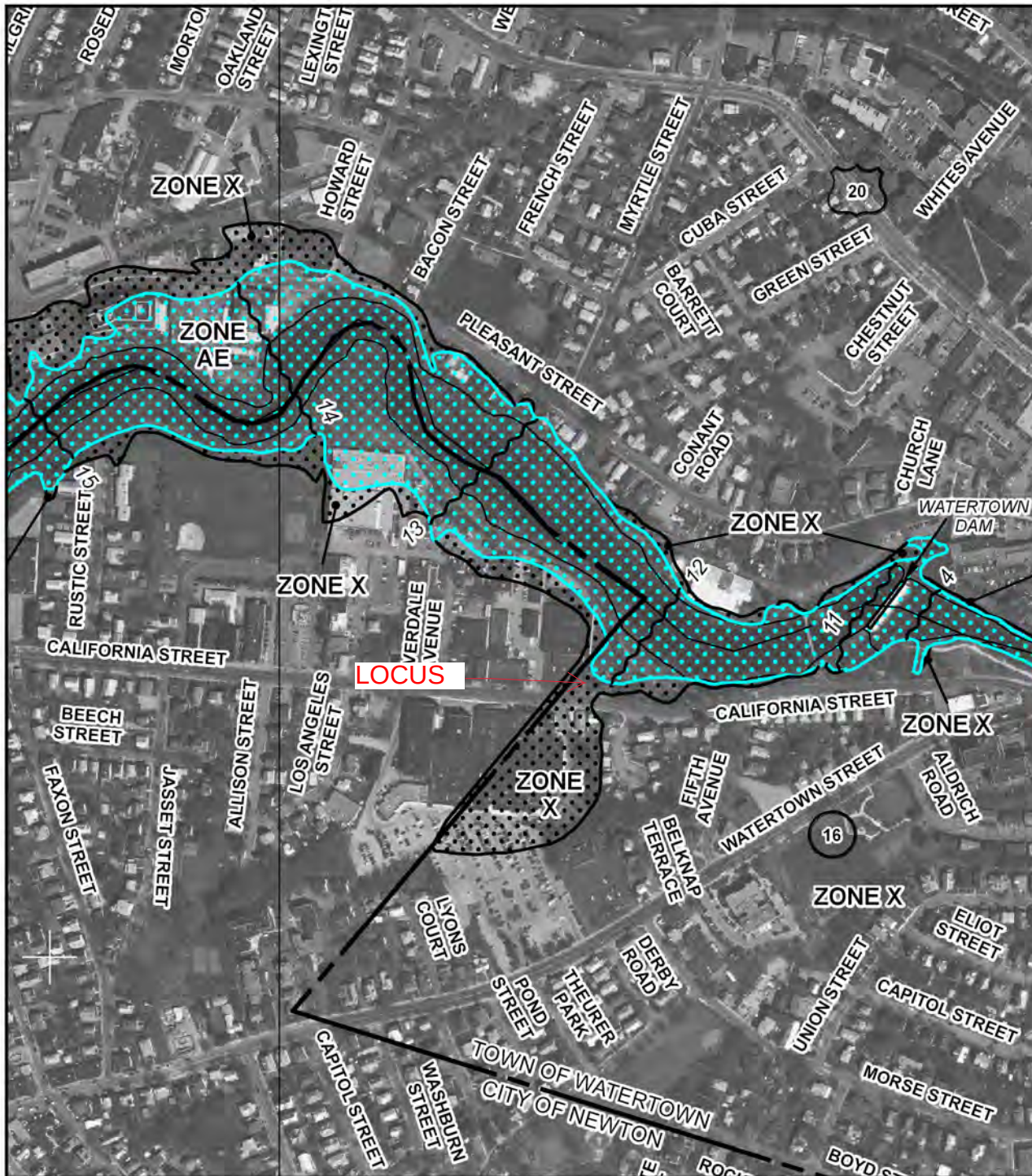


LEC
Environmental Consultants, Inc.
Wakefield, MA
781.245.2500
www.lecenvironmental.com

Figure 1: USGS Topographic Map
93 California Street
Watertown, MA

February 2, 2022

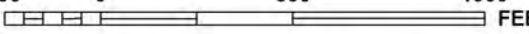






MAP SCALE 1" = 500'

250 0 500 1000



FEET

150 0 150 300



NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0552E

FIRM

FLOOD INSURANCE RATE MAP

**MIDDLESEX COUNTY,
MASSACHUSETTS**
(ALL JURISDICTIONS)

PANEL 552 OF 656
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
NEWTON, CITY OF	250208	0552	F
WALTHAM, CITY OF	250222	0552	F
WATERTOWN, TOWN OF	250223	0552	F

Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.



MAP NUMBER
25017C0552E

EFFECTIVE DATE
JUNE 4, 2010

Federal Emergency Management Agency

Figure 2: FEMA Flood Insurance Rate Map Page 348 of 457

LEGEND



SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.



FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.



ZONE X

OTHER FLOOD AREAS

Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.



ZONE X

OTHER AREAS

Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D

Areas in which flood hazards are undetermined, but possible.



COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS



OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.



1% annual chance floodplain boundary



0.2% annual chance floodplain boundary



Floodway boundary



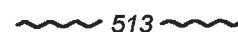
Zone D boundary



CBRS and OPA boundary



Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.



Base Flood Elevation line and value; elevation in feet*

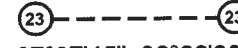
(EL 987)

Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988



Cross section line



Transect line

87°07'45", 32°22'30"

Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere

2476000mN

1000-meter Universal Transverse Mercator grid values, zone 19

600000 FT

5000-foot grid values: Massachusetts State Plane coordinate system, Mainland zone (FIPZONE 2001), Lambert Conformal Conic projection

DX5510 x

Bench mark (see explanation in Notes to Users section of this FIRM panel)

● M1.5

River Mile

MAP REPOSITORY

Refer to listing of Map Repositories on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP

June 4, 2010

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL



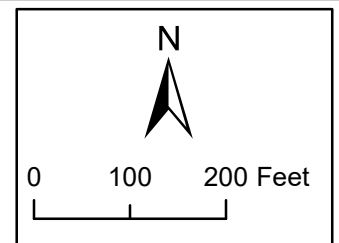
Environmental Consultants, Inc.

Wakefield, MA
781.245.2500

www.lecenvironmental.com

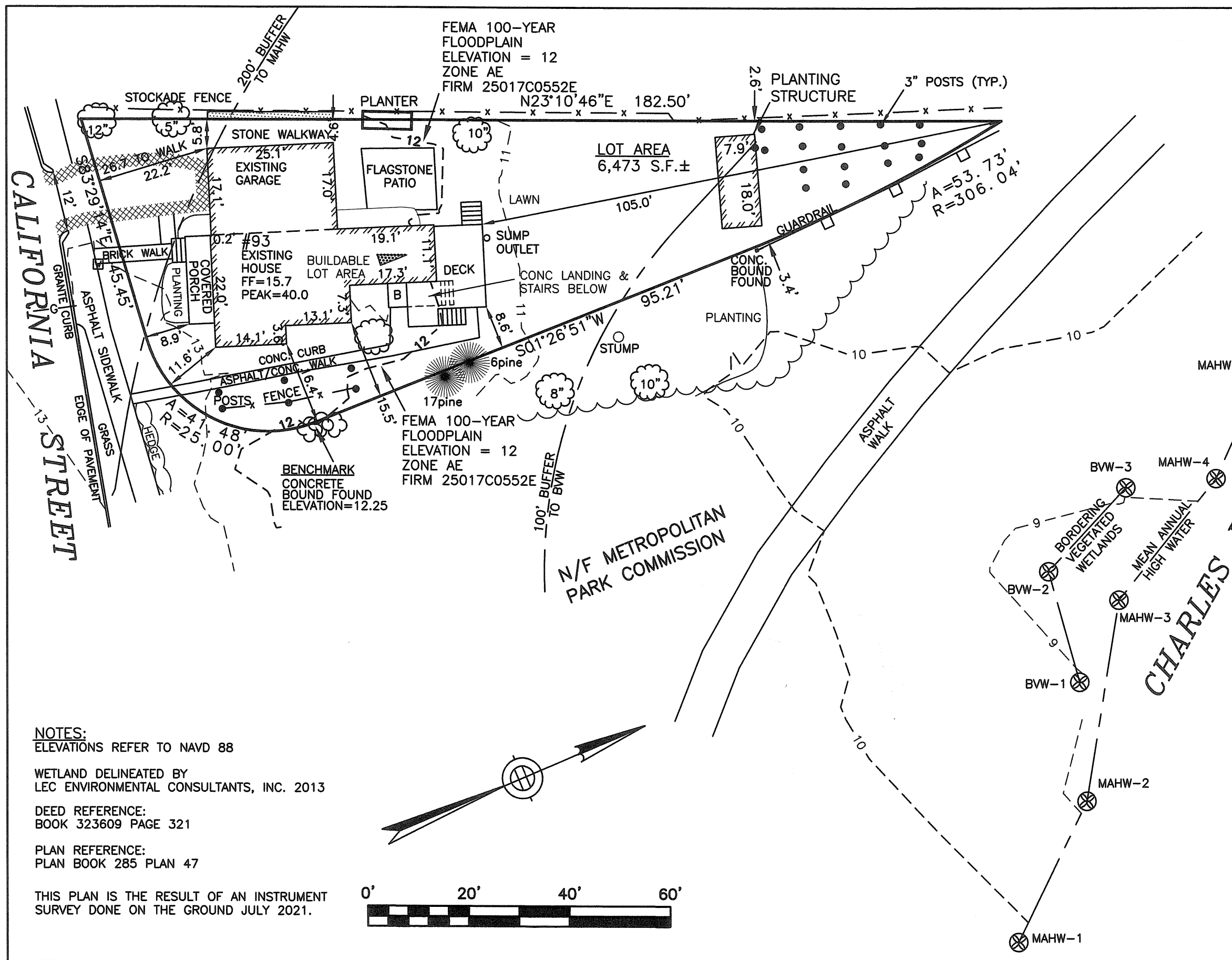
Figure 3: MassGIS Orthophoto & NHESP Map
93 California Street
Watertown, MA

February 2, 2022



Appendix B

Site Plan of Land in Watertown, MA, dated September 15, 2021
revised through October 4, 2021 and February 3, 2022
prepared by Everett M. Brooks Co.



ESTABLISHED 1916

EMB

EVERETT M. BROOKS CO.

SURVEYORS & ENGINEERS

49 LEXINGTON STREET
WEST NEWTON, MA 02465

(617) 527-8750
(617) 332-1578 FAX
info@everettbrooks.com



PLAN OF LAND IN
WATERTOWN, MA

93 CALIFORNIA STREET
EXISTING CONDITIONS

SCALE: 1 IN. = 20 FT.
DATE: SEPTEMBER 15, 2021
DRAWN: JF/ES/LNS
CHECK: BB

REVISIONS:
10/4/21 | 11x17 size | LNS
PROJECT NO. 24044 SHEET 1 OF 3

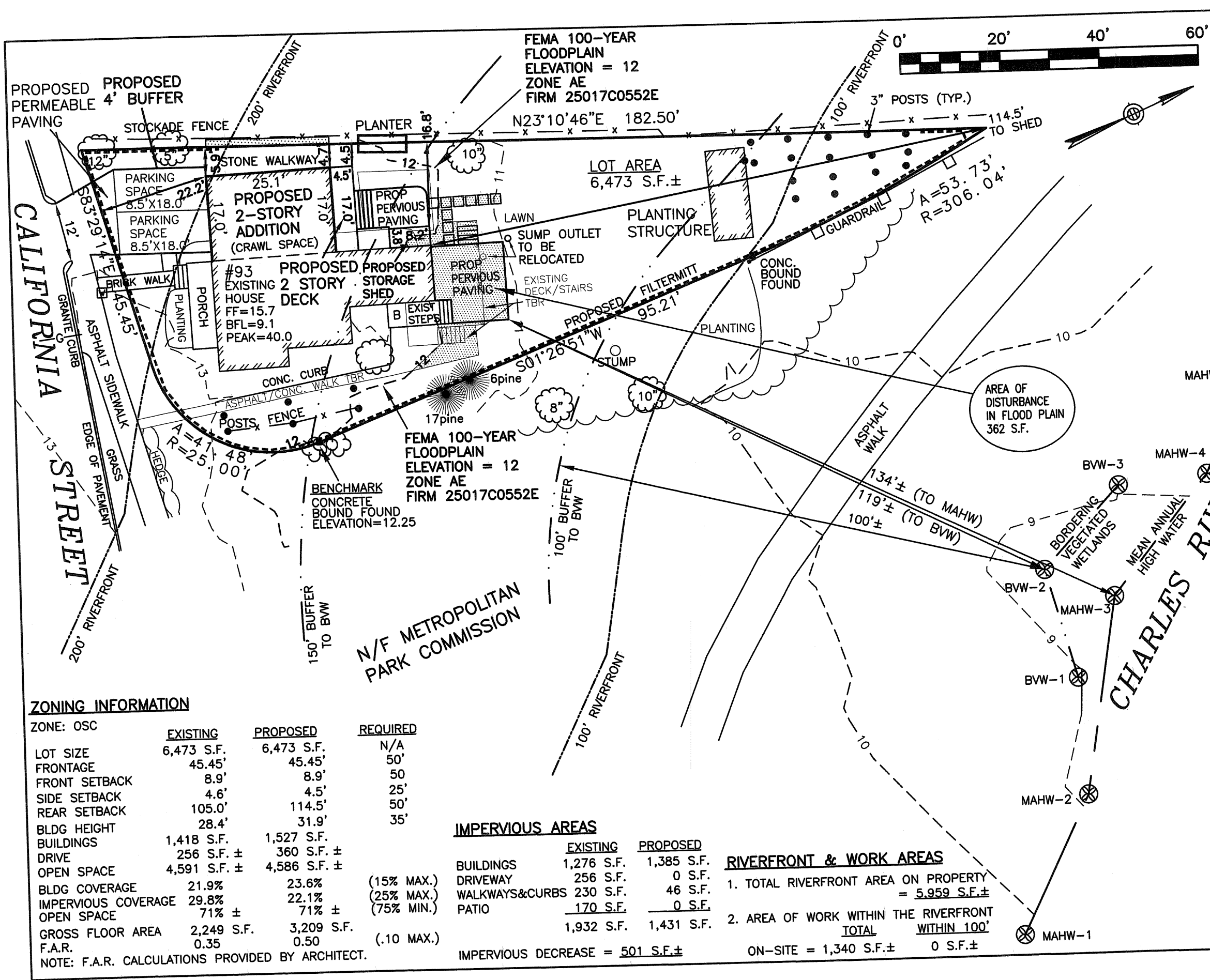
NOTES:
ELEVATIONS REFER TO NAVD 88

WETLAND DELINEATED BY
LEC ENVIRONMENTAL CONSULTANTS, INC. 2013

DEED REFERENCE:
BOOK 323609 PAGE 321

PLAN REFERENCE:
PLAN BOOK 285 PLAN 47

THIS PLAN IS THE RESULT OF AN INSTRUMENT
SURVEY DONE ON THE GROUND JULY 2021.



ESTABLISHED 1916

EMB

EVERETT M. BROOKS CO.

SURVEYORS & ENGINEERS

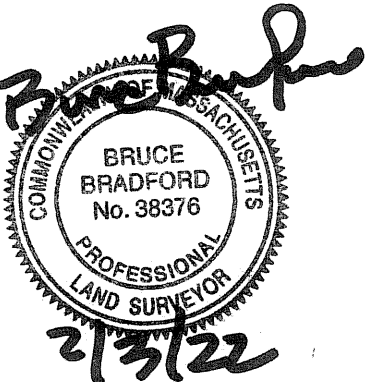
49 LEXINGTON STREET
WEST NEWTON, MA 02465

(617) 527-8750
(617) 332-1578 FAX
info@everettbrooks.com

CUT/ FILL IN FLOODPLAIN

CUT:
EXISTING DECK POSTS & STEPS = 3 C.F. ±
TOTAL = 3 C.F. ±

FILL:
PROPOSED SHED = 1 C.F. ±
TOTAL = 1 C.F. ±



**PLAN OF LAND IN
WATERTOWN, MA**

93 CALIFORNIA STREET
PROPOSED ADDITIONS

SCALE: 1 IN. = 20 FT.
DATE: SEPTEMBER 15, 2021
DRAWN: JF/ES/LNS
CHECK: BB

REVISIONS:

10/4/21	11x17 size	LNS
2/3/22	area of disturbance	LNS

PROJECT NO. 24044 SHEET 2 OF 3

ZONING INFORMATION

ZONE: OSC	EXISTING	PROPOSED	REQUIRED
LOT SIZE	6,473 S.F.	6,473 S.F.	N/A
FRONTAGE	45.45'	45.45'	50'
FRONT SETBACK	8.9'	8.9'	50'
SIDE SETBACK	4.6'	4.5'	25'
REAR SETBACK	105.0'	114.5'	50'
BLDG HEIGHT	28.4'	31.9'	35'
BUILDINGS	1,418 S.F.	1,527 S.F.	
DRIVE	256 S.F. ±	360 S.F. ±	
OPEN SPACE	4,591 S.F. ±	4,586 S.F. ±	
BLDG COVERAGE	21.9%	23.6%	(15% MAX.)
IMPERVIOUS COVERAGE	29.8%	22.1%	(25% MAX.)
OPEN SPACE	71% ±	71% ±	(75% MIN.)
GROSS FLOOR AREA	2,249 S.F.	3,209 S.F.	
F.A.R.	0.35	0.50	(.10 MAX.)

NOTE: F.A.R. CALCULATIONS PROVIDED BY ARCHITECT.

IMPERVIOUS AREAS

	EXISTING	PROPOSED
BUILDINGS	1,276 S.F.	1,385 S.F.
DRIVEWAY	256 S.F.	0 S.F.
WALKWAYS&CURBS	230 S.F.	46 S.F.
PATIO	170 S.F.	0 S.F.
	1,932 S.F.	1,431 S.F.

IMPERVIOUS DECREASE = 501 S.F. ±

RIVERFRONT & WORK AREAS

- TOTAL RIVERFRONT AREA ON PROPERTY = 5,959 S.F. ±
- AREA OF WORK WITHIN THE RIVERFRONT
TOTAL WITHIN 100'
ON-SITE = 1,340 S.F. ± 0 S.F. ±

LEGEND

- 

UTILITY POLE
- 

WATER GATE
- 

HYDRANT
- 

GAS GATE
- 

SEWER MANHOLE
- 

DRAIN MANHOLE
- 

CATCH BASIN
- 

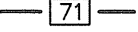
TREE
- 

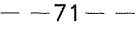
LIGHT POLE
- 

SIGN
- TBR

TO BE REMOVED
- TBA

TO BE ABANDONED
- 71.4 X

SPOT ELEVATION
- 

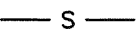
PROPOSED CONTOUR
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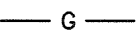
EXISTING CONTOUR
- 

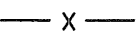
DRAIN LINE
- 

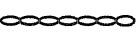
ROOF DRAIN
- 

FOUNDATION DRAIN
- 

WATER LINE
- 

SEWER LINE
- 

GAS LINE
- 

FENCE
- 

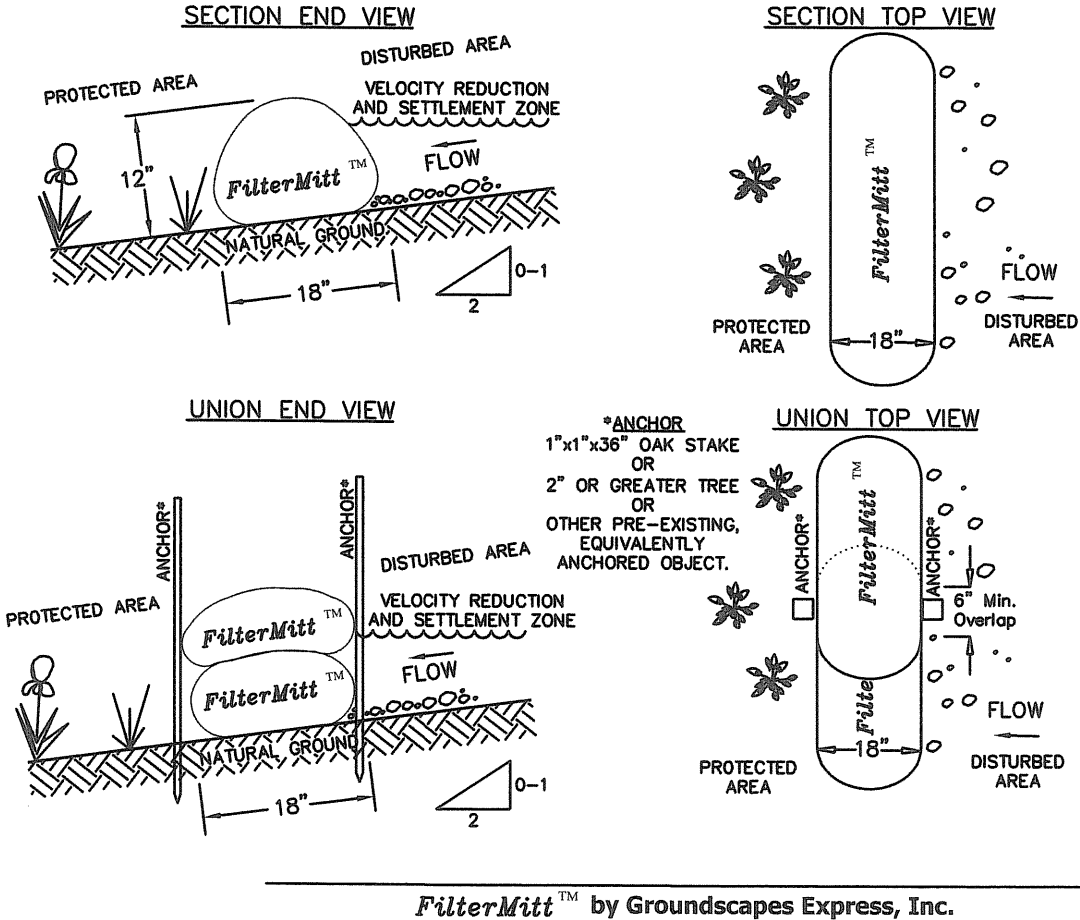
STONEWALL
- 

HEDGE
- 

TREE LINE
- 

FOUND IRON PIPE
- 

WETLAND FLAG



FilterMitt™ by Groundscapes Express, Inc.

2:1 SLOPES OR LESS
SILTATION CONTROL DETAIL
N.T.S.

FilterMitt™ COMPONENTS:
OUTSIDE CASING: 100% organic hessian.
FILLER INGREDIENT: *FiberRoot Mulch™*
• A blend of coarse and fine compost and shredded wood.
• Particle sizes: 100% passing a 3" screen; 90–100% passing a 1" screen; 70–100% passing a 0.75" screen; 30–75% passing a 0.25" screen.
• Weight: Approx. 850 lbs./cu.yd. (Ave. 30 lbs./l.f.)

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www.groundscapesexpress.com
or contact us at:
Groundscapes Express, Inc.
P.O. Box 737
Wrentham, MA 02093
(508) 384-7140

FilterMitt™ INSTALLATION:
With the newest technology and equipment, sections can be constructed on site in lengths from 1' to 100'.
Sections can also be delivered to the site in lengths from 1' to 8'.
The flexibility of FilterMitt™ allows it to conform to any contour or terrain while holding a slightly oval shape at 12" high by 18" wide.
Where section ends meet, there shall be an overlap of 6" or greater. Both sides shall be anchored (oak stakes, trees, etc.) to stabilize the union.

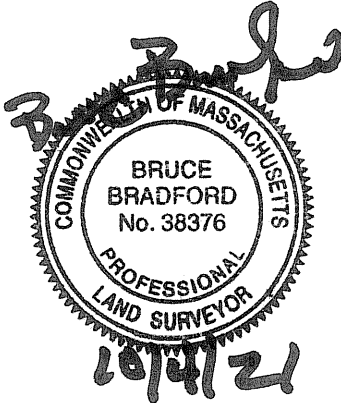
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EVERETT M. BROOKS CO.
SURVEYORS & ENGINEERS

49 LEXINGTON STREET
WEST NEWTON, MA 02465

(617) 527-8750
(617) 332-1578 FAX
info@everettbrooks.com



PLAN OF LAND IN
WATERTOWN, MA

93 CALIFORNIA STREET
LEGEND & DETAIL

SCALE: 1 IN.= 20 FT.
DATE: SEPTEMBER 15, 2021
DRAWN: JF/ES/LNS
CHECK: BB

REVISIONS:
10/4/21 | 11x17 size | LNS
PROJECT NO. 24044 SHEET 3 OF 3



ENVIRONMENTAL CONSULTANTS

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Amherst, Massachusetts 01002
Tel 413.256.0202 Fax 413.256.1092

March 30, 2022

Watertown Conservation Commission
149 Main Street
Watertown, MA 02472

Via email: Ischwab@watertown-ma.gov

**Re: Response to Peer Review Comments and revised site plans
0 Arlington Street . DEP File: 321-0174 . SWCA file: 59467**

Dear Commission Members:

Please find a revised site plan for the development of a small commercial building at 0 Arlington Street. This letter also addresses previous comments made by the Conservation Commission members during previous public hearings, a site visit, and comments made by Patrick Garner, peer reviewer for the Conservation Commission.

The key project changes are summarized below:

- Reduced the size of the commercial building footprint from 7,150 square feet to 5,960 square feet
- Removed the site access driveway to the property from Elm Street
- Shifted the building to the north to eliminate the driveway and reduce wetland impact.
- Reduced the wetland impacts from 4,215 square feet to 2,126 square feet
- Maintained the wetland mitigation area at 6,750 square feet
- Maintained the BVW restoration work (trash removal, invasive removal) at 6,810 square feet
- Designed all pavement with permeable asphalt
- Designed stormwater infiltration system to accommodate all site drainage.
- Designed new hydrodynamic water quality structure for offsite stormwater entering the site and the stream from Elm Street. Capable of storing 8.7 cubic yards of sediment and 758 gallons of water.
- Applicant is willing to create new walking path through site (location to be discussed with Commission)
- Applicant is willing to create an Open Space lot of 35,245 square feet containing the stream, wetlands, and mitigation areas as shown on site plan.

The Applicant is seeking to remove known contamination from the wetlands as part of the Project which will benefit the wetlands and Charles River watershed. A RAM plan has been provided with the NOI, and a Licensed Site Professional (LSP) has been retained to ensure proper compliance and handling of contaminated soils. The proposed commercial building is designed to provide office space for the family's import business of Greek food products.

Mickey Marcus
Professional Wetland Scientist #1635

Enc. Engineering Site Plans, Draft RAM plan

CC: DEP Northeast Region

Rick Salvo, project engineer

Patrick Garner, peer reviewer for Commission

Maximos Hatzilliades., Applicant

R. Nylen, Esq.

Response to DEP Comments for DEP file 321-0174 Provide Soil Pit data for stormwater system.

The soil pit data from Alliance will be provided as a separate response from the Project Engineer.

1. Ensure there is a minimum of two-foot separation between the bottom of the stormwater system and the estimated seasonal high groundwater.

These data will be provided by Project Engineer.

3. What is the TSS rating of the Water Quality Unit?

The TSS removal of the Contech (CDS5640-10-C) will be provided by the Project Engineer.

Response to peer review comments

These responses follow the peer review comment letter prepared by Patrick C. Garner Company, Inc. dated May 29, 2021.

1. Response to Garner-General Comments

Mr. Garner's general comments described the plans that he reviewed, the draft RAM and provided a general description of the existing conditions of the Property, including the relationship of Williams Pond to the downgradient Sawin's Pond. Mr. Garner also references post-industrial uses and identifies the contamination. The Applicant responds to Mr. Garner with the following additional material:

- Civil design plans from Engineering Alliance Group with the revisions noted above, now have a revision date of 09-28-2021 and are attached.
- The Draft RAM plan has been revised by Thomas Hevner, PE, LSP with Alliance Environmental Group is dated March 26, 2021 and is attached as an exhibit.
- The PCB analytical data collection was conducted by Brian Snow, LSP.
- The site was previously used by the Hood Rubber Company as a wastewater treatment pond (see below aerial photo). The historic pond on the property was last used for industrial purposes. It was referred to as the "Williams Property". The source of the PCB contamination on this property was due to an accidental release from the upgradient NSTAR property.



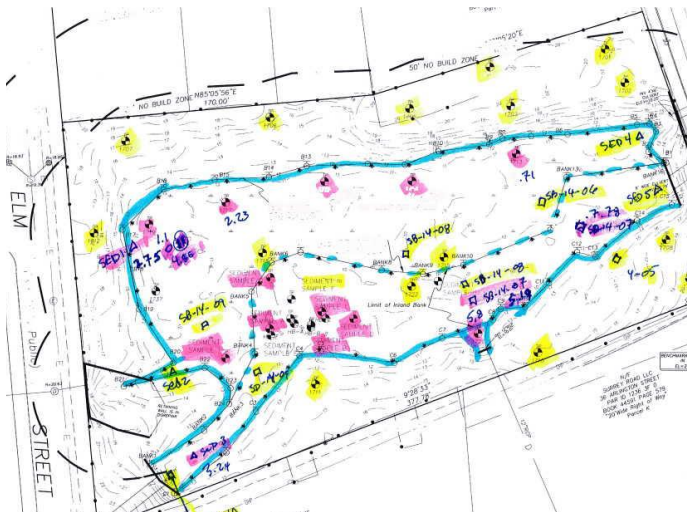
1951 aerial photograph showing the Williams Parcel as a stormwater detention pond for the Hood Rubber Company referenced by the Town's Peer Reviewer.



Undated photo of Hood Rubber Company. Williams' wastewater pond is on the right side of the photo.

- The “garden” on the site is for the use of the property owner (Applicant) who recently brought in topsoil to grow tomatoes and squash, and other edibles. The Watertown Conservation Commission has been informed of this activity. As demonstrated by the analytical work, this upland area is not PCB contaminated.
- Brush and clearing have been conducted as to provide access to the groundwater monitoring wells located on the property. The Applicant will remove all brush from the property during the redevelopment work. The monitoring wells will remain in place until they are decommissioned by the project LSP in compliance with the MCP.

- The Applicant has previously met with DEP Northeast Region to discuss redevelopment and remediation of this property under the Massachusetts Contingency Plan (MCP), and the downgradient property (Sawins Pond). The recommendation by DEP was to file a Notice of Intent with a development plan that also includes remediation of the site contamination. This NOI follows the DEP suggestions as the first step in site development, remediation, and site restoration.
- The proposed wetland alteration has been reduced from 4,215 square feet to 2,126 square feet, whereas the areas of BVW mitigation has been maintained at 6,740 square feet or 3 to 1. The draft RAM plan does not propose to alter all the wetlands on the site, only those associated with the proposed building work areas, and the most contaminated locations which are near the stream inlet. A previous plan discussed with the Conservation Commission and MassDEP involved excavating the entire stream. That alternative was determined to impact too much wetland. The direct BVW impacts have been reduced and are those shown on the current site plans (2,126 square feet of BVW).
- To improve wetland site conditions, the Applicant has not previously proposed but now seeks to excavate and remove three areas of high concentration PCBs from the stream channel (see plan below), with in-place wetland restoration. This requires wetland alteration, which would be considered a Limited Project under 310 CMR 10.53, with the benefit of removing areas of high concentration PCBs from soils to prevent downstream migration. The Purple locations show concentrations of PCBs in the location of the proposed building, and in three separate locations within the stream channel. The yellow sampling locations show no PCBs, or levels below 1 ppm. The analytical data was provided to the Conservation Commission as part of the RAM plan.



Map by Brian Snow, LSP, showing areas of PCBs (purple) above reportable concentrations. The Commission has been provided with all analytical testing data and the draft RAM plan.

- The installation of the Contech CDS stormwater treatment unit has been designed to improve the water quality entering the property from Elm Street. The proposed unit provides TSS removal and contains a sediment sump and hydrocarbon separator. This stormwater improvement was designed by Alliance following a previous meeting with the Watertown DPW who made this specific recommendation. This work is proposed at considerable cost to the Applicant, and it is not necessary for the proposed commercial building stormwater management. The stormwater improvements proposed are intended as an addition to the overall Riverfront Area Redevelopment mitigation plan. This aspect of stormwater mitigation may be deleted from the project plans if it is not acceptable to the Conservation Commission.

2. Wetland Related Overview and Comments

- An ORAD was issued in July 2019 defining the wetland resource areas and locations. The Resource Areas and boundaries are not in dispute for this NOI application. The remaining question is whether the Project activities meet the performance standards under the WPA and the Watertown Wetland Ordinance.
- The NOI application for a proposed commercial building on this upland portion of the property is seeking confirmation as a Riverfront Redevelopment project. As also noted in the peer review comments, this is an urban lot used for 20th century industrial uses, it is surrounded by roadways (Elm Street and Arlington Street), the Watertown Mall, and other commercial/residential development; the project meets the Riverfront Redevelopment standards at 10:58(5) as it is a previously developed urban site (wastewater treatment), contains urban fill (proposed building location); and the site contains PCB contaminated soils. An examination of the filled slope adjacent to the BVW shows that the soils are fill, with construction debris, and other unsuitable materials. The NOI proposes to reuse a degraded previously developed urban property, and to improve existing conditions through the removal of contaminated soil, creation of wetland mitigation areas to compensate for the alteration of contaminated wetlands, and to restore existing wetland by removal of invasive species and replanting native vegetation. We believe that both the Watertown Conservation Commission and DEP would agree that this property should be treated as a Riverfront Redevelopment project, like other approved redevelopment projects in Watertown.
- There is a suggestion by the Town's peer reviewer that the Williams Pond parcel does not qualify as a developed or degraded site for purposes of the Riverfront regulations. That suggestion is contrary to the evidence with respect to the status of Williams Pond and Sawin's Pond as the longstanding sites of contaminated soils, contaminated sediments and debris. There are recorded releases of polychlorinated biphenyl transformer fluid (PCBs) onto the Williams Pond site, which triggered the filing of downgradient status based on the off-site upgradient releases. According to its history, Williams Pond and the downgradient Sawin's Pond were artificially created in the late 1800's as part of a resort developed by George Sawin. When the resort went out of business, Hood Rubber Company purchased the two ponds to supply cooling water to the manufacturing facility. BF Goodrich purchased the property and used the ponds for dumping tires and debris. Sediment analysis of Williams Pond post-1996 (the date used by the Riverfront Act regulations) showed the area as degraded with PCBs, metals and petroleum combination. It is clear that as of 1996, pursuant to the regulations, Williams Pond was a degraded land form. Further, the suggestion by the peer reviewer that the undefined abandoned dumping ground should be restricted to only solid waste facilities is not consistent with case law or the facts. Case law states that when a term is not defined, one turns to the ordinary meaning of the term. An abandoned dumping ground is an area where debris and materials were dumped, similar to Williams Pond.
- In accordance with 310 CMR 10.58(4)(c) there must be no practicable and substantially economic alternative to the proposed project with less adverse effects on the interests of the Act. Based on the configuration of the wetlands and uplands on this property, any proposed development on this site is within the Riverfront Area. The project has been designed to reduce the direct environmental impacts, while providing substantial environmental improvements in the form of stormwater management, removal of contaminants, and ecological restoration.
- As noted by the Peer reviewer, most of the upland area on this property is within the 50-foot no-build zone regulated by the Watertown Wetland Ordinance. The Applicant has requested a waiver/variance since the Ordinance restricts all potential development use on the property. During the Conservation site visit on June 4, 2021, at least one member of the Conservation Commission suggested denying the

project, and then obtaining the subject property for use by the City, presumably using the 50-foot no-build area. This is not currently an option the Applicant is willing to negotiate.

- There is no 100-year floodplain associated with this site as confirmed by the City's peer reviewer.
- The site is not within Estimated, or Priority Habitat for Endangered Species as confirmed by the City's peer reviewer.

Invasive Species.

- There are significant areas of invasive shrub species within the BVW and buffer zone (Riverfront Area) that can be mitigated. The proposed plan is to remove the invasive species, and to replace these areas with native shrubs as encouraged by the Riverfront regulations at 310 CMR 10.58(5). The NOI and site plans proposes to use up to 200 shrubs to be planted following the removal of the invasives. This plan is proposed as additional Riverfront Area redevelopment mitigation. During our site visit with the Conservation Commission, we understood from the Commission members that removal of the invasive species on this property was desirable.
- As noted by the peer reviewer, eradication of species such as Japanese Knotweed will be a difficult but necessary multi-year process. We anticipate 3-5 years of invasive species management will be required on this property. Up to 85% of the invasive species are typically controlled during the first year of herbicide control, with the remaining plants treated by spot treatments in subsequent years. Both spray and dab and wipe herbicide application techniques will be used. Since many of the invasive species are found within BVW, an annual License to Apply will be required each year from MassDEP, and the applications must be performed by a MA aquatic herbicide applicator. We would request the Order of Conditions permit invasive species control work for a 5-year period, with annual reporting to the Conservation Commission on the status of this work.

2. Stormwater Comments

- The peer reviewer informed the Commission that the stormwater design conforms to DEP Stormwater regulations. We agree. The design uses the most recent NOAA Atlas 14 precipitation data to accommodate climate driven rainfall events. LID technology has been incorporated into the design (pervious asphalt parking area, infiltration trenches for roof runoff, and the use tree boxes for infiltration. Additionally, a new stormwater separator is proposed to remove sediment, solids and hydrocarbons coming into the brook from the existing drainage from Elm Street. This is a recommendation previously made by the Watertown DPW.
- Alliance Engineering will provide the Conservation Commissions with the soil test pit log to demonstrate that the subsurface infiltration chambers have at least a two-foot separation from seasonal high groundwater

4. Outstanding Issues

- The proposed alteration of BVW has been reduced from 4,215 square feet to 2,126 square feet. The area of BVW mitigation has been maintained at 6,740 square feet or a 3 to 1 benefit/improvement. There is no additional work proposed within wetlands, other than what is shown on the site plan, unless the additional PCB removal from three locations within the stream channel is requested and approved by the Conservation Commission as a Limited Project.
- As Shown on Sheet C-3 the Alliance plans show a modification of the existing direct discharge of stormwater from Elm Street by incorporating a new Contech CDS unit to remove sediment and hydrocarbons from entering the site and the brook. This recommendation was made by the Watertown

DPW. The Applicant will withdraw this work if the Conservation Commission does not support this water quality improvement. This improvement is not necessary to meet the Performance Standards of the WPA or the Ordinance.

- A grading plan for the southwest corner of the site, adjacent to the Brook has not been provided because the excavation depth will be dependent on the LSP finding of contamination. All located contaminated soils will be removed from the wetlands during construction. The final grade of the constructed BVW will match the existing BVW adjacent to the brook. The Applicant will provide a grading plan if requested by the Commission, as the final excavation depth will be determined by the project LSP.
- The proposed wetland mitigation/restoration is to remove the upland fill dumped previously, and to match the grades to the adjacent wetlands, restoring the wetlands. The mitigation area depth of construction is not based on Seasonal High Ground Water, but to match grades at the adjacent wetlands, which has appropriate hydrology to support wetland vegetation.
- The NOI addresses the removal of invasive plant species from the upland and wetland on the property, and to replace these with approximately 200 native shrubs. The location of these plantings will be based on the spacing available following removal and die-back of the invasive species. We anticipate that the invasive control work and re-planting will take up to 5 years to complete.

Building Discussion

The building has been reduced from a 7,150 square foot footprint to 5,960 square feet, with a footprint altering 2,126 square feet of BVW. This change was made to reduce wetland impacts by shifting the building to the north and west, as far as zoning setbacks allow.

- Preliminary soil borings on the site (see above site plan for locations) have been conducted, including one boring in the location of the building, and five borings within the footprint of the parking lot. A full geotechnical evaluation for the building foundation will be conducted prior to construction, and in coordination with the project LSP. PCB contaminated soils (up to 4.66 ppm) have previously been found in the wetlands proposed to be altered and are functioning at a lower value.
- Based on preliminary boring data, no dewatering during building construction is anticipated.
- The proposed wetland mitigation area will meet all DEP standards for wetland replication in accordance with DEP guidelines, including multiple years of monitoring groundwater and vegetation. We suggest that these standards should be cited in the Order of Conditions.
- The revised building footprint is approximately 40 feet from the banks of the brook, not 18 feet as previously proposed. No additional impacts to Resource Areas are anticipated during construction, or from adjacent uses.
- There is no associated 100-year floodplain associated with this site, and any over-bank flooding is likely to be restricted to the adjacent wetlands. No flooding impacts to the proposed building are expected based upon FEMA elevations. The proposed stormwater management system is designed to improve existing runoff conditions by providing infiltration of all stormwater runoff.
- The proposed building is designed to meet Watertown zoning regulations for property line setbacks and height. There are no anticipated detrimental effects on vegetation, or wildlife use due to building shading, or temperature changes. The site does not support vernal pools, estimated habitat, or priority habitat which may be influenced by subtle environmental changes. The site is surrounded by existing impervious development, and the primary source of water in the brook is runoff from the Watertown Mall parking lot and drainage from Elm Street. The proposed remediation of PCB contamination from the site, and the

stormwater improvements proposed in the NOI are designed to enhance functions as part of the site development.

- A retaining wall is proposed to reduce intrusion into wetlands with grading, and the building is designed with interior footings which will allow construction of the foundation to be completed with interior work, reducing the total wetland impacts.
- The proposed building, and the parking lot, will have vertical walls to reduce wetland impacts by grading. No additional wetland impacts, other than those shown on the site plans are anticipated.
- Following construction of the vertical retaining walls, routine O&M is not anticipated.
- Construction of the building and retaining walls are proposed to be constructed from the upland portion of the site, with no additional wetland intrusion, other than the areas shown on the site plans.

5. **Watertown Wetland Ordinance**

The Applicant has requested in the NOI a waiver/variance from the Ordinance for work within 50 feet of wetlands. The waiver / variance is solely limited to the provision of the Ordinance that prohibits construction of a building within 50-feet of a wetland resource area and is not required for any other provision of the Wetlands Protection Act or its regulations. A waiver / variance for this Project meets the three (3) below provisions of the Watertown regulations as follows:

1. There are no reasonable conditions or alternatives that would allow the proposed activity to proceed in compliance with said regulations.
- The Project has two (2) limiting physical features; the Riverfront Area associated with the stream and the physical contamination in the stream / wetlands. The Project remedies an ongoing contamination source that affects the Charles River watershed and should be welcomed for its benefit to wetland functions. In turn, a portion of a degraded and developed Riverfront Area will also be enhanced, removing an existing eyesore, environmental contamination and introducing stormwater management to the area.
2. Avoidance, Minimization And Mitigation And Have Been Employed To The Maximum Extent Feasible.
- The Project design is based upon these three (3) principles as the Applicant has shown that it cannot avoid work in the no-disturb area. Secondly, the building has been reduced to the extent feasible and as noted above and below, the work mitigates impacts by rotating the entrance, meeting zoning setbacks and has promoted a design that removes contaminated sediments, treats stormwater, removes invasive species and adds wetland species to enhance wetland functions.
3. The variance is necessary to accommodate an overriding public interest or to avoid a decision that so restricts the use of the property as to constitute an unconstitutional taking without compensation.
- In this case, the Project meets both tests. First, as noted above and below, this Project will have an overriding public interest by removing contaminated sediments and soils and treating off-site stormwater. As the Commission is well aware, the upgradient Williams Pond flows downgradient to Sawin's Pond and ultimately to the Charles River. It is an overriding public interest to clean the contaminated sediments and provide treatment of contaminated stormwater prior to discharge to the Charles River.
 - In addition, there are no other allowable uses on the Property which renders the denial of the use a taking of the Property. The Applicant purchased the Property prior to the enactment of the wetland restriction with an investment backed expectation. A variance is supported also by the following:
 - In further support of the waiver / variance the Applicant states:

- The upland property is located entirely in the 50-foot no-build area and there are no alternative designs to remove the building from the no-build area. The Applicant has redesigned the Project to reduce the building size and enhance wetland functions.
- Due to the configuration of wetlands on this lot, a waiver / variance is required to permit the building and remove contamination.
- The Applicant has provided a building plan for redevelopment that will accommodate an overriding public interest, improves the existing conditions, and the interests of the Ordinance by treating stormwater from Elm Street prior to entering the brook; removing PCB contaminated soils and preventing downstream migration; restoring wetlands by removing invasive species and replanting native plants; creating more than 1:1 wetland mitigation; and creating a public access corridor between Elm and Arlington Streets.
- The Applicant has reduced the size of the proposed building, reduced wetland impacts, and has provided full mitigation for all disturbed wetlands on a 3 to 1 basis. Additionally, the Applicant is willing to provide removal of PCB contaminated soils from within three locations in the stream channel as a Limited Project pursuant to 310 CMR 10.53(3).
- The Applicant and his engineering, legal, and professional team, including wetland and LSP experts believe that the proposed project work, along with the recommended mitigation, will not have a significant or cumulative effect on the interests of the Wetlands Protection Act, or the Watertown Wetland Ordinance and meets the performance standards.
- Lastly, the Applicant has provided a proposed parcel segregation to protect the wetlands in the future by creating a protected open space (Lot B, 35,245 sf) which may have protected covenants recommended by the Conservation Commission to ensure permanent protection as open space and a wildlife corridor. The development parcel (Lot A, 26,466 sf) will remain with the Applicant. The proposed property lines are depicted on Site Plan C-2 for conservation restriction.

No Action Alternatives:

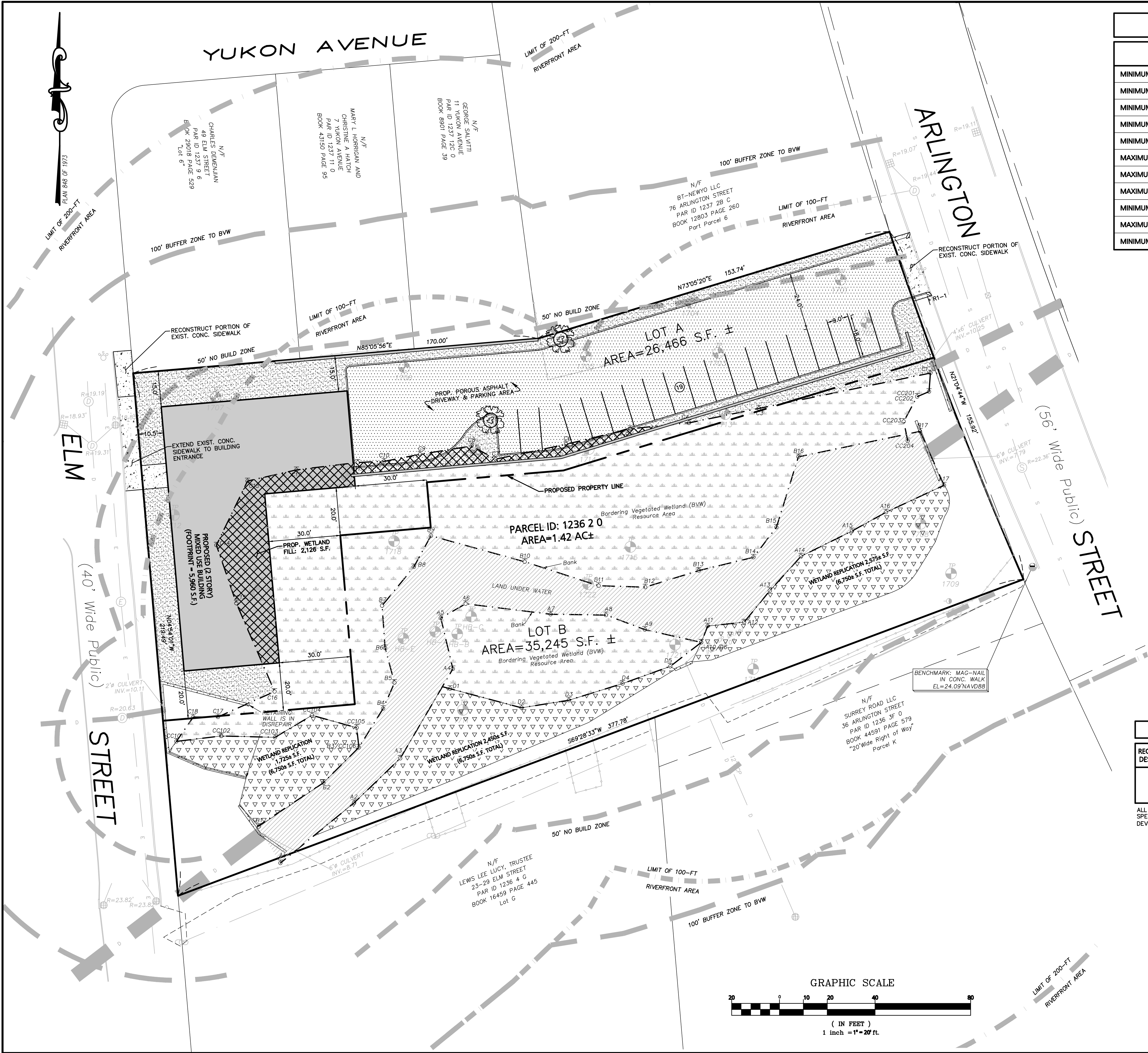
- If the project does not go forward, the Parcel remains a fenced, contaminated property, with Activity and Use Limitation, not generating taxes or local jobs, and leaving the contamination on-site.
- No improvement of impaired water quality
- The potential for migration of contaminated sediment towards Charles River.
- Continued presence of PCB contaminants

Public Benefits:

- Remediation of PCB contamination under the direction of an LSP
- Improve existing municipal stormwater system from Elm Street
- Manage existing stormwater runoff from site by infiltration of roof drainage and parking areas
- Provide public access through property from Elm Street to Arlington Street
- Restore wetlands, enhance habitat, and provide a protected wildlife corridor by creating a 35,245 protected Open Space Lot.

Summary

The Project team has worked hard to address the existing conditions on the lot and the development restrictions of Riverfront Area and contamination. The Project team considers the design to be an important and critical step to addressing a longstanding negative environmental presence in Watertown with contaminant removal and stormwater treatment in the Charles River Watershed. The Project meets the goals of the Wetlands Act and the Ordinance which is protect and enhance the functions of wetland resource areas.



LAND USAGE TABLE				
Regional Mixed Use (RMUD)				
ITEM	REQUIRED	PROVIDED LOT A	PROVIDED LOT B	VARIANCE/WAIVER REQUIRED
MINIMUM LOT SIZE	10,000 SF	26,466 ± SF	35,245 ± SF	NO
MINIMUM LOT FRONTAGE	50 FT	55.9 FT	73.4 FT	NO
MINIMUM FRONT YARD SETBACK	10 FT	10.5 FT	N/A	NO
MINIMUM SIDE YARD SETBACK	15 FT	15 FT	N/A	NO
MINIMUM REAR YARD SETBACK	20 FT	30 FT	N/A	NO
MAXIMUM BUILDING COVERAGE	75 %	22.5%	N/A	NO
MAXIMUM IMPERVIOUS COVERAGE	85 %	61.7%	N/A	NO
MAXIMUM HEIGHT (FT/STORIES)	55 FT / 5	35 FT / 2	N/A	NO
MINIMUM LOT AREA PER DWELLING UNIT	N/A	-	-	NO
MAXIMUM FAR	1.0	0.45	N/A	NO
MINIMUM OPEN SPACE	20 %	38.3%	N/A	NO

NOTES:

SIDE YARDS BETWEEN BUILDINGS WITHOUT DWELLING UNITS MAY BE OMITTED BY SPECIAL PERMIT PROVIDED THAT THE SIDE YARD DOES NOT ADJOURN RESIDENCE DISTRICT, AND THAT THE ACCESS OF EMERGENCY EQUIPMENT TO THE REAR PARKING IS NOT RENDERED INACCESSIBLE.

FOR ALL NEW CONSTRUCTION IN THE RMUD DISTRICT, THE MAXIMUM LENGTH OF A CONTIGUOUS BUILDING FACADE SHALL BE NO MORE THAN 150FT LONG OR UP TO 250FT LONG BY SPECIAL PERMIT IN KEEPING WITH ADOPTED DESIGN GUIDELINES.

LEGEND - SITE LAYOUT PLAN	
PROPERTY LINE	
PROPOSED STRIPING	
PROPOSED BUILDING	
PARKING COUNT	(11)
PROPOSED RETAINING WALL	
PROPOSED CURBING	
PROPOSED POROUS ASPHALT	
PROPOSED CONCRETE SIDEWALK	
PROPOSED LANDSCAPED AREA	
PROPOSED DIRECTIONAL ARROW	
PROPOSED SIGN	

COMPONENT	REQUIRED	PROPOSED
RETAIL	10 SPACES 1.0 space per 350 gsf 3,500/350 = 10 spaces	19 SPACES (STANDARD SPACES)
WAREHOUSE	9 SPACES 1.0 space per 1,200 gsf 10,800/1,200 = 9 spaces	
TOTAL	19 SPACES	19 SPACES

SIGN TABLE					
REGULATORY DESCRIPTION	SIGN	SIZE	MOUNTING HEIGHT (BRACING TO BOTTOM OF SIGN)	DESCRIPTION	REFLECTORIZED
R1-1		24" x 24"	7' - 0"	WHITE ON RED	YES

ALL SIGNS AND PAVEMENT MARKINGS TO BE INSTALLED SHALL CONFORM TO THE APPLICABLE SPECIFICATIONS OF THE CURRENT EDITION OF THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD)

APPLICANT:

Maximos Hatziliades
71 Arlington Street
Watertown, MA 02472

DWG. NO.

C-2

PROJECT:

Proposed Site Plan
Arlington Street & Elm Street
(Parcel ID: 1236 2 0)
Watertown, Massachusetts

DESIGN BY: Calvin Reach

PREPARED BY:

Engineering Alliance, Inc.
Civil Engineering & Land Planning Consultants
194 Central Street
Saugus, MA 01906
Tel: (781) 231-1349
Fax: (603) 6107101

DATE

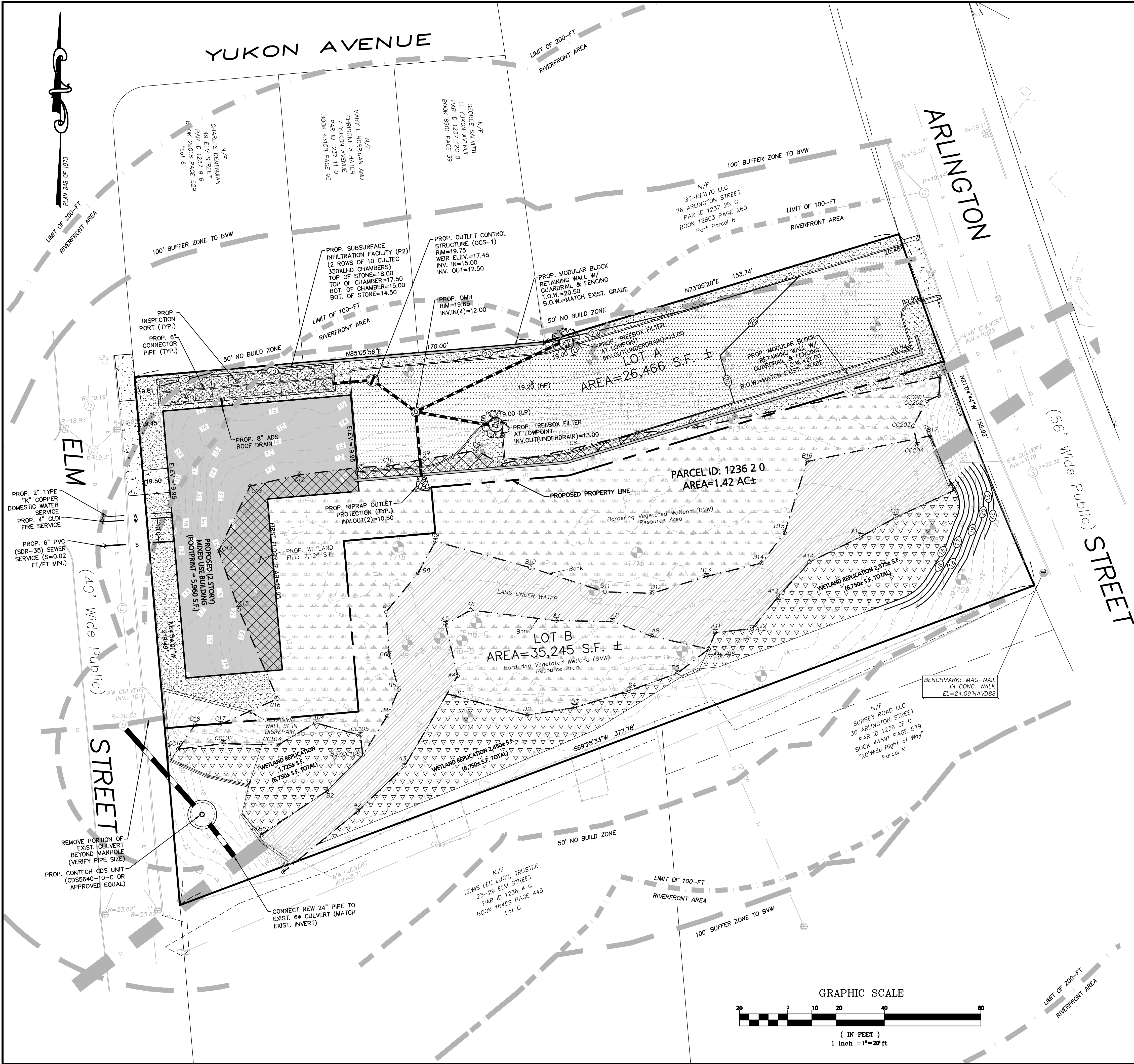
9-28-2021

DRAWING TITLE:

Site Layout Plan

MODIFY WETLAND IMPACT & SUBDIVIDE LOT

DESCRIPTION OF REVISION



LEGEND - GRADING, DRAINAGE, & UTILITY

PROPERTY LINE	
PROPOSED BUILDING	
PROPOSED DRAIN LINE	
PROPOSED SEWER LINE	S
PROPOSED WATER LINE	W
PROPOSED CONTOUR	20.45'
PROPOSED SPOT SHOT	20.45'

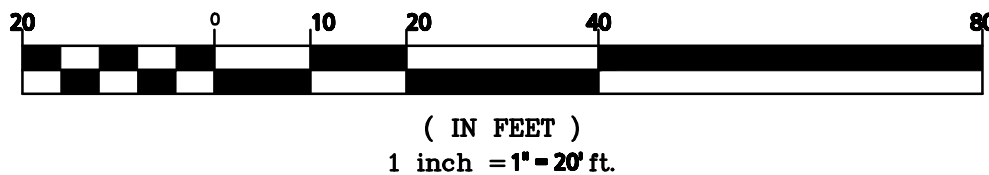
GENERAL UTILITY NOTES:

- THE CONTRACTOR IS SPECIFICALLY CAUTIONED THAT THE LOCATION AND/OR ELEVATION OF EXISTING UTILITIES AND STRUCTURES AS SHOWN ON THESE PLANS IS BASED ON RECORDS OF VARIOUS UTILITY COMPANIES AND WHERE POSSIBLE, MEASUREMENTS TAKEN IN THE FIELD. THIS INFORMATION IS NOT TO BE RELIED UPON AS BEING EXACT OR COMPLETE. THE LOCATION OF ALL UNDERGROUND UTILITIES AND STRUCTURES SHALL BE VERIFIED IN THE FIELD BY THE CONTRACTOR PRIOR TO THE START OF CONSTRUCTION. THE CONTRACTOR MUST CONTACT THE APPROPRIATE UTILITY COMPANY, ANY GOVERNING PERMITTING AUTHORITY, AND "DIGSAFE" AT LEAST 72 HOURS PRIOR TO ANY EXCAVATION WORK TO REQUEST EXACT FIELD LOCATION OF UTILITIES AND THE ENGINEER SHALL BE NOTIFIED IN WRITING OF ANY UTILITIES INTERFERING WITH THE PROPOSED CONSTRUCTION AND APPROPRIATE REMEDIAL ACTION TAKEN BEFORE PROCEEDING WITH THE WORK. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO RELOCATE ALL EXISTING UTILITIES WHICH CONFLICT WITH THE PROPOSED IMPROVEMENTS SHOWN ON THE PLAN.
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR ESTABLISHING AND MAINTAINING ALL CONTROL POINTS AND BENCHMARKS NECESSARY FOR THE WORK.
- THE CONTRACTOR SHALL EXCAVATE TEST PITS PRIOR TO COMMENCING WORK TO DETERMINE THE EXACT LOCATION OF WATER AND GAS SERVICES.
- ALL PROPOSED WORK SHALL BE PERFORMED IN FULL COMPLIANCE WITH THE TOWN OF WATERTOWN, AND IS SUBJECT TO QUALITY CONTROL TESTING AT THE DISCRETION OF THE ENGINEERING DEPT. AT THE EXPENSE OF THE CONTRACTOR. THE CONTRACTOR SHALL NOTIFY THE TOWN OF WATERTOWN D.P.W. PRIOR TO THE COMMENCEMENT OF ANY UTILITY WORK.
- ALL UTILITY WORK WITHIN ANY RIGHT-OF-WAY SHALL BE PERFORMED BY A CONTRACTOR LICENSED BY THE DPW & OBTAIN A PERMIT FOR SUCH WORK FROM THE DPW.
- ANY CHANGE IN THE FIELD CONDITIONS SHOULD BE REPORTED TO THE ENGINEER TO ENSURE THAT ANY MODIFICATIONS TO THE ORIGINAL DESIGN CONFORM TO STANDARD ENGINEERING AND CONSTRUCTION PRACTICES AND ADEQUATE TO SERVE THE PROJECT'S NEEDS AND COMPLY WITH APPLICABLE STANDARDS AND REGULATIONS.
- CONTRACTOR SHALL BE RESPONSIBLE FOR INSTALLING ALL UTILITIES AS SHOWN ON THESE PLANS IN ACCORDANCE WITH THE APPROPRIATE UTILITY COMPANY SPECIFICATIONS. ALL UTILITY CONSTRUCTION SHALL CONFORM TO THE APPROPRIATE UTILITY COMPANY STANDARDS FOR CONSTRUCTION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING SPECIFICATIONS OF MATERIALS AND INSTALLATION PROCEDURES AND INSTALL IN ACCORDANCE WITH THESE REGULATIONS.
- THE CONTRACTOR IS RESPONSIBLE TO CONTACT AND DETERMINE, COORDINATE AND SCHEDULE ALL NECESSARY INSPECTIONS AND MONITORING WITH ALL APPROPRIATE UTILITY COMPANIES.
- THE CONTRACTOR OR OWNER IS RESPONSIBLE FOR OBTAINING AND PAYING FOR ANY PERMITS AND/OR CONNECTION FEES REQUIRED TO PERFORM THE WORK.
- DISPOSAL OF ALL MATERIALS IS THE RESPONSIBILITY OF THE CONTRACTOR AND MUST BE OFF-SITE IN ACCORDANCE WITH ALL FEDERAL, STATE, AND LOCAL MUNICIPAL REQUIREMENTS.
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR SITE RESTORATION AND CLEAN UP UPON COMPLETION OF THE PROJECT & SHALL SUBMIT AN AUTOCAD "AS-BUILT" TO THE ENGINEERING DEPT. UPON COMPLETION OF THE BUILDING & UTILITY WORK.

DRAINAGE NOTES:

- ALL STORM DRAINAGE PIPES SHALL BE 12" HIGH DENSITY POLYETHYLENE PIPE (H.D.P.E.) CORRUGATED OUTSIDE & SMOOTH INSIDE UNLESS NOTED OTHERWISE.
- A MINIMUM OF 18" VERTICAL CLEARANCE SHALL BE MAINTAINED WHERE WATER SERVICES CROSS STORM DRAIN LINES. WATER SERVICES SHALL BE ENCASED IN CONCRETE REGARDLESS OF CLEARANCE WHEN PASSING BELOW STORM DRAIN LINES. ENCASEMENT SHALL EXTEND ALONG WATER SERVICE A MINIMUM DISTANCE OF 10' FROM THE CROSSING POINT OF THE OTHER PIPE AS MEASURED NORMALLY FROM ALL POINTS ALONG THE PIPE.
- REFER TO ARCHITECTURAL DRAWINGS FOR ALL SERVICE CONNECTIONS (I.E., ROOF DRAINS, WATER AND SEWER SERVICES, ETC.) WITHIN 10'-FT OF THE BUILDING WALLS.

GRAPHIC SCALE



PREPARED BY:

Engineering Alliance, Inc.
Civil Engineering & Land Planning Consultants
194 Central Street
Saugus, MA 01906
Tel: (781) 231-1349
Fax: (603) 6107100

PROJECT:

Proposed Site Plan
Arlington Street & Elm Street
(Parcel ID: 1236 2 0)
Watertown, Massachusetts

PROJECT #:

09-27801

SCALE:

As Noted

DESIGN BY:

Calvin Reach

DATE:

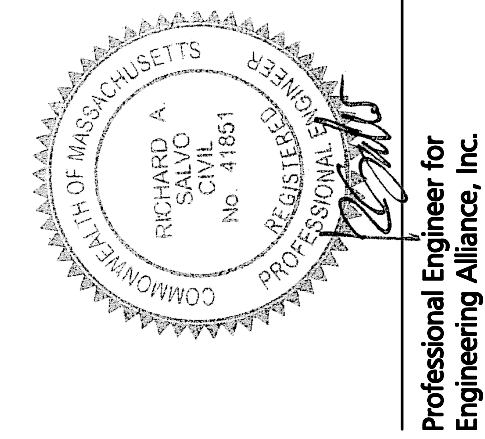
March 12, 2021

DWG FILE NAME:

060120.dwg

CHECKED BY:

Richard A. Salvo, P.E.



Professional Engineer for
Engineering Alliance, Inc.

Maximos Hatziliades
71 Arlington Street
Watertown, MA 02472

DRAWING TITLE:
**Grading, Drainage
& Utility Plan**

DWG. NO.
C-3

MODIFY WETLAND IMPACT & SUBDIVIDE LOT
DESCRIPTION OF REVISION

9-28-2021
DATE





DRAFT RAM Plan



Undeveloped Property

Arlington Street, Coolidge Avenue

Watertown, Massachusetts

F.W. Webb/AEG Project No. 2999.01

March 26, 2021

PREPARED FOR:

Mr. Maximos Hatziliades

5 Madison Street

Belmont, MA 02478

PREPARED BY:



F.W. WEBB COMPANY

Dedicated to Responsive and Resourceful Solutions

100 Jefferson Boulevard, Suite 220

Warwick, Rhode Island 02888

401.732.7600



F.W. WEBB COMPANY

March 26, 2021

Massachusetts Department of Environmental Protection
Northeast Regional Office
205 Lowell Street
Wilmington, MA 01887

**Re: DRAFT Release Abatement Measure (RAM) Plan
Sawins and Williams Pond, Undeveloped Property
Arlington Street, Coolidge Avenue, Watertown, MA
Watertown Tax Map 1236 Block 2 Lot 0
MassDEP RTN 3-0457
F.W. Webb/AEG Project No. 2999.01**

Dear Sir or Madame:

On behalf of Mr. Maximos Hatziliades and SWCA Environmental Consultants, Alliance Environmental Group / An F.W. Webb Company (F.W. Webb/AEG) has completed a DRAFT Release Abatement Measure Plan for a redevelopment project at Arlington Street (Watertown Tax Map 1236 Block 2 Lot 0) in Watertown, Massachusetts, hereinafter the "Site."

In response to the presence of nickel, beryllium, chromium, benzo(a)pyrene and xylenes in soil, a Class B-1 Response Action Outcome (RAO) Statement was filed for the Site with the Massachusetts Department of Environmental Protection (MassDEP) in September 2008. Some of the soil excavation activities associated with the proposed redevelopment at the Site will constitute a Remedial Action after the submittal of Permanent Solution Statement to MassDEP. Since soil excavation activities will likely involve the excavation of more than 100 cubic yards, the remedial actions must be conducted as a RAM as specified in the Massachusetts Contingency Plan (MCP) 310 CMR 40.1067(5)(b).

In accordance with 310 CMR 40.0440, the response actions detailed within this RAM Plan have been designed to support the redevelopment of the Site which includes the construction of a building where a Permanent Solution Statement has been previously submitted to MassDEP. Concurrent with this RAM Plan, a RAM Transmittal Form (BWSC-106) has been uploaded to eDEP. In accordance with 310 CMR 40.0444(2), the RAM Plan fee of \$980, payable to The Commonwealth of Massachusetts, and a copy of the first page

of the RAM transmittal form (BWSC 106) were mailed to the MassDEP Lock Box at P.O. Box 4062 in Boston, Massachusetts 02211-4062.

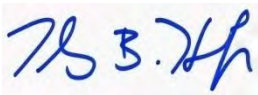
As this RAM Plan proposes the off-Site disposal of over 1,500 cubic yards of Remediation Waste, the Responsible Party undertaking this response action is required to provide a Certification of Financial Assurance, in accordance with 310 CMR 40.0442(5). A copy of this certification is provided in **Appendix A**.

Public notice of proposed RAM implementation will be provided to both the Watertown Health Department and the City Manager's Office to satisfy the notification requirement under 310 CMR 40.1403(3)(d). Copies of these notices are included in **Appendix A**.

F.W. Webb/AEG's investigations are detailed in the attached report. If you have any questions or required additional information, please contact the undersigned at 401-732-7600.

Sincerely,

Alliance Environmental Group / An F.W. Webb Company

A handwritten electronic signature in blue ink, appearing to read 'T. Hevner'.

(Electronic Signature)

Thomas Hevner, P.E., L.S.P.

Vice President – Engineering

Mass PE #41789, Mass LSP #3635

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FIGURES

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- Figure 2 Site Plan
- Figure 3 MassGIS Phase I Site Assessment Map
- Figure 4 Pre-Construction Investigation Plan

APPENDICES

- Appendix A RAM Transmittal Form BWSC-106, Notices to Municipal Officials, and Certificate of Financial Assurance
- Appendix B Remedial Additives Plan – Example

GLOSSARY OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS

AEG	Alliance Environmental Group – Warwick, RI
Alpha	Alpha Analytical – Westboro, MA
ASTM	American Society of Testing and Materials
BMP	Best Management Practices
BOL	Bill of Lading – BWSC-112
BVW	Bordering Vegetated Wetlands
BWSC	Bureau of Waste Site Cleanup
CMR	Code of Massachusetts Regulations
COC	Contaminant of Concern
° F	Degrees Fahrenheit
DPS	Downgradient Property Status
eDEP	Electronic DEP (MassDEP)
F.W. Webb	Parent Company of AEG – Bedford, MA
FEMA	Federal Emergency Management Agency
GIS	Geographical Information Systems
GW	Groundwater
HASP	Health and Safety Plan
LSP	Licensed Site Professional
M1RC	Method 1 Risk Characterization
MassDEP	Massachusetts Department of Environmental Protection
MCP	Massachusetts Contingency Plan – 310 CMR 40.0000
mg/kg	milligrams per kilogram – parts per million
mg/L	Milligrams per Liter – parts per million
MGL	Massachusetts General Law
MSR	Material Shipping Record
NSR	No Significant Risk
OSHA	Occupational Safety and Health Administration
ppb	parts per billion
ppm	parts per million
ppmv	parts per million per volume
PCB	Polychlorinated Biphenyls
P.E.	Professional Engineer
PID	Photoionization Detector
PM10	Particulate Matter – 10 micrometers or less in diameter
PSS	Permanent Solutions Statement
QA/QC	Quality Assurance/Quality Control
QEP	Qualified Environmental Professional
RAM	Release Abatement Measure
RAO	Response Action Outcome
RAPs	Response Action Performance Standards – 310 CMR 40.0191

RC	Reportable Concentrations – 310 CMR 40.1600
RNF	Release Notification Form
RTN	Release Tracking Number
SF	Square Foot or Square Feet
USGS	United State Geological Survey
UST	Underground Storage Tank
UTM	Universal Transverse Mercator
WSC	Waste Site Cleanup

1.0 Introduction

In accordance with the MCP 310 CMR 40.04444(1), a RAM Plan should include the following items:

According to the MCP at 310 CMR 40.04444(1), a RAM Plan should include the following items:

1. Name, address, telephone number and relationship to the responsibility for conducting the RAM (**Section 2.1**);
2. Description of the release(s), Site conditions and surrounding receptors (**Section 2.2**);
3. RAM Plan objective(s), specific plan(s) and proposed implementation schedule (**Section 3.0**);
4. Statement as to whether Remediation Waste, Remedial Wastewater and/or Remedial Additives will be excavated, collected, stored, treated, discharged, applied, reused, or otherwise managed at the Site; (**Section 3.3**)
5. Proposed environmental monitoring plan, where appropriate; (**Section 3.7**)
6. Listing of federal, state, and/or local permits likely to be need to conduct the Release Abatement Measure; (**Section 3.9**)
7. Seal and signature of the Licensed Site Professional who prepared the RAM Plan; (**Section 3.10**)
8. Certification of financial assurance if management of greater than 1,500 cubic yards of Remediation Waste is planned; (**Section 3.11**) and
9. Other information required by MassDEP during its review and evaluation of a RAM Plan determined to be necessary to complete a RAM Plan.

According to the MCP at 310 CMR 40.0442(3), a RAM Plan that involves the construction of a structure which could prevent or impede the implementation of response actions in the future should also include an assessment of Site conditions, focused risk characterization, Background feasibility evaluation and other requirements. Refer **Section 4.0**.

These items are addressed in the following section and appendices of this RAM Plan.

2.0 Background Information

2.1 Responsible Parties for Performance of RAM

The entity undertaking the RAM as Owner is:

Maximos Hatziliades
5 Madison Street
Belmont, MA 02478
Telephone Number: 617-489-6645

The Licensed Site Professional (LSP)-of-Record assisting in the completion of the RAM is:

Thomas Hevner, P.E., L.S.P.
MA LSP Registration No. 3635
Alliance Environmental Group, An F.W. Webb Company
100 Jefferson Boulevard, Suite 220
Warwick, RI 02888
Telephone Number: 401-732-7600

2.2 Description of the Release, Site Conditions, and Surrounding Receptors

2.2.1 Description of the Release

The Site is known as “Arlington Street” and is listed with the Watertown Assessors Office as Tax Map 1236 Block 2 Lot 0. The Site has a release tracking number (RTN 3-0457) issued by Massachusetts Department of Environmental Protection (MassDEP). The identified contaminants of concern (COCs) as discussed in the September 2008 Response Action Outcome (RAO) Statement are benzo(a)pyrene, xylenes, and three metals (nickel, beryllium, and chromium) detected in soil. The RAO was class B-1, indicating that assessed conditions approached Background without remediation.

The Site may have been used as a landfill in the past, and several of the adjacent properties were industrial in nature. The groundwater table is located between approximately 8 and 10 feet below grade depending on the surface elevation at the Site.

The Site contains wetlands that were previously determined to have been impacted by off-Site sources. A downgradient property status (DPS) submittal was filed with MassDEP in 2007 for the Site and the adjoining property known as Sawins Pond. The DPS was limited

to the pond and wetland areas. RTN 3-29157 was created for the DPS to separate the ponds and wetlands from the release conditions associated with RTN 3-0457.

MassDEP issued a Notice of Audit findings on April 1, 2010 for the DPS Opinion and RAO Statements for RTNs 3-0457 and 3-29157. The Audit assigned RTN 3-29157 to the DPS portion (ponds and wetlands) of RTN 3-0457. The audit did not identify any deficiencies in the RAO or DPS and concluded that the property/Site owner (Mr. Hatziliades) was not required to take additional actions.

The Sawins Upland parcel has a third RTN (3-31172) on file with MassDEP. A Permanent Solution Statement (PSS) was filed for RTN 3-31172 in October 2017.

Available information also indicates that the concentrations of COCs detected in groundwater during 2016 are significantly lower than those identified in the September 2008 RAO for RTN 3-0457, and are currently below applicable MCP Method 1 GW-2 and GW-3 Groundwater Standards.

2.2.2 Site Conditions

The parcel is wooded with Bordering Vegetated Wetlands (BVW) located adjacent to a perennial stream, locally referred to as Williams Brook. The site is undeveloped. Four (4) culverts currently exist on-Site, two entering from Elm Street (24-inch diameter and 72-inch diameter) and two existing toward Arlington Street (4-foot by 6-foot and 72-inch diameter). The existing 24-inch diameter culvert discharges into BVW through a headwall that is currently in disrepair.

The entirety of the subject parcel slopes inward from the surrounding area to the area classified as land under water. Elevations range from 24 (+/-) at the parcel perimeter down to 10 (+/-) at the discharge point (6-foot culvert to Arlington Street).

2.2.3 Surrounding Receptors

The Site is located in a mixed industrial, commercial, and residential area. The Williams Pond Parcel, which is 1.42 acres in size, is bordered by commercial properties, residential properties and the UPS Customer Services Office to the north; Arlington Street (beyond which is Sawins Pond) to the east; Gymit Fitness Center and A-Affordable Auto Insurance to the south; and Elm Street (beyond which is the Watertown Mall) to the west.

2.3 Proposed Construction

The Site owner proposes to construct a two-story mixed-use building in the northwest corner of the 1.42± acre parcel of land located on Arlington Street in Watertown, MA (Parcel ID: 1236 2 0). The proposed structure consists of a 7,150 SF footprint which will

consist of 3,500 SF of retail space and 3,650 SF of warehouse on the first floor, and 7,150 SF of warehouse on the second floor. Due to the existing topographic elevation drop in the southeast direction, the building will be situated on a partial mechanically-stabilized earth (MSE) retaining wall structure. Nineteen (19) exterior surface parking spaces will be provided on-Site for the proposed development. The property abuts Elm Street to the west, Arlington Street to the east, and commercial land to the north and south.

The property will have access driveways on both Elm Street and Arlington Street. One-way entry will be provided via a sixteen-foot (16') driveway from Elm Street. Two-way entry will be provided via a twenty-four-foot (24') driveway from Arlington Street. Vehicles will only be permitted to exit the property onto Arlington Street.

A large portion of the subject parcel is occupied the perennial stream and BWV areas. In order to accommodate the proposed development, approximately 4,212 SF of BVW will be filled in. To mitigate the proposed wetland fill, approximately 6,750 SF of wetland replication is proposed on-Site. No work will occur within the perennial stream (area classified as land under water).

The existing 24-inch diameter culvert that enters the property from Elm Street discharges to the BVW located on-Site. The headwall for the culvert entrance is currently in disrepair. The proposed project includes the demolition of the existing concrete headwall, installation of a water quality structure at the discharge point between the existing culvert and BVW, and construction of a new concrete headwall as part of the proposed wetland replication area.

3.0 RAM Plan

The planned RAM activities are limited in scope and complexity and so meet the performance criteria described in 310 CMR 40.0441(2). In the northern portion of the Site, soil deemed unsuitable for construction will be excavated to facilitate the redevelopment effort which includes the construction of a building. The planned RAM activities, as further described in **Section 3.2**, are common activities performed on construction projects in urban areas.

3.1 RAM Plan Objectives

The objective of this RAM Plan is to manage soil that will be excavated during construction. Dewatering discharges will be containerized for off-Site disposal or discharged on-Site under the MCP 310 CMR 40.0045(4). The RAM Plan has been developed to be protective of construction workers during direct contact with potentially contaminated soil, surrounding receptors, and future occupants (including children) at the proposed redeveloped Site. In addition, the RAM Plan was developed so that future investigation and remediation, if necessary (although not expected), will not be significantly impeded by construction of the building at the Site.

3.2 Planned RAM Activities

Planned RAM activities include the following:

- ***Demolition of Below-Grade Structures:*** Demolition of below-grade portions of potential previous building foundations, or other obstructions to proposed construction including railroad rails and ties, former bulkheads and remnant utilities may be necessary as part of proposed construction.
- ***Soil excavation and off-site soil reuse, recycling, and/or disposal:*** Approximately 1,500 cubic yards of soil may be excavated and disposed of off-Site as part of the project. Management of soil as Remediation Waste is further described in **Section 3.3**. Some of this soil will likely be reused on-Site as backfill material.
- ***Soil handling:*** Soil will be excavated to depths up to at least 4 feet below current grade across the Site. The soil is likely to either be re-used on-Site as backfill or be loaded directly onto trucks and transported off-Site for reuse, recycling, and/or disposal at an appropriate receiving facility. Some soil may be stockpiled on-Site for temporary storage. Excavated material will be stockpiled separately based on the anticipated disposal location (based on existing pre-characterization) or based

on field screening results. At a minimum, excavated material with visible stains or unnatural odor indicative of oil and/or hazardous materials (OHM) will be separated from material that does not exhibit these characteristics. Soil will be stockpiled on a 6-mil-thick polyethylene barrier or other impervious surface, if necessary, and covered with a 6-mil-thick polyethylene barrier in bermed areas where storm water runoff is diverted from the stockpile(s).

- ***Soil screening and additional characterization:*** We will periodically screen material on-Site as it is excavated. The screening will consist of visual and olfactory observations combined with jar-headspace measurements of volatile organic compounds (VOCs) using a photoionization detector (PID). If we identify material during excavation as having characteristics inconsistent with those identified during pre-characterization, the material will be stockpiled separately and further characterized.
- ***Reuse or on-site treatment of Toxicity Characteristic Leaching Procedure (TCLP) contaminated soils:*** Up to approximately 150 cubic yards of soil categorized as potentially hazardous waste if excavated and disposed off-Site because the TCLP results for leachable lead were greater than 5 milligrams per liter (mg/L), was identified during the soil pre-characterization program. Total lead concentrations in this area were up to 993 milligrams per kilogram (mg/kg). If this soil is reused within the boundaries of the Site, it is not classified as hazardous waste. Due to elevated total lead concentrations, if the soil is reused on-Site it will be placed at depths greater than 3 feet or below building additions or pavement. If the soil is disposed of off-Site, it may be treated prior to excavation and off-Site removal. If the soil is treated, EnviroBlend® reagent or similar will be applied to the affected soil and mixed with the bucket of an excavator. The mixing zone will be constantly sprayed with water to suppress dust and to activate reagents. After treatment is completed, confirmatory samples will be collected to ensure that the soil no longer contains leachable lead greater than 5 mg/L. Treated material would be transported off-Site to an out-of-state non-hazardous landfill. Management of soil as Remediation Waste is further described in **Section 3.3**. Because this treatment would include applying Remedial Additives within 100 feet of occupied residences, a Remedial Additive Plan has been developed, per 310 CMR 40.0046(3) (**Appendix B**). If Remedial Additives are applied, this plan will be followed.
- ***Additional site assessment, if necessary:*** If required, additional assessment activities will be conducted to further characterize soil and groundwater conditions prior to excavation and off-Site transport, or to provide confirmatory data for regulatory compliance.

- **Construction dewatering and groundwater management:** Dewatering discharges will be containerized for off-Site disposal or discharged on-Site under 310 CMR 40.0045(4).
- **Site Access Control:** Access to the Site will be restricted to authorized persons during construction. A perimeter fence will be erected prior to the start of RAM activities and will be secured during non-working hours.
- **Underground storage tank (UST)/drum removal, if necessary:** Although not expected, if evidence of a possible drum or UST is encountered, work will be temporarily stopped. The presence of a UST will require Watertown Fire Department notification. The area will be screened for the presence of OHM using a PID and visual/olfactory observations. Material considered to be contained within the drum/UST will be evaluated by the LSP or designated Site representative. The materials and drum/UST will be disposed of in accordance with applicable rules and laws.

Periodic RAM Status Reports documenting the status of the soil management activities completed at the Site will be prepared and submitted to MassDEP in accordance with the MCP 310 CMR 40.0445.

3.3 Remediation Waste Management

RAM activities will involve management of contaminated soil (i.e.; Remediation Waste) prior to treatment and/or off-Site removal for reuse/disposal/recycling/treatment. Excavated soils, including Remediation Waste, will be managed in accordance with 310 CMR 40.0030, and this RAM Plan. ***Pre-characterization of Site conditions will be conducted prior to the implementation of construction activities.***

Excavated materials are typically anticipated to be directly loaded for transport to approved receiving facilities proposed by the Contractor, under MassDEP Bills of Lading (BOL), signed/stamped by the undersigned L.S.P. Excavated materials will be monitored on a part- to full-time basis during excavation for visual and olfactory evidence of contamination (such as observed discoloration, texture and/or odor). Additional testing may also be performed for supplemental characterization as required by receiving facilities. If stockpiling of material is necessary, stockpiles will be secured to restrict access by the public and covered with polyethylene sheeting as necessary to control dust.

3.4 Similar Soils Management

The proposed excavation will include management of soils which exhibit concentrations less than applicable MCP RCS-1 Reportable Concentrations, including Miscellaneous Fill, Cohesive Fill, Organic Deposits, and Natural Soils. These soils are typically anticipated to be directly loaded for transport to approved receiving facilities proposed by the Contractor

under MassDEP Material Shipping Records (MSRs), signed and stamped by a Qualified Environmental Professional (QEP), or other documentation as applicable. These soils will be managed as outlined in this RAM Plan and in accordance with antidegradation provisions outlined at 310 CMR 40.0032(3), the Similar Soils Provision Guidance, Policy WSC #13-500, and the Interim Policy on Re-Use of Soil for Large Reclamation Projects, COMM-15-01.

3.5 On-Site Soil Reuse Criteria

Although planned construction activities will remove the majority of Miscellaneous Fill, Cohesive Fill, Organic Deposits, and Marine Sand Deposits from within the proposed building limits, excavated Fill and/or natural materials may be reused as backfill behind the earth support system, around footing foundations (if suitable for geotechnical purposes), for Site grading, and for backfilling utility connections.

3.6 Environmental Monitoring Plan

The contractor will prepare and implement a project Health and Safety Plan (HASP) to protect Site workers from potentially contaminated material.

The contractor will also provide appropriate controls to minimize dust generation. Air monitoring for the health and safety of excavation workers will be performed by the contractor as necessary during the RAM. Action levels and contingency plans will be included in the contractor's project HASP. Dust monitoring will be performed at the Site perimeter by the contractor during excavation for the health and safety of surrounding receptors. The action level for dust (measured as PM₁₀) at the Site perimeter will be 0.150 milligrams per cubic meter in accordance with 310 CMR 6.00. Dust mitigating measures, such as wetting down soils with water, will be conducted if the dust generation action levels are exceeded.

F.W. Webb/AEG as LSP will prepare our own HASP for the protection of F.W. Webb/AEG employees. If action levels as defined in our HASP are exceeded, we will notify the Site Owner or the construction manager, who will notify workers in the immediate area.

3.7 Contingencies

If during work, potentially hazardous conditions are evident, work in the area will be suspended, and the area will be secured to protect against a health risk or release to the environment. These conditions include, but are not limited to, strong chemical odors, flooding, personal injury, exposure to toxic chemicals and encountering unexpected hazardous materials, un-containerized wastes, buried containers and drums.

Based on the results of Site history review, subsurface explorations and chemical testing programs conducted at the Site, no known specific point sources of contamination or

abandoned USTs have been identified to date. In the event conditions warrant it, the required notification will be made to MassDEP in accordance with 310 CMR 40.0300 and to the Watertown Fire Department, as applicable.

3.8 Federal, State, and Local Permits and Requirements

Remediation Waste will be transported off-Site under a BOL and <RCS-1 Material will be transported off-Site under an MSR. The Site Owner will sign all BOLs, MSRs and/or manifests as the generator in accordance with 310 CMR 40.0034/0035.

No other environmental investigation or remediation-related permits are anticipated. The presence of nature resources (wetlands and a stream) at the Site will require local, state, and possibly federal permit submittals.

3.9 RAM Implementation Schedule

The RAM is expected to begin in July 2021 and be completed by May 2022.

3.10 Seal and Signature of Licensed Site Professional

Thomas Hevner is the L.S.P. for implementation of the RAM. The L.S.P. seal and signature are provided on the RAM Plan Transmittal Form BWSC-106 which has been submitted electronically on eDEP, an unsigned copy of which is included in **Appendix A**.

This document contains material facts, data, and other information that support the L.S.P. Opinion that, to the best of the L.S.P.'s knowledge, information and belief, the response actions that are the subject of this submittal (i) have been developed in accordance with the applicable provisions of M.G.L.c.21E and 310 CMR 40.0000, (ii) are appropriate and reasonable to accomplish the purposes of such response actions as set forth in the applicable provisions of M.G.L.c.21E and 310 CMR 40.0000, and (iii) comply with the identified provisions of all orders, permits, and approvals identified in this submittal.

3.11 Financial Assurance

The proposed RAM may involve excavation of more than 1,500 cubic yards of soil with OHM concentrations in excess of applicable RCS-1 Reportable Concentrations. Therefore, in accordance with Section 40.0442(5) of the MCP, acknowledgment of the financial impacts and demonstration of sufficient financial reserves is required. The Site Owner has been informed of the costs to complete the work described in the RAM. Monies to adequately cover the costs associated with the implementation of the RAM are available. A statement providing the certification of knowledge and financial resources executed on behalf of the Site Owner is included in **Appendix A**.

3.12 Greener Technologies

Changes to the MCP promulgated in April 2014 require that response actions incorporate Greener Cleanup Best Management Practices (BMPs) to the extent feasible. Specifically, at 310 CMR 40.0191(3)(e), in order to be compliant with Response Action Performance Standards (RAPS), responsible parties must take into consideration the following:

“Eliminating or reducing, to the extent practicable and consistent with response action requirements and objectives, total energy use, air pollutant emissions, greenhouse gases, water use, materials consumption, and ecosystem and water resources impacts resulting from the performance of response actions through energy efficiency, renewable energy use, materials management, waste reduction, land management, and ecosystem protection.”

Therefore, F.W. Webb/AEG has evaluated the feasibility of incorporating Greener Cleanup BMPs into the response actions described within this RAM Plan Addendum. F.W. Webb/AEG has used as guidance in this effort the MassDEP’s “Greener Cleanup Guidance” WSC #14-150, and ASTM standard E2893-13 “Standard Guide for Greener Cleanups.”

Due to the limited scope of the response actions which will occur under this RAM Plan, the applicable BMPs are limited to environmental oversight, monitoring, and sampling activities. F.W. Webb/AEG has identified the following BMPs from the ASTM guidance that will be implemented during the completion of the proposed RAM Activities:

BMP 1

- **Identified BMP:** Use local staff (including subcontractors) when possible to minimize resource consumption.
- **Specifics of implementation:** Whenever possible, F.W. Webb/AEG will utilize applicable field staff from the office(s) closest to the Site.

BMP 2

- **Identified BMP:** Implement an idle reduction plan.
- **Specifics of implementation:** At the pre-field meeting and daily tailgate meetings, on-Site staff will be reminded to minimize idling of vehicles. Exceptions for health and safety related personnel and heating or cooling are acceptable.

BMP 3

- **Identified BMP:** Contract with a laboratory that uses green practices and/or chemicals.
- **Specifics of implementation:** If samples are collected for laboratory analysis, F.W. Webb/AEG has identified Alpha Analytical in Westboro, MA as the laboratory that will be used. F.W. Webb/AEG will contact Alpha to determine the level of green practices that they use.

BMP 4

- **Identified BMP:** Use local laboratory to minimize impacts from transportation.
- **Specifics of implementation:** If samples are collected for laboratory analysis, F.W. Webb/AEG has identified Alpha Analytical in Westboro, MA as the laboratory that will be used. Westboro is closely situated to Watertown, and Alpha also has a satellite pick up facility in Foxboro, MA. F.W. Webb/AEG will either deliver samples directly to the laboratory or have a laboratory courier pick up the samples at F.W. Webb/AEG's office. Alpha-Westboro is located approximately 27 miles from the Site and 14 miles from F.W. Webb/AEG's Bedford, MA office.

4.0 Requirements of 310 CMR 40.442(3)

As part of the construction of buildings at a contaminated site, the MassDEP Policy for the Construction of Buildings in Contaminated Areas (WSC-00-425) and 310 CMR 40.0442(3) require that a focused site assessment, risk characterization, and feasibility evaluation be included in RAM activities. These should incorporate the concepts and standards specified in the MCP (310 CMR 40.0800 and 40.0900). Site conditions and risks are described below.

4.1 Focused Site Characterization

As discussed in **Section 2.2**, previous investigations were conducted to achieve the Class B-1 RAO that was filed in September 2008. Additional investigations will be conducted prior to construction to characterize subsurface conditions in the areas to be disturbed as part of construction and redevelopment. A conceptual pre-construction investigation plan is presented as **Figure 4**. The proposed investigations will be utilized to support the Focused Site Characterization.

4.2 Focused Risk Characterization

The primary COCs at the Site are benzo(a)pyrene, xylenes, and three metals (nickel, beryllium, and chromium) detected in soil. Potential human receptors include construction and utility workers under current and possible future uses, as well as commercial occupants and residents (including children) under future uses. Possible trespassers and construction workers are also potential human receptors during the planned construction activities. The potential pathways to exposure from contaminated soil include direct contact and inhalation of fugitive dust.

A condition of No Significant Risk (NSR) to human health is expected under current uses (i.e., during construction activities) because:

- Construction workers will follow the HASP prepared by the contractor to reduce potential exposure to these contaminants.
- Management of metals and PAH contamination is often required during construction activities in urban areas, and associated safe practices are well established.
- Soil not suitable for reuse on-Site or designated as contaminated soil will be excavated and transported off-Site to a landfill or other applicable licensed disposal/recycling facility.
- The contractor will perform dust monitoring in the work zone and at the Site perimeter during excavation for the health and safety of construction workers and surrounding receptors.

A condition of NSR to human health is expected under reasonably foreseeable future uses because contaminated soil will be excavated and removed from the Site and groundwater will not be used (e.g., as a source of potable water) in the future. F.W. Webb/AEG anticipates that a risk characterization that accounts for soils to remain on-Site with residual contaminant concentrations will conclude that a condition of NSR will exist.

4.3 Focused Remedial Program

A focused remedial program is planned as part of the construction at the Site to reduce unnecessary risks to construction workers and surrounding populations. These procedures are described in **Sections 3.2 through 3.5** and include requirements for a worker HASP, dust control, and soil stockpiling. The work will generally be staged such that the contaminated soil is handled as little, and by as few contractors, as is practicable.

4.4 Focused Feasibility Study

Contaminated soil will be removed from across the Site, and remaining contaminant concentrations are anticipated to achieve or approach background levels. Construction at the Site will not impede or preclude future investigations or response actions, if necessary.

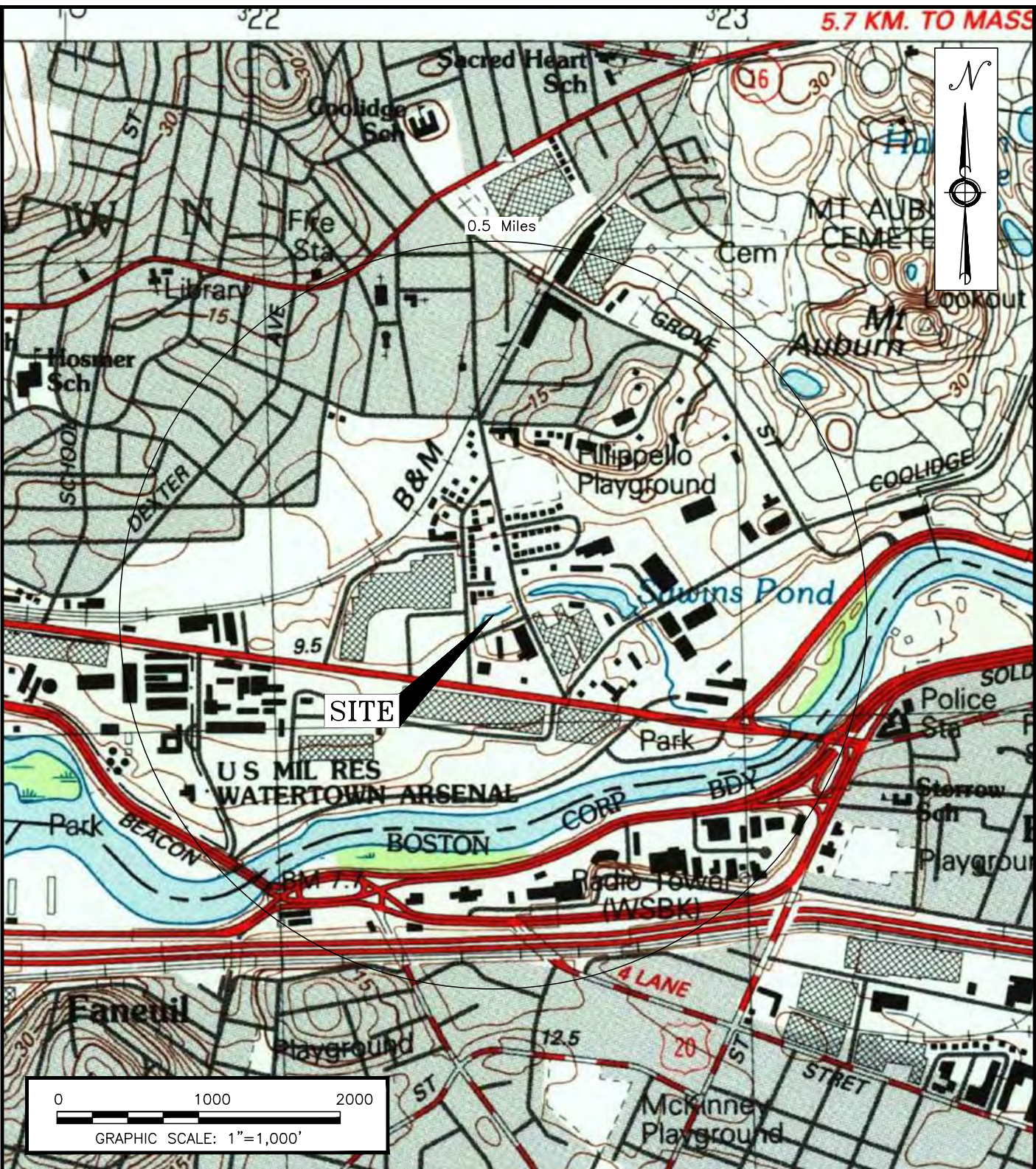
5.0 Limitations

All work product and reports provided F.W. Webb/AEG in connection with the performance of this investigation are subject to the following limitations:

1. The observations described in this report were made under the conditions stated herein. The conclusions presented in the report were based solely upon the services described herein, and not on scientific tasks or procedures beyond the Scope of described Services provided to the Client.
2. In preparing this report, F.W. Webb/AEG has relied on certain information provided by state and local officials and information and representations made by other parties referenced herein, and on information contained in the files of state and/or local agencies made available to at the time of this investigation. To the extent that such files are missing, incomplete or were not provided, F.W. Webb/AEG is not responsible. Although there may have been some degree of overlap in the information provided by these various sources, attempts to independently verify the accuracy or completeness of all information reviewed or received during the course of this investigation was not completed.
3. The conclusions and recommendations contained in this report are based in part upon the data from subsurface explorations. The nature and extent of variations between these explorations may not become evident until further explorations are completed. If variations or other latent conditions become evident, it will be necessary to re-evaluate the conclusions and recommendations of this report.
4. Where quantitative laboratory analyses have been conducted by an outside certified laboratory, F.W. Webb/AEG has relied upon the data provided, and has not conducted an independent evaluation of the reliability of these tests.
5. If the conclusions and recommendations contained in this report are based, in part, upon various types of chemical data then the conclusions and recommendations are contingent upon the validity of such data. These data have been reviewed and interpretations made in the report. It should be noted that variations in the types and concentrations of contaminants and variations in their flow paths may occur due to seasonal water table fluctuations, past disposal practices, the passage of time, and other factors.
6. Chemical analyses were performed for specific parameters identified during the course of the investigation, as described in the text. However, it should be noted that testing for all known chemical constituents was not performed. The

- conclusions and recommendations contained in this report are based only upon the chemical constituents for which testing were accomplished.
7. The activities described and opinions included herein are based on information gathered during subsurface Site investigations, which were limited in scope at the time of their performance. The professional opinion provided herein is based on the information described in this report.
 8. The information contained herein was prepared for the use of the Client solely in conjunction with the task description for this assignment. The conclusions and recommendations set forth in this report are based on Site conditions at the time of the investigation. Future studies and findings could change the contents of this report. The professional opinions presented in this report have been developed by using the degree of care and skill ordinarily exercised, under similar circumstances, by reputable environmental engineering consultants practicing in this or similar localities. No other warranty, expressed or implied, is made as to the professional opinions included in this report.

FIGURES

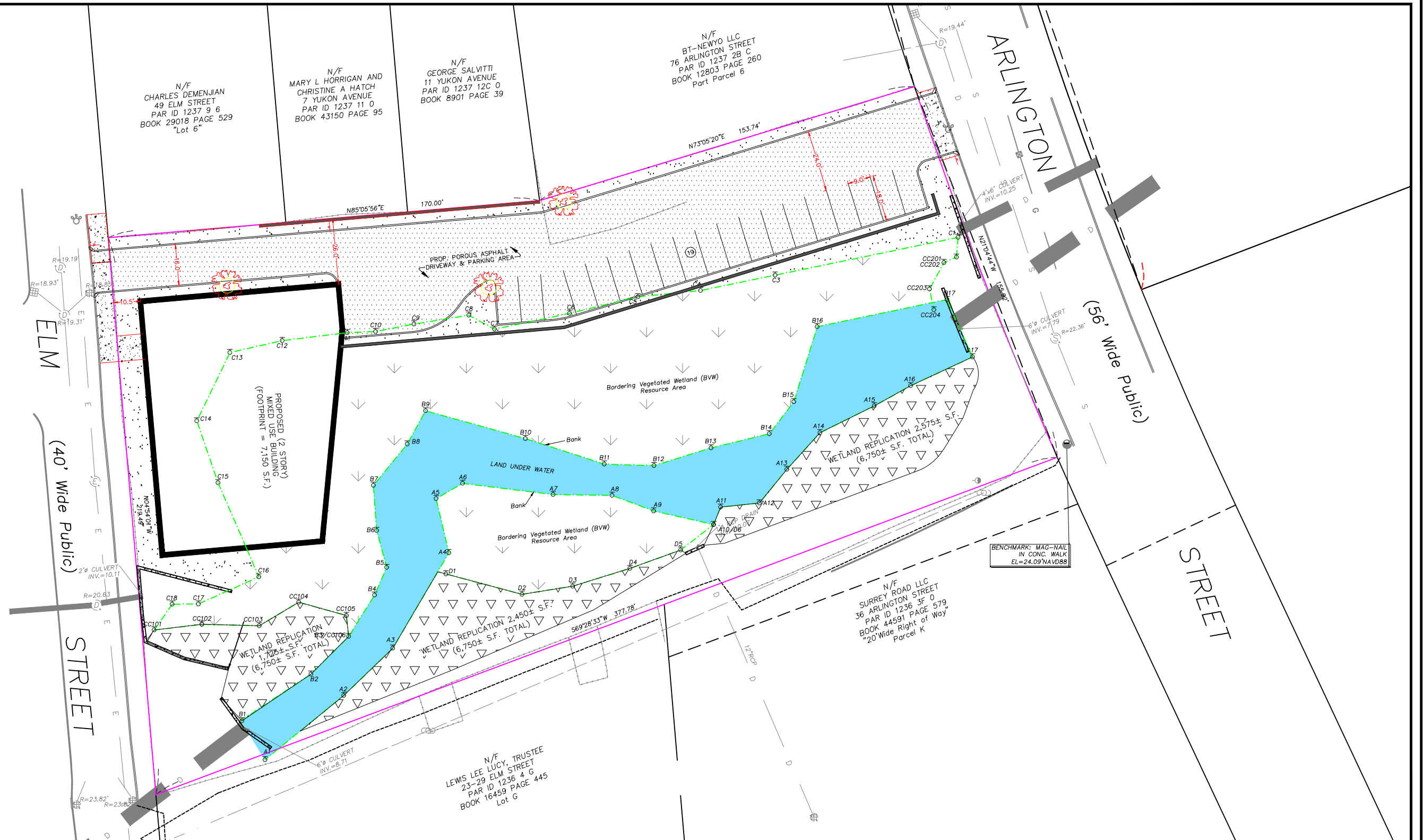


100 JEFFERSON BLVD, SUITE 220 WARWICK, RI 02888
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 email: br113@fwwebb.com

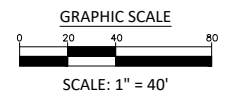
USGS LOCUS MAP-BOSTON SOUTH
 7.5 x 15 MINUTE QUADRANGLE

ARLINGTON STREET & ELM STREET
 WATERTOWN, MASSACHUSETTS

SCALE	PROJECT NO.	DRAWING NUMBER
AS NOTED	2999.01	FIGURE 1



- NOTES:
1. ALL FEATURE LOCATIONS ARE APPROXIMATE. PROPERTY BOUNDARIES SHOULD NOT BE USED TO DETERMINE LEGAL OWNERSHIP.
 2. PLAN REFERENCE: PROPOSED SITE PLAN, ARLINGTON STREET & ELM STREET, WATERTOWN, MA, BY ENGINEERING ALLIANCE INC., DATED OCTOBER 16, 2020.



 An F.W. Webb Company 100 JEFFERSON BLVD, SUITE 220 WARWICK, RI 02888 MA – CT – RI – NH – ME – VT – NY – NJ – PA www.allianceenvironmentalgroup.com email: br113@fwwebb.com				SITE PLAN		
				ARLINGTON STREET & ELM STREET WATERTOWN, MASSACHUSETTS		
	DRAWN	CHECKED	APPROVED	SCALE	PROJECT NO.	DRAWING NUMBER
BY	G.A.D.	T.B.H.		AS NOTED	2999.01	FIGURE 2
DATE	12-16-2020	12-18-2020				

MassDEP - Bureau of Waste Site Cleanup

Phase 1 Site Assessment Map: 500 feet & 0.5 Mile Radii

Site Information:

PROPOSED REDEVELOPMENT
ARLINGTON STREET WATERTOWN, MA
3-000000457

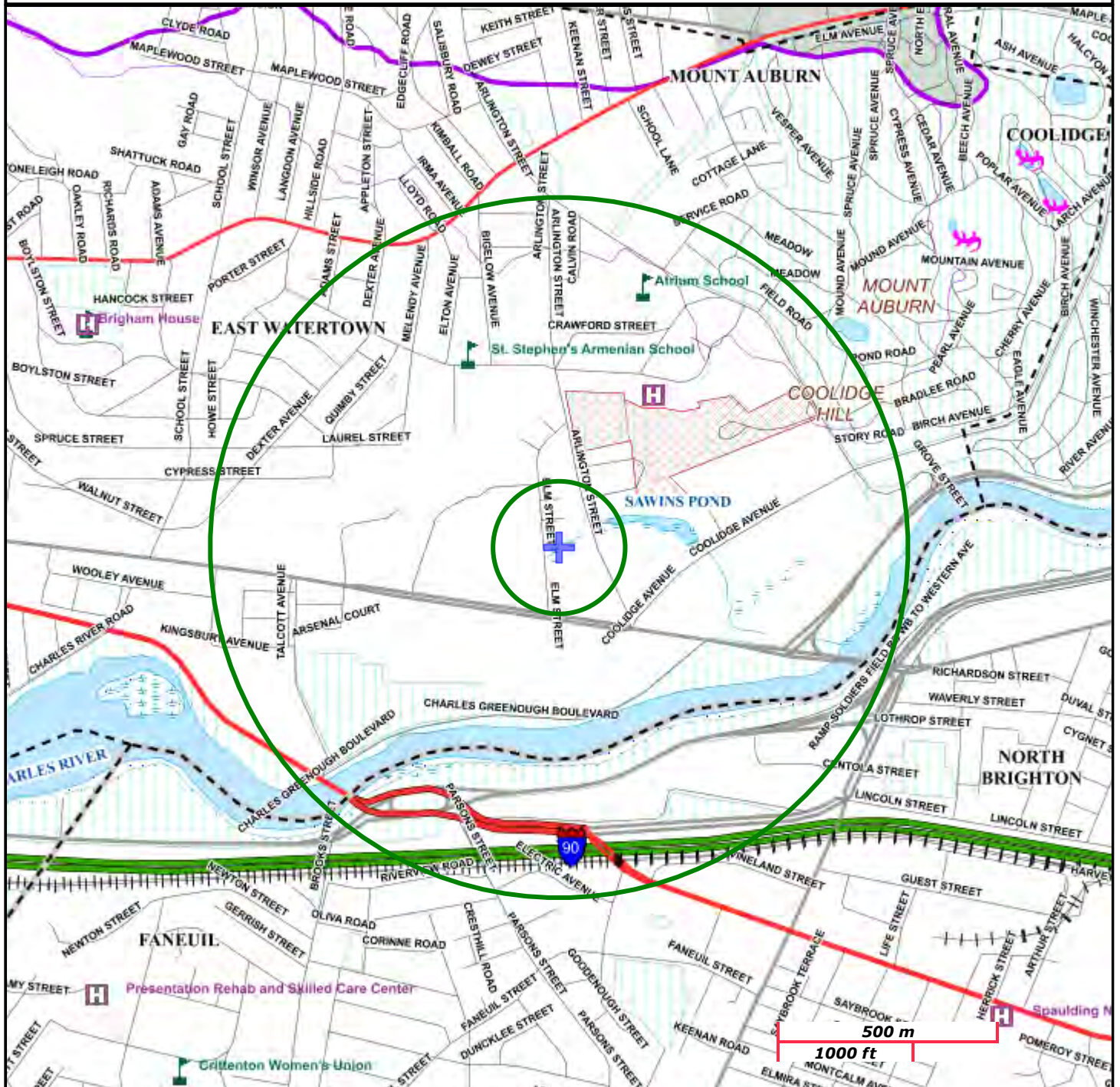
NAD83 UTM Meters:
4692450mN, 322500mE (Zone: 19)
December 26, 2020

The information shown is the best available at the date of printing. However, it may be incomplete. The responsible party and LSP are ultimately responsible for ascertaining the true conditions surrounding the site. Metadata for data layers shown on this map can be found at:
<https://www.mass.gov/orgs/massgis-bureau-of-geographic-information>



MassDEP

Commonwealth of Massachusetts
Department of Environmental Protection



Roads: Limited Access, Divided, Other Hwy, Major Road, Minor Road, Track, Trail

Boundaries: Town, County, DEP Region; Train; Powerline; Pipeline; Aqueduct

Basins: Major, PWS; Streams: Perennial, Intermittent, Man Made Shore, Dam

Aquifers: Medium Yield, High Yield, EPA Sole Source

Non Potential Drinking Water Source Area: Medium, High (Yield)

PWS Protection Areas: Zone II, IWPA, Zone A

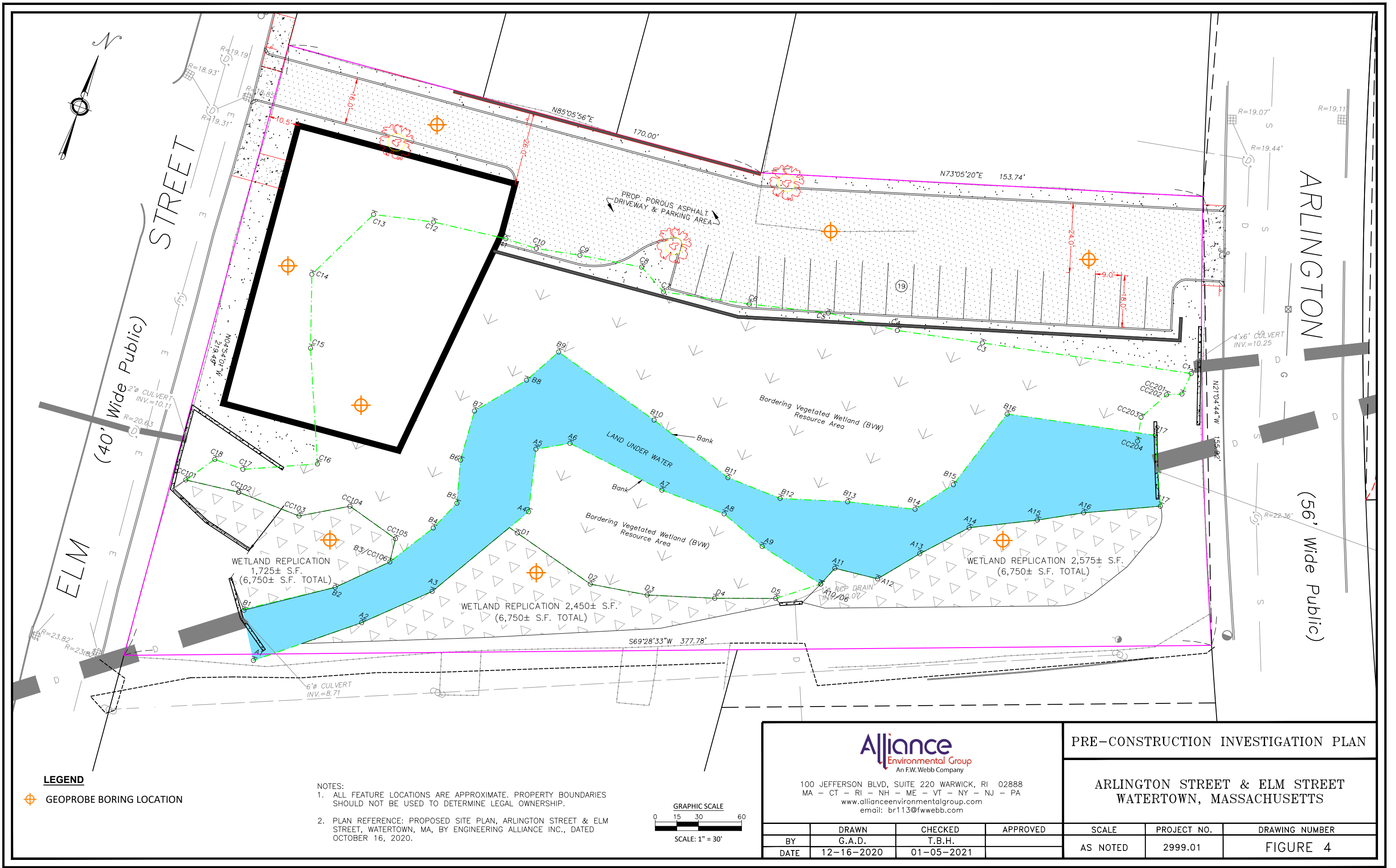
Hydrography: Open Water, PWS Reservoir, Tidal Flat

Wetlands: Freshwater, Saltwater, Cranberry Bog

FEMA 100yr Floodplain; Protected Open Space; ACEC

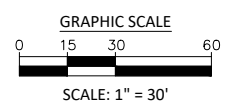
Est. Rare Wetland Wildlife Hab; Vernal Pool: Cert., Potential

Solid Waste Landfill; PWS: Com. GW, SW, Emerg., Non-Com.



LEGEND
⊕ GEOPROBE BORING LOCATION

NOTES:
1. ALL FEATURE LOCATIONS ARE APPROXIMATE. PROPERTY BOUNDARIES SHOULD NOT BE USED TO DETERMINE LEGAL OWNERSHIP.
2. PLAN REFERENCE: PROPOSED SITE PLAN, ARLINGTON STREET & ELM STREET, WATERTOWN, MA, BY ENGINEERING ALLIANCE INC., DATED OCTOBER 16, 2020.





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PRE-CONSTRUCTION INVESTIGATION PLAN

**ARLINGTON STREET & ELM STREET
WATERTOWN, MASSACHUSETTS**

DRAWN		CHECKED	APPROVED	SCALE	PROJECT NO.	DRAWING NUMBER
BY	G.A.D.	T.B.H.		AS NOTED	2999.01	FIGURE 4
DATE	12-16-2020	01-05-2021				

APPENDIX A

RAM Transmittal Form BWSC-106, Notices to Municipal Officials,
and Certificate of Financial Assurance





Massachusetts Department of Environmental Protection
Bureau of Waste Site Cleanup

BWSC106

RELEASE ABATEMENT MEASURE (RAM)
TRANSMITTAL FORM

Release Tracking Number

3

-

0457

Pursuant to 310 CMR 40.0444 - 0446 (Subpart D)

A. SITE LOCATION:

1. Site Name/Location Aid: Sawins and Williams Pond

2. Street Address: Arlington Street Coolidge Avenue

3. City/Town: Watertown

4. ZIP Code: 02172

☐ 5. Check here if the disposal site that is the source of the release is Tier Classified. Check the current Tier Classification Category.

☐ a. Tier I

☐ b. Tier ID

☐ c. Tier II

B. THIS FORM IS BEING USED TO: (check all that apply)

1. List Submittal Date of Initial RAM Plan (if previously submitted): _____

☒ 2. Submit an **Initial Release Abatement Measure (RAM) Plan**.

☒ a. Check here if the RAM is being conducted as part of the construction of a permanent structure. If checked, you must specify what type of permanent structure is to be erected in or in the immediate vicinity of the area where the RAM is to be conducted.

b. Specify type of permanent structure: (check all that apply) ☐ i. School ☐ ii. Residential ☒ iii. Commercial
☐ iv. Industrial ☐ v. Other Specify: _____

☐ 3. Submit a **Modified RAM Plan** of a previously submitted RAM Plan.

☐ 4. Submit a **RAM Status Report**.

☐ 5. Submit a **Remedial Monitoring Report**. (This report can only be submitted through eDEP, concurrent with a RAM Status Report.)

a. Type of Report: (check one) ☐ i. Initial Report ☐ ii. Interim Report ☐ iii. Final Report

b. Frequency of Submittal:

☐ i. A Remedial Monitoring Report(s) submitted every six months, concurrent with a RAM Status Report.

☐ ii. A Remedial Monitoring Report(s) submitted annually, concurrent with a RAM Status Report.

c. Number of Remedial Systems and/or Monitoring Programs: _____

A separate BWSC106A, RAM Remedial Monitoring Report, must be filled out for each Remedial System and/or Monitoring Program addressed by this transmittal form.

☐ 6. Submit a **RAM Completion Statement**.

☐ 7. Submit a **Revised RAM Completion Statement**.

8. Provide Additional RTNs:

☐ a. Check here if this RAM Submittal covers additional Release Tracking Numbers (RTNs). RTNs that have been previously linked to a Primary Tier Classified RTN do not need to be listed here. This section is intended to allow a RAM to cover more than one unclassified RTN and not show permanent linkage to a Primary Tier Classified RTN.

b. Provide the additional Release Tracking Number(s) covered by this RAM Submittal.

☐ -

☐ -

☐ 9. Include in the RAM Plan or Modified RAM Plan a **Plan for the Application of Remedial Additives** near a sensitive receptor, pursuant to 310 CMR 40.0046(3).

(All sections of this transmittal form must be filled out unless otherwise noted above)



Massachusetts Department of Environmental Protection
Bureau of Waste Site Cleanup

BWSC106

RELEASE ABATEMENT MEASURE (RAM)
TRANSMITTAL FORM

Release Tracking Number

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0457

Pursuant to 310 CMR 40.0444 - 0446 (Subpart D)

C. RELEASE OR THREAT OF RELEASE CONDITIONS THAT WARRANT RAM:

1. Media Impacted and Receptors Affected: (check all that apply) ☐ a. Paved Surface ☐ b. Basement ☐ c. School
☐ d. Public Water Supply ☐ e. Surface ☐ f. Zone 2 ☐ g. Private Well ☐ h. Residence ☒ i. Soil
☐ j. Ground Water ☐ k. Sediments ☐ l. Wetland ☐ m. Storm Drain ☐ n. Indoor Air ☐ o. Air
☐ p. Soil Gas ☐ q. Sub-Slab Soil Gas ☐ r. Critical Exposure Pathway ☐ s. NAPL ☐ t. Unknown
☐ u. Others Specify: _____
2. Sources of the Release or TOR: (check all that apply) ☐ a. Transformer ☐ b. Fuel Tank ☐ c. Pipe
☐ d. OHM Delivery ☐ e. AST ☐ f. Drums ☐ g. Tanker Truck ☐ h. Hose ☐ i. Line
☐ j. UST Describe: _____ ☐ k. Vehicle ☐ l. Boat/Vessel
☐ m. Unknown ☒ n. Other: Historic
3. Type of Release or TOR: (check all that apply) ☐ a. Dumping ☐ b. Fire ☐ c. AST Removal ☐ d. Overfill
☐ e. Rupture ☐ f. Vehicle Accident ☐ g. Leak ☐ h. Spill ☐ i. Test Failure ☐ j. TOR Only
☐ k. UST Removal Describe: _____
☐ l. Unknown ☒ m. Other: Historic
4. Identify Oils and Hazardous Materials Released: (check all that apply) ☐ a. Oils ☐ b. Chlorinated Solvents
☒ c. Heavy Metals ☒ d. Others Specify: Benzo(a)pyrene, xylene

D. DESCRIPTION OF RESPONSE ACTIONS: (check all that apply, for volumes list cumulative amounts)

- | | |
|---|---|
| ☐ 1. Assessment and/or Monitoring Only | ☐ 2. Temporary Covers or Caps |
| ☐ 3. Deployment of Absorbent or Containment Materials | ☐ 4. Temporary Water Supplies |
| ☐ 5. Structure Venting System/HVAC Modification System | ☐ 6. Temporary Evacuation or Relocation of Residents |
| ☐ 7. Product or NAPL Recovery | ☐ 8. Fencing and Sign Posting |
| ☐ 9. Groundwater Treatment Systems | ☐ 10. Soil Vapor Extraction |
| ☐ 11. Remedial Additives | ☐ 12. Air Sparging |
| ☐ 13. Active Exposure Pathway Mitigation System | ☐ 14. Passive Exposure Pathway Mitigation System |
| ☐ 15. Monitored Natural Attenuation | ☐ 16. In-Situ Chemical Oxidation |



Massachusetts Department of Environmental Protection
Bureau of Waste Site Cleanup

BWSC106

**RELEASE ABATEMENT MEASURE (RAM)
TRANSMITTAL FORM**

Release Tracking Number

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0457

Pursuant to 310 CMR 40.0444 - 0446 (Subpart D)

D. DESCRIPTION OF RESPONSE ACTIONS (cont.): (check all that apply, for volumes list cumulative amounts)

☒ 17. Excavation of Contaminated Soils

☒ a. Re-use, Recycling or Treatment

☐ i. On Site Estimated volume in cubic yards _____

☒ ii. Off Site Estimated volume in cubic yards 1,500

ia. Receiving Facility: To be Determined Town: _____ State: _____

iib. Receiving Facility: _____ Town: _____ State: _____

iii. Describe: _____

☐ b. Store

☐ i. On Site Estimated volume in cubic yards _____

☐ ii. Off Site Estimated volume in cubic yards _____

ia. Receiving Facility: _____ Town: _____ State: _____

iib. Receiving Facility: _____ Town: _____ State: _____

☐ c. Landfill

☐ i. Cover Estimated volume in cubic yards _____

Receiving Facility: _____ Town: _____ State: _____

☐ ii. Disposal Estimated volume in cubic yards _____

Receiving Facility: _____ Town: _____ State: _____

☐ 18. Removal of Drums, Tanks or Containers:

a. Describe Quantity and Amount: _____

b. Receiving Facility: _____ Town: _____ State: _____

c. Receiving Facility: _____ Town: _____ State: _____

☒ 19. Removal of Other Contaminated Media:

a. Specify Type and Volume: off-Site disposal of non-haz groundwater - estimated volume 21,000 gallons

b. Receiving Facility: To be Determined Town: _____ State: _____

c. Receiving Facility: _____ Town: _____ State: _____

☐ 20. Other Response Actions:

Describe: _____

☐ 21. Use of Innovative Technologies:

Describe: _____



Massachusetts Department of Environmental Protection
Bureau of Waste Site Cleanup

BWSC106

**RELEASE ABATEMENT MEASURE (RAM)
TRANSMITTAL FORM**

Release Tracking Number

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0457

Pursuant to 310 CMR 40.0444 - 0446 (Subpart D)

E. LSP SIGNATURE AND STAMP :

I attest under the pains and penalties of perjury that I have personally examined and am familiar with this transmittal form, including any and all documents accompanying this submittal. In my professional opinion and judgment based upon application of (i) the standard of care in 309 CMR 4.02(1), (ii) the applicable provisions of 309 CMR 4.02(2) and (3), and 309 CMR 4.03(2), and (iii) the provisions of 309 CMR 4.03(3), to the best of my knowledge, information and belief,

> **if Section B of this form indicates that a Release Abatement Measure Plan is being submitted**, the response action(s) that is (are) the subject of this submittal (i) has (have) been developed in accordance with the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000, (ii) is (are) appropriate and reasonable to accomplish the purposes of such response action(s) as set forth in the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000 and (iii) comply(ies) with the identified provisions of all orders, permits, and approvals identified in this submittal;

> **if Section B of this form indicates that a Release Abatement Measure Status Report and/or Remedial Monitoring Report is being submitted**, the response action(s) that is (are) the subject of this submittal (i) is (are) being implemented in accordance with the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000, (ii) is (are) appropriate and reasonable to accomplish the purposes of such response action(s) as set forth in the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000 and (iii) comply (ies) with the identified provisions of all orders, permits, and approvals identified in this submittal;

> **if Section B of this form indicates that a Release Abatement Measure Completion Statement is being submitted**, the response action(s) that is (are) the subject of this submittal (i) has (have) been developed and implemented in accordance with the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000, (ii) is (are) appropriate and reasonable to accomplish the purposes of such response action(s) as set forth in the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000 and (iii) comply(ies) with the identified provisions of all orders, permits, and approvals identified in this submittal:

I am aware that significant penalties may result, including, but not limited to, possible fines and imprisonment, if I submit information which I know to be false, inaccurate or materially incomplete.

1. LSP #: 3635

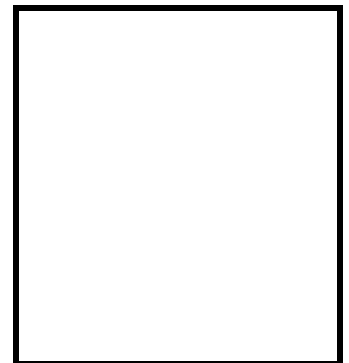
2. First Name: Thomas B 3. Last Name: Hevner

4. Telephone: 401-732-7600 5. Ext.: 6. Email: tbh@fwwebb.com

7. Signature: _____

8. Date: _____
(mm/dd/yyyy)

9. LSP Stamp:





**Massachusetts Department of Environmental Protection
Bureau of Waste Site Cleanup**

BWSC106

**RELEASE ABATEMENT MEASURE (RAM)
TRANSMITTAL FORM**

Release Tracking Number

3

-

0457

Pursuant to 310 CMR 40.0444 - 0446 (Subpart D)

F. PERSON UNDERTAKING RAM:

1. Check all that apply: ☐ a. change in contact name ☐ b. change of address ☐ c. change in the person undertaking response actions
2. Name of Organization: _____
3. Contact First Name: Maximos 4. Last Name: Hatziliades
5. Street: 5 Madison Street 6. Title: _____
7. City/Town: Belmont 8. State: MA 9. ZIP Code: 02478
10. Telephone: 617-331-8209 11. Ext.: _____ 12. Email: _____

G. RELATIONSHIP TO RELEASE OR THREAT OF RELEASE OF PERSON UNDERTAKING RAM:

☐ Check here to change relationship

- ☒ 1. RP or PRP ☒ a. Owner ☐ b. Operator ☐ c. Generator ☐ d. Transporter
- ☐ e. Other RP or PRP Specify: _____
- ☐ 2. Fiduciary, Secured Lender or Municipality with Exempt Status (as defined by M.G.L. c. 21E, s. 2)
- ☐ 3. Agency or Public Utility on a Right of Way (as defined by M.G.L. c. 21E, s. 5(j))
- ☐ 4. Any Other Person Undertaking RAM Specify Relationship: _____

H. REQUIRED ATTACHMENT AND SUBMITTALS:

- ☐ 1. Check here if any Remediation Waste, generated as a result of this RAM, will be stored, treated, managed, recycled or reused at the site following submission of the RAM Completion Statement. You must submit a Phase IV Remedy Implementation Plan along with the appropriate transmittal form (BWSC108).
- ☐ 2. Check here if the Response Action(s) on which this opinion is based, if any, are (were) subject to any order(s), permit(s) and/or approval(s) issued by DEP or EPA. If the box is checked, you MUST attach a statement identifying the applicable provisions thereof.
- ☒ 3. Check here to certify that the Chief Municipal Officer and the Local Board of Health have been notified of the implementation of a Release Abatement Measure.
- ☐ 4. Check here if any non-updatable information provided on this form is incorrect, e.g. Release Address/Location Aid. Send corrections to bwsc.edep@state.ma.us.
- ☒ 5. If a RAM Compliance Fee is required for this RAM, check here to certify that a RAM Compliance Fee was submitted to DEP, P. O. Box 4062, Boston, MA 02211.
- ☒ 6. Check here to certify that the LSP Opinion containing the material facts, data, and other information is attached.



Massachusetts Department of Environmental Protection
Bureau of Waste Site Cleanup

BWSC106

RELEASE ABATEMENT MEASURE (RAM)
TRANSMITTAL FORM

Release Tracking Number

3

-

0457

Pursuant to 310 CMR 40.0444 - 0446 (Subpart D)

I. CERTIFICATION OF PERSON UNDERTAKING RAM:

1. I, Maximos Hatziliades, attest under the pains and penalties of perjury (i) that I have personally examined and am familiar with the information contained in this submittal, including any and all documents accompanying this transmittal form, (ii) that, based on my inquiry of those individuals immediately responsible for obtaining the information, the material information contained in this submittal is, to the best of my knowledge and belief, true, accurate and complete, and (iii) that I am fully authorized to make this attestation on behalf of the entity legally responsible for this submittal. I/the person or entity on whose behalf this submittal is made am/is aware that there are significant penalties, including, but not limited to, possible fines and imprisonment, for willfully submitting false, inaccurate, or incomplete information.

2. By: _____ 3. Title: Owner
Signature

4. For: Maximos Hatziliades 5. Date: _____
(Name of person or entity recorded in Section F) (mm/dd/yyyy)

☐ 6. Check here if the address of the person providing certification is different from address recorded in Section F.

7. Street: _____

8. City/Town: _____ 9. State: _____ 10. ZIP Code: _____

11. Telephone: _____ 12. Ext.: _____ 13. Email: _____

YOU ARE SUBJECT TO AN ANNUAL COMPLIANCE ASSURANCE FEE OF UP TO \$10,000 PER BILLABLE YEAR FOR THIS DISPOSAL SITE. YOU MUST LEGIBLY COMPLETE ALL RELEVANT SECTIONS OF THIS FORM OR DEP MAY RETURN THE DOCUMENT AS INCOMPLETE. IF YOU SUBMIT AN INCOMPLETE FORM, YOU MAY BE PENALIZED FOR MISSING A REQUIRED DEADLINE.

Date Stamp (DEP USE ONLY:)



F.W. WEBB COMPANY

March 26, 2021

Mr. Michael J. Driscoll
Town Manager
149 Main Street
Watertown, MA 02472

Board of Health
149 Main Street
Watertown, MA 02472

**Re: Availability of Release Abatement Measure Plan - EXAMPLE
Sawins and Williams Pond, Undeveloped Property
Arlington Street, Coolidge Avenue, Watertown, MA
Watertown Tax Map 1236 Block 2 Lot 0
MassDEP RTN 3-0457
F.W. Webb/AEG Project No. 2999.01**

Dear Mr. Driscoll and Board of Health Staff:

In accordance with 310 CMR 40.0447(1), notification is hereby made that a Release Abatement Measure (RAM) Plan was prepared for the above-referenced disposal site. The RAM Plan outlines the potential management and/or removal of potentially impacted soil and groundwater, as necessary. Work is scheduled to begin after May 8, 202X.

Copies of the report can be obtained at the Massachusetts Department of Environmental Protection Northeast Regional Office (NERO) in Wilmington, Massachusetts. If you have any questions please call the undersigned at (401) 732-7600.

Sincerely,

Alliance Environmental Group / An F.W. Webb Company

(Electronic Signature)

Thomas Hevner, P.E., LSP
Vice President - Engineering

CERTIFICATION OF FINANCIAL ASSURANCE - EXAMPLE
310 CMR 40.0442(5)

Undeveloped Property
Arlington Street, Watertown, MA
Watertown Parcel ID No. 1510-1-0
MassDEP RTN 3-0457

I, Maximos Hatziliades, attest that based on my inquiry of those individuals immediately responsible for providing estimates of the volume of material to be excavated and the cost associated with the work to be completed, that the person/entity undertaking the Release Abatement Measure has sufficient financial resources to manage the excavated materials in the manner and timeframe specified at 310 CMR 40.0030, and that I am fully authorized to make this attestation on behalf of the entity legally responsible for this submittal.

Signature: _____

Title: _____

Date: _____

APPENDIX B

Remedial Additives Plan - Example

Remedial Additives Plan - Example

This Remedial Additives Plan was prepared to support a Release Abatement Measure (RAM), per 310 CMR 40.0444. The objective of applying Remedial Additives as part of the RAM is to treat TCLP lead contaminated soils via stabilization. TCLP lead contaminated soils are in the vicinity of boring B-10X.

Surrounding Receptors

The Site is in a mixed commercial and residential area of Watertown, Massachusetts. The area of treatment is within 100 feet of occupied residences; therefore, this Remedial Additive Plan was developed per 310 CMR 40.0046(3).

Proposed Treatment and Remedial Additive Application

Approximately 115 cubic yards of TCLP lead-contaminated soil (leachable lead greater than 5 milligrams per liter [mg/L]) may be treated prior to excavation and off-site disposal. Prior to treatment, additional soil sampling may be performed near boring B105 to further delineate the area of this soil to minimize the amount of soil to be managed as hazardous waste. If the soil is treated, EnviroBlend® or similar will be applied (approximately 2% by weight) to the affected soil and mixed with the bucket of an excavator. The zone of treatment is between 5 and 10 feet below ground surface. The mixing zone will be sprayed with water to suppress dust and to activate reagents. The Remedial Additive is expected to be applied only once.

Current Soil Conditions

Soil at the Site consists of shallow fill underlain by glacial till. Laboratory analyses indicated that acenaphthylene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, 2-methylnaphthalene, phenanthrene, total petroleum hydrocarbons (TPH), polychlorinated biphenyls (PCBs) and lead were detected in the fill at concentrations greater than the applicable MCP RCS-1 values. The TCLP lead concentration in one soil sample is greater than 5 mg/L (concentration of 8.03 mg/L).

Current Groundwater Conditions

Groundwater was not sampled as part of subsurface investigations. Groundwater was not observed in the soil borings, so the depth to groundwater is presumed to be greater than 16 feet. Groundwater is not expected to be encountered during construction so all treatment will be performed above the groundwater table. No mounding analysis was performed to evaluate effects of the Remedial Additive on the groundwater table. The Remedial Additive is a dry powder to be mixed into soil and wetted with water.

Post-Application Soil Monitoring

After the Remedial Additive is applied, confirmatory samples will be collected to evaluate the effectiveness of the treatment. Additional Remedial Additive will be applied if TCLP lead concentrations need to be further reduced.

Post-Application Groundwater Monitoring

Groundwater is not expected to be encountered during construction so all treatment will be performed above the groundwater table. Consequently, monitoring of groundwater conditions and hydraulic control are not necessary during application of the Remedial Additive.

REQUEST FOR DETERMINATION OF APPLICABILITY

Parking Lot Improvements 10-30 Manley Way Watertown, Massachusetts

**SUBMITTED TO:**

Watertown Conservation Commission
149 Main Street, 3rd Floor
Watertown, MA 02472-4410

PREPARED FOR:

Affini-T Therapeutics
343 Arsenal Street
Watertown, MA 02472

PREPARED BY:

Lucas Environmental, LLC
500A Washington Street
Quincy, Massachusetts 02169

IN ASSOCIATION WITH:

RJO'Connell & Associates, Inc.
80 Montvale Avenue, Suite 201
Stoneham, MA 02180

REPORT DATE: March 14, 2022





500A Washington Street, Quincy, MA 02169

March 14, 2022

Watertown Conservation Commission
149 Main Street, Third Floor
Watertown, MA 02472-4410

Re: Request for Determination of Applicability
Proposed Parking Lot Improvements
10-30 Manley Way
Watertown, Massachusetts

Members of the Watertown Conservation Commission:

On behalf of Affini-T Therapeutics, Lucas Environmental, LLC (LE), in association with RJO'Connell & Associates, Inc. (RJOC), is pleased to submit this Request for Determination of Applicability (RDA) to the Watertown Conservation Commission for the proposed Parking Lot Improvement Project and utility upgrades located at 10-30 Manley Way, in Watertown, Massachusetts. The project will include repaving a portion of the existing parking area that is deteriorated, and seal coating and restriping the remaining portions of the paved areas. There will be no increase in the amount of impervious area.

A portion of proposed repaving work is located within the 100-Foot Buffer Zone to Bank and BVW as well as the locally regulated 150-Foot Buffer Zone to Bank and BVW. Additionally, a small amount of the sealcoating work is located within the locally regulated 50-Foot No-Build Zone to Bank and BVW. No activities are located within state-regulated wetlands or other resource areas. Erosion and sediment control measures will be installed as shown on the accompanying plans. A limited amount of utility work will occur at the front of the site along Pleasant Street. This work is located outside of state- and locally-regulated resource areas and buffers.

This RDA is submitted in accordance with the Massachusetts Wetlands Protection Act (WPA; M.G.L. Ch. 131, Section 40) and implementing regulations (310 CMR 10.00 et seq.) and the City of Watertown Wetlands Ordinance (Chapter XV) and "Rules and Regulations for the Administration of the Watertown Wetlands Ordinance of 2008", revised December 2012.

Enclosed please find the RDA application package which includes the WPA Form 1, project narrative, figures, project plans, photographic documentation, abutter notification, and local filing fee. A link to an electronic copy of the pdf file of the RDA application and supporting documentation will be provided concurrently with this submittal. We respectfully request that you place this matter on your agenda for the April 6, 2022 Public Hearing.



500A Washington Street, Quincy, MA 02169

If you have any questions, please do not hesitate to contact me at 617.405.4140 or cml@lucasenviro.com.
Thank you for your consideration in this matter.

Sincerely,
LUCAS ENVIRONMENTAL, LLC

A handwritten signature in blue ink that reads 'Christopher M. Lucas'.

Christopher M. Lucas, PWS, CWS, RPSS
Environmental Consultant/Soil Scientist

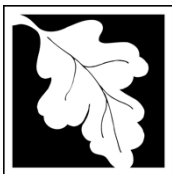
Enclosures

cc : MassDEP – NERO (hard copy)
 Affini-T Therapeutics, Kim Nguyen (electronic copy)
 PPF Industrial 20 Seyon, Bryan Blake (electronic copy)
 BIV – PARCEL 807, LLC, Bryan Blake (electronic copy)
 RJO'Connell & Associates, Inc. (electronic copy)
 Town of Watertown, Town Engineer, Department of Public Works (hard copy)
 Town of Watertown, Town Council (electronic copy)
 Town of Watertown, Planning Board (electronic copy)
 Town of Watertown, Board of Appeals (electronic copy)
 Town of Watertown, Board of Health (electronic copy)
 Town of Watertown, Building Inspector (electronic copy)
 Town of Watertown, Town Manager (electronic copy)
 City of Waltham, Conservation Commission (electronic copy)

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SECTION I – FORMS



Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

Watertown
City/Town

WPA Form 1- Request for Determination of Applicability

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

A. General Information

Important:

When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



1. Applicant:

Affini-T Therapeutics, c/o Kim Nguyen

kim.nguyen@affinitx.com

Name

E-Mail Address

343 Arsenal Street

Mailing Address

Watertown

MA

02472

City/Town

State

Zip Code

617.674.5100

Phone Number

Fax Number (if applicable)

2. Representative (if any):

Lucas Environmental, LLC

Firm

Christopher M. Lucas

cml@lucasenviro.com

Contact Name

E-Mail Address

500A Washington Street

Mailing Address

Quincy

MA

01269

City/Town

State

Zip Code

617.405.4140

Phone Number

617.405.4465

Fax Number (if applicable)

B. Determinations

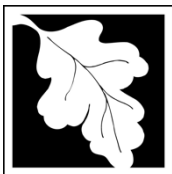
1. I request the Watertown make the following determination(s). Check any that apply:
Conservation Commission

- ☒ a. whether the **area** depicted on plan(s) and/or map(s) referenced below is an area subject to jurisdiction of the Wetlands Protection Act.
- ☐ b. whether the **boundaries** of resource area(s) depicted on plan(s) and/or map(s) referenced below are accurately delineated.
- ☒ c. whether the **work** depicted on plan(s) referenced below is subject to the Wetlands Protection Act.
- ☒ d. whether the area and/or work depicted on plan(s) referenced below is subject to the jurisdiction of any **municipal wetlands ordinance** or **bylaw** of:

Watertown

Name of Municipality

- ☐ e. whether the following **scope of alternatives** is adequate for work in the Riverfront Area as depicted on referenced plan(s).



WPA Form 1- Request for Determination of Applicability

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

C. Project Description

1. a. Project Location (use maps and plans to identify the location of the area subject to this request):

10-30 Manley Way

Street Address

806 and 807

Assessors Map/Plat Number

Watertown

City/Town

1D-0 and 1B-1A

Parcel/Lot Number

- b. Area Description (use additional paper, if necessary):

The proposed project site is located at 10-30 Manley Way in Watertown, Massachusetts. The approximately 5.26-acre commercial property consists of a 94,936 square foot, one story building, paved access/circulation drive and parking areas. Chain link fencing extends along the northern portion of the property at the edge of pavement and along a portion of the eastern side of the site where it meets stockade fencing which continues along Manley Way. The site is bounded by Walker Pond and associated Bordering Vegetated Wetland (BVW) to the north, a residential complex to the east, Pleasant Street to the south, and commercial property to the west. The Waltham/Watertown municipal boundary runs along the western edge of the project site.

- c. Plan and/or Map Reference(s):

Demolition and Sediment Plan prepared by RJ O'Connell & Associates, Inc.

Title

March 10, 2022

Date

Layout Plan prepared by RJ O'Connell & Associates, Inc.

Title

March 10, 2022

Date

Grading, Drainage, and Utility Plan prepared by RJ O'Connell & Associates

Title

March 10, 2022

Date

Details I prepared by RJ O'Connell & Associates

Title

March 10, 2022

Date

2. a. Work Description (use additional paper and/or provide plan(s) of work, if necessary):

The proposed project consists of parking lot improvements on an existing commercial development. The parking lot work is all located within existing paved areas and includes repaving a 31,480 square-foot portion of the existing parking lot and driveway area located in the northeast (rear) corner and east side of the property, and surface sealcoating the remaining portions of the paved areas not requiring replacement (approximately 57,000 square feet). Approximately 10,100 square feet of repaving is located in the locally regulated 150-Foot Buffer Zone. Repaving activities include grinding up the existing pavement and repaving with a 2.5-inch binder layer and finishing with a 1.5-inch asphalt topcoat. There will be no increase in the amount of paved area. Utility work at the front of the site along Pleasant Street includes removal of an existing transformer, installation of concrete pads to support new transformers (2) and switchgear, bollards, new gas line, and pavement restriping.



Massachusetts Department of Environmental Protection

Bureau of Resource Protection - Wetlands

Watertown

City/Town

WPA Form 1- Request for Determination of Applicability

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

C. Project Description (cont.)

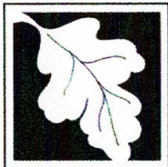
b. Identify provisions of the Wetlands Protection Act or regulations which may exempt the applicant from having to file a Notice of Intent for all or part of the described work (use additional paper, if necessary).

As indicated on the attached Plans, all pavement work is proposed within the existing paved areas of the parking lot, and at the front of the site, within a landscaped area, which would not be subject to regulation. Furthermore, the project involves "minor activities" and is compliant with 310 CMR 10.02(2)(b)1.

3. a. If this application is a Request for Determination of Scope of Alternatives for work in the Riverfront Area, indicate the one classification below that best describes the project.

- ☐ Single family house on a lot recorded on or before 8/1/96
- ☐ Single family house on a lot recorded after 8/1/96
- ☐ Expansion of an existing structure on a lot recorded after 8/1/96
- ☐ Project, other than a single-family house or public project, where the applicant owned the lot before 8/7/96
- ☐ New agriculture or aquaculture project
- ☐ Public project where funds were appropriated prior to 8/7/96
- ☐ Project on a lot shown on an approved, definitive subdivision plan where there is a recorded deed restriction limiting total alteration of the Riverfront Area for the entire subdivision
- ☐ Residential subdivision; institutional, industrial, or commercial project
- ☐ Municipal project
- ☐ District, county, state, or federal government project
- ☐ Project required to evaluate off-site alternatives in more than one municipality in an Environmental Impact Report under MEPA or in an alternatives analysis pursuant to an application for a 404 permit from the U.S. Army Corps of Engineers or 401 Water Quality Certification from the Department of Environmental Protection.

b. Provide evidence (e.g., record of date subdivision lot was recorded) supporting the classification above (use additional paper and/or attach appropriate documents, if necessary.)



Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

Watertown
City/Town

WPA Form 1- Request for Determination of Applicability

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

D. Signatures and Submittal Requirements

I hereby certify under the penalties of perjury that the foregoing Request for Determination of Applicability and accompanying plans, documents, and supporting data are true and complete to the best of my knowledge.

I further certify that the property owner, if different from the applicant, and the appropriate DEP Regional Office were sent a complete copy of this Request (including all appropriate documentation) simultaneously with the submittal of this Request to the Conservation Commission.

Failure by the applicant to send copies in a timely manner may result in dismissal of the Request for Determination of Applicability.

Name and address of the property owners:

PPF INDUSTRIAL 20 SEYON LLC

Name

c/o Morgan Stanley Real Estate, 1585 Broadway, 37th Floor

Mailing Address

New York

City/Town

NY

State

10036

Zip Code

BIV – Parcel 807, LLC

Name

c/o Seyon, 205 Newbury Street, 4th Floor

Mailing Address

Boston

City/Town

MA

State

02116

Zip Code

Signatures:

I also understand that notification of this Request will be placed in a local newspaper at my expense in accordance with Section 10.05(3)(b)(1) of the Wetlands Protection Act regulations.

Kim Nguyen

Digitally signed by Kim Nguyen
Date: 2022.03.08 16:54:48 -05'00'

Signature of Applicant

Date

Signature of Representative (if any)

Date

Christopher M. Inoue

03/10/2022



Town of Watertown
Administration Building
149 Main Street
Watertown, Massachusetts 02472
Conservation Commission
Tel: (617) 972-6426 • Fax: (617) 972-6484

Christopher J. Hayward
Conservation Agent

WATERTOWN WETLANDS ORDINANCE

Application for Permit/Determination

Application for: ☒ Request for Determination of Applicability ☐ Notice of Intent
☐ Other

Owner* 2nd Parcel Owner Info below		Applicant	
Name	PPF Industrial 20 Seyon LLC	Name	Affini-T Therapeutics
Street	c/o Morgan Stanley Real Estate,	Street	343 Arsenal Street
City	1585 Broadway, 37th Floor, NY	City	Watertown
State	New York	State	MA
Zip	10036	Zip	02472
Phone	617.982.6587	Phone	617.674.5100
e-mail	bblack@seyon.com	e-mail	kim.nguyen@affinittx.com

*Name(s) and address(s) under which title of property is recorded at Registry of Deeds.
2nd Parcel Ownership: BIV - PARCEL 807, LLC, c/o Seyon, 205 Newbury Street, 4th Floor,
Boston, MA 02116; 617.982.6587; bblake@seyon.com

1. Location of site where work is proposed: 10-30 Manley Way, Watertown, MA
-

Town of Watertown Assessor's Information:

Map: 806 and 807 Lot: 1D and 1B Block: 0 and 1A

2. Briefly describe the proposed work: Parking lot improvements at an existing commercial development. Work is located within existing paved areas and includes repaving a 31,480 square-foot portion of the existing parking lot area located in the northeast (rear) corner of the property and surface seal coating the remaining portions of the paved areas not requiring replacement (approximately 57,000 square feet). Project also includes limited utility work at the front of the site at Pleasant St. involving removal of a transformer, installation of concrete pads with two new transformers and switchgear, bollards, and pavement striping.

3. Are there any impediments to accessing the site? No x Yes

If yes, what are they (fence, dog, topography, etc.):

Chain link fencing at rear of property divides the parking lot work area and separates wetland resources from parking lot.

If yes, what arrangements have been or will be made to ensure that the Conservation Commission members and designated representatives have safe and easy access to the site?

Property owner and developer will ensure that access to the site is provided when needed.

6. Do you understand that notification of this application and the Public Hearing will be published in a newspaper of local circulation at your expense? Please check-off appropriate box: ☒ Yes ☐ No
7. How much is the filing fee, for this project, under the local ordinance? And under the Wetlands Protection Act?
\$ 1,000.00
(See Fee Schedule). Make check payable to the Town of Watertown.
\$ 0.00
(See NOI Wetland Fee Transmittal Form wpaform3.doc) Make check payable to the Watertown Conservation Commission)

I hereby certify, under the pains and penalties of perjury, that the contents of this application are true and complete.

Signature of Applicant:

Kim Nguyen

Digitally signed by Kim
Nguyen
Date: 2022.03.08 16:53:55
-05'00'

Date: _____

By signing this application the owner grants permission to the Conservation Commission for its members and designated representative to enter upon the premises of the site.

Signature of Owner:

BRYAN BLAKE

Date: 3/8/2022

Waiver

If the next regular meeting of the Conservation Commission is not within 21 days of submission of this filing, or if the agenda for the next regular meeting is full, I waive the 21 day requirement and agree to a later date for this Hearing no later than the next regular scheduled meeting or 30 days from the date of the filing a complete application (whichever is less).

Signature of Applicant:

Kim Nguyen

Digitally signed by Kim

Nguyen

Date: 2022.03.08 16:54:09

-05'00'

Date: _____



SECTION II – PROJECT NARRATIVE

1.0 INTRODUCTION

On behalf of Affini-T Therapeutics, Lucas Environmental, LLC (LE), in association with RJO'Connell & Associates, Inc. (RJOC), is pleased to submit this Request for Determination of Applicability (RDA) to the Watertown Conservation Commission for the proposed Parking Lot Improvement project located at 10-30 Manley Way in Watertown, Massachusetts. Limited utility upgrades are also proposed. The project will include repaving a 31,780 square-foot portion of the existing parking lot area located in the northeast (rear) corner of the property and surface sealcoating the remaining portions of the paved areas not requiring replacement (approximately 57,000 square feet). There will be no increase in the amount of impervious area.

A portion of proposed repaving work is located within the 100-Foot Buffer Zone to Bank and BVW as well as the locally regulated 150-Foot Buffer Zone to Bank and BVW. Additionally, a small sliver of the sealcoating work is located within the locally regulated 50-Foot No-Build Zone to Bank and BVW. No activities are located within state-regulated wetlands or other resource areas. Erosion and sediment control measures will be installed as shown on the accompanying plans. Utility work at the front of the site along Pleasant Street includes removal of an existing transformer, installation of concrete pads to support new transformers (2) and switchgear, bollards, new gas line, and pavement restriping. This work is located entirely outside of regulated resource areas and buffer zones.

This RDA is submitted in accordance with the Massachusetts Wetlands Protection Act (WPA; M.G.L. Ch. 131, Section 40) and implementing regulations (310 CMR 10.00 et seq.) and the City of Watertown Wetlands Ordinance (Chapter XV) and "Rules and Regulations for the Administration of the Watertown Wetlands Ordinance of 2008", revised December 2012. This project narrative describes the existing conditions, wetland resource areas, proposed design, and project impacts for work within jurisdictional areas on the site. RJOC has prepared the attached Site Plans.

2.0 EXISTING CONDITIONS

The proposed project site is located at 10-30 Manley Way in Watertown, Massachusetts. The approximately 5.26-acre commercial property consists of a 94,936 square foot, one story building, paved access/circulation drive and parking areas. Chain link fencing extends along the northern portion of the property at the edge of pavement and along a portion of the eastern side of the site where it meets stockade fencing which continues along Manley Way (See Figure 1 – USGS Map and Figure 2 – Aerial Map). The site is bounded by Walker Pond and associated Bordering Vegetated Wetlands (BVW) to the north, a residential complex to the east, Pleasant Street to the south, and commercial property to the west. The Waltham/Watertown municipal boundary runs along the western edge of the project site. The site is situated in a densely developed area of commercial and residential properties.

Outside of the paved areas, the vegetated area associated with Walker Pond consists of a strip of upland forest outside of a forested wetland fringe to the pond. Upland vegetation consists of red oak (*Quercus rubra*), shagbark hickory (*Carya ovata*), black cherry (*Prunus serotina*), black locust (*Robinia pseudoacacia*), grape (*Vitis* sp.), Oriental bittersweet (*Celastrus orbiculatus*), poison ivy (*Toxicodendron radicans*), and Japanese knotweed (*Polygonum cuspidatum*).

Regulated resource areas include Inland Bank and BVW associated with Walkers Pond; these areas are described in the following section.

A review of the current MassGIS data layer for the Massachusetts Natural Heritage Atlas (effective August 1, 2021) under the Natural Heritage and Endangered Species Program (NHESP) indicates that no portion of the project site is located within Priority Habitat of Rare Species or within Estimated Habitat of Rare Wildlife (See Figure 3 – NHESP Map). No Certified Vernal Pools under the jurisdiction of the Wetlands Protection Act Regulations (310 CMR 10.00 et seq.) or the Massachusetts Endangered Species Act (321 CMR 10.00 et seq.) are mapped on or near the project site.

According to the June 4, 2010 Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM) for Middlesex County, Massachusetts, Map Number 25017C0552E, the project site is located entirely within a Zone X, which is classified as an area determined to be outside the 0.2 percent chance (i.e., 500-year) floodplain (See Figure 4 – FEMA Map). Therefore, Bordering Land Subject to Flooding (BLSF) does not occur within the project site.

The project site is not located within an Area of Critical Environmental Concern (ACEC), Outstanding Resource Water (ORW), or MassDEP Wellhead Protection Area.

3.0 WETLAND RESOURCE AREAS

A Professional Wetland Scientist (PWS) from LE conducted a wetland site investigation at the project site and adjacent areas on December 8, 2021. The wetland investigation was performed in accordance with the Massachusetts Wetlands Protection Act (M.G.L. Ch. 131, § 40) and regulations (310 CMR 10.00 et seq.); Section 404 of the Clean Water Act (33 U.S.C. 1344); Massachusetts Department of Environmental Protection (MassDEP) publication “Delineating Bordering Vegetated Wetlands” under the Massachusetts Wetlands Protection Act (1995); the U.S. Army Corp of Engineers (USACE) Wetland Delineation Manual (1987); the Northcentral and Northeast Regional Supplement (2012); and the City of Watertown Wetlands Ordinance and Rules and Regulations.

The following data sources were examined prior to direct observations at the project site:

- Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps
- United States Geological Survey Topographic Quadrangle;
- MassGIS MassDEP Wetland and Hydrography Datalayers;
- MassGIS Natural Heritage Atlas Datalayers; and
- United States Department of Agriculture, Natural Resources Conservation Service (USDA-NRCS) Soil Survey.

No wetland resource areas are present within the project site; however, Walker Pond and its associated Inland Bank and BVW resource areas are located immediately to the north of the work area, separated by a chain link fence.

3.1 Inland Bank

Section 310 CMR 10.54 of the WPA defines a Bank as *the portion of the land surface which normally abuts and confines a water body. It occurs between a water body and a vegetated bordering wetland and adjacent flood plain, or, in the absence of these, it occurs between a water body and an upland. The upper boundary of a Bank is the first observable break in the slope or the mean annual flood level, whichever is lower. The lower boundary of a Bank is the mean annual low flow level.* The Watertown Rules & Regulations define Bank as *the upper boundary of a Bank is the first observable break in the slope or the Mean Annual Flood Level, whichever is higher.* Based upon field characteristics and local and state definitions, the delineated Bank is further described below and is coincident with the Mean Annual High Water (MAHW) line.

Inland Bank is present north of the project area associated with Walker Pond which is north of the fenced in project site. Bank was delineated with blue survey flagging tape numbered sequentially from BF1-1 to BF1-53 on the south side of the pond. For the most part, Bank is clearly defined and coincident with the edge of water and is bordered by BVW. Two drainage culverts (one 12-inch and one 18-inch) discharge into the pond via a narrow channel and a 15-inch drain line discharges to the pond to the east of the channel. No work is proposed within this resource area.

3.2 Bordering Vegetated Wetland

Section 310 CMR 10.55 of the WPA defines BVW as *freshwater wetlands which border on creeks, rivers, streams, ponds and lakes. The types of freshwater wetlands are wet meadows, marshes, swamps and bogs. Bordering Vegetated Wetlands are areas where the soils are saturated and/or inundated such that they support a predominance of wetland indicator plants. The boundary of Bordering Vegetated Wetlands is the line within which 50% or more of the vegetational community consists of wetland indicator plants and saturated or inundated conditions exist. Wetland indicator plants are also those classified in the indicator categories of Facultative, Facultative+, Facultative Wetland-, Facultative Wetland, Facultative Wetland+, or Obligate Wetland in the National List of Plant Species That Occur in Wetlands: Massachusetts (Fish & Wildlife Service, U.S. Department of the Interior, 1988) or plants exhibiting physiological or morphological adaptations to life in saturated or inundated conditions.* The Watertown Rules & Regulations define BVCW per the WPA, and includes wetlands whether they are bordering or isolated.

Wetland A is a BVW that extends along portions of Walker Pond north of the project site. BVW was delineated with pink survey flagging tape numbered sequentially from WFA-1 to WFA-37. The wetland boundary is coincident with Bank or as a fringe to the pond varying in width up to 30 feet. Further to the north and east of the project site, the BVW widens considerably. Chain link fencing separates the wetland and pond from the pavement areas on the project site. Wetland vegetation includes red maple (*Acer rubrum*), common elderberry (*Sambucus canadensis*), glossy buckthorn (*Frangula alnus*), American elm (*Ulmus americana*), gray birch (*Betula populifolia*), goldenrod (*Solidago* sp.), silky dogwood (*Cornus amomum*), sensitive fern (*Onoclea sensibilis*), and jewelweed (*Impatiens capensis*). No work is proposed within BVW.

4.0 PROPOSED WORK

The proposed project consists of parking lot improvements to an existing commercial development site. The parking lot work is all located within existing paved areas and includes repaving a 31,780 square-foot portion of the existing parking lot area located in the northeast (rear) corner of the property and surface sealcoating the remaining portions of the paved areas not requiring replacement (approximately 57,000 square feet). Repaving activities include grinding up the existing pavement and repaving with a 2.5-inch binder layer and finishing with a 1.5-inch asphalt topcoat. There will be no increase in the amount of paved area.

To protect the nearby Walker Pond and associated BVW, erosion and sediment control measures will be installed as shown on the accompanying plans. Utility work at the front of the site along Pleasant Street includes removal of an existing transformer, installation of concrete pads with new transformers (2) and switchgear, bollards, new gas line, and pavement restriping, totaling approximately 5,700 square feet.

A portion of proposed repaving work is located within the 100-Foot Buffer Zone to Bank and BVW as well as the locally regulated 150-Foot Buffer Zone to Bank and BVW. Additionally, a small sliver (approximately 360 square feet) of the sealcoating work is located within the locally regulated 50-Foot No-Build Zone to Bank and BVW.

As indicated on the attached Plans, all pavement work is proposed within the existing paved areas of the parking lot, and at the front of the site, within a landscaped area and would not be subject to regulation. Furthermore, the project is compliant with 310 CMR 10.02(2)(b)1, which states the following:

1. Minor activities, as described in 310 CMR 10.02(2)(b)2., within the buffer zone and outside any areas specified in 310 CMR 10.02(1)(a) through (e) are not otherwise subject to regulation under M.G.L. c. 131, § 40 provided that the work is performed: solely within the buffer zone, as prescribed in 310 CMR 10.02(2)(b)2.a. through q., in a manner so as to reduce the potential for any adverse impacts to the resource area during construction, and with post-construction measures implemented to stabilize any disturbed areas. Factors to consider when measuring the potential for adverse impacts to resource areas include the extent of the work, the proximity to the resource area, the need for erosion controls, and the measures employed to prevent adverse impacts to resource areas during and following the work.

With respect to local regulation of wetland resources, the Watertown Wetlands Ordinance regulates: (a) Any river (including perennial streams), lake or pond; (b) Any wetland, marsh, wet meadow, bog, swamp or vernal pool; (c) Any bank; (d) Any lands bordering on any lake, pond, intermittent stream, spring, brook or creek; (e) Any land under any river, stream, brook, creek, lake, pond or ditch (known as “Land Under Waters”; (f) Any land subject to flooding or inundation by groundwater or surface water that substantially promotes the purposes of this Ordinance; (g) Any land in the 100 year floodplain as delineated pursuant to the regulations of the Commission; (h) Any land within 200 feet of any river (including perennial streams) (known as the “Riverfront Area”); or (i) Any land within 150 feet of any wetland, marsh, wet meadow, bog, swamp, bank, lake, pond or non-perennial stream (known as the “buffer zone”), regardless of whether the land borders surface waters.

In addition, the Ordinance regulates a No-Build Zone as follows:

(a) Without limiting the foregoing, and as an additional local requirement, no person shall build or enlarge any structure, parking lot or impervious surface upon or within an area that extends fifty (50) feet from the outer limit of a wetland resource area, e.g., any marsh, meadow, bog, swamp or vernal pool; any bank; or any river, stream, creek or brook, lake, pond or spring. (b) The Commission may in its sole discretion make exceptions to this fifty-foot no-build zone, as provided by Section IV.A(9).

Although portions of the work described herein are located within the local 150-Foot Buffer Zone to Bank, BVW, and the 50-foot No-Build Zone, there is no reasonable alternative to performing the work which will occur entirely within an existing developed site. As shown on the attached Plans, the proposed work within the footprint of existing paved areas and will not have any adverse effect on any interests identified in the Wetlands Protection Act or the Watertown Wetlands Ordinance. The project is designed to minimize adverse effects on the resource areas.

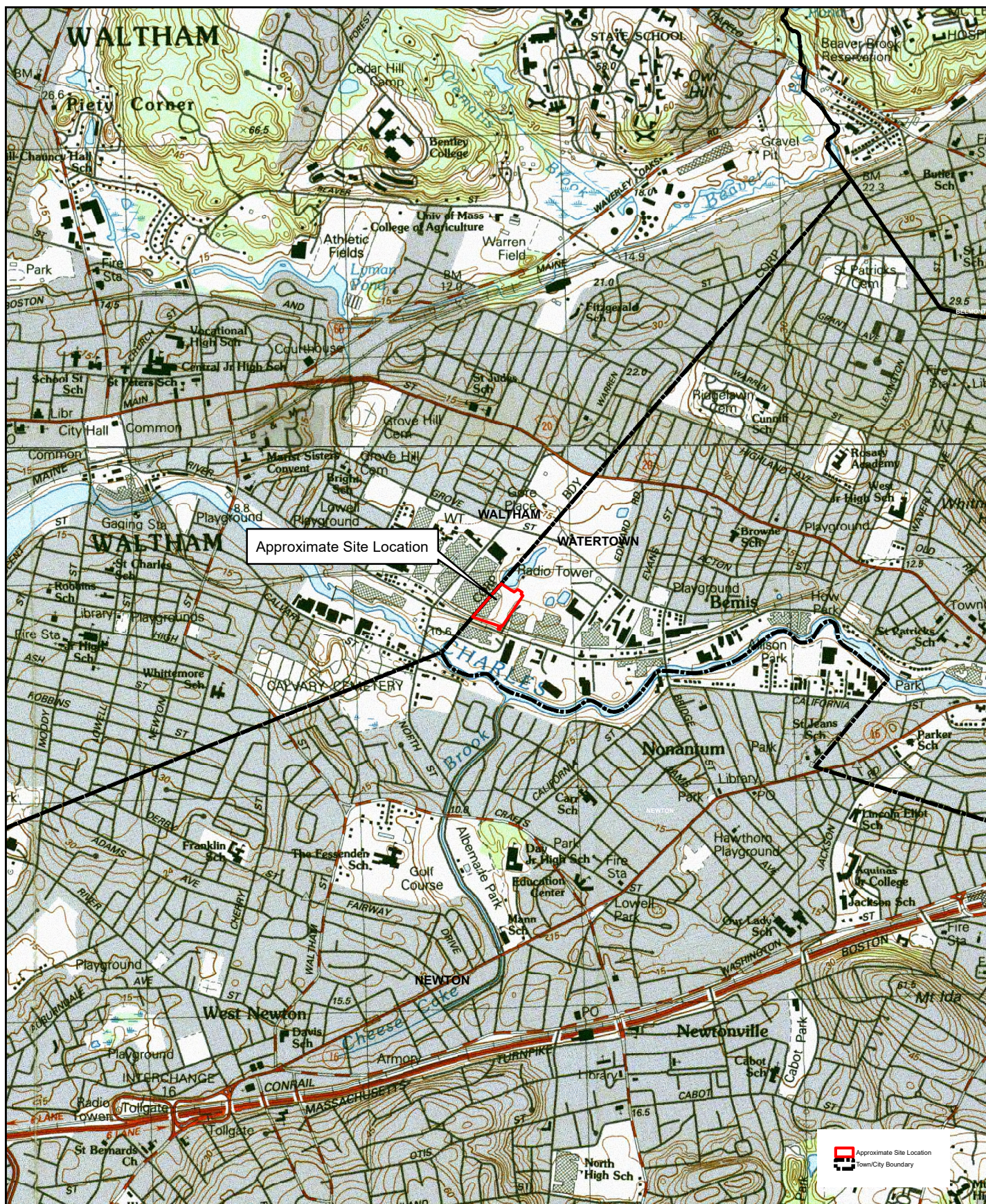
5.0 SUMMARY

The proposed project consists of parking lot improvements within the footprint an existing commercial development at the rear of the site which is within established state and local Buffer Zones of BVW and Bank resources areas. The parking lot work is all located within existing paved areas and includes removal and replacement of a portion of the existing parking area which is deteriorated, and sealcoating and restriping the remainder of the parking areas. In addition, a limited amount of utility work is proposed at the front of the site.

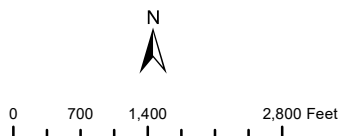
It is LE's opinion, based on our professional education, training, and familiarity with the project site, that the proposed work will not have any adverse effect on any interests identified in the Wetlands Protection Act and Watertown Wetlands Ordinance.

The proposed design achieves the goals of the Applicant, while being sensitive to adjacent regulated resource areas. Accordingly, the Applicant respectfully requests that the Watertown Conservation Commission consider a finding that the proposed design is adequately protective of the interests identified in the Wetlands Ordinance and issue a Negative Determination of Applicability approving the project as described in this RDA application and as shown on the attached Plans.

SECTION III – FIGURES



Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs; USGS Topographic Quadrangle Images

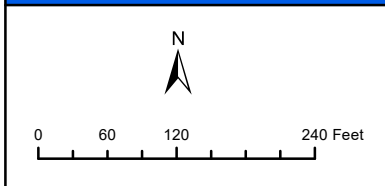


USGS Map
RDA
10-30 Manley Way
Watertown, MA





Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs; USGS Color Ortho Imagery - 15cm (2021)



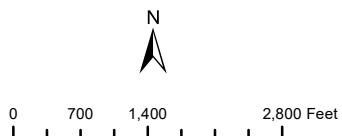
Aerial Map
RDA
10-30 Manley Way
Watertown, MA

FIGURE 2





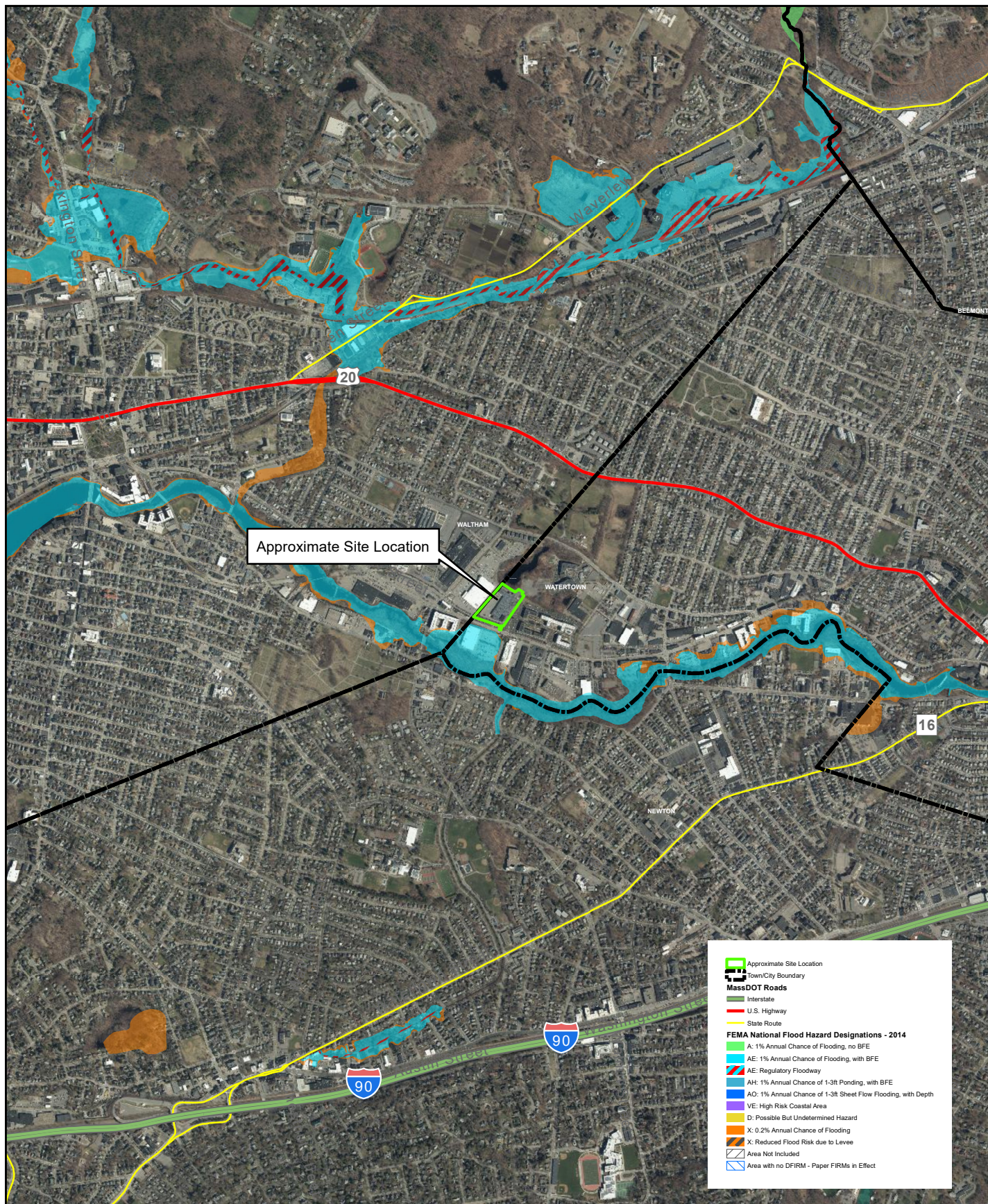
Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs; USGS Color Ortho Imagery - 15cm (2021)



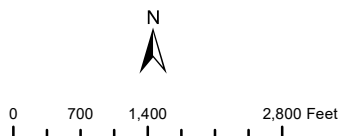
NHESP Map
RDA
10-30 Manley Way
Watertown, MA

FIGURE 3





Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs; USGS Color Ortho Imagery - 15cm (2021)



FEMA Map
RDA
10-30 Manley Way
Watertown, MA



SECTION IV – APPENDICES

PHOTOGRAPHIC DOCUMENTATION

PHOTOGRAPHIC DOCUMENTATION

DATE: December 8, 2021



Photograph 1: View north of paved area requiring repair; Walker Pond and associated wetland fringe in distance beyond fence.



Photograph 2: View north adjacent to Photograph 1.

PHOTOGRAPHIC DOCUMENTATION

DATE: December 8, 2021



Photograph 3: View north of drainage channel that discharges to Walker Pond and Wetland A (BVW).



Photograph 4: View northeast of Walker Pond and Wetland A (BVW).

ABUTTER INFORMATION

NOTIFICATION TO ABUTTERS

WATERTOWN WETLANDS ORDINANCE MASSACHUSETTS WETLANDS PROTECTION ACT M.G.L. C. 131. §40

An Application for Permit has been filed with the Watertown Conservation Commission seeking permission to remove, fill, dredge or alter an area subject to protection under G.L. Ch. 131. §40 and/or the Watertown Wetlands Ordinance.

The name of the Applicant is: **Affini-T Therapeutics**

The address of the land where the activity is proposed is: **10-30 Manley Way, Watertown, MA**

The work proposed is: **repaving, seal-coating, re-striping parking lot at rear of property; utility transformer work at front of property (near Pleasant Street).**

Copies of the Application for Permit and Notice of Intent and accompanying plans may be examined at the office of the Watertown Conservation Commission, Town Hall (3rd floor), 149 Main Street, Watertown MA during regular business hours.

For more information, call **Christopher Lucas/Lucas Environmental, LLC at: 617.405.4140, cml@lucasenviro.com**. Check one: This is the Applicant [☐], Applicant's representative [☒], or other [specify].

Copies of the Application for Permit and Notice of Intent may be obtained from either (check one) the Applicant [☐] or the Applicant's representative [☒], by calling: **617.405.4140 from 9:00 am to 5:00 pm, Monday through Friday, or email: cml@lucasenviro.com**.

Notice of the public hearing to be held [**Wednesday, April 6, 2022, 7:00PM, check Town Calendar for Zoom Link or room location**], will be published in the *Watertown Tab* and will be posted outside the Town Clerk's office on the first floor of the Watertown Town Hall, at least five business days in advance of the hearing.

Contact the Watertown Conservation Commission of the MA Department of Environmental Protection (DEP) Northeast Region Office for information about this Application or the Wetlands Protection Act, and the Commission regarding the Watertown Wetlands Ordinance.

NOTE: To preserve your appeal rights you must submit comments/concerns in writing.

Watertown Conservation Commission
(617) 972-6426

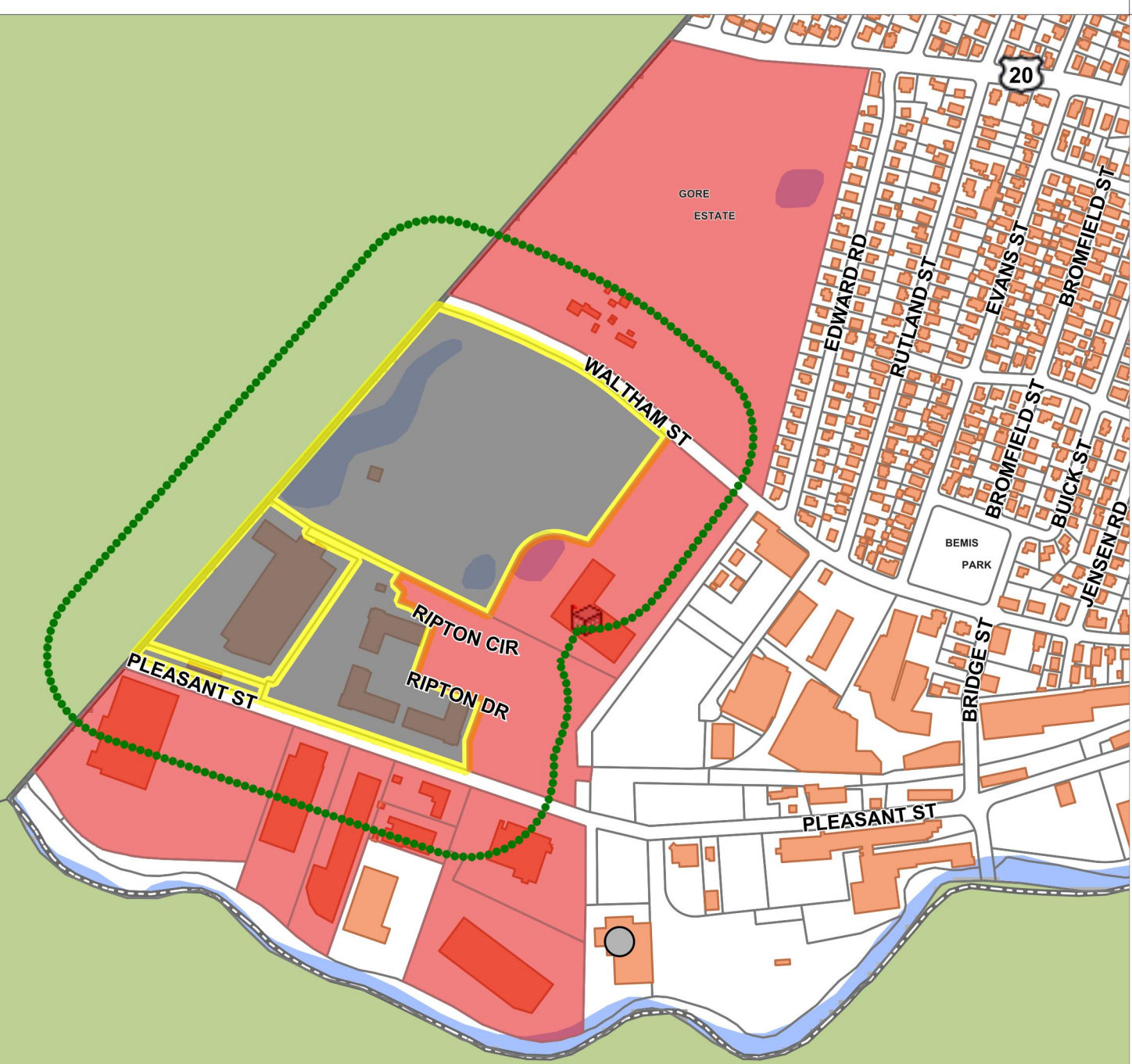
<http://www.watertown-ma.gov/index.aspx?nid=103>

MassDEP Northeast Region Office
(978) 694-3200

<http://www.mass.gov/dep/>



- Fire Stations
- Police Stations
- Schools
- Public Libraries
- Hospitals
- Community Health Centers
- Ice Rinks
- Buildings
- Hooks
- Parcels
- Town Boundary
- MA Highways
 - Interstate
 - US Highway
 - Numbered Routes
- Abutting Town Labels
- Abutting Towns
- Bathymetry
 - 0-5 ft
 - 5-10 ft
 - 10-15 ft
 - 15-20 ft
 - 20-30 ft
 - 30-40 ft
 - 40-50 ft
 - 50-60 ft
 - 60-70 ft
 - 70+ ft
- Streets



The data shown on this site are provided for informational and planning purposes only. The Town and its consultants are not responsible for the misuse or misrepresentation of the data.

0 670 1340 ft

Printed on 03/03/2022 at 05:00 PM

Parcel ID: 806 3 3101
FUXMAN YAIR DAVID
UCCIANI MARIA SOL
3 REPTON CR #3101
WATERTOWN, MA 02472

Parcel ID: 806 3 3102
MARCOTTE EUGENE
LEE ELLEN
3 REPTON CR #3102
WATERTOWN, MA 02472

Parcel ID: 806 3 3103
OLIVAR KAIHLA
3 REPTON CR #3103
WATERTOWN, MA 02472

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LIU TIANZI
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WATERTOWN, MA 02472

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ZOPHIN REBECCA
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WATERTOWN, MA 02472

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YOON KYUNGMOON
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WATERTOWN, MA 02472

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FITZSTEVENS MAIA GES
FITZSTEVENS CHRISTINE
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WATERTOWN, MA 02472

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GULATI ANMOL
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WATERTOWN, MA 02472

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SZETO AMY LEE
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WATERTOWN, MA 02472

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YEN LUCY
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WATERTOWN, MA 02472

Parcel ID: 806 3 3111
ZIRLINGER ANDRES
ZIRLINGER MARIELA
190 TEMPLE STREET
WEST NEWTON, MA 02465

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DONABED RALPH ETUX
3REPTON CR U-3112 REALTY
125 SOTA DRIVE
JUPITER, FL 33458

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VICKI VANSANT 2017 REV
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WATERTOWN, MA 02472

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3 REPTON CR U3114
WATERTOWN, MA 02472

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NOBLE WILLIAM R
MKHITARYAN MARINE
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PIERRE-LOUIS NATIVITA
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130 PIGEON LN
WALTHAM, MA 02452

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WATERTOWN, MA 02472

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C/O VASILLA MAGNISALIS
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WATERTOWN, MA 02472

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NEWELL KANDEE
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V A ASHFIELD TRUST NO. 1
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WATERTOWN, MA 02472

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4 REPTON CR #4111
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SOMERVILLE, MA 02143

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NEWTON, MA 02472

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COLACO IVONE
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WESTBOROUGH, MA 01581

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ANIS SHERIF W
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HACK TRUSTEE SUZANNE M.
1033 ARBORGATE CIRCLE
CHAPEL HILL, NC 27514

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WATERTOWN, MA 02472

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WATERTOWN, MA 02472

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WATERTOWN, MA 02472

Parcel ID: 806 3 5207
CASCAP-METSTATE HOUSING
231 SOMERVILLE AV
SOMERVILLE, MA 02143

Parcel ID: 806 3 5208
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WATERTOWN, MA 02472

Parcel ID: 806 3 5209
BEH CHARLENE
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WATERTOWN, MA 02472

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WATERTOWN, MA 02472

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WATERTOWN, MA 02472

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WATERTOWN, MA 02472

Parcel ID: 806 3 5213
FREUND SIDNEY
FREUND LISA
807 KNOLL WOOD COURT
NAPLES, FL 34108

Parcel ID: 806 3 5214
ZAKHARY MARK ET WAGDY
ZAKHARY MARY
1604 E CLEMENT ST
BALTIMORE, MD 21230

Parcel ID: 806 3 5215
BILLINGS ROBERT
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WATERTOWN, MA 02472

Parcel ID: 806 3 3301
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WATERTOWN, MA 02472

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HAIRSTON TIMOTHY W
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WATERTOWN, MA 02472

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WATERTOWN, MA 02472

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AHN YUN-HWA
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DORFMAN LAURA
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WATERTOWN, MA 02472

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GOLDSTONE EDWARD C
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WATERTOWN, MA 02472

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HILLIKER WILLIAM
HELFET LINDA
3 REPTON CR #3310
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CZMUT JR WALTER J
MC SHANE MARSHA J
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WATERTOWN, MA 02472

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LEE KAREN J
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TRIEDI PURNIMA
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PEZESHKI FARNAZ
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WATERTOWN, MA 02472

Parcel ID: 806 3 4301
HERRANZ DAVID
TOLEDO MONICA
4 REPTON CR #4301
WATERTOWN, MA 02472

Parcel ID: 806 3 4302
HUANG RAYMOND
GUAN MEICHUN
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WATERTOWN, MA 02472

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THOMAS R MERINGOLO REV
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Parcel ID: 806 3 4307
JEWERS KIMBERLY
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Parcel ID: 806 3 4308
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WANG SHWU-CHING
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LI ZHI
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WATERTOWN, MA 02472

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WATERTOWN, MA 02472

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BELSCHNER LAUREN
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WATERTOWN, MA 02472

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WATERTOWN, MA 02472

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TAKAHASHI DAISUKE
TAKAHASHI MISA
4 REPTON CIRCLE
UNIT 4313
WATERTOWN, MA 02472

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C/O VALERIA DIODATO
5 POND PLACE LANE
CONCORD, NH 03301

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FORTH ANNE MARIE
4 REPTON CR #4315
WATERTOWN, MA 02472

Parcel ID: 806 3 5301
PARK JUNG AE
5 REPTON CR U-5301
WATERTOWN, MA 02472

Parcel ID: 806 3 5302
CHEN TRUSTEE DONGLING
DONGLING CHEN TRUST
5 REPTON CR 5302
WATERTOWN, MA 02472

Parcel ID: 806 3 5303
VANARIA JAMIE
5 REPTON CIRCLE U#5303
WATERTOWN, MA 02472

Parcel ID: 806 3 5304
RENCURREL DANIEL B
5 REPTON CR U5304
WATERTOWN, MA 02472

Parcel ID: 806 3 5305
NMW REAL ESTATE LLC
C/O PURITAN FOOD CO INC
17 FOODMART RD
BOSTON, MA 02118

Parcel ID: 806 3 5306
WHEELER RICHARD
5 REPTON CR #5306
WATERTOWN, MA 02472

Parcel ID: 806 3 5307
KARAGOZIAN NANOR
KARAGOZIAN RAFFI
22 BARTLETT ST
WATERTOWN, MA 02472

Parcel ID: 806 3 5308
ORLEWICZ DANUTA
5 REPTON CR #5308
WATERTOWN, MA 02472

Parcel ID: 806 3 5309
CARMI RAOUF
5 REPTON CR U5309
WATERTOWN, MA 02472

Parcel ID: 806 3 5310
BRYSON ELIZABETH M
BRYSON PATRICIA A
5 REPTON CR #5310
WATERTOWN, MA 02472

Parcel ID: 806 3 5311
SMITH BARRY W
5 REPTON CR #5311
WATERTOWN, MA 02472

Parcel ID: 806 3 5312
BARRY MICHAEL J
5 REPTON CR #5312
WATERTOWN, MA 02472

Parcel ID: 806 3 5313
MELIKYAN ARTEM
462 MT AUBURN ST
#4C
WATERTOWN, MA 02472

Parcel ID: 806 3 5314
GE QIN QIN
WANG YANSHENG
5 REPTON CR 5314
WATERTOWN, MA 02472

Parcel ID: 806 3 5315
YUAN LU
5 REPTON CR #5315
WATERTOWN, MA 02472

Parcel ID: 806 3 3401
NIU JINLI
3 REPTON CR U3401
WATERTOWN, MA 02472

Parcel ID: 806 3 3402
DVINOV ELENA
3 REPTON CR U3402
WATERTOWN, MA 02472

Parcel ID: 806 3 3403
SEWELL MARK
3 REPTON CR UNIT 3403
WATERTOWN, MA 02472

Parcel ID: 806 3 3404
PANTAZOPOULOS STELIOS
3 REPTON CIRCLE UNIT 3404
WATERTOWN, MA 02472

Parcel ID: 806 3 3405
YUEN DANA
3 REPTON CR U-3405
WATERTOWN, MA 02472

Parcel ID: 806 3 3406
JUVVADI PADMAJA
3 REPTON CR 3406
WATERTOWN, MA 02472

Parcel ID: 806 3 3407
ZHANG YUYAN
3 REPTON CIRCLE U3407
WATERTOWN, MA 02472

Parcel ID: 806 3 3408
LEE MICHAEL HUA-YUEN
LEE DORA & JOHN
3 REPTON CR #3408
WATERTOWN, MA 02472

Parcel ID: 806 3 3409
YEN KUEILAN GLORIA
3 REPTON CR U3409
WATERTOWN, MA 02472

Parcel ID: 806 3 3410
BASEVICH ANNA ESTER
3 REPTON CR #3410
WATERTOWN, MA 02472

Parcel ID: 806 3 3411
CHASE LAUREN
3 REPTON CR U3411
WATERTOWN, MA 02472

Parcel ID: 806 3 3412
LEWIS RANDALL M
3 REPTON CR U-3412
WATERTOWN, MA 02472

Parcel ID: 806 3 3413
VALLUCCI MARK D TRUSTEE
JAGGER TRUST
3 REPTON CR #3413
WATERTOWN, MA 02472

Parcel ID: 806 3 3414
TAMBASCIO SARAH L TRUSTEE
MAT IRREVOCABLE TRUST
3 REPTON CR #3414
WATERTOWN, MA 02472

Parcel ID: 806 3 3415
YU JIE
XIE BING
3 REPTON CR U3415
WATERTOWN, MA 02472

Parcel ID: 806 3 4401
LVOVICH TAMARA L/E
LVOVICH LEONID R/M
4 REPTON CR #4401
WATERTOWN, MA 02472

Parcel ID: 806 3 4402
WARE JANICE
4 REPTON CIR U4402
WATERTOWN, MA 02472

Parcel ID: 806 3 4403
MENEGON LYNN TRUSTEE
LYNN M MENEGON TRUST
4 REPTON CR U 4403
WATERTOWN, MA 02472

Parcel ID: 806 3 4404
BOYER KRISTEN
4 REPTON CR #4404
WATERTOWN, MA 02472

Parcel ID: 806 3 4405
MAN CHIU-FAI
4 REPTON CR #4405
WATERTOWN, MA 02472

Parcel ID: 806 3 4406
LAFARGUE KATHRYN M
4 REPTON CR #4406
WATERTOWN, MA 02472

Parcel ID: 806 3 4407
RANDO RICHARD J
RANDO LINDA
4 REPTON CR 4407
WATERTOWN, MA 02472

Parcel ID: 806 3 4408
CHOU YI-TING
4 REPTON CR #4408
WATERTOWN, MA 02472

Parcel ID: 806 3 4409
JANG YOUNGHEE
4 REPTON CIRCLE, UNIT4409
WATERTOWN, MA 02472

Parcel ID: 806 3 4410
TSENG LEWIS
CHENG YU-TIEN
4 REPTON CR #4410
WATERTOWN, MA 02472

Parcel ID: 806 3 4411
CHANG SUE HUA
4 REPTON CR #4411
WATERTOWN, MA 02472

Parcel ID: 806 3 4412
KATZ ANA G
4 REPTON CR 4412
WATERTOWN, MA 02472

Parcel ID: 806 3 4413
WILLIG JERILYN G
4 REPTON CR U4413
WATERTOWN, MA 02472

Parcel ID: 806 3 4414
HAMANN LISA A
4 REPTON CR #4414
WATERTOWN, MA 02472

Parcel ID: 806 3 4415
JIN MIN
LIANG YINAN
4 REPTON CR #4415
WATERTOWN, MA 02472

Parcel ID: 806 3 5401
PINSKY VLADIMIR
PINSKY LUDMILA
5 REPTON CR #5401
WATERTOWN, MA 02472

Parcel ID: 806 3 5402
DEW VICTORIA ANITA
5 REPTON CR U5402
WATERTOWN, MA 02472

Parcel ID: 806 3 5403
HUNT TAMI J
HUNT BRIAN D
5 REPTON CR 5403
WATERTOWN, MA 02472

Parcel ID: 806 3 5404
CUTONE ANTONETTE E
5 REPTON CR 5404
WATERTOWN, MA 02472

Parcel ID: 806 3 5405
GARDE SAMANTHA
5 REPTON CR UNIT 5405
WATERTOWN, MA 02472

Parcel ID: 806 3 5406
ROTHMAN LAURA B
5 REPTON CR #5406
WATERTOWN, MA 02472

Parcel ID: 806 3 5407
DEJEAN JACQUELINE S
5 REPTON CR U5407
WATERTOWN, MA 02472

Parcel ID: 806 3 5408
KYAW MYO M
5 REPTON CR U-5408
WATERTOWN, MA 02472

Parcel ID: 806 3 5409
PLATO LISA A
ISENBERG MARCUS A
9 ISLINGTON ST
ALLSTON, MA 02134

Parcel ID: 806 3 5410
KORETSKY IGOR AND
GURVITS KATRINA TRUSTEE
KORETSKY IRREV TRUST
5 REPTON CR U5410
WATERTOWN, MA 02472

Parcel ID: 806 3 5411
CARMI RAJA ROBERT
5 REPTON CR U5411
WATERTOWN, MA 02472

Parcel ID: 806 3 5412
PANTAZOPOULOS STELIOS
5 REPTON CR U5412
WATERTOWN, MA 02472

Parcel ID: 806 3 5413
LEYFER VAL
LEYFER TANYA
2239 COMMONWEALTH AVENUE
AUBURNDALE, MA 02466

Parcel ID: 806 3 5414
WANG YOUZHEN
REN RUIBAO
53 BROOKDALE ROAD
NEWTON, MA 02460

Parcel ID: 806 3 5415
MAO CHENCHEN
5 REPTON CR U5415
WATERTOWN, MA 02472

Parcel ID: 807 1B 1A
BIV - PARCEL 807, LLC
C/O SEYON
43 BROAD STREET C404
HUDSON, MA 01749

Parcel ID: 806 1D 0
PPF INDUSTRIAL 20 SEYON
C/O MORGAN STANLEY REAL ESTATE
1585 BROADWAY, 37TH FLOOR
NEW YORK, NY 10036

Parcel ID: 806 4 0
MELKONIAN GROUP LLC
185 MAIN STREET
STONEHAM, MA 02180

Parcel ID: 807 1B 1
BELL HNW EXCHANGE
C/O BELL PARTNERS INC
1511 SUNDAY DRIVE, SUITE 316
RALEIGH, NC 27607

Parcel ID: 702 1A 0
GORE PLACE SOCIETY
52 GORE ST
WALTHAM, MA 02154

Parcel ID: 806 3 0
VRS/MCRT WATERTOWN MEWS
BOZZUTO MGMT -ATTN:
1 REPTON PL
WATERTOWN, MA 02472

Parcel ID: 807 1B 0
JEWISH COMMUNITY DAY SCH
57 STANLEY AV
WATERTOWN, MA 02472

Parcel ID: 809 2D 0
RUSSO OLGO A TRUSTEE
OLGO A RUSSO REALTY
560 PLEASANT ST
WATERTOWN, MA 02472

Parcel ID: 810 1 7
FLUID MANAGEMENT SYSTEMS
580 PLEASANT ST
WATERTOWN, MA 02472

Parcel ID: 810 4 1A
SIX FIFTY PSW LLC
650 PLEASANT ST
WATERTOWN, MA 02472

Parcel ID: 810 5 3A
WCV-610 PLEASANT, LLC
C/O GCP MANAGEMENT LLC
313 WASHINGTON ST STE 301
NEWTON, MA 02458

Parcel ID: 810 7 8
KEZERIAN FAMILY LLC
P.O.BOX 117
WATERTOWN, MA 02472

Parcel ID: 810 9 9
586 PLEASANT ST REALTY
152 BELLEVUE ST
WATERTOWN, MA 02472

Parcel ID: 810 9 9U1
586 PLEASANT ST REALTY
152 BELLEVUE ST
WATERTOWN, MA 02472

Parcel ID: 810 9 9U2
586 UNIT 2 REALTY LLC
P O BOX 79092
WAVERLEY, MA 02479

Parcel ID: 810 9 9U3
TZIAVAS COMMERCIAL
19 ROBINWOOD RD
BELMONT, MA 02478

Parcel ID: 810 9 9U4
586 PLEASANT ST REALTY
152 BELLEVUE ST
WATERTOWN, MA 02472

Parcel ID: 810 9 9U5
T&S INVESTMENTS LLC
57 LEITHA DRIVE
WALTHAM, MA 02451

Parcel ID: 810 9 9U6
T & S INVESTMENTS LLC
57 LEITHA DRIVE
WALTHAM, MA 02478

Parcel ID: 810 9 9U7
PORTNOY REALTY GROUP
25 CHANNING RD
WATERTOWN, MA 02472

Parcel ID: 810 9 9U8
586 PLEASANT ST REALTY
152 BELLEVUE ST
WATERTOWN, MA 02472

Parcel ID: 812 1 3
BREM SIMBA 700 PLEASANT,
C/O EQUITY INDUSTRIAL
20 PICKERING STREET SUITE 200
NEEDHAM, MA 02492

20 SEYON STREET,
100 WOODVIEW WAY,
AND 0 STANLEY AVENUE
PARCEL ABUTTERS
CITY OF WALTHAM
MASSACHUSETTS



DISCLAIMER:
This map is for reference and planning purposes only. It is prepared for the inventory of real property within the City of Waltham and is compiled from tax maps, recorded deeds and plats. Users of this tax map are hereby notified that the aforementioned public primary information sources should be consulted for the verification of the information contained on this map. The City of Waltham and its mapping contractors assume no legal responsibility for the information contained herein.

DATA SOURCE:
The digital planimetric base map data were developed by Chas H Sells, Inc. and are updated using spring 2021 1"= 40' scale color orthophotographs. The parcel data and are current as of January 2022. Map prepared by City of Waltham GIS.

Legend

- 300 Foot Radius

Edge of Pavement

Unpaved Road

Fence

Guard Rail

Retaining Wall

Stone Wall

Rail Lines

Stream

Tax Map Grid

Parcel Lines

Watertown Parcels
- Walkway/Sidewalk

Building Footprint

Deck

Paved Area

Unpaved Area

Water Bodies

Wetland Area

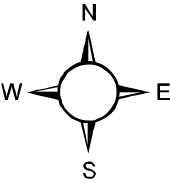
Vegetated Area

Park

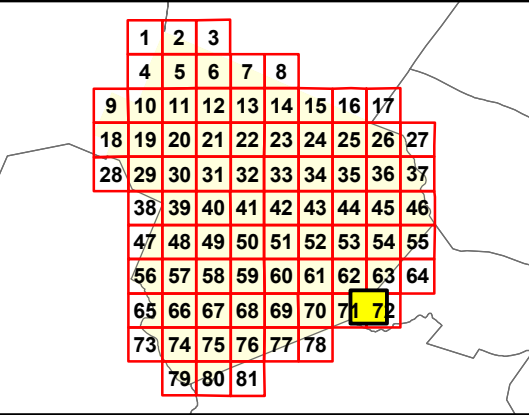
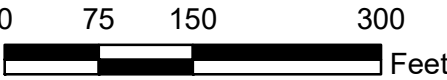
Parcel NumberAddress Number

R022 015 0001

19



1 inch = 153 feet



Map No.:

71

PARCELID	LOCATION	OWNER NAME	OWNER ADDRESS	OWNER CITY	OWNER STATE	OWNER ZIP
R063 025 0001	52 GORE ST	GORE PLACE SOCIETY	52 GORE ST. /	WALTHAM	MA	02453-6866
R071 004 0002	66 SEYON ST	I-PARK WEST SEYON, LLC / C/O JOSEPH CLANCY	433 SOUTH MAIN ST /	WEST HARTFORD	CT	06110
R071 004 0004	26 SEYON ST	WATERTOWN FORD SERVICE LLC.	185 MAIN ST. /	STONEHAM	MA	02180
R071 005 0001	37 RIVER ST	TP WALTHAM STORAGE, LLC.	2265 E. MURRAY HOLLADAY RD.	SALT LAKE CITY	UT	84117
R071 005 0002	37 R RIVER ST	MELKONIAN GROUP, LLC / % WATERTOWN FORD, INC.	625 PLEASANT ST	WATERTOWN	MA	02472
R071 008 0001	36 RIVER ST	UDR CURRENTS ON THE CHARLES / LLC	1745 SHEA CENTER DR S-200	HIGHLANDS RANCH	CO	80129
R071 008 0002	10 RIVER ST	LCP SUPERMARKETS REMAINDER / 2000 LLC., STOP & SHOP CO.	P.O.BOX 6500 /	CARLISLE	PA	17013
R072 004 0005 001	8 GROVE ST 1	NADD4-8U1 LLC.	205-1 HAMMOND ST /	WALTHAM	MA	02451
R072 004 0005 002	8 GROVE ST 2	LACAVA, ANTHONY J & JENNA / M LACAVA	8 GROVE ST #2 /	WALTHAM	MA	02453
R072 004 0006 001	12 GROVE ST 1	CHENG, LEO & YING WANG	12 GROVE ST #1 /	WALTHAM	MA	02453
R072 004 0006 002	12 GROVE ST 2	SOLOMON, PAUL R & ELIZABETH / VASSEY	12 GROVE ST #2 /	WALTHAM	MA	02453
R072 004 0007 001	18 GROVE ST 1	COMEAU, THOMAS F. & ANN M.	18 GROVE ST #1 /	WALTHAM	MA	02453
R072 004 0007 002	18 GROVE ST 2	KUMAR, SANGEETA & RIJU KUMAR	18 GROVE ST #2 /	WALTHAM	MA	02453
R072 004 0008 001	22 GROVE ST 1	XIA, ZHINAN & NANCY Y SU	22 GROVE ST #1 /	WALTHAM	MA	02453
R072 004 0008 002	22 GROVE ST 2	DEBRA COLEMAN REV. TRUST; / DEBRA COLEMAN TR.	22 GROVE ST #2 /	WALTHAM	MA	02453
R072 004 0009 001	30 GROVE ST 1	LIN, TAI-AN & WAN-LIN YANG	30 GROVE ST #1 /	WALTHAM	MA	02453
R072 004 0009 002	30 GROVE ST 2	SWANSON, KENNETH D. & LILY I. / PAO	30 GROVE ST #2 /	WALTHAM	MA	02453
R072 004 0010 001	34 GROVE ST 1	NANDY, INDRANI & KAILAS N. / NANDI	34 GROVE ST #1 /	WALTHAM	MA	02453
R072 004 0010 002	34 GROVE ST 2	YEO, SEUNGHWAN & YOON / KYUNG KIM	34 GROVE ST #2 /	WALTHAM	MA	02453

**VERIFICATION OF INFORMATION
PROVIDED**


**APPROVED BY THE
WALTHAM BOARD OF ASSESSORS**

DATE 3-3-2022

FILING FEE INFORMATION



CALCULATED FILING FEE STATEMENT

The proposed project involves the parking lot improvements and utility work at 10-30 Manley Way in Watertown, Massachusetts. There are no fees associated with the submission of a Request for Determination of Applicability application under the Massachusetts Wetlands Protection Act; however, the local Watertown Wetlands Ordinance establishes a local fee based the project size.

Local Fees:

Project Size: ~95,000 square feet

Fee: \$1,000.00

Check Payable to: Town of Watertown for \$1,000.00



Town of Watertown
Administration Building
149 Main Street
Watertown, Massachusetts 02472
Conservation Commission
Tel: (617) 972-6426 • Fax: (617) 972-6484

Christopher J. Hayward
Conservation Agent

WATERTOWN WETLANDS ORDINANCE Fee Calculation and Transmittal Form

Owner	2nd Parcel Owner Info below	Applicant	
Name	PPF Industrial 20 Seyon LLC	Name	Affini-T Therapeutics
Street	c/o Morgan Stanley Real Estate,	Street	343 Arsenal Street
City	1585 Broadway, 37th Floor, NY	City	Watertown
State	New York	State	MA
Zip	10036	Zip	02472
Phone	617.982.6587	Phone	617.674.5100
e-mail	bblake@seyon.com	e-mail	kim.nguyen@affinittx.com

2nd Parcel Ownership: BIV - PARCEL 807, LLC, c/o Seyon, 205 Newbury Street, 4th Floor, Boston, MA 02116; 617.982.6587; bblake@seyon.com

Project Location:

10-30 Manley Way, Watertown, MA

Any person filing an Application for Permit/RDA/NOI pursuant to the Ordinance shall, at the same time, pay a filing fee in accordance with the Filing Fee Schedule contained in the *Rules and Regulations for the Administration of the Watertown Wetlands Ordinance of 2008*. Municipal agencies are exempt from this requirement.

A. Fee Schedule:

Project Size	Fees
Less than 1,000 sq. ft	\$50.00
1,000 sq. ft. to less than 2,000 sq. ft.	\$100.00
2,000 sq. ft. to less than 3,000 sq. ft.	\$150.00
3,000 sq. ft. to less than 4,000 sq. ft.	\$200.00
4,000 sq. ft. to less than 5,000 sq. ft.	\$250.00
5,000 sq. ft. to less than 6,000 sq. ft.	\$300.00
6,000 sq. ft. to less than 10,000 sq. ft.	\$400.00
10,000 sq. ft. to less than 15,000 sq. ft.	\$500.00
15,000 sq. ft. to less than 20,000 sq. ft.	\$650.00

20,000 sq. ft. to less than 30,000 sq. ft.	\$750.00
30,000 sq. ft. to less than 50,000 sq. ft.	\$850.00
50,000 sq. ft. or greater	\$1000.00

Project Fee

\$1,000.00

B. Fee Exemption

The Commission may waive the filing fee for an Application or Request for Determination filed by a government agency, for an RDA filed by a person having no financial connection with the subject property, for any projects whose sole effect is to substantially enhance a Resource Area, or for other reasonable grounds as determined by the Commission at its discretion.

Grounds for Exemption (to be filled out by CC staff)

Signature of Owner or Applicant:

Kim Nguyen

Digitally signed by Kim
Nguyen
Date: 2022.03.08 16:52:46
-05'00'

Date:

Enclose this form with a check or money order for the calculated amount payable to the Town of Watertown with the Application for Permit or Request for Determination of Applicability. These fees are non-refundable.

Please note this payment does not relieve the Applicant from the further fee requirements as stated in the Wetlands Protection Act Regulations MGL Chapter 44, Section 53G.

DATE:03/08/2022 CK#:285 TOTAL:\$1,000.00*** BANK:PPF 20 Seyon, LLC-Oper(ppf24op)
PAYEE:TOWN OF WATERTOWN(v0000205)

Property Address - Code	Invoice - Date	Description	Amount
PPF Industrial 20 Seyon, LLC - ms	3082022 - 03/08/2022		1,000.00
			1,000.00

SGP™ SECURITY WARNING: THE FRONT OF THIS DOCUMENT CONTAINS A HIDDEN VOID PANTOGRAPH AND CAN NOT BE COPIED. THE REVERSE SIDE CONTAINS AN ARTIFICIAL WATERMARK AND COIN REACTIVE INK. SGP™

PPF Industrial 20 Seyon, LLC

c/o Seyon Management LLC
535 Boylston Street, Ste 11
Boston, MA 02116

Boston Private Bank
10 Post Office Square
Boston, MA 02109

285

011002343

**** ONE THOUSAND AND 00/100 DOLLARS

TO THE
ORDER OF

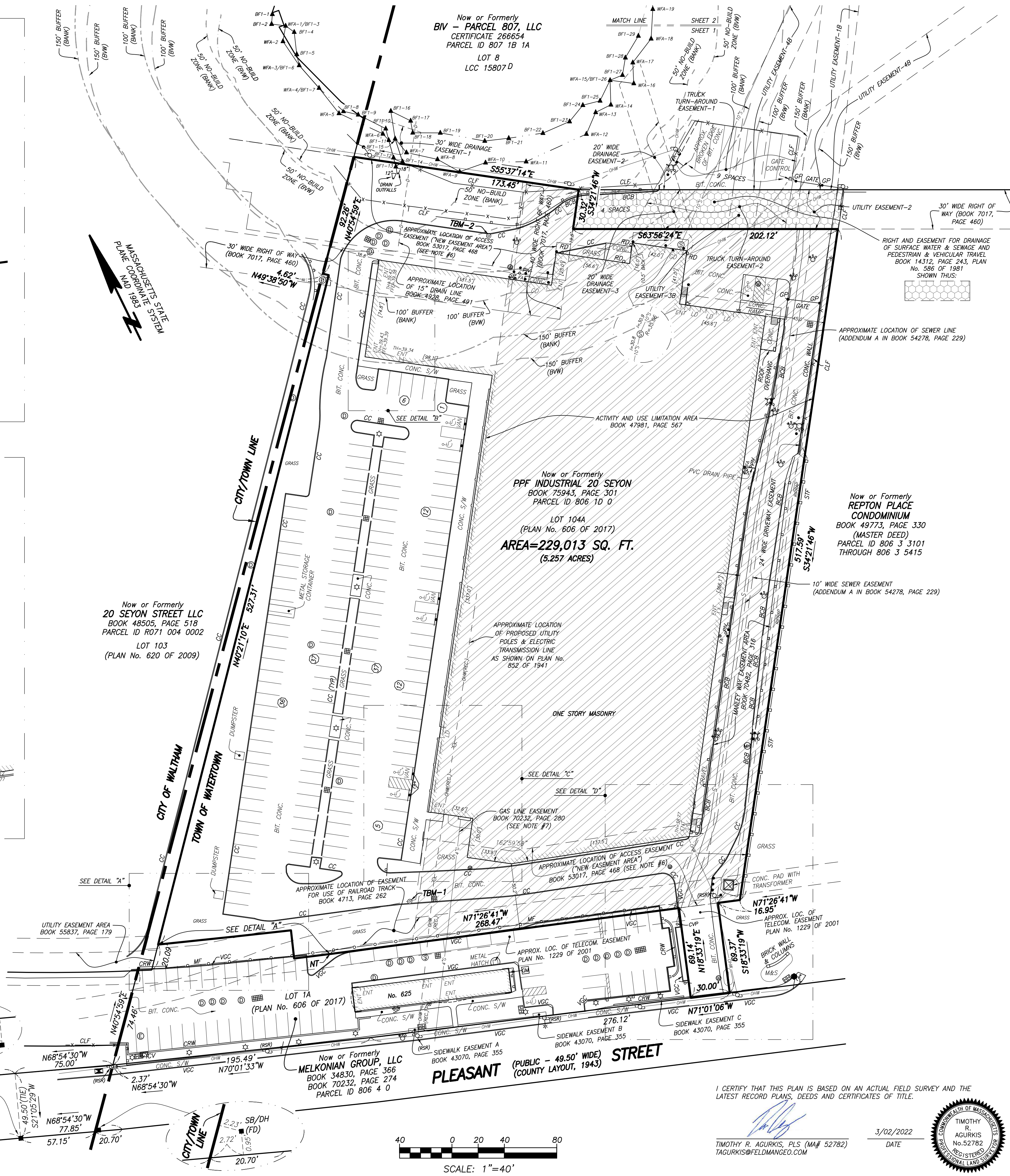
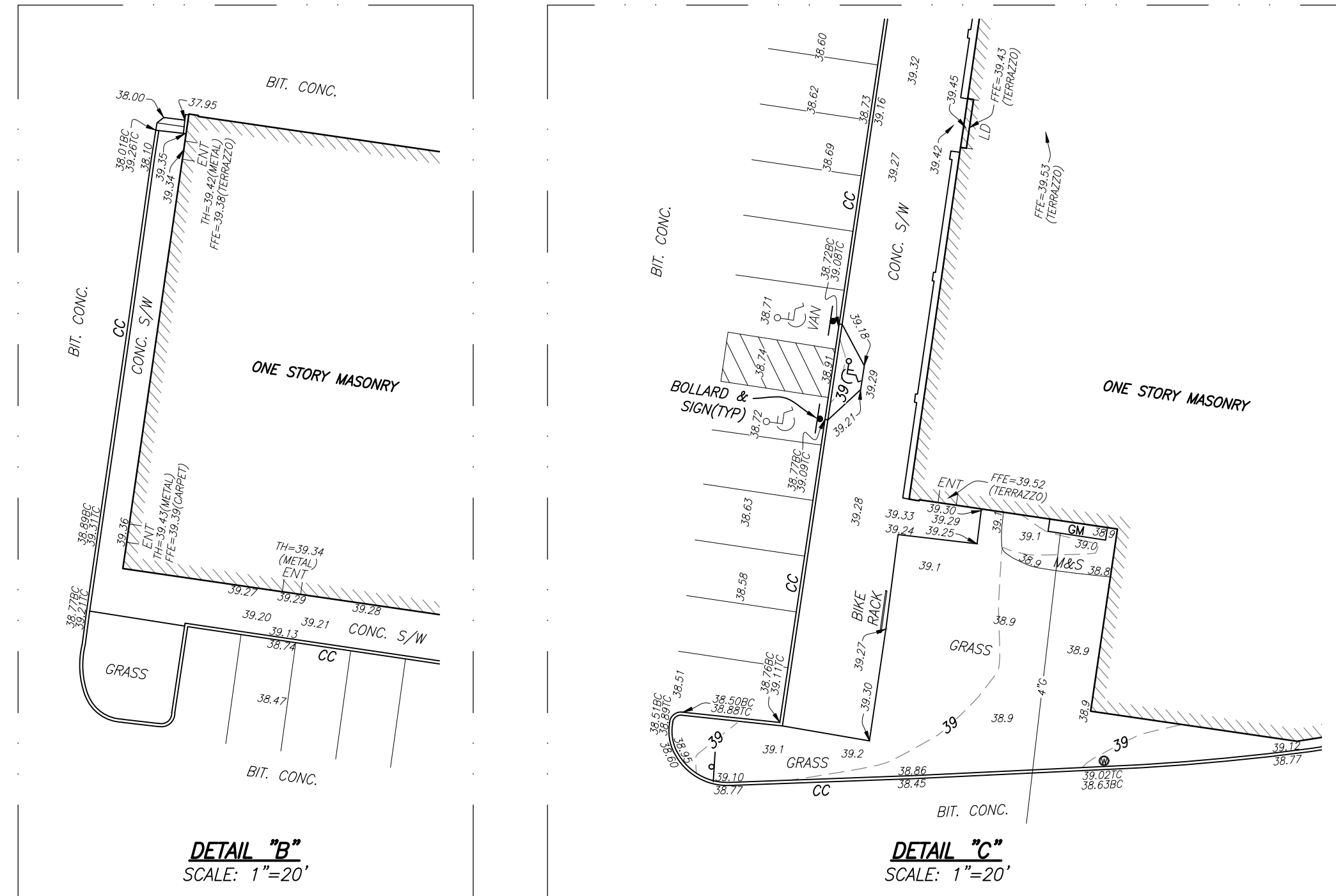
03/08/2022

\$1,000.00***

TOWN OF WATERTOWN
P O BOX 850
WATERTOWN, MA 02471

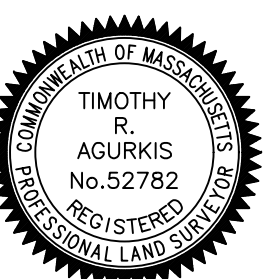


FILENAME: S:\PROJETS\2021\2100795\DWG\2100795-PI-3.dwg



TIMOTHY R. AGURKIS, PLS (MA# 52782)
TAGURKIS@FELDMANGE.O.COM

3/02/2021
DATE

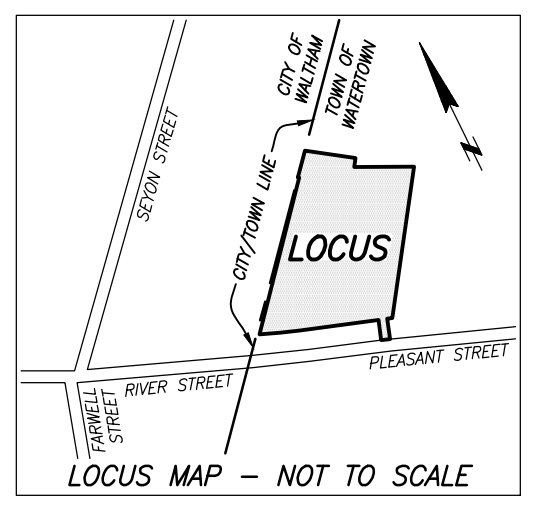


FELDMAN
G E O S P A T I A L

BOSTON HEADQUARTERS
52 HAMPDEN STREET
BOSTON, MA 02119
(617)357-9740

WORCESTER OFFICE
27 MECHANIC STREET
WORCESTER, MA 01608
www.feldmangeo.com

Building Renovation
10-30 Manley Way
Watertown, MA 02472

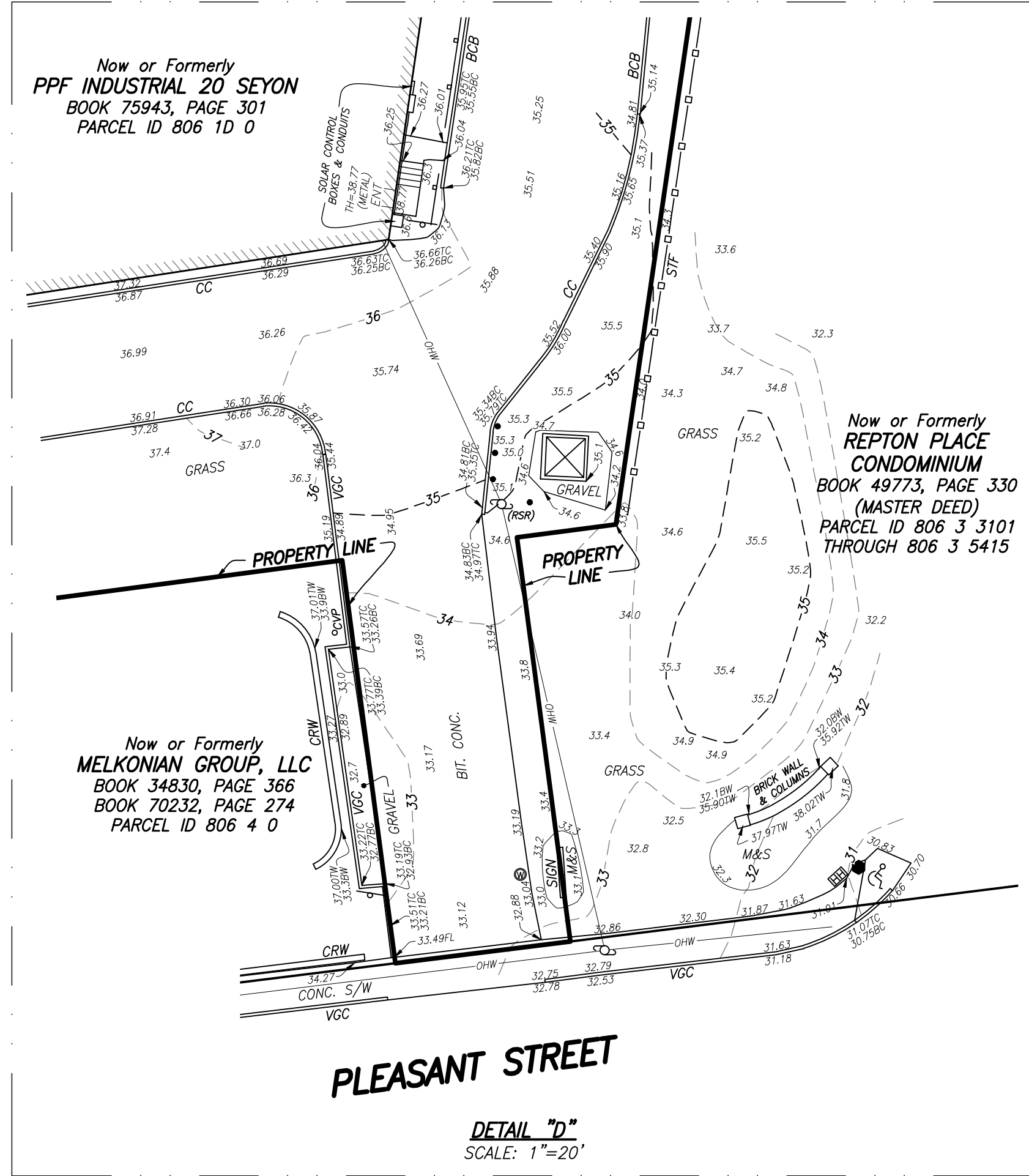
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NOT FOR
CONSTRUCTION

DATE: 1/10/2022
ISSUANCE: SITE PLAN REVIEW/
SPECIAL PERMIT

SHEET TITLE AND NUMBER:
SP-001
PARTIAL TOPOGRAPHIC PLAN

THE LINE SHOWN HERE IS EXACTLY
ONE HUNDRED AND FIFTY FEET
ORIGINAL PLATE SIZE



LEGEND

- ⊙ SEWER MANHOLE
⊙ DRAIN MANHOLE
⊙ MANHOLE
⊙ HYDRANT
⊙ WATER SHUT OFF/WATER GATE
⊙ CATCH BASIN
⊙ GUY WIRE
⊙ TRAFFIC SIGNAL
⊙ GUY POLE
⊙ UTILITY POLE
⊙ (RSR) UTILITY POLE WITH RISER
⊙ RECORD UTILITY POLE
⊙ LIGHT POLE
⊙ ELECTRIC HANDHOLE
⊙ BOLLARD
⊙ SIGN
⊙ CO CLEAN OUT
⊙ FA FIRE ALARM
⊙ CVP CAPPED VERTICAL PIPE
⊙ PIV POST INDICATOR VALVE
⊙ RD ROOF DRAIN
⊙ OBSERVATION WELL
⊙ SECURITY CAMERA
⊙ STAND PIPE/SIAMESE CONNECTION
⊙ UTILITY POLE W/ LIGHT
⊙ TRANSFORMER
⊙ GAS METER
⊙ DISABLED PARKING SPACE
⊙ WETLAND FLAG
⊙ FLARED END SECTION
⊙ HANDICAP RAMP
⊙ GP GATE POST
⊙ IRRIGATION CONTROL VALVE
⊙ RIGHT AND EASEMENT FOR DRAINAGE OF SURFACE WATER & SEWAGE AND PEDESTRIAN & VEHICULAR TRAVEL (BOOK 14312, PAGE 243, PLAN No. 586 OF 1981)
⊙ ACTIVITY AND USE LIMITATION AREA (BOOK 47981, PAGE 567)

- APPROX. APPROXIMATE
BC BOTTOM OF CURB
BCB BIT. CONC. BERM
[X.X"] BUILDING DIMENSION
BIT BITUMINOUS
BIV BORDERING VEGETATED WETLANDS
BW BOTTOM OF WALL
CC CONCRETE CURB
CHB CHORD BEARING
CHD CHORD DISTANCE
CLF CHAIN LINK FENCE
CONC CONCRETE
CRW CONCRETE RETAINING WALL
CTR CENTER
CW CONCRETE WALL
Δ= DELTA ANGLE
DH DRILL HOLE
ENT ENTRANCE
FD FOUND
FFE FINISH FLOOR ELEVATION
GD GARAGE DOOR
I= INVERT ELEVATION
L= ARC LENGTH
LCC LAND COURT CASE
LD LOADING DOCK
LOC LOCATION
MF METAL FENCE
M&S MULCH & SHRUBS
NT NON-TANGENT
R= RADIUS OR RIM ELEVATION
SB STONE BOUND
SQ. FT. SQUARE FEET
STF STOCKADE FENCE
S/W SIDEWALK
TBM TEMPORARY BENCH MARK
TC TOP OF CURB
TH THRESHOLD
TELECOM TELECOMMUNICATIONS
TW TOP OF WALL
TYP TYPICAL
VGC VERTICAL GRANITE CURB
VGC GAS
OHW OVERHEAD WIRES
OHW(REC) OVERHEAD WIRES (RECORD)
S SEWER
X CHAIN LINK FENCE
○ METAL FENCE
□ WOOD FENCE
□ GUARD RAIL

NOTES:

- BENCH MARK INFORMATION:
BENCH MARK USED:

TEMPORARY BENCH MARKS USED (FELDMAN JOB #12199M):
TBM-D: A "BENCH TIE" BRAND NAIL SET 1" UP IN A UTILITY POLE ON THE NORTHWESTERLY SIDE OF SEYON STREET, WALTHAM, LOCATED APPROXIMATELY 430' NORTHEAST OF RIVER STREET, WALTHAM. ELEVATION = 42.79
TBM-E: A "BENCH TIE" BRAND NAIL SET 1" UP IN A UTILITY POLE ON THE NORTHWESTERLY SIDE OF SEYON STREET, WALTHAM, LOCATED APPROXIMATELY 530' NORTHEAST OF TBM-D. ELEVATION = 41.95
TEMPORARY BENCH MARKS SET:
TBM-1: MAG NAIL SET IN THE SOUTHWESTERLY SIDE OF LOCUS DRIVEWAY, NEAR THE SOUTHWESTERLY CORNER OF LOCUS BUILDING, AS SHOWN HEREON. ELEVATION = 38.25
TBM-2: MAG NAIL SET IN THE NORTHEASTERLY SIDE OF LOCUS DRIVEWAY, NEAR THE NORTHERLY CORNER OF LOCUS, AS SHOWN HEREON. ELEVATION = 38.25
- ELEVATIONS REFER TO NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88)
- CONTOUR INTERVAL EQUALS ONE (1) FOOT.
- WETLANDS FLAGS SHOWN HEREON WERE SET BY LUCAS ENVIRONMENTAL ON 12/08/2021 AND FIELD LOCATED BY FELDMAN GEOSPATIAL. AT THE TIME OF SURVEY, FLAG BF1-30 WAS NOT FOUND. THE LINE SHOWN HEREON BETWEEN FLAGS BF1-29 & BF1-31 IS APPROXIMATE ONLY.
- THIS PLAN WAS PREPARED WITHOUT THE BENEFIT OF A TITLE REPORT AND IS SUBJECT TO ANY FINDINGS SUCH A REPORT MIGHT DISCLOSE.
- ACCESS EASEMENT IS SHOWN AS PLOTTED FROM THE METES AND BOUNDS DESCRIPTION IN EXHIBIT B OF BOOK 53017, PAGE 488. EXHIBIT A EASEMENT PLAN DENOTES THAT THE EASEMENT WRAPS AROUND THE FACADE OF THE BUILDING AS IT EXISTED AT THAT TIME.
- THE GAS LINE EASEMENT PER BOOK 70232, PAGE 280 IS NOT SHOWN OR DESCRIBED AS HAVING PARTICULAR LIMITS. THE RECORD GAS LINE SERVING THE BUILDING ON LOCUS IS SHOWN HEREON.
- BY GRAPHIC PLOTTING ONLY, THE PARCEL SHOWN HEREON LIES ENTIRELY WITHIN A ZONE "X" (UNSHADED), AN AREA OUTSIDE OF THE 0.2% ANNUAL CHANCE FLOOD, AS SHOWN ON THE FEDERAL EMERGENCY MANAGEMENT AGENCY (F.E.M.A) FLOOD INSURANCE RATE MAP (F.I.R.M.) FOR MIDDLESEX COUNTY, MASSACHUSETTS, MAP NUMBER 25017C0552E, TOWN OF WATERTOWN, COMMUNITY NUMBER 250223, PANEL NUMBER 0552-E, HAVING AN EFFECTIVE DATE OF JUNE 4, 2010.
- UTILITY INFORMATION SHOWN IS BASED ON BOTH A FIELD SURVEY AND PLANS OF RECORD. THE LOCATIONS OF UNDERGROUND PIPES AND CONDUITS HAVE BEEN DETERMINED FROM THE AFOREMENTIONED RECORD PLANS AND ARE APPROXIMATE ONLY. WE CANNOT ASSUME RESPONSIBILITY FOR DAMAGES INCURRED AS A RESULT OF UTILITIES THAT ARE OMITTED OR INACCURATELY SHOWN ON SAID RECORD PLANS. SINCE SUBSURFACE UTILITIES CANNOT BE VISIBLY VERIFIED, BEFORE PLANNING FUTURE CONNECTIONS, THE PROPER UTILITY ENGINEERING DEPARTMENT SHOULD BE CONSULTED AND THE ACTUAL LOCATION OF SUBSURFACE STRUCTURES SHOULD BE DETERMINED IN THE FIELD. CALL, TOLL FREE, THE DIG SAFE CALL CENTER AT 1-888-344-7233 SEVENTY-TWO HOURS PRIOR TO EXCAVATION.
- THIS DOCUMENT IS AN INSTRUMENT OF SERVICE OF FELDMAN GEOSPATIAL ISSUED TO OUR CLIENT FOR PURPOSES RELATED DIRECTLY AND SOLELY TO FELDMAN GEOSPATIAL'S SCOPE OF SERVICES UNDER CONTRACT TO OUR CLIENT FOR THIS PROJECT. ANY USE OR REUSE OF THIS DOCUMENT FOR ANY REASON BY ANY PARTY FOR PURPOSES UNRELATED DIRECTLY AND SOLELY TO SAID CONTRACT SHALL BE AT THE USER'S SOLE AND EXCLUSIVE RISK AND LIABILITY, INCLUDING LIABILITY FOR VIOLATION OF COPYRIGHT LAWS, UNLESS WRITTEN CONSENT IS PROVIDED BY FELDMAN GEOSPATIAL.

REFERENCES

MIDDLESEX COUNTY REGISTRY OF DEEDS,
SOUTHERN DISTRICT

DEEDS	BOOK	5584, PAGE	353
		7955,	420
		9260,	589
		9354,	218
		12047,	679
		12780,	176
		31612,	547
		31879,	48
		34340,	204
		34830,	366
		46700,	33
		47416,	147
		48505,	518
		52492,	320
		69901,	552
		70232,	274

CERTIFICATE OF TITLE No. 40179

PLANS	PLAN No.	1029 OF 1999
		1083 OF 2000
		1229 OF 2001
		627 OF 2004
		535 OF 2006
		539 OF 2008
		165 OF 2009
		166 OF 2009
		352 OF 2009
		620 OF 2009
		606 OF 2017

MASSACHUSETTS LAND COURT

LCC	9865A
	15807A
	15807B
	15807C
	15807D
	31213A

CITY OF WALTHAM ENGINEERING DEPARTMENT

"PLAN AND PROFILE OF RIVER STREET", DATED NOVEMBER, 1896, APPROVED JANUARY 2, 1897, COPIED FROM ORIGINAL PLAN JUNE, 1942

"PLAN & PROFILE SHOWING PROPOSED WIDENING OF GROVE STREET BETWEEN BRIGHT ST. & THE CITY BOUNDARY", DATED JULY 1971, APPROVED AUGUST 3, 1971

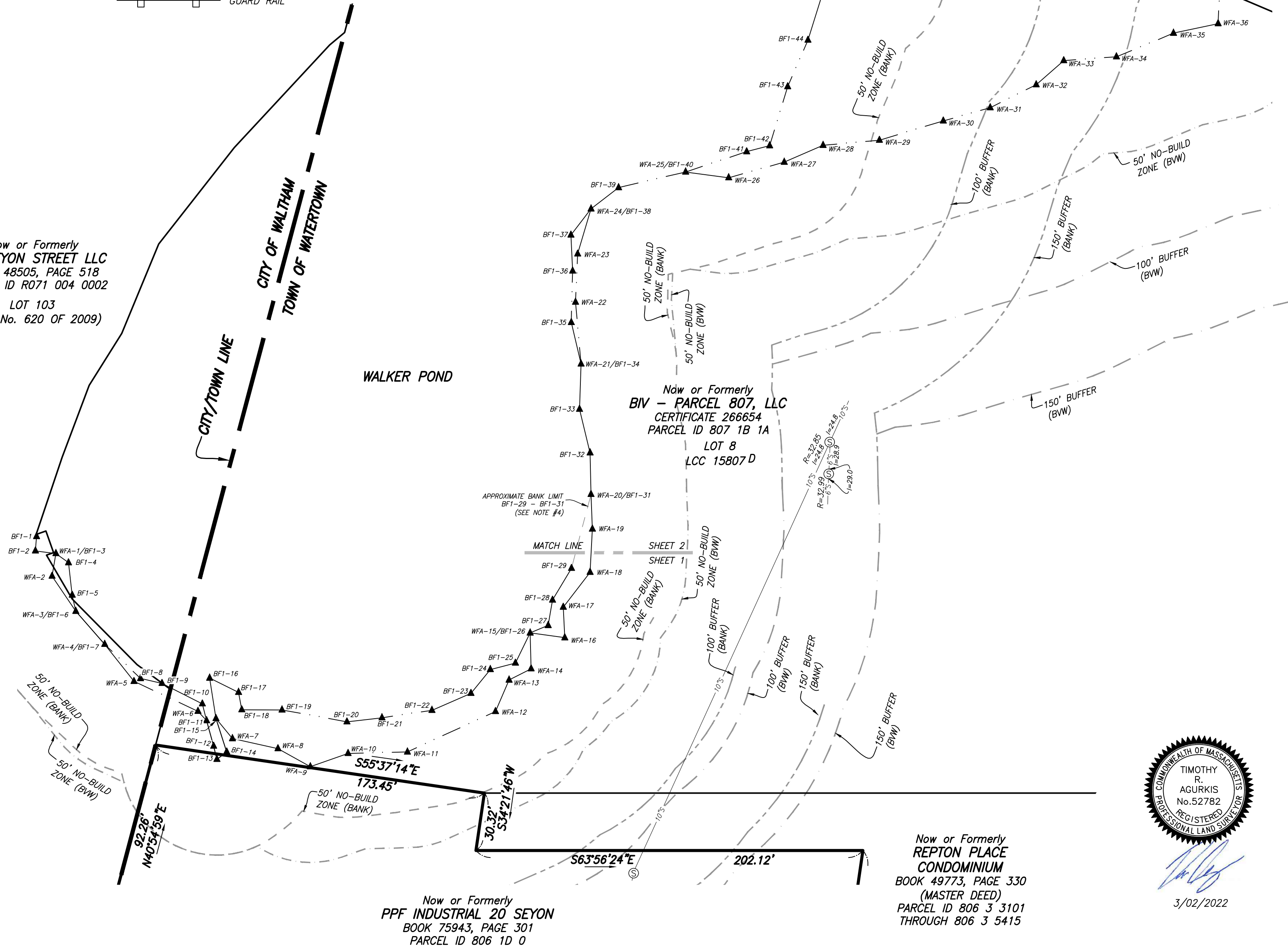
MIDDLESEX COUNTY ENGINEERING DEPARTMENT

"PLAN OF PLEASANT STREET, WATERTOWN, AS ORDERED BY THE COUNTY COMMISSIONERS", DATED 1943"

"PLAN OF THE RELOCATION OF A PORTION OF WALTHAM STREET, WATERTOWN, AS ORDERED BY THE COUNTY COMMISSIONERS", DATED 1964

PAN AM RAILWAYS

VALUATION PLAN V36.2/6



THE LINE SHOWN ABOVE IS EXACTLY ONE FOOTING, FIVE FEET

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GENERAL NOTES:

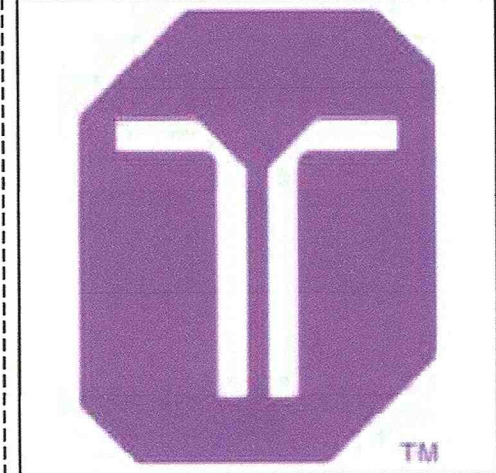
- THE CONTRACTOR IS SPECIFICALLY ADVISED THAT THE LOCATION AND/OR ELEVATION OF EXISTING UTILITIES AND STRUCTURES AS SHOWN ON THESE PLANS IS BASED ON RECORDS OF VARIOUS UTILITY COMPANIES AND WHERE POSSIBLE, MEASUREMENTS TAKEN IN THE FIELD. THIS INFORMATION IS NOT TO BE RELIED ON AS BEING EXACT OR COMPLETE. THE LOCATION OF ALL UNDERGROUND UTILITIES AND STRUCTURES ESPECIALLY WHERE NEW UTILITIES CONNECT TO OR CROSS EXISTING, SHALL BE VERIFIED IN THE FIELD BY THE CONTRACTOR PRIOR TO THE START OF CONSTRUCTION. THE CONTRACTOR MUST CONTACT THE APPROPRIATE UTILITY COMPANY, ANY GOVERNING PERMITTING AUTHORITY, AND "DIG SAFE" (1-888-344-7233 OR 811) AT LEAST 72 HOURS PRIOR TO ANY EXCAVATION WORK TO REQUEST EXACT FIELD LOCATION OF UTILITIES AND THE ENGINEER SHALL BE NOTIFIED IN WRITING OF ANY UTILITIES INTERFERING WITH THE PROPOSED CONSTRUCTION AND APPROPRIATE REMEDIAL ACTION TAKEN BEFORE PROCEEDING WITH THE WORK. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO RELOCATE ALL EXISTING UTILITIES WHICH CONFLICT WITH THE PROPOSED IMPROVEMENTS SHOWN ON THE PLANS.
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR ESTABLISHING AND MAINTAINING ALL HORIZONTAL CONTROL POINTS AND VERTICAL BENCH MARKS NECESSARY FOR THE WORK.
- DISPOSAL OF ALL DEMOLISHED MATERIALS IS THE RESPONSIBILITY OF THE CONTRACTOR AND MUST BE DISPOSED OF OFF-SITE IN ACCORDANCE WITH ALL FEDERAL, STATE AND MUNICIPAL REQUIREMENTS. NO ON-SITE BURIAL PITS ARE ALLOWED.
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFICATION OF ALL INFORMATION SHOWN ON THESE PLANS PRIOR TO THE START OF CONSTRUCTION. THE CONTRACTOR SHALL NOTIFY THE ENGINEER IN WRITING IMMEDIATELY OF ANY DISCREPANCIES BETWEEN ACTUAL FIELD CONDITIONS AND THE EXISTING FIELD CONDITIONS AS SHOWN ON THESE PLANS.
- THE CONTRACTOR SHALL REFER TO THE ARCHITECTURAL/BUILDING PLANS FOR ITEMS SUCH AS: BUILDING LOCATIONS AND DIMENSIONS, EXIT DOORS, TRUCK DOCKS, UTILITY PENETRATIONS AND SIDEWALK LAYOUT. THE CONTRACTOR SHALL NOTIFY THE OWNER/ENGINEER IN WRITING OF ANY DISCREPANCIES ENCOUNTERED.
- ALL CONSTRUCTION DUMPSTERS SHALL BE PROPERLY MAINTAINED. ALL DUMPSTERS SHALL BE LOCATED ON A BITUMINOUS CONCRETE OR CEMENT CONCRETE SURFACE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR TRASH DISPOSAL ON A REGULAR BASIS AND SHALL ENSURE THAT THE DUMPSTER AREAS ARE PROPERLY MAINTAINED.
- THE CONTRACTOR WILL BE RESPONSIBLE FOR THE GENERAL UPKEEP AND ROUTINE MAINTENANCE OF THE ENTIRE SITE TO ENSURE AN AESTHETICALLY PLEASING APPEARANCE DURING ALL PHASES OF CONSTRUCTION.
- UNLESS OTHERWISE INDICATED, AREAS DISTURBED BY CONSTRUCTION SHALL BE RESTORED TO ITS ORIGINAL CONDITION.
- EXISTING LANDSCAPE OPEN SPACE AREAS SHALL BE KEPT FREE OF DEBRIS AND SHALL BE MAINTAINED FREE OF PHYSICAL DAMAGE. DAMAGED PLANTS SHALL BE REPLACED IN KIND.
- THE CONTRACTOR SHALL NOTIFY THE MUNICIPALITY AT LEAST FORTY EIGHT (48) HOURS PRIOR TO THE COMMENCEMENT OF SITE WORK CONSTRUCTION ACTIVITIES.

EROSION CONTROL NOTES:

- ALL EROSION AND SEDIMENTATION CONTROL MEASURES SHALL BE INSTALLED AND/OR CONSTRUCTED IN ACCORDANCE WITH THE MASSACHUSETTS EROSION AND SEDIMENT CONTROL GUIDELINES FOR URBAN AND SUBURBAN AREAS, DATED MARCH 1997, REPRINTED MAY 2003, AND ALL LOCAL MUNICIPAL REGULATIONS.
- ALL EROSION AND SEDIMENT CONTROL MEASURES SHALL BE INSPECTED DAILY AND CLEANED, REPAIRED OR REPLACED AS NECESSARY THROUGHOUT CONSTRUCTION. EROSION AND SEDIMENT CONTROL MEASURES SHALL BE INSPECTED AFTER EACH STORM EVENT.
- THE CONTRACTOR SHALL KEEP ON-SITE, AT ALL TIMES, ADDITIONAL WATTLES, FILTER BAGS, SILT FENCE, ETC. FOR INSTALLATION TO MITIGATE ANY EMERGENCY CONDITION.
- THE CONSTRUCTION ENTRANCE/EXIT AREA TO AND FROM THE SITE SHALL BE MAINTAINED IN A CONDITION THAT PREVENTS TRACKING AND DISCHARGE OF SEDIMENT OFF-SITE. ALL SEDIMENT SPILLED, DROPPED, TRACKED OR OTHERWISE DEPOSITED ON THE PUBLIC RIGHT-OF-WAY SHALL BE REMOVED IMMEDIATELY.

LEGEND

- APPROXIMATE LIMITS OF EXISTING BUILDING AND APPURTENANCES TO BE REMOVED (OR RELOCATED)
- SILT SOCK



PPF Industrial 20 Seyon, LLC & Affili-T Therapeutics, Inc.

Building Renovation
10-30 Naney Way
Waltham, MA 02472

PROJECT: 2021081

DATE	DESCRIPTION



NOT FOR
CONSTRUCTION

ISSUE DATE: 03/10/2022
ISSUANCE: DEVELOPER'S CONFERENCE

SHEET TITLE AND NUMBER:

C-1

DEMOLITION AND SEDIMENT PLAN

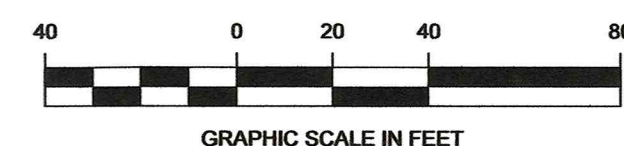
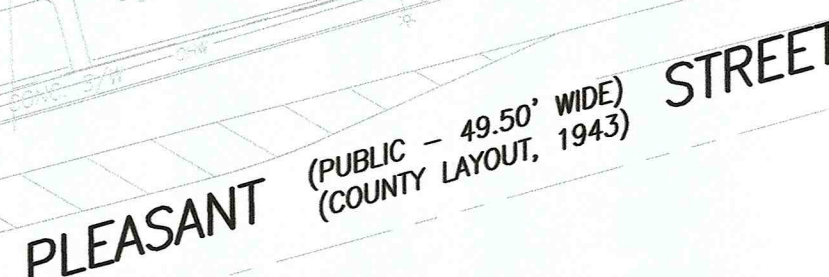
Page 455 of 457

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GENERAL NOTES;

- GAS NOTES;**

- A. THE EXCAVATING CONTRACTOR MUST PAD THE TRENCH BOTTOM WITH SIX (6) INCHES OF SAND AND MUST PROVIDE SAND SUFFICIENT TO PROVIDE A MINIMUM OF (6) INCHES OF COVER ABOVE THE GAS PIPE.



Building Renovation
10-30 Manley Way
Watertown MA 02472

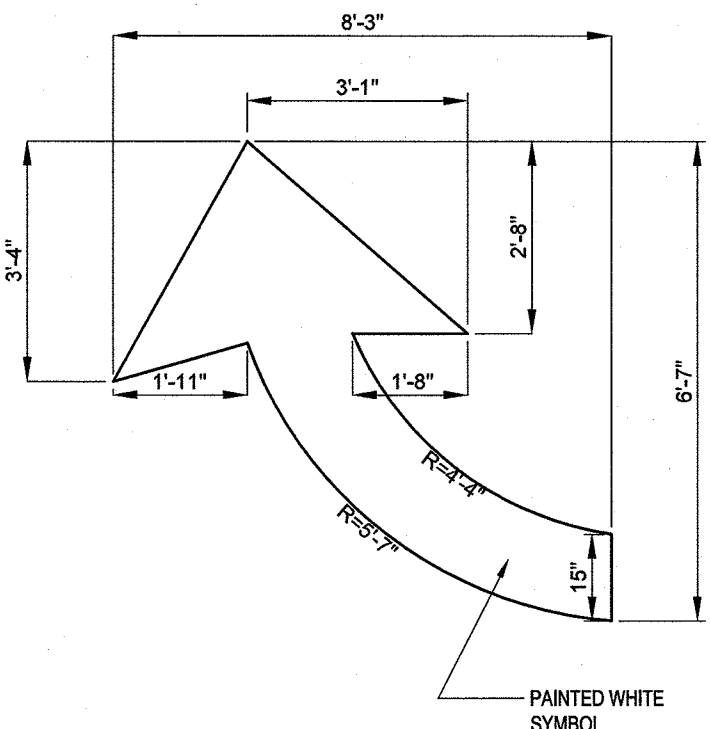
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SHEET TITLE AND NUMBER

C-3

GRADING, DRAINAGE, AND UTILITY PLAN

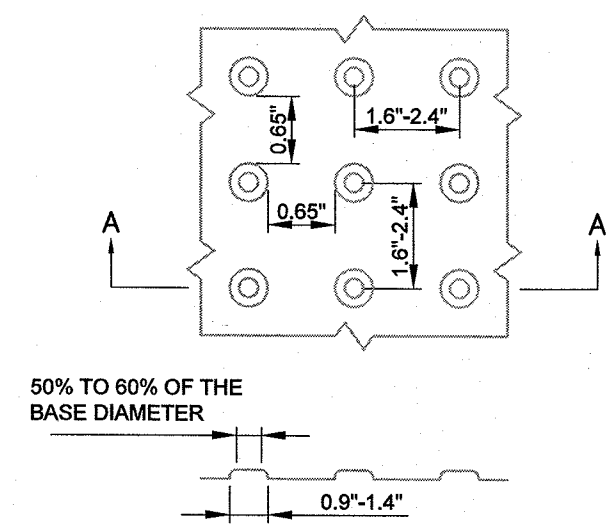
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WHAT IS SHOWN ON THE
ORIGINAL PAGE SIZE



NOTES:

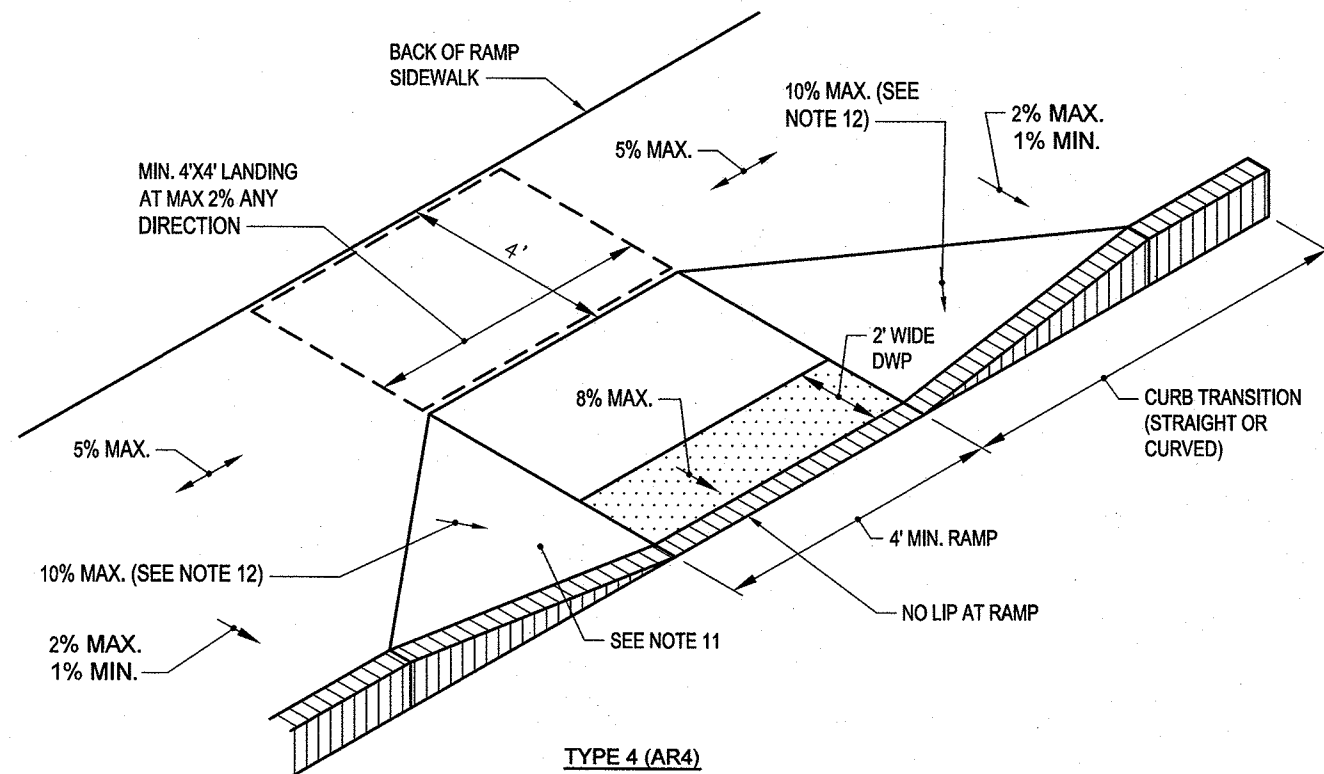
1. PAINT SHALL MEET OR EXCEED FEDERAL SPECIFICATIONS TT-P-115F, TYPE II, FAST DRYING ALKYD PAINT.
2. PAVEMENT MARKINGS TO RECEIVE TWO (2) COATS OF PAINT.

TYPICAL PAINTED TURN ARROW DETAIL
SCALE: N.T.S.



SECTION A-A

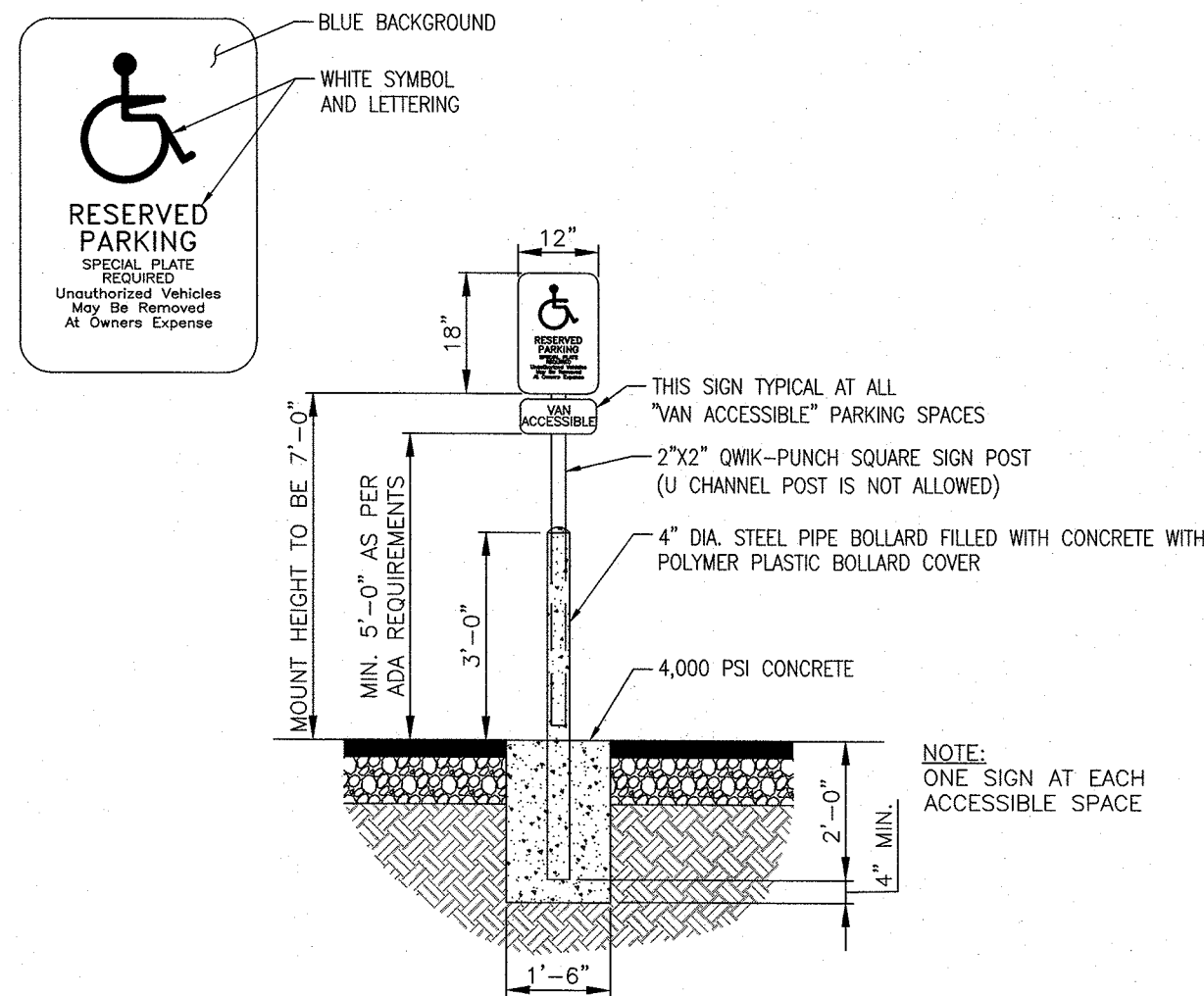
DETECTABLE WARNING PANEL



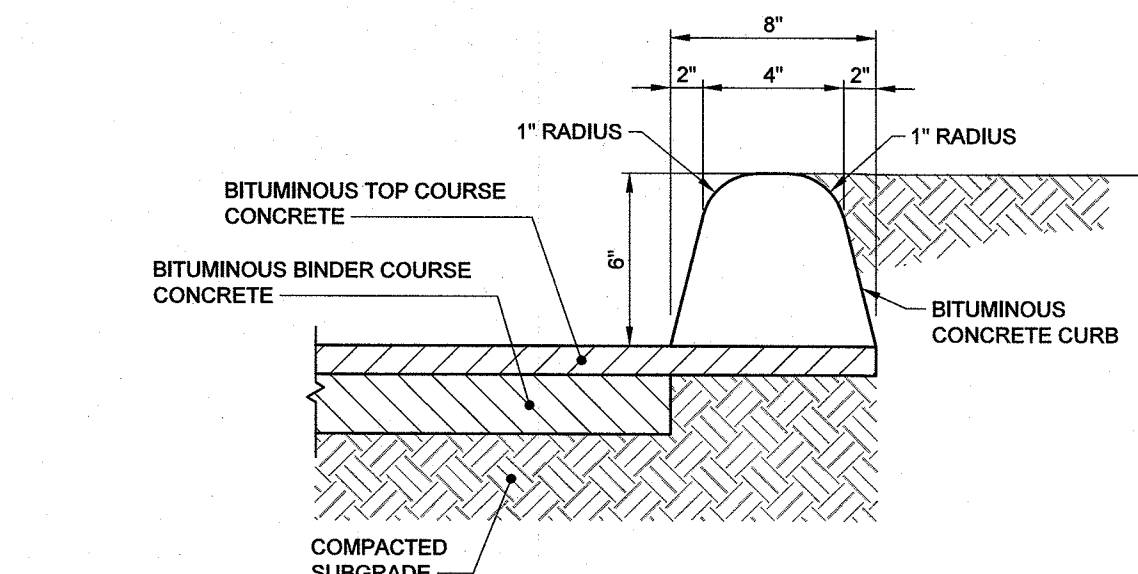
NOTE:

1. SEE PLANS FOR CURB TYPE.
2. CURB, RAMPS AND WALKS ALONG ACCESSIBLE ROUTES SHALL MEET OR EXCEED STANDARDS SET FORTH IN THE ARCHITECTURAL ACCESS BOARD (AAB), 521CMR AND THE AMERICANS WITH DISABILITIES ACT (ADA) 2010 ADA STANDARDS FOR ACCESSIBLE DESIGN.
3. THE MAXIMUM ALLOWABLE SIDEWALK AND CURB RAMP CROSS SLOPES SHALL BE 2% (1% MIN.).
4. THE MAXIMUM ALLOWABLE RUNNING SLOPE OF AN ACCESSIBLE ROUTE, EXCLUDING CURB RAMPS, SHALL BE 5%.
5. THE MAXIMUM ALLOWABLE SLOPE OF AN ACCESSIBLE ROUTE CURB RAMPS SHALL BE 8%.
6. MAINTAIN A MINIMUM OF 4 FEET CLEAR AT ANY PERMANENT OBSTACLE IN ACCESSIBLE ROUTE (I.E., HYDRANTS, UTILITY POLES, TREE WELLS, SIGNS ETC.).
7. GRADE BASE OF RAMP TO PREVENT PONDING.
8. RAMP CONSTRUCTION SHALL CONFORM TO TYPICAL SIDEWALK SECTION.
9. WHERE ACCESSIBLE ROUTES ARE LESS THAN 5' IN WIDTH (EXCLUDING CURBING) A 5'x5' PASSING AREA SHALL BE PROVIDED AT INTERVALS NOT TO EXCEED 200' FEET.
10. ALL CURBING AT RAMPS SHALL BE VERTICAL CURBING SET FLUSH WHERE IT ABUTS ROADWAY.
11. WHEELCHAIR RAMP SLOPE AND SIDE SLOPES (TRANSITIONS) MUST NOT EXCEED 1:12 (8% MAXIMUM, 7.5% PREFERRED).
12. ALL RAMPS SHALL BE CEMENT CONCRETE WITH EXPOSED AGGREGATE SURFACE.
13. DETECTABLE WARNING PANELS (DWPS) SHALL BE A SUITABLE MATERIAL PERMANENTLY APPLIED TO THE RAMP. DETECTABLE WARNING SURFACES SHALL CONTRAST WITH ADJACENT WALKING SURFACES, EITHER LIGHT-ON-DARK OR DARK-ON-LIGHT.

ACCESSIBLE CURB RAMPS (AR)
SCALE: N.T.S.



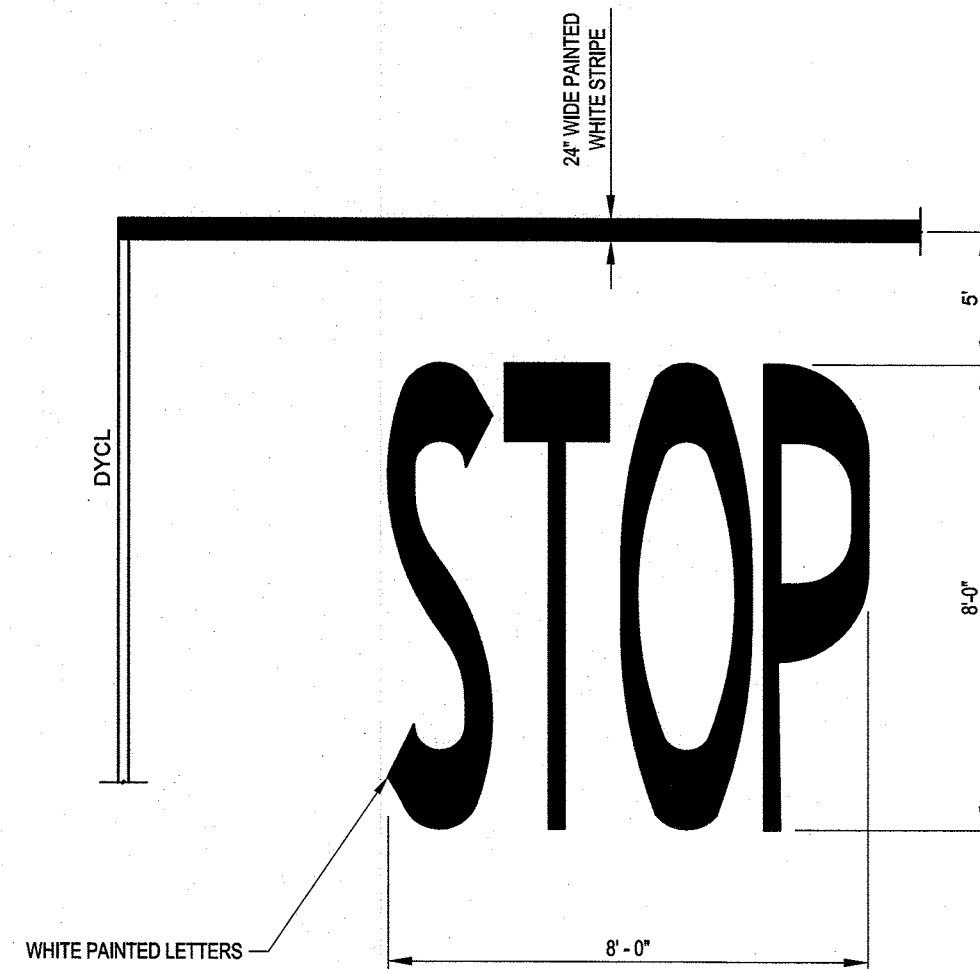
BOLLARD MOUNTED ACCESSIBLE PARKING SIGN DETAIL
SCALE: N.T.S.



NOTES:

1. BITUMINOUS CONCRETE FOR CURBING SHALL BE CLASS I CONFORMING TO THE APPLICABLE REQUIREMENTS FOR DENSE MIX IN SECTION M3.11.03, TABLE A, OF THE MASSDOT STANDARD SPECIFICATIONS FOR HIGHWAYS AND BRIDGES.
2. THE BITUMINOUS CONCRETE MIXTURE SHALL BE PLACED AND COMPACTED WITH A MACHINE CAPABLE OF SPREADING THE MIXTURE TRUE TO LINE AND GRADE AND TO THE SHAPE STIPULATED.
3. IF AT ANY TIME BEFORE ACCEPTANCE OF THE WORK ANY SOFT OR IMPERFECT SPOTS DEVELOP IN THE EXPOSED SURFACE OF THE CURB, THAT PORTION OF THE CURB SHALL BE REMOVED AND REPLACED WITH NEW CURBING AT NO COST TO THE OWNER.

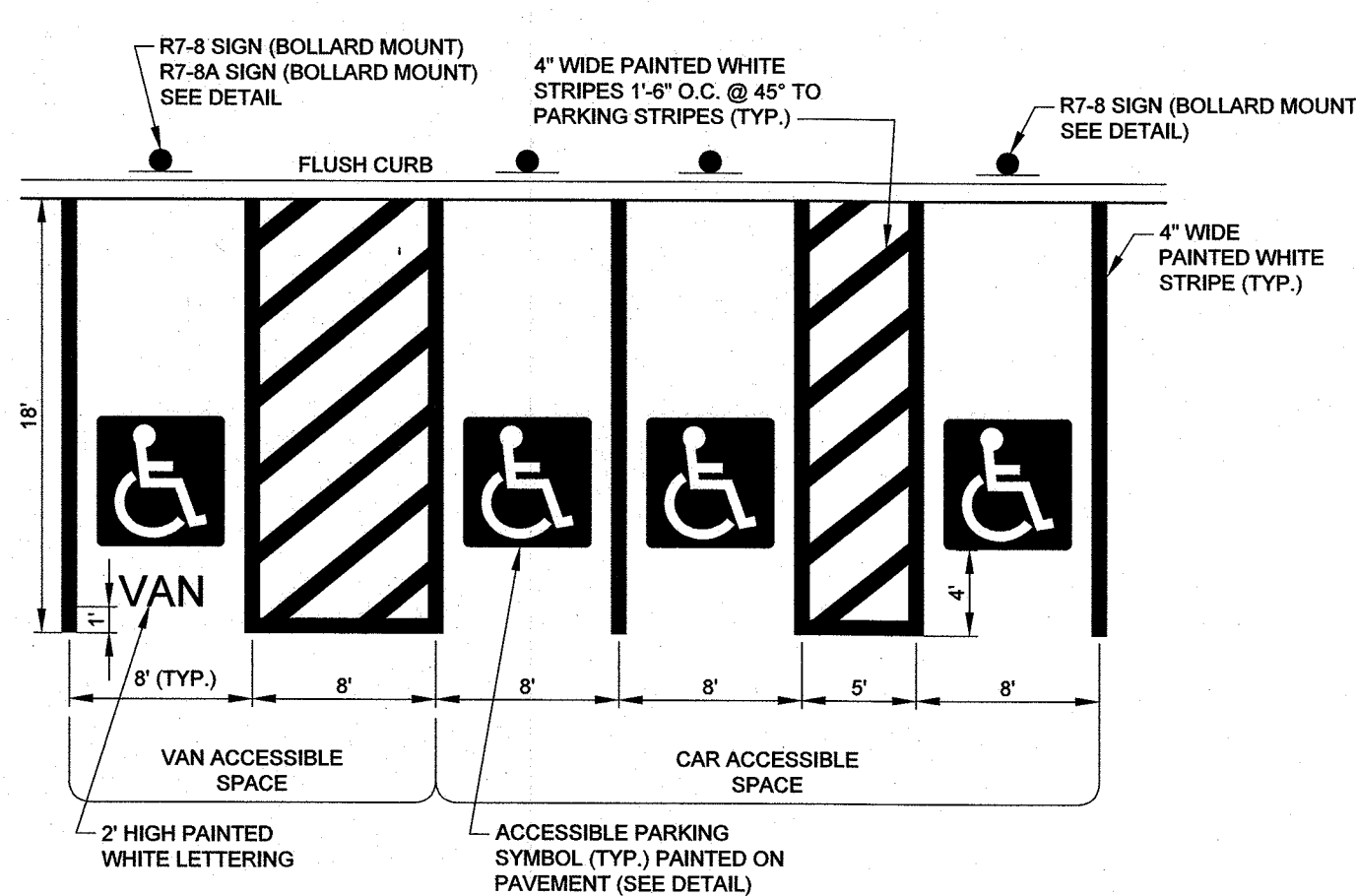
BITUMINOUS CONCRETE CURB DETAIL (TYPE A)



NOTES:

1. PAINT SHALL MEET OR EXCEED FEDERAL SPECIFICATIONS TT-P-115F, TYPE II, FAST DRYING ALKYD PAINT.
2. PAVEMENT MARKINGS TO RECEIVE TWO (2) COATS OF PAINT.

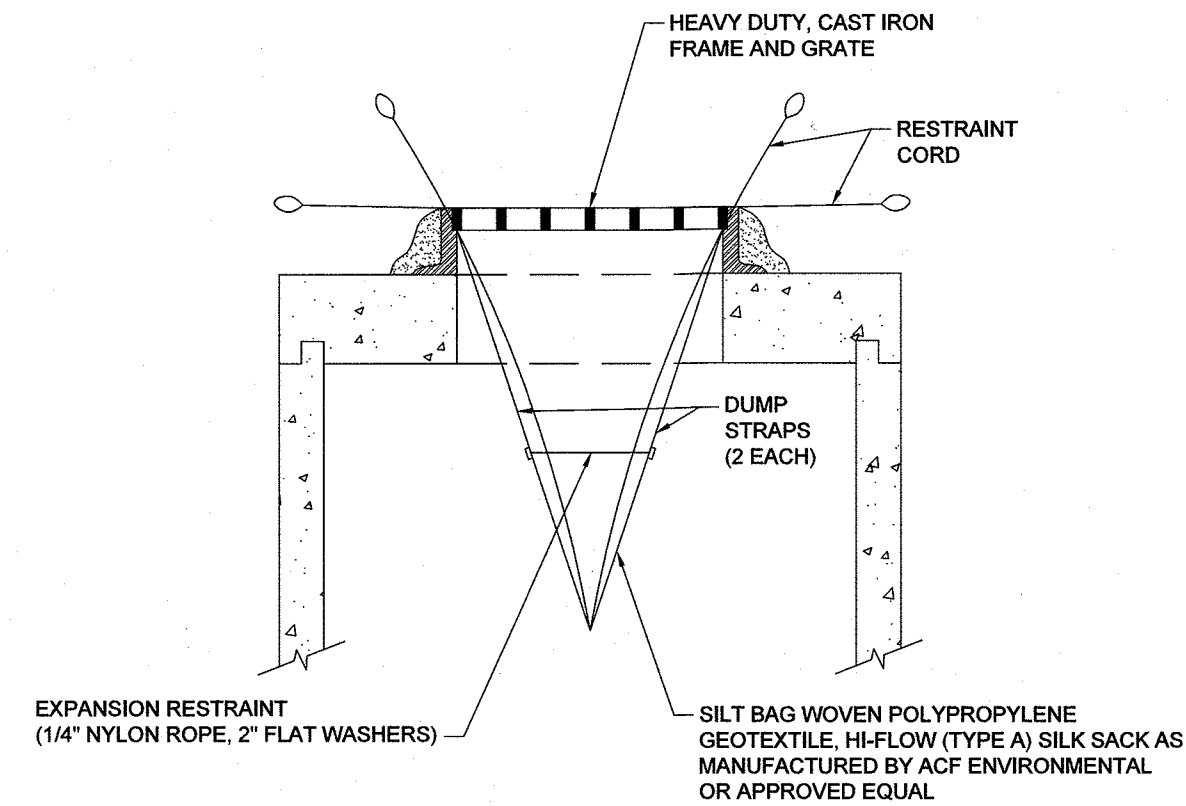
TYPICAL PAINTED 'STOP' DETAIL
SCALE: N.T.S.



NOTES:

1. PAINT SHALL MEET OR EXCEED FEDERAL SPECIFICATIONS TT-P-115F, TYPE II, FAST DRYING ALKYD PAINT.
2. PAVEMENT MARKINGS TO RECEIVE TWO (2) COATS OF PAINT.

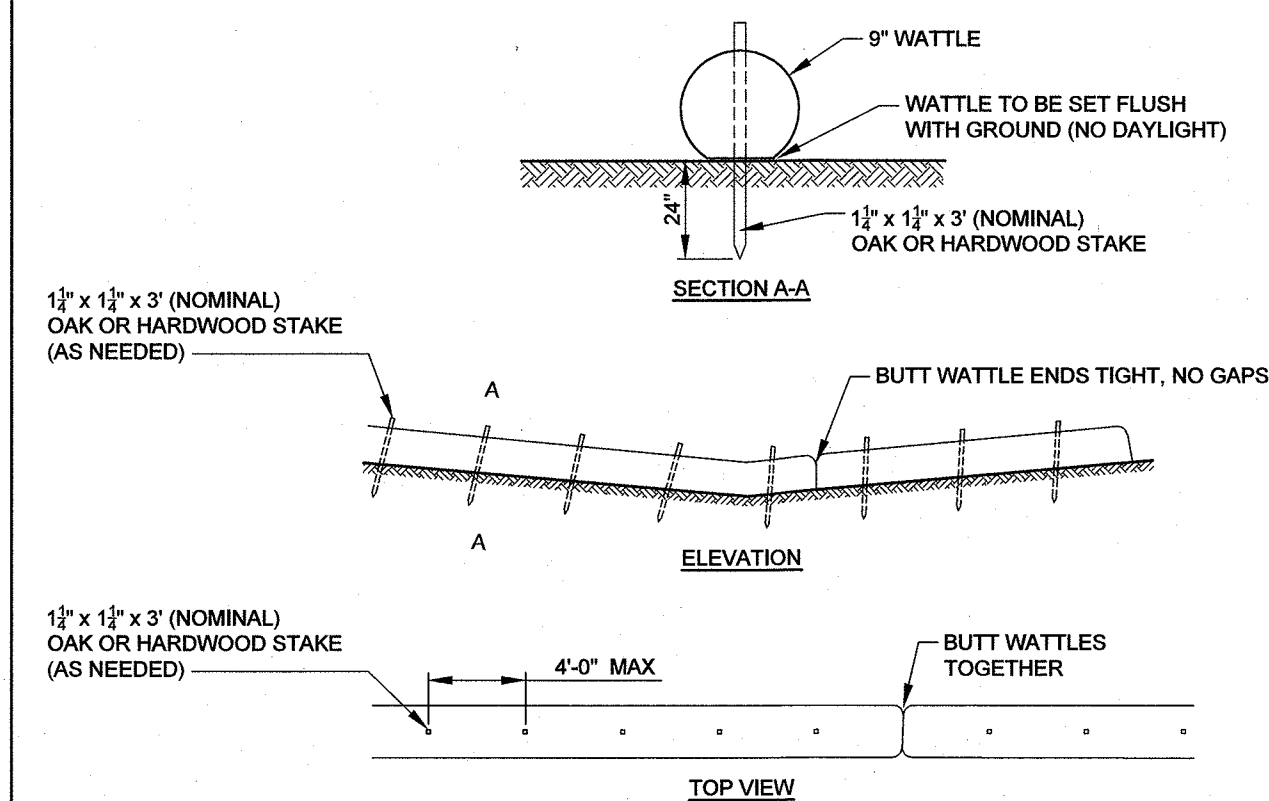
ACCESSIBLE PARKING STALLS DETAIL



NOTES:

1. INSTALL SILT SACK IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.
2. SILT SACK SHALL BE INSPECTED AND CLEANED WHEN THE EXPANSION RESTRAINT CORD IS NO LONGER VISIBLE.
3. REMOVE SILT BAG PER MANUFACTURER'S INSTRUCTIONS.

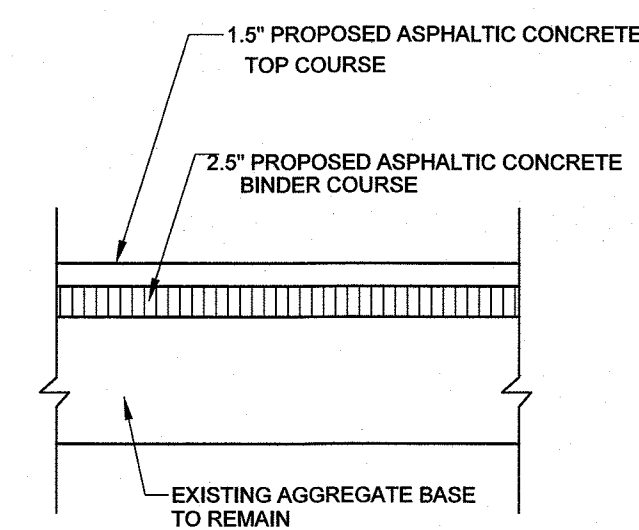
TYPICAL FILTER BAG DETAIL (SILT SACK)



NOTES:

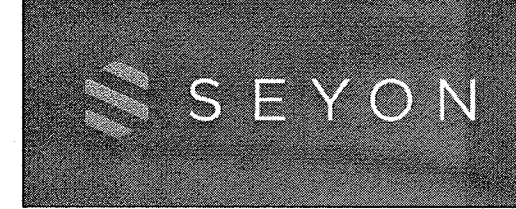
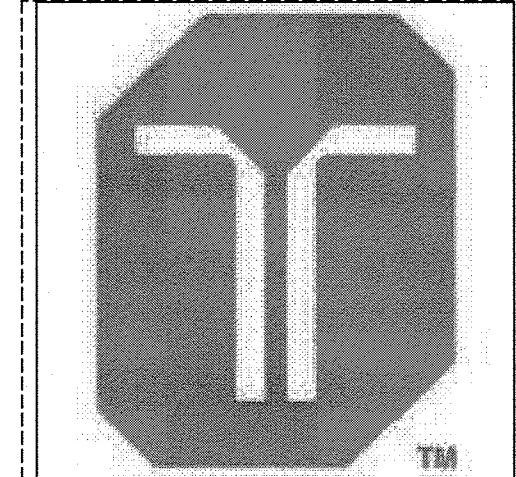
1. WATTLES SHALL BE A MACHINE PRODUCED TUBE THAT IS 100% STRAW FIBER THAT IS CERTIFIED WEED FREE FORAGE.
2. THE NETTING SHALL CONSIST OF SEAMLESS HIGH DENSITY POLYETHYLENE AND ETHYL VINYL ACETATE AND CONTAIN ULTRA VIOLET INHIBITORS.
3. WATTLE BARRIER TO BE INSPECTED AND AFTER EACH RAINFALL EVENT GREATER THAN 0.25 INCHES.
4. DAMAGED AND/OR DECOMPOSED WATTLES SHALL BE REPLACED IMMEDIATELY.

TYPICAL SINGLE ROW WATTLE INSTALLATION DETAIL



NOTE: 1" ASPHALTIC PAVEMENT OVERLAY/TOPCOURSE TO BE FIBER REINFORCED. SEE SPECIFICATIONS

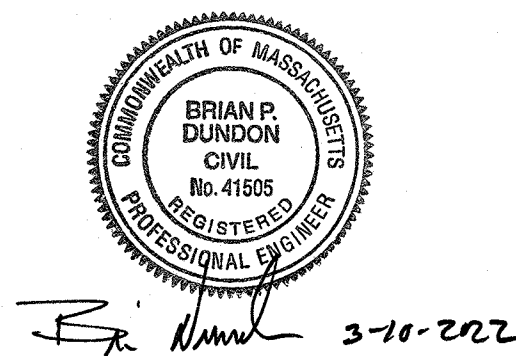
TYPICAL OVERLAY/REPLACEMENT PAVEMENT DETAIL
SCALE: N.T.S.



PPF Industrial 20 Seyon, LLC & Affini-T Therapeutics, Inc.

Building Renovation
10-30 Manley Way
Watertown, MA 02472

DATE	DESCRIPTION



ISSUE DATE: 03/10/2022
ISSUANCE: DEVELOPER'S CONFERENCE

SHEET TITLE AND NUMBER:

C-4
DETAILS I

PROJECT: 2021081