Appendix A

Site Plans

(submitted as separate PDF)

Appendix B

Massachusetts Inland Resource Area Delineation Report

Massachusetts Inland Resource Area Delineation Report
Resource Area Description

Report Date: May 27, 2022

Prepared For: City of Haverhill
4 Summer Street
Haverhill, MA, Belchertown, MA 01830

Project number: 20171390.U30

Site Address/Location: Little River, between Essex Street and Greenhill Farm Road
42.782623706 N, 71.09047162 W

Inspection Date: September 27, 2021 and April 29, 2022

Regulated Inland Wetland Resource Areas:

- ☒ Bank
- ☒ Land Under Water Bodies and Waterways (LUWW)
- ☒ Riverfront Area
- ☒ Buffer Zone
- ☐ Vernal Pool (Certified and/or Potential)
- ☒ Bordering Vegetated Wetland (BVW)
- ☒ Land Subject to Flooding (BLSF/ILSF)
- ☐ Estimated Habitats of Rare Wildlife
- ☐ Priority Habitats of Rare Species

Delineated Resource Area Field Numbering Sequence [see Attachment, *Sketch Map of Inland Resource Areas*]:

Flag Series
Bank: A100-A247, G700-G741
BVW: A100-A120, B200-B203, C300-C309, D400-D402, E500-E506, F600-F607, H800-H804

Inland resource areas were delineated in accordance with applicable local, state and federal statutes, as detailed within the Resource Area Description attachment. This delineation does not constitute an official wetland boundary until such time as it is accepted and approved by local, state or federal regulatory agencies.

The wetlands delineation was conducted by:

Michael E. Soares
Wetlands Scientist

ATTACHMENTS

- Resource Areas Description
- Sketch Map of Inland Resource Areas
- U.S. Army Corps of Engineers Wetland Determination Data Forms
- FEMA National Flood Hazard Layer
- NRCS Soil Map and Soil Report
- Site Photographs
- Explanation of Terms Used in Wetlands Functions and Values Assessments

Introduction

Fuss & O'Neill Inc. performed a wetland resource area field inspection and delineation of a project area containing Little River and associated wetland resource areas near Winter Street in Haverhill, Massachusetts ("Site"). The field inspection and delineation occurred on September 27, 2021 and April 29, 2022. The purpose of the delineation was to locate the jurisdictional limits of areas regulated under the Wetlands Protection Act (M.G.L. c. 131 sec. 40) and associated Wetlands Protection Act Regulations (310 CMR 10).

The following inland wetland resource areas were identified and delineated at the Site during the field investigation: Bordering Vegetated Wetland (BVW), Bank, Land Under Water Bodies and Waterways (LUWW), and Bordering Land Subject to Flooding (BLSF). Consecutively numbered flags were placed in the field to demarcate BVW and Bank. These boundary flags were then located via sub-meter GPS. Due to specific site restrictions or safety concerns, it was not possible to access and field-delineate some segments of riverbank and bordering wetlands. In locations where a typical field delineation of the Bank, LUWW, and/or BVW was not practicable, boundaries of resource areas between field delineated segments were completed in GIS through a review of aerial imagery (2014-2021, spring and summer), federal and state wetlands mapping (National Wetlands Inventory and Mass DEP, respectively), and 1-foot contours (derived from 2013-2014 LiDAR). State-regulated Riverfront Area is measured horizontally from Bank of Little River, and state-regulated Buffer Zone is measured horizontally from the boundaries of BVW identified at the Site.

Maps retrieved from Mass Mapper (https://maps.massgis.digital.mass.gov/MassMapper/MassMapper.html) were used to determine if specific regulated inland wetland resources have been mapped and/or documented at the Site. MassGIS mapping does not depict Massachusetts Natural Heritage and Endangered Species Program (NHESP) Priority Habitats of Rare Species, Estimated Habitats of Rare Wildlife, or Certified Vernal Pools at the Site. A description of each resource area present at the Site is provided below.

In addition to the field delineation of resource areas, an inspection of Little River and the surrounding habitats was conducted. Little River is a mapped, perennial watercourse that flows in a southerly direction through the project area. For many decades, this river has been impounded by a stone spillway dam, constructed across the river approximately 70 feet north-northwest of the Winter Street bridge crossing. Below the dam, the river is deeply incised and bound almost entirely by vertical walls of stone or concrete. Approximately 650 feet downstream (southeast) of the dam, Little River is culverted under the city for approximately 2,000 feet until its confluence with the Merrimack River. Upstream of the dam, urban development comprises most of the river corridor, and natural terrestrial habitats are limited to the riverbanks and patches of adjacent land that are undevelopable (due to slope or bordering wetlands). Terrestrial habitats are primarily narrow forested upland between the river bank and developed areas. Larger blocks of woodlands were observed near Cashmans Park and 300 feet northwest of the end of Stevens Street. Most of the bordering wetlands identified and delineated are scrub-shrub and forested wetlands; an inundated emergent wetland of approximately 0.4 acres is located just south of Cashmans Park. Typical riparian bird species (red winged blackbird, great blue heron, cormorant, kingfisher osprey, red shoulder hawk, mallard, robin, cardinal, blue jay, etc.) were seen regularly. Mammals were not directly observed but tracks (racoon, deer) and beaver chew were noted. Green frogs were common in the upper reach of the project area along the western bank. Due to the low transparency of the water, fish were not observed.

Resource Areas

Bank: Regulatory Framework and Delineation Methodology

Bank is defined under 310 CMR 10.54(2)(c) 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*." Fuss & O'Neill Inc. performed a delineation of Bank within the area of interest using consecutively numbered flags placed in the field to demarcate the Bank of Little River, a perennial waterway. In locations where a typical field delineation of the Bank, LUWW, and/or BVW was not practicable, boundaries of resource areas between field delineated segments were determined in GIS through a review of aerial imagery (2014-2021, spring and summer), federal and state wetlands mapping (National Wetlands Inventory and Mass DEP, respectively), and 1-foot contours (derived from 2013-2014 LiDAR).

Bank: Resource Description

Some portions of the armored bank downstream of the dam are deteriorated and continuing to shed stone and sediment into the river. Where armoring or development is absent from the river's edge, banks are generally well vegetated and range from upland forest assemblage to shrubs, depending on the slope and local conditions. Bank was located in the field by the first observable break in topography between the waterway and the adjacent upland. The delineated Bank was observed to coincide with the MAHWL, as defined under 310 CMR 10.58 (2)(a)(2).

Land under Water Bodies and Waterways (LUWW)

LUWW is defined under 310 CMR 10.56 (2)(a) as "*the land beneath any creek, river, stream, pond or lake. Said land may be composed of organic muck or peat, fine sediments, rocks or bedrock*." The boundary of LUWW is defined as the mean annual low water level (310 CMR 10.56 (2)(c). LUWW was not specifically field delineated. For the intents and purposes of this resource area delineation, locations of Bank as described previously are considered to be analogous to the limits of LUWW.

Riverfront Area: Regulatory Framework and Delineation Methodology

Riverfront Area is defined under 310 CMR 10.58(2)(a) as "*the area of land between a river's mean annual high water line and a parallel line measured horizontally*." 310 CMR 10.58(2)(a)(1) defines rivers as, "*any natural flowing body of water that empties to any ocean, lake, pond or other river and which flows throughout the year. Rivers include streams (see 310 CMR 10.04: Stream) that are perennial because surface water flows within them throughout the year. Intermittent streams are not rivers as defined herein because surface water does not flow within them throughout the year*." 310 CMR 10.58(2)(a)(2) further specifies that "*The Riverfront Area is the area of land between a river's mean annual high-water line measured horizontally outward from the river and a parallel line located 200 feet away, …*" continuing with exceptions that are not applicable at the Site.

The extent of the Riverfront Area at the Site was determined by measuring a horizontal line 200 feet from the locations of Bank identified along Little River.

Riverfront Area: Resource Area Description

Riverfront Area at the Site is associated with Little River. It is comprised mainly of urbanized land use (residential/commercial/industrial buildings, yards, and parking; municipal roads, railroad); in some locations, particularly near the dam and downstream of it, development of Riverfront goes right to the water line of the Little River. Where applicable, common vegetation identified within the Riverfront Area includes [common name (*scientific name*), wetland indicator status]: red maple (*Acer rubrum*), FAC; shagbark hickory (*Carya ovata*), silver maple (*Acer saccharinum*), FACW; Norway maple (*Acer platanoides*), UPL; American beech (*Fagus grandifolia*), FACU; black cherry (*Prunus* serotina), FACU; northern red oak (*Quercus rubra*), FACU; white oak (*Quercus alba*), FACU; American ash (*Fraxinus americana*), FACU; multiflora rose (*Rosa multiflora*), FACU; Tatar's honeysuckle (*Lonicera tatarica*), FACU; silky dogwood (*Swida amomum*), FACW; sweet pepperbush (*Clethra alnifolia*), FAC; burning bush (*Euonymus alatus*), not classified; Japanese knotweed (Fallpopia japonica), FACU, cattail (*Typha sp.),* OBL ; oriental bittersweet (*Celastrus orbiculatus*), UPL; fox grape (*Vitis labrusca*), FACU; and poison ivy (*Toxicodendron radicans*), FAC.

Riverfront Area at the Site includes the following regulated resource areas: BVW, BLSF, and Buffer Zone are included. No NHESP Priority Habitats of Rare Species, Estimated Habitats of Rare Wildlife, or Certified Vernal Pools were mapped within the Riverfront Area at the Site.

Bordering Vegetated Wetlands (BVW): Regulatory Framework and Delineation Methodology

As stated in 310 CMR (2)(a), "*Bordering Vegetated Wetlands are 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 ground and surface water regime and the vegetation community which occur in each type of freshwater wetland are specified in M.G.L. c 131 sec. 40*."

Fuss & O'Neill Inc. inspected the Site for bordering vegetated wetlands in accordance with methodology provided in the Massachusetts DEP (MA DEP) handbook, *Delineating Bordering Vegetated Wetlands under the Massachusetts Wetlands Protection Act*, (March 1995), the 1987 *Corps of Engineers Wetlands Delineation Manual*, and the *Regional Supplement to the Corps of Engineers Wetlands Delineation Manual: Northcentral and Northeast Region* (Version 2.0. January 2012). Data regarding vegetation, soils, and hydrology were gathered to complete the required MA DEP BVW delineation field forms. Wetlands are categorized in accordance with *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al. 1979).

Hydric soil determinations were made in accordance with *Field Indicators for Identifying Hydric Soils in New England*, *Version 4* (New England Hydric Soils Technical Committee, 2018). The Wetland Indicator Status for plant species was ascertained using the U.S. Army Corps of Engineers *Northcentral and Northeast 2020 Subregional Regional Wetland Plant List* (U.S. Army Corps of Engineer, National Wetlands Plant List, version 3.5, 2020).

BVW: Resource Area Description

Vegetation

The BVW identified at the Site are classified as (in order of predominance) palustrine scrub-shrub, emergent, and forested wetlands. Table 1 summarizes the common vegetation identified within these wetlands [common name (*scientific name*), wetland indicator status]:

Scrub-shrub BVW (PSS)		Emergent BVW (PEM)		Forested BVW (PFO)	
• silky dogwood (*Cornus amomum*)	FACW	• cattail (Typha *angustifolia*)	OBL	• red maple (*Acer rubrum*)	FAC
• Tatar's honeysuckle (*Lonicera tatarica*) (Rosa multiflora)	FACU	• purple loosestrife (*Lythrum salicaria*)	OBL	• American elm (*Ulmus americana*)	FACW
• jewelweed (*Impatiens capensis*)	FACW	• sensitive fern (*Onoclea sensibilis*)	FACW	• silky dogwood (*Cornus amomum*)	FACW
• sensitive fern (*Onoclea sensibilis*)	FACW	• skunk cabbage (*Symplocarpus foetidus)*	OBL	• Tatar's honeysuckle (*Lonicera tatarica*)	FACU
• skunk cabbage (*Symplocarpus foetidus)*	OBL			• jewelweed (*Impatiens capensis*)	FACW
				• skunk cabbage (*Symplocarpus foetidus)*	OBL
				• fox grape (*Vitis labrusca*)	FACU
				• poison ivy (*Toxicodendron radicans*)	FACU

Hydrology

The Site is located within the local drainage basin of Little River, a perennial stream that joins the Merrimack River approximately 1,800 feet downstream (to the southeast). Upstream of the site, the drainage area of Little River is nearly 27 square miles of land area (according to the USGS website StreamStats, https://streamstats.usgs.gov/ss/). Within the reach investigated, no tributaries to the Little River were observed or are mapped by Mass DEP. Stormwater outfalls were found along the east and west banks.

Upstream of the dam at the Site, the river is impounded and a low rate of riverine flow was observed. Downstream of the dam, and especially downstream of Winter Street, more typical stream channel features and flow conditions are present (except for the armored banks mentioned previously). BVW identified and delineated at the Site are associated with the impoundment. They are either narrow fringe wetlands along the riverbanks or broader low areas with a high water table (maintained by the dam) and permanently saturated soils.

Soils

Soil types mapped by the Natural Resource Conservation Service (NRCS) along Little River include: Elmwood fine sandy loam, Hinckley loamy sand, Merrimac fine sandy loam, Windsor loamy sand, Urban land, and Udorthents smoothed. Detailed information regarding these soils is included within the Attachment *NRCS Soil Map and Soil Report*. Results of the detailed field analyses of soils at the Site were generally consistent with the published NRCS soil mapping with minor exceptions.

Buffer Zone

Buffer Zone is defined in 310 CMR 10.04 as "*that area of land extending 100 feet horizontally outward from the boundary of any area specified in 310 CMR 10.02(1)(a)*." Buffer Zone within the project area is associated with BVW delineated at the Site. Buffer Zone at the Site is comprised mainly of urbanized land use (residential/commercial/industrial buildings, yards, and parking; municipal roads); in some locations, particularly near the dam and downstream of it, development of Riverfront goes right to the water line of the Little River. Where applicable, common vegetation identified within the Riverfront Area includes [common name (*scientific name*), wetland indicator status]: red maple (*Acer rubrum*), FAC; shagbark hickory (*Carya ovata*), silver maple (*Acer saccharinum*), FACW; Norway maple (*Acer platanoides*), UPL; American beech (*Fagus grandifolia*), FACU; black cherry (*Prunus* serotina), FACU; northern red oak (*Quercus rubra*), FACU; white oak (*Quercus alba*), FACU; American ash (*Fraxinus americana*), FACU; multiflora rose (*Rosa multiflora*), FACU; Tatar's honeysuckle (*Lonicera tatarica*), FACU; silky dogwood (*Swida amomum*), FACW; pepperbush (*Clethra alnifolia*), FAC; burning bush (*Euonymus alatus*), not classified; Japanese knotweed (Fallpopia japonica), FACU, cattail (*Typha sp.),* OBL ; oriental bittersweet (*Celastrus orbiculatus*), UPL; fox grape (*Vitis labrusca*), FACU; and poison ivy (*Toxicodendron radicans*), FAC.

Bordering Land Subject to Flooding (BLSF): Resource Area Description

The National Flood Hazard Layer, provided by FEMA, dated July 3, 2012 depicts areas at the Site within Flood Zones AE and A, which designate areas likely to experience flooding in 100-year storm events (see attached *FEMA National flood Hazard Layer*). This area likely coincides with the historical lateral extent of floodplains and bordering wetlands at the Site; however, urban development now comprises much of these areas, and the physical characteristics that define BLSF in 310 CMR 10.57(2)(a)1 are absent. To determine the extent BLSF at the Site, Fuss & O'Neill conducted hydraulic modeling.

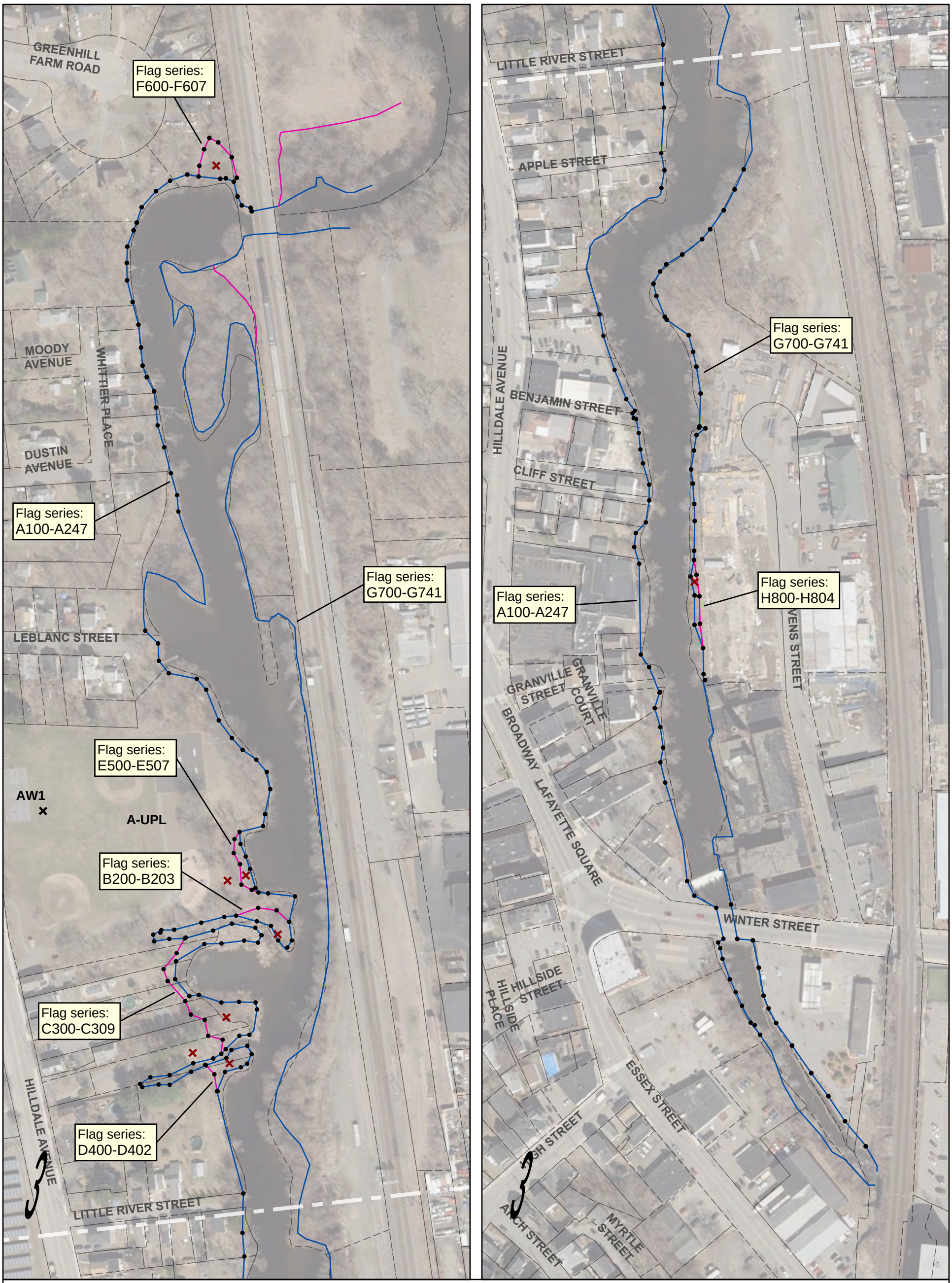
Wetlands Functions & Values Assessment

During the field inspection, a function & values assessment was conducted of the wetland resource areas delineated in the project area. The assessment is largely based on the procedure outlined in the U.S. Army Corps of Engineers "Highway Methodology Work Book: Supplement. Wetland Functions and Values: A Descriptive Approach" (1999, NAEEP-360-1-30a). This methodology is descriptive and does not rely upon semi-quantitative numerical models to identify principal functions and values. In addition, other assessment methods were incorporated (e.g. Wisc. DNR, 1992, "Rapid Assessment Methodology for Evaluating Wetland functions and Values." and Ammann, et al., 1996) as well as professional experience.

Table 1 provides a summary of the Principal and Secondary functions and values identified for each resource area at the Site. Definitions for the functions and values listed below can be found in the Attachment *Explanation of Terms Used in Wetlands Function and Values.*

Functions & Values	Delineated BVW (flag series, and wetland classification (from Cowardin, 1979))					
	B200-B203, PSS1E	C300-C309, PEM1E	D400-D402, PSS1E	E500-E507, PFO1E	F600-F607, PFO/PSS1E	H800-H804, PSS1E
Groundwater Recharge/Discharge	-	S (Recharge)	-	-	S (Recharge)	-
Floodflow Alteration	-	S	-	S	S	-
Fish and Shellfish Habitat	-	-	-	-	P	-
Sediment, Pollutant, & Nutrient Removal	-	P	-	S	S	S
Production Export	S	S	S	S	S	-
Wildlife Habitat	-	P	S	S	S	-
Educational & Scientific Value	S	-	-	S	-	-
Uniqueness/Heritage	-	-	-	-	-	-

Table 1. Summary of wetlands functions & values assessments. Assessments conducted in the field yielded the identification of resource areas as having Principal ("P") or Secondary ("S") functions or values; "-" indicates that the assessment yielded no attributable functions or values. Wetlands Resource Areas are depicted on the Attachment *Sketch Map of Inland Resource Areas.*



Sketch Map of Inland Resource Areas

Little River, between Essex Street and Greenhill Farm Road
Haverhill, MA

May 2022

LEGEND

- Bank/Land Under Waterbodies and Waterways
- Bordering Vegetated Wetland
- Wetland flag
- Sampling plot location

The regulated resource areas depicted in this sketch were identified and delineated in the field by Michael E. Soares, Wetlands Scientist (Fuss & O'Neill) on September 27, 2021 and April 29, 2022.

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Project #: 20170390.U30

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Little River, between Essex St and Greenhhill Farm Rd City/County: Haverhill MA Sampling Date: 9/27/21

Applicant/Owner: City of Haverhill State: MA Sampling Point: BW1

Investigator(s): Michael Soares Section, Township, Range: Essex County

Landform (hillside, terrace, etc.): terrace Local relief (concave, convex, none): level Slope (%): 0

Subregion (LRR or MLRA): LRR R, MLRA 144A Lat: 42.782910506084036 Long: -71.09060922967129 Datum: WGS 84

Soil Map Unit Name: Udorthents, smoothed NWI classification: n/a

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area**	
Hydric Soil Present?	Yes X	No ____	**within a Wetland?**	**Yes** X **No** ____
Wetland Hydrology Present?	Yes X	No ____	If yes, optional Wetland Site ID:	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- X Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches):	____
Water Table Present?	Yes X	No ____	Depth (inches):	10
Saturation Present? (includes capillary fringe)	Yes X	No ____	Depth (inches):	6

Wetland Hydrology Present? **Yes** X **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: BW1

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Rhus hirta*	35	Yes	UPL
2. *Acer rubrum*	5	No	FAC
3.			
4.			
5.			
6.			
7.			
	40	=Total Cover	
Sapling/Shrub Stratum (Plot size:)			
1. *Cornus amomum*	50	Yes	FACW
2. *Lonicera tatarica*	5	No	FACU
3.			
4.			
5.			
6.			
7.			
	55	=Total Cover	
Herb Stratum (Plot size:)			
1. *Impatiens capensis*	15	Yes	FACW
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	15	=Total Cover	
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 66.7% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	65	x 2 =	130
FAC species	5	x 3 =	15
FACU species	5	x 4 =	20
UPL species	35	x 5 =	175
Column Totals:	110	(A)	340 (B)

Prevalence Index = B/A = 3.09

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: BW1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-23	10YR 2/1	100					Muck	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- X Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ High Chroma Sands (S11) (**LRR K, L**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** ___

Remarks:

This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to reflect the NRCS Field Indicators of Hydric Soils version 7.0 March 2013 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Little River, between Essex St and Greenhhill Farm Rd City/County: Haverhill MA Sampling Date: 9/27/21

Applicant/Owner: City of Haverhill State: MA Sampling Point: CW1

Investigator(s): Michael Soares Section, Township, Range: Essex County

Landform (hillside, terrace, etc.): mudflat Local relief (concave, convex, none): level Slope (%): 0

Subregion (LRR or MLRA): LRR R, MLRA 144A Lat: 42.78258810348406 Long: -71.09084240907697 Datum: WGS 84

Soil Map Unit Name: Udorthents, smoothed NWI classification: n/a

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area**	
Hydric Soil Present?	Yes X	No ____	**within a Wetland?**	**Yes** X **No** ____
Wetland Hydrology Present?	Yes X	No ____	If yes, optional Wetland Site ID:	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- X High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- X Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- X Inundation Visible on Aerial Imagery (B7)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Water-Stained Leaves (B9)
- ____ Aquatic Fauna (B13)
- ____ Marl Deposits (B15)
- ____ Hydrogen Sulfide Odor (C1)
- ____ Oxidized Rhizospheres on Living Roots (C3)
- ____ Presence of Reduced Iron (C4)
- ____ Recent Iron Reduction in Tilled Soils (C6)
- ____ Thin Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- X Drainage Patterns (B10)
- ____ Moss Trim Lines (B16)
- ____ Dry-Season Water Table (C2)
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Stunted or Stressed Plants (D1)
- X Geomorphic Position (D2)
- ____ Shallow Aquitard (D3)
- ____ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No ____	Depth (inches): 1	
Water Table Present?	Yes X	No ____	Depth (inches): ____	
Saturation Present? (includes capillary fringe)	Yes X	No ____	Depth (inches): ____	**Wetland Hydrology Present?** **Yes** X **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: CW1

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	=Total Cover		
Herb Stratum (Plot size:)			
1. *Typha angustifolia*	60	Yes	OBL
2. *Lythrum salicaria*	30	Yes	OBL
3. *Lycopus americanus*	5	No	OBL
4. *Onoclea sensibilis*	5	No	FACW
5. *Peltandra virginica*	5	No	OBL
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	105 =Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	=Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	100	x 1 =	100
FACW species	5	x 2 =	10
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	105 (A)		110 (B)

Prevalence Index = B/A = 1.05

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

X 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: CW1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-24	10YR 2/1	100					Muck	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- X Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ High Chroma Sands (S11) (**LRR K, L)**
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** ___

Remarks:

This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to reflect the NRCS Field Indicators of Hydric Soils version 7.0 March 2013 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Little River, between Essex St and Greenhhill Farm Rd City/County: Haverhill MA Sampling Date: 9/27/21

Applicant/Owner: City of Haverhill State: MA Sampling Point: DW1

Investigator(s): Michael Soares Section, Township, Range: Essex County

Landform (hillside, terrace, etc.): terrace Local relief (concave, convex, none): level Slope (%): 0

Subregion (LRR or MLRA): LRR R, MLRA 144A Lat: 42.782328247058935 Long: -71.09077776279197 Datum: WGS 84

Soil Map Unit Name: Udorthents, smoothed NWI classification: n/a

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area**	
Hydric Soil Present?	Yes X	No ____	**within a Wetland?**	**Yes** X **No** ____
Wetland Hydrology Present?	Yes X	No ____	If yes, optional Wetland Site ID:	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- X Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- X Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches):	____
Water Table Present?	Yes X	No ____	Depth (inches):	12
Saturation Present? (includes capillary fringe)	Yes X	No ____	Depth (inches):	11

Wetland Hydrology Present? **Yes** X **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: DW1

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Salix nigra*	15	Yes	OBL
2.			
3.			
4.			
5.			
6.			
7.			
	15	=Total Cover	
Sapling/Shrub Stratum (Plot size:)			
1. *Cornus amomum*	95	Yes	FACW
2.			
3.			
4.			
5.			
6.			
7.			
	95	=Total Cover	
Herb Stratum (Plot size:)			
1. *Impatiens capensis*	10	Yes	FACW
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	10	=Total Cover	
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	15	x 1 =	15
FACW species	105	x 2 =	210
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	120 (A)		225 (B)

Prevalence Index = B/A = 1.88

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

X 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: DW1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-12	10YR 3/1	100					Sandy	
12-14	10YR 4/1	75	10YR 5/8	10	C	M	Sandy	Prominent redox concentrations
			10YR 6/2	5	C	M		Faint redox concentrations
14-20	10YR 6/2	80	10YR 5/8	20	C	M	Mucky Loam/Clay	Prominent redox concentrations
20-24	10YR 2/1	100					Muck	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- X Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ? Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ? Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ High Chroma Sands (S11) (**LRR K, L**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** ___

Remarks:

This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to reflect the NRCS Field Indicators of Hydric Soils version 7.0 March 2013 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Little River, between Essex St and Greenhhill Farm Rd City/County: Haverhill MA Sampling Date: 9/27/21

Applicant/Owner: City of Haverhill State: MA Sampling Point: EW1

Investigator(s): Michael Soares Section, Township, Range: Essex County

Landform (hillside, terrace, etc.): abandoned beach? Local relief (concave, convex, none): level Slope (%): 1

Subregion (LRR or MLRA): LRR R, MLRA 144A Lat: 42.783243257552684 Long: -71.09100194115186 Datum: WGS 84

Soil Map Unit Name: Udorthents, smoothed NWI classification: n/a

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area**	
Hydric Soil Present?	Yes X	No ____	**within a Wetland?**	**Yes** X **No** ____
Wetland Hydrology Present?	Yes X	No ____	If yes, optional Wetland Site ID:	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- x Water Marks (B1)
- ___ Sediment Deposits (B2)
- X Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- X Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- X Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches):	____
Water Table Present?	Yes X	No ____	Depth (inches):	12
Saturation Present? (includes capillary fringe)	Yes X	No ____	Depth (inches):	7

Wetland Hydrology Present? **Yes** X **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: EW1

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	70	Yes	FAC
2. *Ulmus americana*	5	No	FACW
3.			
4.			
5.			
6.			
7.			
	75	=Total Cover	
Sapling/Shrub Stratum (Plot size:)			
1. *Cornus amomum*	40	Yes	FACW
2. *Lonicera tatarica*	25	Yes	FACU
3. *Rosa multiflora*	5	No	FACU
4.			
5.			
6.			
7.			
	70	=Total Cover	
Herb Stratum (Plot size:)			
1. *Osmunda regalis*	5	Yes	OBL
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	5	=Total Cover	
Woody Vine Stratum (Plot size:)			
1. *Celastrus orbiculatus*	5	Yes	UPL
2.			
3.			
4.			
	5	=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 60.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	5	x 1 =	5
FACW species	45	x 2 =	90
FAC species	70	x 3 =	210
FACU species	30	x 4 =	120
UPL species	5	x 5 =	25
Column Totals:	155 (A)		450 (B)

Prevalence Index = B/A = 2.90

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

X 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: EW1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-8	10YR 2/1	100					Mucky Sand	
8-11	10YR 4/2	60	10YR 4/6	40	C	M	Sandy	Prominent redox concentrations
11-19	2.5Y 4/3	100					Sandy	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- X Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- X Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ? Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ High Chroma Sands (S11) (**LRR K, L**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: rock

Depth (inches): 19

Hydric Soil Present? **Yes** X **No** ___

Remarks:

This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to reflect the NRCS Field Indicators of Hydric Soils version 7.0 March 2013 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Little River, between Essex St and Greenhhill Farm Rd City/County: Haverhill MA Sampling Date: 4/29/22

Applicant/Owner: City of Haverhill State: MA Sampling Point: FW1

Investigator(s): Michael Soares Section, Township, Range: Essex County

Landform (hillside, terrace, etc.): floodplain Local relief (concave, convex, none): level Slope (%): 0

Subregion (LRR or MLRA): LRR R, MLRA 144A Lat: 42.78666483584293 Long: -71.09239706707794 Datum: WGS 84

Soil Map Unit Name: Elmwood fine sandy loam NWI classification: n/a

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area**	
Hydric Soil Present?	Yes X	No ____	**within a Wetland?**	**Yes** X **No** ____
Wetland Hydrology Present?	Yes X	No ____	If yes, optional Wetland Site ID:	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- X Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- X Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Sparsely Vegetated Concave Surface (B8)
- X Water-Stained Leaves (B9)
- ____ Aquatic Fauna (B13)
- ____ Marl Deposits (B15)
- ____ Hydrogen Sulfide Odor (C1)
- ____ Oxidized Rhizospheres on Living Roots (C3)
- ____ Presence of Reduced Iron (C4)
- ____ Recent Iron Reduction in Tilled Soils (C6)
- ____ Thin Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- X Surface Soil Cracks (B6)
- X Drainage Patterns (B10)
- ____ Moss Trim Lines (B16)
- ____ Dry-Season Water Table (C2)
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Stunted or Stressed Plants (D1)
- X Geomorphic Position (D2)
- ____ Shallow Aquitard (D3)
- ____ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches):	
Water Table Present?	Yes X	No ____	Depth (inches):	14
Saturation Present? (includes capillary fringe)	Yes X	No ____	Depth (inches):	0

Wetland Hydrology Present? **Yes** X **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: FW1

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	10	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
	10	=Total Cover	
Sapling/Shrub Stratum (Plot size:)			
1. *Cornus amomum*	60	Yes	FACW
2. *Lonicera tatarica*	10	No	FACU
3. *Alnus incana*	5	No	FACW
4.			
5.			
6.			
7.			
	75	=Total Cover	
Herb Stratum (Plot size:)			
1. *Symplocarpus foetidus*	10	Yes	OBL
2. *Impatiens capensis*	10	Yes	FACW
3. *Alliaria petiolata*	7	Yes	FACU
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	27	=Total Cover	
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 80.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	10	x 1 =	10
FACW species	75	x 2 =	150
FAC species	10	x 3 =	30
FACU species	17	x 4 =	68
UPL species	0	x 5 =	0
Column Totals:	112 (A)		258 (B)

Prevalence Index = B/A = 2.30

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

X 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: FW1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-8	10YR 2/1	100					Mucky Sand	
8-12	2.5Y 4/2	100					Mucky Loam/Clay	
12-16	2.5Y 4/1	90	10YR 4/6	10	C	M	Mucky Loam/Clay	Prominent redox concentrations
16-21	5Y 7/2	68	2.5Y 5/1	20	C	M	Mucky Loam/Clay	Distinct redox concentrations
			2.5Y 5/6	7	C	M		Prominent redox concentrations
			10YR 5/6	5	C	M		Prominent redox concentrations

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- X Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ High Chroma Sands (S11) (**LRR K, L)**
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** ___

Remarks:

This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to reflect the NRCS Field Indicators of Hydric Soils version 7.0 March 2013 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Little River, between Essex St and Greenhhill Farm Rd City/County: Haverhill MA Sampling Date: 4/29/22

Applicant/Owner: City of Haverhill State: MA Sampling Point: HW1

Investigator(s): Michael Soares Section, Township, Range: Essex County

Landform (hillside, terrace, etc.): floodplain Local relief (concave, convex, none): level Slope (%): 2

Subregion (LRR or MLRA): LRR R, MLRA 144A Lat: 42.779103747288616 Long: -71.08928404099665 Datum: WGS 84

Soil Map Unit Name: Urban land NWI classification: n/a

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area**	
Hydric Soil Present?	Yes X	No ____	**within a Wetland?**	**Yes** X **No** ____
Wetland Hydrology Present?	Yes X	No ____	If yes, optional Wetland Site ID:	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- X Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- X Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches):	____
Water Table Present?	Yes X	No ____	Depth (inches):	9
Saturation Present? (includes capillary fringe)	Yes X	No ____	Depth (inches):	3

Wetland Hydrology Present? **Yes** X **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: HW1

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	10	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
	10	=Total Cover	
Sapling/Shrub Stratum (Plot size:)			
1. *Cornus amomum*	85	Yes	FACW
2. *Lonicera tatarica*	5	No	FACU
3.			
4.			
5.			
6.			
7.			
	90	=Total Cover	
Herb Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
		=Total Cover	
Woody Vine Stratum (Plot size:)			
1. *Vitis labrusca*	5	Yes	FACU
2. *Toxicodendron radicans*	5	Yes	FAC
3.			
4.			
	10	=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 75.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	85	x 2 =	170
FAC species	15	x 3 =	45
FACU species	10	x 4 =	40
UPL species	0	x 5 =	0
Column Totals:	110 (A)		255 (B)

Prevalence Index = B/A = 2.32

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

X 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: HW1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-7	10YR 2/1	100					Muck	
7-17	10YR 3/1	100					Muck	
17-22	5Y 3/1	100					Mucky Sand	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- X Histosol (A1)
- X Histic Epipedon (A2)
- X Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ High Chroma Sands (S11) (**LRR K, L**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** ___

Remarks:

This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to reflect the NRCS Field Indicators of Hydric Soils version 7.0 March 2013 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Little River, between Essex St and Greenhhill Farm Rd City/County: Haverhill MA Sampling Date: 9/27/21

Applicant/Owner: City of Haverhill State: MA Sampling Point: C-UPL

Investigator(s): Michael Soares Section, Township, Range: Essex County

Landform (hillside, terrace, etc.): upland terrace Local relief (concave, convex, none): level Slope (%): 3

Subregion (LRR or MLRA): LRR R, MLRA 144A Lat: 42.78225155093082 Long: -71.09109201222371 Datum: WGS 84

Soil Map Unit Name: Urban land NWI classification: n/a

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No X	**Is the Sampled Area**
Hydric Soil Present?	Yes ____	No X	**within a Wetland?** **Yes** ____ **No** X
Wetland Hydrology Present?	Yes ____	No X	If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches): ____
Water Table Present?	Yes ____	No X	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No X	Depth (inches): ____

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: C-UPL

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Picea rubens*	50	Yes	FACU
2. *Catalpa bignonioides*	5	No	FACU
3.			
4.			
5.			
6.			
7.			
	55	=Total Cover	
Sapling/Shrub Stratum (Plot size:)			
1. *Rosa multiflora*	5	Yes	FACU
2.			
3.			
4.			
5.			
6.			
7.			
	5	=Total Cover	
Herb Stratum (Plot size:)			
1. *Solidago altissima*	15	Yes	FACU
2. *Rubus phoenicolasius*	7	Yes	FACU
3. *Fallopia japonica*	5	No	FACU
4. *Elymus virginicus*	5	No	FACW
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	32	=Total Cover	
Woody Vine Stratum (Plot size:)			
1. *Parthenocissus quinquefolia*	12	Yes	FACU
2.			
3.			
4.			
	12	=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	5	x 2 =	10
FAC species	0	x 3 =	0
FACU species	99	x 4 =	396
UPL species	0	x 5 =	0
Column Totals:	104 (A)		406 (B)

Prevalence Index = B/A = 3.90

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ___ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: C-UPL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-8	10YR 2/2	100					Sandy	
8-11	10YR 4/3	100					Sandy	
11-17	2.5Y 5/4	100					Sandy	
17-								HTM

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ High Chroma Sands (S11) (**LRR K, L)**
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to reflect the NRCS Field Indicators of Hydric Soils version 7.0 March 2013 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Little River, between Essex St and Greenhhill Farm Rd City/County: Haverhill MA Sampling Date: 9/27/21

Applicant/Owner: City of Haverhill State: MA Sampling Point: E-UPL

Investigator(s): Michael Soares Section, Township, Range: Essex County

Landform (hillside, terrace, etc.): backslope Local relief (concave, convex, none): level Slope (%): 3

Subregion (LRR or MLRA): LRR R, MLRA 144A Lat: 42.783228910818714 Long: -71.09107042574841 Datum: WGS 84

Soil Map Unit Name: Urban land NWI classification: n/a

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No X	**Is the Sampled Area**
Hydric Soil Present?	Yes ____	No X	**within a Wetland?** **Yes** ____ **No** X
Wetland Hydrology Present?	Yes ____	No X	If yes, optional Wetland Site ID:

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches): ____
Water Table Present?	Yes ____	No X	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No X	Depth (inches): ____

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: E-UPL

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Quercus rubra*	40	Yes	FACU
2. *Acer ruburm*	25	Yes	
3.			
4.			
5.			
6.			
7.			
	65	=Total Cover	
Sapling/Shrub Stratum (Plot size:)			
1. *Rosa multiflora*	25	Yes	FACU
2. *Frangula alnus*	10	Yes	FAC
3.			
4.			
5.			
6.			
7.			
	35	=Total Cover	
Herb Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
		=Total Cover	
Woody Vine Stratum (Plot size:)			
1. *Celastrus orbiculatus*	60	Yes	UPL
2. *Parthenocissus quinquefolia*	10	No	FACU
3.			
4.			
	70	=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 20.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	10	x 3 =	30
FACU species	75	x 4 =	300
UPL species	60	x 5 =	300
Column Totals:	145 (A)		630 (B)

Prevalence Index = B/A = 4.34

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ___ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: E-UPL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR 3/1						Sandy	
3-15	10YR 4/6						Loamy/Clayey	
15-19	2.5Y 5/6						Sandy	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ High Chroma Sands (S11) (**LRR K, L)**
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: rock

Depth (inches): 19

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to reflect the NRCS Field Indicators of Hydric Soils version 7.0 March 2013 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

FEMA National Flood Hazard Layer

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
- NO SCREEN — Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 — Cross Sections with 1% Annual Chance
- 17.5 — Water Surface Elevation
- Coastal Transect
- 513 — Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

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 5/26/2022 at 6:06 PM 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.

Hydrologic Soil Group—Essex County, Massachusetts, Northern Part
(Little River, Haverhill MA)

Map Scale: 1:8,230 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 100 200 400 600

Feet: 0 400 800 1600 2400

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

A
A/D
B
B/D
C
C/D
D
Not rated or not available

Soil Rating Lines

A
A/D
B
B/D
C
C/D
D
Not rated or not available

Soil Rating Points

A
A/D
B
B/D
C
C/D
D
Not rated or not available

Water Features

Streams and Canals

Transportation

Rails
Interstate Highways
US Routes
Major Roads
Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Essex County, Massachusetts, Northern Part
Survey Area Data: Version 17, Sep 2, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 13, 2020—Oct 18, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
1	Water		9.4	12.8%
240A	Elmwood fine sandy loam, 0 to 3 percent slopes	B	3.0	4.1%
240B	Elmwood fine sandy loam, 3 to 8 percent slopes	B	2.8	3.8%
253D	Hinckley loamy sand, 15 to 25 percent slopes	A	1.4	1.9%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	A	1.6	2.2%
255B	Windsor loamy sand, 3 to 8 percent slopes	A	0.1	0.1%
255D	Windsor loamy sand, 15 to 25 percent slopes	A	0.7	0.9%
411B	Sutton fine sandy loam, 0 to 8 percent slopes, very stony	B/D	2.1	2.9%
421D	Canton fine sandy loam, 15 to 25 percent slopes, very stony	A	0.5	0.7%
602	Urban land		46.5	63.3%
651	Udorthents, smoothed	A	5.4	7.3%
Totals for Area of Interest			**73.4**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Figure 1. Little River at the southern (downstream) terminus of project area. Looking southeast from flag G700, toward the culvert which conveys the river to the Merrimack River.

Figure 2. Western bank of Little River. Looking northwest (upstream) from flag G700.

Figure 3. Urban development immediately east of Little River south of Winter Street. Looking northwest (upstream) near flag G701.

Figure 4. Little River and banks south of Winter Street. Looking northwest (upstream) near flag G702.

Figure 5. Little River and banks south of Winter Street, with the Winter Street bridge in background. Looking northwest (upstream) near flag A102.

Figure 6. Little River and banks south of Winter Street, with the Winter Street bridge in background. Looking northwest (upstream) near flag G707.

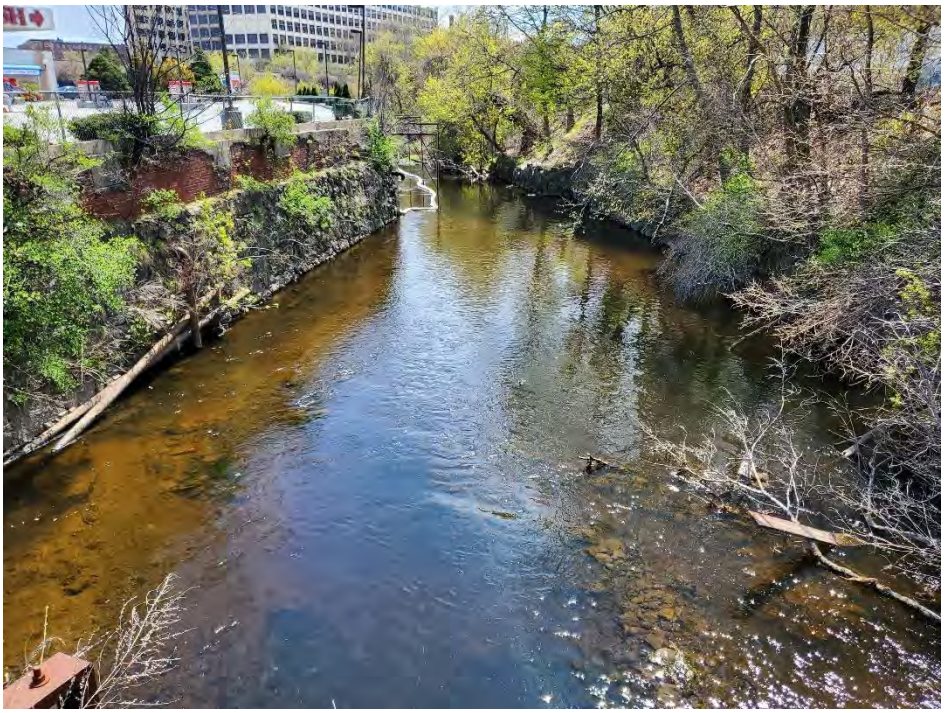

Figure 7. Little River and banks south of Winter Street. Looking southeast (downstream) from the Winter Street bridge.

Figure 8. Spillway dam just upstream of Winter Street. Looking northwest (upstream) from the Winter Street bridge.

Figure 9. Spillway dam and eastern bank. Looking north (upstream) from the Winter Street bridge.

Figure 10. Spillway dam and western bank. Looking northwest (upstream) from the Winter Street bridge.

Figure 11. Little River, with old mill on eastern bank in the background. Looking north (upstream) near flag A113.

Figure 12. Typical conditions of the western bank and adjacent uplands. Looking south near flag A113.

Figure 13. Little River and its western bank. The building visible at left is a portion of the old mill. Looking south (downstream) near flag G712.

Figure 14. Little River and its western bank. Looking northwest (upstream) near flag G712.

Figure 15. Urban development immediately east of Little River eastern bank, located north of the old mill off Stevens St. Looking north near flag G 714.

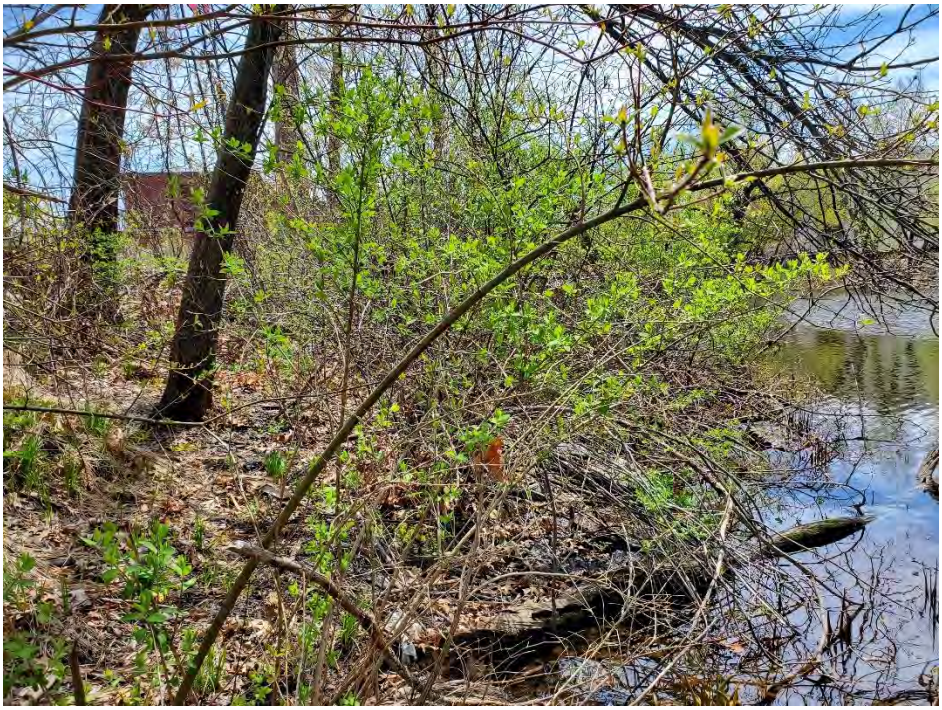

Figure 16. Upstream limit of fringe BVW along eastern banks (flag series H800-H804). Looking south (downstream) near flag H804.

Figure 17. Stormwater outfall on the western bank. Looking northwest near flag A130.

Figure 18. Stormwater outfall on the eastern bank. Looking east near flag G728.

Figure 19. Little River and its we4stern bank in the background. Looking southwest (downstream) near flag G731.

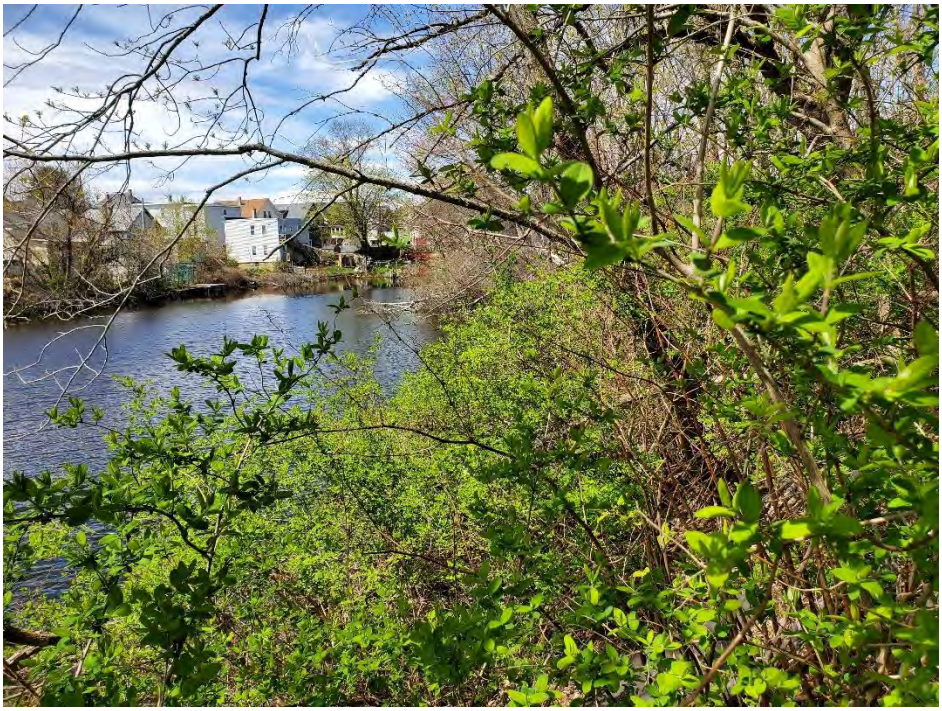

Figure 20. Little River and its western bank in the background. Looking northwest (upstream) near flag G731.

Figure 21. Little River and its eastern and western banks (left and right, respectively). Looking south (downstream) near flag G735.

Figure 22. Little River and its and western bank. Looking west-southwest (downstream) near flag G740.

Figure 23. Little River and its eastern and western banks (left and right, respectively). Looking south (downstream) near flag A146.

Figure 24. Emergent BVW along the western bank. Looking north-northwest near flag A149.

Figure 25. Drainage channel and culvert outlet (in background, flags A156 and A157) just south of undeveloped parcel (125 Hilldale Ave). Looking west-southwest near flag A159.

Figure 26. Outfall (flags A183 and A184) on the western bank just south of Cashmans Park. Looking southwest near flag A186.

Figure 27. Little River from its western bank. Looking southeast (downstream) near flag A225.

Figure 28. Little River, with its western bank at left and eastern bank in background at upper right. Looking north (upstream) near flag A227.

Figure 29. Little River from its eastern bank. Looking northeast toward the scrub-shrub BVW of 0.6± acres just south of the railroad bridge.

Figure 30. Little River from its eastern bank. Looking east toward the scrub-shrub BVW of 0.6± acres just south of the railroad bridge (at left).

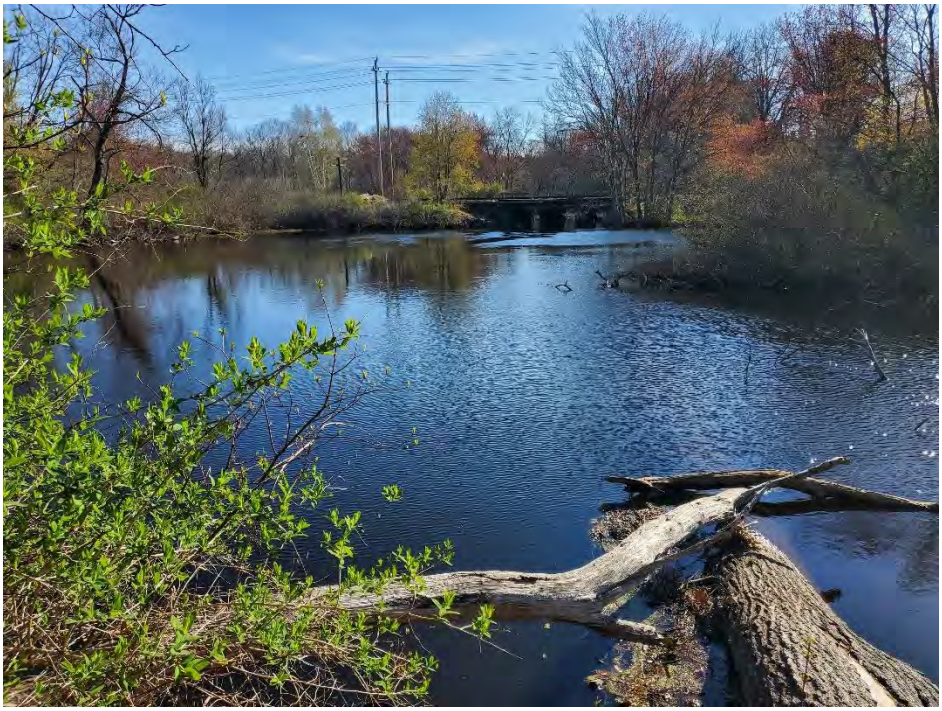

Figure 31. Little River and its eastern and western banks (right and left, respectively) downstream of the railroad bridge, in background. Looking east (upstream) near flag A235.

Figure 32. Little River and its eastern and western banks (left and right, respectively) downstream of the railroad bridge. Looking south (downstream) near flag A235.

Figure 33. Scrub-shrub BVW (flag series F600-F607) on the western bank, just downstream of the railroad bridge. Looking east near flag F605.

Figure 34. Scrub-shrub BVW (flag series F600-F607) on the western bank, just downstream of the railroad bridge. Looking west near flag A242, with Little River at left.

Figure 35. Little River at the railroad bridge. Looking southeast near flag A246.

Figure 36. Little River and its eastern and western banks (left and right, respectively), Immediately downstream of the railroad bridge. Looking southwest (downstream) near flag A246.

FUSS & O'NEILL

Explanation of Terms Used in Wetlands Function and Values

According to the U.S. Army Corps of Engineers "Highway Methodology Work Book: Supplement. Wetland Functions and Values: A Descriptive Approach" (1999, NAEEP-360-1-30a):

Functions are self-sustaining properties and processes of a wetland. They result from living and non-living components of a specific wetland and describe its ecological significance independent of human valuation. **Values** are benefits that derive from one or more functions and characteristics associated with a wetland. Most wetlands have corresponding societal value that is recognized in federal, state, and/or local legislation to protect these resources.

An assessment of *Primary* or *Secondary* indicates the relative number of satisfied criteria used as "considerations and qualifiers" for a particular function or value.

Groundwater Recharge & Discharge
The capacity or potential for a wetland to interact with groundwater such that water moves from surface water to ground water (Recharge) or from ground water to surface water (Discharge).

Floodflow Alteration
The storage of inflowing water from storm or flooding events, resulting in detention and retention of water on the wetland surface.

Fish and Shellfish Habitat (Streams & Rivers)
Considers the quality of the aquatic habitat of a perennial watercourse, and its capacity to support finfish.

Sediment, Pollutant & Nutrient Removal
The capacity of a wetland to remove dissolved, suspended and floatable material from storm water runoff and prevents degradation of water quality.

Production Export
The capacity of a wetland to produce wildlife food sources, or to export biomass that sustains downstream ecosystems and local wildlife populations.

Wildlife Habitat
The capacity of a wetland to support a diverse and abundant wildlife community typically associated with wetland and wetland edges.

Recreation
Considers the ability of watercourses to provide passive or active recreational opportunities such as canoeing, boating, fishing, hunting, and other activities.

Educational/Scientific Value
The suitability of a wetland for classroom field trips or scientific research.

Uniqueness/Heritage
The degree to which a wetland is considered a unique natural and/or historical resource.

Appendix C

Environmental Monitor Notice

Notification for Submission of Notice of Intent, Ecological Restoration Project: Little River Dam Removal and River Restoration

Expected NOI Submission Date: June 8, 2023
Municipality where Proposed Project is located: Haverhill
Location of Proposed Project: The dam is located approximately 70 feet upstream of Winter Street (Route 97) and approximately 240 feet west of the intersection with Stevens Street. River restoration will occur along the Little River between the Winter Street Bridge and the MBTA bridge.

Project Description: The City of Haverhill is proposing a dam removal and river restoration project in the Little River in Haverhill, Massachusetts. Key elements of the proposed restoration will include:

- Removal of the Little River Dam and existing impoundment to restore the natural flow of the river, restore land area along the river's edge, and provide flood protection.
- Restoration of the river corridor including installation of a nature-like fishway, construction of low flow channel downstream of the Winter Street bridge, and installation of scour protection beneath the bridge and native plantings. River Restoration will provide multiple ecological benefits such as habitat restoration, water quality improvement, and increased carbon sequestration potential.

The proposed project meets the definition of Ecological Restoration Project as defined in 310 CMR 10.00. Once filed, copies of the NOI application will be available upon request applicant's representative, Julianne Busa of Fuss & O'Neill, can be reached at 413-333-5469 or at jbusa@fando.com. A public hearing for the project is expected to be scheduled in late June and details on the date, time, and location of the hearing will be posted in Haverhill City Hall no less than 48 hours in advance, at least five days in advance in the *Haverhill Gazette* newspaper.

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California
Connecticut
Maine
Massachusetts
New Hampshire
Rhode Island
Vermont

Appendix D

Invasive Species Control Plan

INVASIVE SPECIES CONTROL PLAN
Little River Dam Removal and River Restoration
City of Haverhill
Haverhill, Massachusetts

1 Introduction

The City of Haverhill is proposing a dam removal and river restoration project in the Little River in Haverhill, Massachusetts. The limit of disturbance includes approximately 12 acres and spans approximately 3,600 linear feet of Little River from south of Winter Street to the MBTA Bridge.

This Invasive Species Control Plan has been developed in accordance with the Massachusetts General Permit General Condition 25. Invasive and Other Unacceptable Species.

2 Risks Posed by Invasive Species

Invasive species impact native vegetative communities by out-competing for habitat through the physical crowding out of native species. This crowding can be responsible for interfering with natural succession, and can cause a reduction in the overall biodiversity of an area or community. Invasive species are aggressive in their reproduction, spread, and persistence within a community, all at levels with which native species cannot compete.

The project site is located within a densely developed urban environment. Little River is bordered by the MBTA railroad, portions of vegetated wetlands and uplands, and industrial, commercial, and residential properties. Historic development of the adjacent areas likely provided conditions suitable for invasive species to establish and spread.

Multiple invasive species were observed within the project site during the wetland resource area investigations in September 2021 and April 2022 (refer to Table 2-1). These invasive species may continue to spread prior to project commencement. In addition, the proposed project includes the re-use of sediment and material on-site. The seed bank of invasives may still be viable after construction and there is potential for germination of invasives during and after the proposed project.

Table 2-1. Known (bolded) or Potential Invasive Species in the Project Area

Common Name	Scientific Name[1]	Invasive Classification[2]	Wetland Indicator Status[1, 3]
Autumn Olive	*Elaeagnus umbellata*	Invasive	N/A
Asiatic Bittersweet	***Celastrus orbiculatus***	**Invasive**	**FACU**
Black Locust	*Robinia pseudoacacia*	Invasive	FACU
Creeping Buttercup	*Ranunculus repens*	Likely Invasive	FAC
European Privet	*Ligustrum vulgare*	Do not list at this time	FACU
Garlic Mustard	*Alliaria petiolate*	Invasive	FACU
Glossy Buckthorn	*Frangula alnus*	Invasive	FAC
Japanese Barberry	*Berberis thunbergia*	Invasive	FACU
Japanese Knotweed	***Polygonum cuspidatum***	**Invasive**	**FACU**
Morrow's honeysuckle	*Lonicera morrowii*	Invasive	FACU
Mugwort	*Artemisia vulgaris*	Unlisted	UPL
Multiflora Rose	***Rosa multiflora***	**Invasive**	**FACU**
Norway Maple	***Acer platanoides***	**Invasive**	**UPL**
Purple Loosestrife	*Lythrum salicaria*	Invasive	OBL
Tatarian Honeysuckle	***Lonicera tatarica***	**Likely Invasive**	**FACU**
Tree of Heaven	*Ailanthus altissima*	Invasive	UPL
Winged Euonymus	*Euonymus alatus*	Invasive	NI

[1]Scientific Name and indicator status as determined by The PLANTS Database. USDA, NRCS. 2022. The PLANTS Database (http://plants.usda.gov, 11/01/2022).

[2]According to the Massachusetts Invasive Plant Advisory Group

[3]OBL: Occur almost always, under natural conditions, in a wetland (probability: >99%) FACW: Usually occur in wetlands (probability: 67-99%), but occasionally found in non-wetlands

FAC: Equally likely to be found in wetlands or non-wetlands

FACU: Usually occur in non-wetlands (probability: 67-99%), but occasionally found in wetlands (probability: 1-33%)

UPL: Occur in wetlands in another region, but almost always occur (probability: >99%) under natural conditions, in non-wetlands in this region. If a species does not occur in wetlands in any region, it is not listed.

NI: No indicator status designated.

3 Monitoring and Management of Invasive Species

Monitoring for the presence or spread of invasive species should be included as part of construction activities within areas of active construction. Any area which is treated should be re-examined several times over multiple growing seasons to ensure the control of the invasive species has been obtained. An emphasis should be placed on spring observations to catch new incursions, and to check the status of those areas treated in the previous season. **Those conducting the monitoring should look for all known and potential species noted in this plan during all seasons. If additional species are identified, supplemental control strategy information can be found from the sources listed in this report.** A complete list of invasive species for the State, as compiled by the Massachusetts Invasive Plant Advisory Group (https://www.massnrc.org/mipag/index.htm) should be consulted prior to executing a field management plan.

"Tips" for recognizing certain species addressed in this plan are listed in Table 3-1 (*tips are not provided for all species*). Discussions for individual species including appropriate timing for treatments is provided below.

Table 3-1. Recognizing Invasive Species

Season	"Tips for Observations"	Notes
Spring	Japanese Barberry, Multiflora Rose and Garlic Mustard are some of the first plants in the landscape to 'green-up', and very easy to recognize.	Thoroughly check areas treated the previous summer and fall for newly emerging seedlings
Summer	Garlic Mustard will be one of the tallest of the herbaceous species in the surrounding area, and its long thin seed pods are easily visible in the summer.	Field mark or make notes of areas treated to be re-evaluated the following spring. Try to catch and treat species before they reach the seed-bearing stage to halt further establishment
Fall	Fruits of Japanese Barberry are easy to spot in the fall.	Use care in removing species which have gone to seed, so as to prevent spread of seeds to soil. Field mark, or make notes of areas treated to be re-evaluated the following spring

3.1 Preventive Measures

During routine maintenance activities, practices can be adhered to that will decrease the chances of inadvertently spreading invasive species across the Site. Practices include:

- Fill materials which are brought in for the landscaping activities should be certified to be weed-free.
- Native plants shall be considered for the majority of all proposed plantings.
- Any hay or straw which is used for the mulching of planting beds shall be certified as sterile.
- Control mechanisms shall be employed until eradication or control is reached. In some cases, such as the repeated mowing approach, control or eradication may not be reached for several years.
- Following removal of invasive species, any plant material shall, to the extent practical, be disposed of offsite to avoid depositing any potential seeds within the Site. **Do not chip or mulch woody stems from invasive species.**
- Invasive plant material which has been removed shall not be placed in any compost piles/bins on or off site (particularly municipal compost sites) because of the potential for spreading seed sources.
- This proposed management Plan shall be reviewed and expanded, as necessary, to address new invasive species, should they establish on-site, and as new control techniques are established.

3.2 Control

Unless otherwise noted above, the paragraphs below describe preferred treatment strategies for all of the invasive species currently known to exist on-site, or with the potential to colonize the site. Whenever practical, strategies which cause the least disturbance are preferred. The implementation of invasive species control methods will be limited to the areas of construction activity and determined by the selected contractor.

Note: *The use or application of any chemical treatments for the control of invasive species should be undertaken with caution and extreme care. Foliar application of herbicides can result in the eradication of desirable species through drift of the herbicides during spraying. Measures to avoid unintended application should be implemented such as spraying on non-windy days, and using wind screens where necessary. Rodeo™ or other wetland-approved herbicides shall be used in areas near streams or watercourses. Always read and follow product specifications and precautions. Lastly, the application of chemical treatments should always be conducted in a manner consistent with State and Federal laws and regulations.*

3.2.1 Autumn Olive

Autumn Olive (*Elaeagnus umbellata*) grows rapidly and is a prolific seed producer. It establishes in disturbed sites adjacent to ornamental plantings where it shades out other plants that require direct sunlight. It is widely disseminated by birds and can easily adapt to many sites including areas with infertile soil. Its ability to fix nitrogen can adversely affect the nitrogen cycle of native plant communities that depend on low soil fertility.

Control methods: The most effective control method for autumn olive is to prevent establishment by annually monitoring for and hand pulling small plants. Cutting and burning stimulate sprouting. Repeated cuttings over several consecutive years will reduce plant vigor and may prevent spread. However, herbicide use in combination with cutting may be more effective.

Mechanical Control: Seedlings and small plants should be hand pulled when the soil is moist. Be sure to remove the entire plant including all roots, since new plants can sprout from root fragments. Root sprouts resemble seedlings, but are attached to a lateral root and are nearly impossible to pull up. Larger plants can be cut off at the main stem and treated with herbicide.

Chemical Control: Herbicides can be applied broad scale as a foliar spray, or to select individuals as injection or cut stump treatments. Foliar sprays are highly effective, but should be used only where contact with nearby native vegetation can be prevented. Injection treatment can inhibit or prevent sprouting if done at the right time of year.

1) Foliar pray: this method is most effective on small stands. Spraying should be done in late August or September when plants are actively translocating nutrients to the roots. Use a 1-2% solution of glyphosate (e.g., Roundup ™ or Rodeo™ and water). If plants are in or near wetlands, only Rodeo™ should be used. Glyphosate is a non-selective herbicide that will kill all vegetation. Managers should be cautious not to spray so heavily that herbicide drips off the leaves. Other herbicides that have proven effective, but remain in the soil for longer, are specific for broadleaf and woody species. These include Dicamba (Banvel™, Picloram Tordon™, Silvex, and 2,4,5-T applied in late June in a 90% water/10% oil carrier. Dicamba applied in late June at 4 lbs./gal. (2 qts./100 gal./acre) with a surfactant is also effective

2) Cut stump treatment: This method is most effective if done in late August or September. To ensure uptake of the herbicide before the plant seals off the cut, apply immediately after cutting, within 5-15 minutes. Use a 10-20% solution of glyphosate (e.g., Roundup™ or Rodeo™) and water. Apply with a sponge or paint brush or spray with a spray bottle or backpack sprayer. Follow-up with a foliar spray or cut stump treatment the next year if sprouts appear

3) Injection Treatment: This treatment is most effective if done during the dormant season, in March. Using a hand axe, make downward-angled cuts into the sapwood around the tree trunk. Make one cut for each inch of diameter, plus one extra (e.g., for a 10 inch diameter tree, make 11 cuts). Space the cuts so that 1-2 inches of uncut living tissue remains between them. Apply a low concentration (down to 1% in oil) of oil-soluble triclopyr (Garlon 4™) into each cut so that the bottom of the cut is covered, but not running over. A trigger spray bottle works well as an applicator. This method is relatively easy for one person to do, but working with a partner is recommended in case of accident. Follow-up with a foliar spray or cut stump treatment the next year to control any sprouts.

Biological Control: Currently, there are no known biological control methods.

3.2.2 Asiatic Bittersweet

Asiatic Bittersweet (*Celastrus orbiculatus*) also known as oriental bittersweet, is a deciduous, climbing, woody vine that can grow to lengths of up to 60 feet in height and 4 inches in diameter. Its leaves are simple and alternate and blooms in May with small yellow-green flowers. Fruits are round and green when young and ripen to yellow, splitting to reveal red/orange berries that persist into winter. Roots are orange-like when the fruit is pulled out.

Asiatic bittersweet was introduced from East Asia in 1860 as an ornamental and for erosion control. The main method of dispersal is through birds who will eat the fruits and disperse the seeds. This vine is also used for decorative purposes and then discarded into the natural landscape, resulting in dispersal of the plant. In addition to seed dispersal, Asiatic bittersweet expands vegetatively through root suckers. It is a vigorously growing vine that climbs over and smothers vegetation which may die from excessive shading or breakage. When Asiatic bittersweet climbs high on trees, the increased weight can lead to uprooting and blow-over during high winds and heavy snowfalls. Asiatic bittersweet is displacing American bittersweet (*Celastrus scandens*) through competition and hybridization. The two look relatively similar but can be distinguished by American bittersweet having flowers and fruits at the ends of branches rather than the axils of the leaves.

Control methods: Asiatic bittersweet is most effectively controlled by recognizing its appearance early and removing isolated plants before they begin to produce seed. Herbicides can also be used as a control method.

Mechanical Control: Hand pulling (grubbing) is effective in small infestations and cutting is feasible on small populations, as pretreatment on large impenetrable site, and in areas where herbicide cannot be used.

1. Grubbing: Using a "Pulaski" or similar digging tool, remove the entire plant, including all roots and runners. Juvenile plants can be hand pulled depending on soil conditions and root development. Any portion of the root system not removed will potentially re-sprout. All plant parts, including mature fruit, should be bagged and disposed of in a trash dumpster to prevent reestablishment.
2. Cutting: Manually cutting and removing vines can be effective as long as care is taken to properly bag and dispose seed and plants. Cut climbing or trailing vines as close to the root collar as possible and Asiatic bittersweet will resprout unless cut frequently enough that its root stock is exhausted. This method of treatment should begin early in the growing season and be repeated at 2-week intervals until autumn.

Chemical Control: Asiatic bittersweet is fairly tolerant of glyphosate but is susceptible to triclopyr. Young vines or low-growing patches can be sprayed with triclopyr any time during active growth. Larger vines or vines that have climbed high into trees should be cut or girdled just above ground level in summer or early fall. Paint undiluted triclopyr into the freshly cut surfaces of the stump. Repeated applications may be necessary to eliminate re-sprouting.

Biological Control: Currently, there are no known biological control methods.

3.2.3 Black Locust

Black Locust (*Robinia pseudoacacia*) is an early successional species, preferring full sun, well drained soils and little competition. It is a fast growing tree that reaches 40-100 feet in height at maturity. The bark of young Black Locust is smooth and green, while mature bark is dark brown and deeply furrowed, with flat topped ridges. Seedlings and sprouts grow rapidly and are easily identified by long paired thorns. Leaves are pinnately compound, alternate, and are composed of seven (7) to twenty-one (21) leaflets. Leaflets are oval to round in outline, dark green above and pale beneath. Fragrant white flowers with a yellow blotch on the uppermost petal appear in drooping clusters in May and June. Fruit pods are smooth, two (2) to four (4) inches long, and contain four (4) to eight (8) seeds. It is commonly found in disturbed areas such as old fields, degraded woods, and roadsides. Roots are shallow and sensitive to soil conditions. Black Locust is a legume with nitrogen-fixing bacteria within the root nodules, which increases the nitrogen content of the soil in which the tree grows.

Once Black Locust is introduced into an area, it readily expands into areas where their shade reduces competition from other sun-loving plants. Dense stands of locusts create shaded islands with little ground vegetation, and the large, fragrant blossoms compete with native plants for pollinating insects. Black Locust reproduces vigorously by root suckering and stump sprouting to form groves (or clones) of trees interconnected by a common fibrous root system. Physical damage to the roots and stems increases suckering and sprouting, making control difficult. Black Locust produces an abundance of seeds; however, they seldom germinate.

Mechanical Control: Non-chemical control of Black Locust is largely ineffective because of the plant's vigorous re-sprouting ability. Cutting generally increases sucker and sprout productivity. However, seedlings may be hand pulled if the entire root is removed. Repeated cutting or mowing may achieve some level of control but likely will not result in eradication.

Chemical Control: Triclopyr application is more effective at controlling Black Locust than glyphosate, but both have been used. Foliar sprays are most effective when the leaves are fully expanded. For larger trees, cut down and apply undiluted triclopyr into the freshly cut surfaces of the stump. Basal bark herbicide application works well for smaller trees, and girdling with herbicide application around the scar works well for larger trees. These methods minimize re-sprouting from toots and stumps when applied between mid-July and the end of December. Repeated treatments may be necessary.

Biological Control: Black Locust is susceptible to some damage from two native insects, the locust borer and the locust leafminer. Research on the effectiveness of insects as a control for Black Locust is incomplete and is not considered a viable option at this time.

3.2.4 Creeping Buttercup

Creeping Buttercup (*Ranunculus repens*) is a low-growing perennial species of buttercup originally from Europe and now found throughout North America. It is a competitive plant that spreads by stolons and forms thick carpets on wet, poorly drained soils everywhere from farms to city gardens to natural wetlands. Leaves are dark green with light patches and are divided into three-toothed leaflets. Flowers usually have five (5) glossy, bright yellow petals and grow singly on long grooved stalks.

Creeping buttercup's competitive growth crowds out other plants, especially in wet soils. It also depletes potassium in the soil and can have a detrimental effect on surrounding plants. It spreads by seed (dispersed by wind, water, and animals) and by long branching stolons that root at the nodes, forming new plants.

Mechanical Control: Plants can be dug out with special care to remove the entire root system, as it can re-sprout from nodes along stem and root fragments. Disturbance of the soil can increase seed germination, as the number of seeds in the soils can be immense compared to the number of plants present, and the seeds remain viable in the soil for approximately 20 years.

Chemical Control: Creeping Buttercup can be controlled by the application of glyphosate and metsulfuron directly on the leaves. Multiple applications are necessary to eradicate the plant population because of the seed bank and because some mature plants will generally recover.

Biological Control: No biological controls are currently known for Creeping Buttercup.

3.2.5 European Privet

European Privet (*Ligustrum vulgare*) is a deciduous shrub that forms a dense thicket, which reduces light and moisture availability for native shrubs and wildflowers. This decreases plant diversity and impacts the animals which depend on them for food and shelter. It has opposite or whorled stems that are brown to gray with slightly rough bark. Privets produce white flowers from April to June, which are followed by green drupes from July to March. These fruit gradually ripen to a dark purple or black color in the winter. Privets seem to prefer disturbed areas with rich soil. Seed dispersal is provided mainly by birds. Once introduced, privet can regenerate from root and stump sprouts, making it difficult to eradicate.

Mechanical Control: Small populations of European Privet can be removed by hand, taking special care to remove all of the roots since those left behind can re-sprout.

Chemical Control: Large populations of European Privet can be effectively controlled with herbicide application of glyphosate to the leaves or on cut stems or stumps. Once the herbicide is applied, disturbances to the privet should be avoided for approximately one year, in order for the herbicide to travel through the privet's root system.

Biological Control: No biological controls are currently known for European Privet.

3.2.6 Garlic Mustard

Garlic mustard (*Alliaria petiolata*) is a naturalized European biennial herb that typically invades partially shaded forested and roadside areas. It is capable of dominating the ground layer and excluding other herbaceous species. Its seeds germinate in early spring and it develops into a basal rosette during the first year. Garlic mustard produces white flowers between late April and June of the following spring. Plants die after producing seeds, which typically mature and disperse in August. Normally its seeds are dormant for 20 months and germinate the second spring after being formed. Seeds remain viable for up to 5 years. Garlic mustard is a biennial that spreads only by seed. Therefore, elimination of the plant before it can go to seed is the best method of minimizing proliferation.

Management Options: Several effective methods of control are available for Garlic Mustard, including chemical and non-chemical, depending on the extent of the infestation and available time and labor.

Mechanical Control: Removal strategy of Garlic Mustard includes repeat cutting or pulling to removal all vegetation and prevent the deposit of additional seed. The two methods of mechanical control include hand pulling and cutting.

1) Hand pulling is an effective method for removing small populations of garlic mustard, since plants pull up easily in most forested habitats. Plants can be pulled during most of the year. However, if plants have capsules present, they should be bagged and disposed of to prevent seed dispersal. Care should be taken to minimize soil disturbance but to remove all root tissues. Soil disturbance can bring garlic mustard seeds to the surface, thus creating a favorable environment for their germination. To avoid this, soil should be tamped down firmly after removing the plant. Re-sprouting is uncommon but may occur from mature plants not entirely removed.

2) Cutting is effective for medium- to large-sized populations depending on available time and labor resources. Cut stems when in flower (late spring/early summer) at ground level either manually (with clippers or a scythe) or with a motorized string trimmer. This technique will result in almost total mortality of existing plants and will minimize re-sprouting. Dormant seeds in the soil are unaffected by this technique due to minimal disturbance of the soil. However, as viable seeds may be produced from cut stems, they should be removed from the Site when possible. Cuttings should be conducted annually until the seedbank is depleted.

Chemical Control: The post-emergence herbicides listed below should be applied after seedlings have emerged, but prior to flowering of second-year plants. None of these herbicides will affect subsequent seedling emergence of Garlic Mustard or other plants. It is very important to limit damage to non-target vegetation. If other plants are killed, garlic mustard will likely replace them. Indiscriminate herbicide applications can thus increase garlic mustard populations! As with cutting, the goal is to selectively remove garlic mustard leaving the desired plant community. As a cool season herb, garlic mustard continues to grow on snow-free days when temperatures exceed freezing. This provides an opportunity for selective treatment of garlic mustard if applications are made when other plants have not yet appeared (spring) or have died for the year (late fall).

Application of 1-2% glyphosate (Roundup) provides effective control of garlic mustard seedlings and rosettes. Note: glyphosate is a non-selective herbicide meaning that it will kill or damage most plants it comes into contact with (including woody plants). However, to be effective, this herbicide must be absorbed by growing leaf tissue or bark, i.e. the plant must be actively growing. Applications in very early spring (March-April) can often be timed for periods when few if any other plants beside garlic mustard are actively growing. Similarly in late fall, applications can be made with reduced risk to many non-target species. However, glyphosate will damage sedges and other species that are actively growing at this time and therefore susceptible to herbicide uptake. Always take precautions to avoid contacting desirable plants with the herbicide. This may include the hard to see stems of small woody shrubs and trees. Bentazon (Basagran) applied at 8 ounces (by weight) per acre may be an acceptable substitute, less effective on garlic mustard but with reduced risk to some non-targets particularly annual and perennial grasses.

Biological: At this time no means of biological control are available in the United States for treating Garlic Mustard infestations.

3.2.7 Glossy Buckthorn

Glossy Buckthorn (*Frangula alnus*) is a tall woody shrub or small tree that can grow 20 to 25 feet tall and up to 10 inches in diameter. The bark is dark brown or gray in color, often with scattered short, horizontal lenticels. Buds and shiny green leaves are mostly alternate and thornless. Leaves area oval in shape, have fine hairs on the undersides, lack teeth on the margins, have 8–9 pairs of veins that run

parallel from the midrib, and are sometimes pointed at the tip. Fruits ripen from a distinctive red to a dark purple-black in late summer, and are about 1/3-inch in diameter. A distinctive characteristic is its bright yellow or yellow-orange inner bark. Glossy buckthorn can form dense, shady stands in forest understories and former open areas. Birds eat the abundant fruits, thus facilitating long-distance seed dispersal. It is an aggressive invader of wet or moist soils and has become a problem in wetlands. It is capable of growing in full sun and shaded habitats.

Management Options: Glossy buckthorn can be controlled mechanically or with herbicides, or both. Burning can also be a useful supplement to other control methods. In wetlands with artificially lowered water tables, restoring the water to its former level will often kill glossy buckthorn by submerging its roots.

Mechanical Control: Removal strategy of glossy buckthorn includes hand pulling small plants, repeated cutting or mowing, and prescribed burning. The best time of year for hand pulling and/or cutting is spring, summer, and fall. The best time of year for prescribed burning is early spring or fall.

1) Hand pulling may be effective for the removal of buckthorn when the stems are 3/8-inch in diameter or less. Larger plants may be pulled with heavy equipment. Mechanical controls are effective, but may not be practical for extensive stands due to the amount of labor involved.
2) Cutting or mowing multiple (3 to 4) times during the growing season over several years can reduce plant vigor by starving the roots. However, this is only practical in small infestations.
3) Prescribed burning shortly after leaf-out in early spring may reduce resprouting since root reserves will be low at that time. Burning may be needed annually for several years to deplete the seedbank, which generally lasts two to three years.

Chemical Control: Chemical methods are best used during late fall when most native plants are dormant and buckthorns are still green. Two treatment applications include basal bark treatment and foliar spray.

1) Basal bark treatment includes the application of herbicides containing triclopyr at 12.5% a.i. (active ingredient) formulated for oil dilution mixed with non-toxic bark penetrating oil. Paint or spray a band around the base of the trunk that is three times as wide as the diameter of the trunk.
2) Foliar spray treatment includes the application of glyphosate (1.5% a.i.) or triclopyr (1-2% a.i.) formulated for water on leafy stems using a backpack sprayer or long-handled wick. Foliar spray is less effective and often requires a greater volume of herbicides than other methods.

Biological Control: At this time, no means of biological control are available in the United States for treating glossy buckthorn infestations.

3.2.8 Japanese Barberry

Japanese Barberry *(Berberis thunbergii)* is multi-branched dense shrub that can grow to 2.5 m (8 ft) in height. Shiny green to burgundy leaves are alternate along its thorny stems. Solitary yellow flowers bloom from March to April, and the fruit is a round or elliptical red berry. Japanese barberry is a popular landscape shrub that has escaped into many natural areas, and can grow in dense thickets in the understory of woods and forests. It is a prolific seed producer, and numerous birds eat and subsequently disperse the seeds.

Mechanical Control: Removal strategy for Japanese Barberry includes repeated cutting to stop the spread of the shrub. However, cutting alone will not eradicate the shrubs. For eradication it is recommended that herbicide be used.

Chemical Control: Japanese barberry breaks bud earlier in the spring than most woody species. Thus, it is possible to selectively spray its young leaves before other woody species have produced leaves. For such early season treatments, triclopyr is usually more effective than glyphosate. Wait until significant leaf expansion to ensure sufficient absorption of triclopyr. From mid-summer to fall, both glyphosate and triclopyr are effective when applied as foliar sprays or as cut stump treatments. The half-life of triclopyr in water is less than 24 hours so it may be safe to use near open water. As always, the owner should consult state regulations and a licensed applicator prior to use of herbicide. Treatment is expected to require two to three years of management to achieve control of the plant.

Biological Control: At this time no means of biological control are available in the United States for treating Japanese barberry infestations.

3.2.9 Japanese Knotweed

Japanese knotweed (*Polygonum cuspidatum*) is a herbaceous perennial which forms dense clumps 3-10 feet high and looks like bamboo. The semi-woody stem is hollow and upright with enlarged nodes. Leaves are alternate, 6 inches long, 3-4 inches wide, broadly-ovate, and pointed at the tip. Clusters of tiny greenish-white flowers are borne in leaf axils during August and September with the fruit being a small, brown triangular achene.

Japanese knotweed is native to eastern Asia and was first introduced into North America in the late 1800s. It was used as an ornamental plant on properties and for erosion control due to its deep and interwoven root system. Japanese knotweed commonly invades disturbed areas with high light but can also grow in full shade conditions with a high drought, temperature, and salinity tolerance. Reproduction occurs both by rhizomes (lateral growing roots) and seeds, making this plant extremely hard to eradicate. The plant has also been known to reproduce simply from cuttings which allows for many means of dispersion. Japanese knotweed stands are so dense they shade out other plant species, reducing wildlife habitat for native species.

Control options: This plant is extremely hard to eradicate once established, so the key is preventing establishment by annually monitoring for and manually removing immature clusters. Due to Japanese knotweeds ability to regrow from cuttings, rhizomes, and seeds, the plants must be dug up with the entire root structure disposed of fully. A combination of chemical and mechanical techniques, in conjunction with on-going monitoring provides the most effective control of this species.

Mechanical Control: Juvenile plants are best removed by hand pulling. The entire plant, roots, and rhizomes should be removed as any remaining fragments may resprout. All plant parts should be bagged and disposed of in a trash dumpster to prevent reestablishment. Small stands can be reduced or eliminated by cutting above-ground stalks. Cutting is effective at any time during the growing season, but only when done repeatedly. Cutting greatly reduces the reserves in below-ground rhizomes. At least three cuts are needed in one growing season to offset rhizome production and should be performed for several consecutive years. Shading, in conjunction with cutting, may also help control small stands. After cutting, stands can be covered with black plastic or shade cloth kept level with the ground.

Chemical Control: Chemical control is most effective if done in fall when plants are translocating nutrients to the rhizomes. Large stands can be controlled with foliar sprays or cut stem treatments of glyphosate. If stands are in or near wetlands, only RodeoTM should be used. Glyphosate is a non-selective herbicide that will kill all vegetation. When using foliar sprays, managers should be cautious not to spray so heavily that herbicide drips off leaves. Foliar treatment is most effective if stalks are first cut to ground level and regrowth sprayed with a 2% solution of glyphosate and water. To reduce the risk to non-target species, use cut stem treatments rather than foliar sprays. Cut stalks about 2 inches above ground level and immediately apply a 25% solution of glyphosate and water to the cut. A follow-up foliar spray may be needed to control resprouts.

Biological Control: There are no established methods of biological control.

3.2.10 Morrow's Honeysuckle

Morrow's honeysuckle (*Lonicera morrowii*) is an upright, dense deciduous shrub with white to yellow flowers and dark red berries. It is one of several species of honeysuckle commonly referred to as "bush honeysuckles" that were introduced from Asia. Bush honeysuckles are tolerant of a wide range of conditions and thrive in many habitats throughout New England. Seed dispersal is mainly provided by birds and other wildlife that readily consume the fruits and defecate the seeds at various distances from the parent plant. Seeds may remain viable for two (2) years and tend to germinate best in areas that have minimal herbaceous cover.

Mechanical Control: For small patches, repeated pulling of entire vines and root systems may be effective. Hand-pull seedlings and young plants when the soil is moist, holding low on the stem to remove the whole plant along with its roots. Monitor frequently and remove any new plants. Plants can also be grubbed out using a Pulaski or similar digging tool, taking care to remove all roots, as any portions of the root system not removed will potentially re-sprout. In certain situations, tethered goats have been used to remove honeysuckle growth, but must be monitored to prevent their escape to the wild where they would become an added ecological threat.

Chemical Control: In moderate cold climates, Morrow's honeysuckle leaves continue to photosynthesize long after most other plants have lost their leaves. This allows for application of herbicides when many native species are dormant. However, for effective control with herbicides, healthy green leaves must be present at application time and temperatures must be sufficient for plant activity. Several systemic herbicides (e.g., glyphosate and triclopyr) move through the plant to the roots when applied to the leaves or stems and have been used effectively on Japanese honeysuckle. Following label guidelines, apply a 2

fl.oz./gal rate of glyphosate (e.g., Roundup for uplands) mixed with water and an appropriate surfactant, to foliage from late summer to mid fall. Alternatively, apply a 4 fl. oz./gal concentration of triclopyr (e.g., Brush-B-Gon) plus water to foliage, thoroughly wetting the leaves but not to the point of drip-off. A coarse, low-pressure spray should be used. Repeat applications may be needed. Treatment in the fall, when many non-target plants are going dormant, is best. Also, a 41% glyphosate solution mixed with water or an undiluted 8% triclopyr solution can be applied to cut stem surfaces throughout the year as long as the ground is not frozen.

Biological control: No biological control agents are currently available for Morrow's honeysuckle.

3.2.11 Mugwort

Mugwort (*Artemisia vulgaris*), also known as common wormwood, is a perennial weed with a strong medicinal small that repels herbivores. Mugwort leaves are alternate, papery, with large pinnate lobes and a gray-green color with a silvery underside. Foliage is aromatic with a chrysanthemum or sage-like odor. Leaves emerging from the ground have shallower and broader lobes, whereas leaves on mid and upper portions of the plant have lobes that are more linear and deeper. This plant can reach five or six feet tall, forming spires of tiny, off-white flowers that lack petals that occur in small terminal clusters which develop into dull brown seed capsules. Stems are purplish-brown, branched, and covered with short hairs.

Mugwort is native to Europe and Eastern Asia and was brought to North America as early as the 1600's for medicinal purposes. It spread throughout the Northeastern U.S. as a contaminant on ships and nurseries. Mugwort is wind-pollinated and forms large, fast-spreading patches through aggressive rhizomes. Mugwort pollen is a common cause of allergies and hay fever.

Control Options: Timing on control mechanisms for mugwort is key for control of this plant. Mowing from early summer to mid-September can prevent seed dispersal. If mowing after mid-September, collect and bag mugwort cuttings if possible. Hand pulling young plants in spring or early summer, before formation of rhizomes, may keep spread in check and prevent establishment of new colonies.

Mechanical Control: Mowing immature seed heads in early fall is an excellent way to prevent further seed dispersal and formation of new patches. Cut immature seeds will not mature into a viable seed. Though, mowing from mid-fall through winter is not recommended as it will further disperse seeds. If early summer and early fall mowing are combined, a mugwort monoculture can be averted.

Chemical Control: Glyphosate application in late summer or early fall will suppress mugwort for the following year, but generally will not eradicate it. Triclopyr and clopyralid are more selective herbicides that effectively control mugwort.

Biological Control: No biological control agents are currently available.

3.2.12 Multiflora Rose

Multiflora rose *(Rosa multiflora)* is a large, dense shrub that has escaped from ornamental and conservation plantings to become a serious invasive plant problem across the eastern half of the U.S. It invades natural areas, pastures, and light gaps in forests. Multiflora rose produces abundant small white flowers in the spring. Birds and mammals consume the red fruits, called hips, and may disperse them long distances. The majority of plants develop from seeds in the soil, which may remain viable for 10 to 20 years. It may also spread vegetatively when tips of arching branches touch the ground and develop roots (called layering), and from plants that emerge from shallow roots. Plants grow slowly for the first one or two years followed by rapid expansion through layering and root sprouts. Multiflora rose spreads quickly and may grow 1 to 2 feet per week to form impenetrable thickets of thorny stems.

Mechanical Control: Hand pulling can be an effective strategy for young small stems of multiflora rose, and repeated harvesting can control the spread and top growth of established shrubs, but total eradication comes from the use of herbicides.

Chemical Control: Multiflora rose is susceptible to both glyphosate and triclopyr. Triclopyr can be applied starting in spring before or during flowering. Glyphosate is most effective when applied after flowering (early summer) until early fall. Cut-stump treatments with both herbicides also provide control, but cutting stumps in established thickets is very difficult because of the numerous thorny branches.

Biological Control: No biological control agents are currently available for Multiflora Rose.

3.2.13 Norway Maple

Norway Maple (*Acer platanoides*) is a large deciduous tree with a broad, rounded crown. The milky white sap observed oozing from torn or cut leaves and twigs readily distinguishes it from other maples. Norway maples can grow up to 65 feet in height with up to a seven (7) foot trunk diameter. Dark green leaves are simple, opposite, about six (6) inches wide and five (5) inches long, and have five (5) to seven (7) lobes. The bark is smooth and gray-brown, twigs are stout and brown, and buds are green with overlapping bus scales. Norway maple produces winged fruits that are dispersed by the wind. The seeds germinate readily and grow quickly when young. The species is extremely shade tolerant and is a frequent invader of urban and suburban forests.

Mechanical Control: Norway Maple seedlings are easiest to pull when the soil is moist. Larger plants must be cut down and dug out, with special care to remove all of the roots. Trees can be girdled by cutting through the bark and growing layer (cambium) all round the trunk. The method of girdling is most effective in the spring.

Chemical Control: Norway Maple is effectively controlled by herbicide application of either glyphosate or triclopyr. Trees up to four (4) inches in diameter can be controlled by applying triclopyr mixed with a horticultural oil to the bark, about one (1) foot up from the base of the trunk. This can be done in early spring or from the beginning of June to the end of September. The cut stump method may also be used – cut the tree and immediately apply the herbicide around the outer ring of the stump.

Biological Control: No biological control agents are currently available for Norway Maple.

3.2.14 Purple Loosestrife

Purple loosestrife (*Lythrum salicaria*) is a wetland perennial native to Eurasia that forms large, monotypic stands throughout the temperate regions of the U.S. and Canada. It has a vigorous rootstock that serves as a storage organ, providing resources for growth in spring and regrowth if the plant has been damaged from cuttings. New stems emerge from the perennial roots enabling the plant to establish dense stands within a few years. Seedling densities can approach 10,000-20,000 plants/m2 with growth rates exceeding 1 cm/day. A single, mature plant can produce more than 2.5 million seeds annually which can remain viable after 20 months of submergence in water. In addition, plant fragments produced by animals and mechanical clipping can contribute to the spread of purple loosestrife through rivers and lakes.

Mechanical Control: In small populations, younger plants (1-2 years old) can be pulled by hand. Plants more than 2 years old should be dug out with special care to include the entire rootstock. Use of tools, such as a Weed Wrench, on plants once they have developed a woody cane can be an effective way to remove this rootstock. Plants should be removed before flowering to ensure that seeds are not dispersed during the disturbance. All plant parts should be carefully bagged, removed from the Site, and placed in approved landfills or preferably burned to prevent escape to other non-infested sites. In addition, clothing, boots, and equipment should be properly cleaned to ensure that no seeds are transported. Follow-up treatments of sites are recommended for 3 years to eliminate re-sprouts from fragments left behind.

Hand tools may be used to cut plants, particularly younger plants (1-2 years old) which have not yet developed woody stems. Since these tools mow the plants and leave the root structures intact, repeated cuttings may be necessary over the course of a growing season. All plant parts should be removed immediately from the Site and properly disposed of. Once severed, stems are buoyant and may disperse to other areas and re-sprout.

Purple loosestrife produces a huge volume of seeds that contribute to the seedbank in the soil. In areas where this plant is expanding and removal is not feasible, cutting the flowers off with common garden clippers or shears can dramatically slow the spread of seeds. Again, all plant parts that are cut should be bagged and removed from the Site to prevent re-sprouting.

Mowing is not recommended for purple loosestrife because it can further spread the species by distributing plant stems that will sprout vegetatively. If feasible, native plants should be restored to the control area by seeding or planting. This re-establishment of vegetation will deter new loosestrife seedling development.

Biological Control: Several insects that feed specifically on purple loosestrife in Europe have undergone intensive laboratory and field tests in the U.S. To date four insects have been approved for release in Connecticut.

Two leaf-eating beetles, *Galerucella calmariensis* and *G. pusilla* defoliate purple loosestrife, leaving behind dried out skeleton of the leaves. By defoliating large portions of the plant, these beetles impact the plant's ability to photosynthesize. This type of stress reduces the plant's ability to store reserves for overwintering and limits its capacity to form flowers. Beginning in 1996, Donna Ellis at the University of Connecticut has released *Galerucella* beetles at several study sites in Connecticut as part of a long-term research project. The beetles are causing extensive feeding damage to purple loosestrife at the release sites, and they have been overwintering and reproducing successfully.

Hylobius transversovittatus is a weevil that attacks the entire plant. Adults feed on aboveground portions of purple loosestrife, while the larvae attack the roots and crown of the plant. By attacking the rootstock, Hylobius weevil larvae affect nutritional uptake and the plant's ability to overwinter and survive during stressful conditions.

Another weevil, *Nanophyes marmoratus*, attacks the flowers of purple loosestrife. Upon emerging, overwintering adults move to young plants and feed on the newly developing leaves. After flowering is initiated the adults move to the flower spike and feed on the opened flowers located on the bottom of the spike. Adults feed exclusively on the flowers. Long-term effects should be significant since feeding action and oviposition prevent normal flower development thereby limiting seed production.

For more information about biological control of purple loosestrife, contact: Donna Ellis, Dept. of Plant Science, Box U4067, University of Connecticut, Storrs, CT 06269, Tel: (860) 486-6448, Email: donna.ellis@uconn.edu

Chemical Control: In dense, monotypic stands of purple loosestrife, spray loosestrife seedlings before they reach 12" tall with glyphosate. For established loosestrife growing from perennial rootstocks, spray glyphosate when loosestrife is actively growing from full flowering to just after flowering (late summer to early fall, before frost). Use Rodeo formulation if loosestrife is growing in standing water or if spray

will contact water. The following concentrations of Roundup© and Rodeo© are recommended: Roundup [glyphosate (41%)]: 2.5 fl. oz./gal, Rodeo [glyphosate (53.8%)]: 2 fl. oz./gal.

3.2.15 Tatarian Honeysuckle

Tartarian Honeysuckle (*Lonicera tatarica*) is a shrub that may grow up to 17 feet tall, with dense tangles of leggy branches with hollow twigs. Leaves are smooth, hairless, and bluish-green and this plant flowers in late May-June. Pink or white, strongly asymmetrical flowers are borne in pairs in the axils of the leaves and are pollinated by bees. Round red fruit ripens mid to late summer on the stem which is the easiest identification feature of this shrub. Birds consume the berries and disperse the seeds. Once a population establishes, vegetative sprouting continues the spread of these plants.

Tartarian Honeysuckle was introduced to the U.S. for use in landscaping, erosion control, and wildlife cover. It is regarded as highly invasive throughout much of its North American range and hybridizes with another invasive honeysuckle, *Lonicera morrowii*. This plant forms large dense stands that outcompete native plant species. They can alter habitats by decreasing light availability and depleting soil moisture and nutrients.

Control Options: The two main methods of control are mechanical and chemical. Severe infestations may be controlled by repeated treatments of cutting, burning or applying herbicide. Control methods must be repeated for a period of three to five years to inhibit growth of new shoots and eradicate target plants.

Mechanical Control: Hand removal of plants is possible for light infestations and where native species co-occur with it. When the soil is moist, firmly grasp the plan low and tug gently until the main root loosens from the soil and the entire plant pulls out. Remove the plant with its entire root system or new plants may sprout from root fragments. Remove completely from the site and dispose of in garbage bags. Larger populations should be cut to ground level at least once per year, in either early spring or late fall. If prescribed burning is chosen, it should be conducted during the growing season.

Chemical Control: Glyphosate can be sprayed on leaves or applied to cut stems in order to kill the root system.

Biological Control: No biological controls are known that would target solely nonnative bush honeysuckle species.

3.2.16 Tree of Heaven

Tree of Heaven (*Ailanthus altissima*) has smooth stems with pale grey bark and twigs which are light chestnut brown. It grows quickly and can ultimately reach up to 80-100 inches in height. Tree of Heaven has large compound leaves 1-4 feet in length, and composed of 10-41 smaller leaflets with one to two protruding bumps, called glandular teeth, are at the base of each leaflet. Flowers occur in large terminal clusters and are small and pale yellow to greenish. Flat, twisted, winged fruits hang in clusters and remain on the tree from late summer to early fall. Glands at the base of the leaves are a diagnostic feature and Tree of Heaven can be distinguished from other native plants by their smooth leaf margins.

First introduced from China to the U.S. in 1751, it was planted throughout American cities because it is fast-growing, resistant to pollution, and provides ample shade. Tree of Heaven reproduces through seeds and vegetative sprouting. Tree of Heaven can displace native trees through fast growth and reproduction, creating large thickets. It also has the ability to poison root systems.

Control Options: The correct timing of treatment and follow-up maintenance during subsequent years are critical to eradication success.

Mechanical Control:

a. Young seedlings can be pulled by hand, most effectively when the soil is moist. Care must be taken to remove as much of the entire root system as possible, as broken root fragments will re-sprout. Once plants develop a significant taproot, which can occur within 3 months, they become very difficult to remove.
b. Larger trees may be cut at ground level with power or manual saws. Cutting is most effective when trees have begun to flower (June to early July). A cut or injured tree of heaven may send up dozens of root sprouts. At least two cuttings per year may be necessary (one early in the growing season and one late in the growing season) to significantly weaken the plant. Although plants may not be killed after cutting, seed production will be inhibited, and vigor will be reduced. If the cutting process is repeated for many years, plants will be severely stressed and will likely eventually die.

Chemical Control: A foliar spray of glyphosate (after mid-August) or a basal bark application of triclopyr (year-round; best in summer) may be effective. Systemic herbicides are most effectively applied in mid-to late summer (until the onset of fall color), when the tree is moving carbohydrates to the roots. Herbicide applications made outside this late growing season window will only injure above-ground growth. Following treatment, repeated site monitoring and treatment of signs of regrowth is critical to prevent reinfestation. Herbicide application to foliage, bark, or frill girdles are effective at controlling the tree of heaven, but cut stump herbicide applications can encourage root suckering and are not generally recommended without repeated follow up treatments. Apply all herbicide treatments after July 1, up until the tree begins to show fall color. Tree of heaven tends to be more susceptible to triclopyr than to glyphosate, especially prior to late summer.

Biological Control: No biological controls are known.

3.2.17 Winged Euonymus

Winged Euonymus, or burning-bush, *(Euonymus alatus)* is a deciduous shrub that averages 6 to 9 feet in height but is capable of reaching 15 feet. It has opposite, simple, elliptical toothed leaves which turn bright scarlet in autumn. Among its distinctive features are the prominently corky-winged green and brown twigs. Winged Euonymus grows in a variety of soil conditions and spreads readily from cultivation into old fields, open woods, and mature second growth forests. In open woodlands, winged Euonymus replaces native shrubs. In areas where it forms dense monotypic stands, it reduces habitat diversity. The root system forms a dense mat just below the soil surface. The combination of the dense shade provided and the tight root system makes survival of other plants beneath Euonymus impossible.

Mechanical Control: Hand pulling sprouts and saplings can be effective. Larger shrubs may require heavy equipment for eradication of the plant.

Chemical Control: Use of herbicides on cut stumps and young plants may be effective.

Biological Control: No biological control agents are currently available for Winged Euonymus.

Appendix E

Abutter Notification List & Letter

H. ABUTTER NOTIFICATION FORM

In accordance with the second paragraph of Massachusetts General Laws Chapter 131, Section 40 (the Wetlands Protection Act) and Haverhill Municipal Ordinance Chapter 253, Section 5, you are hereby notified of the following:

1. The name of the applicant is Mayor James Fiorentini
2. Brief Project Description: The proposed project is a dam removal and river restoration project in the Little River. The aim is to remove the Little River Dam to restore the Little River corridor to a free-flowing state and eliminate the public health and safety concerns associated with the dam. Dam removal and river restoration includes the following elements: dredging sediment for targeted sediment cleanup, installation of fish passage structures, construction of low flow channel downstream of Winter Street Bridge, installation of bioengineered slope stabilization and scour protection, and installation of native plantings.
3. The applicant has filed a Notice of Intent ("NOI") with the Haverhill Conservation Commission seeking permission to remove, fill, dredge or alter an Area Subject to Protection Under the Wetlands Protection Act and/or Haverhill Municipal Ordinance Chapter 253 and/or to perform work within the buffer zone of such an Area.
4. The address of the lot where the activity is proposed is See attached Property Owners List
   (INCLUDE ASSESSOR'S MAP/BLOCK/LOT)
5. Copies of the NOI may be examined at *the Haverhill Conservation Department Office* between the hours of *8am and 4pm* from *Monday through Friday*. Contact information is below. You may also find helpful application materials on the "Projects Under Review" section of the Commission's website.
6. Copies of the NOI may be obtained from either (check one) the applicant _____, or the applicant's representative Julianne Busa, by calling this telephone number (413) 333-5469 between the hours of 9:00 AM and 5:00 PM on the following days of the week Monday through Friday
7. Information regarding the *date, time, and place* of the public hearing may be obtained from the *Haverhill Conservation Department Office* between the hours of *8am and 4pm* from *Monday through Friday*. Contact information is below. You may also consult the "Agenda" section of the Commission's website.

NOTE: Notice of the public hearing, including its date, time and place, will be published at least five (5) days in advance in the *Haverhill Gazette newspaper*.

NOTE: Notice of the public hearing, including its date, time, and place, will be posted in Haverhill City Hall not less than forty-eight (48) hours in advance.

NOTE: You may contact the Haverhill Conservation Department for more information about this application, the Wetlands Protection Act, and Haverhill Municipal Ordinance Chapter 253. Please note the Department has only one staff person; every effort will be made to assist you in a timely manner.

Website: http://www.cityofhaverhill.org/departments/conservation_commission/index.php.
Email: conservation@cityofhaverhill.com
Phone: 978.374.2334

NOTE: For additional information about this application and the Act, you may contact the MA Department of Environmental Protection Northeast Regional Office Service Center.

Website: http://www.mass.gov/eea/agencies/massdep/about/contacts/northeast-region.html
Phone: 978.694.3200

Little River Dam Removal and River Restoration - 300 Ft Abutters

Property ID	Site Address	Owner	Owner 2	Owner Address	Owner City	Owner State	Owner Zip
304-57-1	40 LOCKE ST	FC HAVERHILL, LLC	FOREST CITY ENTERPRISES	50 PUBLIC SQUARE STE 1410	CLEVELAND	OH	44113-2204
304-57-3	151 ESSEX ST	THE SOCIETY FOR PRESERVATION OF N.E. ANTIQUITIES	C/O HISTORIC NEW ENGLAND	151 ESSEX ST	HAVERHILL	MA	01832
304-57-4	ESSEX ST	M BAY TRANS AUTHORITY		45 HIGH ST	BOSTON	MA	02110
304-58-4	258 WINTER ST	FC WINTER STREET LLC	FOREST CITY ENTERPRISES	50 PUBLIC SQUARE STE 1410	CLEVELAND	OH	44113-2204
304-61-5	35 DUNCAN ST	BURGETT ENT., LLC		4111-A NORTH FREEWAY BLVD	SACRAMENTO	CA	95834-1209
304-61-6	246 WINTER ST	GACEMA, INC		246 WINTER ST	HAVERHILL	MA	01830
306-76-2	251 WINTER ST	RICE PHIL		P O BOX 1626	HAVERHILL	MA	01831
306-76-4	9 HALE ST	PSI ATLANTIC HAVERHILL MA, LLC	PTA-CS# 877	P.O. BOX 320099	ALEXANDRIA	VA	22320
306-79-1	6 HALE ST	PSI ATLANTIC HAVERHILL MA,LLC	PTA-CS# 877	P.O. BOX 320099	ALEXANDRIA	VA	22320
306-79-1-2	24 HALE ST	G & C CONCRETE CONSTRUCTION IN		19 HALE STREET	HAVERHILL	MA	01830
306-79-1A	WINTER ST	MASSACHUSETTS ELECTRIC CO	PROPERTY TAX DEPT	40 SYLVAN RD	WALTHAM	MA	02451-2286
307-2-1	284 WINTER ST	HAFFNER REALTY TRUST	E HAFFNER FOURNIER	2 INTERNATIONAL WAY	LAWRENCE	MA	01843
307-2-10	30 STEVENS ST	G & C CONCRETE CONSTRUCTION IN		19 HALE STREET	HAVERHILL	MA	01830
307-2-12	STEVENS ST	37 STEVENS STREET, LLC		P.O. BOX 1626	HAVERHILL	MA	01831
307-2-3	WINTER ST	M BAY TRANS AUTHORITY		45 HIGH ST	BOSTON	MA	02110
307-2-4	STEVENS ST	G & C CONCRETE CONSTRUCTION IN		19 HALE STREET	HAVERHILL	MA	01830
307-2-5	265 WINTER ST	KENNEBEC REALTY TRUST	LAMBERT RICHARD TRUSTEE	265 WINTER ST	HAVERHILL	MA	01830
307-2-6	STEVENS ST	SHAIN REALTY TRUST	SHAIN STEVEN + CAROL	2506 FAIRWAY DRIVE NORTH	JUPITER	FL	33477
307-2-7	31 STEVENS ST	G & C CONCRETE CONSTRUCTION IN		19 HALE STREET	HAVERHILL	MA	01830
307-2-8	37 STEVENS ST	37 STEVENS STREET, LLC		P.O. BOX 1626	HAVERHILL	MA	01831
307-2-9	14 STEVENS ST	SHAIN REALTY TRUST	SHAIN STEVEN + CAROL	2506 FAIRWAY DRIVE NORTH	JUPITER	FL	33477
515-295-1	2 LAFAYETTE SQ	OCP REALTY LLC		P.O. BOX 615	EAST HAMPSTEAD	NH	03826
515-295-11	20 HILLSIDE ST	HARRIS CLIFFORD C		20 HILLSIDE ST	HAVERHILL	MA	01832
515-295-12	14 HILLSIDE ST	THE GOOD SHEPHERD UNIT #1 TR	THE GOOD SHEPHERD REAL ESTATE	14 HILLSIDE ST	HAVERHILL	MA	01832
515-295-13	16 HILLSIDE ST	IRAHETA EDMUNDO E ETUX	GOMES ANDREILA P	16 HILLSIDE ST	HAVERHILL	MA	01832
515-295-14	10 HILLSIDE ST	RYAN FAMILY PROPERTIES, LLC		2 LAURA LANE	NEWTON	NH	03858
515-295-15	12 HILLSIDE ST	KEV-LO REALTY TRUST	KEVIN E. SARRETTE-	8 SAGAMORE PL	HAVERHILL	MA	01830
515-295-16	26 LAFAYETTE SQ	RYAN FAMILY PROPERTIES, LLC		2 LAURA LANE	NEWTON	NH	03858
515-295-17	18 LAFAYETTE SQ	WILLIAM H RYAN TRUST	RYAN WILLIAM H-TRUSTEE	16 CONCORD ST	HAVERHILL	MA	01830
515-295-17A	12 LAFAYETTE SQ	OCP REALTY LLC		P O BOX 615	EAST HAMPSTEAD	NH	03826
515-295-2	9 HIGH ST	GUERRA ANGELA		11 HIGH ST	HAVERHILL	MA	01832
515-295-3	13 HIGH ST	FAE HOLDINGS 465426R,LLC		75 WILLIAMS ST	CHELSEA	MA	02150

515-296-18	191 ESSEX ST	ALOSKY REALTY CORP	JOSEPH ALOSKY TR	203 ESSEX ST	HAVERHILL	MA	01832
515-296-3	221 ESSEX ST	LEBLANC STEPHEN		221 ESSEX ST	HAVERHILL	MA	01830
515-297-10	51 WEST MYRTLE ST	CARTER PROPERTIES, LLC		675 MAIN ST	HAVERHILL	MA	01830
515-297-11	16 HIGH ST	SEVERINO VERONICA A-ETAL	MORALES JOSE M	16 HIGH ST	HAVERHILL	MA	01832
515-297-13	HIGH ST	FAE HOLDINGS 465426R,LLC		75 WILLIAMS ST	CHELSEA	MA	02150
515-297-14	8 HIGH ST	DIAZ GLENNYS M		29 SEVENTEENTH AVE	HAVERHILL	MA	01830
515-297-15	6 HIGH ST	DIAZ GLENNYS M		29 SEVENTEENTH AVE	HAVERHILL	MA	01830
515-297-16	2 HIGH ST	MAUREEN E. RYAN TRUST	RYAN MAUREEN E-TRUSTEE	16 CONCORD ST	HAVERHILL	MA	01830
515-297-16A	246 ESSEX ST	WILLIAM H RYAN TRUST	RYAN WILLIAM H-TRUSTEE	16 CONCORD ST	HAVERHILL	MA	01830
515-297-18	240 ESSEX ST	RUSTANI MASSACHUSETTS TRUST	RUSTANI JONUS-TRUSTEE	240 ESSEX STREET	HAVERHILL	MA	01832
515-297-20	228 ESSEX ST	230 ESSEX STREET TRUST	ANDREW R. DIPIETRO-TRUSTEE	230 ESSEX ST	HAVERHILL	MA	01832
515-297-22	216 ESSEX ST	GEORGE MANAKAS IRREVOCABLE FAM	PAGE ESTELLE J TRUSTEE	834 BROADWAY	HAVERHILL	MA	01832
515-297-24	ESSEX ST	NOFSKER WILLIAM		143 ESSEX ST	HAVERHILL	MA	01832
515-297-5	WEST MYRTLE ST	ESSEX COUNTY GREENBELT ASSOC		82 EASTERN AVE (B-05)	ESSEX	MA	01929
515-297-6	WEST MYRTLE ST	CITY OF HAVERHILL		4 SUMMER ST	HAVERHILL	MA	01830
515-297-7	WEST MYRTLE ST	CITY OF HAVERHILL		4 SUMMER ST	HAVERHILL	MA	01830
515-297-9	47 WEST MYRTLE ST	VARGAS MARGARITA-ETAL	MENDEZ JOSE	47 WEST MYRTLE ST	HAVERHILL	MA	01832
515-298-12	57 ARCH ST	57-59 ARCH STREET NOMINEE TR	C/O JH ONE PROPERTIES	491 WASHINGTON ST	LYNN	MA	01901
515-298-13	48 WEST MYRTLE ST	HIPPOLYTE SHENELL-ETUX	LAMBERT FELIX	48 WEST MYRTLE ST	HAVERHILL	MA	01832
516-300-1	15 HILLSIDE ST	KRISTA M. BLUM REVOCABLE TR	BLUM KRISTA M-TRUSTEE	9 FIRE SIDE LN	HAVERHILL	MA	01832
516-300-11	10.5 HILLSIDE PL	AMARAL TONY J		10.5 HILLSIDE PL	HAVERHILL	MA	01832-4707
516-300-12	10 HILLSIDE PL	MAILLET NORMAN L		4 CRYSTAL LANE	NEWTON	NH	03858
516-300-13	6 HILLSIDE PL	DE LA ROSA HERRERA		6 HILLSIDE PLACE	HAVERHILL	MA	01832
516-300-2	17 HILLSIDE ST	DEAZA LUISA		17 HILLSIDE ST	HAVERHILL	MA	01832
516-301-11	106 LAFAYETTE SQ	DEVEN REALTY, LLC		106 LAFAYETTE SQ	HAVERHILL	MA	01832
516-301-12	100 LAFAYETTE SQ	ONE HUNDRED LAFAYETTE SQUARE LLC		11 OSCAR`S WAY	NORTH READING	MA	01864
516-301-14	76 LAFAYETTE SQ	76 LAFAYETTE SQUARE, LLC		11 OSCAR`S WAY	NORTH READING	MA	01864
516-301-15	16 HILLSIDE PL	ONE HUNDRED LAFAYETTE SQUARE LLC		11 OSCAR`S WAY	NORTH READING	MA	01864
516-301-7	7 LAFAYETTE AVE	DELTWAS ALEXANDER S		48 MCINTOSH RD	DANVILLE	NH	03819
516-302-13	150 LAFAYETTE SQ	QUADRANT HAVERHILL REAL ESTATE	C/O MARVIN SMITH	2100 S. OCEAN BLVD #206 S	PALM BEACH	FL	33480
516-302-4	8 LAFAYETTE AVE	VARGAS FRANCISCO-ETUX	VARGAS MARIA	8 LAFAYETTE AVE	HAVERHILL	MA	01832-4771
516-302-7	35 OAK TR	LAWRENCE ERICK C		44 OAK TERRACE	HAVERHILL	MA	01832
516-303-1	LAFAYETTE SQ	MAROUN FAMILY TRUST	MAROUN AYAD J-TRUSTEE	62 FRYE RD	METHUEN	MA	01844

516-303-2	HILLSIDE ST	AGUIRRE HUGO L		370 WOMACK RD	COVINGTON	GA	30016
516-303-3	9 HILLSIDE PL	NIEVES WILLIAM		9 HILLSIDE PLACE	HAVERHILL	MA	01832
516-303-3A	5 HILLSIDE PL	5 HILLSIDE PLACE REALTY TRUST	LANTIGUA JOSE M-TRUSTEE	9 DEXTER ST	HAVERHILL	MA	01830
516-303-4	68 LAFAYETTE SQ	MAROUN FAMILY TRUST	MAROUN AYAD J-TRUSTEE	62 FRYE RD	METHUEN	MA	01844
516-303-4A	LAFAYETTE SQ	CITY OF HAVERHILL	PUBLIC WORKS DEPT	4 SUMMER ST	HAVERHILL	MA	01830
516-304-1	89 LAFAYETTE SQ	K BROTHERS, LLC		2138 SILAS DEANE HIGHWAY	ROCKY HILL	CT	06067
516-304-10	9 GRANVILLE ST	PETA REALTY TRUST	PETER SCHEVARZ TRUSTEE	53 CHEEVER ST	MILTON	MA	02186
516-304-5	107 LAFAYETTE SQ	OCP REALTY LLC		P.O. BOX 615	EAST HAMPSTEAD	NH	03826
516-304-6	119 LAFAYETTE SQ	MAUREEN E RYAN TRUST	RYAN MAUREEN E-TRUSTEE	16 CONCORD ST	HAVERHILL	MA	01830
516-304-6A	117 LAFAYETTE SQ	NEDCO 117, LLC		59 HAROLD ST	MILTON	MA	02186
516-304-7	123 LAFAYETTE SQ	PHANEUF PETER J		6 VILLAGE WOODS RD	HAVERHILL	MA	01832-1077
516-304-8	135 LAFAYETTE SQ	133-135 LAFAYETTE SQUARE LLC		20C DELCARMINE ST, SUITE 101	WAKEFIELD	MA	01880
516-305-10	17 HILLDALE AVE	MACEK MARIA-ETAL	FINLAY PATRICIA	227 CONCORD ST	HAVERHILL	MA	01830
516-305-10A	21 HILLDALE AVE	LAGASSE STEPHEN J		21 HILLDALE AVE	HAVERHILL	MA	01832
516-305-11	4 CLIFF ST	ROGERS JOHN P		4 CLIFF ST	HAVERHILL	MA	01832
516-305-11A	25 HILLDALE AVE	PATEL ARVIND		42 STILLMAN RD	LYNNFIELD	MA	01940
516-305-11B	1 CLIFF ST	ROGERS JOHN P		4 CLIFF STREET	HAVERHILL	MA	01832
516-305-11C	2 CLIFF ST	ROGERS JOHN P		4 CLIFF ST	HAVERHILL	MA	01832
516-305-11D	3 CLIFF ST	COLBY MAUREEN		3 CLIFF STREET	HAVERHILL	MA	01832
516-305-12	6 GRANVILLE ST	RONQUILLO PEDRO ALVARO		6 GRANVILLE STREET	HAVERHILL	MA	01832
516-305-13	8 GRANVILLE ST	TAYLOR HELEN R LIFE ESTATE	TAYLOR BRUCE	8 GRANVILLE ST	HAVERHILL	MA	01832
516-305-15	1 GRANVILLE CT	ALCANTARA EDWARD G		1 GRANVILLE CT	HAVERHILL	MA	01832
516-305-16	7 GRANVILLE CT	BALLESTER IVAN JR-ETAL	GIL NATASHA	7 GRANVILLE COURT	HAVERHILL	MA	01832
516-305-17	9 GRANVILLE CT	DUPUIS SHAWN		9 GRANVILLE COURT	HAVERHILL	MA	01832
516-305-5	141 LAFAYETTE SQ	BOURAPHAEL ELIE		141 LAFAYETTE SQ	HAVERHILL	MA	01832
516-305-9	7 HILLDALE AVE	CASMO REALTY TRUST	C/O SHOWCASE ENTERPRISES INC	380 LOWELL ST UNIT 201 A-B	WAKEFIELD	MA	01880
521-316-1	29 HILLDALE AVE	ROGERS JOHN P		4 CLIFF ST	HAVERHILL	MA	01832
521-316-2A	37 HILLDALE AVE	ROGERS JOHN P		4 CLIFF ST	HAVERHILL	MA	01832
521-316-4	5 BENJAMIN ST	K & S LEBLANC REALTY CO., INC		45 HILLDALE AV	HAVERHILL	MA	01832
521-317-2	45 HILLDALE AVE	K & S LEBLANC REALTY CO., INC		45 HILLDALE AV	HAVERHILL	MA	01832
521-317-3	53 HILLDALE AVE	K & S LEBLANC REALTY CO., INC		45 HILLDALE AV	HAVERHILL	MA	01832
521-317-4	59 HILLDALE AVE	FERNANDEZ EDUARDO	LISA R FERNANDEZ	59 HILLDALE AVE	HAVERHILL	MA	01832-3829
521-317-4A	61 HILLDALE AVE	L&B REALTY TRUST	BROOKS J BRADFORD-TRUSTEE	6 LANCASTER ST	HAVERHILL	MA	01830
521-317-5	65 HILLDALE AVE	BOUCHER FAMILY TRUST	BOUCHER GERARD R TRUSTEE	65 HILLDALE AVE	HAVERHILL	MA	01832
521-317-6	69 HILLDALE AVE	RICHARD ARTHUR M		69 HILLDALE AVE	HAVERHILL	MA	01832

521-317-7	71 HILLDALE AVE	71-73 HILLDALE AVENUE R.T.	CAMPBELL, RENAE, TRUSTEE	P.O. BOX 733	SEABROOK	NH	03874
521-317-8	77 HILLDALE AVE	AG REAL ESTATE TRUST	GEEHAN GREGORY C-TRUSTEE	10 HARTSHORNE ROAD	WAKEFIELD	MA	01880-4913
521-318-11	6 FEDERAL ST	MARTINEZ FREDY	MARTINEZ MARTA	10 RUSSETT HILL RD	HAVERHILL	MA	01830
521-318-12	5 BROADWAY	D & G REALTY DEVELOPMENT, LLC		PO BOX 3	SALEM	NH	03079
521-318-13	1 WINGATE AVE	ARROYO KIMBERLY		1 WINGATE AVE	HAVERHILL	MA	01832
521-318-14	3 WINGATE AVE	KAVANAGH LIAM A		59 MERRILL AV #3	LYNN	MA	01902-1926
521-318-15	9 BROADWAY	BROADWAY-VINE REALTY TR	BUCKLEY DAVID G TRUSTEE	411 MAIN ST	WEST NEWBURY	MA	01985
521-318-19	7 BROADWAY	THE NESSON NOMINEE TRUST	BENNETT NESSON-TRUSTEE	59 FLETCHER ST	KENNEBUNK	ME	04043
521-318-2	22 HILLDALE AVE	KRISTA M BLUM REVOCABLE TRUST	BLUM KRISTA TRUSTEE	396 MAIN ST	HAVERHILL	MA	01830
521-318-2-2	FEDERAL ST	PAOLERA MICHAEL DELLA		278 WASHINGTON ST	GROVELAND	MA	01834
521-318-3	1 BROADWAY	HAVERHILL GAS REALTY LLC		P.O. BOX 311	YONKERS	NY	10710
521-318-4	BROADWAY	RCA ST JOSEPH		120 BELLEVUE AVE	HAVERHILL	MA	01832
521-322-1	56 HILLDALE AVE	ATHENA REALTY, LLC		30 ROLLING MEADOW LANE	HAVERHILL	MA	01832
521-322-3	50 HILLDALE AVE	BIRD JOHN ETUX	BIRD DALE	P.O. BOX 205	NEWTON	NH	03858
521-322-4	46 HILLDALE AVE	KRISTA M BLUM REVOCABLE TRUST	BLUM KRISTA TRUSTEE	396 MAIN ST	HAVERHILL	MA	01830
521-322-5	3 FEDERAL ST	FOURNIER BRAD T		18 MOCCASIN PATH	HAVERHILL	MA	01832
521-322-7	5 GOVE ST	MCCORMICK ANTHONY A ETUX	MCCORMICK CATHERINE J	5 GOVE AV	HAVERHILL	MA	01832
521-322-7A	7 GOVE ST	FOURNIER BRAD T		1431 BROADWAY	HAVERHILL	MA	01832
521-322-8	4 LAFAYETTE ST	HARNOIS JAMES R ETAL	NOURY KAREN J	4 LAFAYETTE ST	HAVERHILL	MA	01832
521-323-1	3 LAFAYETTE ST	RUANE SCOTT K-ETUX	RUANE PAMELA	942 AMESBURY RD	HAVERHILL	MA	01830-1755
521-323-1A	17 LAFAYETTE ST	SEVENTEEN LAFAYETTE ST TR	FRANK CONSTABILE, TR	17 LAFAYETTE ST	HAVERHILL	MA	01832
521-323-1B	82 HILLDALE AVE	THE KATHLEEN A COLBY REVOCABLE TRUST	COLBY KATHLEEN A-TRUSTEE	18 KENDRICKS COURT	AMESBURY	MA	01913
523-317-1	83 HILLDALE AVE	BERROA MIGUEL A		83 HILLDALE AVE	HAVERHILL	MA	01832
523-317-3	5 APPLE ST	ROUTIER JOHN ETAL	CHETWYND KAREN M	5 APPLE ST	HAVERHILL	MA	01832
523-317-4	7 APPLE ST	ESTRADA JOSE ETAL	MARSH MICHELLE	7 APPLE ST	HAVERHILL	MA	01832
523-324-1	8 APPLE ST	DILONE YLANDER		8 APPLE ST	HAVERHILL	MA	01832
523-324-10	7 LITTLE RIVER ST	MELLO JUDINE A		7 LITTLE RIVER	HAVERHILL	MA	01832
523-324-11	9 LITTLE RIVER ST	CEFALO NICHOLAS R-ETUX	CEFALO BOBBI-JO	9 LITTLE RIVER ST	HAVERHILL	MA	01832
523-324-2	4 APPLE ST	MCLAUGHLIN HELEN		4 APPLE ST	HAVERHILL	MA	01832
523-324-3	93 HILLDALE AVE	JOHNSON GREGORY C		93 HILLDALE AVE	HAVERHILL	MA	01832
523-324-3A	87 HILLDALE AVE	JOHNSON GREGORY C		93 HILLDALE AVE	HAVERHILL	MA	01832
523-324-4	95 HILLDALE AVE	MCCUTCHEON SHERMAN P-LIFE EST.	MCCUTCHEON JILL D	95 HILLDALE AVE	HAVERHILL	MA	01832
523-324-5	101 HILLDALE AVE	101 HILLDALE AVENUE LLC		20C DELCARMINE ST STE 101	WAKEFIELD	MA	01880-3487

523-324-6	1 LITTLE RIVER ST	SCOTT ALEXANDRA		189 GEORGETOWN ROAD	BOXFORD	MA	01921
523-324-7	3 LITTLE RIVER ST	JENNINGS LLOYD E		6 LANCASTER ST	HAVERHILL	MA	01830
523-324-8	3 LITTLE RIVER ST	LANGLOIS BERT N		3 1/2 LITTLE RIVER	HAVERHILL	MA	01832-3835
523-324-9	5 LITTLE RIVER ST	HERNANDEZ JUAN		5 LITTLE RIVER ST	HAVERHILL	MA	01832
523-325-1	4 LITTLE RIVER ST	GIRARD GEORGE RAYMOND		6 LITTLE RIVER ST	HAVERHILL	MA	01832
523-325-10	145 HILLDALE AVE	OSPINA CLARA		145 HILLDALE AVE	HAVERHILL	MA	01832
523-325-11	149 HILLDALE AVE	MCLAUGHLIN JANE E		149 HILLDALE AVE	HAVERHILL	MA	01832
523-325-2	2 LITTLE RIVER ST	MIMMS JEANNE LISA		2 LITTLE RIVER ST	HAVERHILL	MA	01832
523-325-3A	107 HILLDALE AVE	BOUCHER REALTY TRUST	BOUCHER GERARD R TRUSTEE	65 HILLDALE AVE	HAVERHILL	MA	01832
523-325-5	123 HILLDALE AVE	MEIDANIS FAMILY REALTY TRUST	ROBERT J MEIDANIS-TRUSTEE	92 MERRIMACK STREET	HAVERHILL	MA	01830
523-325-6	125 HILLDALE AVE	BOSTON GAS COMPANY		40 SYLVAN RD	WALTHAM	MA	02451
523-325-6A	HILLDALE AVE	CITY OF HAVERHILL		4 SUMMER ST	HAVERHILL	MA	01830
523-325-7	133 HILLDALE AVE	HAVERHILL GROUP, LLC		23 MEETING PLACE CIRCLE	BOXFORD	MA	01921
523-325-7A	131 HILLDALE AVE	MEDINA CARLOS R		131 HILLDALE AVE	HAVERHILL	MA	01832
523-325-8	135 HILLDALE AVE	ONE HUNDRED THIRTY FIVE HILLDALE AVE REALTY TRUST	NEWHALL MATTHEW D TRUSTEE	8 SPOFFORD ST	GEORGETOWN	MA	01833
523-325-9	141 HILLDALE AVE	AUDET JOHN T ETUX	AUDET SHEILA K	141 HILLDALE AV	HAVERHILL	MA	01830
523-326-1	175 HILLDALE AVE	CITY OF HAVERHILL	PARK DEPT	4 SUMMER ST	HAVERHILL	MA	01830
524-326-1	193 HILLDALE AVE	ACOSTA MARIO		193 HILLDALE AV	HAVERHILL	MA	01832
524-326-2	197 HILLDALE AVE	PALAU JOSE DANIEL		197 HILLDALE AVE	HAVERHILL	MA	01832
524-326-3	3 LE BLANC ST	MORTIMER KATINA M-ETAL	CHILDS JUNE M	8 LEBLANC STREET	HAVERHILL	MA	01832
524-326-4	5 LE BLANC ST	WESTER THURE		5 LEBLANC ST	HAVERHILL	MA	01832
524-326-5	7 LE BLANC ST	CHILDS JUNE M		8 LEBLANC ST	HAVERHILL	MA	01832
524-327-1	10 LE BLANC ST	COMEAU LAWRENCE L	ELAINE D COMEAU	10 LEBLANC ST	HAVERHILL	MA	01832
524-327-2	8 LE BLANC ST	MORTIMER KATINA M-ETAL	CHILDS JUNE M	8 LEBLANC STREET	HAVERHILL	MA	01832
524-327-20	21 DUSTIN AVE	LAMFAM DEVELOPMENT, LLC		265 WINTER ST	HAVERHILL	MA	01830
524-327-28	215 HILLDALE AVE	EVERBECK GARY C-ETUX	EVERBECK BONNIE M	99 SYLVAN WAY	WELLS	ME	04090
524-327-3	6 LE BLANC ST	CHILDS JUNE M		8 LEBLANC STREET	HAVERHILL	MA	01832
524-327-4	4 LE BLANC ST	CHILDS JUNE M		8 LEBLANC ST	HAVERHILL	MA	01832
524-327-5	203 HILLDALE AVE	MILLER JOSHUA G ETUX	MILLER KATHLEEN S	P O BOX 709	HAMPSTEAD	NH	03841
524-327-6	207 HILLDALE AVE	GIDDINGS LLOYD W		207 HILLDALE AVE	HAVERHILL	MA	01832
524-327-7	211 HILLDALE AVE	JIMENEZ JOEL-ETAL	DURAN KENYA	211 HILLDALE AVE	HAVERHILL	MA	01832
524-328-22	10 DUSTIN AVE	DRISCOLL JOAN E		10 DUSTIN AVE	HAVERHILL	MA	01832
524-328-23	MOODY AVE	KLINCH THOMAS A	MARIE E KLINCH	15 WHITTIER PL	HAVERHILL	MA	01832
524-328-30	225 HILLDALE AVE	CRITTENDEN ANDREW R		24 WOODCREST DR	NORTH ANDOVER	MA	01845

524-328A-10	11 WHITTIER PL	MORTIMER KATINA M-ETAL	CHILDS JUNE M	8 LEBLANC STREET	HAVERHILL	MA	01832
524-328A-13	3 WHITTIER PL	FOUNTAINE ERNEST H-ETUX	FOUNTAINE NANCY L	3 WHITTIER PLACE	HAVERHILL	MA	01832
524-328A-13A	1 WHITTIER PL	HAY BRITTANY		1 WHITTIER PL	HAVERHILL	MA	01832
524-328A-8	15 WHITTIER PL	KLINCH THOMAS A	MARIE E KLINCH	15 WHITTIER PL	HAVERHILL	MA	01832
524-328A-9	13 WHITTIER PL	LATERELLA BRUCE R ETAL	MARY JO LATERELLA	13 WHITTIER PLACE	HAVERHILL	MA	01832
524-329-233	233 HILLDALE AVE	CLANCY ANTHONY A		233 HILLDALE AV	HAVERHILL	MA	01832
524-329-235	235 HILLDALE AVE	RIGANO JOSEPH A		235 HILLDALE AVE	HAVERHILL	MA	01832
524-329-3	241 HILLDALE AVE	PALMISANO JUSTIN-ETUX	PALMISANO GIORGIA	241 HILLDALE AV	HAVERHILL	MA	01832
524-329-3-1	245 HILLDALE AVE	CHUTE DAVID		245 HILLDALE AV	HAVERHILL	MA	01832
524-329-3-2	239 HILLDALE AVE	BROWNE CURTIS D-ETUX	CAMILLE L. WESCOTT	239 HILLDALE AV	HAVERHILL	MA	01832
524-329-5	22 WHITTIER PL	CEREZO ISAIAS-ETUX	QUINTANA ISIS G	22 WHITTIER PL	HAVERHILL	MA	01832
524-329-8	247 HILLDALE AVE	PARE SCOT J		247 HILLDALE AV	HAVERHILL	MA	01832
524-329-8-251	251 HILLDALE AVE	JANKOWSKI ADAM-ETUX	JANKOWSKI CAROLINE	251 HILLDALE AVE	HAVERHILL	MA	01832
524-329-8-253	253 HILLDALE AVE	WAGER RICHARD J ETUX	WAGER JUDITH A	253 HILLDALE AVE	HAVERHILL	MA	01832
525-1-1	100 HILLDALE AVE	ESSEX COUNTY GAS CO	DBA NATIONAL GRID	40 SYLVAN RD	WALTHAM	MA	02451
525-1-2	160 HILLDALE AVE	PLASDIST, LLC		419 RIVER ST	HAVERHILL	MA	01832
525-1-3	140 HILLDALE AVE	140 HILLDALE, L.L.C.	C/O PETER BIGELOW	140 HILLDALE AVE	HAVERHILL	MA	01832
525-1-7	168 HILLDALE AVE	LAITSAS CHRIS		863 KENOZA ST	HAVERHILL	MA	01830
526-1-2	261 HILLDALE AVE	PROPHET STANLEY	GRACE M PROPHET	P.O. BOX 933	HAMPSTEAD	NH	03841
526-1-2B-1A	1 GREENHILL FARM RD	NGARUIYA EDWIN K		1A GREENHILL FARM RD	HAVERHILL	MA	01832
526-1-2B-1B	1 GREENHILL FARM RD	SMITH DOUGLAS A		1B GREENHILL FARM RD	HAVERHILL	MA	01832
526-1-2C-3A	3 GREENHILL FARM RD	SANDS BRANDON REID		3 GREENHILL FARM RD #A	HAVERHILL	MA	01832
526-1-2C-3B	3 GREENHILL FARM RD	WHITEHEAD JANE M		3 GREENHILL FARM RD UNIT B	HAVERHILL	MA	01832
526-1A-10-29	29 JEFFERY LN	GAINER DINAL L	GAINER ARTHUR P B	29 JEFFREY LANE	HAVERHILL	MA	01832
526-1A-10-31	31 JEFFERY LN	THOMPSON SANDRA LEE ETUX	THOMPSON MICHAEL	31 JEFFERY LANE	HAVERHILL	MA	01832
526-1A-9	33 JEFFERY LN	HARRINGTON DANIEL P ETUX	HARRINGTON ERIN B	33 JEFFERY LN	HAVERHILL	MA	01832
526-1B-10-11	11 GREENHILL FARM RD	RICCIO ERIC		11 GREENHILL FARM RD	HAVERHILL	MA	01832
526-1B-10-9	9 GREENHILL FARM RD	O`CONNOR JOHN P JR., ETUX	O`CONNOR LINDA A	9 GREENHILL FARM RD	HAVERHILL	MA	01832
526-1B-11-5	5 GREENHILL FARM RD	RUSSELL WENDELL A		5 GREENHILL FARM RD	HAVERHILL	MA	01832
526-1B-11-7	7 GREENHILL FARM RD	FARES NICOLE		33 PARSONAGE HILL RD	HAVERHILL	MA	01832
526-1B-2-6	6 GREENHILL FARM RD	ZELIC IVAN-ETUX	ZELIC MAGDA	20 HANCOCK CIRCLE	METHUEN	MA	01844
526-1B-2-8	8 GREENHILL FARM RD	SULLIVAN PAUL J-ETUX	SULLIVAN MARY A	8 GREENHILL FARM RD	HAVERHILL	MA	01832
526-1B-3-10	10 GREENHILL FARM RD	NORTHRUP KRYSTLE		10 GREENHILL FARM RD	HAVERHILL	MA	01832
526-1B-3-12	12 GREENHILL FARM RD	LIVERSIDGE JOSHUA		12 GREENHILL FARM RD	HAVERHILL	MA	01832
526-1B-4-14	14 GREENHILL FARM RD	BOLDUC DEBRA L		14 GREENHILL FARM RD	HAVERHILL	MA	01832
526-1B-4-16	16 GREENHILL FARM RD	HARTFORD RICHARD C-ETAL	CARLISLE ALISHA	16 GREENHILL FARM RD	HAVERHILL	MA	01832
526-1B-5-18	18 GREENHILL FARM RD	GRANDMAISON CHRISTOPHER		18 GREENHILL FARM RD	HAVERHILL	MA	01832

526-1B-5-20	20 GREENHILL FARM RD	BAEZ AMELIA	BAEZ D ANTONIO	20 GREENHILL FARM ROAD	HAVERHILL	MA	01832
526-1B-6-22	22 GREENHILL FARM RD	SCOTT KAREN A ETUX	SCOTT STEPHEN J	22 GREENHILL FARM RD	HAVERHILL	MA	01832
526-1B-6-24	24 GREENHILL FARM RD	HOUDE MICHAEL G ETUX	BRENDA L HOUDE	24 GREENHILL FARM RD	HAVERHILL	MA	01832
526-1B-7-21	21 GREENHILL FARM RD	MOUSSA HUSAM		23 GREENHILL FARM RD	HAVERHILL	MA	01832
526-1B-7-23	23 GREENHILL FARM RD	MOUSSA HUSAM		23 GREENHILL FARM RD	HAVERHILL	MA	01832
526-1B-7-23	23 GREENHILL FARM RD	MOUSSA HUSAM		23 GREENHILL FARM RD	HAVERHILL	MA	01832
526-1B-8-17	17 GREENHILL FARM RD	LAPLANTE LAWRENCE W- ETUX	LAPLANTE LAURIE A	89 BROOK ST	HAVERHILL	MA	01832
526-1B-8-19	19 GREENHILL FARM RD	NOURY JOHN F ETUX	NOURY ANGELA SILVA	19 GREENHILL FARM RD	HAVERHILL	MA	01832
526-1B-9-13	13 GREENHILL FARM RD	GALVIN SEAN		13 GREENHILL FARM RD	HAVERHILL	MA	01832
526-1B-9-15	15 GREENHILL FARM RD	STEVENS SHARON A		15 GREENHILL FARM RD	HAVERHILL	MA	01832
526-2-4	HILLDALE AVE	M BAY TRANS AUTHORITY		45 HIGH ST	BOSTON	MA	02110
577-1-16	BROOK ST	HAVERHILL HOUSING AUTHORITY	CHAPTER 705	P.O. BOX 751	HAVERHILL	MA	01831
577A-1-1	1 KATHY DR	WILLIAMS NANCY J		1 KATHY DR	HAVERHILL	MA	01832
577A-1-11	11 KATHY DR	PARKER FRANCIS T ETAL	DEBRA MORGAN	11 KATHY DR	HAVERHILL	MA	01832
577A-1-13	13 KATHY DR	PIANDEE DAVID T- ETUX	MARIE-PAULINE A. PIANDEE	13 KATHY DRIVE #7	HAVERHILL	MA	01832
577A-1-15	15 KATHY DR	DEIORIO ANTHONY JOSEPH	DEIORIO STACEY	15 KATHY DR	HAVERHILL	MA	01830
577A-1-17	17 KATHY DR	SKIPPER NANCY		17 KATHY DRIVE	HAVERHILL	MA	01832
577A-1-19	19 KATHY DR	WILLWERTH NATALIE M		19 KATHY DR	HAVERHILL	MA	01832-5752
577A-1-21	21 KATHY DR	MALIGNAGGI LORRAINE		21 KATHY DRIVE	HAVERHILL	MA	01832
577A-1-23	23 KATHY DR	ANTONIELLO KIM		23 KATHY DR	HAVERHILL	MA	01832
577A-1-25	25 KATHY DR	HUXTABLE DONNA J		25 KATHY DRIVE	HAVERHILL	MA	01830
577A-1-27	27 KATHY DR	ESMEAL TRACY J		27 KATHY DR	HAVERHILL	MA	01832
577A-1-29	29 KATHY DR	KRUG MARIE A		29 KATHY DR	HAVERHILL	MA	01832
577A-1-3	3 KATHY DR	MATHEWS MELANIE ETAL	MONTALVO ELFREN	3 KATHY DR	HAVERHILL	MA	01832
577A-1-31	31 KATHY DR	DILLAWAY AMANDA L		31 KATHY DR UNIT 16	HAVERHILL	MA	01832
577A-1-33	33 KATHY DR	REED MARILYN E		33 KATHY DRIVE	HAVERHILL	MA	01832
577A-1-35	35 KATHY DR	NEVILLE BRIAN J- ETUX	NEVILLE DONNA E	35 KATHY DRIVE	HAVERHILL	MA	01832
577A-1-37	37 KATHY DR	SANVILLE PAMELA A		37 KATHY DR	HAVERHILL	MA	01832
577A-1-38	38 KATHY DR	THOMPSON LISA		126 CROSBY STREET	HAVERHILL	MA	01830
577A-1-39	39 KATHY DR	BUCKLEY ALICE M		39 KATHY DR	HAVERHILL	MA	01832
577A-1-40	40 KATHY DR	DEROCHE GERARD P		40 KATHY DRIVE	HAVERHILL	MA	01832
577A-1-41	41 KATHY DR	GOGUEN KIMBERLY J		41 KATHY DR	HAVERHILL	MA	01832
577A-1-43	43 KATHY DR	BIDWELL SARA- ETAL	BIDWELL FRANCES A	43 KATHY DR	HAVERHILL	MA	01832
577A-1-45	45 KATHY DR	DIAZ JUAN A		49 HAVERHILL ST	LAWRENCE	MA	01841
577A-1-47	47 KATHY DR	PRATT PAUL		47 KATHY DR	HAVERHILL	MA	01832
577A-1-49	49 KATHY DR	BONITZ CHERYL ANN		49 KATHY DRIVE	HAVERHILL	MA	01832
577A-1-5	5 KATHY DR	LOVETT KATHY		5 KATHY DR	HAVERHILL	MA	01832

577A-1-50	50 KATHY DR	CURTIS SUSAN J		50 KATHY DR	HAVERHILL	MA	01832
577A-1-51	51 KATHY DR	LOOSIAN TAMMY J		51 KATHY DR	HAVERHILL	MA	01832
577A-1-52	52 KATHY DR	MURAD DIANE J		52 KATHY DRIVE	HAVERHILL	MA	01832
577A-1-53	53 KATHY DR	CORMIER LORNA Z		53 KATHY DR	HAVERHILL	MA	01832
577A-1-54	54 KATHY DR	HAMILTON JOSHUA W-ETUX	HAMILTON BARBARA E	54 KATHY DR	HAVERHILL	MA	01832
577A-1-55	55 KATHY DR	MATTUCCI PAULA-MARIE		55 KATHY DR	HAVERHILL	MA	01832
577A-1-56	56 KATHY DR	CONTRADA GERALD M		56 KATHY DR	HAVERHILL	MA	01832
577A-1-57	57 KATHY DR	DISTAFANO GREGORY A ETUX	DISTAFANO ANNETTE	57 KATHY DRIVE	HAVERHILL	MA	01832
577A-1-58	58 KATHY DR	MOLEY TARA LYNN		58 KATHY DRIVE	HAVERHILL	MA	01832
577A-1-59	59 KATHY DR	WILMINGTON SAVINGS FUND SOCIETY, FSB		501 CARR RD, SUITE 100	WILMINGTON	DE	19809
577A-1-60	60 KATHY DR	CATANZARO ROBERT P ETUX	CATANZARO JANICE E	60 KATHY DRIVE	HAVERHILL	MA	01832
577A-1-61	61 KATHY DR	MERCEDES BETTY		61 KATHY DRIVE	HAVERHILL	MA	01832
577A-1-62	62 KATHY DR	BURNS ANDREW A ETUX	BURNES KAREN E	62 KATHY DR UNIT 40	HAVERHILL	MA	01832
577A-1-63	63 KATHY DR	RUBINO AMANDA L		18 JUSTIN ST	HAVERHILL	MA	01832
577A-1-64	64 KATHY DR	STEWART BRENDA		64 KATHY DR	HAVERHILL	MA	01832
577A-1-65	65 KATHY DR	BUCKNAM VICTORIA R		65 KATHY DRIVE	HAVERHILL	MA	01832
577A-1-66	66 KATHY DR	LONGO RUDOLPH J JR ETUX	LONGO SUSAN A	66 KATHY DR	HAVERHILL	MA	01832
577A-1-67	67 KATHY DR	MALDONADO TIFFANY A		67 KATHY DRIVE	HAVERHILL	MA	01832
577A-1-68	68 KATHY DR	WOOD ANDREW P ETUX	WELLS JENNIFER L	68 KATHY DR	HAVERHILL	MA	01832
577A-1-69	69 KATHY DR	SCIACCA TORRY J ETUX	SCIACCA LEANNE	69 KATHY DR	HAVERHILL	MA	01832
577A-1-7	7 KATHY DR	GIUFFRE HEATHER J ETUX	GIUFFRE JR JOSEPH P	7 KATHY DR UNIT #4	HAVERHILL	MA	01832
577A-1-70	70 KATHY DR	KENNETH C LOMBARDI SPECIAL NEEDS TRUST	LOMBARDI JOSEPH-TRUSTEE	4 MARK ST	NASHUA	NH	03060
577A-1-71	71 KATHY DR	OUELLETTE PATRICIA E		71 KATHY DRIVE	HAVERHILL	MA	01832
577A-1-72	72 KATHY DR	CORRIGAN CAROL A		72 KATHY DRIVE	HAVERHILL	MA	01832
577A-1-9	9 KATHY DR	SALCEDO VANESSA		9 KATHY DR	HAVERHILL	MA	01832
579-1-17	266 HILLDALE AVE	JACOBS JOSEPH-ETAL	JACOBS JAMES	98 NOON PEAK RD	WATERVILLE VALLEY	NH	03215
579-1-18	262 HILLDALE AVE	HILLDALE AVENUE, LLC		12 HOVEY`S POND DR	BOXFORD	MA	01921
579-1-19	85 GREENOUGH ST	BRADFORD UNLIMITED CORP		PO BOX 5415	BRADFORD	MA	01835
579-1-21	81-83 GREENOUGH	BRADFORD UNLIMITED CORP		PO BOX 5415	BRADFORD	MA	01835
579-2-16	248 HILLDALE AVE	CATALANO JOSEPH		248 HILLDALE AV	HAVERHILL	MA	01832
579-2-17	242 HILLDALE AVE	PROPHET STANLEY	PROPHET BERNADETTE	242 HILLDALE AVENUE	HAVERHILL	MA	01832
600-447-10	65 HALE ST	AMERICAN HERITAGE LLC		683 BROADWAY	HAVERHILL	MA	01832
600-448-10	81 HALE ST	EAST HALE REALTY TRUST	MARILYN GOLDBERG-TRUSTEE	81 HALE ST	HAVERHILL	MA	01830
600-451-2	102 HALE ST	JALBERT JOHN J		102 HALE ST	HAVERHILL	MA	01830
600-451-2A	104 HALE ST	SMITH JAY B-ETAL	SMITH DIANE K	129 MILLVALE RD	HAVERHILL	MA	01830
600-451-3A	HALE ST	WEST HALE REALTY TRUST	GOLDBERG MARILYN TRUSTEE	81 HALE ST	HAVERHILL	MA	01830

600-451-6A-1	82 HALE ST	82 HALE STREET, LLC		2 LUPINE AVE	METHUEN	MA	01844
600-451-6A-2	84 HALE ST	NELSON DAVID-ETUX	NELSON PATRICIA	43 SHERWOOD DR	BRADFORD	MA	01835
600-451-6A-3	86 HALE ST	THE RAG MAN, LLC		73 SOUTH POLICY ST	SALEM	NH	03079
600-451-6A-4	88 HALE ST	MONTO MARTIN-ETAL	MONTO JANICE	6 PINDAU DR	GROVELAND	MA	01834
600-451-6A-5	90 HALE ST	90 HALE STREET REALTY , LLC		12 BOND ST	BRADFORD	MA	01835
600-451-6A-6	92 HALE ST	LONG JOSEPH J		59 14TH AV	HAVERHILL	MA	01830
600-451-6A-7	100 HALE ST	100 HALE ST LLC		100 HALE ST, UNIT 7	HAVERHILL	MA	01830
600-452-1	HALE ST	M BAY TRANS AUTHORITY		45 HIGH ST	BOSTON	MA	02110
600-452-3C	HALE ST	MASSACHUSETTS ELECTRIC CO	PROPERTY TAX DEPT	40 SYLVAN RD	WALTHAM	MA	02451-2286
601-451-1	112 HALE ST	MALVERS MICHAEL W		14 BENNINGTON ST	HAVERHILL	MA	01832
601-451-1A	114 HALE ST	HALE STREET BRIDGE, LLC		P.O. BOX 134	HAVERHILL	MA	01831
601-451-2	134 HALE ST	134 HALE STREET REALTY TRUST	MARK C. PISTONE-TRUSTEE	89 SEVEN SISTER RD	HAVERHILL	MA	01830
601-451-2A	HALE ST	134 HALE STREET REALTY TRUST	PISTONE MARK C-TRUSTEE	89 SEVEN SISTER RD	HAVERHILL	MA	01830
601-451-2B	HALE ST	MASSACHUSETTS ELECTRIC CO	PROPERTY TAX DEPT	40 SYLVAN RD	WALTHAM	MA	02451-2286
601-451-4	138 HALE ST	JOZ PROPERTY MANAGEMENT, INC.		140 HALE ST	HAVERHILL	MA	01830
601-453-1	HALE ST	M BAY TRANS AUTHORITY		45 HIGH ST	BOSTON	MA	02110
601-453-2A	HALE ST	M BAY TRANS AUTHORITY		45 HIGH ST	BOSTON	MA	02110
602-451-1	EIGHTH AVE	M BAY TRANS AUTHORITY		45 HIGH ST	BOSTON	MA	02110
602-457-1	161 EIGHTH AVE	A & B CROSSING, LLC		168 HALE ST	HAVERHILL	MA	01830
602-457-2	168 HALE ST	BEEHIVE REALTY, LLC		168 HALE ST	HAVERHILL	MA	01830
602-461-1	NORFOLK ST	THE CATHOLIC CEMETERY ASSOC	OF THE ARCHDIOCESE OF BOSTON	175 BROADWAY	MALDEN	MA	02148
602-461-5	NORFOLK ST	SERRATORE JAMES LEO		15 WOODROW	HAVERHILL	MA	01830
649-611-4	PRIMROSE ST	THE CATHOLIC CEMETERY ASSOC.	OF THE ARCHIDOCESE OF BOSTON	175 BROADWAY	MALDEN	MA	02148
649-611-6	PRIMROSE ST	M BAY TRANS AUTHORITY		45 HIGH STREET	BOSTON	MA	02110
649-611-7	HALE ST	CITY OF HAVERHILL		4 SUMMER ST	HAVERHILL	MA	01830

Appendix F

Water Quality Certification

Julianne Busa

From: April Doroski
Sent: Tuesday, April 11, 2023 1:01 PM
To: peteracarbone@yahoo.com
Subject: 401 Water Quality Certification Application - Little River Dam Removal and River Restoration

Good Afternoon,

On behalf of the City of Haverhill, we are sending a copy of the 401 Water Quality Certification Application for the Little River Dam Removal and River Restoration for your records. The Board of Health is receiving a copy in accordance with 314 CMR 9.07.

- 401 Water Quality Certification Application - Little River Dam Removal and River Restoration

Thank You,

April Doroski, PWS, CPSS (she / her)
Water Resources and Climate Resilience Specialist

Fuss & O'Neill, Inc. | ADoroski@fando.com

(413) 333-5881 | cell: (413) 282-7008
1550 Main Street Suite 400 | Springfield, MA 01103
CA CT MA ME NH NY RI VT
www.FandO.com | Instagram | Vimeo | Facebook | Linkedin

Let's See What We Can Create Together
www.FandO.com/careers

Appendix G

Chapter 253 Dam Safety Permit

dcr
Massachusetts

Certified Mail No. 7018 0680 0001 3243 0230
Return Receipt Requested

M.G.L. Chapter 253
Dam Safety Permit
Permit No. 104-2023-415

Applicant

Dean Audet, PE
Fuss & O'Neill, Inc.
146 Hartford Road
Manchester, CT 06040

On behalf of:
City of Haverhill
c/o James J. Fiorentini, Mayor
4 Summer Street
Haverhill, MA 01830

Re: Little River Dam Removal and River Restoration Project
National Dam ID: MA00739
Registry Location: Essex South, Deed Book 39278, Page 35
Owner: Little River Dam Owner, LLC
Dam Location: Haverhill

Date: April 18, 2023

Dear Mr. Audet:

Reference is made to the application dated February 15, 2023 and supplemental information provided by Fuss & O'Neill, Inc. (F&O). These were submitted for Department of Conservation and Recreation (DCR) Office of Dam Safety (ODS) regulatory review of the above-referenced dam removal project.

Permission is hereby granted under M.G.L. Chapter 253, as amended, to perform work indicated on the drawings titled "**Little River Dam Removal and River Restoration, Haverhill, Massachusetts**" dated June 30, 2022 and as described in supporting documentation provided by F&O.

Permission is granted subject to the following conditions:

(a) At least 21 days before the start of construction, the dam owner shall provide the DCR/ODS - Permits Section a completed **DAM SAFETY IMPROVEMENTS – NOTICE OF CONSTRUCTION** (form attached) with a construction schedule and proof of recording of the Ch. 253 Permit at the Registry of Deeds in the county where the dam lies. If the Notice of Construction provided to ODS lacks a construction schedule, proof of recording of the permit, or an explanation of why permit recording is not possible, ODS will return the Notice of Construction to the dam owner indicating the Notice of Construction is incomplete and informing the owner that construction shall not commence until ODS has received a complete Notice of Construction with the required attachments.

(b) For all features of the project, the Dam Engineer (F&O) shall notify ODS of any design change from the original design submitted with the permit application due to regulatory requirements, changes in field conditions or any other unanticipated occurrence. This notification shall be a formal submittal to ODS which includes all relevant revised plans, computations and data (survey, geotechnical, etc.) supporting the design change(s). This submittal shall be forwarded to ODS by registered mail, return receipt requested, and will require an amendment to the permit. Review time may vary based upon the complexity of the design change(s), however, ODS will generally issue the permit amendment within five (5) business days of receipt of a complete design revision submittal.

(c) The Dam Engineer must report to ODS any unforeseen incidents that occur at the work site during project work. Unforeseen incidents include, but are not limited to, significant uncontrolled seepage into the work area, significant earth support failures or slope failures. The report must explain in detail what occurred, corrective measures taken to mitigate the occurrence and any impacts the occurrence may have had on the project. If the incident results in a design change, ODS must be provided revised design documents (refer to Condition (b), above).

(d) The following shall be prepared by the contractor, approved by the Dam Engineer, and submitted to ODS prior to construction:

- Cofferdam designs. The cofferdams shall be carefully designed to resist anticipated forces without failing and to ensure that seepage around, under, or through the cofferdams is manageable;
- A water control and diversion plan describing methods to be employed to allow work to be performed "in the dry" and to manage both the water level in Little River and outflow from Little River while construction is in progress; and
- A flood response plan. While construction is underway, weather forecasts, stream flows and water levels shall be monitored to allow adequate time to respond to rising water levels at the construction site. If high water levels are expected, equipment and materials shall be removed from the work area and personnel

evacuated. Sufficient materials and equipment required for flood response shall be maintained in a safe location at, or near, the construction site.

(e) A sufficient level of construction oversight shall be provided by the Dam Engineer to ensure the work conforms to: the project plans and specifications; the Ch. 253 Permit conditions; and generally-accepted dam construction practices as determined by the U.S. Army Corps of Engineers, the U.S. Bureau of Reclamation and/or the U.S. Natural Resources Conservation Service.

Guidance, procedures, checklists, worksheets, and references to aid in construction quality assurance are available in the United States Department of Agriculture Natural Resources Conservation Service National Engineering Handbook Part 645-Construction Inspection and can be accessed at this link: https://directives.sc.egov.usda.gov/viewerFS.aspx?hid=31701 .

(f) The Dam Engineer shall invite ODS to the preconstruction meeting, another project meeting at 50% completion and the final inspection meeting. ODS reserves the right to make site visits and inspections at any time during the permit period. ODS requests the following items be addressed at the pre-construction meeting:

- Identification of the
  - resident engineer (Owner's representative overseeing the project);
  - contractor's qualified site superintendent; and
  - Dam Engineer's representative overseeing the project.
- Provide emergency contact information for the contractor and resident engineer;
- Presentation of the resident engineer's weekly work schedule and discussion of the level of construction oversight to be provided by the resident engineer;
- Water control features anticipated and the process for the Dam Engineer to either develop or approve the overall control and diversion of water plan. Flood emergency warning and response procedures must be identified;
- Level of Dam Engineer construction oversight including: identification of any critical construction items to be overseen by the Dam Engineer; procedures for the Dam Engineer's review and approval of shop drawings and other submittals; documentation of Dam Engineer's approval of any design modifications; procedures for coordinating and scheduling the Dam Engineer's inspection of critical construction elements;
- Anticipated schedule of construction meetings and required attendees. It is expected that while construction is ongoing, weekly construction meetings will be held and attended by the Dam Engineer, the resident engineer, the contractor's superintendent and other appropriate participants; and
- Presentation of the initial construction schedule with identification and discussion of major items.

ODS shall be provided a copy of the preconstruction meeting minutes.

(g) The Dam Engineer shall provide ODS written documentation that he/she has reviewed and approved all pertinent submittals or samples concerning critical project features. This documentation may be in the form of a submittal log which may be submitted as part of the "as-built" report, described below.

(h) Upon completion of work the Applicant shall submit to ODS a **DAM SAFETY CERTIFICATE OF COMPLETION** (form attached). With this certificate of completion submit one bound (utilizing plastic comb bindings) as-built report with 11"x17" record drawings signed and stamped by a registered professional civil engineer with contractor's signature attesting that all work was performed according to the plans and specifications. The as-built report shall include documentation of submittals reviewed and approved by the Dam Engineer, copies of any materials or construction testing reports and color photos of construction phases and appurtenant installations. Photograph numbers, location and direction in which each photo was taken must be identified. An electronic copy (as a .pdf) of the as-built report and record drawings shall be provided to ODS via email, .ftp site or on a USB flash drive.

(i) Upon completion of work, the Dam Engineer shall submit an **APPLICATION TO CHANGE HAZARD CLASSIFICATION OF DAM** with supporting documentation demonstrating that the former dam can no longer re-impound and no longer meets the jurisdictional requirements of ODS. Refer to the ODS website for the application form and description of required information.

(j) The Certificate of Completion, as-built report and Application to Change Hazard Classification of Dam shall be provided to ODS within 90 days of substantial completion of work unless ODS agrees to later submission of these documents. Submission of these documents is required prior to ODS issuing a Certificate of Approval.

Any permit issued by DCR shall be subject to revocation by order of the Commissioner if the permittee fails to conform to 302 CMR 10.00, Dam Safety Rules and Regulations, provisions of this permit, or any other applicable laws and regulations.

This permit does not release the applicant from the requirements of any other regulatory authority. Such authorizations and/or notifications include, but are not limited to:

Local Conservation Commission;
Massachusetts Department of Environmental Protection (DEP);
Massachusetts Department of Fish and Game (DFG);
Massachusetts Executive Office of Environmental Affairs (EOEA), MEPA Unit; and
U.S. Army Corps of Engineers.

This permit must be recorded by the applicant at the Registry of Deeds in the county where the dam lies. Recording must be done prior to the commencement of construction and a copy of the recorded permit filed with the Office of Dam Safety.

This permit remains valid for two (2) years from the date of issue: **April 18, 2023**.

Permit expiration date: **April 18, 2025**.

William Salomaa, Director
DCR, Office of Dam Safety

David Ouellette, Permit Engineer
DCR, Office of Dam Safety

Attachments: Dam Safety Improvements – Notice of Construction form
Dam Safety Certificate of Completion form

Informational (NOT TO BE RECORDED AT REGISTRY OF DEEDS)

Excerpts from Dam Safety Rules Regulations:

302 CMR 10.09(5): Recording a Chapter 253 Permit.

A permit to construct, drawdown, repair, alter, breach or remove a dam shall be recorded at the Registry of Deeds in the county where the dam lies. Recording must be done prior to the commencement of construction and a copy of the recorded permit filed with the Commissioner.

To: DCR, Office of Dam Safety – Permits Section
251 Causeway Street, Suite 600
Boston, MA 02114

DAM SAFETY IMPROVEMENTS - NOTICE OF CONSTRUCTION

Dam Owner/Applicant
Name:
Representative:
Address:
Phone:
Fax:
Email Address:

Project
Project location Town/City:
Dam name:
National Dam ID Number:
State Dam ID Number:
Nature of Dam Safety Improvements:
Chapter 253 Permit date of issue:
Chapter 253 Permit expiration date:
Permit Recorded at_____ Registry of Deeds
Dam Parcel Registry of Deeds Book Number:
Dam Parcel Registry of Deeds Page Number:
Recorded Permit Registry of Deeds Book Number:
Recorded Permit Registry of Deeds Page Number:
Copy of the recorded permit attached Yes ( )
Construction start date:
Construction schedule attached Yes ( )

Engineer
Company Name:
Representative:
Address:
Phone:
Fax:
Email Address:

Contractor
Company Name:
Representative:
Address:
Phone:
Fax:
Email Address :

Brief description of project, note location and dates of construction:

_____

_____

_____

By Contractor

Print name and title: _____

Signature and date: _____

By Engineer

Print name, title: _____

Signature and date: _____

By Dam Owner/Applicant

Print name and title: _____

Signature and date: _____

To: DCR, Office of Dam Safety – Permits Section
251 Causeway Street, Suite 600
Boston, MA 02114

DAM SAFETY CERTIFICATE OF COMPLETION

Dam Owner/Applicant
Name:
Representative:
Address:
Phone:
Fax:
Email Address:

Project
Project location Town/City:
Dam name:
National Dam ID Number:
State Dam ID Number:
Nature of Dam Safety Improvements:
Chapter 253 Permit date of issue:
Chapter 253 Permit expiration date:
Permit Recorded at_____ Registry of Deeds
Dam Parcel Registry of Deeds Book Number:
Dam Parcel Registry of Deeds Page Number:
Recorded Permit Registry of Deeds Book Number:
Recorded Permit Registry of Deeds Page Number:
Project completion date:

Engineer
Company Name:
Representative:
Address:
Phone:
Fax:
Email Address:

Contractor
Company Name:
Representative:
Address:
Phone:
Fax:
Email Address :

Brief description of project and dates of construction:

_____

_____

_____

Statement of project completion in accordance with plans, specifications, dam safety permit conditions and standard construction practices:

_____

_____

_____

By Contractor

Print name and title:_____

Signature and date:_____

By Engineer

Print name, title and PE stamp here:_____

Signature and date:_____

By Dam Owner/Applicant

Print name and title:_____

Signature and date:_____

Appendix H

Time of Year Restriction Determination

The Commonwealth of Massachusetts
Division of Marine Fisheries

251 Causeway Street, Suite 400, Boston, MA 02114
p: (617) 626-1520 | f: (617) 626-1509
www.mass.gov/marinefisheries

CHARLES D. BAKER, Governor
KARYN E. POLITO, Lt. Governor
BETHANY A. CARD, Secretary
RONALD S. AMIDON, Commissioner
DANIEL J. MCKIERNAN, Director

November 10, 2022

Haverhill Conservation Commission
Attn: Harmony Wilson, Chair
Haverhill City Hall, Room 300
4 Summer Street
Haverhill, MA 01830

Dear Commissioners:

MA DMF has reviewed the proposed dam removal and river restoration project located along the Little River from approximately 70ft downstream of the Winter Street/Route 97 Bridge to the MBTA Bridge as a potential Ecological Restoration Project and provides the following written determination regarding time of year (TOY) restrictions, diadromous fish passage impacts, and other recommended conditions.

- DMF has considered the need for a TOY restriction and has concluded:
  - ❑ The waterbody is not listed in TR 47, but we recommend a TOY restriction of March 1 to June 30 for the purpose of minimizing impacts to diadromous fish resources in the adjacent Merrimack River from sedimentation and turbidity [1].
- DMF has reviewed the project's impact on diadromous fish passage and has concluded:
  - ❑ The project is in the Little River fish run. The project is anticipated to be compatible with the fish passage requirements of this fish run (provided adherence to the recommended TOY restrictions). This project may be eligible for the Restoration Order of Conditions.
    - ❑ A DMF Fishway Construction Permit will be needed. Final design approval will occur during the DMF Fishway Construction Permit review.
- DMF recommends including additional conditions to further minimize potential adverse effects of the project:
  - ❑ MA DMF concurs that in water work be sequenced to occur during periods of low flow stream conditions in the Little River (i.e. July 1 – October 31), downstream turbidity curtains be used, and temporary coffer dams be installed to minimize sedimentation and turbidity in downstream areas.

Questions regarding this review may be directed to Forest Schenck in our Gloucester office at forest.schenck@mass.gov.

Sincerely,

FS/bg

Cc.
C. Jacek, USACE
R. Boeri, MA CZM
K. Shaw, NMFS
B. Gahagan, MA DMF
J. Busa, Fuss & O'Neill
A. Doroski, Fuss & O'Neill
Mass Wildlife

References:
[1] Evans, NT, KH Ford, BC Chase and JJ Sheppard (2011). Recommended Time of Year Restrictions (TOYs) for Coastal Alteration Projects to Protect Marine Fisheries Resources in Massachusetts. Technical Report DMF TR-47.

Appendix I

Permission Letters/Authorizations

JAMES J. FIORENTINI
MAYOR

CITY OF HAVERHILL
MASSACHUSETTS

CITY HALL, ROOM 100
FOUR SUMMER STREET
HAVERHILL, MA 01830
PHONE 978-374-2300
FAX 978-373-7544
MAYOR@CITYOFHAVERHILL.COM
WWW.CITYOFHAVERHILL.COM

March 17, 2023

To whom it may concern:

The City of Haverhill (The "Permittee") has retained Fuss & O'Neill, Inc. (The "Agent") to prepare engineering design plans and documents relating to the Little River Dam Removal and Restoration project occurring along the reach of Little River from approximately 65 feet downstream of Winter Street north to the MBTA Bridge. This letter shall serve as authorization for the Agent to act on behalf of the Permittee for the filing of local and state permitting documents as related to environmental resources. These fillings include but are not limited to:

- MA Department of Environmental Protection (MassDEP) Water-Dependent License/Permit
- Haverhill Conservation Commission Notice of Intent
- Haverhill Planning Board Development Review
- MA Division of Marine Fisheries Fishway Construction Permit
- MassDEP 401 Water Quality Certification
- MA Department of Transportation Access Permit
- MA Bay Transportation Authority License for Entry
- US Army Corps of Engineers Section 404 Pre-Construction Notification
- US Environmental Protection Agency National Pollutant Discharge Elimination System 2022 Construction General Permit

This authorization shall be valid for the period the Agent is under contractual agreement with the Permittee as stated under the contract general terms and conditions.

Very truly yours,

James J. Fiorentini
Mayor

JJF/lyf

Date 3/16/23

To whom it may concern:

As the current owner of the Little River Dam, I am in full support of the City of Haverhill's (The "Permittee") efforts relating to the Little River Dam Removal and Restoration project occurring along the reach of Little River from approximately 65 feet downstream of Winter Street north to the MBTA Bridge. The City of Haverhill (The "Permittee") has retained Fuss & O'Neill, Inc. (The "Agent") to prepare engineering design plans and documents relating to the Little River Dam Removal and Restoration project occurring along the reach of Little River from approximately 65 feet downstream of Winter Street north to the MBTA Bridge.

I am currently negotiating a transfer agreement with the City which would provide for the transfer of the dam from Little River Dam Owner LLC to the City of Haverhill. I authorize the Permittee with the help of Fuss & O'Neill, Inc. to proceed with the filing of local and state permitting documents as related to environmental resources. These fillings include but are not limited to:

- MA Department of Environmental Protection (MassDEP) Water-Dependent License/Permit
- Haverhill Conservation Commission Notice of Intent
- Haverhill Planning Board Development Review
- MA Division of Marine Fisheries Fishway Construction Permit
- MassDEP 401 Water Quality Certification
- MA Department of Transportation Access Permit
- MA Bay Transportation Authority License for Entry
- US Army Corps of Engineers Section 404 Pre-Construction Notification
- US Environmental Protection Agency National Pollutant Discharge Elimination System 2022 Construction General Permit

This authorization shall be valid for the period the Agent is under contractual agreement with the Permittee as stated under the contact general terms and conditions.

Sincerely,

Barry Weiner
Little River Dam Owner, LLC – Resident Agent
617-480-7762
barry@barryweinerstrategies.com

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wetlands Program

WPA Form 3A - Notice of Intent for an Ecological Restoration Project

MassDEP File Number

Haverhill
City or Town

G. Signatures and Submittal Requirements

Certification of Ecological Restoration Project Notice of Intent

I hereby certify under penalties of perjury that **the Ecological Restoration Project Notice of Intent application meets the Eligibility Criteria set forth in 310 CMR 10.13.** I also certify that I am familiar with the information contained in this Notice of Intent application and that the accompanying plans, documents, and supporting data are to the best of my knowledge and belief true, complete, and accurate. I further certify that I possess the authority to undertake the proposed activities.

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 or Authorized Agent

Mayor James J Fiorentini, City of Haverhill
2. Printed Name of Applicant or Authorized Agent

3. Date

4. Signature of Property Owner – Tess Paganeli, MBTA

6/13/2023
5. Date

6. Signature of Representative (if any)

7. Date

The certification must be signed by the applicant; however, it may be signed by a duly authorized agent (named in Item 6) if this form is accompanied by a statement by the applicant designating the agent and agreeing to furnish upon request, supplemental information in support of the application

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:
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.

Date: 6/16/2023

To whom it may concern:

The City of Haverhill (The "Permittee") has retained Fuss & O'Neill, Inc. (The "Agent") to prepare engineering design plans and documents related to the Little River Dam Removal and Restoration project occurring along the reach of Little River that begins approximately 65 feet downstream of Winter Street and continues northward to the MBTA Bridge. The proposed project includes the removal of Little River Dam to restore the Little River corridor to a free-flowing state, installation of a nature-like fishway, installation of native plantings, and recreational improvements including a canoe/kayak launch, fishing platform, pedestrian bridge, walking trail, and river overlook.

A portion of the proposed project (i.e., walking trail) is located on property owned by G&C Concrete Construction Inc. located at 0 and 30 Stevens Street, identified as Haverhill Parcels 307-2-10 and 307-2-4, respectively.

This letter shall serve as authorization by G&C Concrete for the Agent, acting on behalf of the Permittee, to proceed with filing local, state, and federal permitting documents required for the project that indicate work to occur on the aforementioned property owned by G&C Concrete. These filings include but are not limited to:

- Haverhill Conservation Commission Notices of Intent
- Haverhill Engineering Department Development Review
- U.S. Army Corps of Engineers Pre-Construction Notification

This authorization shall be valid for the duration of the permitting process relative to the Little River Dam Removal and Restoration project. This letter does not authorize any construction on G&C Concrete property. All parties acknowledge that further agreement and coordination would take place prior to any construction commencing that involved property owned by G&C Concrete.

Sincerely,

G&C Concrete Construction Inc.

Date: 6/16/2023

To whom it may concern:

The City of Haverhill (The "Permittee") has retained Fuss & O'Neill, Inc. (The "Agent") to prepare engineering design plans and documents related to the Little River Dam Removal and Restoration project occurring along the reach of Little River that begins approximately 65 feet downstream of Winter Street and continues northward to the MBTA Bridge. The proposed project includes the removal of Little River Dam to restore the Little River corridor to a free-flowing state, installation of a nature-like fishway, installation of native plantings, and recreational improvements including a canoe/kayak launch, fishing platform, pedestrian bridge, walking trail, and river overlook.

A portion of the proposed project (i.e., overlook) is located at 93 Lafayette Square identified as Haverhill Parcel ID: 516-304-1 and owned by K Brothers, LLC.

This letter shall serve as authorization by K Brothers, LLC for the Agent, acting on behalf of the Permittee, to proceed with filing local, state, and federal permitting documents required for the project that indicate work to occur on the aforementioned property owned by K Brothers, LLC. These filings include but are not limited to:

- Haverhill Conservation Commission Notices of Intent
- Haverhill Engineering Department Development Review
- U.S. Army Corps of Engineers Pre-Construction Notification

This authorization shall be valid for the duration of the permitting process relative to the Little River Dam Removal and Restoration project. This letter does not authorize any construction on K Brothers, LLC property. All parties acknowledge that further agreement and coordination would take place prior to any construction commencing that involved property owned by K Brothers, LLC.

Sincerely,

K Brothers, LLC