Fuller Brook Park Preservation Project – Phase 3
Final Design & Permitting
Wellesley, MA

Prepared for:

TOWN OF WELLESLEY
FULLER BROOK PARK COORDINATING COMMITTEE

Wetland & Seasonal Inundation Analysis (WSIA)

Prepared by:

BETA
ENGINEERING SUCCESS TOGETHER

and

Horsley Witten Group

August 23, 2012

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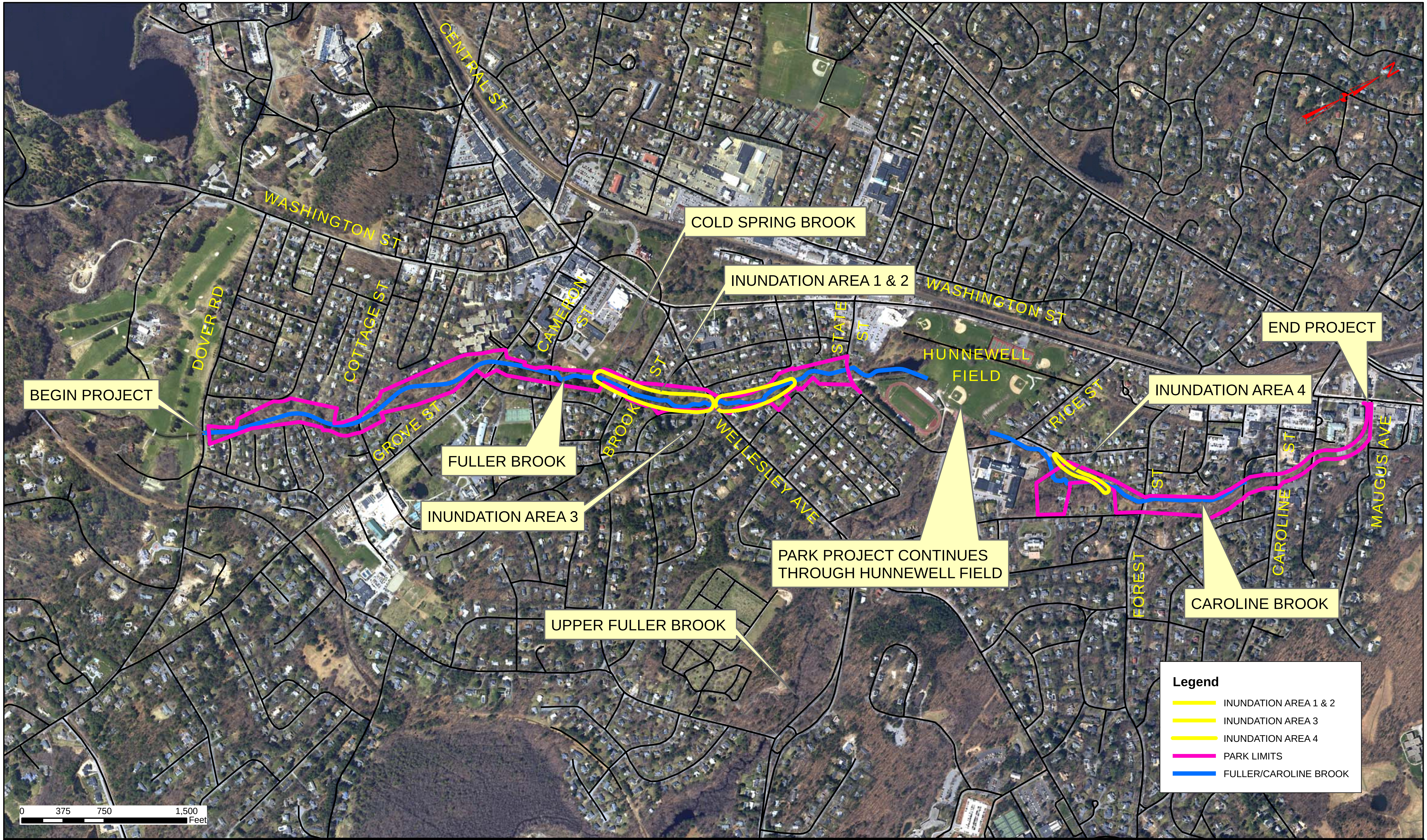

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FULLER BROOK PARK PRESERVATION PROJECT
WELLESLEY, MA

Project Locus Map

Project Location

The Fuller Brook Park Preservation Project extends from Dover Road to Hunnewell Field following Fuller Brook and from Hunnewell Field to Washington Street at Maugus Avenue following Caroline Brook. The wetland and seasonal inundation analysis was completed for Caroline Brook from Caroline Street to the culvert under Hunnewell Field and Lower Fuller Brook from the Hunnewell Field culvert to Dover Road.

Purpose

The purpose of this wetland and seasonal inundation analysis was to evaluate park areas that are reported to be frequently flooded (standing water at the surface) in order to select appropriate path alignment and materials and to create more natural wet meadow communities comprised of native hydrophytic species. Locations indicated on the preliminary plans as proposed wet meadow areas were further investigated for suitability, location, and elevation.

Introduction

During development of preliminary plans, Pressley Associates identified four sections where analysis should be conducted to determine the ideal location for the path and wet meadows in low-lying areas where stormwater runoff collected and/or wet meadows were proposed. The four sections included the following:

1. From the confluence of Cold Spring Brook to Brook Street
2. From Brook Street to Wellesley Avenue
3. From Wellesley Ave to Morton Street Footbridge
4. From Paine Street to the Existing Boardwalk

Methodology

As part of the special studies, a hydraulic analysis was completed for the brooks for the 1-, 2-, 10-, 25- & 100-year storm events to determine peak flow rates and water elevations. The preliminary plans completed in Phase 2 of this project were reviewed along with the approved wetland delineation, topographic survey, and available soils data. Multiple field visits were conducted and a hydrologic model was developed for the Wellesley Avenue to Brook Street park area to supplement field observations of surface conditions and drainage systems.

Summary of Observations

Specific field observations were conducted after several days of rain on two occasions. Areas of standing water of various sizes were observed through the park; these areas within the park were identified as wet areas and/or locations where wet meadows could be created as being areas subject to inundation. Inundation in these areas is caused primarily from stormwater runoff flow having difficulty flowing to the brook and not from brook flow. The following is a summary of observations of the four sections identified above.

Cold Spring Brook to Brook Street

This is predominately an open grass area sloping 5-6% toward Fuller Brook from elevation 128 to 122 feet, while the southern edge slopes to Cold Spring Brook. The small 0.5± acre contributing drainage area primarily only includes the park area and portions of the abutting condominium property to the west. Some small areas of standing water were observed in the paved path after rain events due to the concave grading of the path itself but no standing water was observed in the remaining park area. Data from the hydraulic analysis for this segment are summarized in Table 1. This data indicates that the existing path is inundated from the brook near Cold Spring Brook during the 10-year storm, and that near Brook Street, the existing path is right at the elevation of the 100-year storm event.

Table 1. Hydraulic Analysis Results from Cold Spring Brook to Brook Street

Stream Station	Channel Elevation	Path Elevation	Brook Water Surface Elevation			
			1 Yr	2 Yr	10 Yr	100 Yr
49+15	119.3	122.9	121.0	121.7	123.3	125.1
51+16	120.0	125.1	121.3	122.0	123.4	125.1

Preliminary plans from Pressley for this project include realigning the path and creating two wet meadow areas, one on either side of the path (see Wetland and Seasonal Inundation Plan).

Brook Street to Wellesley Avenue

This area is a mixture of woodland and lawn area with large trees. The path along the west side of the river creates a partial barrier, preventing some overland flow from reaching the brook. Two pipe culverts, a 12-inch reinforced concrete pipe (RCP) and an 8-inch clay pipe, were installed to direct accumulated water in this area to the brook. Although the Town mows the lawn area, portions are delineated as bordering vegetated wetland (BVW), and were included in the approved Order of Resource Area Delineations (ORAD) for this project. Ponded water was observed in the BVW lawn area as much as 8 inches deep after rainfall events. Hydrologic data indicates that the brook overtops the path during the 10-year storm event. Data from the hydraulic analysis for this segment are summarized in Table 2 below. This data indicates that the existing path is inundated from the brook during the 100-year storm event.

Table 2. Hydraulic Analysis Results from Brook Street to Wellesley Avenue.

Stream Station	Channel Elevation	Exist. Path Elevation	Brook Water Surface Elevation			
			1 Yr	2 Yr	10 Yr	100 Yr
53+20	119.9	125.3	121.8	122.3	123.7	125.4
58+03	120.2	124.3	122.1	122.7	123.9	125.4

Preliminary plans for this project include realigning the path to the west and creating a wet meadow area along the bank of the brook (see Wetland and Seasonal Inundation Plan).

Wellesley Avenue to Morton Street Footbridge

This section on the west side of the brook is a low-lying mixture of mowed lawn with a high canopy created by large trees with, and vegetated areas primarily adjacent to the brook. The land varies in slope from 1-6% toward Fuller Brook, from elevation 126 to 123 feet. The 1.5± acre contributing drainage area includes the residential lots on the east side of Aberdeen Road. Some areas of standing water and saturated ground behind house numbers 5, 13 & 15 Aberdeen Road were observed after rain events. Data from the hydraulic analysis for this segment are summarized in Table 3. This data indicates that the existing area is inundated from the brook for all storms greater than the 1-year storm event.

Table 3. Hydraulic Analysis Results from Wellesley Avenue to Morton Street Footbridge.

Stream Station	Channel Elevation	Path Elevation*	Brook Water Surface Elevation			
			1 Yr	2 Yr	10 Yr	100 Yr
61+44	120.3	124.7	122.6	123.2	124.5	125.9
65+93	120.5	126.1	122.8	123.4	124.6	125.9

**It should be noted that the path is located on the east side of the brook (i.e., not in the area where wet meadow is being proposed). Preliminary plans included creating two wet meadow areas along the west bank of the brook (see Wetland and Seasonal Inundation Plan).*

Paine Street to Forest Street

The park path traverses a low-lying forested swamp area east of Paine Street. Wetland resources are delineated on both sides of the existing wood chip path. A wooden boardwalk/bridge was installed for pedestrians to cross the brook. There are also three 8-inch clay pipes installed to allow water from wetlands on the north side of the path to flow beneath the path to the brook.

During a site visit in May 2012, it was observed that a new layer of wood chips had been installed to prevent pedestrians from walking on saturated soil (i.e., mud; see attached photos).

The path in this area is only ~12 inches higher in elevation than the adjacent wetlands areas. The three 8-inch clay pipe cross culverts are either partially or completely buried/blocked, preventing flow from the western wetland area from reaching the brook. During most rainfall events stormwater flow saturates and often overtops portions of the path at the culverts and both ends of the boardwalk.

Recommendations

Cold Spring Brook to Brook Street

The small contributing drainage area is not likely to be able to support two wet meadows as originally proposed during the Phase 2 Preliminary Design Report by Pressley Associates. In order to construct and sustain wetland plantings, these areas would need to be excavated two to three feet to the water table elevation. As such, it makes more sense to create upland meadow habitat (i.e., wildflower meadow) in these locations, which would address the project goal of restoring natural habitats along the stream corridor without excavation and regrading in this location. The realigned path will be properly graded to prevent puddles after rain events, which is currently occurring.

- ❖ Realign the path as proposed and construct upland meadow communities in the locations shown on the Wetland and Inundation Analysis Plan

Brook Street to Wellesley Avenue

A large portion of the park in this area is frequently inundated and delineated as BVW even though it is currently mowed regularly.

- ❖ Realign the path as shown on the Wetland and Inundation Analysis Plan, incorporating a short bridge section and fill areas where the wetland crossing occurs[1]. The existing 12-inch RCP would be removed since the bridged area would span a portion of the wetland area, maintaining hydrologic connectivity between the wetlands and the brook.

[1] While the proposed re-alignment of the path would result in new alterations within the currently mowed BVW, this activity could be proposed as a limited project under the provisions at 310 CMR 10.53(3)(j), which states: "*The construction and maintenance of catwalks, footbridges, wharves, docks, piers, boathouses, boat shelters, duck blinds, skeet and trap shooting decks and observation decks; provided, however, that such structures are constructed on pilings or posts so as to permit the reasonably unobstructed flowage of water and adequate light to maintain vegetation*" [emphasis added]. A preliminary alternatives analysis considered proposed elevated crossings at narrower points along the existing BVW (i.e., minimizing impacts); however, it was concluded that the recommended pathway re-alignment will allow for the greatest amount of created or restored wet meadow community and an opportunity to create greater connectivity of natural wetland habitats along the brook. The alternative considered that allowed the existing path to remain in its current location would avoid wetland impacts associated with the path but would not create an expanded wet meadow community and the connectivity with the brook as recommended in earlier studies.

- ❖ Construct a wet meadow habitat community with a bottom elevation at elevation 123.2 to 123.7± feet by expanding along the existing BVW boundary and planting additional native herbaceous wetland species in this location. Areas north of the pathway could be planted with woody vegetation to enhance and expand the existing wooded portions of the BVW without the need for excavation.
- ❖ In addition, there may be opportunities to create vernal pool habitat within the proposed wet meadow area (also in the floodplain and Riverfront Area to the brook), by excavating to approximately elevation ±122 feet.
- ❖ Mowing of existing and expanded wetland areas should cease and be supplemented with wetland/natural plantings

Wellesley Avenue to Morton Street Footbridge

The topography of the northern portion of the previously proposed (Pressley) smaller wet meadow behind house numbers 19 & 21 Aberdeen Road is higher and steeper in grade than the other proposed wet meadow areas. Creating a wet meadow in this location would require significant regrading and tree loss, and these activities would be within 60 feet of house at 21 Aberdeen Road. Thus, we recommend only the following:

- ❖ Create one wet/upland meadow in this area, shaping it to minimize impacts to the root systems of the large existing trees. This meadow will have the added benefit of providing additional floodplain storage in this area. A variety of plantings should be chosen compatible with the existing vegetation

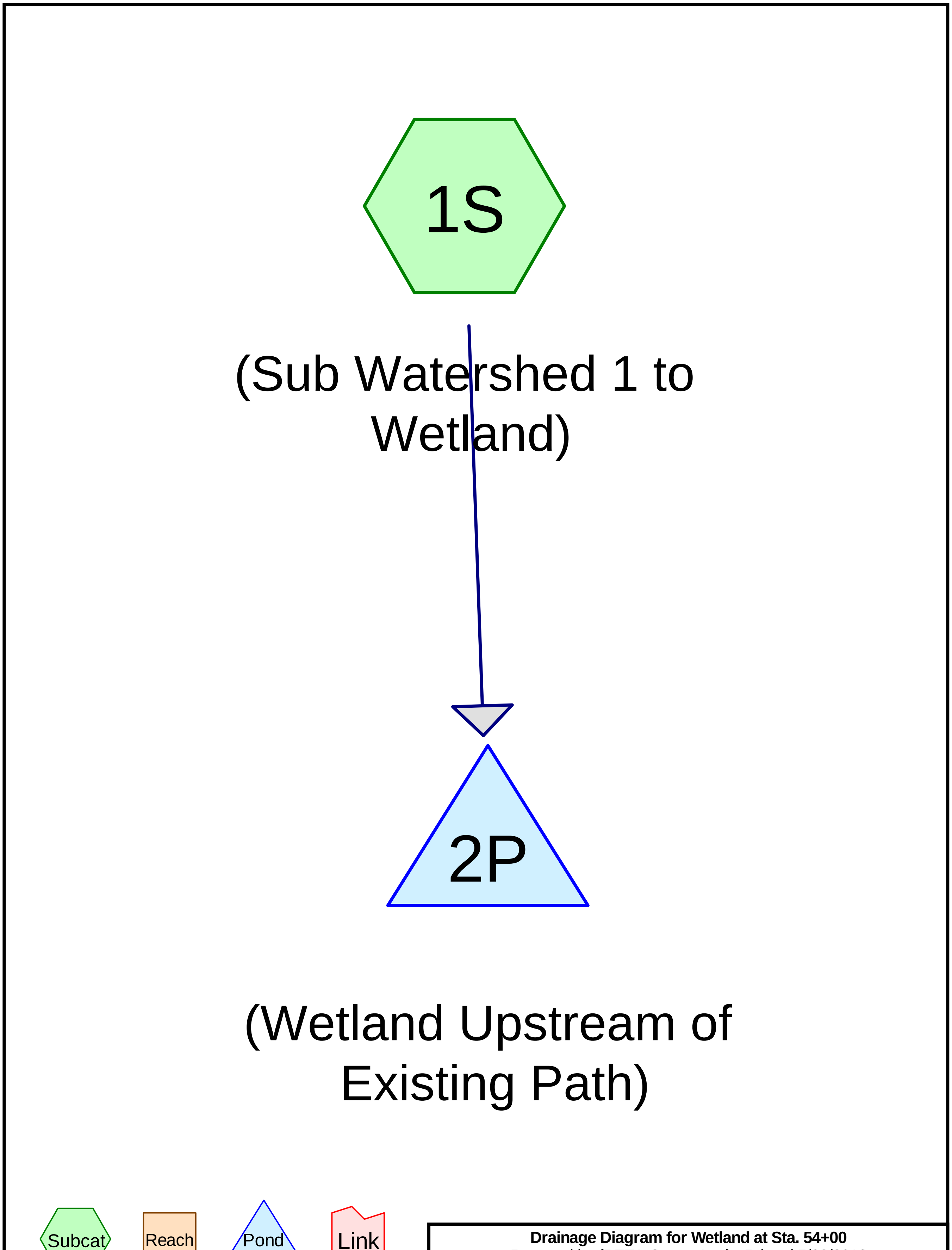
Paine Street Swamp

Proposed modifications to the path shown on the Wetland and Inundation Analysis Plan should include:

- ❖ Remove saturated path section and fill material to allow unrestricted flow within the wetland; restore wetland and extend boardwalk to the north 35± feet.
- ❖ Remove saturated path section and fill material to allow unrestricted flow; restore wetland and extend boardwalk to the south a minimum of 40± feet.
- ❖ Remove saturated path section, damaged/blocked cross pipes, and fill material to re-connect wetland areas and allow unrestricted flow; restore wetland and install two 20± feet boardwalk/bridge sections at low areas.
- ❖ Choose appropriate path surface material that will withstand a continuously saturated base.

APPENDIX A
SITE PHOTOS

APPENDIX B
SUPPLEMENTAL HYDROLOGIC BACKUP DATA



Drainage Diagram for Wetland at Sta. 54+00
Prepared by {BETA Group, Inc.}, Printed 5/30/2012
HydroCAD® 9.00 s/n 01895 © 2009 HydroCAD Software Solutions LLC

Summary for Subcatchment 1S: (Sub Watershed 1 to Wetland)

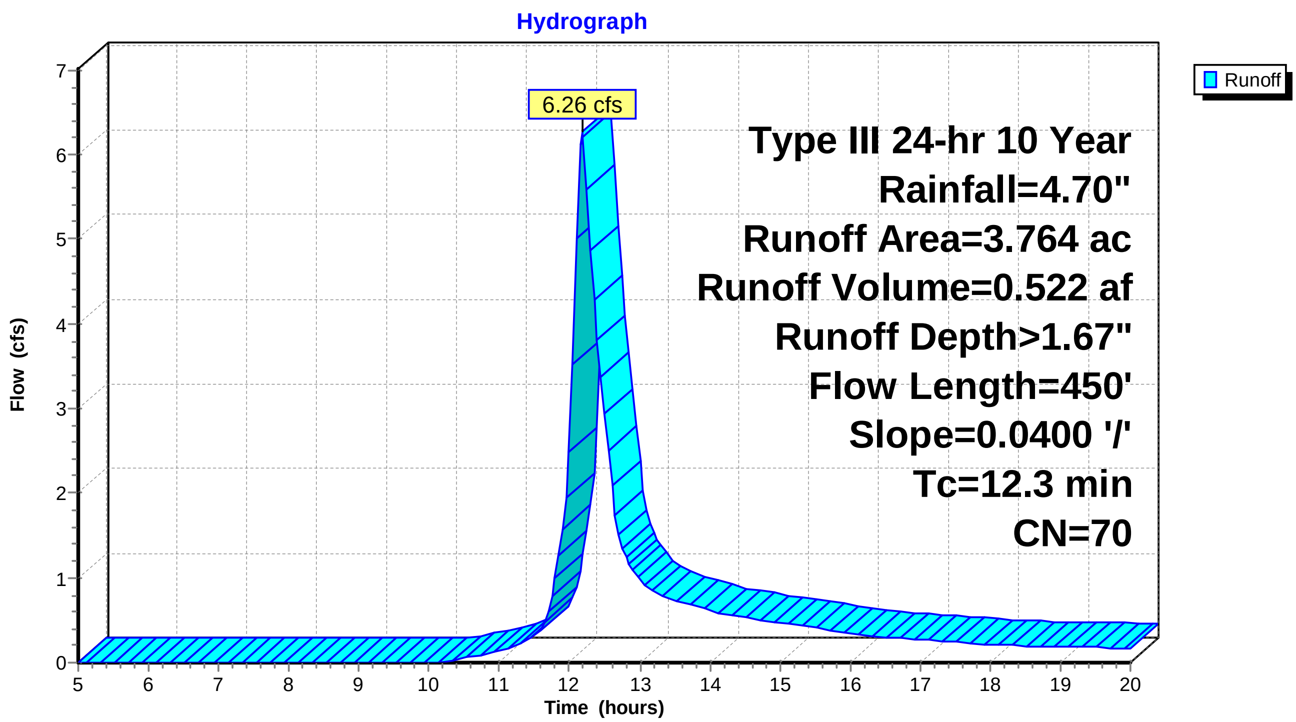
Runoff = 6.26 cfs @ 12.18 hrs, Volume= 0.522 af, Depth> 1.67"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=4.70"

Area (ac)	CN	Description
1.775	61	1/4 acre lots, 38% imp, HSG A
0.327	87	1/4 acre lots, 38% imp, HSG D
0.045	30	Woods, Good, HSG A
0.813	77	Woods, Good, HSG D
0.064	39	>75% Grass cover, Good, HSG A
0.740	80	>75% Grass cover, Good, HSG D
3.764	70	Weighted Average
2.965		78.78% Pervious Area
0.799		21.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	100	0.0400	0.22		**Sheet Flow, Grass - Residential** Grass: Short n= 0.150 P2= 3.20"
1.8	150	0.0400	1.40		**Shallow Concentrated Flow, Grass - Residential** Short Grass Pasture Kv= 7.0 fps
2.5	150	0.0400	1.00		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.6	50	0.0400	1.40		**Shallow Concentrated Flow, Grass surface next to road** Short Grass Pasture Kv= 7.0 fps
12.3	450	Total			

Subcatchment 1S: (Sub Watershed 1 to Wetland)



Summary for Pond 2P: (Wetland Upstream of Existing Path)

Inflow Area = 3.764 ac, 21.22% Impervious, Inflow Depth > 1.67" for 10 Year event
Inflow = 6.26 cfs @ 12.18 hrs, Volume= 0.522 af
Outflow = 2.14 cfs @ 12.60 hrs, Volume= 0.337 af, Atten= 66%, Lag= 25.0 min
Primary = 1.69 cfs @ 12.60 hrs, Volume= 0.306 af
Secondary = 0.45 cfs @ 12.60 hrs, Volume= 0.031 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 124.07' @ 12.60 hrs Surf.Area= 24,120 sf Storage= 9,733 cf

Plug-Flow detention time= 133.5 min calculated for 0.337 af (65% of inflow)
Center-of-Mass det. time= 58.3 min (873.1 - 814.9)

Volume	Invert	Avail.Storage	Storage Description
#1	122.38'	20,055 cf	**Wetland Stage - Storage (Irregular)** Listed below (Recalc)

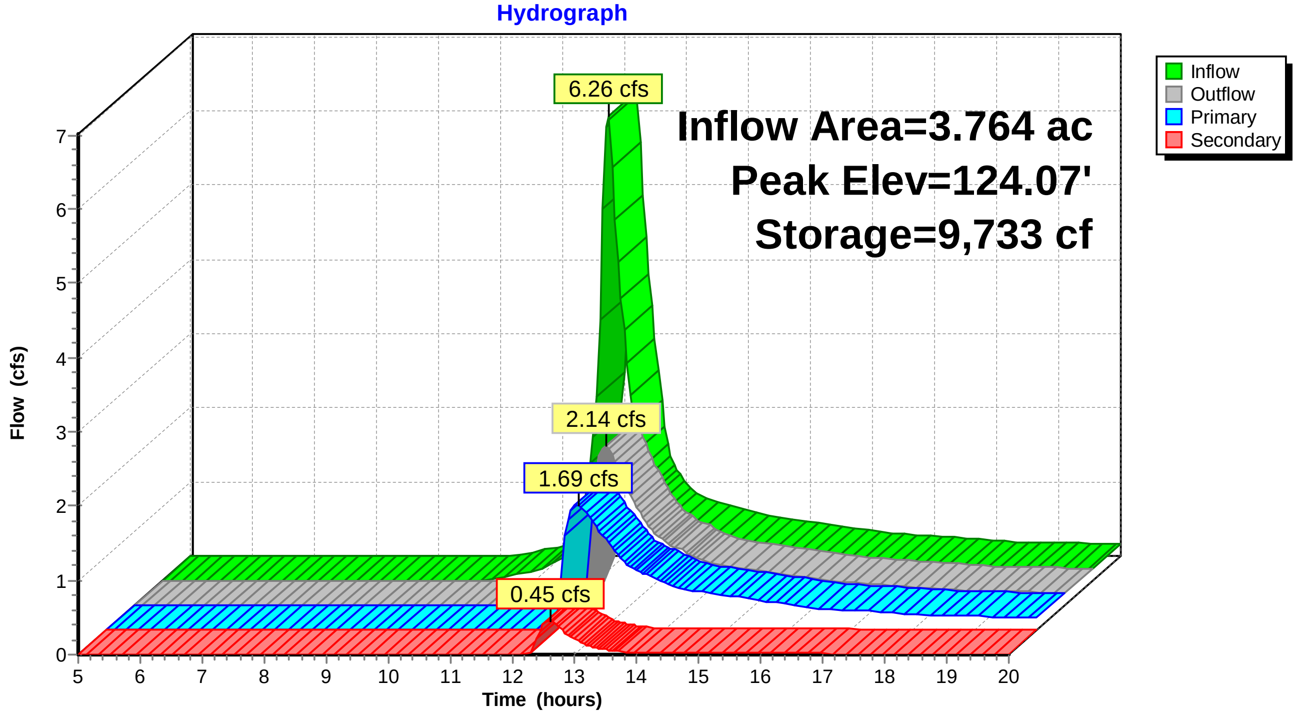
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
122.38	78	32.0	0	0	78
123.00	800	180.0	233	233	2,576
123.50	4,600	330.0	1,220	1,453	8,665
124.00	24,120	1,360.0	6,542	7,995	147,186
124.50	24,120	1,360.0	12,060	20,055	147,866

Device	Routing	Invert	Outlet Devices
#1	Primary	122.98'	**8.0" Round Culvert** L= 20.0' RCP, groove end projecting, Ke= 0.200 Outlet Invert= 122.88' S= 0.0050 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished
#2	Secondary	124.00'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#3	Primary	122.38'	**12.0" Round Culvert** L= 33.0' RCP, groove end projecting, Ke= 0.200 Outlet Invert= 121.94' S= 0.0133 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished

Primary OutFlow Max=1.69 cfs @ 12.60 hrs HW=124.07' TW=124.00' (Fixed TW Elev= 124.00')
—**1=Culvert** (Outlet Controls 0.52 cfs @ 1.48 fps)
—**3=Culvert** (Outlet Controls 1.17 cfs @ 1.49 fps)

Secondary OutFlow Max=0.45 cfs @ 12.60 hrs HW=124.07' (Free Discharge)
—**2=Broad-Crested Rectangular Weir** (Weir Controls 0.45 cfs @ 0.63 fps)

Pond 2P: (Wetland Upstream of Existing Path)



APPENDIX C
SUPPLEMENTAL HYDROLOGIC BACKUP DATA

List of Photos

Site Photos

Photo 1: Adjacent to 21 Brook St. looking south toward Cold Spring Brook

Photo 2: On bridge over Cold Spring Brook looking north toward Wellesley Ave.

Photo 3: Looking north at low area between Wellesley Ave. and Brook St.

Photo 4: Looking south at low area between Wellesley Ave. and Brook St.

Photo 5: Looking south at low area between Wellesley Ave. and Brook St.

Photo 6: Looking south at low area between Wellesley Ave. and Brook St.

Site Photos (cont.)

Photo 7: Just off Wellesley Ave. looking south toward Brook St.

Photo 8: Just off Wellesley Ave. looking north toward Morton St. Footbridge

Site Photos (cont.)

Photo 9: Behind 13 Aberdeen Rd. looking south toward Wellesley Ave.

Photo 10: Adjacent to 28 Wellesley Ave. looking north toward Morton St. Footbridge

Site Photos (cont.)

Photo 11: Behind 13 Aberdeen Rd. looking north toward Morton St. Footbridge

Photo 12: Behind 25 Aberdeen Rd. looking south toward Wellesley Ave.

Site Photos (cont.)

Photo 13: Park path at low area just off Paine St. looking north before the sewer manhole

Photo 14: Same view as above with woodchip path -- stained area is where flow overtops path

Site Photos (cont.)

Photo 15: Park path looking south from end of boardwalk/bridge

Photo 16: Park path looking north from on boardwalk/bridge

Site Photos (cont.)

Photo 17: Park path looking north from on boardwalk/bridge

Map Scale: 1:2,640 if printed on A size (8.5" x 11") sheet.

N

Meters: 0, 25, 50, 100, 150

Feet: 0, 100, 200, 400, 600

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

Special Line Features
- Gully
- Short Steep Slope
- Other

Political Features
- Cities

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:2,640 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:25,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 19N NAD83

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

Soil Survey Area: Norfolk and Suffolk Counties, Massachusetts
Survey Area Data: Version 8, Jul 23, 2010

Date(s) aerial images were photographed: 7/10/2003

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.

Map Unit Legend

Norfolk and Suffolk Counties, Massachusetts (MA616)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
51	Swansea muck, 0 to 1 percent slopes	4.5	93.3%
653	Udorthents, sandy	0.0	0.6%
655	Udorthents, wet substratum	0.3	6.2%
Totals for Area of Interest		**4.8**	**100.0%**

Physical Soil Properties

This table shows estimates of some physical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Particle size is the effective diameter of a soil particle as measured by sedimentation, sieving, or micrometric methods. Particle sizes are expressed as classes with specific effective diameter class limits. The broad classes are sand, silt, and clay, ranging from the larger to the smaller.

Sand as a soil separate consists of mineral soil particles that are 0.05 millimeter to 2 millimeters in diameter. In this table, the estimated sand content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Silt as a soil separate consists of mineral soil particles that are 0.002 to 0.05 millimeter in diameter. In this table, the estimated silt content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of sand, silt, and clay affects the physical behavior of a soil. Particle size is important for engineering and agronomic interpretations, for determination of soil hydrologic qualities, and for soil classification.

The amount and kind of clay affect the fertility and physical condition of the soil and the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, saturated hydraulic conductivity (Ksat), plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3- or 1/10-bar (33kPa or 10kPa) moisture tension. Weight is determined after the soil is dried at 105 degrees C. In the table, the estimated moist bulk density of each soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute linear extensibility, shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. Depending on soil texture, a bulk density of more than 1.4 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water. The estimates in the table are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic conductivity (Ksat) is considered in the design of soil drainage systems and septic tank absorption fields.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each soil layer. The capacity varies, depending on soil properties that affect retention of water. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Linear extensibility refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. It is an expression of the volume change between the water content of the clod at 1/3- or 1/10-bar tension (33kPa or 10kPa tension) and oven dryness. The volume change is reported in the table as percent change for the whole soil. The amount and type of clay minerals in the soil influence volume change.

Linear extensibility is used to determine the shrink-swell potential of soils. The shrink-swell potential is low if the soil has a linear extensibility of less than 3 percent; moderate if 3 to 6 percent; high if 6 to 9 percent; and very high if more than 9 percent. If the linear extensibility is more than 3, shrinking and swelling can cause damage to buildings, roads, and other structures and to plant roots. Special design commonly is needed.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In this table, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter. The content of organic matter in a soil can be maintained by returning crop residue to the soil.

Organic matter has a positive effect on available water capacity, water infiltration, soil organism activity, and tilth. It is a source of nitrogen and other nutrients for crops and soil organisms.

Erosion factors are shown in the table as the K factor (Kw and Kf) and the T factor. Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and Ksat. Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor Kw indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments.

Erosion factor Kf indicates the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind and/or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their susceptibility to wind erosion in cultivated areas. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible. The groups are described in the "National Soil Survey Handbook."

Wind erodibility index is a numerical value indicating the susceptibility of soil to wind erosion, or the tons per acre per year that can be expected to be lost to wind erosion. There is a close correlation between wind erosion and the texture of the surface layer, the size and durability of surface clods, rock fragments, organic matter, and a calcareous reaction. Soil moisture and frozen soil layers also influence wind erosion.

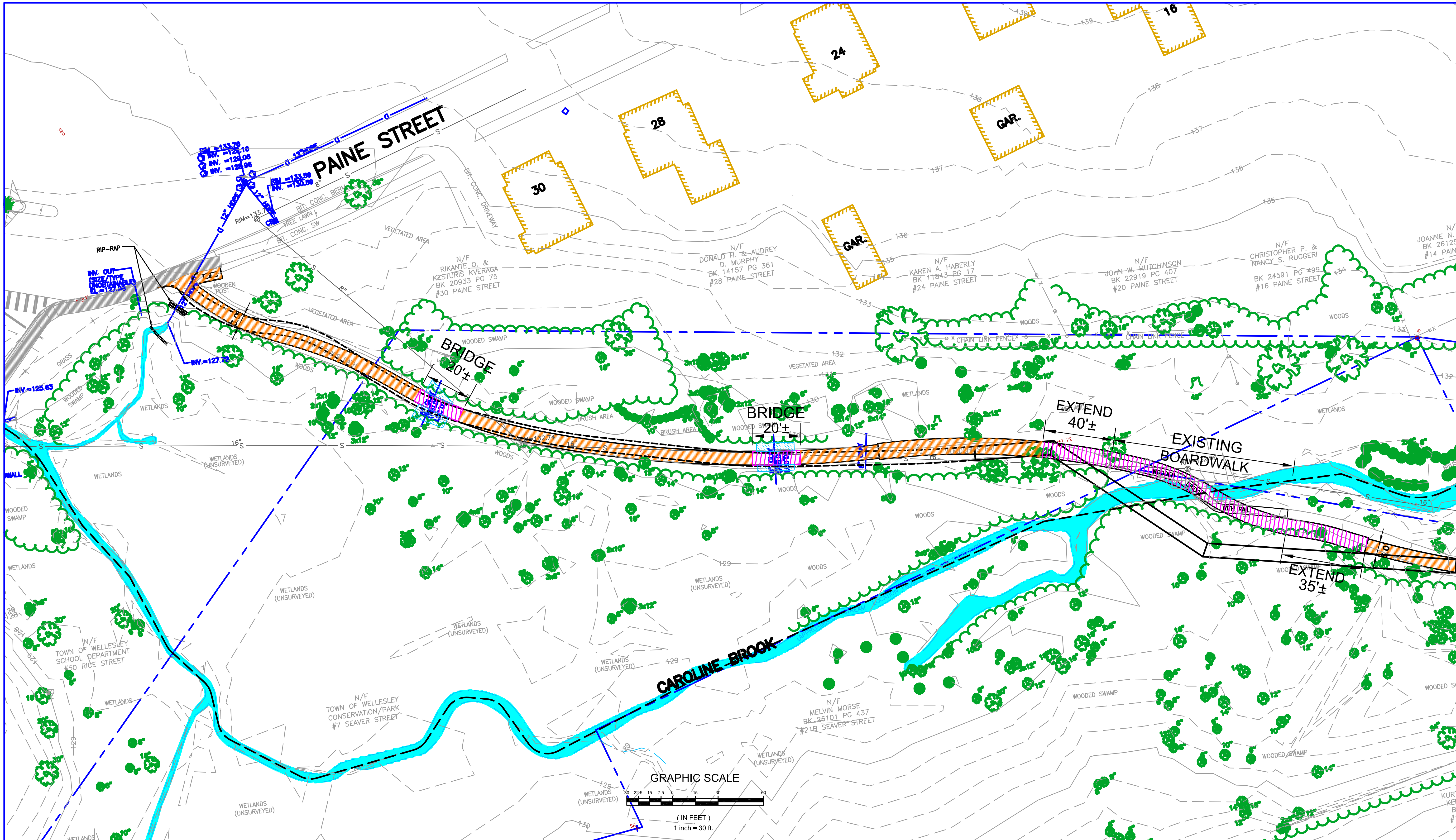
Reference:

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. (http://soils.usda.gov)

Report—Physical Soil Properties

Physical Soil Properties– Norfolk and Suffolk Counties, Massachusetts														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
51—Swansea muck, 0 to 1 percent slopes														
Swansea	0-24	- 0-	—	—	0.10-0.30	4.23-42.34	0.35-0.45	0.0-2.9	30.0-95.0			2	8	0
	24-34	- 0-	—	—	0.15-0.30	4.23-42.34	0.35-0.45	0.0-2.9	30.0-95.0					
	34-60	-96-	- 2-	1- 3- 5	1.15-1.40	141.14-705.00	0.01-0.08	0.0-2.9	0.1-4.0	.10	.15			
626B—Merrimac-Urban land complex, 0 to 8 percent slopes														
Merrimac	0-19	-64-	-31-	3- 5- 7	1.10-1.20	14.11-42.34	0.14-0.19	0.0-2.9	1.0-5.0	.24	.32	5	3	86
	19-23	-81-	-17-	1- 2- 3	1.20-1.40	14.11-141.14	0.03-0.12	0.0-2.9	0.1-2.5	.17	.28			
	23-60	-90-	- 9-	0- 2- 3	1.30-1.50	42.34-141.14	0.01-0.06	0.0-2.9	0.0-1.0	.10	.37			
Urban land	—	—	—	—	—	—	—	—	—				8	0
653—Udorthents, sandy														
Udorthents	0-6	—	—	—	—	0.42-141.14	—	—	—	.10	.10	5	2	134
	6-60	—	—	—	—	0.42-141.14	—	—	—					

APPENDIX D
WETLAND & SEASONAL INUNDATION ANALYSIS PLANS



- - - - Phase 2 Proposed Path Alignment
- Proposed Path Alignment
- Proposed Boardwalk/Bridge
- Proposed Wetland Restoration

Horsley Witten Group

Fuller Brook Park Preservation Project
Wellesley, Massachusetts

BETA
ENGINEERING SUCCESS TOGETHER

WETLAND & SEASONAL INUNDATION CAROLINE BROOK SECTION

O:\4100s\4196 - Wellesley - Fuller Brook Park\Drawing Files\Miscellaneous\4196 Wet Meadow Graphic.dwg

Existing Path Alignment

Phase 2 Proposed Wet Meadow

Phase 2 Proposed Path Alignment

Proposed Path Alignment

Proposed Wet Meadow

Proposed Upland Meadow

BETA ENGINEERING SUCCESS TOGETHER

Horsley Witten Group

SCALE:

GRAPHIC SCALE

30 22.5 15 7.5 0 15 30 60

(IN FEET)
1 inch = 30 ft.

UNLESS OTHERWISE NOTED OR CHANGED BY REPRODUCTION

Fuller Brook Park Preservation Project

WETLAND & SEASONAL INUNDATION FULLER BROOK SECTION

Wellesley, Massachusetts