

# Stormwater Management Report

Boynton Yards: Building 1 & 2

February 2018

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**Prepared by:**



**In conjunction with:**

**DLJ Real Estate Capital Partners**



## TABLE OF CONTENTS

<b>STORMWATER MANAGEMENT REPORT NARRATIVE .....</b>	<b>1</b>
<b>Project Description .....</b>	<b>1</b>
Existing Property Description .....	1
Wetland Resource Areas .....	2
<b>Hydrologic Analysis.....</b>	<b>2</b>
Existing Conditions.....	2
Proposed Conditions.....	4
Hydrologic Results .....	5
<b>Water Quality .....</b>	<b>6</b>
Water Quality Control Measures .....	6
Stormwater Recharge .....	6
<b>Regulatory Compliance .....</b>	<b>7</b>
<b>Hydraulic Analysis .....</b>	<b>8</b>
<b>Conclusion.....</b>	<b>8</b>



## STORMWATER MANAGEMENT REPORT NARRATIVE

**WSP USA** has prepared this Stormwater Management Memorandum on behalf of DLJ Real Estate Capital Partners (the “Applicant”). The Applicant proposes to redevelop two parcels of land identified as Boynton Yards Buildings 1 & 2 in the Boynton Yards Development Area located at South Street and Earle Street in Somerville, Massachusetts (the “Property”). This Stormwater Management Report has been prepared to demonstrate compliance with the Massachusetts Department of Environmental Protection (MassDEP) Stormwater Standards and The City of Somerville Stormwater Management Policy.

### PROJECT DESCRIPTION

The Applicant is proposing to redevelop the Property, which is comprised of two parcels of land that are part of the overall Boynton Yards Area. Lot 5, a parcel of land which will eventually be improved with Building 1 of Boynton Yards, is 0.48 acres in size. Lot B-2, a parcel of land which will eventually be improved with Building 2 of Boynton Yards, is 0.99 acres in size. The Building 1 parcel is currently a vacant asphalt paved parking lot, contains no structures, and is relatively flat other than sloped landscaping on the parking lot boundaries. The Building 2 parcel is currently a hard-packed gravel scaffolding and construction material storage lot, contains no structures, and is relatively flat.

The Applicant proposes to redevelop the Building 1 parcel in order to construct a 10-story, approximately 139,000 gross square foot retail and office mixed-use building with an approximate footprint of 14,000 square feet. The Applicant proposes to redevelop the Building 2 parcel in order to construct an 8-story, approximately 235,000 gross square foot retail and office mixed-use building with an approximate footprint of 30,500 square feet. Building 2 will also include a four-level subsurface parking garage with approximately 233 parking spaces to serve both Buildings 1 & 2. As proposed, the redevelopment project consists of the two aforementioned buildings, public improvements to Earle Street and South Street, landscape and other surface improvements, and stormwater management and utility improvements to support the redevelopment (the “Project”).

### Existing Property Description

The Property is bounded by a paved access easement, Windsor Place, as well as an adjacent industrial property to the north, South Street to the south, commercial development to the west, and Harding Street to the east. The Property is bisected from north to south by Earle Street. The Property lies within the surface watershed of the Charles River Basin (see Figure 1 below).

The existing topography within the Property ranges from approximately elevation 12 NAVD 88 (North American Vertical Datum of 1988) at the center of both parcels, to approximately elevation 9 NAVD 88 at the northern and eastern street frontages. Topography along the frontage on South Street slopes gradually from elevation 9 NAVD 88 at the east side, to approximately elevation 8 NAVD 88 on the west side. The lowest elevations are in Earle Street, which bisects the Property, at approximately elevation 7 NAVD 88. Please refer to the topographic land survey prepared by Partner Engineering and Science, dated August 24, 2017 which is included as part of the Site Plans (Attachment A).

According to the Natural Resources Conservation Service (NRCS) Web Soil Survey, the majority of the Property is classified as Urban land, wet substratum, 0 to 3 percent slopes (#603). Other portions of the analysis area are classified as Merrimac-Urban land complex, 0 to 8 percent slopes (#626B). Urban land refers to land which has been excavated and filled. There is no Hydrologic Soil Group (HSG) associated with Urban land. Additionally, the geotechnical engineer for the Project, Haley & Aldrich, completed subsurface explorations at both building parcels. The geotechnical information revealed surface layers of sand and gravel above thick layers of urban fill. Based on the NRCS Web Soil Survey and the geotechnical information, a HSG of C was used for hydrologic calculations. Per the geotechnical engineer’s recommendations, seasonal high groundwater is estimated to be at elevation 6 NAVD 88. NRCS information and the geotechnical information is included in Attachment B.

Figure 1: Site Locus



Source: MassGIS

### **Wetland Resource Areas**

The Property is located within an area of minimal flood hazard, Zone X, as shown on the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) numbers 25017C0577E and 25017C0439E, dated June 4, 2010. The FIRMs are included in Attachment A.

The northern portion of the Building 2 parcel is located within MassDEP Chapter 91 Historic High Water. This designation refers to the historic high water of the now filled tidelands of the former Miller's River, which was filled in the late 19<sup>th</sup> century. The Property is approximately one mile from the nearest open water of the Charles River Basin. The Property also lies within the Category 2 Hurricane Surge Inundation Zone. These two resource areas do not influence the redevelopment plan or proposed stormwater management for the Project.

### **HYDROLOGIC ANALYSIS**

The hydrologic analysis was performed using the HydroCAD computer program. The HydroCAD model is based on the Natural Resources Conservation Service (NRCS) Technical Release 20 (TR-20) Model for Project Formulation Hydrology. Runoff coefficients for the existing and proposed development conditions, as shown below in Tables 1 and 2 respectively, were determined using NRCS Technical Release 55 (TR-55) methodology as provided in HydroCAD. Rainfall volumes used for this analysis are based on the NRCS Type III, 24-hour storm event for Middlesex County.

### **Existing Conditions**

Under existing conditions, the Property is developed and almost entirely covered by impervious surfaces with generally flat topography. Runoff from the existing area flows overland and untreated to either the existing 42" combined sewer system in Ward Street or to the existing 36" separated storm drain system in South Street. Both the existing 42" combined sewer system and 36" separated storm drain system ultimately discharge to a larger combined system within Medford Street. Figure C1 illustrates the existing drainage patterns, and is included in Attachment C.

The existing Property is divided into five (5) drainage areas and stormwater runoff flows to two (2) design points, which have been identified as the 42" Combined Sewer and the 36" South Street Drain. Descriptions of the existing drainage areas are listed below:

- Drainage Area EX-1A is an 11,907 square foot area that consists of the southern portion of the Building 1 parcel. The area is primarily comprised of the existing asphalt parking lot with minimal landscaping. Stormwater runoff from this drainage area flows overland and untreated directly into a series of catch basins in the South Street right-of-way, ultimately discharging to the 36" drain in South Street.
- Drainage Area EX-2A is an 11,112 square foot area that consists of the southern portion of the Building 2 parcel. The area is primarily comprised of existing hard packed gravel parking lot with minimal landscaping. Stormwater runoff from this drainage area flows overland and untreated directly into a series of catch basins in the South Street right-of-way, ultimately discharging to the 36" drain in South Street.
- Drainage Area EX-1B is an 8,401 square foot area that consists of the northern portion of the Building 1 parcel. The area is primarily comprised of the existing asphalt parking lot. Stormwater runoff from this drainage area flows overland and untreated directly into a series of catch basins on the Building 1 parcel, which convey runoff to an existing subsurface infiltration system on the abutting lot to the north. Overflows for the subsurface infiltration system flow overland to an existing catch basin in Earle Street which ultimately discharges to the 42" combined sewer in Ward Street.
- Drainage Area EX-2B is an 31,974 square foot area that consists of the central and northern portions of the Building 2 parcel. The area is primarily comprised of existing hard packed gravel parking lot with minimal landscaping. Stormwater runoff from this drainage area flows overland and untreated directly into a series of catch basins in the adjacent parking lot to the west or within Earle Street, which ultimately discharge to the 42" combined sewer in Ward Street.
- Drainage Area EX-3B is a 501 square foot area that is comprised of landscaped buffer areas on the west side of the Building 1 parcel. Stormwater runoff from this drainage area flows overland and untreated directly into existing catch basins in Earle Street which ultimately discharge to the 42" combined sewer in Ward Street.

Table 1 below provides a summary of the existing conditions hydrologic data:

**Table 1. Existing Conditions Hydrologic Data**

Drainage Area	Discharge Location	Design Point	Area (sf)	Curve Number	Time of Concentration (minutes)
EX-1A	36" South Street Drain	A	11,907	93	5.0
EX-2A	36" South Street Drain	A	11,112	96	5.0
EX-1B	42" Combined Sewer	B	8,401	98	5.0
EX-2B	42" Combined Sewer	B	31,974	97	5.0
EX-3B	42" Combined Sewer	B	501	81	5.0
<b>Total</b>			<b>63,895</b>		

### **Proposed Conditions**

In the proposed condition, previously untreated runoff from the Property will be directed to new control measures to provide the required water quality treatment. The proposed site layout will result in a net increase in pervious area through the reduction and conversion of impervious area to landscaping. Figure C2 illustrates the proposed post construction drainage conditions, and is included in Attachment C.

In the proposed condition, the analysis area will be divided into six (6) drainage areas that discharge treated stormwater to two (2) design points. Although two (2) design points are shown, stormwater runoff from the Property to the 42" combined sewer is eliminated in the proposed condition. The design point was left in the analysis to demonstrate the separation of flows. As stated previously, both the existing 42" combined sewer system and 36" storm drain system ultimately discharge to a larger combined system within Medford Street. Descriptions of the proposed drainage areas are listed below:

- Drainage Area PR-1A is a 3,381 square foot area that consists of the surface areas around the Building 1 perimeter along the property lines. The area is comprised of concrete sidewalks, paver walkways and small areas of landscaping. Runoff from this drainage area flows overland to either a proposed site area drain or a new deep-sump hooded catch basin within the public roadway. All of this stormwater flow is conveyed to the existing 36" storm drain in South Street.
- Drainage Area PR-2A is a 43,086 square foot area that consists of the entire Building 2 parcel. This area includes the building roof, concrete walkways, paver walkways and site landscaping. Runoff is either collected by site area drains or deep-sump hooded catch basins. Runoff from this area is ultimately discharged to the existing 36" storm drain in South Street.
- Drainage Area PR-3A is a 7,450 square foot area that consists of the northern portion of the Building 1 roof. Clean runoff from this roof area will be directed to the existing subsurface infiltration system on the abutting property to the north. This area replicates the existing flows from the existing parking lot. Overflows for the subsurface infiltration system flow overland to new deep-sump hooded catch basins in Earle Street, which will discharge to the existing 36" storm drain in South Street in the proposed condition.
- Drainage Area PR-4A is a 7,450 square foot area that consists of the southern portion of the Building 1 roof. Clean runoff from this roof area will be discharged directly to the existing 36" storm drain in South Street via a new 8" storm drain service.
- Drainage Area PR-5A is a 552 square foot area that is comprised of a pervious paver walkway and plaza area on the north side of Building 1. The pervious pavers will allow runoff from this area to infiltrate into the ground through a section of specifically selected stone and gravel beneath the pavers which will provide stormwater treatment and storage. Any overflow from the pervious paver storage section will be collected by an area drain located in the adjacent landscape area and will be discharged to the existing subsurface infiltration system on the abutting property to the north, although overflow is not expected in any storm events analyzed.
- Drainage Area PR-6A is a 1,976 square foot area that is comprised of a pervious paver walkway and plaza area on the south side of Building 1. The pervious pavers will allow runoff from this area to infiltrate into the ground through a section of specifically selected stone and gravel beneath the pavers which will provide stormwater treatment and storage. Any overflow from the pervious paver storage section will be collected by area drains on the surface of the plaza area and will be discharged to the existing 36" storm drain in South Street, although overflow is not expected in any storm events analyzed.

Table 2 below provides a summary of the proposed conditions hydrologic data:

**Table 2. Proposed Conditions Hydrologic Data**

Drainage Area	Discharge Location	Design Point	Area (sf)	Curve Number	Time of Concentration (minutes)
PR-1A	36" South Street Drain	A	3,381	90	5.0
PR-2A	36" South Street Drain	A	43,086	97	5.0
PR-3A	36" South Street Drain	A	7,450	98	5.0
PR-4A	36" South Street Drain	A	7,450	98	5.0
PR-5A	36" South Street Drain	A	552	98*	5.0
PR-6A	36" South Street Drain	A	1,976	98*	5.0
<b>Total</b>			<b>63,895</b>		

\*These catchment areas are comprised of pervious pavers. For the purposes of the model, the surface was assigned a Curve Number value of 98 to generate full surface runoff, which is then routed to a storage pond representing the stone section of the pervious pavers.

Please refer to Attachment C for detailed printouts of the HydroCAD analysis. Hydrologic results are summarized below.

### **Hydrologic Results**

The rainfall-runoff response of the Property under existing and proposed conditions was analyzed for storm events with recurrence intervals of 2, 10, 25, and 100 years per City of Somerville requirements. Rainfall volumes used for this analysis were based on the NRCS Type III, 24-hour storm event for Middlesex County; they were 3.1, 4.5, 5.3 and 6.5 inches, respectively. Typically, the project would be designed to reduce peak runoff rates to the two (2) existing design points. In this case, where one design point is a combined sewer, the hydrologic results show that all flow to that design point has been eliminated and flows have been directed to Design Point A, which is an existing 36" separated storm drain in South Street.

**Table 3. Peak Discharge Rates (cubic feet per second)**

Design Point	2-year	10-year	25-year	100-year
<b>A: 36" South Street Drain</b>				
Existing Conditions	1.5	2.2	2.7	3.3
Proposed Conditions	4.2	6.2	7.3	9.0
<b>Δ</b>	+2.7	+4.0	+4.6	+5.7
<b>B: 42" Combined Sewer</b>				
Existing Conditions	2.8	4.1	4.9	6.0
Proposed Conditions	0.0	0.0	0.0	0.0
<b>Δ</b>	-2.8	-4.1	-4.9	-6.0

Additionally, stormwater volumes were analyzed for all storm events to ensure the Project will not cause any downstream flooding impacts. Due to the reduction in impervious area and the use of pervious pavers, the post-development stormwater volumes are less than the pre-development stormwater volumes for all storm events analyzed. Table 4 below summarizes the stormwater volume analysis.

**Table 4. Stormwater Volume Analysis (acre-feet)**

Design Point	2-year	10-year	25-year	100-year
A: 36" South Street Drain				
Existing Conditions	0.10	0.16	0.19	0.24
Proposed Conditions	0.30	0.45	0.54	0.67
$\Delta$	+0.20	+0.29	+0.35	+0.43
B: 42" Combined Sewer				
Existing Conditions	0.20	0.30	0.36	0.45
Proposed Conditions	0.00	0.00	0.00	0.00
$\Delta$	-0.20	-0.30	-0.36	-0.45

Please refer to Attachment C for detailed printouts of the HydroCAD analysis.

## WATER QUALITY

The Project is considered a land use with higher potential pollutant loads (LUHPPL), generating more than 1,000 vehicle trips per day. Therefore, the proposed stormwater management system for on-site vehicular areas has been designed to treat the one-inch Water Quality Volume while providing 80% Total Suspended Solids (TSS) removal prior to discharge.

### Water Quality Control Measures

The proposed stormwater management system for on-site vehicular areas implements a treatment train of Best Management Practices (BMPs) that have been designed to provide 80% TSS removal for stormwater runoff from the proposed Building 2 alleyway. The required TSS removal will be obtained through the use of a deep-sump hooded catch basin and a proprietary particle separator (Stormceptor® water quality unit) prior to ultimately being discharged to the existing municipal storm drain in South Street. Calculations for the proposed TSS removal are provided in Attachment D.

As a redevelopment project, the Project will provide the removal of oil and suspended solids in on-site vehicular areas through the use of a proprietary particle separator. Therefore, the Project will be seeking relief under the provisions of Standard 7 of the stormwater guidelines from the specific BMP requirements of Standard 5 and will utilize a proprietary particle separator that has been verified by MASTEP Technology Reviews. The MASTEP Technology Review for the Stormceptor® STC 900 is included in Attachment D.

Although not required under Stormwater Management Standard 5, additional water quality control measures will be provided in non-vehicular areas by means of infiltration associated with the proposed pervious pavers. In addition, new deep-sump hooded catch basins will be provided in the adjacent public ways with the Project limits on Earle Street, South Street, Harding Street and Windsor Place.

Clean runoff from the building roof areas will be collected and independently routed to either the existing infiltration system or to the municipal storm drain in South Street.

### Stormwater Recharge

Stormwater recharge for the proposed redevelopment is provided through a reduction and conversion of impervious area to landscaping and/or pervious pavers. The Project proposes a small net decrease in impervious surfaces on-site from the pre-development conditions. Therefore, no recharge is required in

accordance with the Stormwater Handbook. Table 5 below summarizes the surface cover type areas for the hydrologic analysis area.

**Table 5. Surface Cover Type Areas (sf)**

Surface Cover Type	Existing	Proposed	Δ
<b>Impervious Surfaces</b>			
Building	0	45,650	45,650
Pavement	17,259	11,113	-6,146
Hard Packed Gravel	39,841	0	-39,841
<b>Total Impervious</b>	<b>57,100</b>	<b>56,763</b>	<b>-337</b>
<b>Pervious/Open Space Area</b>			
Vegetated Surfaces	6,795	4,604	-2,191
Pervious Pavers	0	2,528	2,528
<b>Total Pervious</b>	<b>6,795</b>	<b>7,132</b>	<b>337</b>

## REGULATORY COMPLIANCE

The stormwater management system is designed to meet the MassDEP Stormwater Management Policy guidelines outlined in the 2008 Massachusetts Department of Environmental Protection Stormwater Management Handbook. Table 6 below summarizes the standards and how the project complies:

**Table 6. Summary of Compliance with Redevelopment Stormwater Standards**

DEP Standard	Item	Compliance	Comments
Standard 1 (Maximum extent practicable)	Untreated discharges	Yes	No proposed stormwater conveyances for the Project will discharge untreated stormwater directly to or cause erosion or scour to wetlands or receiving waters of the Commonwealth.
Standard 2 (Maximum extent practicable)	No increase in peak discharge	Yes	See Hydrologic Analysis Section.
Standard 3 (Maximum extent practicable)	Groundwater recharge	Yes	See Water Quality Section.
Standard 4 (Maximum extent practicable)	80% TSS Removal	Yes	See Water Quality Section. A Long Term Pollution Prevention Plan is included in Attachment D.
Standard 5 (Maximum extent practicable)	Higher pollutant loading	Yes	See Water Quality Section. Seeking relief under the provisions of Standard 7.
Standard 6 (Maximum extent practicable)	Discharge to critical areas	Yes	See Water Quality Section.
Standard 7	Redevelopment	Yes	The project is categorized as a redevelopment.
Standard 8	Erosion and Sediment Control	Yes	The Project will disturb more than one (1) acre of land. A Stormwater Pollution Prevention Plan (SWPPP) will be prepared. Attachment E includes a Construction Period Pollution

DEP Standard	Item	Compliance	Comments
			Prevention and Erosion and Sedimentation Control Plan.
Standard 9	Operation and Maintenance Plan	Yes	A Stormwater Operations & Maintenance Plan is included in Attachment F.
Standard 10	Illicit Discharges	Yes	There are known illicit discharges in Earle Street which will be eliminated. There is no existing sanitary sewer service to the Property. There will be no illicit connections associated with the Project after redevelopment.

### HYDRAULIC ANALYSIS

The onsite closed pipe drainage system has been designed for the 25-year storm event in accordance with the City of Somerville requirements and was analyzed by the StormCAD® Storm Sewer Design and Modeling software. The drainage pipes were sized using the direct step method based on Manning's Equation for full-flow capacity and the NRCS TR-20 and TR-55 methodology to determine the corresponding runoff for the 25-year Type III 24-hour storm event for Middlesex County. Calculations for pipe sizing are included in Attachment G.

### CONCLUSION

The stormwater management plan presented herein and as shown on the Site Plans, included as Attachment A, has been prepared in accordance with applicable local, state, and federal regulations. The design includes Best Management Practices for maintaining stormwater runoff quality both during and after construction, and is designed to protect downstream and underlying receiving waters from stormwater related impacts. The redevelopment Project will result in an improvement of stormwater runoff quality and quantity.

## **ATTACHMENT A**

Included in this section, and provided under separate cover:

- Site Plans for Permitting – WSP USA, dated February 13, 2018



## **ATTACHMENT B**

Included in this section:

- NRCS Soil Information
- Site and Subsurface Exploration Plan and Results by Haley & Aldrich, dated November 2017
- FEMA Maps





United States  
Department of  
Agriculture

**NRCS**

Natural  
Resources  
Conservation  
Service

A product of the National  
Cooperative Soil Survey,  
a joint effort of the United  
States Department of  
Agriculture and other  
Federal agencies, State  
agencies including the  
Agricultural Experiment  
Stations, and local  
participants

# Custom Soil Resource Report for **Middlesex County, Massachusetts**



September 13, 2017

# Preface

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Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (<http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/>) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (<https://offices.sc.egov.usda.gov/locator/app?agency=nrcs>) or your NRCS State Soil Scientist ([http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2\\_053951](http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951)).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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# Contents

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<b>Preface</b> .....	2
<b>How Soil Surveys Are Made</b> .....	5
<b>Soil Map</b> .....	8
Soil Map.....	9
Legend.....	10
Map Unit Legend.....	11
Map Unit Descriptions.....	11
Middlesex County, Massachusetts.....	13
603—Urban land, wet substratum.....	13
626B—Merrimac-Urban land complex, 0 to 8 percent slopes.....	13
<b>References</b> .....	16

# How Soil Surveys Are Made

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Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units).

Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

## Custom Soil Resource Report

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

# Soil Map





















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The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

# Custom Soil Resource Report Soil Map



MAP LEGEND

	Area of Interest (AOI)		Spoil Area
	Area of Interest (AOI)		Stony Spot
<b>Soils</b>			Very Stony Spot
	Soil Map Unit Polygons		Wet Spot
	Soil Map Unit Lines		Other
	Soil Map Unit Points		Special Line Features
<b>Special Point Features</b>		<b>Water Features</b>	
	Blowout		Streams and Canals
	Borrow Pit	<b>Transportation</b>	
	Clay Spot		Rails
	Closed Depression		Interstate Highways
	Gravel Pit		US Routes
	Gravelly Spot		Major Roads
	Landfill		Local Roads
	Lava Flow		<b>Background</b>
	Marsh or swamp		Aerial Photography
	Mine or Quarry		
	Miscellaneous Water		
	Perennial Water		
	Rock Outcrop		
	Saline Spot		
	Sandy Spot		
	Severely Eroded Spot		
	Sinkhole		
	Slide or Slip		
	Sodic Spot		

MAP INFORMATION

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 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: Middlesex County, Massachusetts  
Survey Area Data: Version 16, Sep 14, 2016

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

Date(s) aerial images were photographed: Aug 10, 2014—Aug 11, 2014

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

Middlesex County, Massachusetts (MA017)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
603	Urban land, wet substratum	1.8	71.9%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	0.7	28.1%
<b>Totals for Area of Interest</b>		<b>2.4</b>	<b>100.0%</b>

## Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however,

onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

## Middlesex County, Massachusetts

### 603—Urban land, wet substratum

#### Map Unit Setting

*National map unit symbol:* 9951  
*Mean annual precipitation:* 32 to 50 inches  
*Mean annual air temperature:* 45 to 50 degrees F  
*Frost-free period:* 110 to 200 days  
*Farmland classification:* Not prime farmland

#### Map Unit Composition

*Urban land:* 85 percent  
*Minor components:* 15 percent  
*Estimates are based on observations, descriptions, and transects of the mapunit.*

#### Description of Urban Land

##### Setting

*Landform position (two-dimensional):* Footslope  
*Landform position (three-dimensional):* Base slope  
*Down-slope shape:* Linear  
*Across-slope shape:* Linear  
*Parent material:* Excavated and filled land over alluvium and/or marine deposits

#### Minor Components

##### Udorthents, loamy

*Percent of map unit:* 10 percent  
*Hydric soil rating:* No

##### Rock outcrop

*Percent of map unit:* 5 percent  
*Landform:* Ledges  
*Landform position (two-dimensional):* Summit  
*Landform position (three-dimensional):* Head slope  
*Down-slope shape:* Concave  
*Across-slope shape:* Concave

### 626B—Merrimac-Urban land complex, 0 to 8 percent slopes

#### Map Unit Setting

*National map unit symbol:* 2tyr9  
*Elevation:* 0 to 820 feet  
*Mean annual precipitation:* 36 to 71 inches  
*Mean annual air temperature:* 39 to 55 degrees F  
*Frost-free period:* 140 to 250 days  
*Farmland classification:* Not prime farmland

### Map Unit Composition

*Merrimac and similar soils:* 45 percent

*Urban land:* 40 percent

*Minor components:* 15 percent

*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Merrimac

#### Setting

*Landform:* Eskers, kames, outwash plains, outwash terraces, moraines

*Landform position (two-dimensional):* Backslope, footslope, shoulder, summit

*Landform position (three-dimensional):* Side slope, crest, riser, tread

*Down-slope shape:* Convex

*Across-slope shape:* Convex

*Parent material:* Loamy glaciofluvial deposits derived from granite, schist, and gneiss over sandy and gravelly glaciofluvial deposits derived from granite, schist, and gneiss

#### Typical profile

*Ap - 0 to 10 inches:* fine sandy loam

*Bw1 - 10 to 22 inches:* fine sandy loam

*Bw2 - 22 to 26 inches:* stratified gravel to gravelly loamy sand

*2C - 26 to 65 inches:* stratified gravel to very gravelly sand

#### Properties and qualities

*Slope:* 0 to 8 percent

*Depth to restrictive feature:* More than 80 inches

*Natural drainage class:* Somewhat excessively drained

*Runoff class:* Very low

*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to very high (1.42 to 99.90 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Calcium carbonate, maximum in profile:* 2 percent

*Salinity, maximum in profile:* Nonsaline (0.0 to 1.4 mmhos/cm)

*Sodium adsorption ratio, maximum in profile:* 1.0

*Available water storage in profile:* Low (about 4.6 inches)

#### Interpretive groups

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 2e

*Hydrologic Soil Group:* A

*Hydric soil rating:* No

### Description of Urban Land

#### Typical profile

*H - 0 to 6 inches:* material

#### Interpretive groups

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 8

*Hydrologic Soil Group:* D

*Hydric soil rating:* Unranked

**Minor Components**

**Windsor**

*Percent of map unit:* 5 percent  
*Landform:* Deltas, dunes, outwash plains, outwash terraces  
*Landform position (three-dimensional):* Riser, tread  
*Down-slope shape:* Linear, convex  
*Across-slope shape:* Linear, convex  
*Hydric soil rating:* No

**Sudbury**

*Percent of map unit:* 5 percent  
*Landform:* Deltas, outwash plains, terraces  
*Landform position (two-dimensional):* Footslope  
*Landform position (three-dimensional):* Tread, dip  
*Down-slope shape:* Concave  
*Across-slope shape:* Linear  
*Hydric soil rating:* No

**Hinckley**

*Percent of map unit:* 5 percent  
*Landform:* Deltas, eskers, kames, outwash plains  
*Landform position (two-dimensional):* Summit, shoulder, backslope  
*Landform position (three-dimensional):* Nose slope, crest, head slope, side slope, rise  
*Down-slope shape:* Convex  
*Across-slope shape:* Convex, linear  
*Hydric soil rating:* No

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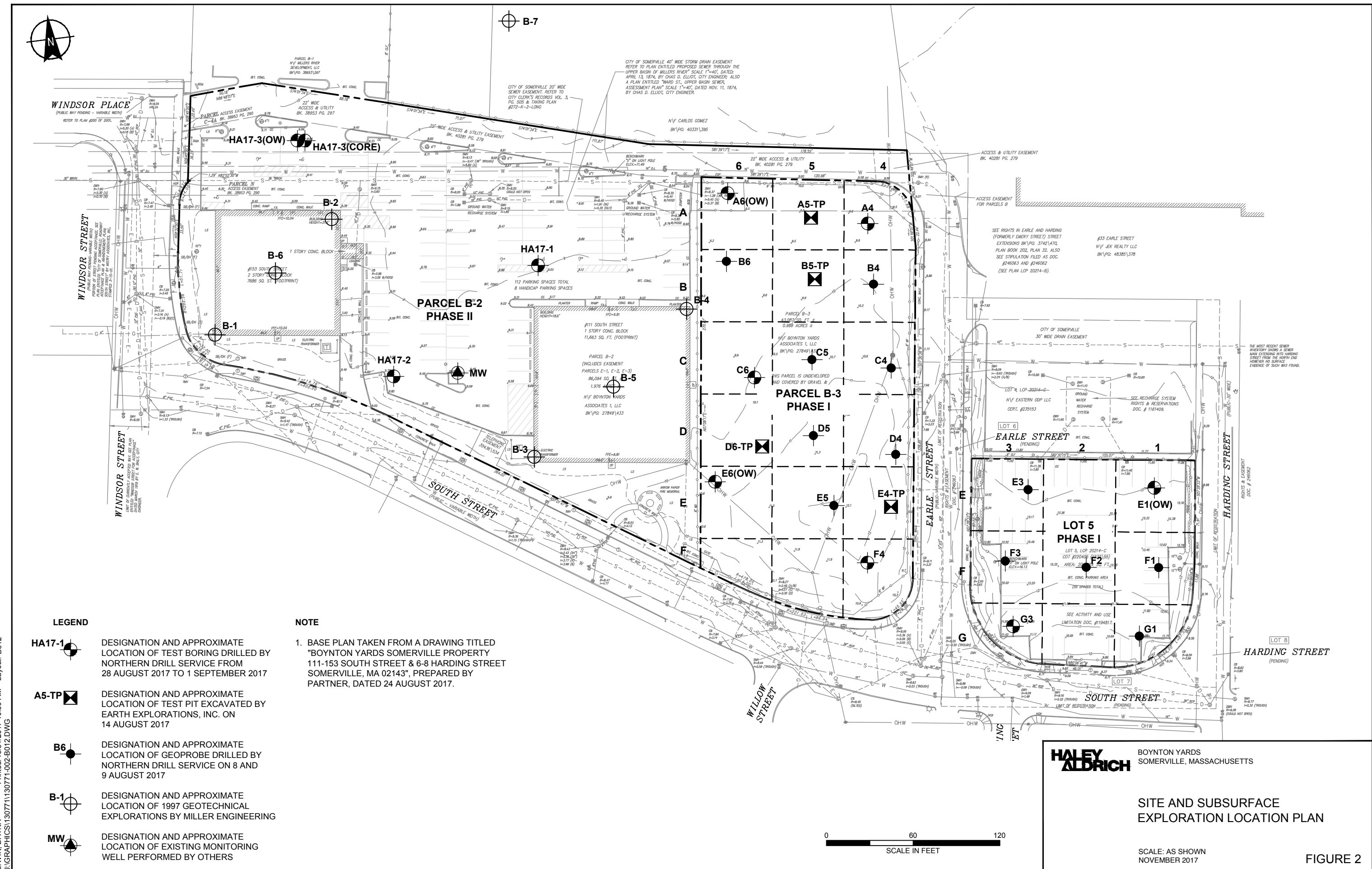
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## TEST BORING REPORT

Boring No. A4


Project BOYNTON YARDS, SOMERVILLE, MA  
 Client DLJ REAL ESTATE CAPITAL PARTNERS  
 Contractor NORTHERN DRILL SERVICE, INC.

File No. 130771-002  
 Sheet No. 1 of 3  
 Start 18 August 2017  
 Finish 18 August 2017  
 Driller John Beirholm  
 H&A Rep. S. Shay

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW	S	--	Rig Make & Model: Mobile Drill B57 Truck
Inside Diameter (in.)	4	1 3/8	--	Bit Type: Roller Bit
Hammer Weight (lb)	140	140	-	Drill Mud: None
Hammer Fall (in.)	30	30	-	Casing: HW Drive to 10.0 ft
				Hoist/Hammer: Winch Automatic Hammer
				PID Make & Model: MiniRAE 2000 10.6 eV

Elevation 9.6 (est.)  
 Datum NAVD 88  
 Location See Plan

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION  (Color, GROUP NAME, max. particle size <sup>†</sup> , structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel		Sand			Field Test					
								% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	Strength	
0	9 6 8 7	S1 24	0.0 2.5	0.9	SP-SM		Medium dense brown to black poorly graded SAND with silt and gravel (SP-SM), mps 3.0 cm, no structure except coarse gravel confined to two distinct 1.0 in. layers, no odor, dry, trace cinders, brick	10	10	20	20	30	10					
	8 9 8 11	S2 20	2.5 5.0		SM	7.1 2.5	Medium dense dark brown to black silty SAND (SM), mps 1.5 cm, no structure, no odor, dry, 5% cinders, trace ash  -FILL-		10	15	15	35	25					
5	8 6 11 4	S3 9	5.0 7.5		SP	4.6 5.0	Medium dense brown poorly graded SAND with gravel (SP), mps 3.0 cm, no structure, no odor, wet (probably from drilling)	10	15	35	20	15	5					
	2 1 3 6	S4 9	7.5 10.0		SP		S4 top 9.0 in.: Similar to above Note: 3.0 in. diameter spoon used from 5.0 to 10.0 ft for sample retrieval.	10	15	35	20	15	5					
					OL/ OH	0.6 9.0	From 3.0 in. spoon stiff olive gray ORGANIC SOIL (OL/OH) with peat, mps 1.0 mm, no structure, no odor, moist					10	90					
10	3 5 6 7	S5 24	10.0 12.5		CL	-0.4 10.0	-ORGANIC DEPOSITS- Stiff olive brown lean CLAY (CL), mps < 0.1 mm, blocky structure, no odor, moist PP 2.5 tsf						100					
	6 6 7 8	S6 14	12.5 15.0		1.3	CL		Stiff olive brown lean CLAY (CL), mps < 0.1 mm, blocky structure, no odor, moist PP 2.5 tsf						100	L	H	M	V
15								-MARINE DEPOSITS-										

Water Level Data						Sample ID		Well Diagram		Summary	
Date	Time	Elapsed Time (hr.)	Depth (ft) to:			O - Open End Rod T - Thin Wall Tube U - Undisturbed Sample S - Split spoon Sample G - Geoprobe				Overburden (ft)	55.7
			Bottom of Casing	Bottom of Hole	Water						
8/18/17	1200	10.0	10.0	55.7	10.8					Rock Cored (ft)	-
										Samples	S14
										Boring No. A4	

Field Tests: Dilatancy: R - Rapid S - Slow N - None Plasticity: N - Nonplastic L - Low M - Medium H - High  
 Toughness: L - Low M - Medium H - High Dry Strength: N - None L - Low M - Medium H - High V - Very High

<sup>†</sup>Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

## TEST BORING REPORT

Boring No. A4

File No. 130771-002

Sheet No. 2 of 3

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION  (Color, GROUP NAME, max. particle size <sup>†</sup> , structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel		Sand			% Fines	Field Test					
								% Coarse	% Fine	% Coarse	% Medium	% Fine		Dilatancy	Toughness	Plasticity	Strength		
20	2	S7 24	20.0 22.0	0.8	CL		Medium stiff olive brown lean CLAY (CL), mps < 0.1 mm, blocky structure, no odor, wet  PP 1.5 tsf						100	N	H	H	V		
	2																		
	3																		
	4	S8 10	22.0 24.0	0.3	CL		Medium stiff olive gray lean CLAY (CL), mps 2.8 cm as single coarse gravel piece, no odor, wet  PP 1.2 tsf  -MARINE DEPOSITS-	5					95	N	M	H	V		
3																			
2																			
25																			
30	2	S9 24	29.0 31.0	0.3	CL		Soft olive gray lean CLAY (CL), mps < 0.1 mm, no structure, no odor, wet  PP 1.0 tsf						100	N	M	H	V		
	2																		
	3																		
35	1	S10 24	34.0 36.0	0.1	CL		Very soft olive gray lean CLAY (CL), mps < 0.1 mm, no structure, no odor, wet  PP <0.5 tsf						100	N	L	H	V		
	1																		
	3																		
40	1	S11 24	39.0 41.0	0.1	CL		Soft olive gray lean CLAY (CL), mps < 0.1 mm, no structure, no odor, wet  PP 0.8 tsf						100	N	L	H	V		
	1																		
	2																		
45	1	S12 24	44.0 46.0	0.2	CL		Similar to above, except very soft  PP 0.5 tsf						100	N	L	H	V		
	1/12																		
	1																		
						-37.4 47.0	Note: Change in drilling effort at 47.0 ft.												
	6	S13	49.0	0.2	CL		Stiff olive gray sandy lean CLAY (CL), mps 2.2 cm, no structure, no	5	10	15	10	60							

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley &amp; Aldrich, Inc.

Boring No. A4

6 Nov 17

G:\130771 - 1 BOYNTON YARDS\GINT\130771-002-TB.GPJ

HA-TB-CORE+WELL-09 W FENCE GDT

HA-LIB09-BOS.GLB HA-TB-CORE+WELL-09 W FENCE GDT HA-LIB09-BOS.GLB

H&amp;A-TEST BORING WITH PERM PID COLUMN

## TEST BORING REPORT

Boring No. A4

File No. 130771-002  
Sheet No. 3 of 3

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION  (Color, GROUP NAME, max. particle size <sup>†</sup> , structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel		Sand		Fines		Field Test			
								% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	Strength
50	8 5 9	12	51.0	0.0		-42.9 52.5	odor, wet										
							-MARINE DEPOSITS-										
							TOP OF WEATHERED BEDROCK 52.5 FT										
							-WEATHERED BEDROCK-										
55	21 22 17 100/2	S14 12	54.0 55.7				Dense light gray completely weathered rock, difficult to discern rock fabric										
							BOTTOM OF EXPLORATION 55.7 FT Note: Split spoon refusal at 55.7 ft.										

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley &amp; Aldrich, Inc.

Boring No. A4

## TEST BORING REPORT

Boring No. A6 (OW)

Project BOYNTON YARDS, SOMERVILLE, MA  
 Client DLJ REAL ESTATE CAPITAL PARTNERS  
 Contractor NORTHERN DRILL SERVICE, INC.

File No. 130771-002  
 Sheet No. 1 of 3  
 Start 14 August 2017  
 Finish 16 August 2017  
 Driller John Beirholm

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW NW	S	--	Rig Make & Model: Mobile Drill B57 Truck
Inside Diameter (in.)	4 - 3	1 3/8	--	Bit Type: Roller Bit
Hammer Weight (lb)	140	140	-	Drill Mud: None
Hammer Fall (in.)	30	30	-	Casing: HW Drive to 20.0 ft NW to 52.0 ft
				Hoist/Hammer: Winch Automatic Hammer
				PID Make & Model: MiniRAE 2000 10.6 eV

H&A Rep. S. Shay  
 Elevation 9.4 (est.)  
 Datum NAVD 88  
 Location See Plan

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	USCS Symbol	Well Diagram	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION  (Color, GROUP NAME, max. particle size <sup>†</sup> , structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel		Sand			Field Test				
									% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	Strength
0	6 13 19 24	S1 24	0.0 2.5		SM			Dense brown to gray brown and dark brown silty SAND (SM), mps 3.0 cm as trace coarse gravel, layers up to 4.0 in. thick, no odor, dry, trace brick		10	20	20	30	20				
	9 13 13 10	S2 24	2.5 5.0		SM			Similar to above, except medium dense layers 4.0 to 6.0 in. thick  -FILL-	5	5	15	20	20	35				
5	6 3 2 2	S3 10	5.0 7.0		SC		4.4 5.0	Loose yellow brown clayey SAND with gravel (SC), mps 2.0 cm, no structure, no odor, moist, disturbed  -COHESIVE FILL-	5	10	10	10	25	40				
	2 2 1 1	S4 8	7.0 9.0		SC			Similar to S3 above  Note: Used 3.0 in. diameter spoon 5.0 to 9.0 ft to recover sample volume. Color change at bottom of sample.	5	10	10	10	25	40				
10							0.4 9.0											
	2 2 3 2	S5 18	10.0 12.5		OL/ OH			Medium stiff gray ORGANIC SOIL (OL/OH), mps 1.0 mm, no structure, no odor, wet, 20% peat fibers throughout sample  -ORGANIC DEPOSITS-					5	95	N	L	M	
	2 1 1 1	S6 12	12.5 15.0		OL/ OH			Similar to S5 above, except very soft						100				
15	5 4 2 3	S7 24	15.0 17.5		SP		-5.6 15.0	Loose gray poorly graded SAND (SP), mps 4.0 mm, weakly stratified, slight organic odor, wet, trace shells, trace peat fibers  -ESTUARINE DEPOSITS-										
	4 4 6 7	S8 24	17.5 20.0		CL		-7.6 17.0	Stiff yellow brown lean CLAY (CL), mps < 0.1 mm, blocky, no odor, wet  -MARINE DEPOSITS-						100	N	M	H	V

Water Level Data						Sample ID		Well Diagram		Summary	
Date	Time	Elapsed Time (hr.)	Depth (ft) to:			O - Open End Rod T - Thin Wall Tube U - Undisturbed Sample S - Splitspoon Sample G - Geoprobe				Overburden (ft)	69.2
			Bottom of Casing	Bottom of Hole	Water					Rock Cored (ft)	-
8/16/17	0650	16.0	NW 52	64.6	14.0					Samples	S19
										Boring No. A6 (OW)	

Field Tests: Dilatancy: R - Rapid S - Slow N - None Plasticity: N - Nonplastic L - Low M - Medium H - High  
 Toughness: L - Low M - Medium H - High Dry Strength: N - None L - Low M - Medium H - High V - Very High

<sup>†</sup>Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

<b>Boring No.</b>	<b>A6 (OW)</b>
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H&A-TEST BORING WITH PERM PID COLUMN HA-LIB09-BOS.GLB HA-TB+CORE+WELL-09 W FENCE.GDT G:\130771 - 1 BOYNTON YARDS\GINT\130771-002-TB.GPJ 9 Nov 17

## TEST BORING REPORT

Boring No. A6 (OW)

File No. 130771-002  
Sheet No. 3 of 3

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	USCS Symbol	Well Diagram	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION  (Color, GROUP NAME, max. particle size <sup>†</sup> , structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel		Sand		% Fines	Field Test				
									% Coarse	% Fine	% Coarse	% Medium		% Fine	Dilatancy	Toughness	Plasticity	Strength
50	22 11 8	18	51.0					no structure, no odor, wet										
							-42.6 52.0	-GLACIOMARINE DEPOSITS- TOP OF WEATHERED BEDROCK 52.0 FT  Note: Abrupt change in drilling effort and effort to drive casing at 52.0 ft.										
	100/5	S16	54.0 54.4					Very dense light gray highly weathered rock, rock fabric present										
55								-WEATHERED BEDROCK-										
	100/5	S17 5	59.0 59.4					Very dense light gray highly weathered rock, rock fabric present										
60																		
	92 100/1	S18 7	64.0 64.6					Very dense light gray completely weathered rock, rock fabric, present, bedding apparent										
65																		
	100/2	S19 2	69.0 69.2				-59.8 69.2	Very dense gray highly weathered rock BOTTOM OF EXPLORATION 69.2 FT  Note: Split spoon refusal at 69.2 ft.  Note: PID readings not recorded due to instrument malfunction.										

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley &amp; Aldrich, Inc.

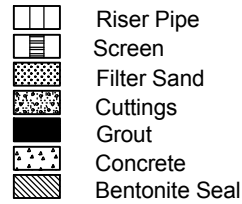
Boring No. A6 (OW)

GROUNDWATER OBSERVATION WELL  
INSTALLATION REPORT

Well No. A6 (OW)

Project BOYNTON YARDS  
 Location SOMERVILLE, MA  
 Client DLJ REAL ESTATE CAPITAL PARTNERS  
 Contractor NORTHERN DRILL SERVICE, INC.  
 Driller John Beirholm

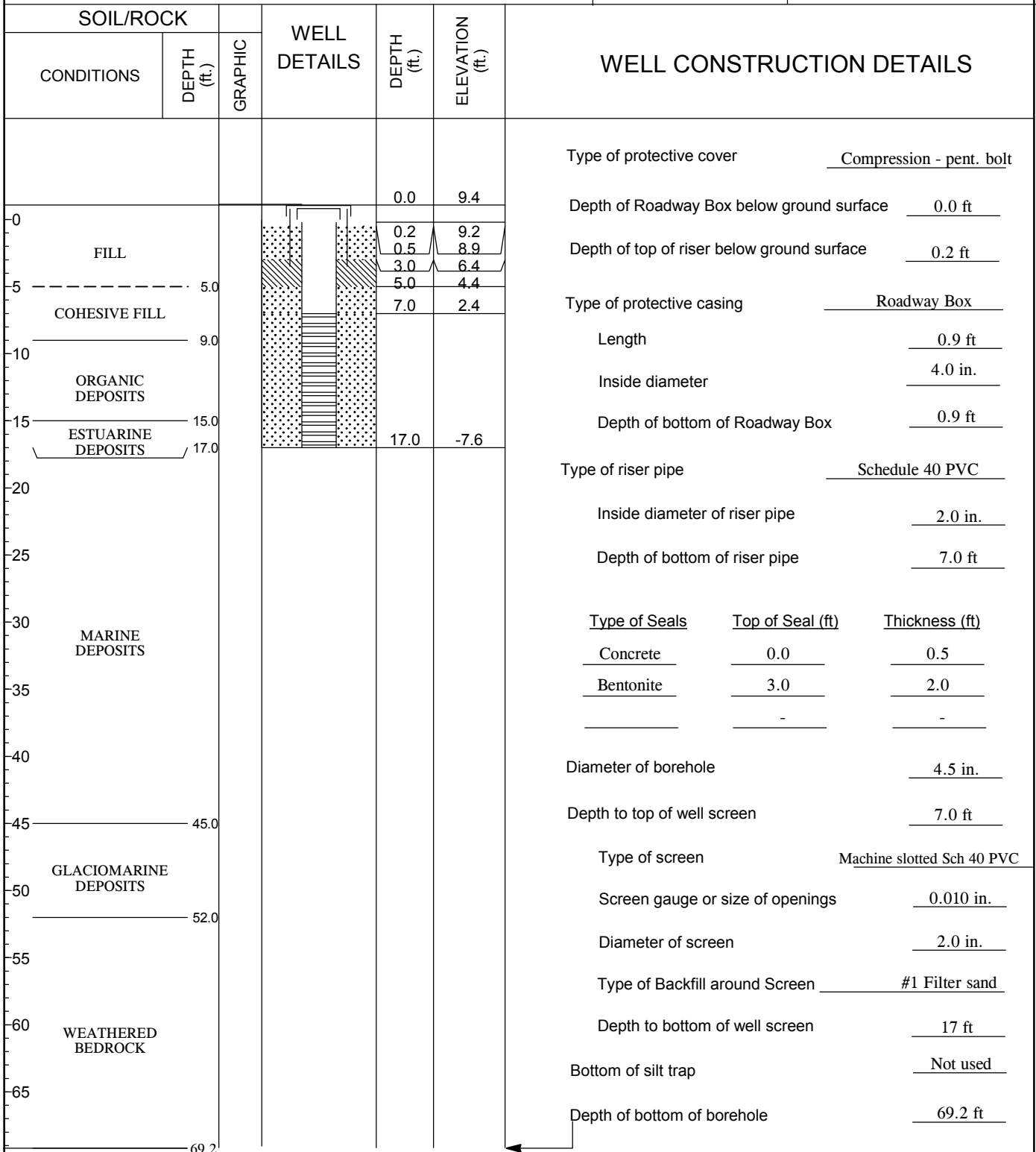
## Well Diagram



File No. 130771-002  
 Date Installed 16 Aug 2017  
 H&A Rep. S. Shay  
 Location See Plan

Ground El. 9.4 (est.)  
 Datum NAVD 88

Initial Water Level (depth bgs) 14.0 ft



COMMENTS:

## TEST BORING REPORT

Boring No. C6


Project BOYNTON YARDS, SOMERVILLE, MA  
 Client DLJ REAL ESTATE CAPITAL PARTNERS  
 Contractor NORTHERN DRILL SERVICE, INC.

File No. 130771-002  
 Sheet No. 1 of 1  
 Start 24 August 2017  
 Finish 24 August 2017  
 Driller Carl Beirholm  
 H&A Rep. S. Shay

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW	S	--	Rig Make & Model: Mobile Drill B57 Truck
Inside Diameter (in.)	4	1 3/8	--	Bit Type: Roller Bit
Hammer Weight (lb)	140	140	-	Drill Mud: None
Hammer Fall (in.)	30	30	-	Casing: HW Drive to 10.0 ft
				Hoist/Hammer: Winch Automatic Hammer
				PID Make & Model: MiniRAE 2000 10.6 eV

Elevation 9.9 (est.)  
 Datum NAVD 88  
 Location See Plan

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Color, GROUP NAME, max. particle size <sup>†</sup> , structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Field Test			
														Dilatancy	Toughness	Plasticity	Strength
0	16 13 10 13	S1 20	0.0 2.0		SM		Medium dense dark gray silty SAND (SM), mps 1.5 cm, no structure, no odor, dry, 5% brick particles	5	5	20	20	30	20				
	15 11 12 33	S2 18	2.0 4.0		SP	7.9 2.0	Medium dense yellow brown poorly graded SAND (SP), mps 6.0 mm, no structure, no odor, moist  -FILL-  Note: Drove 3.0 in. spoon to 5.0 ft to cover environmental interval.			10	10	35	45				
							Note: Recovered 2.0 in. coarse gravel. One extra attempt with 3.0 in. spoon at 5.0 to 7.0 ft no recovery.										
5	3 4 5 9	S3 2	5.0 7.0														
	8 10 8 5	S4 12	7.0 9.0	1.8	SP	2.9 7.0	S4 top 6.0 in.: Medium dense dark brown poorly graded SAND (SP), mps 1.0 mm, no structure, organic odor, wet, trace peat fiber				25	70	5				
				0.1	CL	1.9 8.0	-ESTUARINE DEPOSITS-  S4 bottom 6.0 in.: Stiff olive brown and olive gray lean CLAY (CL), mps < 0.5 mm, irregular coloring, no odor, wet, trace organic fibers						100				
10	9 12 17 21	S5 8	10.0 12.0	0.1	CL		Very stiff olive brown lean CLAY (CL), mps < 0.1 mm, no structure, no odor, wet						100	N	M	H	V
	3 5 7 8	S6 24	12.0 14.0	0.2	CL		Stiff olive brown lean CLAY (CL), mps < 0.1 mm, no structure, no odor, moist  PP 2.5 tsf  -MARINE DEPOSITS-						100				
15	2 4 4 4	S7 24	15.0 17.0	0.0	CL		Similar to above, medium stiff						100				
	4 5 4 3	S8 24	17.0 19.0	0.0	CL		Similar to above, stiff  PP 1.5 tsf  PP 1.0 tsf										
						-9.1 19.0	BOTTOM OF EXPLORATION 19.0 FT										

Water Level Data						Sample ID		Well Diagram		Summary	
Date	Time	Elapsed Time (hr.)	Depth (ft) to:			O - Open End Rod T - Thin Wall Tube U - Undisturbed Sample S - Splitspoon Sample G - Geoprobe				Overburden (ft)	19.0
			Bottom of Casing	Bottom of Hole	Water					Rock Cored (ft)	-
										Samples	S8
										Boring No. C6	

Field Tests: Dilatancy: R - Rapid S - Slow N - None Plasticity: N - Nonplastic L - Low M - Medium H - High  
 Toughness: L - Low M - Medium H - High Dry Strength: N - None L - Low M - Medium H - High V - Very High

<sup>†</sup>Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Project	BOYNTON YARDS, SOMERVILLE, MA
Client	DLJ REAL ESTATE CAPITAL PARTNERS
Contractor	NORTHERN DRILL SERVICE, INC.

File No. 130771-002  
Sheet No. 1 of 3  
Start 10 August 2017  
Finish 10 August 2017  
Driller John Beirholm

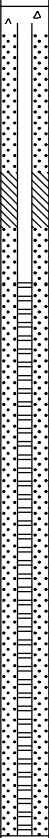

H&A Rep.	S. Shay
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Elevation	12.1 (est.)
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Datum	NAVD 88
Location	S. Bl.

Location	See Plan
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	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW NW	S	--	Rig Make & Model: Mobile Drill B57 Truck
Inside Diameter (in.)	4 - 3	1 3/8	--	Bit Type: Roller Bit
Hammer Weight (lb)	140	140	-	Drill Mud: None
Hammer Fall (in.)	30	30	-	Casing: HW Drive to 14.0 ft NW to 49.0 ft
				Hoist/Hammer: Winch Automatic Hammer
				PID Make & Model: MiniRAE 2000 10.6 eV

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	USCS Symbol	Well Diagram	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION  (Color, GROUP NAME, max. particle size <sup>†</sup> , structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel		Sand			Field Test				
									% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	Strength
0							11.9 0.2	-ASPHALT-  Dense yellow brown poorly graded SAND with gravel (SP), mps 3.0 cm, no structure, no odor, dry	5	15	15	35	25	5				
	12 23 19	S1 10	0.5 2.0		SP			S2 top 6.0 in.: Similar to above, except medium dense	10	10	15	35	30					
	16 10 8 11	S2 12	2.0 4.0	SP	9.1 3.0		-FILL- S2 bottom 6 in.: Medium dense black silty SAND (SM), mps 8.0 mm, no structure, no odor, moist, trace brick Loose white/gray/black 100% ash/cinders			10	20	35	35					
	5 3 2 2	S3 12	4.0 6.0	SM			Medium dense dark brown silty SAND (SM), 2.0 cm, no structure, no odor, wet, trace	5	5	10	10	40	30					
	3 6 7 4	S4 15	6.0 8.0	SM			-FILL-											
	4 4 5 5	S5 12	8.0 10.0	CL	4.1 8.0		Stiff yellow brown sandy lean CLAY (CL) mps 2.0 cm, no structure, no odor, moist		5	5	10	20	60					
							-COHESIVE FILL-											
10	2 2 2 1	S6 6	10.0 12.0	OL/ OH	2.1 10.0		Loose soft dark brown disturbed ORGANIC SOIL (OL/OH) with peat fibers  Note: No recovery first attempt used 3.0 in. diameter spoon for 6.0 recovery.											
	1 2 2 3	S7 24	12.0 14.0				-ORGANIC DEPOSITS-  No recovery											
								-0.9 13.0	Soft light olive gray ORGANIC SOIL (OL/OH), mps < 0.1 mm, no structure, no odor, moist, trace peat fibers					5	95			
					OL/ OH				-ORGANIC DEPOSITS-									
15								-5.4 17.5	-MARINE DEPOSITS-									
	1 1	S8 24	19.0 21.0		CL				Very soft olive gray lean CLAY (CL), mps < 0.1 mm, occasional silt partings, no odor, wet						100	N	L	H

Water Level Data						Sample ID	Well Diagram	Summary	
Date	Time	Elapsed Time (hr.)	Depth (ft) to:		Water	O - Open End Rod T - Thin Wall Tube U - Undisturbed Sample S - Splitspoon Sample G - Geoprobe		Riser Pipe	Overburden (ft) 60.2 Rock Cored (ft) - Samples \$16
			Bottom of Casing	Bottom of Hole				Screen	
8/10/17	1345	0.25	49	60.2	11.2			Filter Sand	
								Cuttings	
								Grout	
							Concrete	<b>Boring No.</b>	<b>E1 (OW)</b>
							Bentonite Seal		

<b>Field Tests:</b>	<b>Dilatancy:</b> R - Rapid S - Slow N - None <b>Toughness:</b> L - Low M - Medium H - High	<b>Plasticity:</b> N - Nonplastic L - Low M - Medium H - High <b>Dry Strength:</b> N - None L - Low M - Medium H - High V - Very High
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<sup>†</sup>Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

<b>Boring No.</b>	<b>E1 (OW)</b>
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H&A-TEST BORING WITH PERM PID COLUMN HA-LIB09-BOS.GLB HA-TB+CORE+WELL-09 W FENCE.GDT G:\130771 - 1 BOYNTON YARDS\GINT\130771-002-TB.GPJ 9 Nov 17

## TEST BORING REPORT

Boring No. E1 (OW)

File No. 130771-002

Sheet No. 3 of 3

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	USCS Symbol	Well Diagram	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION  (Color, GROUP NAME, max. particle size <sup>†</sup> , structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel		Sand		Fines		Field Test			
									% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	Strength
50	9 36 19	9	51.0					occasional irregular fine sandy silt pockets, no odor, moist										
								-GLACIOMARINE DEPOSITS-										
								TOP OF WEATHERED BEDROCK 54.0 FT										
55	12 16 15 16	S15 10	54.0 56.0				-41.9 54.0	Dense light gray completely weathered rock as residual soil										
								-WEATHERED BEDROCK-										
								Very dense light gray completely to severely weathered rock, rock fabric present, bedding plains apparent ARGILLITE										
60	28 54 100/2"	S16 12	59.0 60.2				-48.1 60.2	BOTTOM OF EXPLORATION 60.2 FT										
								Note: Split spoon refusal at 60.2 ft.										
								Note: PID reading not recorded due to instrument malfunction.										

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley &amp; Aldrich, Inc.

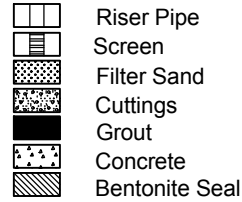
Boring No. E1 (OW)

GROUNDWATER OBSERVATION WELL  
INSTALLATION REPORT

Well No. E1 (OW)

Project BOYNTON YARDS  
 Location SOMERVILLE, MA  
 Client DLJ REAL ESTATE CAPITAL PARTNERS  
 Contractor NORTHERN DRILL SERVICE, INC.  
 Driller John Beirholm

## Well Diagram



File No. 130771-002  
 Date Installed 10 Aug 2017  
 H&A Rep. S. Shay  
 Location See Plan

Ground El. 12.1 (est.)  
 Datum NAVD 88

Initial Water Level (depth bgs) 11.2 ft

## SOIL/ROCK

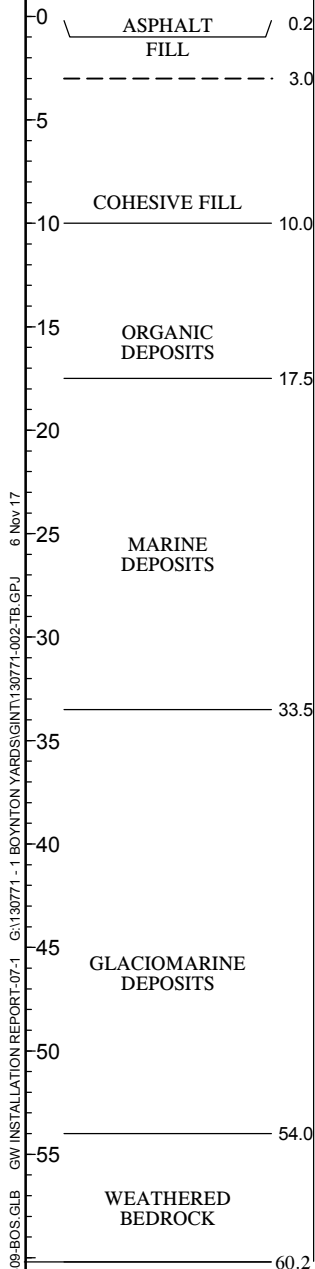
CONDITIONS

DEPTH  
(ft.)

GRAPHIC

WELL  
DETAILSDEPTH  
(ft.)ELEVATION  
(ft.)

## WELL CONSTRUCTION DETAILS



Type of protective cover Compression - pent. bolt

Depth of Roadway Box below ground surface 0.0 ft

Depth of top of riser below ground surface 0.3 ft

Type of protective casing Roadway Box

Length 0.9 ft

Inside diameter 4.0 in.

Depth of bottom of Roadway Box 0.9 ft

Type of riser pipe Schedule 40 PVC

Inside diameter of riser pipe 2.0 in.

Depth of bottom of riser pipe 5.0 ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Concrete	0.0	0.5
Bentonite	3.0	1.0
	-	-

Diameter of borehole 4.5 in.

Depth to top of well screen 5.0 ft

Type of screen Machine slotted Sch 40 PVC

Screen gauge or size of openings 0.010 in.

Diameter of screen 2.0 in.

Type of Backfill around Screen #1 Filter sand

Depth to bottom of well screen 15 ft

Bottom of silt trap Not used

Depth of bottom of borehole 60.2 ft

COMMENTS:

## TEST BORING REPORT

Boring No. E6 (OW)

Project BOYNTON YARDS, SOMERVILLE, MA  
 Client DLJ REAL ESTATE CAPITAL PARTNERS  
 Contractor NORTHERN DRILL SERVICE, INC.

File No. 130771-002  
 Sheet No. 1 of 3  
 Start 21 August 2017  
 Finish 23 August 2017  
 Driller Carl Beirholm  
 H&A Rep. S. Shay

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW	S	--	Rig Make & Model: Mobile Drill B57 Truck
Inside Diameter (in.)	4	1 3/8	--	Bit Type: Roller Bit
Hammer Weight (lb)	140	140	-	Drill Mud: None
Hammer Fall (in.)	30	30	-	Casing: HW Drive to 10.0 ft
				Hoist/Hammer: Winch Automatic Hammer
				PID Make & Model: MiniRAE 2000 10.6 eV

Elevation 10.9 (est.)  
 Datum NAVD 88  
 Location See Plan

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	USCS Symbol	Well Diagram	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION  (Color, GROUP NAME, max. particle size <sup>†</sup> , structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel		Sand			Field Test				
									% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	Strength
0	20 16 19 15	S1	0.0 2.5		SM			Dense black silty SAND with gravel (SM), mps 2.5 cm, no structure, no odor, dry, 5% cinders, trace concrete, trace brick	5	10	15	15	35	20				
	13 11 13 12	S2	2.5 5.0		SM			Similar to above, except 35% red brick pieces	5	10	15	15	35	20				
5	10 5 4 10	S3 4	5.0 7.0				2.4 8.5	Note: Used 3.0 in. diameter 0.0 to 5.0 ft to increase sample volume.  -FILL-										
	9 6 5 10	S4 18 S4A	7.0 8.0 8.0 9.0		SP-SM			Medium dense dark brown poorly graded SAND with silt (SP-SM), mps 2.0 mm, no structure, slight petroleum-like odor, wet, trace brick				20	70	10				
					CL			Soft stiff olive gray/yellow brown lean CLAY (CL)						100				
10	6 11 14 18	S5 24	10.0 12.0		CL			Very stiff olive brown lean CLAY (CL), mps < 0.1 mm, blocky, structure, no odor, moist  PP 4.5 tsf						100	N	H	M	V
	10 13 11 9	S6 24	12.0 14.0		CL			Similar to S5 above  PP 4.0 tsf  -MARINE DEPOSITS-  Note: 3.0 in spoon to 15.0 ft to recover environmental.						100	N	H	M	V
15	2 3 2 5	S7 24	15.0 17.0	0.1	CL			Medium stiff olive gray lean CLAY (CL), mps < 0.1 mm, no structure, no odor, wet  PP 1.5 tsf						100	N	M	H	V
	4 3 4 3	S8 19	17.0 19.0	0.1	CL			Similar to S7 above  PP 1.5 tsf  Note: 3.0 in. spoon to 20.0 ft to recover environmental sample.						100	N	M	H	V
20																		

Water Level Data						Sample ID		Well Diagram		Summary	
Date	Time	Elapsed Time (hr.)	Depth (ft) to:			O - Open End Rod T - Thin Wall Tube U - Undisturbed Sample S - Splitspoon Sample G - Geoprobe				Overburden (ft)	Rock Cored (ft)
			Bottom of Casing	Bottom of Hole	Water						
8/23/17	0650	40.0	10.0	15.0	5.7					59.2	-
8/24/17	0658	16.0	10.0	59.2	11.2						
										Samples S14	
										Boring No. E6 (OW)	

Field Tests: Dilatancy: R - Rapid S - Slow N - None Plasticity: N - Nonplastic L - Low M - Medium H - High  
 Toughness: L - Low M - Medium H - High Dry Strength: N - None L - Low M - Medium H - High V - Very High

<sup>†</sup>Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

<b>Boring No.</b>	<b>E6 (OW)</b>
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H&A-TEST BORING WITH PERM PID COLUMN HA-LIB09-BOS.GLB HA-TB+CORE+WELL-09 W FENCE.GDT G:\130771 - 1 BOYNTON YARDS\GINT\130771-002-TB.GPJ 6 Nov 17

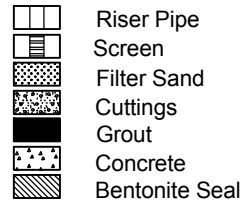
<b>Boring No.</b>	<b>E6 (OW)</b>
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GROUNDWATER OBSERVATION WELL  
INSTALLATION REPORT

Well No. E6 (OW)

Project BOYNTON YARDS  
 Location SOMERVILLE, MA  
 Client DLJ REAL ESTATE CAPITAL PARTNERS  
 Contractor NORTHERN DRILL SERVICE, INC.  
 Driller Carl Beirholm

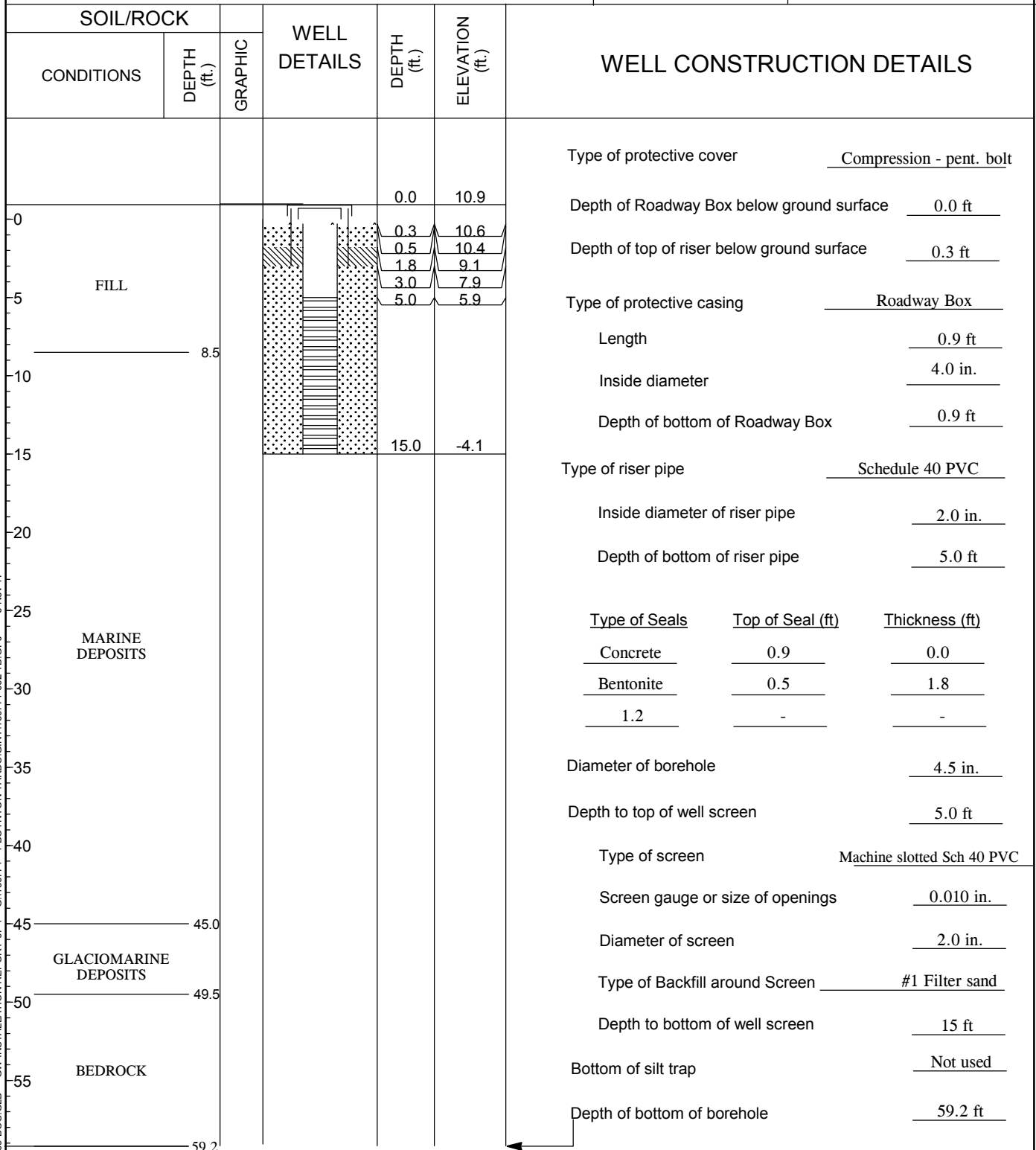
## Well Diagram



File No. 130771-002  
 Date Installed 23 Aug 2017  
 H&A Rep. S. Shay  
 Location See Plan

Ground El. 10.9 (est.)  
 Datum NAVD 88

Initial Water Level (depth bgs) 5.7 ft



COMMENTS:

## TEST BORING REPORT

Boring No. F4

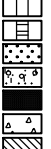
Project BOYNTON YARDS, SOMERVILLE, MA  
 Client DLJ REAL ESTATE CAPITAL PARTNERS  
 Contractor NORTHERN DRILL SERVICE, INC.

File No. 130771-002  
 Sheet No. 1 of 3  
 Start 16 August 2017  
 Finish 17 August 2017  
 Driller John Beirholm  
 H&A Rep. S. Shay

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW	S	--	Rig Make & Model: Mobile Drill B57 Truck
Inside Diameter (in.)	4	1 3/8	--	Bit Type: Roller Bit
Hammer Weight (lb)	140	140	-	Drill Mud: None
Hammer Fall (in.)	30	30	-	Casing: HW Drive to 15.0 ft
				Hoist/Hammer: Winch Automatic Hammer
				PID Make & Model: MiniRAE 2000 10.6 eV

Elevation 10.5 (est.)  
 Datum NAVD 88  
 Location See Plan

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION  (Color, GROUP NAME, max. particle size <sup>†</sup> , structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel		Sand			Field Test				
								% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	Strength
0	6 8 6 4	S1 24	0.0 2.5		SM		Medium dense brown to dark brown silty SAND with gravel (SM), mps 2.0 cm, no structure, no odor, dry, trace brick	10	15	10	15	25	25				
	4 3 2 3	S2 20	2.5 5.0		SM		Similar to above, except loose, occasional clayey pockets -FILL-	10	10	15	15	30	20				
5	10 4 6 6	S3 24	5.0 7.5		SC	5.5 5.0	Loose yellow brown clayey SAND with gravel (SC), mps 3.0 cm, no structure although appears to be disturbed										
	4 3 2 3	S4 18	7.5 10.0		SC		Similar to S3 above  -COHESIVE FILL-	10	10	10	15	20	35				
10	2 3 1 1	S5 24	10.0 12.5		OL/ OH	0.5 10.0	Soft gray sandy ORGANIC SOIL (OL/OH), mps 3.0 mm, frequent irregular peat pockets, slight organic odor, wet -ORGANIC DEPOSITS-				25	25	50				
	2 2 4 5	S6 24	12.5 15.0		OL/ OH		S6 top 10.0 in.: Soft gray ORGANIC SOIL with sand (OL/OH), mps 1.0 mm, no structure, no odor, wet					25	75				
15					CL	-3.5 14.0	S6 bottom 14.0 in.: Medium stiff olive brown lean CLAY (CL), mps < 0.1 mm, blocky structure, no odor, moist					5	95				
	2 2 3 2	S7 24	15.0 17.0	0.9	CL		Medium stiff olive brown lean CLAY (CL), mps < 0.1 mm, blocky structure, no odor, moist PP 1.5 tsf -MARINE DEPOSITS-					100	N	H	H	V	
	4 4 3 2	S8 24	17.0 19.0	0.6	CL		Medium stiff olive brown lean CLAY (CL), mps <0.1 mm, blocky structure, no odor, moist PP 0.3 tsf										
	1 1	S9 20	19.0 21.0	0.3	CL		Soft olive gray lean CLAY (CL), mps < 0.1 mm, no structure, no odor, wet					100	N	M	H	V	

Water Level Data						Sample ID		Well Diagram		Summary	
Date	Time	Elapsed Time (hr.)	Depth (ft) to:			O - Open End Rod T - Thin Wall Tube U - Undisturbed Sample S - Splitspoon Sample G - Geoprobe				Overburden (ft)	56.0
			Bottom of Casing	Bottom of Hole	Water					Rock Cored (ft)	
8/17/17	1235	0.5	15.0	56.0	6.1					Samples	S16
										Boring No. F4	

**Field Tests:** Dilatancy: R - Rapid S - Slow N - None Plasticity: N - Nonplastic L - Low M - Medium H - High  
 Toughness: L - Low M - Medium H - High Dry Strength: N - None L - Low M - Medium H - High V - Very High

<sup>†</sup>Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No.	F4
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H&amp;A-TEST BORING WITH PERM PID COLUMN H

## TEST BORING REPORT

Boring No. F4

File No. 130771-002  
Sheet No. 3 of 3

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION  (Color, GROUP NAME, max. particle size <sup>†</sup> , structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel		Sand		% Fines	Field Test				
								% Coarse	% Fine	% Coarse	% Medium		% Fine	Dilatancy	Toughness	Plasticity	Strength
50	6 8 9	18	51.0				odor, wet										
55	19 32 36 41	S16 12	54.0 56.0			-43.3 53.8	Note: Abrupt change in drilling effort at 53.8 ft. Very dense light gray completely weathered rock, rock fabric present										
						-45.5 56.0	BOTTOM OF EXPLORATION 56.0 FT										

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley &amp; Aldrich, Inc.

Boring No. F4

## TEST BORING REPORT

Boring No. G3

Project BOYNTON YARDS, SOMERVILLE, MA  
 Client DLJ REAL ESTATE CAPITAL PARTNERS  
 Contractor NORTHERN DRILL SERVICE, INC.

File No. 130771-002  
 Sheet No. 1 of 3  
 Start 11 August 2017  
 Finish 14 August 2017  
 Driller John Beirholm  
 H&A Rep. S. Shay

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW NW	S	--	Rig Make & Model: Mobile Drill B57 Truck
Inside Diameter (in.)	4 - 3	1 3/8	--	Bit Type: Roller Bit
Hammer Weight (lb)	140	140	-	Drill Mud: None
Hammer Fall (in.)	30	30	-	Casing: HW Drive to 14.0 ft NW to 52.0 ft
				Hoist/Hammer: Winch Automatic Hammer
				PID Make & Model: MiniRAE 2000 10.6 eV

Elevation 11.4 (est.)  
 Datum NAVD 88  
 Location See Plan

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Color, GROUP NAME, max. particle size <sup>†</sup> , structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Field Test			
														Dilatancy	Toughness	Plasticity	Strength
0						11.2	-ASPHALT-										
	8	S1	0.5		SP	0.2	Medium dense yellow brown poorly graded SAND (SP), mps 9.0 mm, no structure, no odor, dry	10	10	60	15	5					
	6	10	2.0														
	9																
	6	S2	2.0		SM		Medium dense black silty SAND (SM), mps 2.5 mm, no structure, no odor, moist, trace ash and cinders, trace brick	5	5	20	20	30	20				
	7	14	4.0														
	9																
	9																
	5	S3	4.0				Loose white/gray/black ash and cinders, trace glass										
	4	10	6.0														
	2						-FILL-										
	4																
	8	S4	6.0		CL	5.4	Soft yellow brown sandy lean CLAY (CL), mps 2.5 cm, no structure, no odor, moist	5	5	10	10	20	50				
	5	9	8.0			6.0											
	4						-COHESIVE FILL-										
	7																
	2	S5	8.0		SP/ML		Loose soft dark gray SILT/SAND mix (SP/ML), mps 1.5 cm, no structure, no odor, wet				25	25	50				
	2	9	10.0														
	2																
	2																
10	2	S6	10.0		OL/OH	1.4	Soft gray with black staining sandy ORGANIC SOIL (OL/OH), mps 8.0 mm, appears to be disturbed, no odor, wet, trace gravel				5	20	75				
	2	12	12.0			10.0											
	2						-ORGANIC DEPOSITS-										
	2																
	4	S7	12.0		CL	-0.6	Medium stiff olive brown lean CLAY (CL), mps < 0.1 mm, blocky structure, no odor, moist, pocket						100	N	H	H	V
	5	20	14.0			12.0											
	3						PP = 2.0 tsf										
	6																
	4	S8	14.0		CL		Similar to above						100	N	H	H	V
	4	24	16.0														
	4						PP = 1.4 tsf										
	3																
							-MARINE DEPOSITS-										
	2	S9	19.0		CL		Soft olive brown lean CLAY (CL), mps < 0.1 mm, no structure, no odor, wet						100	N	L	H	V
	2	8	21.0														
20																	

Water Level Data						Sample ID		Well Diagram		Summary	
Date	Time	Elapsed Time (hr.)	Depth (ft) to:			O - Open End Rod	T - Thin Wall Tube	U - Undisturbed Sample	S - Splitspoon Sample	G - Geoprobe	Overburden (ft)
			Bottom of Casing	Bottom of Hole	Water						
8/14/17	0708	64.0	14.0	41.0	9.5						54.5
											Rock Cored (ft)
											-
											Samples
											S16
										Boring No. G3	

Field Tests: Dilatancy: R - Rapid S - Slow N - None Plasticity: N - Nonplastic L - Low M - Medium H - High  
 Toughness: L - Low M - Medium H - High Dry Strength: N - None L - Low M - Medium H - High V - Very High

<sup>†</sup>Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No.	G3
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H&A-TEST BORING WITH PERM PID COLUMN HA-LIB09-BOS.GLB HA-TB+CORE+WELL-09 W FENCE.GDT G:\130771 - 1 BOYNTON YARDS\GINT\130771-002-TB.GPJ 9 Nov 17

## TEST BORING REPORT

Boring No. G3

File No. 130771-002

Sheet No. 3 of 3

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION  (Color, GROUP NAME, max. particle size <sup>†</sup> , structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel		Sand		% Fines		Field Test			
								% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	Strength
50	18 24 29	15	51.0				structure, no odor, wet										
							-GLACIOMARINE DEPOSITS-										
						-40.6 52.0	Note: Abrupt change in drilling effort at 52.0 ft.										
	100	S16 2	54.0 54.5		GP- GC	-43.1 54.5	Very dense gray poorly graded GRAVEL with clay and sand (GP-GC), mps 2.5 cm, no structure, no odor, wet BOTTOM OF EXPLORATION 54.5 FT Note: Split spoon refusal at 54.5 ft. Note: PID readings not recorded due to instrument malfunction.	15	65	5	5	10					

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley &amp; Aldrich, Inc.

Boring No. G3

## TEST BORING REPORT

Boring No. HA17-1


Project BOYNTON YARDS, SOMERVILLE, MA  
 Client DLJ REAL ESTATE CAPITAL PARTNERS  
 Contractor NORTHERN DRILL SERVICE, INC.

File No. 130771-002  
 Sheet No. 1 of 3  
 Start 29 August 2017  
 Finish 29 August 2017  
 Driller Carl Beirholm

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW	S	--	Rig Make & Model: Mobile Drill B57 Truck
Inside Diameter (in.)	4	1 3/8	--	Bit Type: Roller Bit
Hammer Weight (lb)	140	140	-	Drill Mud: None
Hammer Fall (in.)	30	30	-	Casing: HW Drive to 10.0 ft
				Hoist/Hammer: Winch Automatic Hammer
				PID Make & Model: MiniRAE 2000 10.6 eV

H&A Rep. S. Shay  
 Elevation 8.9 (est.)  
 Datum NAVD 88  
 Location See Plan

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION  (Color, GROUP NAME, max. particle size <sup>†</sup> , structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel		Sand		% Fines	Field Test				
								% Coarse	% Fine	% Coarse	% Medium		% Fine	Dilatancy	Toughness	Plasticity	Strength
0						8.7 0.2	-ASPHALT-  Medium dense black silty SAND with gravel (SM), mps 3.0 cm, semi-cemented, platy structure, no odor dry, 5-10% cinders, trace brick, trace fibers	10	10	10	15	25	30				
	24 14 12 19	S1 18	0.5 3.0		SM		Similar to above, except dense	10	10	10	15	25	30				
	20 25 19 18	S2 24	2.5 5.0		SM		-FILL-  Note: 30.0 in. drive to reach environmental target depth.										
5	5 5 5 6	S3 20	5.0 7.0	0.9	SC/ CL	3.9 5.0	Loose olive brown clayey SAND (SC) with lean CLAY mixed (CL), mps 3.0 cm, disturbed, no odor, wet, trace shells, trace brick	5	5	10	10	20	50				
	9 6 3 3	S4 18	7.0 9.0	0.9	SC/ SM		Loose gray to black clayey SAND (SC) with silty SAND (SM), disturbed, slight petroleum-like odor, bottom of sample (black)  -COHESIVE FILL-  S5: Top 4.0 in.: Similar to above		10	10	15	25	40				
10	3 3 3 2	S5 14	9.0 11.0	0.8			S5 bottom 10.0 in.: Medium stiff dark brown ORGANIC SOIL (OL/OH), smooth texture, organic odor, wet						100				
	5 5 4 4	S6 10	11.0 13.0		SP	-2.1 11.0	-ORGANIC DEPOSITS-  Loose gray poorly graded SAND (SP), mps 1.5 cm, no structure, no odor, wet  -ESTUARINE DEPOSITS-  Loose gray poorly graded SAND with gravel (SP), mps 2.0 cm, no structure, no odor, wet		10	25	35	25	5				
15	2 3 4 7	S7 11	13.0 15.0	0.5	SP												
	10 2 3 2	S8 10	15.0 17.0	0.6	CL	-6.6 15.5	Note: Change in effort to drive split spoon at 15.5 ft. S8: Medium stiff olive brown lean CLAY (CL), mps < 0.1 mm, blocky structure, no odor, moist						100	N	M	H	V
	2 2 3 4	S9 19	17.0 19.0	0.5	CL		Similar to S8 above  PP 1.5 tsf  -MARINE DEPOSITS-  Medium stiff olive gray lean CLAY (CL), mps < 0.1 mm, no structure, no odor, wet						100	N	M	H	V
20				0.0	CL								100				

Water Level Data						Sample ID		Well Diagram		Summary	
Date	Time	Elapsed Time (hr.)	Depth (ft) to:			O - Open End Rod T - Thin Wall Tube U - Undisturbed Sample S - Split spoon Sample G - Geoprobe				Overburden (ft)	64.9
			Bottom of Casing	Bottom of Hole	Water						
8/29/17	0708	16.0	NW 54.0	54.0	5.5					Rock Cored (ft)	
8/29/17	0915	0.25	59.0	64.9	11.5					Samples	S19
										Boring No. HA17-1	

Field Tests: Dilatancy: R - Rapid S - Slow N - None Plasticity: N - Nonplastic L - Low M - Medium H - High  
 Toughness: L - Low M - Medium H - High Dry Strength: N - None L - Low M - Medium H - High V - Very High

<sup>†</sup>Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

## TEST BORING REPORT

Boring No. HA17-1

File No. 130771-002

Sheet No. 2 of 3

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Color, GROUP NAME, max. particle size <sup>†</sup> , structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel		Sand		Fines		Field Test			
								% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	Strength
20							PP 1.3 tsf										
	1 3 4 3	S10 24	21.0 23.0				-MARINE DEPOSITS-										
	1 1 2 2	S11 24	24.0 26.0	0.0	CL		Soft olive gray lean CLAY (CL), mps < 0.1 mm, no structure, no odor, wet						100	N	L	H	V
25							PP 0.8 tsf										
	1 1 1 2	S12 24	29.0 31.0	0.0	CL		Similar to above, very soft						100	N	L	H	V
30							PP 0.3 tsf										
	1 1 1 2	S13 24	34.0 36.0	0.0	CL		Very soft olive gray lean CLAY (CL), mps < 0.1 mm, no structure, no odor, wet						100	N	L	H	V
35							PP 0.5 tsf										
	1 2 2 3	S14 24	39.0 41.0	0.1	CL		Similar to above, except soft						100	N	L	H	V
40							PP 0.75 tsf										
	1 1 3 7	S15 24	44.0 46.0		CL		Soft olive gray lean CLAY with sand (CL), mps 1.0 cm, no odor, wet, sand and rounded gravel confined to bottom 6.0 in. of sample	5	5	5	5	10	75				
45																	
						-38.1 47.0	Note: Intermittent chatter 47.0 to 48.0 ft indicates strata change.										
							-GLACIOFLUVIAL DEPOSITS-										
	5	S16	49.0	0.0	GP		Medium dense gray poorly graded GRAVEL (GP), mps 2.5 cm, no	20	65	5	5	5					

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley &amp; Aldrich, Inc.

Boring No. HA17-1

6 Nov 17

H&amp;A-TEST BORING WITH PERM PID COLUMN HA-LIB09-BOS.GLB HA-TB-CORE+WELL-09 W FENCE GDT G:130771 - 1 BOYNTON YARDS GINT130771-002-TB.GPJ

## TEST BORING REPORT

Boring No. HA17-1

File No. 130771-002

Sheet No. 3 of 3

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION  (Color, GROUP NAME, max. particle size <sup>†</sup> , structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel		Sand				Field Test			
								% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	Strength
50	15 15 17	8	51.0	0.0	SM	-43.6 52.5	structure although gravel rounded, no odor, wet										
							-GLACIOFLUVIAL DEPOSITS-										
55	13 19 17 14	S17 10	54.0 56.0				Dense gray silty SAND with gravel (SM), mps 1.5 cm, moderately well bonded, no odor, moist	15	15	20	20	30					
							-GLACIOMARINE DEPOSITS-										
							Note: Abrupt change in effort to drive casing at 57.5 ft.										
60	14 15 17 50	S18 16	59.0 61.0		SM	-51.6 60.5	S18 top 10.0 in.: Dense gray silty SAND (SM), mps 8.0 mm as trace fine gravel, no structure, no odor, wet TOP OF WEATHERED BEDROCK 60.5 FT										
	72 120/5	S19	61.0 63.0				S18 bottom 6.0 in.: Very dense light gray completely weathered rock, difficult to discern rock fabric excel in split spoon tip S19: Very dense light gray/white completely weathered rock, approaching residual soil, rock fabric present in split spoon in tip										
							-WEATHERED BEDROCK-										
						-56.0 64.9	BOTTOM OF EXPLORATION 64.9 FT										
							Note: Split spoon refusal at 64.9 ft.										

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley &amp; Aldrich, Inc.

Boring No. HA17-1

## TEST BORING REPORT

Boring No. HA17-2


Project BOYNTON YARDS, SOMERVILLE, MA  
 Client DLJ REAL ESTATE CAPITAL PARTNERS  
 Contractor NORTHERN DRILL SERVICE, INC.

File No. 130771-002  
 Sheet No. 1 of 3  
 Start 25 August 2017  
 Finish 28 August 2017  
 Driller Carl Beirholm  
 H&A Rep. S. Shay

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW NW	S	--	Rig Make & Model: Mobile Drill B57 Truck
Inside Diameter (in.)	4 - 3	1 3/8	--	Bit Type: Roller Bit
Hammer Weight (lb)	140	140	-	Drill Mud: None
Hammer Fall (in.)	30	30	-	Casing: HW Drive to 14.0 ft NW to 49.0 ft
				Hoist/Hammer: Winch Automatic Hammer
				PID Make & Model: MiniRAE 2000 10.6 eV

Elevation 9.7 (est.)  
 Datum NAVD 88  
 Location See Plan

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Color, GROUP NAME, max. particle size <sup>†</sup> , structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Field Test			
														Dilatancy	Toughness	Plasticity	Strength
0						9.5	-ASPHALT-										
9	S1	0.5			SM/SP	0.2	Medium dense brown/gray/gray brown multi layered sand/silty sand (SM/SP), layers up to 8.0 in. thick										
7	20	2.5															
7																	
13																	
16	S2	2.5		0.4	SM/SC		Medium dense brown silty with clayey SAND mix (SM/SC), mps 2.0 cm, no structure, no odor, wet, trace brick	5	5	15	25	50					
10	24	5.0															
10																	
8																	
5	S3	5.0		0.5	SM/SC		Similar to S2 above, except loose	5	5	15	25	50					
4	24	7.0															
3																	
4																	
4	S4	7.0			SM/SC		Similar to above	5	5	15	25	50					
4	12	9.0															
3																	
2																	
2	S5	9.0			OL/OH	0.7	Loose dark brown disturbed ORGANIC SOIL with sand (OL/OH)			10	15	75					
5	15	11.0				9.0											
10							-ORGANIC DEPOSITS-										
1	S6	11.0					S6 top 5.0 in.: Wood/wood fibers										
2	10	13.0															
1																	
1	S7	13.0			OL/OH	-2.3	S6 bottom 5.0 in.: Soft dark brown ORGANIC SOIL (OL/OH), mps 4.0 mm, no structure, no odor, wet					10	90				
2	24	15.0				12.0											
2																	
2																	
15	S8	15.0		1.6	CL	-5.3	Stiff olive brown lean CLAY (CL), mps < 0.1 mm, blocky structure, no odor, moist						100	N	M	H	V
4	24	17.0				15.0											
5				2.0			PP 4.0 tsf										
6																	
6	S9	17.0		0.7	CL		Stiff olive brown lean CLAY (CL), mps < 0.1 mm, blocky structure, no odor, moist						100	N	M	H	V
6	24	19.0															
5							PP 1.5 tsf										
4																	
1	S10	19.0		0.2	CL		Soft olive gray lean CLAY (CL), < 0.1 mm, no structure, no odor, wet						100	N	L	H	V
1	19	21.0															
20																	

Water Level Data						Sample ID		Well Diagram		Summary	
Date	Time	Elapsed Time (hr.)	Depth (ft) to:			O - Open End Rod T - Thin Wall Tube U - Undisturbed Sample S - Splitspoon Sample G - Geoprobe				Overburden (ft)	50.5
			Bottom of Casing	Bottom of Hole	Water						
8/25/17	1420	10.0	NW 43.0	50.5	10.9					Rock Cored (ft)	-
8/28/17	0652	64.0	NW 43.0	50.5	10.1					Samples	S17
										Boring No. HA17-2	

Field Tests: Dilatancy: R - Rapid S - Slow N - None Plasticity: N - Nonplastic L - Low M - Medium H - High  
 Toughness: L - Low M - Medium H - High Dry Strength: N - None L - Low M - Medium H - High V - Very High

<sup>†</sup>Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.



## TEST BORING REPORT

Boring No. HA17-2

File No. 130771-002

Sheet No. 3 of 3

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION  (Color, GROUP NAME, max. particle size <sup>†</sup> , structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel		Sand				Field Test			
								% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	Strength
50	51 120	9	50.5			-40.8 50.5	-WEATHERED BEDROCK- BOTTOM OF EXPLORATION 50.5 FT Note: Split spoon refusal at 50.5 ft.										

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley &amp; Aldrich, Inc.

Boring No. HA17-2

Project	BOYNTON YARDS, SOMERVILLE, MA
Client	DLJ REAL ESTATE CAPITAL PARTNERS
Contractor	NORTHERN DRILL SERVICE, INC.

File No. 130771-002  
Sheet No. 1 of 3  
Start 29 August 2017  
Finish 1 September 2017  
Driller Carl Beirholm

H&amp;A Rep. S. Shay

Elevation	10.0 (est.)
Datum	NAVD 88

Location	See Plan
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[illegible]

Water Level Data						Sample ID	Well Diagram	Summary
Date	Time	Elapsed Time (hr.)	Depth (ft) to:			O - Open End Rod T - Thin Wall Tube U - Undisturbed Sample S - Splitspoon Sample G - Geoprobe	<div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div><div><div></div><div></div><div></div></div></div> <div>Riser Pipe Screen Filter Sand Cuttings Grout Concrete Bentonite Seal</div>	Overburden (ft) 53 Rock Cored (ft) 9 Samples S13, C2
			Bottom of Casing	Bottom of Hole	Water			
9/1/17	0705	16.0	NW 42.5	44.0	9.2			

<b>Field Tests:</b>	<b>Dilatancy:</b> R - Rapid S - Slow N - None	<b>Plasticity:</b> N - Nonplastic L - Low M - Medium H - High
	<b>Toughness:</b> L - Low M - Medium H - High	<b>Dry Strength:</b> N - None L - Low M - Medium H - High V - Very High

<sup>†</sup> Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

<b>Boring No.</b>	<b>HA17-3 (OW)</b>
-------------------	--------------------

H&A-TEST BORING WITH PERM PID COLUMN HA-LIB09-BOS.GLB HA-TB+CORE+WELL-09 W FENCE.GDT G:\130771 - 1 BOYNTON YARDS\GINT\130771-002-TB.GPJ 9 Nov 17

## CORE BORING REPORT

Boring No. HA17-3 (OW)

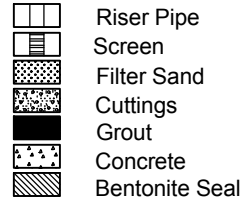
File No. 130771-002

Sheet No. 3 of 3

Depth (ft)	Drilling Rate (min./ft)	Run No.	Run Depth (ft)	Recovery/RQD		Weath- ering	Well Dia- gram	Elev./ Depth (ft)	Visual Description and Remarks
				in.	%				
45	4	C1	44.0 49.0	60 44	100.0 73.3	Fresh			SEE TEST BORING REPORT FOR OVERBURDEN DETAILS
	3					Slight			C1: Very hard fresh to slightly weathered gray aphanitic to fine grained DIABASE. Bedding not apparent. Joints dipping at low to moderate angles, close to moderate, stepped to planar, discolored, open. Extremely thin to very thin secondary mineralization in irregular stringers minimal water loss after 46.0 ft within gray, silty wash water return.
	4								
	3								
	3					Fresh			-BEDROCK-
4	C2	49.0 53.0	48 47	100.0 97.9	Fresh	C2: Recovered bottom 1.0 ft of C1. Very hard fresh, gray, aphanitic to fine grained DIABASE. Similar to above, minimal water loss. Core barrel jammed at 53.0 ft.			
4									
4									
4									
50	4					Fresh	-43.0 53.0	BOTTOM OF EXPLORATION 53.0 FT	
55									
60									
65									
70									
75									

Project	BOYNTON YARDS
Location	SOMERVILLE, MA
Client	DLJ REAL ESTATE CAPITAL PARTNERS
Contractor	NORTHERN DRILL SERVICE, INC.
Driller	Carl Beirholm

## Well Diagram



File No. 130771-002  
Date Installed 1 Sep 2017  
H&A Rep. S. Shay  
Location See Plan

Ground El. 10.0 (est.)  
Datum NAVD 88

Initial Water Level (depth bgs) 9.2 ft

SOIL/ROCK		GRAPHIC	WELL DETAILS	DEPTH (ft.)	ELEVATION (ft.)	WELL CONSTRUCTION DETAILS	
CONDITIONS	DEPTH (ft.)						
				0.0	10.0	Type of protective cover	<u>Compression - pent. bolt</u>
0	ASPHALT	0.2		0.4	9.6	Depth of Roadway Box below ground surface	<u>0.0 ft</u>
				0.5	9.5	Depth of top of riser below ground surface	<u>0.4 ft</u>
				2.0	8.0		
				3.0	7.0		
5				4.5	5.5	Type of protective casing	<u>Roadway Box</u>
						Length	<u>0.9 ft</u>
						Inside diameter	<u>4.0 in.</u>
						Depth of bottom of Roadway Box	<u>0.9 ft</u>
10	FILL					Type of riser pipe	<u>Schedule 40 PVC</u>
				15.0	-5.0	Inside diameter of riser pipe	<u>2.0 in.</u>
15		14.0		17.0	-7.0	Depth of bottom of riser pipe	<u>5.0 ft</u>
20							
25	MARINE DEPOSITS					<u>Type of Seals</u>	<u>Top of Seal (ft)</u>
						<u>Concrete</u>	<u>0.0</u>
						<u>Bentonite</u>	<u>2.0</u>
						<u>Bentonite</u>	<u>17.0</u>
30							<u>Thickness (ft)</u>
							<u>0.5</u>
							<u>1.0</u>
							<u>18.0</u>
35		34.5		35.0	-25.0	Diameter of borehole	<u>4.5 in.</u>
		35.0				Depth to top of well screen	<u>5.0 ft</u>
40	WEATHERED BEDROCK					Type of screen	<u>Machine slotted Sch 40 PVC</u>
						Screen gauge or size of openings	<u>0.010 in.</u>
						Diameter of screen	<u>2.0 in.</u>
45						Type of Backfill around Screen	<u>#1 Filter sand</u>
						Depth to bottom of well screen	<u>15 ft</u>
50	BEDROCK					Bottom of silt trap	<u>Not used</u>
						Depth of bottom of borehole	<u>53.0 ft</u>
53.0							

COMMENTS:

HA-TP07-1 GDT G:\130771 - 1 BOYNTON YARDS\GINT\130771-002-TP-GPJ 6 Nov 17 HA-TP07-1 GDT HA-LIB09-BOS.GLB HA-TESTPIT-07-1

<div style="display: flex; justify-content: space-between; align-items: center;"> <div> <b>TEST PIT LOG</b> </div> <div> <b>Test Pit No.    A5-TP</b> </div> </div>														
<div style="display: flex; justify-content: space-between;"> <div style="width: 65%;"> <b>Project</b>      BOYNTON YARDS  <b>Location</b>    SOMERVILLE, MASSACHUSETTS  <b>Client</b>       DLJ REAL ESTATE CAPITAL PARTNERS  <b>Contractor</b>   EARTH EXPLORATIONS, INC.  <b>Equipment Used</b>   Bobcat E45                 </div> <div style="width: 30%;"> <b>File No.</b>        130771-002  <b>H&amp;A Rep</b>       M. Dodson  <b>Date</b>            14 Aug 2017  <b>Weather</b>        Sunny, 70s                 </div> </div>														
<b>Ground El.:</b> 9.5 (est.) <b>El. Datum:</b> NAVD 88		<b>Location:</b> See Plan		<b>Groundwater depths/entry rates (in./min.):</b> Seepage from approximately 6.0 ft										
Depth (ft)	Sample ID	Stratum Change Elev./Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION <small>(color, natural grain size and artificial component percentage estimates, maximum particle size, manual test properties, structure, odors, moisture, other descriptions and observations GEOLOGIC INTERPRETATION)</small>	Gravel		Sand			Field Tests				
					% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	Strength
0	0.0 - 5.0	9.3	SM	-BITUMINOUS CONCRETE- PID = ND	15	20	10	15	25	15				
0.2		Gray brown silty sand with gravel (SM), no oversized, mps 6 in., no structure, no odor, moist to dry, trace plastic trash												
8.7		SM	Dark gray brown silty SAND with gravel (SM), no oversized, mps 10 in., no structure, no odor, moist, 5% brick, concrete, mortar, trace ash, cinders	10	10	15	20	25	20					
0.8														
2		7.7	GW-GM	Light gray well graded GRAVEL with silt and sand (GW-GM) -FILL- PID = ND	20	30	15	10	15	10				
1.8	7.0													
4	5.0 - 6.5	2.5	SM	Dark gray silty SAND with gravel (SM), trace oversized, mps 1.5 in., no structure, no odor, moist, 15% rubble (primarily brick and concrete), trace plastic (plastic bags and poly), trace wood, glass, steel scrap	10	15	15	10	25	25				
6		4.5	SM/SC	Note: Stratum change varies between 4.5 and 5.0 ft. PID = ND										
		5.0												
8	6.5 - 8.5	3.0	OL/OH	-COHESIVE FILL- Note: Stratum change varies between 6.0 and 6.5 ft. PID = ND						100				
8		6.5		Olive gray to gray to black ORGANIC SOIL (OL/OH), organic odor, wet, 5-10% organic fibers, top foot appears disturbed (possibly from fill placement above), layered below approximately 6.5-7.0 ft -ORGANIC DEPOSITS-										
		1.0		Note: PEAT/ORGANIC SOIL from 7.5-8.0 ft. Olive gray sandy ORGANIC SOIL from 8.0-8.5 ft.										
		8.5		BOTTOM OF EXCAVATION 8.5 FT										
<b>Obstructions:</b> None			<b>Remarks:</b>		<b>Field Tests</b> Dilatancy            R - Rapid    S - Slow    N - None Toughness            L - Low    M - Medium    H - High Plasticity            N - Nonplastic    L - Low    M - Medium    H - High Dry Strength    N - None    L - Low    M - Medium    H - High    V - Very High									
<b>Standing Water in Completed Pit</b> at depth            Dry            ft measured after            hours elapsed				<b>Boulders</b> Diameter (in.)    Number    Approx. Vol. (cu.ft) 12 to 24            3            =        3 over 24            -            =        -			<b>Test Pit Dimensions (ft)</b> Pit Length x Width (ft)    9 x 3 Pit Depth (ft)                8.5							
NOTE: Soil identification based on visual-manual methods of the USCS system as practiced by Haley & Aldrich, Inc.														

HA-TESTPIT-07-1 HA-LIB09-BOS.GLB HA-TP07-1.GDT G:\130771 - 1 BOYNTON YARDS\GINT\130771-002-TP.GPJ 6 Nov 17

<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="text-align: left;"> </div> <div style="text-align: center;"> <h1 style="margin: 0;">TEST PIT LOG</h1> </div> <div style="text-align: right;"> <b>Test Pit No.    B5-TP</b> </div> </div>														
<div style="display: flex; justify-content: space-between;"> <div style="width: 65%;"> <b>Project</b>      BOYNTON YARDS  <b>Location</b>    SOMERVILLE, MASSACHUSETTS  <b>Client</b>       DLJ REAL ESTATE CAPITAL PARTNERS  <b>Contractor</b>   EARTH EXPLORATIONS, INC.  <b>Equipment Used</b>    Bobcat E45             </div> <div style="width: 30%;"> <b>File No.</b>        130771-002  <b>H&amp;A Rep</b>       M. Dodson  <b>Date</b>            14 Aug 2017  <b>Weather</b>        Sunny, 80s             </div> </div>														
<b>Ground El.:</b> 9.9 (est.) <b>El. Datum:</b> NAVD 88		<b>Location:</b> See Plan		<b>Groundwater depths/entry rates (in./min.):</b> Seepage below approximately 6.5 ft										
Depth (ft)	Sample ID	Stratum Change Elev./Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION <small>(color, natural grain size and artificial component percentage estimates, maximum particle size, manual test properties, structure, odors, moisture, other descriptions and observations GEOLOGIC INTERPRETATION)</small>	Gravel		Sand			Field Tests				
					% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	Strength
0	0.0 - 4.5	9.2	SM	Light gray brown to dark gray brown silty SAND with gravel (SM), no oversized, mps 3.0 in., no structure, no odor, moist <div style="text-align: right;">PID = ND</div>	15	25	15	15	15	15				
0.7		SM	Gray brown silty SAND with gravel (SM), no oversized, mps 11.0 in., no structure, no odor, moist, 5% brick/concrete/mortar fragments, trace cinders, ash, coal, porcelain, wood, asphalt, metal scrap	10	10	10	20	30	20					
2														
4														
4														
	4.5 - 7.0	5.4	SC	Light brown clayey SAND (SC), occasionally sandy lean CLAY (CL), no structure, no odor, moist, occasional brick particles, cinders, occasional pieces/fragments of light gray lean CLAY <div style="text-align: right;">PID = ND</div> -COHESIVE FILL-		5		10	25	60	N	L	L	
4.5														
6														
	7.0 - 9.0	3.9	GW	Red yellow to brown to dark gray well graded GRAVEL (GW) (cobbles), no structure, no odor, moist to wet below approximately 6.5 ft <div style="text-align: right;">-FILL-</div>										
6.0														
2.9		OL/OH	Dark gray to gray brown sandy ORGANIC SOIL (OL/OH), becoming less sandy with depth and mottled olive gray below approximately 8.0 ft, 10% peat fibers at 7.5-8.5 ft <div style="text-align: right;">PID = ND</div> -ORGANIC DEPOSITS-					35	65	N	L	L		
8		7.0												
	7.0 - 9.0													
0.9														
		9.0		BOTTOM OF EXPLORATION 9.0 FT										
<b>Obstructions:</b> None			<b>Remarks:</b>		<b>Field Tests</b> Dilatancy            R - Rapid    S - Slow    N - None Toughness            L - Low    M - Medium    H - High Plasticity            N - Nonplastic    L - Low    M - Medium    H - High Dry Strength    N - None    L - Low    M - Medium    H - High    V - Very High									
<b>Standing Water in Completed Pit</b> at depth            8.5            ft measured after    0.5            hours elapsed				<b>Boulders</b> Diameter (in.)    Number    Approx. Vol. (cu.ft) 12 to 24            -            =            - over 24            -            =            -			<b>Test Pit Dimensions (ft)</b> Pit Length x Width (ft) 9 x 3 Pit Depth (ft) 9.0							
NOTE: Soil identification based on visual-manual methods of the USCS system as practiced by Haley & Aldrich, Inc.														

HA-TESTPIT-07-1 HA-LIB09-BOS.GLB HA-TP07-1.GDT G:\130771 - 1 BOYNTON YARDS\GINT\130771-002-TP.GPJ 6 Nov 17

<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="text-align: left;"> </div> <div style="text-align: center; flex-grow: 1;"> <h1 style="margin: 0;">TEST PIT LOG</h1> </div> <div style="text-align: right;"> <b>Test Pit No.    D6-TP</b> </div> </div>														
<div style="display: flex; justify-content: space-between;"> <div style="width: 65%;"> <b>Project</b>    BOYNTON YARDS  <b>Location</b>    SOMERVILLE, MASSACHUSETTS  <b>Client</b>    DLJ REAL ESTATE CAPITAL PARTNERS  <b>Contractor</b>    EARTH EXPLORATIONS, INC.  <b>Equipment Used</b>    Bobcat E45             </div> <div style="width: 30%;"> <b>File No.</b>    130771-002  <b>H&amp;A Rep</b>    M. Dodson  <b>Date</b>    14 Aug 2017  <b>Weather</b>    Sun and clouds, 80s             </div> </div>														
<b>Ground El.:</b> 10.1 (est.) <b>El. Datum:</b> NAVD 88		<b>Location:</b> See Plan		<b>Groundwater depths/entry rates (in./min.):</b> Rapid from NE corner at approximately 6.0 ft										
Depth (ft)	Sample ID	Stratum Change Elev./Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION <small>(color, natural grain size and artificial component percentage estimates, maximum particle size, manual test properties, structure, odors, moisture, other descriptions and observations GEOLOGIC INTERPRETATION)</small>	Gravel		Sand			Field Tests				
					% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	Strength
0	0.0 - 5.0	9.2 0.9	SM	Gray brown silty SAND with gravel (SM), oversized, 10% brick and concrete fragments  PID = ND	10	25	20	15	15	15				
1				Similar to above except brown to gray brown and 15% porcelain, plastic, glass, ash, cinders, wood, metal scrap, asphalt pieces  PID = ND										
2														
3														
4														
5	5.0 - 6.5	4.6 5.5	SM	Dark gray silty SAND with gravel (SM), 10% oversized concrete pieces (especially at south edge of pit), 20% mussel shells, no odor, moist to wet, approximately 25% fine cinders, clinkers, ash intermixed -FILL- PID = ND										
6														
		3.6 6.5 6.8	CL	Note: Bottom of final bucket: olive gray brown mottled lean CLAY (CL) -POSSIBLE MARINE DEPOSITS- Note: Terminated test pit due to rapid water entry in northeast corner of pit at 5.5 ft.  BOTTOM OF EXCAVATION 6.8 FT										
<b>Obstructions:</b> Rubble			<b>Remarks:</b>		<b>Field Tests</b> Dilatancy    R - Rapid    S - Slow    N - None Toughness    L - Low    M - Medium    H - High Plasticity    N - Nonplastic    L - Low    M - Medium    H - High Dry Strength    N - None    L - Low    M - Medium    H - High    V - Very High									
<b>Standing Water in Completed Pit</b> at depth    5.5    ft measured after    0.1    hours elapsed				<b>Boulders</b> Diameter (in.)    Number    Approx. Vol. (cu.ft) 12 to 24    2    =    3 over 24    -    =    -			<b>Test Pit Dimensions (ft)</b> Pit Length x Width (ft)    8 x 3 Pit Depth (ft)    6.8							
<b>NOTE: Soil identification based on visual-manual methods of the USCS system as practiced by Haley &amp; Aldrich, Inc.</b>														

HA-TESTPIT-07-1 HA-LIB09-BOS.GLB HA-TP07-1.GDT G:\130771 - 1 BOYNTON YARDS\GINT\130771-002-TP.GPJ 6 Nov 17

<div style="display: flex; justify-content: space-between; align-items: center;"> <div> <b>TEST PIT LOG</b> </div> </div>						<b>Test Pit No. E4-TP</b>								
<div style="display: flex; justify-content: space-between;"> <div> <b>Project</b> BOYNTON YARDS  <b>Location</b> SOMERVILLE, MASSACHUSETTS  <b>Client</b> DLJ REAL ESTATE CAPITAL PARTNERS  <b>Contractor</b> EARTH EXPLORATIONS, INC.  <b>Equipment Used</b> Bobcat E45               </div> <div> <b>File No.</b> 130771-002  <b>H&amp;A Rep</b> M. Dodson  <b>Date</b> 14 Aug 2017  <b>Weather</b> Sun and clouds, 80s               </div> </div>														
<b>Ground El.:</b> 11.1 (est.) <b>El. Datum:</b> NAVD 88		<b>Location:</b> See Plan		<b>Groundwater depths/entry rates (in./min.):</b> None										
Depth (ft)	Sample ID	Stratum Change Elev./Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION <small>(color, natural grain size and artificial component percentage estimates, maximum particle size, manual test properties, structure, odors, moisture, other descriptions and observations GEOLOGIC INTERPRETATION)</small>	Gravel		Sand		Field Tests					
					% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	Strength
0	0.0 - 5.0	10.6 0.5	GW-GM SM	Gray brown well graded GRAVEL with silt and sand (GW-GM), no oversized, mps 11 in. (concrete piece), no structure, no odor, moist, 5% brick fragments, trace concrete <div style="text-align: right;">PID = ND</div>										
2			Brown to gray brown silty SAND with gravel (SM), oversized, no structure, no odor, moist, 15% brick and concrete fragments and pieces, 5% ash, cinders, clinkers, coal, 5% wood fragments, trace plastic, clay pieces <div style="text-align: right;">PID = ND</div>											
4			-FILL-											
6	5.0 - 9.0	6.1 5.0	CL	Brown mottled/disturbed lean CLAY with sand (CL), no oversized, mps 8 in., disturbed, no odor, moist, becoming more gray with depth, slight petroleum-like odor from approximately 6-8 ft <div style="text-align: right;">PID = ND</div>										
8			Note: At approximately 6.0 ft depth, encountered an approximately 3-in. probable steel pipe running East to West towards a light pole in the street. <div style="text-align: center;">-COHESIVE FILL-</div> Note: Below approximately 7.5 ft, material is olive gray to olive to light gray with occasional darker gray zones, variable organic and sand content, occasional cinders, very disturbed in appearance. Note: Bottom 6 in. may be natural organic soil but observation made based on coloration in-situ only. <div style="text-align: right;">PID = ND</div>											
			BOTTOM OF EXCAVATION 9.0 FT											
<b>Obstructions:</b> Pipe at 6.0 ft		<b>Remarks:</b>			<b>Field Tests</b> Dilatancy R - Rapid S - Slow N - None Toughness L - Low M - Medium H - High Plasticity N - Nonplastic L - Low M - Medium H - High Dry Strength N - None L - Low M - Medium H - High V - Very High									
<b>Standing Water in Completed Pit</b> at depth Dry ft measured after hours elapsed				<b>Boulders</b> Diameter (in.) Number Approx. Vol. (cu.ft) 12 to 24 - = - over 24 - = -			<b>Test Pit Dimensions (ft)</b> Pit Length x Width (ft) 10 x 3 Pit Depth (ft) 9.0							
<b>NOTE: Soil identification based on visual-manual methods of the USCS system as practiced by Haley &amp; Aldrich, Inc.</b>														

71°05'37.5"  
42°22'30"



MAP SCALE 1" = 500'



## NATIONAL FLOOD INSURANCE PROGRAM

NEIP

PANEL 0577E

### FIRM

FLOOD INSURANCE RATE MAP  
MIDDLESEX COUNTY,  
MASSACHUSETTS  
(ALL JURISDICTIONS)

PANEL 577 OF 656

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

#### CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
CAMBRIDGE CITY OF	250186	0577	E
SOMERVILLE CITY OF	250214	0577	E

Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.



MAP NUMBER  
25017C0577E  
EFFECTIVE DATE  
JUNE 4, 2010

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at [www.msc.fema.gov](http://www.msc.fema.gov)





MAP SCALE 1" = 500'



NFIP

PANEL 0439E

**FIRM**

FLOOD INSURANCE RATE MAP  
MIDDLESEX COUNTY,  
MASSACHUSETTS  
(ALL JURISDICTIONS)

PANEL 439 OF 656

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
EVERETT, CITY OF	250192	0439	E
MEDFORD, CITY OF	250205	0439	E
SOMERVILLE, CITY OF	250214	0439	E

Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.



MAP NUMBER  
25017C0439E  
EFFECTIVE DATE  
JUNE 4, 2010

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at [www.msc.fema.gov](http://www.msc.fema.gov)

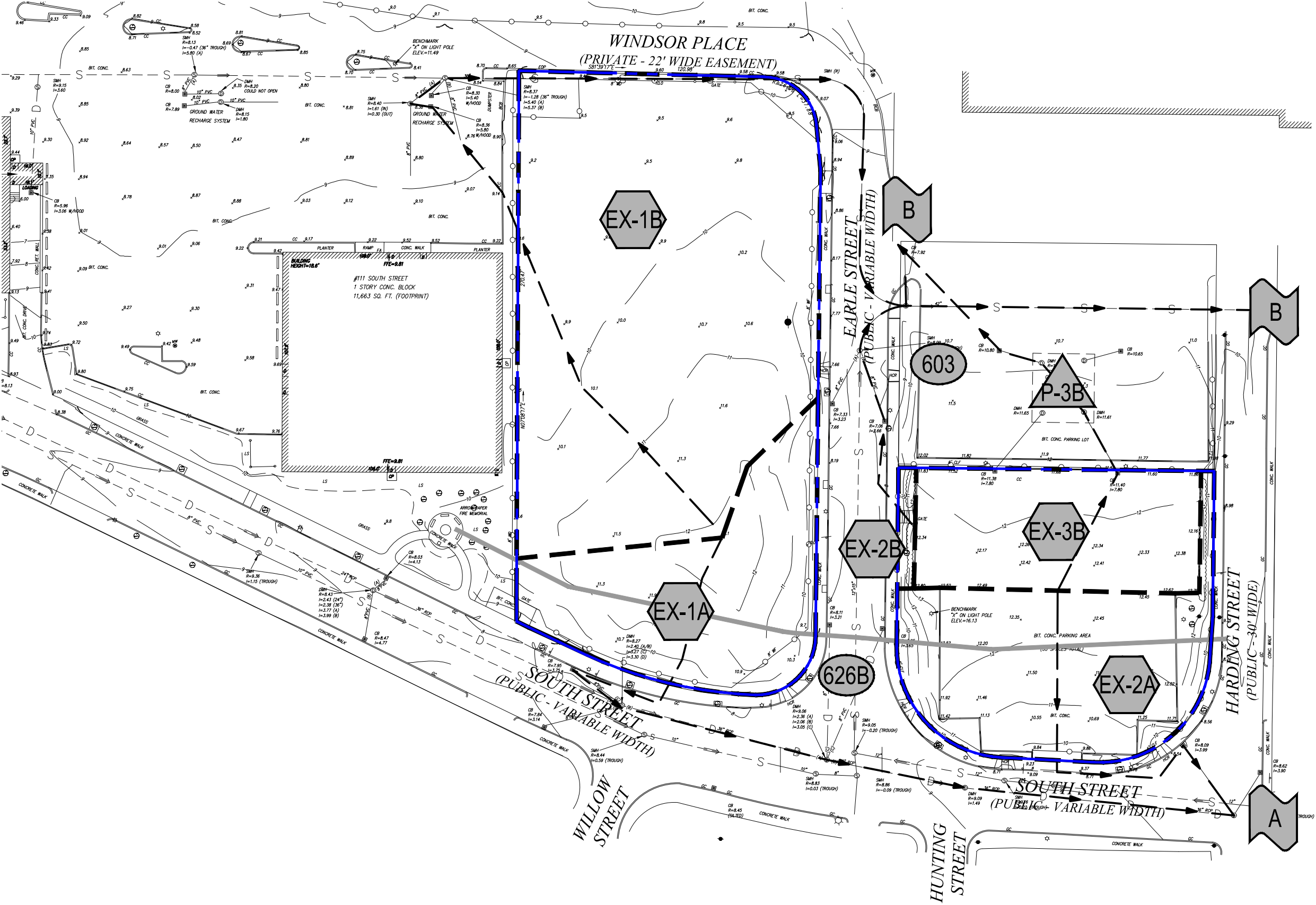


## **ATTACHMENT C**

Included in this section:

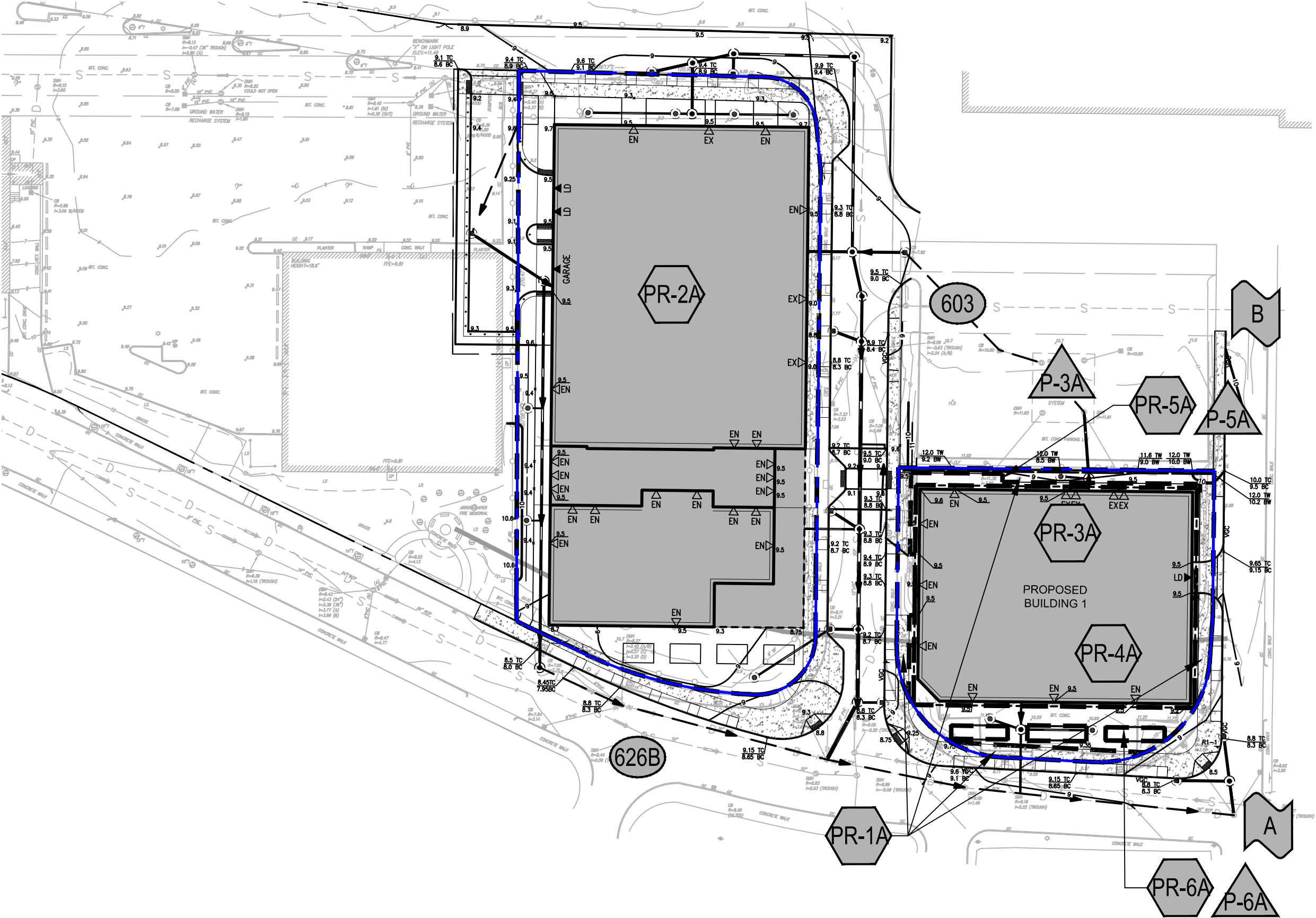
- Figure C1 – Existing Conditions Drainage Areas
- Figure C2 – Proposed Conditions Drainage Areas
- Existing Conditions HydroCAD Analysis
- Proposed Conditions HydroCAD Analysis





Legend	
Symbol	Description
	DESIGN POINT
	DRAINAGE AREA
	NRCS SOIL CLASSIFICATION URBAN LAND
	NRCS SOIL CLASSIFICATION MERRIMAC URBAN LAND COMPLEX
	POND
	TIME OF CONCENTRATION FLOW LINE
	DRAINAGE AREA BOUNDARY
	SOIL TYPE AREA BOUNDARY

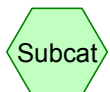
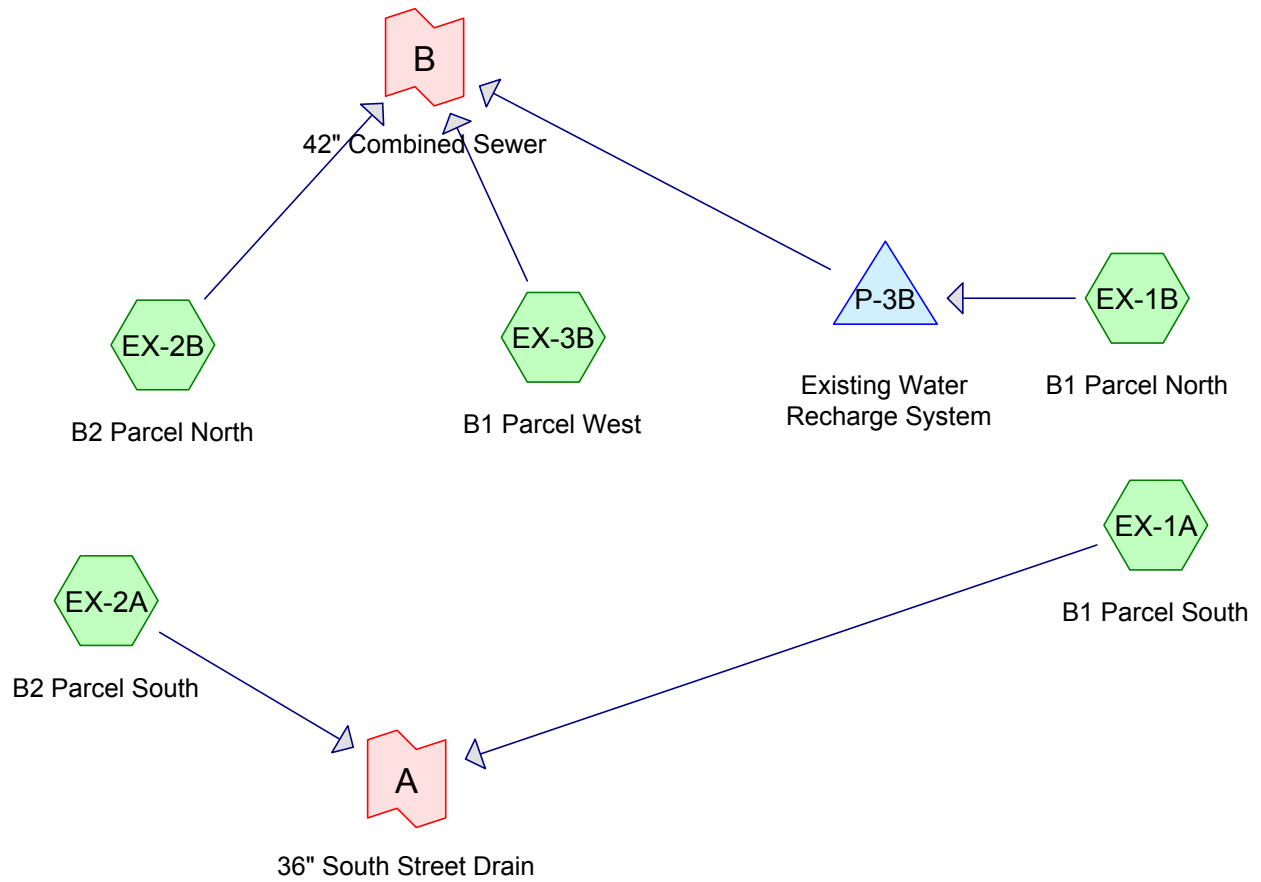




Boynton Yards - Buildings 1 & 2  
Somerville, Massachusetts

Figure C2  
Proposed Conditions Drainage Areas

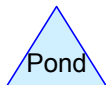




Subcat



Reach



Pond



Link

#### Routing Diagram for Existing Conditions

Prepared by WSP USA, Printed 2/9/2018

HydroCAD® 10.00-12 s/n 05488 © 2014 HydroCAD Software Solutions LLC

**Existing Conditions**

Prepared by WSP USA

Printed 2/9/2018

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Page 2

**Area Listing (all nodes)**

Area (acres)	CN	Description (subcatchment-numbers)
0.156	79	50-75% Grass cover, Fair, HSG C (EX-1A, EX-2A, EX-2B, EX-3B)
0.915	98	Hard packed gravel, HSG C (EX-2A, EX-2B)
0.393	98	Paved parking, HSG C (EX-1A, EX-1B)
0.003	98	Unconnected pavement, HSG C (EX-2A, EX-3B)
<b>1.467</b>	<b>96</b>	<b>TOTAL AREA</b>

**Existing Conditions**

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Page 3

**Soil Listing (all nodes)**

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
1.467	HSG C	EX-1A, EX-1B, EX-2A, EX-2B, EX-3B
0.000	HSG D	
0.000	Other	
<b>1.467</b>		<b>TOTAL AREA</b>

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Page 4

**Ground Covers (all nodes)**

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.156	0.000	0.000	0.156	50-75% Grass cover, Fair	EX-1A, EX-2A, EX-2B, EX-3B
0.000	0.000	0.915	0.000	0.000	0.915	Hard packed gravel	EX-2A, EX-2B
0.000	0.000	0.393	0.000	0.000	0.393	Paved parking	EX-1A, EX-1B
0.000	0.000	0.003	0.000	0.000	0.003	Unconnected pavement	EX-2A, EX-3B
<b>0.000</b>	<b>0.000</b>	<b>1.467</b>	<b>0.000</b>	<b>0.000</b>	<b>1.467</b>	<b>TOTAL AREA</b>	

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Type III 24-hr 2-Year Rainfall=3.10"

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Page 5

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**SubcatchmentEX-1A: B1 Parcel South**      Runoff Area=11,907 sf   73.21% Impervious   Runoff Depth>2.22"  
Tc=5.0 min   CN=93   Runoff=0.73 cfs   0.051 af

**SubcatchmentEX-1B: B1 Parcel North**      Runoff Area=8,401 sf   100.00% Impervious   Runoff Depth>2.68"  
Tc=5.0 min   CN=98   Runoff=0.58 cfs   0.043 af

**SubcatchmentEX-2A: B2 Parcel South**      Runoff Area=11,112 sf   87.39% Impervious   Runoff Depth>2.50"  
Tc=5.0 min   CN=96   Runoff=0.74 cfs   0.053 af

**SubcatchmentEX-2B: B2 Parcel North**      Runoff Area=31,974 sf   94.51% Impervious   Runoff Depth>2.59"  
Tc=5.0 min   CN=97   Runoff=2.19 cfs   0.159 af

**SubcatchmentEX-3B: B1 Parcel West**      Runoff Area=501 sf   10.58% Impervious   Runoff Depth>1.22"  
Tc=5.0 min   UI Adjusted CN=80   Runoff=0.02 cfs   0.001 af

**Pond P-3B: Existing Water Recharge System**      Inflow=0.58 cfs   0.043 af  
Primary=0.58 cfs   0.043 af

**Link A: 36" South Street Drain**      Inflow=1.48 cfs   0.104 af  
Primary=1.48 cfs   0.104 af

**Link B: 42" Combined Sewer**      Inflow=2.79 cfs   0.203 af  
Primary=2.79 cfs   0.203 af

**Total Runoff Area = 1.467 ac   Runoff Volume = 0.307 af   Average Runoff Depth = 2.51"**  
**10.63% Pervious = 0.156 ac   89.37% Impervious = 1.311 ac**

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Type III 24-hr 2-Year Rainfall=3.10"

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Page 6

### Summary for Subcatchment EX-1A: B1 Parcel South

[49] Hint:  $T_c < 2dt$  may require smaller  $dt$

Runoff = 0.73 cfs @ 12.07 hrs, Volume= 0.051 af, Depth> 2.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs,  $dt= 0.05$  hrs  
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
8,717	98	Paved parking, HSG C
3,190	79	50-75% Grass cover, Fair, HSG C
11,907	93	Weighted Average
3,190		26.79% Pervious Area
8,717		73.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

### Summary for Subcatchment EX-1B: B1 Parcel North

[49] Hint:  $T_c < 2dt$  may require smaller  $dt$

Runoff = 0.58 cfs @ 12.07 hrs, Volume= 0.043 af, Depth> 2.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs,  $dt= 0.05$  hrs  
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
8,401	98	Paved parking, HSG C
8,401		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

### Summary for Subcatchment EX-2A: B2 Parcel South

[49] Hint:  $T_c < 2dt$  may require smaller  $dt$

Runoff = 0.74 cfs @ 12.07 hrs, Volume= 0.053 af, Depth> 2.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs,  $dt= 0.05$  hrs  
Type III 24-hr 2-Year Rainfall=3.10"

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Type III 24-hr 2-Year Rainfall=3.10"

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Page 7

	Area (sf)	CN	Description
*	9,623	98	Hard packed gravel, HSG C
	88	98	Unconnected pavement, HSG C
	1,401	79	50-75% Grass cover, Fair, HSG C
	11,112	96	Weighted Average
	1,401		12.61% Pervious Area
	9,711		87.39% Impervious Area
	88		0.91% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

### Summary for Subcatchment EX-2B: B2 Parcel North

[49] Hint: Tc<2dt may require smaller dt

Runoff = 2.19 cfs @ 12.07 hrs, Volume= 0.159 af, Depth> 2.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2-Year Rainfall=3.10"

	Area (sf)	CN	Description
*	30,218	98	Hard packed gravel, HSG C
	1,756	79	50-75% Grass cover, Fair, HSG C
	31,974	97	Weighted Average
	1,756		5.49% Pervious Area
	30,218		94.51% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

### Summary for Subcatchment EX-3B: B1 Parcel West

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.02 cfs @ 12.08 hrs, Volume= 0.001 af, Depth> 1.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2-Year Rainfall=3.10"

	Area (sf)	CN	Adj	Description
	53	98		Unconnected pavement, HSG C
	448	79		50-75% Grass cover, Fair, HSG C
	501	81	80	Weighted Average, UI Adjusted
	448			89.42% Pervious Area
	53			10.58% Impervious Area
	53			100.00% Unconnected

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Type III 24-hr 2-Year Rainfall=3.10"

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Page 8

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

### Summary for Pond P-3B: Existing Water Recharge System

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.193 ac, 100.00% Impervious, Inflow Depth > 2.68" for 2-Year event  
Inflow = 0.58 cfs @ 12.07 hrs, Volume= 0.043 af  
Primary = 0.58 cfs @ 12.07 hrs, Volume= 0.043 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

### Summary for Link A: 36" South Street Drain

Inflow Area = 0.528 ac, 80.06% Impervious, Inflow Depth > 2.36" for 2-Year event  
Inflow = 1.48 cfs @ 12.07 hrs, Volume= 0.104 af  
Primary = 1.48 cfs @ 12.07 hrs, Volume= 0.104 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

### Summary for Link B: 42" Combined Sewer

Inflow Area = 0.938 ac, 94.61% Impervious, Inflow Depth > 2.60" for 2-Year event  
Inflow = 2.79 cfs @ 12.07 hrs, Volume= 0.203 af  
Primary = 2.79 cfs @ 12.07 hrs, Volume= 0.203 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

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Type III 24-hr 10-Year Rainfall=4.50"

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Page 9

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**SubcatchmentEX-1A: B1 Parcel South**      Runoff Area=11,907 sf   73.21% Impervious   Runoff Depth>3.50"  
Tc=5.0 min   CN=93   Runoff=1.13 cfs   0.080 af

**SubcatchmentEX-1B: B1 Parcel North**      Runoff Area=8,401 sf   100.00% Impervious   Runoff Depth>3.96"  
Tc=5.0 min   CN=98   Runoff=0.85 cfs   0.064 af

**SubcatchmentEX-2A: B2 Parcel South**      Runoff Area=11,112 sf   87.39% Impervious   Runoff Depth>3.79"  
Tc=5.0 min   CN=96   Runoff=1.11 cfs   0.081 af

**SubcatchmentEX-2B: B2 Parcel North**      Runoff Area=31,974 sf   94.51% Impervious   Runoff Depth>3.88"  
Tc=5.0 min   CN=97   Runoff=3.22 cfs   0.238 af

**SubcatchmentEX-3B: B1 Parcel West**      Runoff Area=501 sf   10.58% Impervious   Runoff Depth>2.29"  
Tc=5.0 min   UI Adjusted CN=80   Runoff=0.03 cfs   0.002 af

**Pond P-3B: Existing Water Recharge System**      Inflow=0.85 cfs   0.064 af  
Primary=0.85 cfs   0.064 af

**Link A: 36" South Street Drain**      Inflow=2.24 cfs   0.160 af  
Primary=2.24 cfs   0.160 af

**Link B: 42" Combined Sewer**      Inflow=4.11 cfs   0.303 af  
Primary=4.11 cfs   0.303 af

**Total Runoff Area = 1.467 ac   Runoff Volume = 0.464 af   Average Runoff Depth = 3.79"**  
**10.63% Pervious = 0.156 ac   89.37% Impervious = 1.311 ac**

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Page 10

### Summary for Subcatchment EX-1A: B1 Parcel South

[49] Hint:  $T_c < 2dt$  may require smaller  $dt$

Runoff = 1.13 cfs @ 12.07 hrs, Volume= 0.080 af, Depth> 3.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs,  $dt= 0.05$  hrs  
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
8,717	98	Paved parking, HSG C
3,190	79	50-75% Grass cover, Fair, HSG C
11,907	93	Weighted Average
3,190		26.79% Pervious Area
8,717		73.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

### Summary for Subcatchment EX-1B: B1 Parcel North

[49] Hint:  $T_c < 2dt$  may require smaller  $dt$

Runoff = 0.85 cfs @ 12.07 hrs, Volume= 0.064 af, Depth> 3.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs,  $dt= 0.05$  hrs  
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
8,401	98	Paved parking, HSG C
8,401		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

### Summary for Subcatchment EX-2A: B2 Parcel South

[49] Hint:  $T_c < 2dt$  may require smaller  $dt$

Runoff = 1.11 cfs @ 12.07 hrs, Volume= 0.081 af, Depth> 3.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs,  $dt= 0.05$  hrs  
Type III 24-hr 10-Year Rainfall=4.50"

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Type III 24-hr 10-Year Rainfall=4.50"

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Page 11

	Area (sf)	CN	Description
*	9,623	98	Hard packed gravel, HSG C
	88	98	Unconnected pavement, HSG C
	1,401	79	50-75% Grass cover, Fair, HSG C
	11,112	96	Weighted Average
	1,401		12.61% Pervious Area
	9,711		87.39% Impervious Area
	88		0.91% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

### Summary for Subcatchment EX-2B: B2 Parcel North

[49] Hint: Tc<2dt may require smaller dt

Runoff = 3.22 cfs @ 12.07 hrs, Volume= 0.238 af, Depth> 3.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10-Year Rainfall=4.50"

	Area (sf)	CN	Description
*	30,218	98	Hard packed gravel, HSG C
	1,756	79	50-75% Grass cover, Fair, HSG C
	31,974	97	Weighted Average
	1,756		5.49% Pervious Area
	30,218		94.51% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

### Summary for Subcatchment EX-3B: B1 Parcel West

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.03 cfs @ 12.08 hrs, Volume= 0.002 af, Depth> 2.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10-Year Rainfall=4.50"

	Area (sf)	CN	Adj	Description
	53	98		Unconnected pavement, HSG C
	448	79		50-75% Grass cover, Fair, HSG C
	501	81	80	Weighted Average, UI Adjusted
	448			89.42% Pervious Area
	53			10.58% Impervious Area
	53			100.00% Unconnected

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Type III 24-hr 10-Year Rainfall=4.50"

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Page 12

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

### Summary for Pond P-3B: Existing Water Recharge System

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.193 ac, 100.00% Impervious, Inflow Depth > 3.96" for 10-Year event  
Inflow = 0.85 cfs @ 12.07 hrs, Volume= 0.064 af  
Primary = 0.85 cfs @ 12.07 hrs, Volume= 0.064 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

### Summary for Link A: 36" South Street Drain

Inflow Area = 0.528 ac, 80.06% Impervious, Inflow Depth > 3.64" for 10-Year event  
Inflow = 2.24 cfs @ 12.07 hrs, Volume= 0.160 af  
Primary = 2.24 cfs @ 12.07 hrs, Volume= 0.160 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

### Summary for Link B: 42" Combined Sewer

Inflow Area = 0.938 ac, 94.61% Impervious, Inflow Depth > 3.88" for 10-Year event  
Inflow = 4.11 cfs @ 12.07 hrs, Volume= 0.303 af  
Primary = 4.11 cfs @ 12.07 hrs, Volume= 0.303 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

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Page 13

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**SubcatchmentEX-1A: B1 Parcel South**      Runoff Area=11,907 sf   73.21% Impervious   Runoff Depth>4.24"  
Tc=5.0 min   CN=93   Runoff=1.36 cfs   0.097 af

**SubcatchmentEX-1B: B1 Parcel North**      Runoff Area=8,401 sf   100.00% Impervious   Runoff Depth>4.69"  
Tc=5.0 min   CN=98   Runoff=1.01 cfs   0.075 af

**SubcatchmentEX-2A: B2 Parcel South**      Runoff Area=11,112 sf   87.39% Impervious   Runoff Depth>4.53"  
Tc=5.0 min   CN=96   Runoff=1.31 cfs   0.096 af

**SubcatchmentEX-2B: B2 Parcel North**      Runoff Area=31,974 sf   94.51% Impervious   Runoff Depth>4.62"  
Tc=5.0 min   CN=97   Runoff=3.81 cfs   0.282 af

**SubcatchmentEX-3B: B1 Parcel West**      Runoff Area=501 sf   10.58% Impervious   Runoff Depth>2.95"  
Tc=5.0 min   UI Adjusted CN=80   Runoff=0.04 cfs   0.003 af

**Pond P-3B: Existing Water Recharge System**      Inflow=1.01 cfs   0.075 af  
Primary=1.01 cfs   0.075 af

**Link A: 36" South Street Drain**      Inflow=2.67 cfs   0.193 af  
Primary=2.67 cfs   0.193 af

**Link B: 42" Combined Sewer**      Inflow=4.86 cfs   0.361 af  
Primary=4.86 cfs   0.361 af

**Total Runoff Area = 1.467 ac   Runoff Volume = 0.554 af   Average Runoff Depth = 4.53"**  
**10.63% Pervious = 0.156 ac   89.37% Impervious = 1.311 ac**

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Page 14

### Summary for Subcatchment EX-1A: B1 Parcel South

[49] Hint:  $T_c < 2dt$  may require smaller  $dt$

Runoff = 1.36 cfs @ 12.07 hrs, Volume= 0.097 af, Depth> 4.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs,  $dt= 0.05$  hrs  
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
8,717	98	Paved parking, HSG C
3,190	79	50-75% Grass cover, Fair, HSG C
11,907	93	Weighted Average
3,190		26.79% Pervious Area
8,717		73.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

### Summary for Subcatchment EX-1B: B1 Parcel North

[49] Hint:  $T_c < 2dt$  may require smaller  $dt$

Runoff = 1.01 cfs @ 12.07 hrs, Volume= 0.075 af, Depth> 4.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs,  $dt= 0.05$  hrs  
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
8,401	98	Paved parking, HSG C
8,401		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

### Summary for Subcatchment EX-2A: B2 Parcel South

[49] Hint:  $T_c < 2dt$  may require smaller  $dt$

Runoff = 1.31 cfs @ 12.07 hrs, Volume= 0.096 af, Depth> 4.53"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs,  $dt= 0.05$  hrs  
Type III 24-hr 25-Year Rainfall=5.30"

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Page 15

	Area (sf)	CN	Description
*	9,623	98	Hard packed gravel, HSG C
	88	98	Unconnected pavement, HSG C
	1,401	79	50-75% Grass cover, Fair, HSG C
	11,112	96	Weighted Average
	1,401		12.61% Pervious Area
	9,711		87.39% Impervious Area
	88		0.91% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

### Summary for Subcatchment EX-2B: B2 Parcel North

[49] Hint: Tc<2dt may require smaller dt

Runoff = 3.81 cfs @ 12.07 hrs, Volume= 0.282 af, Depth> 4.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 25-Year Rainfall=5.30"

	Area (sf)	CN	Description
*	30,218	98	Hard packed gravel, HSG C
	1,756	79	50-75% Grass cover, Fair, HSG C
	31,974	97	Weighted Average
	1,756		5.49% Pervious Area
	30,218		94.51% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

### Summary for Subcatchment EX-3B: B1 Parcel West

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.04 cfs @ 12.08 hrs, Volume= 0.003 af, Depth> 2.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 25-Year Rainfall=5.30"

	Area (sf)	CN	Adj	Description
	53	98		Unconnected pavement, HSG C
	448	79		50-75% Grass cover, Fair, HSG C
	501	81	80	Weighted Average, UI Adjusted
	448			89.42% Pervious Area
	53			10.58% Impervious Area
	53			100.00% Unconnected

## Existing Conditions

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Type III 24-hr 25-Year Rainfall=5.30"

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Page 16

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

### Summary for Pond P-3B: Existing Water Recharge System

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.193 ac, 100.00% Impervious, Inflow Depth > 4.69" for 25-Year event  
Inflow = 1.01 cfs @ 12.07 hrs, Volume= 0.075 af  
Primary = 1.01 cfs @ 12.07 hrs, Volume= 0.075 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

### Summary for Link A: 36" South Street Drain

Inflow Area = 0.528 ac, 80.06% Impervious, Inflow Depth > 4.38" for 25-Year event  
Inflow = 2.67 cfs @ 12.07 hrs, Volume= 0.193 af  
Primary = 2.67 cfs @ 12.07 hrs, Volume= 0.193 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

### Summary for Link B: 42" Combined Sewer

Inflow Area = 0.938 ac, 94.61% Impervious, Inflow Depth > 4.61" for 25-Year event  
Inflow = 4.86 cfs @ 12.07 hrs, Volume= 0.361 af  
Primary = 4.86 cfs @ 12.07 hrs, Volume= 0.361 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

## Existing Conditions

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Type III 24-hr 100-Year Rainfall=6.50"

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Page 17

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**SubcatchmentEX-1A: B1 Parcel South**      Runoff Area=11,907 sf   73.21% Impervious   Runoff Depth>5.35"  
Tc=5.0 min   CN=93   Runoff=1.69 cfs   0.122 af

**SubcatchmentEX-1B: B1 Parcel North**      Runoff Area=8,401 sf   100.00% Impervious   Runoff Depth>5.78"  
Tc=5.0 min   CN=98   Runoff=1.24 cfs   0.093 af

**SubcatchmentEX-2A: B2 Parcel South**      Runoff Area=11,112 sf   87.39% Impervious   Runoff Depth>5.63"  
Tc=5.0 min   CN=96   Runoff=1.62 cfs   0.120 af

**SubcatchmentEX-2B: B2 Parcel North**      Runoff Area=31,974 sf   94.51% Impervious   Runoff Depth>5.71"  
Tc=5.0 min   CN=97   Runoff=4.69 cfs   0.350 af

**SubcatchmentEX-3B: B1 Parcel West**      Runoff Area=501 sf   10.58% Impervious   Runoff Depth>3.98"  
Tc=5.0 min   UI Adjusted CN=80   Runoff=0.06 cfs   0.004 af

**Pond P-3B: Existing Water Recharge System**      Inflow=1.24 cfs   0.093 af  
Primary=1.24 cfs   0.093 af

**Link A: 36" South Street Drain**      Inflow=3.31 cfs   0.242 af  
Primary=3.31 cfs   0.242 af

**Link B: 42" Combined Sewer**      Inflow=5.98 cfs   0.446 af  
Primary=5.98 cfs   0.446 af

**Total Runoff Area = 1.467 ac   Runoff Volume = 0.688 af   Average Runoff Depth = 5.63"**  
**10.63% Pervious = 0.156 ac   89.37% Impervious = 1.311 ac**

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Type III 24-hr 100-Year Rainfall=6.50"

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Page 18

### Summary for Subcatchment EX-1A: B1 Parcel South

[49] Hint:  $T_c < 2dt$  may require smaller  $dt$

Runoff = 1.69 cfs @ 12.07 hrs, Volume= 0.122 af, Depth> 5.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs,  $dt=0.05$  hrs  
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
8,717	98	Paved parking, HSG C
3,190	79	50-75% Grass cover, Fair, HSG C
11,907	93	Weighted Average
3,190		26.79% Pervious Area
8,717		73.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

### Summary for Subcatchment EX-1B: B1 Parcel North

[49] Hint:  $T_c < 2dt$  may require smaller  $dt$

Runoff = 1.24 cfs @ 12.07 hrs, Volume= 0.093 af, Depth> 5.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs,  $dt=0.05$  hrs  
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
8,401	98	Paved parking, HSG C
8,401		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

### Summary for Subcatchment EX-2A: B2 Parcel South

[49] Hint:  $T_c < 2dt$  may require smaller  $dt$

Runoff = 1.62 cfs @ 12.07 hrs, Volume= 0.120 af, Depth> 5.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs,  $dt=0.05$  hrs  
Type III 24-hr 100-Year Rainfall=6.50"

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Page 19

	Area (sf)	CN	Description
*	9,623	98	Hard packed gravel, HSG C
	88	98	Unconnected pavement, HSG C
	1,401	79	50-75% Grass cover, Fair, HSG C
	11,112	96	Weighted Average
	1,401		12.61% Pervious Area
	9,711		87.39% Impervious Area
	88		0.91% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

### Summary for Subcatchment EX-2B: B2 Parcel North

[49] Hint: Tc<2dt may require smaller dt

Runoff = 4.69 cfs @ 12.07 hrs, Volume= 0.350 af, Depth> 5.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 100-Year Rainfall=6.50"

	Area (sf)	CN	Description
*	30,218	98	Hard packed gravel, HSG C
	1,756	79	50-75% Grass cover, Fair, HSG C
	31,974	97	Weighted Average
	1,756		5.49% Pervious Area
	30,218		94.51% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

### Summary for Subcatchment EX-3B: B1 Parcel West

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.06 cfs @ 12.07 hrs, Volume= 0.004 af, Depth> 3.98"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 100-Year Rainfall=6.50"

	Area (sf)	CN	Adj	Description
	53	98		Unconnected pavement, HSG C
	448	79		50-75% Grass cover, Fair, HSG C
	501	81	80	Weighted Average, UI Adjusted
	448			89.42% Pervious Area
	53			10.58% Impervious Area
	53			100.00% Unconnected

## Existing Conditions

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Type III 24-hr 100-Year Rainfall=6.50"

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Page 20

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

### Summary for Pond P-3B: Existing Water Recharge System

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.193 ac, 100.00% Impervious, Inflow Depth > 5.78" for 100-Year event  
Inflow = 1.24 cfs @ 12.07 hrs, Volume= 0.093 af  
Primary = 1.24 cfs @ 12.07 hrs, Volume= 0.093 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

### Summary for Link A: 36" South Street Drain

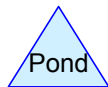
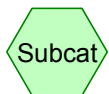
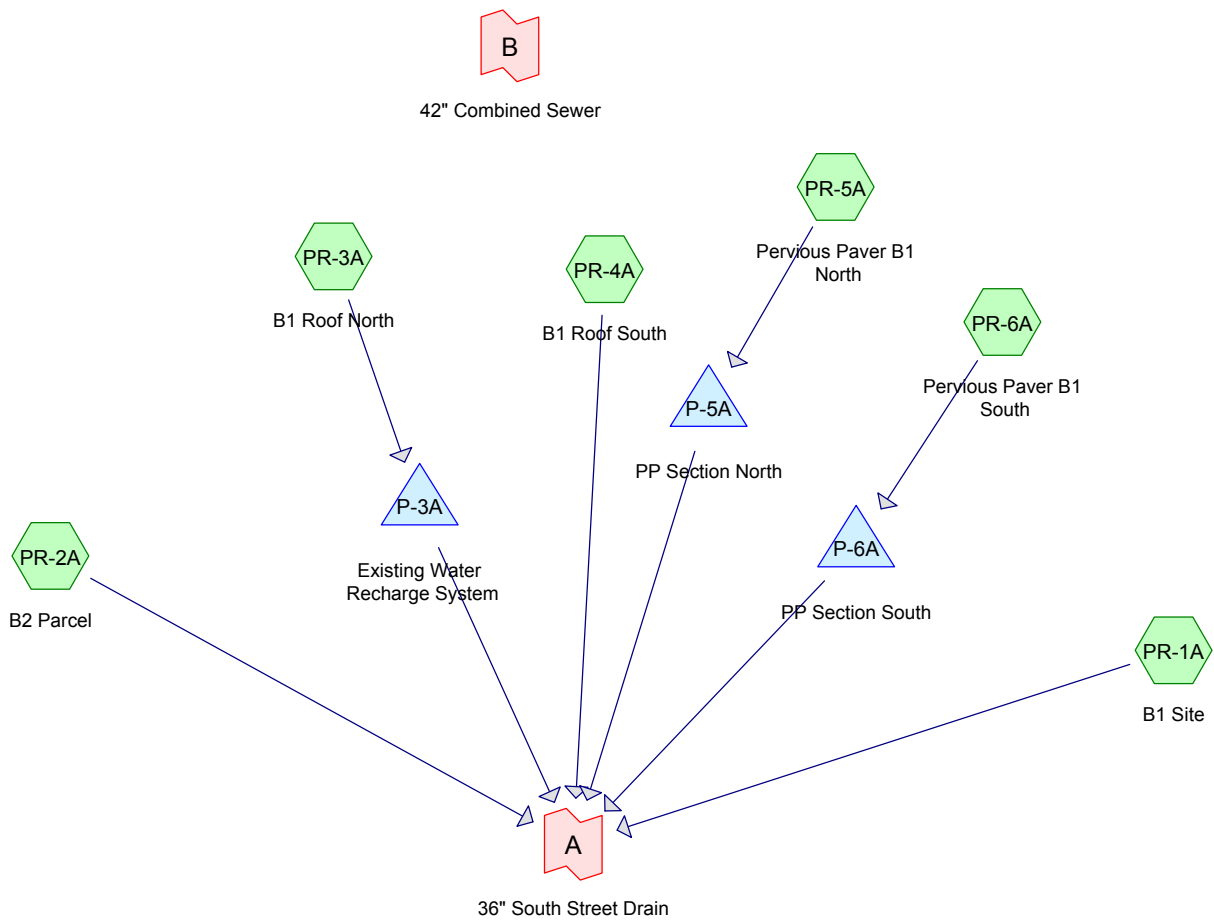
Inflow Area = 0.528 ac, 80.06% Impervious, Inflow Depth > 5.49" for 100-Year event  
Inflow = 3.31 cfs @ 12.07 hrs, Volume= 0.242 af  
Primary = 3.31 cfs @ 12.07 hrs, Volume= 0.242 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

### Summary for Link B: 42" Combined Sewer

Inflow Area = 0.938 ac, 94.61% Impervious, Inflow Depth > 5.71" for 100-Year event  
Inflow = 5.98 cfs @ 12.07 hrs, Volume= 0.446 af  
Primary = 5.98 cfs @ 12.07 hrs, Volume= 0.446 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs



**Routing Diagram for Proposed Conditions**  
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Page 2

**Area Listing (all nodes)**

Area (acres)	CN	Description (subcatchment-numbers)
0.106	79	50-75% Grass cover, Fair, HSG C (PR-1A, PR-2A)
0.313	98	Paved parking, HSG C (PR-1A, PR-2A, PR-5A, PR-6A)
1.048	98	Unconnected roofs, HSG C (PR-2A, PR-3A, PR-4A)
<b>1.467</b>	<b>97</b>	<b>TOTAL AREA</b>

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Page 3

**Soil Listing (all nodes)**

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
1.467	HSG C	PR-1A, PR-2A, PR-3A, PR-4A, PR-5A, PR-6A
0.000	HSG D	
0.000	Other	
<b>1.467</b>		<b>TOTAL AREA</b>

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Page 4

**Ground Covers (all nodes)**

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.106	0.000	0.000	0.106	50-75% Grass cover, Fair	PR-1A, PR-2A
0.000	0.000	0.313	0.000	0.000	0.313	Paved parking	PR-1A, PR-2A, PR-5A, PR-6A
0.000	0.000	1.048	0.000	0.000	1.048	Unconnected roofs	PR-2A, PR-3A, PR-4A
<b>0.000</b>	<b>0.000</b>	<b>1.467</b>	<b>0.000</b>	<b>0.000</b>	<b>1.467</b>	<b>TOTAL AREA</b>	

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Type III 24-hr 2-Year Rainfall=3.10"

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Page 5

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**SubcatchmentPR-1A: B1 Site** Runoff Area=3,381 sf 59.69% Impervious Runoff Depth>1.95"  
Tc=5.0 min CN=90 Runoff=0.19 cfs 0.013 af

**SubcatchmentPR-2A: B2 Parcel** Runoff Area=43,086 sf 92.48% Impervious Runoff Depth>2.59"  
Tc=5.0 min CN=97 Runoff=2.95 cfs 0.214 af

**SubcatchmentPR-3A: B1 Roof North** Runoff Area=7,450 sf 100.00% Impervious Runoff Depth>2.68"  
Tc=5.0 min CN=98 Runoff=0.52 cfs 0.038 af

**SubcatchmentPR-4A: B1 Roof South** Runoff Area=7,450 sf 100.00% Impervious Runoff Depth>2.68"  
Tc=5.0 min CN=98 Runoff=0.52 cfs 0.038 af

**SubcatchmentPR-5A: Pervious Paver B1** Runoff Area=552 sf 100.00% Impervious Runoff Depth>2.68"  
Tc=5.0 min CN=98 Runoff=0.04 cfs 0.003 af

**SubcatchmentPR-6A: Pervious Paver B1** Runoff Area=1,976 sf 100.00% Impervious Runoff Depth>2.68"  
Tc=5.0 min CN=98 Runoff=0.14 cfs 0.010 af

**Pond P-3A: Existing Water Recharge System** Inflow=0.52 cfs 0.038 af  
Primary=0.52 cfs 0.038 af

**Pond P-5A: PP Section North** Peak Elev=6.90' Storage=50 cf Inflow=0.04 cfs 0.003 af  
Discarded=0.00 cfs 0.003 af Primary=0.00 cfs 0.000 af Outflow=0.00 cfs 0.003 af

**Pond P-6A: PP Section South** Peak Elev=7.05' Storage=169 cf Inflow=0.14 cfs 0.010 af  
Discarded=0.01 cfs 0.010 af Primary=0.00 cfs 0.000 af Outflow=0.01 cfs 0.010 af

**Link A: 36" South Street Drain** Inflow=4.17 cfs 0.303 af  
Primary=4.17 cfs 0.303 af

**Link B: 42" Combined Sewer** Primary=0.00 cfs 0.000 af

**Total Runoff Area = 1.467 ac Runoff Volume = 0.316 af Average Runoff Depth = 2.58"**  
**7.21% Pervious = 0.106 ac 92.79% Impervious = 1.361 ac**

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Page 6

### Summary for Subcatchment PR-1A: B1 Site

[49] Hint:  $T_c < 2dt$  may require smaller  $dt$

Runoff = 0.19 cfs @ 12.07 hrs, Volume= 0.013 af, Depth> 1.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs,  $dt=0.05$  hrs  
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
0	98	Unconnected roofs, HSG C
2,018	98	Paved parking, HSG C
1,363	79	50-75% Grass cover, Fair, HSG C
3,381	90	Weighted Average
1,363		40.31% Pervious Area
2,018		59.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

### Summary for Subcatchment PR-2A: B2 Parcel

[49] Hint:  $T_c < 2dt$  may require smaller  $dt$

Runoff = 2.95 cfs @ 12.07 hrs, Volume= 0.214 af, Depth> 2.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs,  $dt=0.05$  hrs  
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
30,750	98	Unconnected roofs, HSG C
9,095	98	Paved parking, HSG C
3,241	79	50-75% Grass cover, Fair, HSG C
43,086	97	Weighted Average
3,241		7.52% Pervious Area
39,845		92.48% Impervious Area
30,750		77.17% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

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Page 7

### Summary for Subcatchment PR-3A: B1 Roof North

[49] Hint:  $T_c < 2dt$  may require smaller  $dt$

Runoff = 0.52 cfs @ 12.07 hrs, Volume= 0.038 af, Depth> 2.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs,  $dt=0.05$  hrs  
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
7,450	98	Unconnected roofs, HSG C
7,450		100.00% Impervious Area
7,450		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

### Summary for Subcatchment PR-4A: B1 Roof South

[49] Hint:  $T_c < 2dt$  may require smaller  $dt$

Runoff = 0.52 cfs @ 12.07 hrs, Volume= 0.038 af, Depth> 2.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs,  $dt=0.05$  hrs  
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
7,450	98	Unconnected roofs, HSG C
7,450		100.00% Impervious Area
7,450		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

### Summary for Subcatchment PR-5A: Pervious Paver B1 North

[49] Hint:  $T_c < 2dt$  may require smaller  $dt$

Runoff = 0.04 cfs @ 12.07 hrs, Volume= 0.003 af, Depth> 2.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs,  $dt=0.05$  hrs  
Type III 24-hr 2-Year Rainfall=3.10"

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Area (sf)	CN	Description
552	98	Paved parking, HSG C
552		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

### Summary for Subcatchment PR-6A: Pervious Paver B1 South

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.14 cfs @ 12.07 hrs, Volume= 0.010 af, Depth> 2.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
1,976	98	Paved parking, HSG C
1,976		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

### Summary for Pond P-3A: Existing Water Recharge System

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.171 ac, 100.00% Impervious, Inflow Depth > 2.68" for 2-Year event  
Inflow = 0.52 cfs @ 12.07 hrs, Volume= 0.038 af  
Primary = 0.52 cfs @ 12.07 hrs, Volume= 0.038 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

### Summary for Pond P-5A: PP Section North

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.013 ac, 100.00% Impervious, Inflow Depth > 2.68" for 2-Year event  
Inflow = 0.04 cfs @ 12.07 hrs, Volume= 0.003 af  
Outflow = 0.00 cfs @ 11.60 hrs, Volume= 0.003 af, Atten= 91%, Lag= 0.0 min  
Discarded = 0.00 cfs @ 11.60 hrs, Volume= 0.003 af  
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Peak Elev= 6.90' @ 12.92 hrs Surf.Area= 552 sf Storage= 50 cf

Plug-Flow detention time= 120.3 min calculated for 0.003 af (99% of inflow)

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Center-of-Mass det. time= 116.2 min ( 854.3 - 738.1 )

Volume	Invert	Avail.Storage	Storage Description
#1	6.67'	514 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc) 1,286 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
6.67	552	0	0
9.00	552	1,286	1,286

Device	Routing	Invert	Outlet Devices
#1	Discarded	6.67'	<b>0.270 in/hr Exfiltration over Surface area</b>
#2	Primary	8.50'	<b>8.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads

**Discarded OutFlow** Max=0.00 cfs @ 11.60 hrs HW=6.69' (Free Discharge)

↑**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

**Primary OutFlow** Max=0.00 cfs @ 5.00 hrs HW=6.67' (Free Discharge)

↑**2=Orifice/Grate** ( Controls 0.00 cfs)

## Summary for Pond P-6A: PP Section South

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.045 ac, 100.00% Impervious, Inflow Depth > 2.68" for 2-Year event  
Inflow = 0.14 cfs @ 12.07 hrs, Volume= 0.010 af  
Outflow = 0.01 cfs @ 12.74 hrs, Volume= 0.010 af, Atten= 89%, Lag= 40.0 min  
Discarded = 0.01 cfs @ 12.74 hrs, Volume= 0.010 af  
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Peak Elev= 7.05' @ 12.74 hrs Surf.Area= 2,321 sf Storage= 169 cf

Plug-Flow detention time= 93.6 min calculated for 0.010 af (99% of inflow)

Center-of-Mass det. time= 90.2 min ( 828.3 - 738.1 )

Volume	Invert	Avail.Storage	Storage Description
#1	6.87'	2,163 cf	<b>Custom Stage Data (Conic)</b> Listed below 5,408 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
6.87	2,321	0	0	2,321
9.20	2,321	5,408	5,408	2,719

Device	Routing	Invert	Outlet Devices
#1	Discarded	6.87'	<b>0.270 in/hr Exfiltration over Wetted area</b>
#2	Primary	9.20'	<b>8.0" Horiz. Orifice/Grate X 2.00</b> C= 0.600 Limited to weir flow at low heads

## Proposed Conditions

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Boynton Yards - Somerville, MA  
Type III 24-hr 2-Year Rainfall=3.10"

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Page 10

**Discarded OutFlow** Max=0.01 cfs @ 12.74 hrs HW=7.05' (Free Discharge)

↑1=Exfiltration (Exfiltration Controls 0.01 cfs)

**Primary OutFlow** Max=0.00 cfs @ 5.00 hrs HW=6.87' (Free Discharge)

↑2=Orifice/Grate ( Controls 0.00 cfs)

### Summary for Link A: 36" South Street Drain

Inflow Area = 1.467 ac, 92.79% Impervious, Inflow Depth > 2.48" for 2-Year event

Inflow = 4.17 cfs @ 12.07 hrs, Volume= 0.303 af

Primary = 4.17 cfs @ 12.07 hrs, Volume= 0.303 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

### Summary for Link B: 42" Combined Sewer

[43] Hint: Has no inflow (Outflow=Zero)

Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

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Boynton Yards - Somerville, MA  
Type III 24-hr 10-Year Rainfall=4.50"

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Page 11

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**SubcatchmentPR-1A: B1 Site** Runoff Area=3,381 sf 59.69% Impervious Runoff Depth>3.21"  
Tc=5.0 min CN=90 Runoff=0.30 cfs 0.021 af

**SubcatchmentPR-2A: B2 Parcel** Runoff Area=43,086 sf 92.48% Impervious Runoff Depth>3.88"  
Tc=5.0 min CN=97 Runoff=4.34 cfs 0.320 af

**SubcatchmentPR-3A: B1 Roof North** Runoff Area=7,450 sf 100.00% Impervious Runoff Depth>3.96"  
Tc=5.0 min CN=98 Runoff=0.76 cfs 0.056 af

**SubcatchmentPR-4A: B1 Roof South** Runoff Area=7,450 sf 100.00% Impervious Runoff Depth>3.96"  
Tc=5.0 min CN=98 Runoff=0.76 cfs 0.056 af

**SubcatchmentPR-5A: Pervious Paver B1** Runoff Area=552 sf 100.00% Impervious Runoff Depth>3.96"  
Tc=5.0 min CN=98 Runoff=0.06 cfs 0.004 af

**SubcatchmentPR-6A: Pervious Paver B1** Runoff Area=1,976 sf 100.00% Impervious Runoff Depth>3.96"  
Tc=5.0 min CN=98 Runoff=0.20 cfs 0.015 af

**Pond P-3A: Existing Water Recharge System** Inflow=0.76 cfs 0.056 af  
Primary=0.76 cfs 0.056 af

**Pond P-5A: PP Section North** Peak Elev=7.05' Storage=84 cf Inflow=0.06 cfs 0.004 af  
Discarded=0.00 cfs 0.003 af Primary=0.00 cfs 0.000 af Outflow=0.00 cfs 0.003 af

**Pond P-6A: PP Section South** Peak Elev=7.17' Storage=281 cf Inflow=0.20 cfs 0.015 af  
Discarded=0.01 cfs 0.013 af Primary=0.00 cfs 0.000 af Outflow=0.01 cfs 0.013 af

**Link A: 36" South Street Drain** Inflow=6.16 cfs 0.454 af  
Primary=6.16 cfs 0.454 af

**Link B: 42" Combined Sewer** Primary=0.00 cfs 0.000 af

**Total Runoff Area = 1.467 ac Runoff Volume = 0.473 af Average Runoff Depth = 3.87"**  
**7.21% Pervious = 0.106 ac 92.79% Impervious = 1.361 ac**

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Boynton Yards - Somerville, MA  
Type III 24-hr 10-Year Rainfall=4.50"

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Page 12

### Summary for Subcatchment PR-1A: B1 Site

[49] Hint:  $T_c < 2dt$  may require smaller  $dt$

Runoff = 0.30 cfs @ 12.07 hrs, Volume= 0.021 af, Depth> 3.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs,  $dt=0.05$  hrs  
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
0	98	Unconnected roofs, HSG C
2,018	98	Paved parking, HSG C
1,363	79	50-75% Grass cover, Fair, HSG C
3,381	90	Weighted Average
1,363		40.31% Pervious Area
2,018		59.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

### Summary for Subcatchment PR-2A: B2 Parcel

[49] Hint:  $T_c < 2dt$  may require smaller  $dt$

Runoff = 4.34 cfs @ 12.07 hrs, Volume= 0.320 af, Depth> 3.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs,  $dt=0.05$  hrs  
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
30,750	98	Unconnected roofs, HSG C
9,095	98	Paved parking, HSG C
3,241	79	50-75% Grass cover, Fair, HSG C
43,086	97	Weighted Average
3,241		7.52% Pervious Area
39,845		92.48% Impervious Area
30,750		77.17% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

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Type III 24-hr 10-Year Rainfall=4.50"

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Page 13

### Summary for Subcatchment PR-3A: B1 Roof North

[49] Hint:  $T_c < 2dt$  may require smaller  $dt$

Runoff = 0.76 cfs @ 12.07 hrs, Volume= 0.056 af, Depth> 3.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs,  $dt= 0.05$  hrs  
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
7,450	98	Unconnected roofs, HSG C
7,450		100.00% Impervious Area
7,450		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

### Summary for Subcatchment PR-4A: B1 Roof South

[49] Hint:  $T_c < 2dt$  may require smaller  $dt$

Runoff = 0.76 cfs @ 12.07 hrs, Volume= 0.056 af, Depth> 3.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs,  $dt= 0.05$  hrs  
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
7,450	98	Unconnected roofs, HSG C
7,450		100.00% Impervious Area
7,450		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

### Summary for Subcatchment PR-5A: Pervious Paver B1 North

[49] Hint:  $T_c < 2dt$  may require smaller  $dt$

Runoff = 0.06 cfs @ 12.07 hrs, Volume= 0.004 af, Depth> 3.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs,  $dt= 0.05$  hrs  
Type III 24-hr 10-Year Rainfall=4.50"

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Type III 24-hr 10-Year Rainfall=4.50"

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Page 14

Area (sf)	CN	Description
552	98	Paved parking, HSG C
552		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

### Summary for Subcatchment PR-6A: Pervious Paver B1 South

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.20 cfs @ 12.07 hrs, Volume= 0.015 af, Depth> 3.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
1,976	98	Paved parking, HSG C
1,976		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

### Summary for Pond P-3A: Existing Water Recharge System

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.171 ac, 100.00% Impervious, Inflow Depth > 3.96" for 10-Year event  
Inflow = 0.76 cfs @ 12.07 hrs, Volume= 0.056 af  
Primary = 0.76 cfs @ 12.07 hrs, Volume= 0.056 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

### Summary for Pond P-5A: PP Section North

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.013 ac, 100.00% Impervious, Inflow Depth > 3.96" for 10-Year event  
Inflow = 0.06 cfs @ 12.07 hrs, Volume= 0.004 af  
Outflow = 0.00 cfs @ 11.05 hrs, Volume= 0.003 af, Atten= 94%, Lag= 0.0 min  
Discarded = 0.00 cfs @ 11.05 hrs, Volume= 0.003 af  
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Peak Elev= 7.05' @ 13.61 hrs Surf.Area= 552 sf Storage= 84 cf

Plug-Flow detention time= 168.4 min calculated for 0.003 af (78% of inflow)

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Type III 24-hr 10-Year Rainfall=4.50"

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Page 15

Center-of-Mass det. time= 111.0 min ( 846.0 - 735.0 )

Volume	Invert	Avail.Storage	Storage Description
#1	6.67'	514 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc) 1,286 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
6.67	552	0	0
9.00	552	1,286	1,286

Device	Routing	Invert	Outlet Devices
#1	Discarded	6.67'	<b>0.270 in/hr Exfiltration over Surface area</b>
#2	Primary	8.50'	<b>8.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads

**Discarded OutFlow** Max=0.00 cfs @ 11.05 hrs HW=6.69' (Free Discharge)

↑**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

**Primary OutFlow** Max=0.00 cfs @ 5.00 hrs HW=6.67' (Free Discharge)

↑**2=Orifice/Grate** ( Controls 0.00 cfs)

### Summary for Pond P-6A: PP Section South

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.045 ac, 100.00% Impervious, Inflow Depth > 3.96" for 10-Year event  
Inflow = 0.20 cfs @ 12.07 hrs, Volume= 0.015 af  
Outflow = 0.01 cfs @ 13.12 hrs, Volume= 0.013 af, Atten= 93%, Lag= 63.1 min  
Discarded = 0.01 cfs @ 13.12 hrs, Volume= 0.013 af  
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Peak Elev= 7.17' @ 13.12 hrs Surf.Area= 2,321 sf Storage= 281 cf

Plug-Flow detention time= 156.4 min calculated for 0.013 af (90% of inflow)

Center-of-Mass det. time= 122.3 min ( 857.4 - 735.0 )

Volume	Invert	Avail.Storage	Storage Description
#1	6.87'	2,163 cf	<b>Custom Stage Data (Conic)</b> Listed below 5,408 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
6.87	2,321	0	0	2,321
9.20	2,321	5,408	5,408	2,719

Device	Routing	Invert	Outlet Devices
#1	Discarded	6.87'	<b>0.270 in/hr Exfiltration over Wetted area</b>
#2	Primary	9.20'	<b>8.0" Horiz. Orifice/Grate X 2.00</b> C= 0.600 Limited to weir flow at low heads

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Type III 24-hr 10-Year Rainfall=4.50"

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Page 16

**Discarded OutFlow** Max=0.01 cfs @ 13.12 hrs HW=7.17' (Free Discharge)

↑1=Exfiltration (Exfiltration Controls 0.01 cfs)

**Primary OutFlow** Max=0.00 cfs @ 5.00 hrs HW=6.87' (Free Discharge)

↑2=Orifice/Grate ( Controls 0.00 cfs)

### Summary for Link A: 36" South Street Drain

Inflow Area = 1.467 ac, 92.79% Impervious, Inflow Depth > 3.71" for 10-Year event

Inflow = 6.16 cfs @ 12.07 hrs, Volume= 0.454 af

Primary = 6.16 cfs @ 12.07 hrs, Volume= 0.454 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

### Summary for Link B: 42" Combined Sewer

[43] Hint: Has no inflow (Outflow=Zero)

Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

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Type III 24-hr 25-Year Rainfall=5.30"

Printed 2/9/2018

Page 17

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**SubcatchmentPR-1A: B1 Site** Runoff Area=3,381 sf 59.69% Impervious Runoff Depth>3.94"  
Tc=5.0 min CN=90 Runoff=0.37 cfs 0.025 af

**SubcatchmentPR-2A: B2 Parcel** Runoff Area=43,086 sf 92.48% Impervious Runoff Depth>4.62"  
Tc=5.0 min CN=97 Runoff=5.13 cfs 0.381 af

**SubcatchmentPR-3A: B1 Roof North** Runoff Area=7,450 sf 100.00% Impervious Runoff Depth>4.69"  
Tc=5.0 min CN=98 Runoff=0.89 cfs 0.067 af

**SubcatchmentPR-4A: B1 Roof South** Runoff Area=7,450 sf 100.00% Impervious Runoff Depth>4.69"  
Tc=5.0 min CN=98 Runoff=0.89 cfs 0.067 af

**SubcatchmentPR-5A: Pervious Paver B1** Runoff Area=552 sf 100.00% Impervious Runoff Depth>4.69"  
Tc=5.0 min CN=98 Runoff=0.07 cfs 0.005 af

**SubcatchmentPR-6A: Pervious Paver B1** Runoff Area=1,976 sf 100.00% Impervious Runoff Depth>4.69"  
Tc=5.0 min CN=98 Runoff=0.24 cfs 0.018 af

**Pond P-3A: Existing Water Recharge System** Inflow=0.89 cfs 0.067 af  
Primary=0.89 cfs 0.067 af

**Pond P-5A: PP Section North** Peak Elev=7.15' Storage=106 cf Inflow=0.07 cfs 0.005 af  
Discarded=0.00 cfs 0.003 af Primary=0.00 cfs 0.000 af Outflow=0.00 cfs 0.003 af

**Pond P-6A: PP Section South** Peak Elev=7.25' Storage=352 cf Inflow=0.24 cfs 0.018 af  
Discarded=0.01 cfs 0.014 af Primary=0.00 cfs 0.000 af Outflow=0.01 cfs 0.014 af

**Link A: 36" South Street Drain** Inflow=7.28 cfs 0.540 af  
Primary=7.28 cfs 0.540 af

**Link B: 42" Combined Sewer** Primary=0.00 cfs 0.000 af

**Total Runoff Area = 1.467 ac Runoff Volume = 0.562 af Average Runoff Depth = 4.60"**  
**7.21% Pervious = 0.106 ac 92.79% Impervious = 1.361 ac**

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Type III 24-hr 25-Year Rainfall=5.30"

Printed 2/9/2018

Page 18

### Summary for Subcatchment PR-1A: B1 Site

[49] Hint:  $T_c < 2dt$  may require smaller  $dt$

Runoff = 0.37 cfs @ 12.07 hrs, Volume= 0.025 af, Depth> 3.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs,  $dt=0.05$  hrs  
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
0	98	Unconnected roofs, HSG C
2,018	98	Paved parking, HSG C
1,363	79	50-75% Grass cover, Fair, HSG C
3,381	90	Weighted Average
1,363		40.31% Pervious Area
2,018		59.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

### Summary for Subcatchment PR-2A: B2 Parcel

[49] Hint:  $T_c < 2dt$  may require smaller  $dt$

Runoff = 5.13 cfs @ 12.07 hrs, Volume= 0.381 af, Depth> 4.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs,  $dt=0.05$  hrs  
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
30,750	98	Unconnected roofs, HSG C
9,095	98	Paved parking, HSG C
3,241	79	50-75% Grass cover, Fair, HSG C
43,086	97	Weighted Average
3,241		7.52% Pervious Area
39,845		92.48% Impervious Area
30,750		77.17% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

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Type III 24-hr 25-Year Rainfall=5.30"

Printed 2/9/2018

Page 19

### Summary for Subcatchment PR-3A: B1 Roof North

[49] Hint:  $T_c < 2dt$  may require smaller  $dt$

Runoff = 0.89 cfs @ 12.07 hrs, Volume= 0.067 af, Depth> 4.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs,  $dt=0.05$  hrs  
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
7,450	98	Unconnected roofs, HSG C
7,450		100.00% Impervious Area
7,450		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

### Summary for Subcatchment PR-4A: B1 Roof South

[49] Hint:  $T_c < 2dt$  may require smaller  $dt$

Runoff = 0.89 cfs @ 12.07 hrs, Volume= 0.067 af, Depth> 4.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs,  $dt=0.05$  hrs  
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
7,450	98	Unconnected roofs, HSG C
7,450		100.00% Impervious Area
7,450		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

### Summary for Subcatchment PR-5A: Pervious Paver B1 North

[49] Hint:  $T_c < 2dt$  may require smaller  $dt$

Runoff = 0.07 cfs @ 12.07 hrs, Volume= 0.005 af, Depth> 4.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs,  $dt=0.05$  hrs  
Type III 24-hr 25-Year Rainfall=5.30"

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Type III 24-hr 25-Year Rainfall=5.30"

Printed 2/9/2018

Page 20

Area (sf)	CN	Description
552	98	Paved parking, HSG C
552		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

### Summary for Subcatchment PR-6A: Pervious Paver B1 South

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.24 cfs @ 12.07 hrs, Volume= 0.018 af, Depth> 4.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
1,976	98	Paved parking, HSG C
1,976		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

### Summary for Pond P-3A: Existing Water Recharge System

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.171 ac, 100.00% Impervious, Inflow Depth > 4.69" for 25-Year event  
Inflow = 0.89 cfs @ 12.07 hrs, Volume= 0.067 af  
Primary = 0.89 cfs @ 12.07 hrs, Volume= 0.067 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

### Summary for Pond P-5A: PP Section North

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.013 ac, 100.00% Impervious, Inflow Depth > 4.69" for 25-Year event  
Inflow = 0.07 cfs @ 12.07 hrs, Volume= 0.005 af  
Outflow = 0.00 cfs @ 10.60 hrs, Volume= 0.003 af, Atten= 95%, Lag= 0.0 min  
Discarded = 0.00 cfs @ 10.60 hrs, Volume= 0.003 af  
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Peak Elev= 7.15' @ 13.99 hrs Surf.Area= 552 sf Storage= 106 cf

Plug-Flow detention time= 169.5 min calculated for 0.003 af (69% of inflow)

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Boynton Yards - Somerville, MA  
Type III 24-hr 25-Year Rainfall=5.30"

Printed 2/9/2018

Page 21

Center-of-Mass det. time= 99.4 min ( 833.5 - 734.1 )

Volume	Invert	Avail.Storage	Storage Description
#1	6.67'	514 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc) 1,286 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
6.67	552	0	0
9.00	552	1,286	1,286

Device	Routing	Invert	Outlet Devices
#1	Discarded	6.67'	<b>0.270 in/hr Exfiltration over Surface area</b>
#2	Primary	8.50'	<b>8.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads

**Discarded OutFlow** Max=0.00 cfs @ 10.60 hrs HW=6.69' (Free Discharge)

↑**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

**Primary OutFlow** Max=0.00 cfs @ 5.00 hrs HW=6.67' (Free Discharge)

↑**2=Orifice/Grate** ( Controls 0.00 cfs)

### Summary for Pond P-6A: PP Section South

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.045 ac, 100.00% Impervious, Inflow Depth > 4.69" for 25-Year event  
Inflow = 0.24 cfs @ 12.07 hrs, Volume= 0.018 af  
Outflow = 0.01 cfs @ 13.55 hrs, Volume= 0.014 af, Atten= 94%, Lag= 88.8 min  
Discarded = 0.01 cfs @ 13.55 hrs, Volume= 0.014 af  
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Peak Elev= 7.25' @ 13.55 hrs Surf.Area= 2,321 sf Storage= 352 cf

Plug-Flow detention time= 166.7 min calculated for 0.014 af (79% of inflow)

Center-of-Mass det. time= 111.5 min ( 845.6 - 734.1 )

Volume	Invert	Avail.Storage	Storage Description
#1	6.87'	2,163 cf	<b>Custom Stage Data (Conic)</b> Listed below 5,408 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
6.87	2,321	0	0	2,321
9.20	2,321	5,408	5,408	2,719

Device	Routing	Invert	Outlet Devices
#1	Discarded	6.87'	<b>0.270 in/hr Exfiltration over Wetted area</b>
#2	Primary	9.20'	<b>8.0" Horiz. Orifice/Grate X 2.00</b> C= 0.600 Limited to weir flow at low heads

## Proposed Conditions

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Type III 24-hr 25-Year Rainfall=5.30"

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Page 22

**Discarded OutFlow** Max=0.01 cfs @ 13.55 hrs HW=7.25' (Free Discharge)

↑1=Exfiltration (Exfiltration Controls 0.01 cfs)

**Primary OutFlow** Max=0.00 cfs @ 5.00 hrs HW=6.87' (Free Discharge)

↑2=Orifice/Grate ( Controls 0.00 cfs)

### Summary for Link A: 36" South Street Drain

Inflow Area = 1.467 ac, 92.79% Impervious, Inflow Depth > 4.42" for 25-Year event

Inflow = 7.28 cfs @ 12.07 hrs, Volume= 0.540 af

Primary = 7.28 cfs @ 12.07 hrs, Volume= 0.540 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

### Summary for Link B: 42" Combined Sewer

[43] Hint: Has no inflow (Outflow=Zero)

Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

## Proposed Conditions

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Type III 24-hr 100-Year Rainfall=6.50"

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Page 23

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**SubcatchmentPR-1A: B1 Site** Runoff Area=3,381 sf 59.69% Impervious Runoff Depth>5.04"  
Tc=5.0 min CN=90 Runoff=0.46 cfs 0.033 af

**SubcatchmentPR-2A: B2 Parcel** Runoff Area=43,086 sf 92.48% Impervious Runoff Depth>5.71"  
Tc=5.0 min CN=97 Runoff=6.32 cfs 0.471 af

**SubcatchmentPR-3A: B1 Roof North** Runoff Area=7,450 sf 100.00% Impervious Runoff Depth>5.78"  
Tc=5.0 min CN=98 Runoff=1.10 cfs 0.082 af

**SubcatchmentPR-4A: B1 Roof South** Runoff Area=7,450 sf 100.00% Impervious Runoff Depth>5.78"  
Tc=5.0 min CN=98 Runoff=1.10 cfs 0.082 af

**SubcatchmentPR-5A: Pervious Paver B1** Runoff Area=552 sf 100.00% Impervious Runoff Depth>5.78"  
Tc=5.0 min CN=98 Runoff=0.08 cfs 0.006 af

**SubcatchmentPR-6A: Pervious Paver B1** Runoff Area=1,976 sf 100.00% Impervious Runoff Depth>5.78"  
Tc=5.0 min CN=98 Runoff=0.29 cfs 0.022 af

**Pond P-3A: Existing Water Recharge System** Inflow=1.10 cfs 0.082 af  
Primary=1.10 cfs 0.082 af

**Pond P-5A: PP Section North** Peak Elev=7.31' Storage=141 cf Inflow=0.08 cfs 0.006 af  
Discarded=0.00 cfs 0.004 af Primary=0.00 cfs 0.000 af Outflow=0.00 cfs 0.004 af

**Pond P-6A: PP Section South** Peak Elev=7.38' Storage=469 cf Inflow=0.29 cfs 0.022 af  
Discarded=0.02 cfs 0.015 af Primary=0.00 cfs 0.000 af Outflow=0.02 cfs 0.015 af

**Link A: 36" South Street Drain** Inflow=8.98 cfs 0.668 af  
Primary=8.98 cfs 0.668 af

**Link B: 42" Combined Sewer** Primary=0.00 cfs 0.000 af

**Total Runoff Area = 1.467 ac Runoff Volume = 0.696 af Average Runoff Depth = 5.70"**  
**7.21% Pervious = 0.106 ac 92.79% Impervious = 1.361 ac**

## Proposed Conditions

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Boynton Yards - Somerville, MA  
Type III 24-hr 100-Year Rainfall=6.50"

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Page 24

### Summary for Subcatchment PR-1A: B1 Site

[49] Hint:  $T_c < 2dt$  may require smaller  $dt$

Runoff = 0.46 cfs @ 12.07 hrs, Volume= 0.033 af, Depth> 5.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs,  $dt=0.05$  hrs  
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
0	98	Unconnected roofs, HSG C
2,018	98	Paved parking, HSG C
1,363	79	50-75% Grass cover, Fair, HSG C
3,381	90	Weighted Average
1,363		40.31% Pervious Area
2,018		59.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

### Summary for Subcatchment PR-2A: B2 Parcel

[49] Hint:  $T_c < 2dt$  may require smaller  $dt$

Runoff = 6.32 cfs @ 12.07 hrs, Volume= 0.471 af, Depth> 5.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs,  $dt=0.05$  hrs  
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
30,750	98	Unconnected roofs, HSG C
9,095	98	Paved parking, HSG C
3,241	79	50-75% Grass cover, Fair, HSG C
43,086	97	Weighted Average
3,241		7.52% Pervious Area
39,845		92.48% Impervious Area
30,750		77.17% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

## Proposed Conditions

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Type III 24-hr 100-Year Rainfall=6.50"

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Page 25

### Summary for Subcatchment PR-3A: B1 Roof North

[49] Hint:  $T_c < 2dt$  may require smaller  $dt$

Runoff = 1.10 cfs @ 12.07 hrs, Volume= 0.082 af, Depth> 5.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs,  $dt=0.05$  hrs  
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
7,450	98	Unconnected roofs, HSG C
7,450		100.00% Impervious Area
7,450		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

### Summary for Subcatchment PR-4A: B1 Roof South

[49] Hint:  $T_c < 2dt$  may require smaller  $dt$

Runoff = 1.10 cfs @ 12.07 hrs, Volume= 0.082 af, Depth> 5.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs,  $dt=0.05$  hrs  
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
7,450	98	Unconnected roofs, HSG C
7,450		100.00% Impervious Area
7,450		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

### Summary for Subcatchment PR-5A: Pervious Paver B1 North

[49] Hint:  $T_c < 2dt$  may require smaller  $dt$

Runoff = 0.08 cfs @ 12.07 hrs, Volume= 0.006 af, Depth> 5.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs,  $dt=0.05$  hrs  
Type III 24-hr 100-Year Rainfall=6.50"

## Proposed Conditions

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Type III 24-hr 100-Year Rainfall=6.50"

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Page 26

Area (sf)	CN	Description
552	98	Paved parking, HSG C
552		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

### Summary for Subcatchment PR-6A: Pervious Paver B1 South

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.29 cfs @ 12.07 hrs, Volume= 0.022 af, Depth> 5.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
1,976	98	Paved parking, HSG C
1,976		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

### Summary for Pond P-3A: Existing Water Recharge System

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.171 ac, 100.00% Impervious, Inflow Depth > 5.78" for 100-Year event  
Inflow = 1.10 cfs @ 12.07 hrs, Volume= 0.082 af  
Primary = 1.10 cfs @ 12.07 hrs, Volume= 0.082 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

### Summary for Pond P-5A: PP Section North

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.013 ac, 100.00% Impervious, Inflow Depth > 5.78" for 100-Year event  
Inflow = 0.08 cfs @ 12.07 hrs, Volume= 0.006 af  
Outflow = 0.00 cfs @ 9.95 hrs, Volume= 0.004 af, Atten= 96%, Lag= 0.0 min  
Discarded = 0.00 cfs @ 9.95 hrs, Volume= 0.004 af  
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Peak Elev= 7.31' @ 14.72 hrs Surf.Area= 552 sf Storage= 141 cf

Plug-Flow detention time= 167.7 min calculated for 0.004 af (58% of inflow)

## Proposed Conditions

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Boynton Yards - Somerville, MA  
Type III 24-hr 100-Year Rainfall=6.50"

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Page 27

Center-of-Mass det. time= 85.1 min ( 818.2 - 733.1 )

Volume	Invert	Avail.Storage	Storage Description
#1	6.67'	514 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc) 1,286 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
6.67	552	0	0
9.00	552	1,286	1,286

Device	Routing	Invert	Outlet Devices
#1	Discarded	6.67'	<b>0.270 in/hr Exfiltration over Surface area</b>
#2	Primary	8.50'	<b>8.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads

**Discarded OutFlow** Max=0.00 cfs @ 9.95 hrs HW=6.69' (Free Discharge)

↑**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

**Primary OutFlow** Max=0.00 cfs @ 5.00 hrs HW=6.67' (Free Discharge)

↑**2=Orifice/Grate** ( Controls 0.00 cfs)

### Summary for Pond P-6A: PP Section South

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.045 ac, 100.00% Impervious, Inflow Depth > 5.78" for 100-Year event  
Inflow = 0.29 cfs @ 12.07 hrs, Volume= 0.022 af  
Outflow = 0.02 cfs @ 14.01 hrs, Volume= 0.015 af, Atten= 95%, Lag= 116.3 min  
Discarded = 0.02 cfs @ 14.01 hrs, Volume= 0.015 af  
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Peak Elev= 7.38' @ 14.01 hrs Surf.Area= 2,321 sf Storage= 469 cf

Plug-Flow detention time= 169.6 min calculated for 0.015 af (68% of inflow)

Center-of-Mass det. time= 98.3 min ( 831.3 - 733.1 )

Volume	Invert	Avail.Storage	Storage Description
#1	6.87'	2,163 cf	<b>Custom Stage Data (Conic)</b> Listed below 5,408 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
6.87	2,321	0	0	2,321
9.20	2,321	5,408	5,408	2,719

Device	Routing	Invert	Outlet Devices
#1	Discarded	6.87'	<b>0.270 in/hr Exfiltration over Wetted area</b>
#2	Primary	9.20'	<b>8.0" Horiz. Orifice/Grate X 2.00</b> C= 0.600 Limited to weir flow at low heads

## Proposed Conditions

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Boynton Yards - Somerville, MA  
Type III 24-hr 100-Year Rainfall=6.50"

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Page 28

**Discarded OutFlow** Max=0.02 cfs @ 14.01 hrs HW=7.38' (Free Discharge)

↑1=Exfiltration (Exfiltration Controls 0.02 cfs)

**Primary OutFlow** Max=0.00 cfs @ 5.00 hrs HW=6.87' (Free Discharge)

↑2=Orifice/Grate ( Controls 0.00 cfs)

### Summary for Link A: 36" South Street Drain

Inflow Area = 1.467 ac, 92.79% Impervious, Inflow Depth > 5.47" for 100-Year event

Inflow = 8.98 cfs @ 12.07 hrs, Volume= 0.668 af

Primary = 8.98 cfs @ 12.07 hrs, Volume= 0.668 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

### Summary for Link B: 42" Combined Sewer

[43] Hint: Has no inflow (Outflow=Zero)

Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

## **ATTACHMENT D**

Included in this section:

- Long-Term Pollution Prevention Plan
- Water Quality Volume Calculations
- Stormceptor® Sizing Calculations
- TSS Removal Calculations
- MASTEP Technology Review - Stormceptor® STC 900



## **LONG TERM POLLUTION PREVENTION PLAN**

**WSP USA** has prepared this Long Term Pollution Prevention Plan (LTPPP) to identify potential sources of pollution that may affect the quality of stormwater discharges at the redevelopment of the parcel of land identified as Boynton Yards Buildings 1 & 2 located at the intersection of South Street and Earle Street in Somerville, Massachusetts. The LTPPP also describes practices to reduce potential pollutants in stormwater discharges. The owner and other designated parties are responsible for compliance with the Stormwater Operations & Maintenance Plan. This LTPPP has been prepared in accordance with Standard 4 of the Massachusetts Department of Environmental Protection (MassDEP) Stormwater Management Standards.

The Site Plans for the Boynton Yards Buildings 1 & 2, in Somerville, Massachusetts dated February 13, 2018 are made part of this LTPPP by reference.

### **Stormwater Management System Owner:**

DLJ Real Estate Capital Partners, LLC  
Boston Office  
18 Tremont Street, 7<sup>th</sup> Floor  
Boston, MA 02110  
978.729.9010

The following maintenance program is proposed to ensure the continued effectiveness of the water quality controls and structural BMPs proposed as part of the redevelopment:

### **Maintenance of Pavement Systems**

Regular maintenance of pavement surfaces will prevent pollutants such as oil and grease, trash, and sediments from entering the stormwater management system. The following practices should be performed:

- Sweep or vacuum asphalt pavement areas bi-annually with a commercial cleaning unit and dispose of removed material.
- Check loading and dumpster areas frequently for spillage and/or pavement staining and clean as necessary.
- Routinely pick up and remove litter from the parking areas, islands, and perimeter landscaping.

### **Maintenance of Vegetated Areas**

Proper maintenance of vegetated areas can prevent the pollution of stormwater runoff by controlling the source of pollutants such as suspended sediments, excess nutrients, and chemicals from landscape care products. Practices that should be followed under the regular maintenance of the vegetated landscape include:

- Inspect planted areas on a semi-annual basis and remove any litter.
- Maintain planted areas adjacent to pavement to prevent soil washout.
- Immediately clean any soil deposited on pavement.
- Re-seed bare areas; install appropriate erosion control measures when native soil is exposed or erosion channels are forming.
- Plant alternative mixture of grass species in the event of unsuccessful establishment.
- Grass vegetation should not be cut to a height less than four inches.
- Pesticide/Herbicide Usage – No pesticides are to be used unless a single spot treatment is required for a specific control application.
- Fertilizer usage should be avoided. If deemed necessary, slow release fertilizer should be used. Fertilizer may be used to begin the establishment of vegetation in bare or damaged areas, but should not be applied on a regular basis unless necessary.

### **Storage and Disposal of Snow and Ice**

Snow shall be stockpiled on standard pavement surfaces so sand and salt may be swept in the spring or removed as snow melts and drains through the stormwater management system. Key practices for the safe storage and disposal of snow include:

- Under no circumstances shall snow be disposed or stored in stormwater basins, ponds, rain gardens, swales, channels, or trenches.
- Do not stockpile snow on permeable pavement surfaces. Sand and grit in snow will clog pavement.

### **Salt, Sand and Deicing Chemicals**

The amount of salt, sand and deicing chemicals to be used on the property shall be reduced to the minimum amount needed to provide safe pedestrian and vehicle travel. The following practices should be followed to control the amount of salt and deicing materials that come into contact with stormwater runoff:

- Devices used for spreading sand and alternative deicing chemicals should be capable of varying the rate of application based on the site specific conditions.
- In cases where weather conditions warrant significant amounts of sand for public safety, the frequency of catch basin cleaning and water quality unit cleaning will be increased.
- Salt and sand should be stockpiled under covered storage facilities that prevent precipitation and adjacent runoff from coming in contact with the deicing materials. MassDEP recommends storage areas that are flat, impervious with the possibility of roof coverage.



## WATER QUALITY VOLUME CALCULATIONS

Project Name: Boynton Yards: Buildings 1 & 2  
Project Location: Somerville, Massachusetts  
Project Number: 52771

Date: 2/13/2018  
Calculated By: JVC  
Checked By: BKF

Structure Name: **WQS-B4**

Description: **Stormceptor STC 900**

Subcatchment: **Building 2 Driveway**

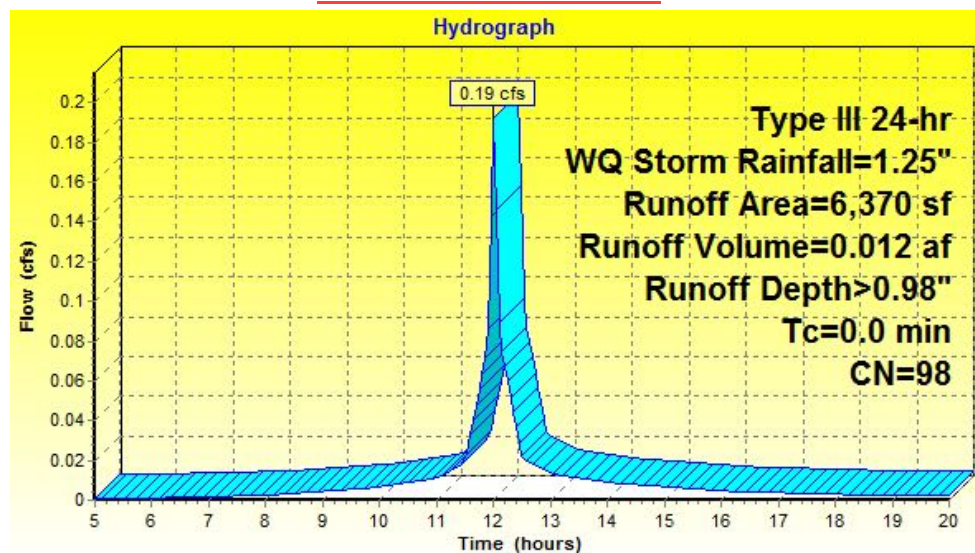
Total Drainage Area: **6,370** sq ft  
**0.146** ac

Total Impervious Area: **6,263** sq ft  
**0.144** ac

Runoff Depth to be Treated: **1.0** inches

**REQUIRED WATER QUALITY VOLUME: 0.012 ac ft**

### FLOW RATE CONVERSION



Note: 12-hr Duration, Type III, 24-hour Storm producing  
**1.0** inches of runoff from impervious surfaces

Design Peak Flow Rate: **0.19** cfs (Based on HydroCAD Analysis)  
Water Quality Runoff Volume: **0.012** ac-ft (Based on HydroCAD Analysis)

**STC 900 will provide a treatment capacity of  
0.19 cfs at 95% TSS Removal Efficiency**

(Based on Manufacturer's sizing. See attached calculation.)



## Brief Stormceptor Sizing Report - Boynton Yards Building 2 Driveway

Project Information & Location			
<b>Project Name</b>	Boynton Yards Building 2	<b>Project Number</b>	52771
<b>City</b>	Somerville	<b>State/ Province</b>	Massachusetts
<b>Country</b>	United States of America	<b>Date</b>	1/25/2018
Designer Information		EOR Information (optional)	
<b>Name</b>	Joe Cappellino	<b>Name</b>	
<b>Company</b>	WSP	<b>Company</b>	
<b>Phone #</b>	617-960-4950	<b>Phone #</b>	
<b>Email</b>	j.cappellino@wsp.com	<b>Email</b>	

### Stormwater Treatment Recommendation

The recommended Stormceptor Model(s) which achieve or exceed the user defined water quality objective for each site within the project are listed in the below Sizing Summary table.

<b>Site Name</b>	Boynton Yards Building 2 Driveway
<b>Target TSS Removal (%)</b>	80
<b>TSS Removal (%) Provided</b>	92
<b>Recommended Stormceptor Model</b>	STC 450i

The recommended Stormceptor Model achieves the water quality objectives based on the selected inputs, historical rainfall records and selected particle size distribution.

Stormceptor Sizing Summary	
Stormceptor Model	% TSS Removal Provided
STC 450i	92
STC 900	95
STC 1200	95
STC 1800	96
STC 2400	97
STC 3600	97
STC 4800	98
STC 6000	98
STC 7200	98
STC 11000	99
STC 13000	99
STC 16000	99
StormceptorMAX	Custom

Sizing Details			
Drainage Area		Water Quality Objective	
Total Area (acres)	0.15	TSS Removal (%)	80.0
Imperviousness %	99.0	Runoff Volume Capture (%)	
Rainfall		Oil Spill Capture Volume (Gal)	
Station Name	BOSTON WSFO AP	Peak Conveyed Flow Rate (CFS)	
State/Province	Massachusetts	Water Quality Flow Rate (CFS)	0.19
Station ID #	0770	Up Stream Storage	
Years of Records	58	Storage (ac-ft)	Discharge (cfs)
Latitude	42°21'38"N	0.000	0.000
Longitude	71°0'38"W	Up Stream Flow Diversion	
		Max. Flow to Stormceptor (cfs)	

Particle Size Distribution (PSD) The selected PSD defines TSS removal		
Fine Distribution		
Particle Diameter (microns)	Distribution %	Specific Gravity
20.0	20.0	1.30
60.0	20.0	1.80
150.0	20.0	2.20
400.0	20.0	2.65
2000.0	20.0	2.65

Notes
<ul style="list-style-type: none"> <li>Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor, which uses the EPA Rainfall and Runoff modules.</li> <li>Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal defined by the selected PSD, and based on stable site conditions only, after construction is completed.</li> <li>For submerged applications or sites specific to spill control, please contact your local Stormceptor representative for further design assistance.</li> </ul>

**For Stormceptor Specifications and Drawings Please Visit:**  
<http://www.imbriumsystems.com/technical-specifications>



## TOTAL SUSPENDED SOLIDS (TSS) REMOVAL CALCULATION

Project Name: Boynton Yards: Buildings 1 & 2  
Project Location: Somerville, Massachusetts  
Project Number: 52771

Date: 2/13/2018  
Calculated By: JVC  
Checked By: BKF

Catchment PR-2A: Building 2 Driveway Area Only	A	B	C	D	E
	BMP *	TSS Removal Rate *	Starting TSS Load **	Amount Removed (C x D)	Remaining Load (C - D)
	Deep Sump and Hooded Catch Basin	25%	1.00	0.25	0.75
	WQS-B5	80%	0.75	0.60	0.15

**TOTAL TSS REMOVAL = 85%**

\* BMP and TSS Removal Rates taken from MassDEP Stormwater Handbook Volume 1.

\*\* Equals remaining load from previous BMP (Column E) which enters the BMP.

\*\*\* Stormceptor continuous simulation modeling determines a TSS removal rate greater than 90%. To be conservative, an 80% removal rate was used for this calculation in accordance with the MASTEP performance evaluation for Stormceptor 900 units.





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Evaluation Project

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[www.mastep.net](http://www.mastep.net)

## MASTEP Technology Review

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**Technology Name:** Stormceptor

**Studies Reviewed:** Final NJCAT Technology Verification Stormceptor STC900 September 2004; Coventry University Study, 1996; Technology Assessment, University of Massachusetts, 1997; SeaTac Stormceptor Performance report 2001; SWAMP report Ontario 2004; Phoenix Group Edmonton report 1995; Stormceptor 1200 Field Evaluation report 2004; Applied Hydrology Associates Denver report 2003; Rinker Materials Como Park St. Paul MN report 2002; VA DOT / UVA "Testing of Ultra-Urban Stormwater Best Management Practices" report 2001. Hydrodynamic Separator Sediment Retention Testing, Mohseni, 2010.

**Date:** September 17, 2013

**Reviewer:** Jerry Schoen

**Rating:** 2

**Brief rationale for rating:** This rating is primarily based on the 2005 NJCAT Technology Verification study.

In general, this was a well-conducted test, which in large part followed NJDEP test guidelines for laboratory studies, which MASTEP considers as the laboratory equivalent of TARP field protocols. Issues of concern: the study measured suspended sediment concentration (SSC) rather than total suspended solids (TSS). Although SSC is considered by many scientists to be the preferred method, it is at odds with Massachusetts stormwater regulations, which are based on TSS treatment. Comparing SSC and TSS results is considered an inexact science. The test was conducted with higher influent sediment concentrations than is preferred, but results were fairly consistent across all ranges studied. The particle size distribution also appears to be slightly higher than the target test range. There are additional field studies that in general support the results obtained in this laboratory studies. These studies do not satisfy TARP protocols, but they do not contradict results obtained in the NJCAT study.

**TARP Requirements Not Met\*:**

- Measurements in TSS.
- Influent sediment concentration is 100 – 300 mg/l: actual was 153-460.
- No documentation of a Quality Assurance Project Plan
- Third party studies are preferred. This was conducted by Stormceptor personnel, with sample analyses conducted by an external laboratory.

**Other Comments:**

\* The 2010 Mohseni study evaluates the susceptibility of the Stormceptor to scouring, or washout of collected sediments. Report concluded that the unit does not scour at high flows as long as sediment depth does not exceed maintenance level.

\* Criteria also based on NJDEP laboratory testing guidelines.



## **ATTACHMENT E**

Included in this section:

- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan
- Construction Best Management Practices Maintenance Checklist



## **CONSTRUCTION PERIOD POLLUTION PREVENTION AND EROSION AND SEDIMENTATION CONTROL PLAN**

**WSP USA** has prepared this Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan to ensure the effectiveness of the erosion and sedimentation controls being used as part of the construction and redevelopment of the parcel of land identified as Boynton Yards Buildings 1 & 2 located at the intersection of South Street and Earle Street in Somerville, Massachusetts. Attached to this plan is a Construction Best Management Practices Maintenance Checklist for use during the long term operation and maintenance of the stormwater management system. This Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan has been prepared in accordance with Standard 8 of the Massachusetts Department of Environmental Protection (MassDEP) Stormwater Management Standards.

Construction Period erosion and sedimentation controls shall be installed and maintained as identified on the Site Plans for the Boynton Yards Buildings 1 & 2, in Somerville, Massachusetts dated February 13, 2018. The erosion and sedimentation controls are specifically shown on Sheet C-101 – Site Preparation & Erosion Control Plan.

### **Party Responsible for Compliance:**

DLJ Real Estate Capital Partners, LLC  
Boston Office  
18 Tremont Street, 7<sup>th</sup> Floor  
Boston, MA 02110  
978.729.9010

## **DESCRIPTION OF EROSION AND SEDIMENT CONTROLS**

### **Erosion Control Barriers (Silt Sock)**

Erosion Control Barriers shall be placed at the perimeter of the work area, at the toe of slope and as shown on the plans to prevent sediment laden surface runoff from leaving the property. The barriers will be replaced as determined by periodic field inspections.

### **Catch Basin Inlet Protection**

Existing catch basins will be protected with silt sacks or erosion control barriers until demolition of the structure. Newly constructed catch basins will be protected with silt sacks or erosion control barriers until final site stabilization. Newly constructed trench drains will be protected with erosion control barriers until final site stabilization.

### **Stabilized Construction Exit**

A temporary stabilized construction exit will be constructed. A cross slope will be placed at the entrance to direct runoff to a protected catch basin inlet or settling area. If deemed necessary after construction begins, a wash pad may be included to wash off vehicle wheels before leaving the property.

### **Vegetative Slope Stabilization**

Stabilization of open soil surfaces will be implemented within 14 days after grading or construction activities have temporarily or permanently ceased, unless there is sufficient snow cover to prohibit implementation. Vegetative slope stabilization will be used to minimize erosion on slopes of 3:1 or steeper. Annual grasses, such as annual rye, will be used to ensure rapid germination and production of root mass. Permanent stabilization will be completed with the planting of perennial grasses or legumes. Establishment of temporary and permanent vegetative cover may be provided by hydro-seeding or sodding. A suitable topsoil, good seedbed preparation, and adequate lime, fertilizer and water will be provided for effective establishment of these vegetative stabilization methods. Mulch or hay can be used after permanent seeding to protect soil from the impact of falling rain and to increase the capacity of the soil to absorb water.

**Maintenance**

- The site contractor will be responsible for implementing each control identified as part of this Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan.
- The site contractor will be responsible for inspecting all sediment and erosion controls periodically and after each rainfall event. Records of the inspections shall be prepared and maintained on-site by the contractor.
- Damaged or deteriorated items will be repaired immediately after identification or at the direction of the owner's engineer or the City of Somerville Engineer.
- The site contractor shall comply with the General Notes regarding Erosion Control as shown on the Site Plans and the notes shown on Sheet C-101 – Site Preparation & Erosion Control Plan.
- Sediment shall be removed from behind barriers when it reaches one-half the height of the barrier or as determined by periodic field inspections or manufacturer's recommendations.
- Sediment that is collected in structures shall be disposed of properly and covered if stored on-site.
- The stabilized construction exits shall be inspected weekly. The exits shall be maintained by adding additional clean, angular, durable stone to remove sediment from the tires of construction vehicles when exiting the property. Adjacent roadways shall be kept clean and swept as needed to avoid deposition of sediment as a result of construction traffic exiting the property.
- Dust pollution shall be controlled using an on-site water source and/or an approved soil stabilization product.
- Erosion control structures shall remain in place until all disturbed earth has been securely stabilized. After removal of structures, disturbed areas shall be re-graded and stabilized as necessary.

CONSTRUCTION BEST MANAGEMENT PRACTICES MAINTENANCE CHECKLIST

Best Management Practice	Inspection Frequency	Date Inspected	Inspector	Minimum Maintenance and Key Items to Check	Cleaning or Repair Needed (List Items if Required)	Date of Cleaning or Repair	Performed by
Catch Basin Inlet Protection (Silt Sack)	Inspect at least once every 7 calendar days or once every 14 calendar days and within 24 hours of the occurrence of storm event of 0.25 inches or greater.			Inspect for proper operation. If clogged, remove accumulated sediment and properly dispose of to maintain the capacity of the catch basin.			
Erosion Control Barrier (Silt Sock)	Inspect at least once every 7 calendar days or once every 14 calendar days and within 24 hours of the occurrence of storm event of 0.25 inches or greater.			Ensure that the silt sock is intact and the area behind the sock is not filled with sediment. If there is excessive ponding behind the silt sock or accumulated sediments reach the top of the sock, an additional sock should be added on top or in front of the existing silt sock without disturbing the soil or accumulated sediment.  If the silt sock was overtopped during a storm event, the operator should install an additional silt sock on top of the original or place an additional silt sock further up the slope.			
Stabilized Construction Exit	Inspect at least once every 7 calendar days or once every 14 calendar days and within 24 hours of the occurrence of storm event of 0.25 inches or greater.			The exit shall be maintained in a condition that will prevent tracking of sediment onto public rights-of-way. The contractor shall sweep or wash pavement at exits which have experienced mud-tracking onto the pavement or traveled way. When wheel washing is required, it shall be done on an area stabilized with aggregate that drains into an approved sediment trapping device.  When the construction exit becomes ineffective, the stone shall be removed along with the collected soil material and redistributed on-site in a stable manner. The exit should then be reconstructed.  All sediment shall be prevented from entering storm drains, ditches, or waterways.			
Vegetated Slope Stabilization	Inspect at least once every 7 calendar days or once every 14 calendar days and within 24 hours of the occurrence of storm event of 0.25 inches or greater.			Inspect for erosion. Re-grade and re-seed as necessary.			

Stormwater Supervisor Contact Information:





## **ATTACHMENT F**

Included in this section:

- Stormwater Operation and Maintenance Plan (O&M) Plan
- Stormwater Best Management Practices Maintenance Checklist
- Manufacturer's Inspection and Maintenance Recommendations - Stormceptor®



## **STORMWATER OPERATION AND MAINTENANCE PLAN**

**WSP USA** has prepared this Stormwater Operation and Maintenance (O&M) Plan to ensure the continued effectiveness of the stormwater management system designed as part of the redevelopment of the parcel of land identified as Boynton Yards Building 1 & 2 located at the intersection of South Street and Earle Street in Somerville, Massachusetts. Attached to this plan is a Stormwater Best Management Practices Maintenance Checklist for use during the long term operation and maintenance of the stormwater management system. This Stormwater O&M Plan has been prepared in accordance with Standard 9 of the Massachusetts Department of Environmental Protection (MassDEP) Stormwater Management Standards.

The Site Plans for the Boynton Yards Buildings 1 & 2, in Somerville, Massachusetts dated February 13, 2018 are made part of this Stormwater O&M Plan by reference.

### **Stormwater Management System Owner:**

DLJ Real Estate Capital Partners, LLC  
Boston Office  
18 Tremont Street, 7<sup>th</sup> Floor  
Boston, MA 02110  
978.729.9010

### **Party Responsible for Maintenance:**

DLJ Real Estate Capital Partners, LLC  
Boston Office  
18 Tremont Street, 7<sup>th</sup> Floor  
Boston, MA 02110  
978.729.9010

## **DESCRIPTION OF STORMWATER MAINTENANCE PROCEDURES**

### **Deep Sump and Hooded Catch Basins**

- All catch basins shall be inspected a minimum of at least four times per year.
- Sediment, if more than two (2) feet deep, and/or floatable pollutants shall be pumped from the basin and disposed of at an approved offsite facility in accordance with all applicable regulations.
- Any structural damage or other indication of malfunction will be reported to the site manager and repaired as necessary.
- During cleanings, confirm the oil/debris trap (hood) is installed properly, is free of clogs, and is functional. Reinstall or replace as needed.
- During colder periods, the catch basin grates must be kept free of snow and ice.
- During warmer periods, the catch basin grates must be kept free of leaves, litter, sand, and debris.

### **Water Quality Structures**

- See the attached Manufacturer's instructions on operation and maintenance requirements and methodology.
- Inspect and clean twice per year or as required by manufacturer.
- Remove sediment and other trapped pollutants at the frequency or level specified by the manufacturer.

### **Roof Drain Leaders**

- Perform routine roof inspections twice per year, typically in the spring and fall.
- Inspect for blockage and remove debris if required.



- Keep roofs clean and free of debris.
- Keep roof drainage systems clear.
- Keep roof access limited to authorized personnel.

**Subsurface Infiltration System (existing)**

- See the attached Manufacturer's instructions on operation and maintenance requirements and methodology.
- Perform routine inspections on a monthly basis for the first three months after installation. Then, at a minimum, the treatment structure is to be inspected twice annually and the infiltrating structure is to be inspected annually.
- The subsurface infiltration system will be inspected twice during for the first year and annually thereafter by removing the manhole/access port covers and determining the thickness of sediment that has accumulated.
- If sediment is more than two inches deep, it must be suspended via flushing with clean water and removed using a vactor truck.
- Emergency overflow pipes will be examined at least once each year and verified that no blockage has occurred.

**Pervious Concrete / Paver Sidewalk**

- Inspect annually.
- Vacuum sweep the area and then clean the surface with a power washer to dislodge any trapped particles.
- Visually assess (evidence of ponding, etc.) the infiltration capacity of the sidewalk at least once per year.

STORMWATER BEST MANAGEMENT PRACTICES MAINTENANCE CHECKLIST

Best Management Practice	Inspection Frequency	Date Inspected	Inspector	Minimum Maintenance and Key Items to Check	Cleaning or Repair Needed (List Items if Required)	Date of Cleaning or Repair	Performed by
Deep Sump and Hooded Catch Basins	Inspect four times per year. Clean four times per year, in the spring and fall, or whenever sediment buildup exceeds two (2) feet in depth.			Remove trash and deposits. During cleanings, confirm the oil/debris trap (hood) is installed properly, is free of clogs, and is functional. Reinstall or replace as needed. Take care not to damage the oil/debris trap (hood) during cleaning.			
Water Quality Structure	Inspect and clean twice per year or as required by the manufacturer.			Remove sediment and other trapped pollutants at the frequency or level specified by the manufacturer. No use of clamshell buckets without prior approval. Increase inspection frequency, as needed, based on observed sediment loading.			
Roof Drain Leaders	Inspect twice per year, typically in the spring and fall.			Inspect for blockage and remove debris if required.			
Subsurface Infiltration System	Inspect monthly for the first three months. Then, at a minimum, the treatment structure is to be inspected twice annually and the infiltrating structure is to be inspected annually as required by the manufacturer.			Inspect the system twice in the first year for proper function. Remove sediment once per year or when buildup exceeds two (2) inches in depth.			
Pervious Concrete / Paver Sidewalk	Inspect annually.			Vacuum sweep the area and then clean the surface with a power washer to dislodge any trapped particles.  Visually assess (evidence of ponding, etc.) the infiltration capacity of the sidewalk at least once per year.			

Stormwater Supervisor Contact Information:





## Inspection and Maintenance. Easy. Convenient.

When it rains, oils, sediment and other contaminants are captured and contained by over 40,000 Stormceptor units operating worldwide. While Stormceptor's patented scour prevention technology ensures captured pollutants remain in the unit during all rainfall events, the accumulated pollutants must eventually be removed as part of a regular maintenance program.

If neglected, oil and sediment gradually build up and diminish any BMP's efficiency, harming the environment and leaving owners and operators vulnerable to fines, surcharges and bad publicity.

### Maintenance is a must

Ease, frequency and cost of maintenance are often overlooked by specifiers when considering the merits of a stormwater treatment system. In reality, maintenance is fundamental to the long-term performance of any stormwater quality treatment device.

While regular maintenance is crucial, it shouldn't be complicated. An ongoing maintenance program with Stormceptor is convenient and practically effortless. With virtually no disruptions, you can concentrate on your core business.

### Quick inspections

Inspections are easily carried out above ground from any standard surface access cover through a visual inspection of the orifice and drop tee components. A sludge judge and oil dip-stick are all that are needed for sediment and oil depth measurements.

### Easy unit access

Maintenance is typically conducted from the same surface access cover, eliminating the need for confined space entry into the unit. Your site remains undisturbed, saving you time and money.



## No muss, no fuss and fast

Maintenance is performed quickly and inexpensively with a standard vacuum truck. Servicing usually takes less than two hours, with no disruption to your site.

A complete stormwater management plan for Stormceptor extends beyond installation and performance to regular maintenance. It's the smart, cost-effective way to ensure your unit continues to remove more pollutants than any other separator for decades to come.



## Stormceptor maintenance recommendations

- Units should be inspected post-construction, prior to being put into service.
- Inspect every six months for the first year of operation to determine the oil and sediment accumulation rate.
- In subsequent years, inspections can be based on first-year observations or local requirements.
- Cleaning is recommended once the sediment depth reaches 15% of storage capacity, (generally taking one year or longer). Local regulations for maintenance frequency may vary.
- Inspect the unit immediately after an oil, fuel or chemical spill.
- A licensed waste management company should remove captured petroleum waste products from any oil, chemical or fuel spills and dispose responsibly.

**With over 40,000 units operating worldwide, Stormceptor performs and protects every day, in every storm.**



[www.imbriumsystems.com](http://www.imbriumsystems.com)

USA: (888) 279 8826  
CANADA: (800) 565 4801

## **ATTACHMENT G**

Included in this section:

- Pipe Sizing Calculations





Project Name: Boyton Yards: Buildings 1 & 2  
Project Location: Somerville | Massachusetts  
Project Number: 52771

**DRAINAGE PIPE CAPACITY  
CALCULATIONS**

Date: 2/13/2018  
Calculated By: SDB  
Checked By: JVC

STRUCTURES		AREA				FLOW TIME			ELEVATIONS			PIPE DESIGN				PIPE CONDITIONS			NOTES
FROM	TO	AREA (AC)	C	CxA	TOC (MIN)	PIPE FLOW (MIN)	TOTAL TIME (MIN)	LENGTH (FT)	RIM	INVERT: UPSTREAM	INVERT: DNSTREAM	SLOPE	DIA (IN)	n	CAPACITY (CFS)	FLOW (CFS)	CAPACITY (%)	VELOCITY (FPS)	
AD-A23	AD-A21	0.012	0.305	0.00	5.0	0.51	5.00	35.4	9	6.80	6.6	0.01	8.0	0.01	0.98	0.02	2.2	1.16	
AD-A22	AD-A20	0.006	0.396	0.00	5.0	0.51	5.00	32.4	9	6.80	6.6	0.01	8.0	0.01	1.03	0.01	1.4	1.05	
AD-A21	DMH-A19	0.011	0.365	0.01	5.0	0.12	5.51	15.7	9	6.60	6.3	0.02	8.0	0.01	1.81	0.05	2.5	2.21	
AD-A20	DMH-A19	0.008	0.420	0.01	5.0	0.14	5.51	16.4	9	6.60	6.3	0.02	8.0	0.01	1.77	0.03	1.9	1.98	
DMH-A19	DMH-A17	(N/A)	(N/A)	0.01	0.0	0.25	5.65	25.2	9.2	6.20	6	0.01	12.0	0.01	3.17	0.08	2.5	1.72	
CB-A18	DMH-A17	0.060	0.873	0.05	5.0	0.12	5.00	20.1	8.70	6.20	6	0.01	12.0	0.01	3.55	0.32	8.9	2.80	
DMH-A17	DMH-A15	(N/A)	(N/A)	0.07	0.0	0.13	5.90	22.7	9	5.90	5.7	0.01	12.0	0.01	3.34	0.39	11.7	2.85	
CB-A16	DMH-A15	0.051	0.876	0.05	5.0	0.06	5.00	10.1	8.7	5.80	5.7	0.01	12.0	0.01	3.54	0.27	7.6	2.66	
DMH-A15	DMH-A14	(N/A)	(N/A)	0.11	0.0	0.26	6.03	57.8	9	5.60	5.2	0.01	12.0	0.01	3.85	0.66	17	3.66	
DMH-A14	DMH-A12	(N/A)	(N/A)	0.11	0.0	0.52	6.29	95.9	9.2	5.10	4.4	0.01	12.0	0.01	3.04	0.65	21.4	3.08	
CB-A13	DMH-A12	(N/A)	(N/A)	0.00	0.0	N/A	0.00	27.2	9	4.80	4.6	0.01	12.0	0.01	3.05	0	0	0.00	
DMH-A12	DMH-A11	0.353	0.900	0.43	5.0	0.08	6.81	22.6	8.7	4.30	4.1	0.01	12.0	0.01	3.35	2.48	74.1	4.67	
DMH-A11	DMH-A9	(N/A)	(N/A)	0.43	0.0	0.08	6.89	21.6	8.5	4.10	3.9	0.01	12.0	0.01	3.43	2.48	72.2	4.76	
CB-A10	DMH-A9	0.222	0.832	0.19	5.0	0.06	5.00	15.5	8.1	4.10	3.9	0.01	12.0	0.01	4.04	1.12	27.6	4.40	
DMH-A9	DMH-A7	(N/A)	(N/A)	0.61	0.0	0.32	6.97	92.9	8.3	3.80	3.1	0.01	18.0	0.01	9.12	3.54	38.8	4.83	
CB-A8	DMH-A7	0.062	0.881	0.06	5.0	0.09	5.00	17.6	8.5	3.60	3.3	0.02	12.0	0.01	4.65	0.33	7.1	3.43	
DMH-A7	DMH-A4	0.353	0.900	0.99	5.0	0.16	7.29	48.7	8.7	3.00	2.7	0.01	18.0	0.01	8.24	5.62	68.2	5.02	
AD-A6	CB-A5	0.051	0.764	0.04	5.0	0.14	5.00	44.4	8.9	6.00	3.5	0.06	8.0	0.01	3.11	0.24	7.6	5.25	
CB-A5	DMH-A4	0.078	0.877	0.11	5.0	0.06	5.14	13.6	8.1	3.20	3	0.02	12.0	0.01	4.32	0.65	15	3.96	
DMH-A4	DMH-A2	(N/A)	(N/A)	1.09	0.0	0.12	7.45	35.9	8.4	2.60	2.4	0.01	18.0	0.01	7.84	6.2	79.2	4.92	
CB-A3	DMH-A2	0.057	0.771	0.04	5.0	0.05	5.00	11.6	8.3	3.00	2.7	0.03	12.0	0.01	5.73	0.27	4.6	3.72	
DMH-A2	DMH-A1 (EX)	(N/A)	(N/A)	1.14	0.0	0.11	7.57	32.4	8.6	2.30	2.1	0.01	18.0	0.01	8.25	6.43	77.9	5.16	
AD-F3	DMH-F1	0.022	0.200	0.00	5.0	0.08	5.00	16	9.3	6.00	5	0.06	8.0	0.01	3.93	0.03	0.7	3.19	
AD-F2	DMH-F1	0.019	0.200	0.00	5.0	0.25	5.00	35.1	9.2	6.00	5	0.03	8.0	0.01	2.65	0.02	0.9	2.32	
DMH-F1	EX 36 DRAIN"	0.171	0.900	0.16	5.0	0.07	5.25	31.4	9.4	3.00	2.1	0.03	8.0	0.01	2.66	0.98	36.7	7.03	
AD-E2	DMH-E1	0.026	0.200	0.01	5.0	0.13	5.00	14	8.5	6.20	6	0.01	8.0	0.01	1.56	0.03	2	1.78	
DMH-E1	EX RECHARGE SYS	0.171	0.900	0.16	5.0	0.14	5.13	32.8	9	6.00	5.7	0.01	12.0	0.01	3.69	0.96	26	3.95	
CB-D4	DMH-D2	0.078	0.811	0.06	5.0	0.16	5.00	26.1	8.3	4.30	4.1	0.01	12.0	0.01	3.12	0.38	12.3	2.70	
CB-D3	DMH-D2	0.108	0.810	0.09	5.0	0.12	5.00	21.8	8.3	4.30	4.1	0.01	12.0	0.01	3.41	0.53	15.5	3.16	
DMH-D2	DMH-D1-EX	(N/A)	(N/A)	0.15	0.0	0.09	5.16	17.2	8.8	4.00	3.9	0.01	12.0	0.01	2.71	0.91	33.5	3.11	
CB-B5	WQS-B4	0.118	0.900	0.11	5.0	0.14	5.00	36.2	8.8	5.80	5.2	0.02	12.0	0.01	4.97	0.64	12.9	4.36	
WQS-B4	WYE 1	(N/A)	(N/A)	0.11	0.0	0.31	5.14	77.8	8.4	5.10	3.95	0.02	12.0	0.01	4.69	0.64	13.7	4.18	
AD-B3	WYE 1	0.024	0.537	0.01	5.0	0.03	5.00	9.7	9.2	5.00	3.95	0.11	8.0	0.01	4.31	0.08	1.8	4.77	
WYE 1	WYE 2	(N/A)	(N/A)	0.12	0.0	0.21	5.45	54.7	9.3	3.95	3.1	0.02	12.0	0.01	4.81	0.71	14.9	4.39	
CB-B2	WYE 2	0.022	0.542	0.01	5.0	0.03	5.00	8.5	9.2	4.00	3.1	0.11	8.0	0.01	4.26	0.07	1.7	4.60	
WYE 2	DMH-B1	(N/A)	(N/A)	0.131	0	0.334	5.656	72.3	9.3	3.1	2.5	0.008	12	0.01	3.52	0.78	22.3	3.6	

