STORMWATER REPORT

Sunrise of Chestnut Hill

Stormwater Management Report
11 Florence Street - Newton, MA

PREPARED FOR

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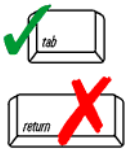
Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

A. Introduction

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the Massachusetts Stormwater Handbook. The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.[1] This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8[2]
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

[1] The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

[2] For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature

Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

■ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

- ■ No disturbance to any Wetland Resource Areas
- ■ Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- ☐ Reduced Impervious Area (Redevelopment Only)
- ■ Minimizing disturbance to existing trees and shrubs
- ☐ LID Site Design Credit Requested:
  - ☐ Credit 1
  - ☐ Credit 2
  - ☐ Credit 3
- ☐ Use of "country drainage" versus curb and gutter conveyance and pipe
- ☐ Bioretention Cells (includes Rain Gardens)
- ☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- ☐ Treebox Filter
- ☐ Water Quality Swale
- ☐ Grass Channel
- ☐ Green Roof
- ☐ Other (describe): _____

Standard 1: No New Untreated Discharges

- ■ No new untreated discharges
- ■ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- ■ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☐ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

■ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

■ Soil Analysis provided.

■ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

■ Sizing the infiltration, BMPs is based on the following method: Check the method used.

■ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

☐ Runoff from all impervious areas at the site discharging to the infiltration BMP.

■ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

■ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

- ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
- ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
- ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
- ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

■ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

[1] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

■ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☐ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

- ☐ is within the Zone II or Interim Wellhead Protection Area
- ☐ is near or to other critical areas
- ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
- ☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

■ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

■ The BMP is sized (and calculations provided) based on:

- ■ The ½" or 1" Water Quality Volume or
- ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

■ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

■ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

N/A **Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)**

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☐ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

N/A **Standard 6: Critical Areas**

☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☐ Critical areas and BMPs are identified in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

N/A **Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable**

☐ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- ☐ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☐ Bike Path and/or Foot Path
- ☐ Redevelopment Project
- ☐ Redevelopment portion of mix of new and redevelopment.

☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

■ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☐ The project is ***not*** covered by a NPDES Construction General Permit.

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

■ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☐ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

■ Name of the stormwater management system owners;

TBD ☐ Party responsible for operation and maintenance;

■ Schedule for implementation of routine and non-routine maintenance tasks;

Refer to Design Plans ■ Plan showing the location of all stormwater BMPs maintenance access areas;

N/A ☐ Description and delineation of public safety features;

TBD ☐ Estimated operation and maintenance budget; and

■ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;

☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

☐ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☐ An Illicit Discharge Compliance Statement is attached;

■ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

Stormwater Report Narrative

This Stormwater Report has been prepared to demonstrate compliance with the Massachusetts Stormwater Management Standards in accordance with the Massachusetts Wetlands Protection Act Regulations (310 CMR 10.00) and Water Quality Certification Regulations (314 CMR 9.00). This report also demonstrates compliance with the City of Newton rules and regulations for stormwater design and mitigation.

Project Description

The Applicant, Sunrise Development, Inc, is proposing to construct a 5-story residential building and associated parking infrastructure at 11 Florence Street in Newton, MA. As proposed, the Project consists of 92,791 gross square feet of building space, ancillary hardscape/landscape improvements, parking spaces, and utility improvements to support this use.

The Project will entail the construction of a residential building with associated parking and drive aisles and is/is not considered a Land Use with Higher Potential Pollutant Loads (LUHPPL).

Site Description

The Project Site are two parcels of land totaling 1.9 Acres (the Site) located at 11 Florence in Newton, Massachusetts (see Figure 1). The Site lies within the Charles River Watershed in the South Meadow Brook Drainage Basin and is bounded by Florence Street to the north, Single Family Residential uses to the south and East, and a Multifamily Residential use to the west. See Figure 1, Site Locus Map.

Wetland Resource Areas on the Site include the following:

Table 1 Existing Conditions Hydrologic Data

Name	Critical Area (yes/no)	Zone 1 or Zone A (yes/no)	ORW or SRW (yes/no)	Zone II or IWPA (yes/no)	Other
Charles River Watershed	no	no	no	no	*South Meadow Brook Drainage Basin / Sub-watershed*

According to the National Resources Conservation Service (NRCS), surface soils on the Site include Canton fine sandy loam and urban land. Canton soils have a Hydrologic Soil Group (HSG) rating of B, Urban soils do not have a rating. Based on the soil evaluation included in Appendix C, the Site *is not* considered to be within an area of rapid infiltration (soils with a saturated hydraulic conductivity greater than 2.4 inches per hour).

Existing Drainage Conditions

Under existing conditions, the Site is developed and is predominately impervious except for wooded areas along the eastern and southern property lines. Currently the Site operates as a florist shop with several detached green houses, a kiosk, hardscaped outdoor display areas, and gravel and paved parking areas. Generally, stormwater runoff from the developed portion of the site flows northwest to southeast. Slopes are between 2-5%. Figure 2 illustrates the existing drainage patterns on the Site.

Most of the runoff from the developed portion of the site is collected in two catch basins that discharge to an on-Site swale. The swale conveys the runoff to a set of twin culverts within a drain easement near the southeast corner of the Site. A small portion of parking and driveway areas along the northern property line discharges to the closed drainage system in Florence Street. Existing stormwater runoff is not treated before it discharges off site. Stormwater run-on from the property along the western property flows overland onto the site. Additionally, there is an existing drainpipe that traverses across the western portion of the site. The upstream invert is located offsite to the west and the downstream invert discharges to the twin culverts. Flow out of this pipe was observed in the field.

Currently, the Site is divided into drainage areas as stormwater runoff flows to 3 Design Points, which have been identified as DP1 (the existing inlet of dual culvert pipes that lead offsite), DP2 (the offsite existing downstream outlet of the dual culvert pipe), and DP3 (an offsite existing roadway catch basin which accepts drainage from a portion of Florence street). Table 2 below provides a summary of the existing conditions hydrologic data.

Table 2 Existing Conditions Hydrologic Data

Drainage Area	Discharge Location	Design Point	Area (Acres)	Curve Number	Time of Concentration (min)
1	Beginning of Drainage Easement	DP1	1.623	90	6.2
2	Drainage Easement Offsite	DP2	0.165	55	11.6
3	Florence Street Catch basin	DP3	0.376	88	6.0

Proposed Drainage Conditions

Figure 3 illustrates the proposed "post construction" drainage conditions for the project. As shown, the Site will be divided into drainage areas that discharge treated stormwater to the 3 existing Design Points. Table 3 below provides a summary of the proposed conditions hydrologic data.

Table 3 Proposed Conditions Hydrologic Data

Drainage Area	Discharge Location	Design Point	Area (Acres)	Curve Number	Time of Concentration (min)
1A	Beginning of Drainage Easement	DP1	0.357	84	6.0
1B	Beginning of Drainage Easement	DP1	0.495	84	6.0
1C	Beginning of Drainage Easement	DP1	0.823	87	6.0
2	Drainage Easement Offsite	DP2	0.245	57	11.6
3	Florence Street Catch basin	DP3	0.246	96	6.0

The site design integrates a comprehensive stormwater management system that has been developed in accordance with the Massachusetts Stormwater Handbook. The proposed stormwater management system has been designed to treat the one-inch Water Quality Volume (in addition to the required treatment volume of 0.5 inches) and provides 86% Total Suspended Solids (TSS) pretreatment prior to infiltration.

Environmentally Sensitive and Low Impact Development (LID) Techniques

Low Impact Development (LID) techniques and stormwater Best Management Practices (BMPs) implemented into the site design *include minimized disturbance to existing mature trees and vegetation* around the perimeter of the site so they can continue to provide shade and visual buffers to neighbors in addition to the additional landscaping provided in the proposed condition. Additionally, most of the provided parking will be structured below the building to minimize disturbance. Generally, stormwater runoff from the developed portion of the site will be collected in a closed drainage system and conveyed to either a biofiltration basin or subsurface infiltration system for treatment and attenuation. An overflow from the subsurface infiltration system is required and will discharge to the twin culverts. A small portion of runoff will continue to flow offsite to the closed drainage system in Florence Street. Exiting peak runoff rates to the municipal drainage system and the drainage easements will be maintained in proposed conditions.

Figure 1 Site Locus Map

0 100 200 Feet

Sunrise of Chestnut Hill
11 Florence Street
Newton, MA
Locus Map

Figure 1

Figure 2 Existing Drainage Area

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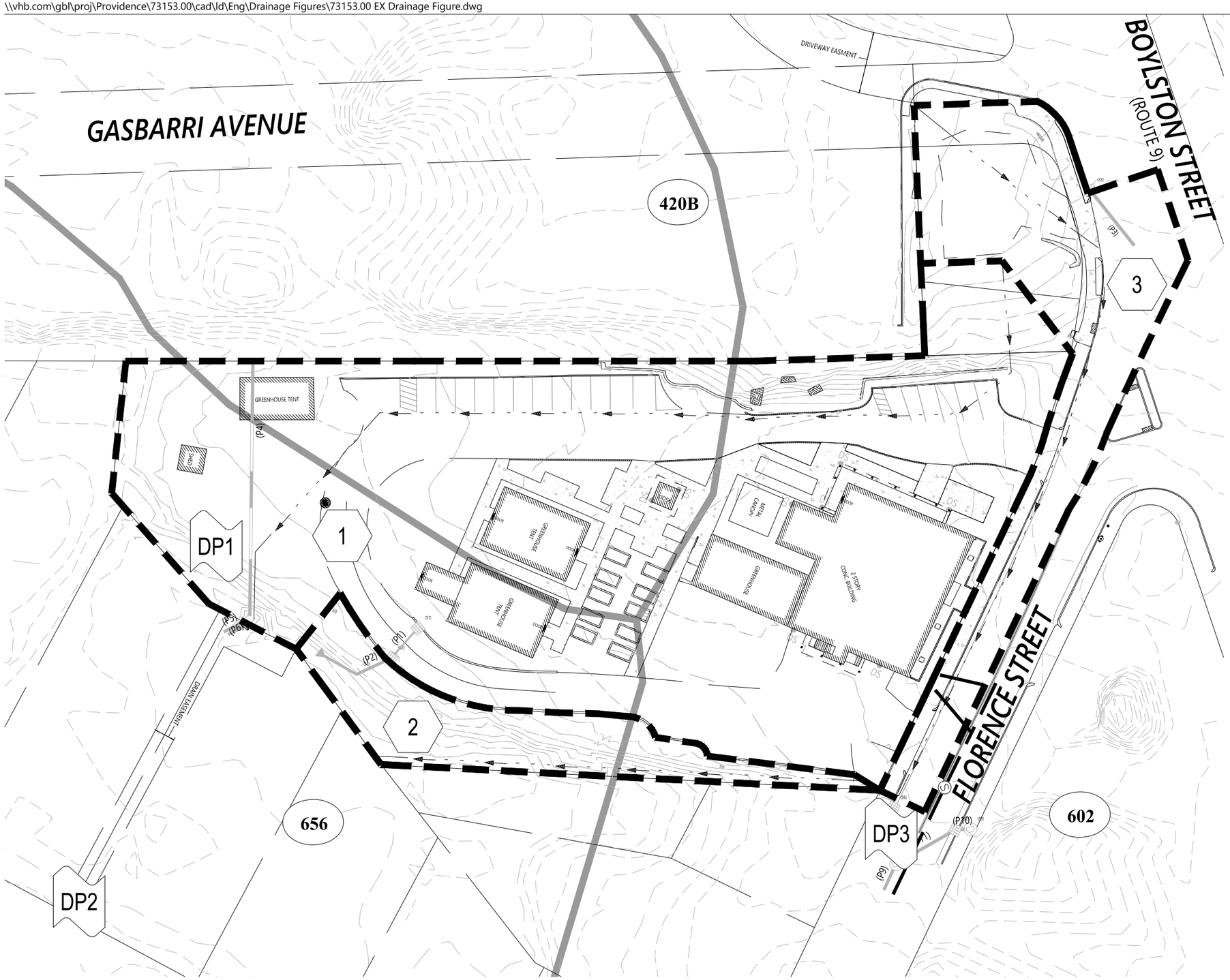

Legend

SYMBOLS

- X — **DESIGN POINT**
- X — **DRAINAGE AREA DESIGNATION**
- X — **POND**

LINETYPES

- **DRAINAGE AREA BOUNDARY**
- **TIME OF CONCENTRATION FLOW LINE**
- **SOIL TYPE BOUNDARY**

SCS SOIL CLASSIFICATIONS

- 420B — **Canton fine sandy loam, 3 to 8 percent slopes, HSG B**
- 602 — **Urban Land, HSG not assigned**
- 656 — **Udorthents-Urban Land complex, HSG not assigned**

0 25 50 Feet

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Existing Drainage Conditions
Sunrise of Chestnut Hill
11 Florence Street
Newton, MA

Figure 2

November 2021

Figure 3 Proposed Drainage Area

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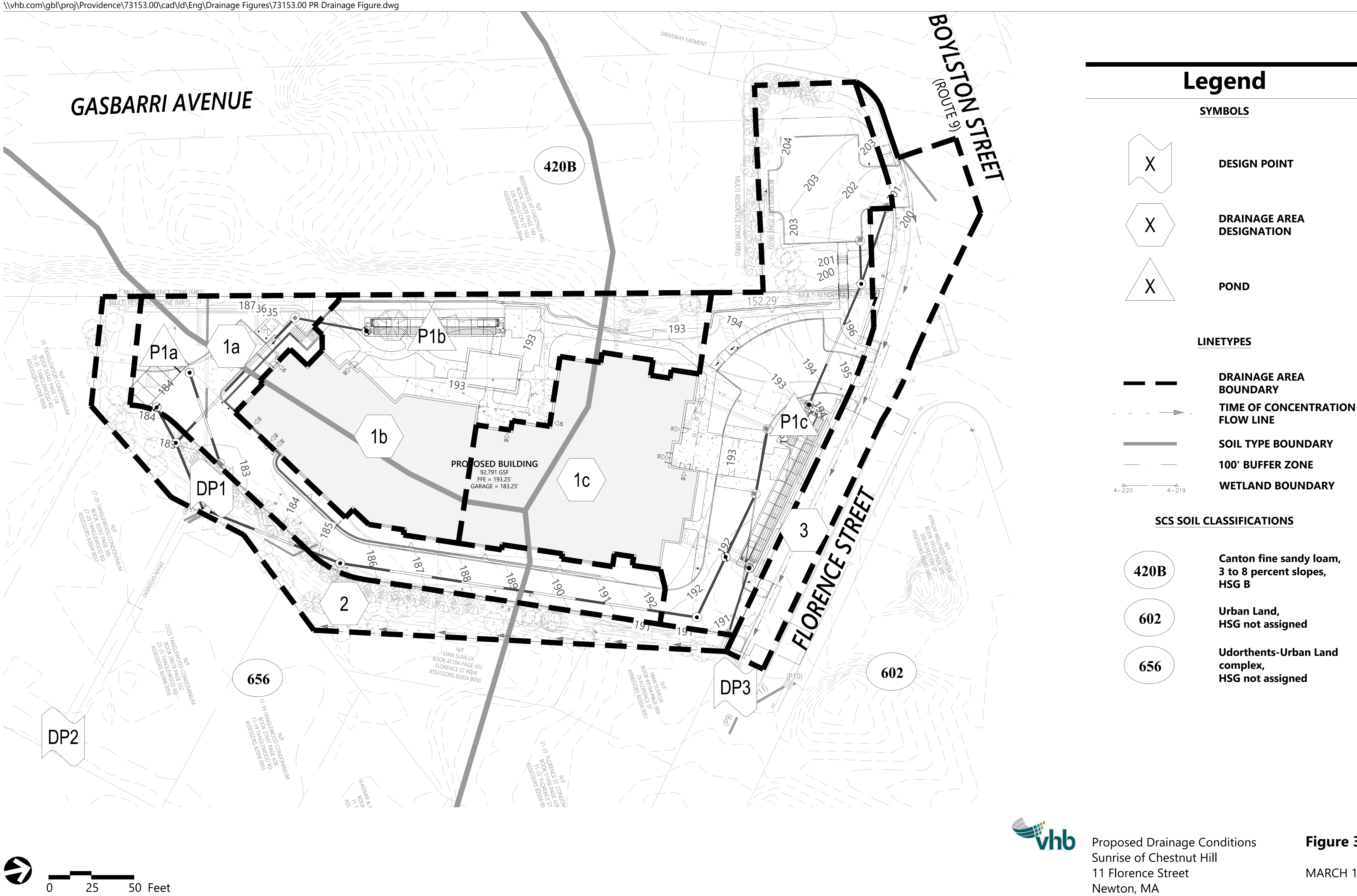

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Proposed Drainage Conditions
Sunrise of Chestnut Hill
11 Florence Street
Newton, MA

Figure 3

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Regulatory Compliance

Massachusetts Department of Environmental Protection (DEP) – Stormwater Management Standards

As demonstrated below, the proposed Project fully complies with the DEP Stormwater Management Standards.

Standard 1: No New Untreated Discharges or Erosion to Wetlands

The Project has been designed to comply with Standard 1.

The Best Management Practices (BMPs) included in the proposed stormwater management system have been designed in accordance with the Massachusetts Stormwater Handbook. Supporting information and computations demonstrating that no new untreated discharges will result from the Project are presented through compliance with Standards 4 through 6.

All proposed Project stormwater outlets and conveyances have been designed to not cause erosion or scour to wetlands or receiving waters. Outlets from closed drainage systems have been designed with flared end sections and stone protection to dissipate discharge velocities. The overflow exits from BMP's that impound stormwater have been designed with stone rip-rap to protect downgradient areas from erosion.

Standard 2: Peak Rate Attenuation

The Project has been designed to comply with Standard 2. The post-development peak discharge rates will decrease as a result of the stormwater BMPs associated with the Project. The Project is directing run-off to infiltration systems which will reduce the pre-development peak discharge rates.

The rainfall-runoff response of the Site under existing and proposed conditions was analyzed for storm events with recurrence intervals of 2, 10, 25 and 100 years. The results of the analysis, as summarized in Table 4 below, indicate that there is no increase in peak discharge rates between the existing and proposed conditions *for the 2, 10, 25, and 100 year storm events.*

Computations and supporting information regarding the hydrologic modeling are included in Appendix B.

Table 4 Peak Discharge Rates (cfs*)

Design Point	2-year	10-year	25-year	100-year
Design Point: DP1				
Existing	3.86	6.40	8.44	12.66
Proposed	1.58	4.87	7.63	11.70
Design Point: DP2				
Existing	3.86	6.47	8.60	13.06
Proposed	1.62	5.05	7.94	12.38
Design Point: DP3				
Existing	0.83	1.39	1.85	2.82
Proposed	0.70	1.08	1.38	2.01

Standard 3: Stormwater Recharge

The Project has been designed to comply with Standard 3.

In accordance with the Stormwater Handbook, the Required Recharge Volume for the Project is therefore *1,807* cubic feet. Recharge of stormwater has been provided through the use of *infiltration BMPs* which have been sized using the *Static* method. Each infiltration BMP has been designed to drain completely within 72 hours. Table 5 below provides a summary of the proposed infiltration BMPs utilized for the Project.

The infiltration systems does not meet (due to site restrictions) a section of "Table IB.1 – Site Criteria for Infiltration Basins" from *Volume 2 Chapter 2 of the Structural BMP specifications for the Massachusetts Stormwater Handbook* – "Distance from any building foundations including slab foundations without basements – minimum 10 ft downslope and 100 ft upslope."

Table 5 Summary of Recharge Calculations

Infiltration BMP	Provided Recharge Volume (cubic feet)
Loading Area StormTrap SandFilter (P1a)	0
Garden ADS Stormtech SC-740 Chambers on 6" Crushed Stone Base (P1b)	1,340
Front Yard ADS Stormtech SC-740 Chambers on 6" Crushed Stone Base (P1c)	2,262
Total Required Recharge	**1,807**
Total Provided Recharge	**3,602**

Soil evaluation (including Geotechnical Report), computations, and supporting information are included in Appendix C.

Standard 4: Water Quality

The Project has been designed to comply with Standard 4.

The proposed stormwater management system implements a treatment train of BMPs that has been designed to provide 80% TSS removal of stormwater runoff from all proposed impervious surfaces.

Computations and supporting information, including the Long-Term Pollution Prevention Plan, are included in Appendix D.

Standard 5: Land Uses with Higher Potential Pollutant Loads (LUHPPLs)

For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable. If, through source control and/or pollution prevention, all land uses with higher potential pollutant loads cannot be completely protected from exposure to rain, snow, snow melt, and stormwater runoff, the proponent shall use the specific structural stormwater BMPs determined by the Department to be suitable for such uses as provided in the Massachusetts Stormwater Handbook. Stormwater discharges from land uses with higher potential pollutant loads shall also comply with the requirements of the Massachusetts Clean Waters Act, M.G.L. c. 21, §§ 26-53 and the regulations promulgated there under at 314 CMR 3.00, 314 CMR 4.00 and 314 CMR 5.00.

The Project is not considered a LUHPPL.

Standard 6: Critical Areas

Stormwater discharge to critical areas must utilize certain stormwater management BMPs approved for critical areas. Critical areas are Outstanding Resource Waters ("ORWs"), shellfish beds, swimming beaches, cold-water fisheries and recharge areas for public water supplies.

The Project will not discharge stormwater near or to a critical area.

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the Maximum Extent Practicable

This project is not a redevelopment.

The Project has been designed to comply with all ten of the Stormwater Management Standards.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Controls

The Project will disturb more than one acres of land and is therefore required to obtain coverage under the Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System (NPDES) Construction General Permit. As required under this permit, a Stormwater Pollution Prevention Plan (SWPPP) will be developed and submitted before land disturbance begins. Recommended construction period pollution prevention and erosion and sedimentation controls to be finalized in the SWPPP are included in Appendix F.

Standard 9: Operation and Maintenance Plan

In compliance with Standard 9, a Post Construction Stormwater Operation and Maintenance (O&M) Plan has been developed for the Project. The O&M Plan is included in Appendix D as part of the Long-Term Pollution Prevention Plan.

Standard 10: Prohibition of Illicit Discharges

Sanitary sewer and storm drainage structures which were part of the previous development on this site are to be completely removed during the site redevelopment. The design plans submitted with this report have been designed in full compliance with current standards. The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges.

Local Municipal Rules and Regulations

Regulatory Compliance

Through the proposed stormwater management systems approach described above, the Project will meet stormwater management regulatory requirements while providing broad environmental and community benefits. Regulatory requirements applicable to the Project stormwater management plan include:

- Final TMDL for Nutrients in the Upper/Middle Charles River, CN 272.0 (May 2011);
- Massachusetts Stormwater Management Standards; and
- City of Newton Requirements for On-Site Drainage.

In addition, runoff from the site will be collected in or passed through one or more BMPs, as described above, designed specifically to recharge groundwater and/or remove TSS and phosphorus to levels prescribed by DEP, prior to discharge to the twin culverts or connecting into the municipal drainage system in Florence Street.

Annual Phosphorus Loading Reduction

The Project will comply with the nutrient TMDL for phosphorus. Per Table ES-3 of the Total Maximum Daily Load for Nutrients in the Upper/Middle Charles Technical Report (CN 272.0), Commercial and High Density/Multi-Family residential uses require a 65 percent reduction in annual phosphorus loading.

Stormwater Best Management Practices (BMP) Performance Analysis prepared for the U.S. Environmental Protection Agency (EPA) by Tetra Tech dated March 2010 contains BMP performance curves of how well different types of BMPS reduce certain pollutants for BMPs that are sized to treat 1-inch depth of runoff.

The curves indicate that

- infiltration systems are up to 97 percent effective for reducing total phosphorus for high-density residential land use (Assuming the HSG B soils on site have an infiltration rate of 1.02 inches/hour).

Therefore, the Project's proposed stormwater management systems will meet the required 65 percent reduction in annual phosphorus loading.

Stormwater Management for Parking Garages

Stormwater management for the parking garage will be designed, approved, and maintained in accordance with 360 CMR: Massachusetts Water Resources Authority, Section 10.000: Sewer Use and 248 CMR: Board of State Examiners of Plumbers and Gas Fitter Section10.00: Uniform State Plumbing Code.

As required, gas/oil separators will be installed in the parking garages and connect to a separate building system before discharging to sanitary sewer. The separators will be included in the Project's Long-Term Pollution Prevention Plan. This Plan will indicate the required frequency of inspection, maintenance procedures and documentation.

Proposed Long-Term Operations Pollution Prevention Plan

A Long-Term Pollution Prevention Plan (LTPPP) will be prepared to address:

- Required maintenance of pavement systems, vegetated areas, and snow and ice during the winter.
- Spill Prevention and Response, including the names and numbers of entities to contact during an emergency spill
- A description and required maintenance of the stormwater management systems, including a schedule and checklist to regularly inspect and clean the proposed drainage infrastructure.

Overall, the Project will comply with the MassDEP Stormwater Management Regulations, the TMDL for Nutrients (phosphorus), and the City of Newton stormwater Standards through the design and implementation of a newly constructed stormwater management network.

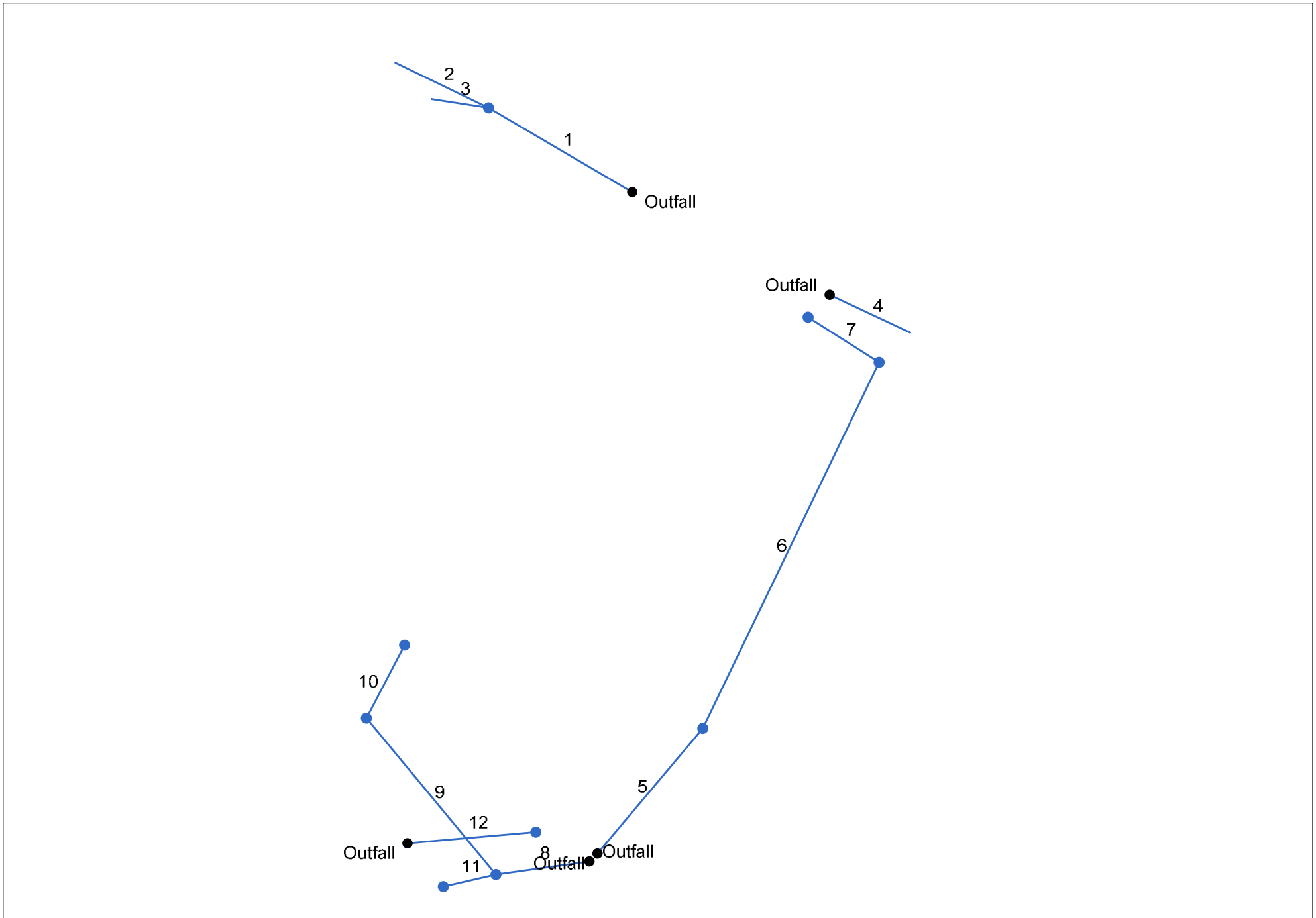
Appendix A: Standard 1 Computations and Supporting Information

Pipe Sizing Calculations

The closed drainage system was designed for the 25 year storm event based on Newton NOAA Rainfall Intensity Data.

Drainage pipes were sized using Manning's Equation for full-flow capacity and the Rational Method. Additionally, the performance of the system was analyzed using AutoCAD Civil 3D Hydraflow Hydrographs Extension, a HEC-22 based program.

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: 73153.00 - STRM.stm	Number of lines: 12	Date: 3/17/2022

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	77.030	0.01	0.16	0.95	0.01	0.15	5.0	6.0	7.9	1.21	8.42	3.40	12	4.76	189.00	192.67	189.46	193.13	193.79	198.79	18-17
2	1	47.213	0.08	0.08	0.95	0.08	0.08	5.0	5.0	8.2	0.63	4.42	3.38	12	1.31	196.38	197.00	196.63	197.33	198.79	200.93	20-18
3	1	25.203	0.07	0.07	0.95	0.07	0.07	5.0	5.0	8.2	0.55	10.87	4.95	12	7.94	195.00	197.00	195.15	197.31	198.79	201.11	19-18
4	End	40.328	0.11	0.11	0.95	0.10	0.10	5.0	5.0	8.2	0.86	4.30	3.06	12	1.24	187.50	188.00	187.89	188.39	192.07	190.63	16-15
5	End	81.269	0.01	0.02	0.95	0.01	0.02	5.0	6.3	7.9	4.00	11.27	4.76	15	2.60	177.00	179.11	177.81	179.92	178.34	185.38	11-10
6	5	211.169	0.01	0.01	0.95	0.01	0.01	5.0	5.2	8.2	3.93	9.90	4.70	15	2.00	179.11	183.34	179.92	184.14	185.38	191.45	12-11
7	6	39.139	0.00	0.00	0.95	0.00	0.00	5.0	5.0	0.0	3.85	5.12	4.59	15	0.54	183.34	183.55	184.15	184.36	191.45	191.90	13-12
8	End	41.179	0.01	0.02	0.95	0.01	0.02	5.0	6.2	7.9	3.90	5.11	4.61	15	0.53	177.00	177.22	177.80	178.05	178.09	186.17	02-01
9	8	101.121	0.01	0.01	0.95	0.01	0.01	5.0	5.3	8.2	2.26	7.20	2.91	15	1.06	177.22	178.29	178.34	178.89	186.17	184.75	04-02
10	9	42.516	0.00	0.00	0.95	0.00	0.00	5.0	5.0	0.0	2.18	11.07	7.56	12	8.23	183.00	186.50	183.30	187.13	184.75	192.78	05-04
11	8	23.682	0.00	0.00	0.95	0.00	0.00	5.0	5.0	0.0	1.57	7.61	2.41	15	1.18	177.22	177.50	178.34	178.00	186.17	186.36	03-02
12	End	55.964	0.36	0.36	0.95	0.34	0.34	5.0	5.0	8.2	2.82	4.95	4.17	15	0.50	179.22	179.50	179.89	180.18	183.89	183.59	07-06

Project File: 73153.00 - STRM.stm

Number of lines: 12

Run Date: 3/17/2022

NOTES:Intensity = 102.61 / (Inlet time + 16.50) ^ 0.82; Return period =Yrs. 25 ; c = cir e = ellip b = box

Inlet Report

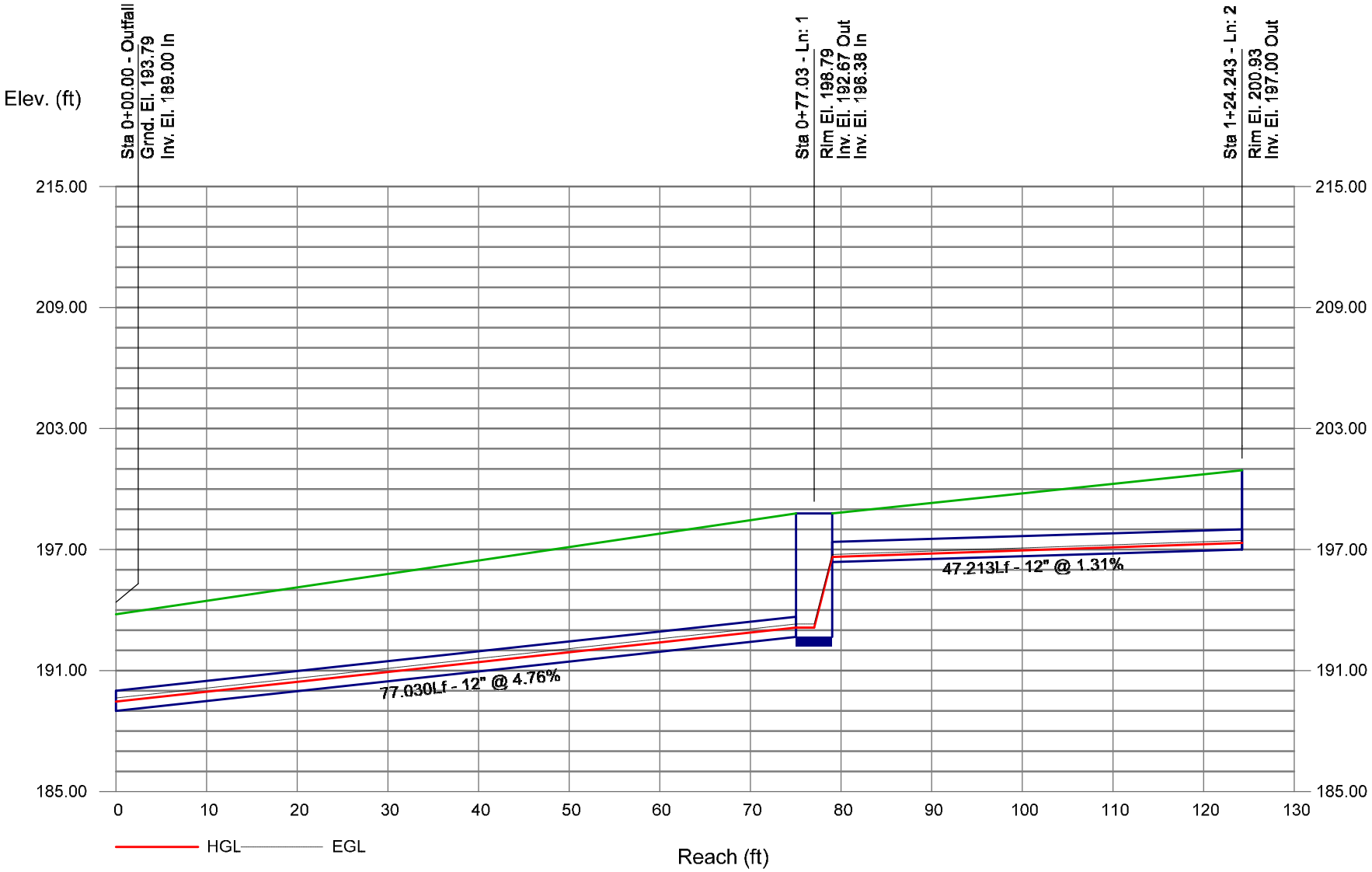
Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1	018	0.08	0.00	0.00	0.08	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
2	020	0.63	0.00	0.63	0.00	Comb	4.0	1.50	3.00	1.50	2.00	Sag	2.00	0.050	0.020	0.000	0.16	5.16	0.16	5.16	0.0	Off
3	019	0.55	0.00	0.55	0.00	Comb	4.0	1.50	3.00	1.50	2.00	Sag	2.00	0.050	0.020	0.000	0.15	4.67	0.15	4.67	0.0	Off
4	016	0.86	0.00	0.86	0.00	Comb	4.0	1.50	3.00	1.50	2.00	Sag	2.00	0.050	0.020	0.000	0.19	6.49	0.19	6.49	0.0	Off
5	011	0.08	0.00	0.00	0.08	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
6	012	0.08	0.00	0.00	0.08	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
7	013	3.85*	0.00	0.00	3.85	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
8	002	0.08	0.00	0.00	0.08	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
9	004	0.08	0.00	0.08	0.00	Curb	4.0	1.50	0.00	0.00	0.00	Sag	2.00	0.050	0.020	0.000	0.10	1.91	0.10	1.91	0.0	Off
10	005	2.18*	0.00	0.00	2.18	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
11	003	1.57*	0.00	0.00	1.57	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
12	007	2.82	0.00	2.82	0.00	Comb	4.0	3.00	6.00	3.00	2.00	Sag	2.00	0.050	0.020	0.000	0.31	12.62	0.31	12.62	0.0	Off

Project File: 73153.00 - STRM.stm | Number of lines: 12 | Run Date: 3/17/2022

NOTES: Inlet N-Values = 0.016; Intensity = 102.61 / (Inlet time + 16.50) ^ 0.82; Return period = 25 Yrs. ; * Indicates Known Q added. All curb inlets are throat.

Storm Sewer Profile

Proj. file: 73153.00 - STRM.stm



Storm Sewer Profile

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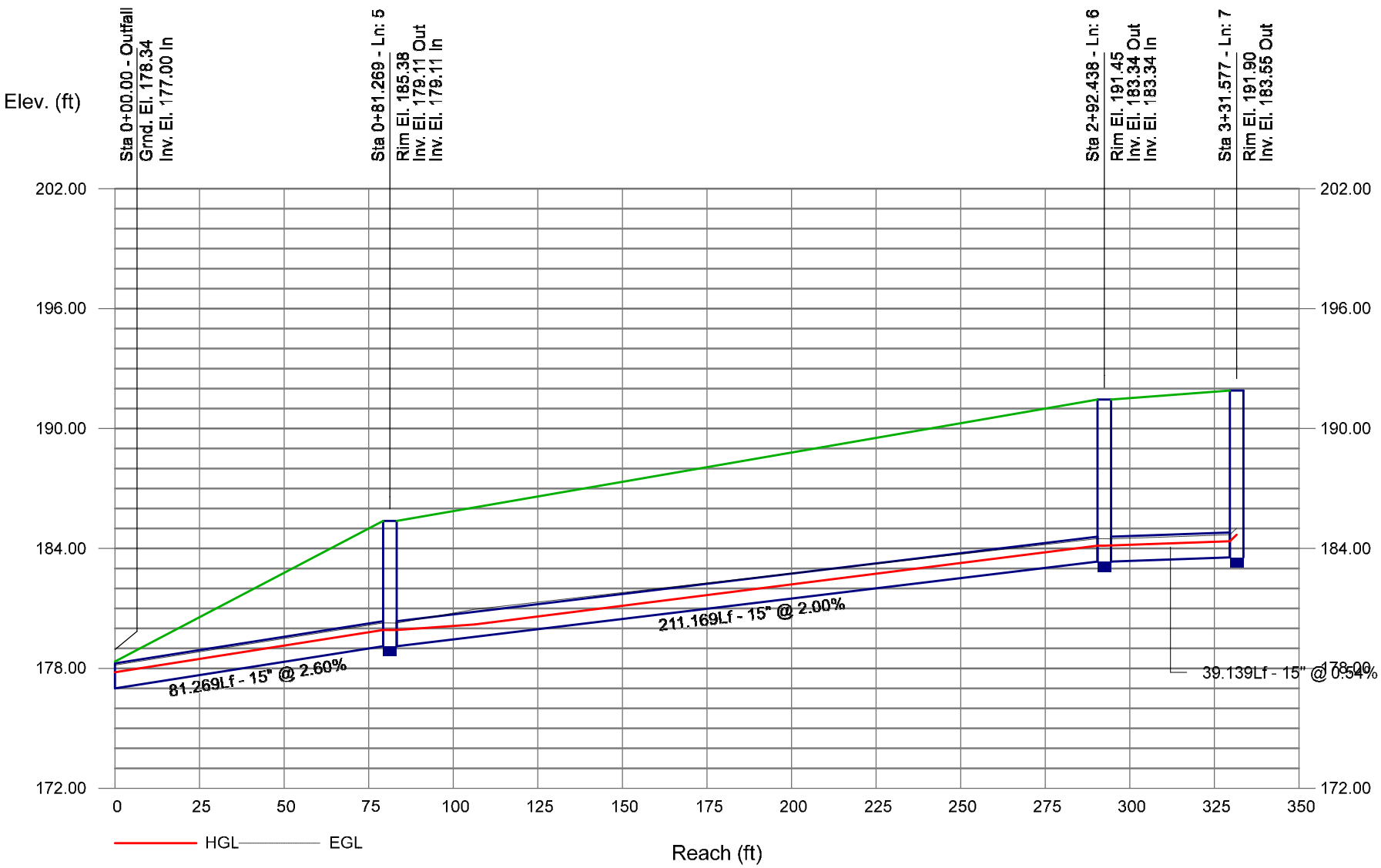

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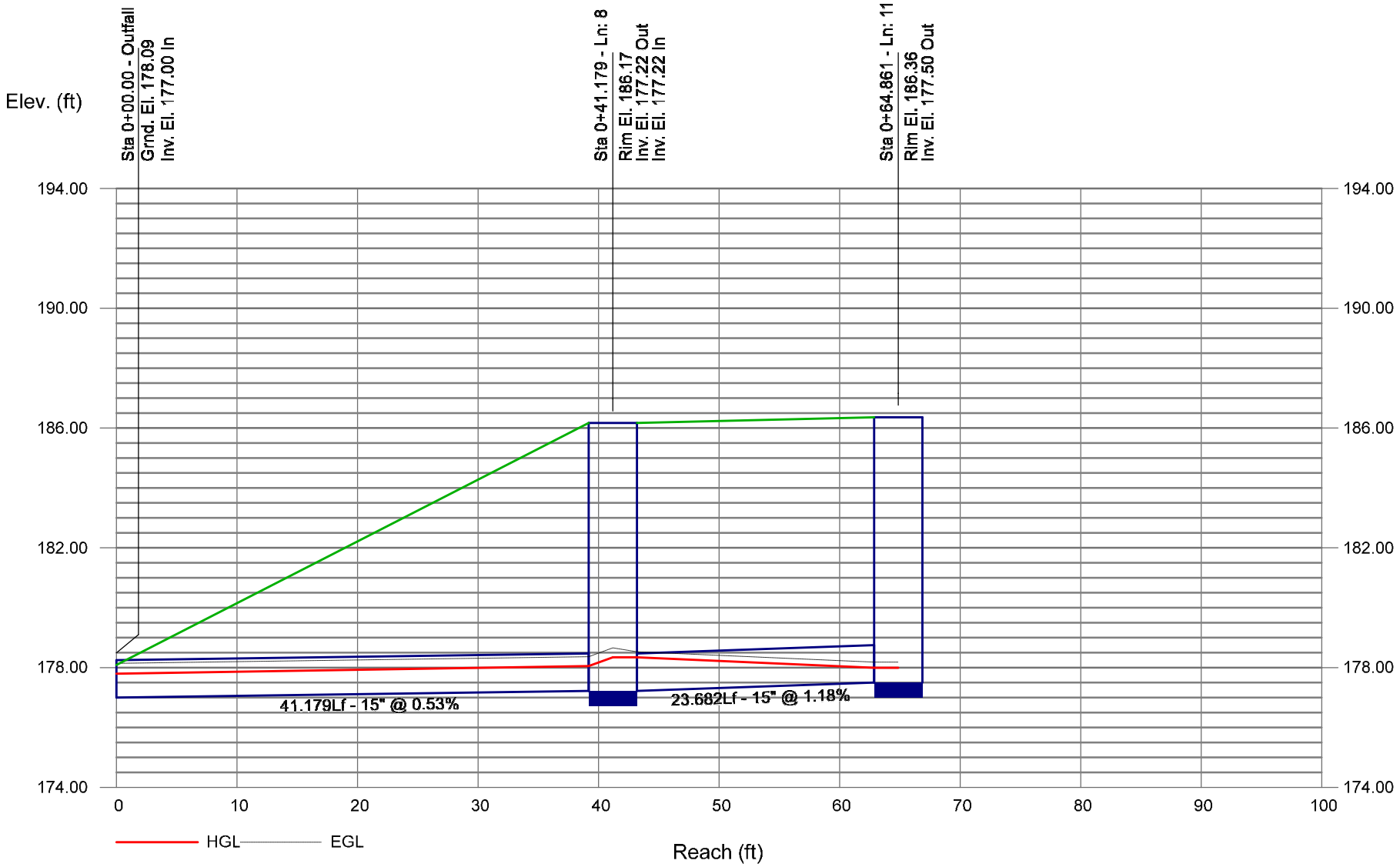

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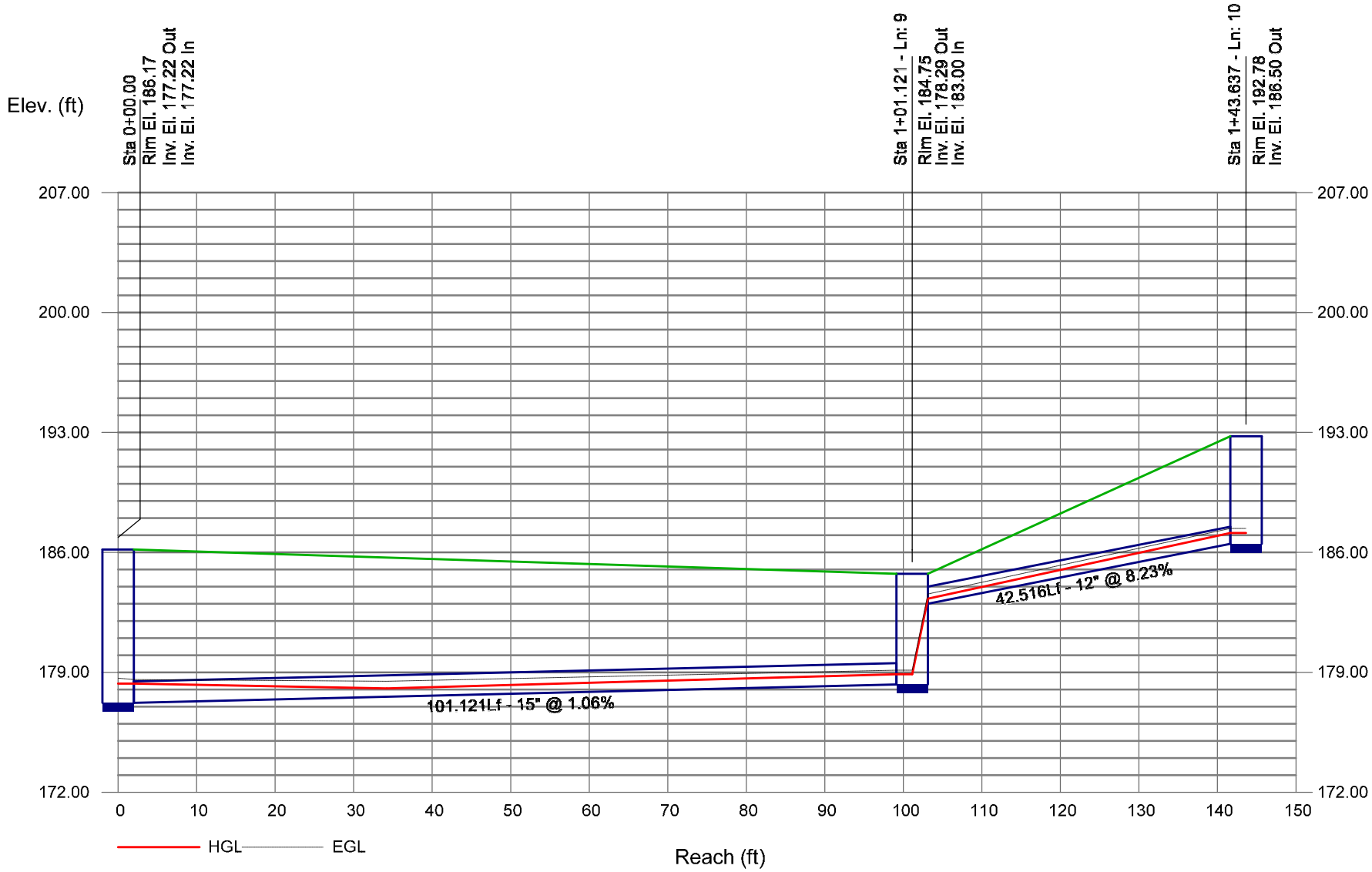

Appendix B: Standard 2 Computations and Supporting Information

The rainfall-runoff response of the Site under existing and proposed conditions was evaluated for storm events with recurrence intervals of *[2, 10, 25 and 100-years]*. Rainfall volumes used for this analysis were based on the Natural Resources Conservation Service (NRCS) Type III, 24-hour storm and NOAA Atlas 14 precipitation depths for the site: *3.28, 5.16, 6.33, and 8.14* inches, respectively. Runoff coefficients for the pre- and post-development conditions, as previously shown in Tables 2 and 3 respectively, were determined using NRCS Technical Release 55 (TR-55) methodology as provided in HydroCAD. Drainage areas used in the analyses were described in previous sections and shown on Figures 2 and 3. The HydroCAD model is based on the NRCS Technical Release 20 (TR-20) Model for Project Formulation Hydrology.

NOAA Atlas 14, Volume 10, Version 3
Location name: Newton Center, Massachusetts, USA*
Latitude: 42.3186°, Longitude: -71.1814°
Elevation: 192.27 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.300** (0.241-0.376)	**0.372** (0.297-0.466)	**0.488** (0.389-0.615)	**0.585** (0.463-0.742)	**0.717** (0.548-0.962)	**0.816** (0.610-1.12)	**0.922** (0.669-1.33)	**1.05** (0.710-1.54)	**1.23** (0.800-1.89)	**1.39** (0.879-2.18)
10-min	**0.426** (0.341-0.533)	**0.526** (0.421-0.660)	**0.691** (0.551-0.870)	**0.828** (0.656-1.05)	**1.02** (0.777-1.36)	**1.16** (0.864-1.59)	**1.31** (0.947-1.88)	**1.48** (1.01-2.19)	**1.75** (1.13-2.68)	**1.97** (1.25-3.09)
15-min	**0.501** (0.401-0.627)	**0.619** (0.496-0.777)	**0.813** (0.648-1.02)	**0.973** (0.772-1.23)	**1.20** (0.914-1.60)	**1.36** (1.02-1.87)	**1.54** (1.12-2.22)	**1.75** (1.18-2.57)	**2.05** (1.34-3.15)	**2.32** (1.47-3.64)
30-min	**0.683** (0.548-0.856)	**0.846** (0.677-1.06)	**1.11** (0.887-1.40)	**1.33** (1.06-1.69)	**1.64** (1.25-2.20)	**1.86** (1.39-2.57)	**2.10** (1.53-3.04)	**2.39** (1.62-3.53)	**2.83** (1.84-4.35)	**3.20** (2.03-5.03)
60-min	**0.866** (0.694-1.09)	**1.07** (0.859-1.35)	**1.41** (1.13-1.78)	**1.69** (1.34-2.15)	**2.08** (1.59-2.79)	**2.36** (1.77-3.26)	**2.67** (1.94-3.87)	**3.04** (2.06-4.49)	**3.61** (2.34-5.54)	**4.09** (2.59-6.42)
2-hr	**1.12** (0.904-1.39)	**1.39** (1.12-1.74)	**1.84** (1.48-2.31)	**2.21** (1.76-2.79)	**2.72** (2.10-3.64)	**3.10** (2.34-4.26)	**3.51** (2.58-5.07)	**4.02** (2.74-5.88)	**4.82** (3.14-7.34)	**5.51** (3.50-8.57)
3-hr	**1.31** (1.06-1.62)	**1.62** (1.31-2.02)	**2.14** (1.73-2.67)	**2.57** (2.06-3.23)	**3.17** (2.45-4.22)	**3.60** (2.73-4.94)	**4.08** (3.01-5.88)	**4.68** (3.19-6.82)	**5.63** (3.67-8.52)	**6.45** (4.10-9.98)
6-hr	**1.70** (1.38-2.09)	**2.10** (1.71-2.59)	**2.76** (2.23-3.41)	**3.30** (2.66-4.11)	**4.05** (3.15-5.35)	**4.60** (3.50-6.25)	**5.20** (3.85-7.42)	**5.96** (4.08-8.59)	**7.13** (4.67-10.7)	**8.16** (5.20-12.5)
12-hr	**2.18** (1.79-2.67)	**2.68** (2.19-3.28)	**3.49** (2.85-4.30)	**4.17** (3.37-5.16)	**5.09** (3.98-6.66)	**5.78** (4.41-7.76)	**6.52** (4.83-9.18)	**7.43** (5.11-10.6)	**8.83** (5.80-13.1)	**10.0** (6.42-15.2)
24-hr	**2.65** (2.18-3.22)	**3.28** (2.70-3.99)	**4.30** (3.53-5.26)	**5.16** (4.20-6.34)	**6.33** (4.98-8.23)	**7.20** (5.53-9.61)	**8.14** (6.07-11.4)	**9.31** (6.42-13.2)	**11.1** (7.33-16.3)	**12.7** (8.15-19.0)
2-day	**3.04** (2.52-3.67)	**3.83** (3.18-4.63)	**5.13** (4.24-6.23)	**6.21** (5.09-7.58)	**7.69** (6.09-9.96)	**8.77** (6.80-11.7)	**9.98** (7.52-14.0)	**11.5** (7.97-16.2)	**14.0** (9.26-20.4)	**16.2** (10.4-24.0)
3-day	**3.35** (2.79-4.03)	**4.21** (3.50-5.07)	**5.61** (4.65-6.79)	**6.78** (5.58-8.25)	**8.39** (6.67-10.8)	**9.56** (7.44-12.7)	**10.9** (8.23-15.2)	**12.6** (8.71-17.5)	**15.3** (10.1-22.1)	**17.7** (11.4-26.2)
4-day	**3.63** (3.03-4.35)	**4.52** (3.77-5.43)	**5.98** (4.96-7.20)	**7.19** (5.93-8.71)	**8.85** (7.05-11.4)	**10.1** (7.85-13.3)	**11.4** (8.66-15.9)	**13.2** (9.15-18.3)	**16.0** (10.6-23.1)	**18.6** (12.0-27.3)
7-day	**4.40** (3.70-5.25)	**5.33** (4.47-6.36)	**6.85** (5.72-8.20)	**8.10** (6.72-9.77)	**9.83** (7.87-12.5)	**11.1** (8.69-14.5)	**12.5** (9.50-17.2)	**14.3** (9.99-19.7)	**17.3** (11.5-24.7)	**19.9** (12.9-28.9)
10-day	**5.11** (4.31-6.08)	**6.06** (5.10-7.21)	**7.61** (6.38-9.09)	**8.90** (7.41-10.7)	**10.7** (8.56-13.5)	**12.0** (9.38-15.6)	**13.4** (10.2-18.2)	**15.2** (10.6-20.9)	**18.1** (12.1-25.7)	**20.6** (13.4-29.9)
20-day	**7.17** (6.08-8.46)	**8.19** (6.93-9.68)	**9.86** (8.32-11.7)	**11.3** (9.42-13.4)	**13.2** (10.6-16.4)	**14.6** (11.4-18.6)	**16.1** (12.1-21.3)	**17.8** (12.6-24.2)	**20.4** (13.7-28.6)	**22.5** (14.6-32.2)
30-day	**8.85** (7.53-10.4)	**9.93** (8.44-11.7)	**11.7** (9.90-13.8)	**13.2** (11.1-15.6)	**15.2** (12.2-18.7)	**16.7** (13.1-21.1)	**18.3** (13.7-23.8)	**19.9** (14.1-26.8)	**22.2** (14.9-30.9)	**24.0** (15.6-34.1)
45-day	**10.9** (9.36-12.8)	**12.1** (10.3-14.2)	**14.0** (11.9-16.4)	**15.5** (13.1-18.3)	**17.6** (14.2-21.6)	**19.3** (15.1-24.1)	**20.9** (15.6-26.9)	**22.5** (16.0-30.0)	**24.5** (16.5-33.9)	**25.9** (16.9-36.7)
60-day	**12.7** (10.9-14.8)	**13.9** (11.9-16.2)	**15.8** (13.5-18.6)	**17.4** (14.7-20.6)	**19.6** (15.9-23.9)	**21.4** (16.7-26.5)	**23.0** (17.2-29.4)	**24.6** (17.5-32.6)	**26.4** (17.9-36.4)	**27.7** (18.1-39.0)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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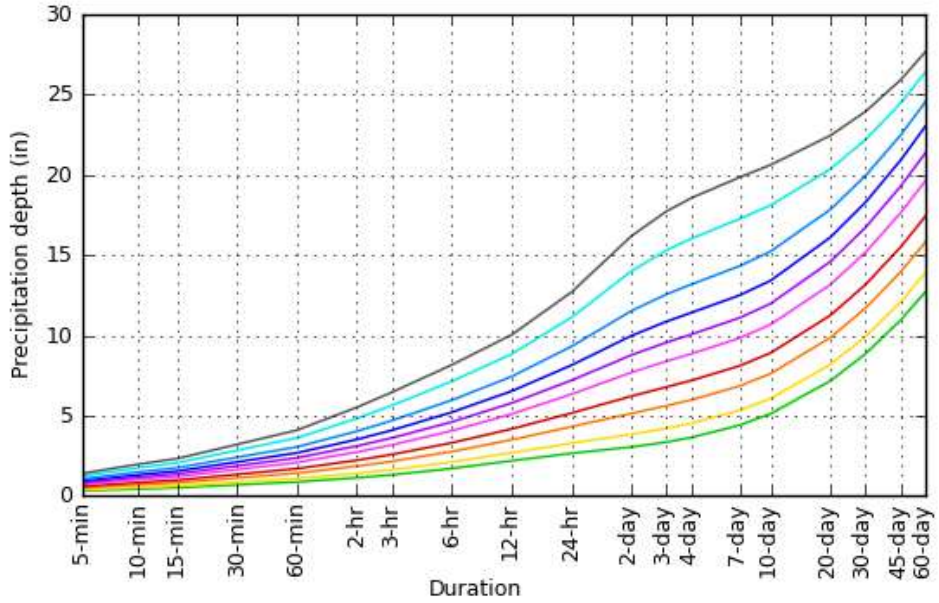
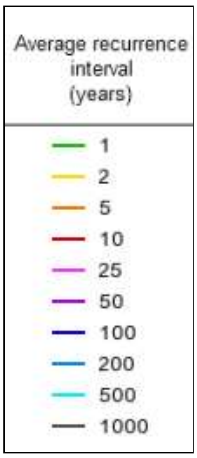
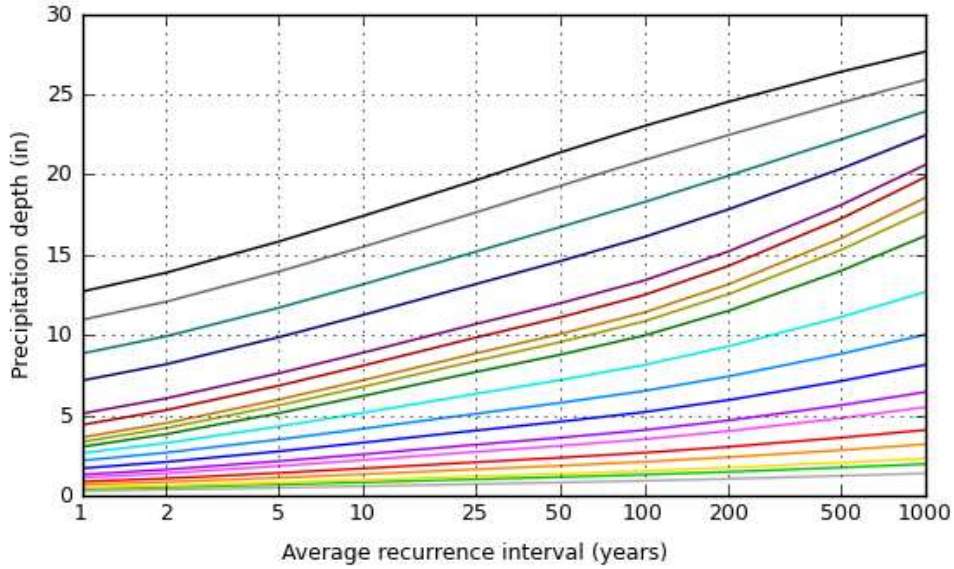
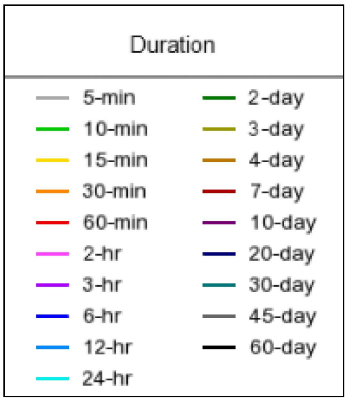
PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 42.3186°, Longitude: -71.1814°









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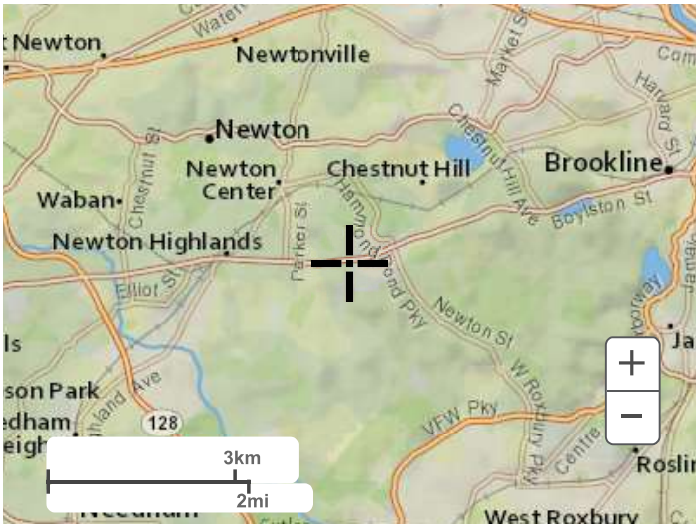
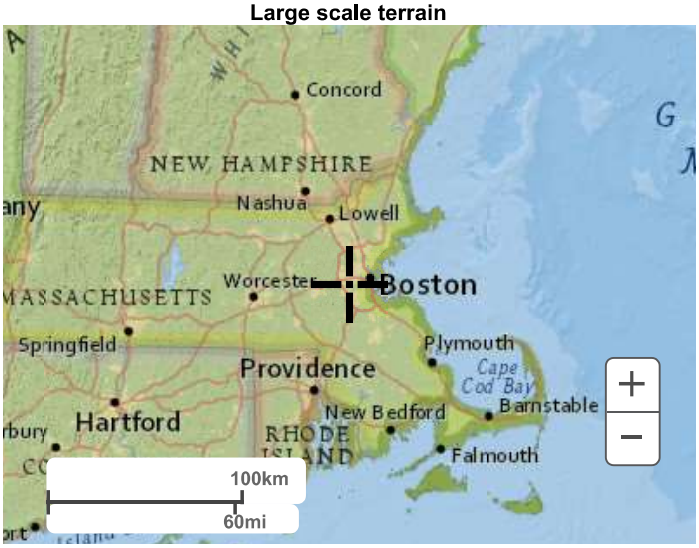
Maps & aerials

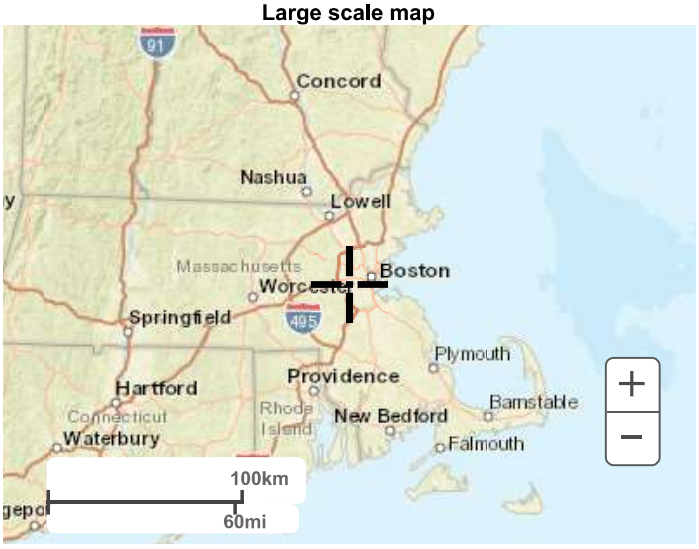
Small scale terrain



Large scale terrain



Large scale map



Large scale aerial

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National Water Center
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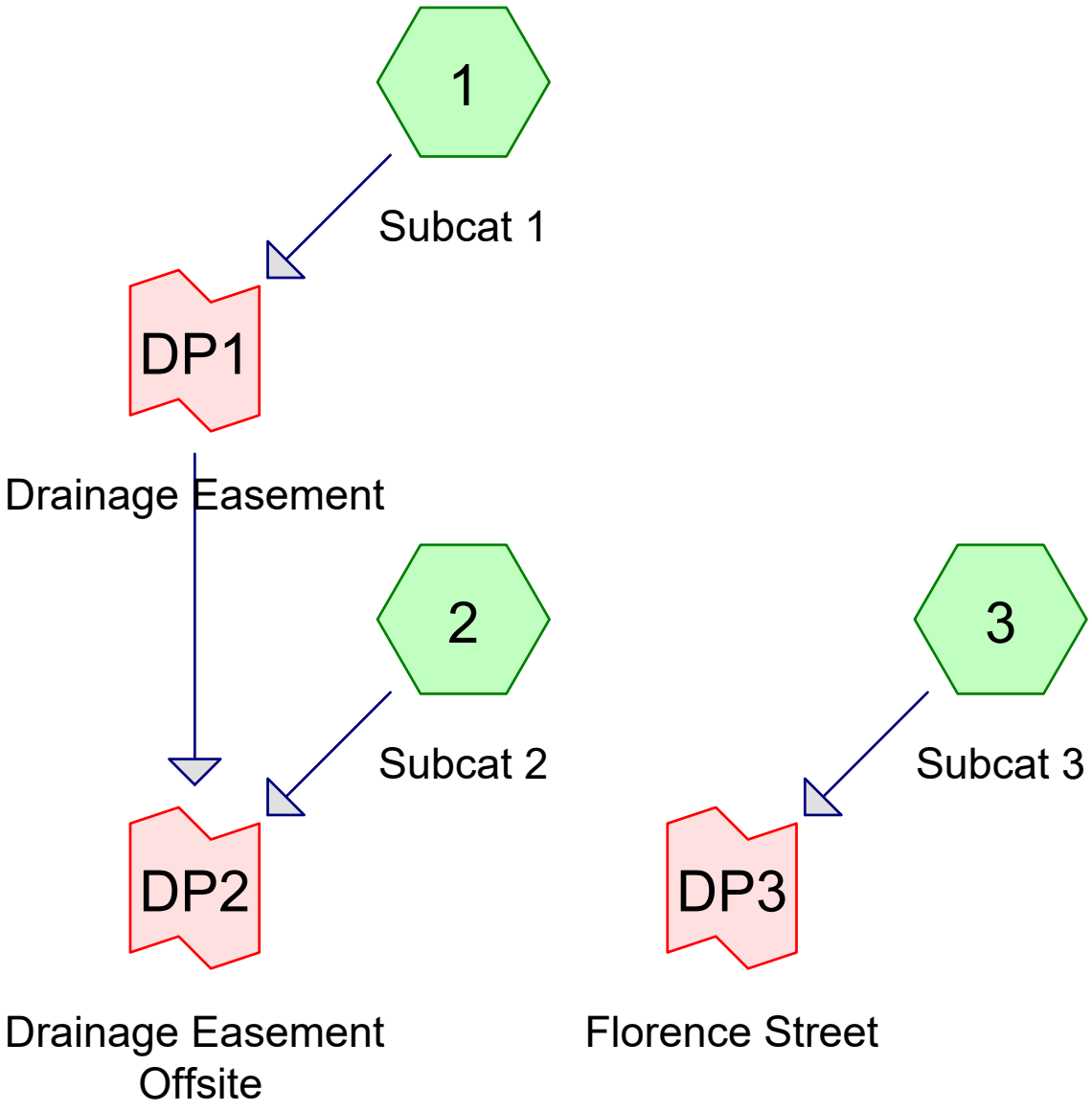
HydroCAD Analysis: Existing Conditions



Subcat Reach Pond Link

Routing Diagram for 73153.00 EX
Prepared by VHB, Printed 3/28/2022

Summary for Subcatchment 1: Subcat 1

Runoff = 3.86 cfs @ 12.09 hrs, Volume= 13,412 cf, Depth= 2.28"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 year Rainfall=3.20"

Area (ac)	CN	Description
0.074	61	>75% Grass cover, Good, HSG B
0.022	48	Brush, Good, HSG B
0.390	96	Gravel surface, HSG B
0.679	98	Paved parking, HSG B
0.256	98	Roofs, HSG B
0.202	55	Woods, Good, HSG B
1.623	90	Weighted Average
0.688	79	42.40% Pervious Area
0.935	98	57.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	50	0.1200	0.21		**Sheet Flow, Grass** Grass: Dense n= 0.240 P2= 3.28"
1.8	316	0.0200	2.87		**Shallow Concentrated Flow, Paved Driveway** Paved Kv= 20.3 fps
0.2	32	0.0200	2.28		**Shallow Concentrated Flow, Gravel Area** Unpaved Kv= 16.1 fps
0.2	32	0.3000	2.74		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
6.2	430	Total			

Summary for Subcatchment 2: Subcat 2

Runoff = 0.02 cfs @ 12.42 hrs, Volume= 151 cf, Depth= 0.25"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 year Rainfall=3.20"

Area (ac)	CN	Description
0.000	61	>75% Grass cover, Good, HSG B
0.000	98	Paved parking, HSG B
0.165	55	Woods, Good, HSG B
0.165	55	Weighted Average
0.165	55	100.00% Pervious Area
0.000	98	0.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	50	0.0463	0.10		**Sheet Flow, Woods** Woods: Light underbrush n= 0.400 P2= 3.28"
2.9	187	0.0463	1.08		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
11.6	237	Total			

Summary for Subcatchment 3: Subcat 3

Runoff = 0.83 cfs @ 12.09 hrs, Volume= 2,949 cf, Depth= 2.16"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 year Rainfall=3.20"

Area (ac)	CN	Description
0.059	61	>75% Grass cover, Good, HSG B
0.067	85	Gravel roads, HSG B
0.231	98	Paved parking, HSG B
0.020	55	Woods, Good, HSG B
0.376	88	Weighted Average
0.146	71	38.76% Pervious Area
0.231	98	61.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.3	25	0.0450	0.18		**Sheet Flow, Grass** Grass: Short n= 0.150 P2= 3.28"
0.3	25	0.0366	1.34		**Sheet Flow, Gravel** Smooth surfaces n= 0.011 P2= 3.28"
1.5	300	0.0280	3.40		**Shallow Concentrated Flow, Florence Street** Paved Kv= 20.3 fps
4.1	350	Total, Increased to minimum Tc = 6.0 min			

Summary for Link DP1: Drainage Easement

Inflow Area = 70,715 sf, 57.60% Impervious, Inflow Depth = 2.28" for 2 year event
Inflow = 3.86 cfs @ 12.09 hrs, Volume= 13,412 cf
Primary = 3.86 cfs @ 12.09 hrs, Volume= 13,412 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Link DP2: Drainage Easement Offsite

Inflow Area = 77,921 sf, 52.27% Impervious, Inflow Depth = 2.09" for 2 year event
Inflow = 3.86 cfs @ 12.09 hrs, Volume= 13,563 cf
Primary = 3.86 cfs @ 12.09 hrs, Volume= 13,563 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Link DP3: Florence Street

Inflow Area = 16,399 sf, 61.24% Impervious, Inflow Depth = 2.16" for 2 year event
Inflow = 0.83 cfs @ 12.09 hrs, Volume= 2,949 cf
Primary = 0.83 cfs @ 12.09 hrs, Volume= 2,949 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: Subcat 1 Runoff Area=1.623 ac 57.60% Impervious Runoff Depth=2.28"
Flow Length=430' Tc=6.2 min CN=79/98 Runoff=3.86 cfs 13,412 cf

Subcatchment 2: Subcat 2 Runoff Area=0.165 ac 0.00% Impervious Runoff Depth=0.25"
Flow Length=237' Slope=0.0463 '/' Tc=11.6 min CN=55/98 Runoff=0.02 cfs 151 cf

Subcatchment 3: Subcat 3 Runoff Area=0.376 ac 61.24% Impervious Runoff Depth=2.16"
Flow Length=350' Tc=6.0 min CN=71/98 Runoff=0.83 cfs 2,949 cf

Link DP1: Drainage Easement Inflow=3.86 cfs 13,412 cf
Primary=3.86 cfs 13,412 cf

Link DP2: Drainage Easement Offsite Inflow=3.86 cfs 13,563 cf
Primary=3.86 cfs 13,563 cf

Link DP3: Florence Street Inflow=0.83 cfs 2,949 cf
Primary=0.83 cfs 2,949 cf

Total Runoff Area = 94,321 sf Runoff Volume = 16,511 cf Average Runoff Depth = 2.10"
46.17% Pervious = 43,549 sf 53.83% Impervious = 50,772 sf

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: Subcat 1 Runoff Area=1.623 ac 57.60% Impervious Runoff Depth=3.78"
Flow Length=430' Tc=6.2 min CN=79/98 Runoff=6.40 cfs 22,282 cf

Subcatchment 2: Subcat 2 Runoff Area=0.165 ac 0.00% Impervious Runoff Depth=0.90"
Flow Length=237' Slope=0.0463 '/' Tc=11.6 min CN=55/98 Runoff=0.11 cfs 541 cf

Subcatchment 3: Subcat 3 Runoff Area=0.376 ac 61.24% Impervious Runoff Depth=3.59"
Flow Length=350' Tc=6.0 min CN=71/98 Runoff=1.39 cfs 4,910 cf

Link DP1: Drainage Easement Inflow=6.40 cfs 22,282 cf
Primary=6.40 cfs 22,282 cf

Link DP2: Drainage Easement Offsite Inflow=6.47 cfs 22,824 cf
Primary=6.47 cfs 22,824 cf

Link DP3: Florence Street Inflow=1.39 cfs 4,910 cf
Primary=1.39 cfs 4,910 cf

Total Runoff Area = 94,321 sf Runoff Volume = 27,734 cf Average Runoff Depth = 3.53"
46.17% Pervious = 43,549 sf 53.83% Impervious = 50,772 sf

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: Subcat 1 Runoff Area=1.623 ac 57.60% Impervious Runoff Depth=5.00"
Flow Length=430' Tc=6.2 min CN=79/98 Runoff=8.44 cfs 29,483 cf

Subcatchment 2: Subcat 2 Runoff Area=0.165 ac 0.00% Impervious Runoff Depth=1.59"
Flow Length=237' Slope=0.0463 '/' Tc=11.6 min CN=55/98 Runoff=0.22 cfs 957 cf

Subcatchment 3: Subcat 3 Runoff Area=0.376 ac 61.24% Impervious Runoff Depth=4.77"
Flow Length=350' Tc=6.0 min CN=71/98 Runoff=1.85 cfs 6,522 cf

Link DP1: Drainage Easement Inflow=8.44 cfs 29,483 cf
Primary=8.44 cfs 29,483 cf

Link DP2: Drainage Easement Offsite Inflow=8.60 cfs 30,439 cf
Primary=8.60 cfs 30,439 cf

Link DP3: Florence Street Inflow=1.85 cfs 6,522 cf
Primary=1.85 cfs 6,522 cf

Total Runoff Area = 94,321 sf Runoff Volume = 36,961 cf Average Runoff Depth = 4.70"
46.17% Pervious = 43,549 sf 53.83% Impervious = 50,772 sf

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: Subcat 1 Runoff Area=1.623 ac 57.60% Impervious Runoff Depth=7.56"
Flow Length=430' Tc=6.2 min CN=79/98 Runoff=12.66 cfs 44,573 cf

Subcatchment 2: Subcat 2 Runoff Area=0.165 ac 0.00% Impervious Runoff Depth=3.33"
Flow Length=237' Slope=0.0463 '/' Tc=11.6 min CN=55/98 Runoff=0.52 cfs 2,000 cf

Subcatchment 3: Subcat 3 Runoff Area=0.376 ac 61.24% Impervious Runoff Depth=7.27"
Flow Length=350' Tc=6.0 min CN=71/98 Runoff=2.82 cfs 9,935 cf

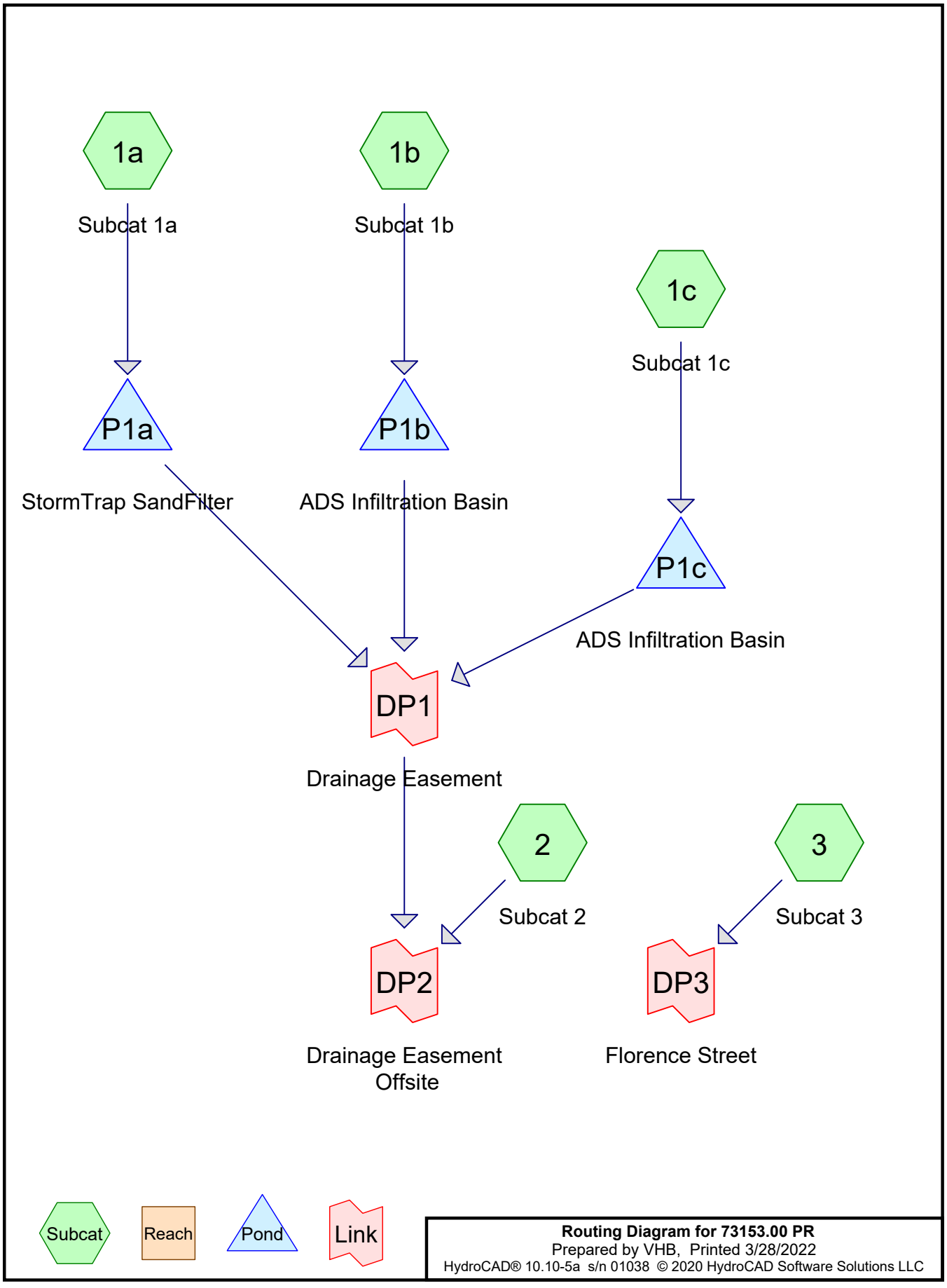
Link DP1: Drainage Easement Inflow=12.66 cfs 44,573 cf
Primary=12.66 cfs 44,573 cf

Link DP2: Drainage Easement Offsite Inflow=13.06 cfs 46,572 cf
Primary=13.06 cfs 46,572 cf

Link DP3: Florence Street Inflow=2.82 cfs 9,935 cf
Primary=2.82 cfs 9,935 cf

Total Runoff Area = 94,321 sf Runoff Volume = 56,507 cf Average Runoff Depth = 7.19"
46.17% Pervious = 43,549 sf 53.83% Impervious = 50,772 sf

HydroCAD Analysis: Proposed Conditions


1a
Subcat 1a
1b
Subcat 1b
1c
Subcat 1c
P1a
StormTrap SandFilter
P1b
ADS Infiltration Basin
P1c
ADS Infiltration Basin
DP1
Drainage Easement
2
Subcat 2
3
Subcat 3
DP2
Drainage Easement Offsite
DP3
Florence Street
Subcat
Reach
Pond
Link
Routing Diagram for 73153.00 PR
Prepared by VHB, Printed 3/28/2022
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Summary for Subcatchment 1a: Subcat 1a

Runoff = 0.71 cfs @ 12.09 hrs, Volume= 2,596 cf, Depth= 2.00"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 year Rainfall=3.20"

Area (ac)	CN	Description
0.136	61	>75% Grass cover, Good, HSG B
0.221	98	Paved parking, HSG B
0.357	84	Weighted Average
0.136	61	38.22% Pervious Area
0.221	98	61.78% Impervious Area

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

Summary for Subcatchment 1b: Subcat 1b

Runoff = 1.00 cfs @ 12.09 hrs, Volume= 3,658 cf, Depth= 2.04"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 year Rainfall=3.20"

Area (ac)	CN	Description
0.182	61	>75% Grass cover, Good, HSG B
0.092	98	Paved parking, HSG B
0.220	98	Roofs, HSG B
0.495	84	Weighted Average
0.182	61	36.86% Pervious Area
0.312	98	63.14% Impervious Area

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

Summary for Subcatchment 1c: Subcat 1c

Runoff = 1.86 cfs @ 12.09 hrs, Volume= 6,741 cf, Depth= 2.26"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 year Rainfall=3.20"

Area (ac)	CN	Description
0.194	61	>75% Grass cover, Good, HSG B
0.304	98	Paved parking, HSG B
0.291	98	Roofs, HSG B
0.035	55	Woods, Good, HSG B
0.823	87	Weighted Average
0.229	60	27.81% Pervious Area
0.594	98	72.19% Impervious Area

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

Summary for Subcatchment 2: Subcat 2

Runoff = 0.03 cfs @ 12.37 hrs, Volume= 275 cf, Depth= 0.31"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 year Rainfall=3.20"

Area (ac)	CN	Description
0.070	61	>75% Grass cover, Good, HSG B
0.175	55	Woods, Good, HSG B
0.245	57	Weighted Average
0.245	57	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	50	0.0463	0.10		**Sheet Flow, Woods** Woods: Light underbrush n= 0.400 P2= 3.28"
2.9	187	0.0463	1.08		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
11.6	237	Total			

Summary for Subcatchment 3: Subcat 3

Runoff = 0.70 cfs @ 12.09 hrs, Volume= 2,499 cf, Depth= 2.80"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 year Rainfall=3.20"

Area (ac)	CN	Description
0.016	61	>75% Grass cover, Good, HSG B
0.230	98	Paved parking, HSG B
0.246	96	Weighted Average
0.016	61	6.63% Pervious Area
0.230	98	93.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	20	0.0254	1.11		**Sheet Flow, East Side of PL** Smooth surfaces n= 0.011 P2= 3.28"
0.3	30	0.0519	1.60		**Sheet Flow, East Side of Lot** Smooth surfaces n= 0.011 P2= 3.28"
0.2	51	0.0532	4.68		**Shallow Concentrated Flow, Boylston Street** Paved Kv= 20.3 fps
0.5	103	0.0280	3.40		**Shallow Concentrated Flow, Florence Street** Paved Kv= 20.3 fps
0.8	161	0.0280	3.40		**Shallow Concentrated Flow, Florence Street** Paved Kv= 20.3 fps
2.1	365	Total, Increased to minimum Tc = 6.0 min			

Summary for Pond P1a: StormTrap SandFilter

Inflow Area = 15,556 sf, 61.78% Impervious, Inflow Depth = 2.00" for 2 year event
Inflow = 0.71 cfs @ 12.09 hrs, Volume= 2,596 cf
Outflow = 0.39 cfs @ 12.27 hrs, Volume= 2,589 cf, Atten= 45%, Lag= 10.7 min
Primary = 0.39 cfs @ 12.27 hrs, Volume= 2,589 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 181.59' @ 12.25 hrs Surf.Area= 415 sf Storage= 942 cf

Plug-Flow detention time= 342.4 min calculated for 2,589 cf (100% of inflow)
Center-of-Mass det. time= 340.3 min (1,110.1 - 769.8)

Volume	Invert	Avail.Storage	Storage Description
#1	177.50'	1,070 cf	**27.58'W x 15.06'L x 5.17'H StormTrap ST1 - 4.5' Tall - 4 Chambers** 2,147 cf Overall - 623 cf Embedded = 1,524 cf x 70.2% Voids
#2	178.50'	187 cf	**27.58'W x 15.06'L x 1.50'H 18" Sand above underdrain** Inside #1 623 cf Overall x 30.0% Voids
		1,257 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	177.50'	**15.0" Round Outlet Culvert** L= 26.3' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 177.50' / 177.22' S= 0.0106 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Device 1	177.50'	**6.0" Vert. 6" Underdrains** C= 0.600 Limited to weir flow at low heads
#3	Device 1	181.50'	**4.0' long Weir Wall inside Control Structure** 2 End Contraction(s)
#4	Device 2	177.50'	**2.000 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Primary OutFlow Max=0.34 cfs @ 12.27 hrs HW=181.59' (Free Discharge)
- **1=Outlet Culvert** (Passes 0.34 cfs of 10.99 cfs potential flow)
  - **2=6" Underdrains** (Passes 0.02 cfs of 1.85 cfs potential flow)
    - **4=Exfiltration** (Exfiltration Controls 0.02 cfs)
  - **3=Weir Wall inside Control Structure** (Weir Controls 0.33 cfs @ 0.96 fps)

Summary for Pond P1b: ADS Infiltration Basin

Inflow Area = 21,544 sf, 63.14% Impervious, Inflow Depth = 2.04" for 2 year event
Inflow = 1.00 cfs @ 12.09 hrs, Volume= 3,658 cf
Outflow = 0.29 cfs @ 12.44 hrs, Volume= 3,658 cf, Atten= 71%, Lag= 20.8 min
Discarded = 0.01 cfs @ 3.95 hrs, Volume= 583 cf
Primary = 0.29 cfs @ 12.44 hrs, Volume= 3,074 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 189.09' @ 12.44 hrs Surf.Area= 823 sf Storage= 1,132 cf

Plug-Flow detention time= 101.5 min calculated for 3,655 cf (100% of inflow)
Center-of-Mass det. time= 101.9 min (871.0 - 769.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	187.00'	785 cf	**11.00'W x 74.82'L x 3.50'H Garden System** 2,880 cf Overall - 919 cf Embedded = 1,962 cf x 40.0% Voids
#2A	187.50'	919 cf	**ADS_StormTech SC-740 +Cap** x 20 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 20 Chambers in 2 Rows
		1,703 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	187.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	186.50'	**12.0" Round Culvert out of Control Structure** L= 44.5' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 186.50' / 183.00' S= 0.0787 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	189.50'	**4.0' long (Profile 1) Weir Wall Inside Control Structure** Head (feet) 0.49 0.98 1.48 Coef. (English) 2.92 3.37 3.59
#4	Device 2	187.50'	**3.0" Vert. 3" Drawdown Orifice** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.01 cfs @ 3.95 hrs HW=187.04' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.29 cfs @ 12.44 hrs HW=189.09' (Free Discharge)
└**2=Culvert out of Control Structure** (Passes 0.29 cfs of 5.47 cfs potential flow)
  ├**3=Weir Wall Inside Control Structure** (Controls 0.00 cfs)
  └**4=3" Drawdown Orifice** (Orifice Controls 0.29 cfs @ 5.83 fps)

Summary for Pond P1c: ADS Infiltration Basin

Inflow Area = 35,858 sf, 72.19% Impervious, Inflow Depth = 2.26" for 2 year event
Inflow = 1.86 cfs @ 12.09 hrs, Volume= 6,741 cf
Outflow = 1.46 cfs @ 12.17 hrs, Volume= 6,742 cf, Atten= 22%, Lag= 4.9 min
Discarded = 0.03 cfs @ 7.15 hrs, Volume= 4,304 cf
Primary = 1.43 cfs @ 12.17 hrs, Volume= 2,438 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 186.96' @ 12.17 hrs Surf.Area= 1,293 sf Storage= 2,415 cf

Plug-Flow detention time= 444.9 min calculated for 6,737 cf (100% of inflow)
Center-of-Mass det. time= 445.5 min (1,210.2 - 764.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	184.00'	1,222 cf	**11.00'W x 117.54'L x 3.50'H Front Yard** 4,525 cf Overall - 1,470 cf Embedded = 3,055 cf x 40.0% Voids
#2A	184.50'	1,470 cf	**ADS_StormTech SC-740 +Cap** x 32 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 32 Chambers in 2 Rows
		2,692 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#0	Primary	187.50'	**Automatic Storage Overflow** (Discharged without head)
#1	Primary	183.55'	**15.0" Round Culvert out of Control Structure** L= 42.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 183.55' / 183.31' S= 0.0057 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Discarded	184.00'	**1.020 in/hr Exfiltration over Surface area**
#3	Device 1	186.70'	**4.0' long (Profile 1) Broad-Crested Rectangular Weir** Head (feet) 0.49 0.98 1.48 Coef. (English) 2.92 3.37 3.59

Discarded OutFlow Max=0.03 cfs @ 7.15 hrs HW=184.04' (Free Discharge)
↑└**2=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=1.25 cfs @ 12.17 hrs HW=186.93' (Free Discharge)
↑└**1=Culvert out of Control Structure** (Passes 1.25 cfs of 9.62 cfs potential flow)
↑└**3=Broad-Crested Rectangular Weir** (Weir Controls 1.25 cfs @ 1.39 fps)

Summary for Link DP1: Drainage Easement

Inflow Area = 72,958 sf, 67.30% Impervious, Inflow Depth = 1.33" for 2 year event
Inflow = 1.58 cfs @ 12.25 hrs, Volume= 8,102 cf
Primary = 1.58 cfs @ 12.25 hrs, Volume= 8,102 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Link DP2: Drainage Easement Offsite

Inflow Area = 83,630 sf, 58.71% Impervious, Inflow Depth = 1.20" for 2 year event
Inflow = 1.62 cfs @ 12.24 hrs, Volume= 8,377 cf
Primary = 1.62 cfs @ 12.24 hrs, Volume= 8,377 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Link DP3: Florence Street

Inflow Area = 10,707 sf, 93.37% Impervious, Inflow Depth = 2.80" for 2 year event
Inflow = 0.70 cfs @ 12.09 hrs, Volume= 2,499 cf
Primary = 0.70 cfs @ 12.09 hrs, Volume= 2,499 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1a: Subcat 1a Runoff Area=0.357 ac 61.78% Impervious Runoff Depth=2.00"
Tc=6.0 min CN=61/98 Runoff=0.71 cfs 2,596 cf

Subcatchment 1b: Subcat 1b Runoff Area=0.495 ac 63.14% Impervious Runoff Depth=2.04"
Tc=6.0 min CN=61/98 Runoff=1.00 cfs 3,658 cf

Subcatchment 1c: Subcat 1c Runoff Area=0.823 ac 72.19% Impervious Runoff Depth=2.26"
Tc=6.0 min CN=60/98 Runoff=1.86 cfs 6,741 cf

Subcatchment 2: Subcat 2 Runoff Area=0.245 ac 0.00% Impervious Runoff Depth=0.31"
Flow Length=237' Slope=0.0463 '/' Tc=11.6 min CN=57/0 Runoff=0.03 cfs 275 cf

Subcatchment 3: Subcat 3 Runoff Area=0.246 ac 93.37% Impervious Runoff Depth=2.80"
Flow Length=365' Tc=6.0 min CN=61/98 Runoff=0.70 cfs 2,499 cf

Pond P1a: StormTrap SandFilter Peak Elev=181.59' Storage=942 cf Inflow=0.71 cfs 2,596 cf
Outflow=0.39 cfs 2,589 cf

Pond P1b: ADS Infiltration Basin Peak Elev=189.09' Storage=1,132 cf Inflow=1.00 cfs 3,658 cf
Discarded=0.01 cfs 583 cf Primary=0.29 cfs 3,074 cf Outflow=0.29 cfs 3,658 cf

Pond P1c: ADS Infiltration Basin Peak Elev=186.96' Storage=2,415 cf Inflow=1.86 cfs 6,741 cf
Discarded=0.03 cfs 4,304 cf Primary=1.43 cfs 2,438 cf Outflow=1.46 cfs 6,742 cf

Link DP1: Drainage Easement Inflow=1.58 cfs 8,102 cf
Primary=1.58 cfs 8,102 cf

Link DP2: Drainage Easement Offsite Inflow=1.62 cfs 8,377 cf
Primary=1.62 cfs 8,377 cf

Link DP3: Florence Street Inflow=0.70 cfs 2,499 cf
Primary=0.70 cfs 2,499 cf

Total Runoff Area = 94,337 sf Runoff Volume = 15,769 cf Average Runoff Depth = 2.01"
37.36% Pervious = 35,241 sf 62.64% Impervious = 59,095 sf

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1a: Subcat 1a Runoff Area=0.357 ac 61.78% Impervious Runoff Depth=3.33"
Tc=6.0 min CN=61/98 Runoff=1.20 cfs 4,318 cf

Subcatchment 1b: Subcat 1b Runoff Area=0.495 ac 63.14% Impervious Runoff Depth=3.38"
Tc=6.0 min CN=61/98 Runoff=1.68 cfs 6,061 cf

Subcatchment 1c: Subcat 1c Runoff Area=0.823 ac 72.19% Impervious Runoff Depth=3.66"
Tc=6.0 min CN=60/98 Runoff=3.02 cfs 10,935 cf

Subcatchment 2: Subcat 2 Runoff Area=0.245 ac 0.00% Impervious Runoff Depth=1.02"
Flow Length=237' Slope=0.0463 '/' Tc=11.6 min CN=57/0 Runoff=0.20 cfs 908 cf

Subcatchment 3: Subcat 3 Runoff Area=0.246 ac 93.37% Impervious Runoff Depth=4.38"
Flow Length=365' Tc=6.0 min CN=61/98 Runoff=1.08 cfs 3,911 cf

Pond P1a: StormTrap SandFilter Peak Elev=181.70' Storage=974 cf Inflow=1.20 cfs 4,318 cf
Outflow=1.17 cfs 4,334 cf

Pond P1b: ADS Infiltration Basin Peak Elev=189.71' Storage=1,435 cf Inflow=1.68 cfs 6,061 cf
Discarded=0.01 cfs 608 cf Primary=1.38 cfs 5,443 cf Outflow=1.38 cfs 6,051 cf

Pond P1c: ADS Infiltration Basin Peak Elev=187.10' Storage=2,483 cf Inflow=3.02 cfs 10,935 cf
Discarded=0.03 cfs 4,600 cf Primary=2.91 cfs 6,327 cf Outflow=2.94 cfs 10,926 cf

Link DP1: Drainage Easement Inflow=4.87 cfs 16,104 cf
Primary=4.87 cfs 16,104 cf

Link DP2: Drainage Easement Offsite Inflow=5.05 cfs 17,011 cf
Primary=5.05 cfs 17,011 cf

Link DP3: Florence Street Inflow=1.08 cfs 3,911 cf
Primary=1.08 cfs 3,911 cf

Total Runoff Area = 94,337 sf Runoff Volume = 26,132 cf Average Runoff Depth = 3.32"
37.36% Pervious = 35,241 sf 62.64% Impervious = 59,095 sf

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1a: Subcat 1a Runoff Area=0.357 ac 61.78% Impervious Runoff Depth=4.44"
Tc=6.0 min CN=61/98 Runoff=1.61 cfs 5,755 cf

Subcatchment 1b: Subcat 1b Runoff Area=0.495 ac 63.14% Impervious Runoff Depth=4.49"
Tc=6.0 min CN=61/98 Runoff=2.25 cfs 8,064 cf

Subcatchment 1c: Subcat 1c Runoff Area=0.823 ac 72.19% Impervious Runoff Depth=4.81"
Tc=6.0 min CN=60/98 Runoff=3.98 cfs 14,377 cf

Subcatchment 2: Subcat 2 Runoff Area=0.245 ac 0.00% Impervious Runoff Depth=1.76"
Flow Length=237' Slope=0.0463 '/' Tc=11.6 min CN=57/0 Runoff=0.38 cfs 1,561 cf

Subcatchment 3: Subcat 3 Runoff Area=0.246 ac 93.37% Impervious Runoff Depth=5.64"
Flow Length=365' Tc=6.0 min CN=61/98 Runoff=1.38 cfs 5,032 cf

Pond P1a: StormTrap SandFilter Peak Elev=181.74' Storage=987 cf Inflow=1.61 cfs 5,755 cf
Outflow=1.57 cfs 5,762 cf

Pond P1b: ADS Infiltration Basin Peak Elev=189.80' Storage=1,468 cf Inflow=2.25 cfs 8,064 cf
Discarded=0.01 cfs 618 cf Primary=2.23 cfs 7,455 cf Outflow=2.24 cfs 8,074 cf

Pond P1c: ADS Infiltration Basin Peak Elev=187.18' Storage=2,525 cf Inflow=3.98 cfs 14,377 cf
Discarded=0.03 cfs 4,688 cf Primary=3.85 cfs 9,690 cf Outflow=3.88 cfs 14,378 cf

Link DP1: Drainage Easement Inflow=7.63 cfs 22,907 cf
Primary=7.63 cfs 22,907 cf

Link DP2: Drainage Easement Offsite Inflow=7.94 cfs 24,468 cf
Primary=7.94 cfs 24,468 cf

Link DP3: Florence Street Inflow=1.38 cfs 5,032 cf
Primary=1.38 cfs 5,032 cf

Total Runoff Area = 94,337 sf Runoff Volume = 34,790 cf Average Runoff Depth = 4.43"
37.36% Pervious = 35,241 sf 62.64% Impervious = 59,095 sf

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1a: Subcat 1a Runoff Area=0.357 ac 61.78% Impervious Runoff Depth=6.82"
Tc=6.0 min CN=61/98 Runoff=2.49 cfs 8,845 cf

Subcatchment 1b: Subcat 1b Runoff Area=0.495 ac 63.14% Impervious Runoff Depth=6.88"
Tc=6.0 min CN=61/98 Runoff=3.47 cfs 12,360 cf

Subcatchment 1c: Subcat 1c Runoff Area=0.823 ac 72.19% Impervious Runoff Depth=7.26"
Tc=6.0 min CN=60/98 Runoff=6.03 cfs 21,687 cf

Subcatchment 2: Subcat 2 Runoff Area=0.245 ac 0.00% Impervious Runoff Depth=3.57"
Flow Length=237' Slope=0.0463 '/' Tc=11.6 min CN=57/0 Runoff=0.83 cfs 3,174 cf

Subcatchment 3: Subcat 3 Runoff Area=0.246 ac 93.37% Impervious Runoff Depth=8.24"
Flow Length=365' Tc=6.0 min CN=61/98 Runoff=2.01 cfs 7,354 cf

Pond P1a: StormTrap SandFilter Peak Elev=181.83' Storage=1,011 cf Inflow=2.49 cfs 8,845 cf
Outflow=2.44 cfs 8,843 cf

Pond P1b: ADS Infiltration Basin Peak Elev=189.91' Storage=1,508 cf Inflow=3.47 cfs 12,360 cf
Discarded=0.01 cfs 630 cf Primary=3.40 cfs 11,742 cf Outflow=3.40 cfs 12,372 cf

Pond P1c: ADS Infiltration Basin Peak Elev=187.32' Storage=2,597 cf Inflow=6.03 cfs 21,687 cf
Discarded=0.03 cfs 4,784 cf Primary=5.87 cfs 16,903 cf Outflow=5.90 cfs 21,687 cf

Link DP1: Drainage Easement Inflow=11.70 cfs 37,488 cf
Primary=11.70 cfs 37,488 cf

Link DP2: Drainage Easement Offsite Inflow=12.38 cfs 40,662 cf
Primary=12.38 cfs 40,662 cf

Link DP3: Florence Street Inflow=2.01 cfs 7,354 cf
Primary=2.01 cfs 7,354 cf

Total Runoff Area = 94,337 sf Runoff Volume = 53,420 cf Average Runoff Depth = 6.80"
37.36% Pervious = 35,241 sf 62.64% Impervious = 59,095 sf

Appendix C: Standard 3 Computations and Supporting Documentation

- Soil Evaluation in accordance with Volume 3, Chapter 1 of the Handbook
- Recharge Volume Calculations
- 72 hour drawdown analysis

Soil Evaluation and Analysis

> USDA Web Soil Survey – Hydraulic Soil Group Mapping and Data

>Geotechnical Due Diligence Memorandum

>Proposed Test Pit Locations and Data

Map Scale: 1:1,420 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 20 40 80 120

Feet: 0 50 100 200 300

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

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

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

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

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

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 20, Jun 9, 2020

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

Date(s) aerial images were photographed: Sep 25, 2020—Oct 4, 2020

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
420B	Canton fine sandy loam, 3 to 8 percent slopes	B	1.4	13.6%
602	Urban land		4.7	45.4%
656	Udorthents-Urban land complex		4.2	41.0%
Totals for Area of Interest			**10.4**	**100.0%**

Description

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

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

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

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

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

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

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

SANBORN HEAD
Building Trust. Engineering Success.

1 Technology Park Drive
Westford, MA 01886

MEMORANDUM

To: Jackie Dominguez (Sunrise Senior Living)

From: Kevin Stetson, P.E., Americo Santamaria (Sanborn Head)

File: 4890.00

Date: April 7, 2021

Re: Geotechnical Due Diligence Memorandum
11 Florence Street & 318 Boylston Street
Newton (Chestnut Hill), MA

Sanborn, Head & Associates, Inc. (Sanborn Head) has prepared this geotechnical due diligence memorandum to transmit logs of recent explorations and provide preliminary geotechnical engineering recommendations to Sunrise Senior Living (Sunrise) for initial design and permitting of the proposed project located at 11 Florence Street and 318 Boylston Street, Newton, Massachusetts (Site). This memorandum describes our observations during the subsurface exploration program advanced by Vanasse Hangen Brustlin, Inc. (VHB), and seismic refraction survey completed by Hager-Richter Geoscience, Inc. (HRGS). The Site is currently occupied by a garden center, including a 2-story building, 4 greenhouse structures, concrete and gravel landscaping, and an asphalt-paved access road and parking area circling the structures. The adjacent property at 318 Boylston Street contains a gravel parking lot. We understand the proposed project will include a 4-story, 90-unit assisted living facility with a one-level below grade parking garage, with an approximate footprint of 24,000 square feet. Based on the current concept plan (Scheme D dated March 22, 2021) provided by you on April 1, 2021, the proposed first floor is at elevation (El.) 195 feet and the proposed garage floor is at El. 183 feet. This memorandum is subject to the limitations in Attachment A.

SUBSURFACE EXPLORATION PROGRAM

Geotechnical Test Borings

Between October 21 and 26, 2020, and between March 8 and 11, 2021, Geosearch, Inc. of Sterling, MA (Geosearch) advanced multiple borings for both environmental and geotechnical purposes at the 11 Florence Street property. A total of seven (7) geotechnical test borings (designated SB-4, SB-5, SB-7 through SB-10 and SB-105) were advanced to depths between approximately 5 and 26.5 feet below ground surface (bgs) under the full-time observation of VHB and Sanborn Head. Prior to the geotechnical drilling observed by Sanborn Head, the test borings were pre-cleared for utility clearance by vacuum excavation to depths between approximately 3 and 8 feet bgs under the observation of VHB. The test borings were drilled using hollow-stem auger drilling techniques, with supplemental air hammer drilling used to advance test boring SB-9 after auger refusal was encountered. VHB installed monitoring wells at SB-5 (MW-2), SB-8 (MW-3), and SB-10 (MW-4), and MW/SB-100, which were not observed by Sanborn Head. The approximate locations of the geotechnical test borings observed by Sanborn Head are shown on Figure 1.

Logs of the geotechnical test borings were prepared by Sanborn Head and are provided in Attachment B. Refer to logs from VHB, provided under separate cover, for soil descriptions in the upper pre-cleared sections of the test borings and for monitoring well details. Standard Penetration Tests (SPTs) were performed in general accordance with ASTM D1586. The soil samples were field classified by Sanborn Head geotechnical engineers based on visual estimates of grain size distribution and plasticity using the Modified Burmister System. Additional soil characteristics, such as density and consistency, color, and moisture were noted on the logs. A legend is provided in Attachment B that describes the classification system. Elevations on the logs and in this memorandum were estimated from a plan titled "Existing Conditions Plan of Land, Progress Print" prepared by VHB and dated October 5, 2020.

Geophysical Survey

On February 1, 2021, HRGS of Salem, NH completed a geophysical survey as a subconsultant to Sanborn Head to obtain additional data to support bedrock rippability and general depth to competent bedrock at the Site. The geophysical survey included four transects (designated Seismic Line 1 through 4) of seismic refraction measurements which provide a compressional wave velocity and approximate depth to bedrock. The report prepared by HRGS dated February 15, 2021 is provided in Attachment C.

SUBSURFACE CONDITIONS

The subsurface conditions of the Site consist of up to approximately 10 feet of granular urban fill, consisting of sand with varying proportions of gravel and silt and very few non-soil constituents, including brick, asphalt, wood chips, and wire fragments. Based on a limited number of SPT samples with blow counts within the fill layer (blow counts are not available for soil removed by vacuum excavation), the fill appears to range from very loose to medium dense.

Underlying the granular fill, an isolated pocket of organic silt approximately 2 feet thick was observed at SB-7. In other locations at the site, the fill was underlain by a discontinuous layer of very dense sand and gravel, approximately 2 feet thick as observed between 8 and 10 feet at SB-10. Glacial till was observed to further underly the fill, organic silt, and/or sand and gravel layers at SB-5, SB-7, SB-8, and SB-10.

At SB-4 and SB-105, weathered bedrock was observed at approximately 3 feet bgs and was penetrable with drilling augers to depths of 15 and 5 feet bgs, respectively. At SB-9, weathered bedrock was observed underlying the fill material at 10 feet bgs and was observed to be penetrable with a split spoon sampler to approximately 12.5 feet bgs. Advancement with an air hammer at SB-9 indicated competent bedrock was present below the weathered bedrock at a depth of approximately 15 feet. A surface bedrock outcrop is present on the western portion of the Site, near SB-4 as noted on Figure 1. The bedrock, where encountered, generally consists of Roxbury Conglomerate.

The depth to competent bedrock along the seismic refraction lines varies between about 9 and 23 feet below ground surface (between approximately El. 184 and 167 feet) as

summarized in Table 1 in Attachment C. Based on the subsurface explorations and the geophysical survey, the general trend of competent bedrock suggests increasing depth from north to south and from west to east and consists of compression velocities ranging between 8,900 feet per second (fps) and 15,300 fps. Material above the top of competent bedrock exhibited compression wave velocities ranging from 1,100 fps to 3,150 fps and is interpreted to consist of dry to moist fill, glacial till, and highly weathered conglomerate bedrock. As called out in Attachment C, please note that the accuracy of the depth to competent bedrock determined by the geophysical survey is estimated to be ±10 percent of the depth to bedrock, or ±2 feet, whichever is greater.

Based on groundwater measurements taken on October 30, 2020 and provided by VHB, groundwater flow is expected to be approximately west to east across the Site, with groundwater varying from approximately 10.95 feet bgs at SB-8/MW-3 to approximately 19.2 feet bgs at SB-5/MW-2 (approximately El. 178 ft to 172 ft, respectively). It should be noted that groundwater levels and flow directions may be locally influenced by subsurface utilities acting as preferential pathways, and that groundwater levels will also fluctuate depending on seasonal variations in temperature and precipitation.

GEOTECHNICAL ENGINEERING CONSIDERATIONS AND POTENTIAL PREMIUM COSTS

Based on the subsurface conditions, we have identified the following preliminary geotechnical considerations and recommendations for the proposed Site concept. Additional explorations during design should be completed to further evaluate subsurface conditions including fill thickness and depth to bedrock. A final geotechnical engineering report will be prepared at a later date following additional explorations to provide subgrade preparation, material specifications and additional recommendations.

- ***Excavation for Below Grade Parking Garage:*** We anticipate that a large excavation will be required to allow for the construction of the below-grade parking garage with footing elevation at approximately El. 179 feet (4 feet below the proposed garage floor and 6 to 14 feet below existing grade). We anticipate the excavation can be an open cut with temporary slopes; however, site constraints may require portions of the excavation to have a temporary excavation support. Temporary excavation support system(s) should be designed by a Professional Engineer licensed to practice in Massachusetts and retained by the contractor with design review by our office on behalf of the Owner.

  If competent bedrock is encountered as part of the excavation for the below-grade garage, we recommend that temporary cut slopes in the competent bedrock be constructed at a slope angle of 1 horizontal to 6 vertical (1V:6H) while temporary cut slopes in the weathered bedrock be constructed at a slope angle of 1.5V:1H. Weathered bedrock should be evaluated during excavation to determine if the slope angle could be steeper than 1.5V:1H.

- ***Bedrock Excavation*:** The existing fill soil and glacial till material are expected to contain boulders. In addition, bedrock excavation will be necessary in the northwestern portion of the proposed building. Based on the current Scheme D building footprint, we anticipate approximately 1,000 CY of weathered rock may need to be removed by excavation and an additional approximately 500 CY of competent bedrock may need to be removed by

mechanical means to accommodate the below-grade parking garage and associated foundations. Based on the geophysical survey, the majority of weathered bedrock does appear excavatable. The competent bedrock is not rippable based on the compression wave velocities. Given the small volume of competent bedrock, we recommend bedrock be removed by mechanical means such as pre-drilling and hoe ramming; however, if required, blasting operations must be conducted in accordance with the Massachusetts Fire Prevention Regulations in 527 CMR 1.00. Blasting operations require, but are not limited to: pre-blast surveys, preparation of a blasting plan, performing the work within regulatory limits for vibration and overpressure (noise), field monitoring of same using seismographs, and maintaining logs of the drilling and blasting work and blasting permits from the City of Newton . To the extent practical, blasting, if required, should be completed prior to construction of the building foundations, finishes, and retaining walls, so as to limit vibration of the proposed structures. Blasting should not be conducted within 7 days after concrete has been poured, unless approved by the engineer. Excavation of weathered bedrock and competent bedrock by mechanical means or by blasting are anticipated to be a premium cost to the project.

- ***Existing Fill:*** Based on the test borings, fill extends to El. 189 feet at SB-4 and to El. 177 feet at SB-7. The existing fill is unsuitable to support the building foundations. Based on a proposed footing elevation of El. 179 feet (4 feet below the proposed garage floor), limited over-excavation and replacement of existing fill will be required. At this time, we anticipate the existing fill can remain below the proposed floor slab after proof compaction.

- ***Excess Soil and Soil Management:*** The excavation for the below-grade parking garage is anticipated to generate a large volume of excess soil. The earthwork contractor should limit off-site disposal of on-site soils to the extent practical. Excavated soils will need to be managed in accordance with local, state, and federal environmental regulations including the Massachusetts Contingency Plan (MCP) in 310 CMR 40. Excess soil which cannot be reused as fill at the Site will need to be shipped off-site for disposal at a facility permitted to accept the soil based on the environmental pre-characterization data obtained for the Site. We understand that VHB is the environmental consultant for the project and should be involved in soil management planning and coordination.

- ***Dewatering and Groundwater Control:*** Based on the groundwater levels and anticipated bottom of footing of El. 179 feet (4 feet below the proposed garage floor), we do not anticipate that dewatering will be required during excavation for footings and the slab of the below-grade parking garage, but may be required to manage stormwater that enters the excavation. Foundation drains should be installed along the perimeter of the below-grade foundation wall for long-term control of groundwater in the garage. Dewatering should be conducted in accordance with local, state, and federal environmental regulations.

FOUNDATION DESIGN RECOMMENDATIONS

Our preliminary recommended building foundation and wall design criteria are as follows:

Foundation Type: Spread footings with the garage floor level constructed as slab-on-grade.

Seismic Site Class: Site Class "C" per Massachusetts State Building Code (MSBC), 9th Edition.
Seismic Spectral Response Accelerations for City of Newton: S_s = 0.208g; S_1 =0.068g.
Design Spectral Response Accelerations: S_{DS} = 0.166g; S_{D1} = 0.077g.
Net Allowable Bearing Capacity: 6 kips per square foot (ksf) for soil subgrade – see below.
Min. Footing Width: 24 inches for continuous wall footings, 36 inches for spread footings.
Bearing Depth: Minimum of 4 feet below finished exterior grade for frost protection, including building foundations and cast-in-place concrete wall foundations.
Floor Slab – Modulus of Subgrade Reaction: 150 pounds per cubic inch (pci).

Based on conditions observed in our subsurface explorations, it is our opinion that the foundation soils at the site are not expansive or susceptible to liquefaction.

We recommend that all footings be supported by a soil subgrade, which may consist of natural materials or structural fill placed during construction, instead of a combination of soil and bedrock, to control differential settlement. Where bedrock is present, the bedrock should be removed to provide a minimum 12-inch thick soil cushion between top of rock and bottom of footing.

GEOTECHNICAL EXPLORATION AND CONSTRUCTION MONITORING

We recommend that additional explorations be performed for development of a full Geotechnical Engineering Report, to further evaluate the fill thickness, density, and depth to bedrock and to better quantify the soil and rock to be excavated for the proposed building. We further recommend that Sanborn Head be provided the opportunity to review the design plans and specifications to see that the recommendations of this memorandum have been properly incorporated, and that we be retained during site work to observe earthwork operations, perform quality control testing on compacted fill, and assist in the development of design changes should subsurface conditions differ from those anticipated prior to the start of construction.

CRD/AJS/LDN/KPS

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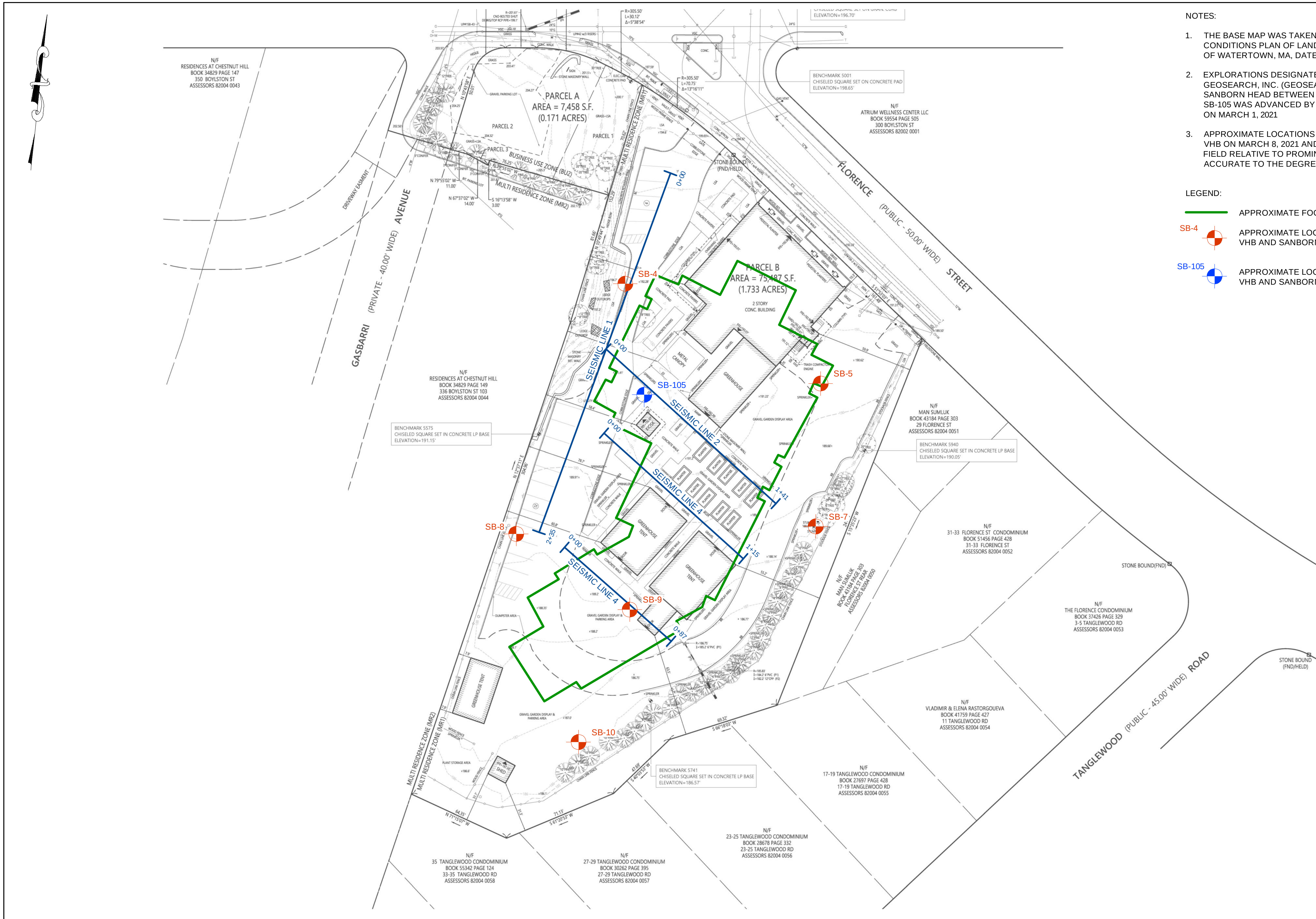
FIGURE



NOTES:

1. THE BASE MAP WAS TAKEN FROM AN ELECTRONIC PLAN ENTITLED, "EXISTING CONDITIONS PLAN OF LAND", PREPARED BY VANASSE HANGEN BRUSTLIN, INC. (VHB) OF WATERTOWN, MA, DATED OCTOBER 5, 2020 WITH AN ORIGINAL SCALE OF 1" = 20'.
2. EXPLORATIONS DESIGNATED SB-4 THROUGH SB-10 WERE ADVANCED BY GEOSEARCH, INC. (GEOSEARCH) OF STERLING, MA AND OBSERVED BY VHB AND SANBORN HEAD BETWEEN OCTOBER 21 AND 23, 2020. EXPLORATION DESIGNATED SB-105 WAS ADVANCED BY GEOSEARCH AND OBSERVED BY VHB AND SANBORN HEAD ON MARCH 1, 2021
3. APPROXIMATE LOCATIONS OF EXPLORATIONS WERE PROVIDED ELECTRONICALLY BY VHB ON MARCH 8, 2021 AND ARE BASED ON TAPED MEASUREMENTS MADE IN THE FIELD RELATIVE TO PROMINENT SITE FEATURES AND SHOULD ONLY BE CONSIDERED ACCURATE TO THE DEGREE IMPLIED BY THE METHOD USED.

LEGEND:

APPROXIMATE FOOTPRINT OF PROPOSED BUILDING

SB-4 APPROXIMATE LOCATION AND DESIGNATION OF TEST BORING OBSERVED BY VHB AND SANBORN HEAD (OCTOBER 2020)

SB-105 APPROXIMATE LOCATION AND DESIGNATION OF TEST BORING OBSERVED BY VHB AND SANBORN HEAD (MARCH 2021)

SANBORN HEAD

GRAPHICAL SCALE

30' 15' 0' 30' 60'

NO.	DATE	DESCRIPTION	BY

DRAWN BY: C.DIAS/D.DOMBROWSKY
DESIGNED BY: C.DISENHOF
REVIEWED BY: A.SANTAMARIA
PROJECT MGR: A.SANTAMARIA
PIC: K.STETSON
DATE: APRIL 2021

GEOTECHNICAL ENGINEERING MEMORANDUM

SUNRISE OF CHESTNUT HILL

NEWTON, MASSACHUSETTS

EXPLORATION LOCATION PLAN

PROJECT NUMBER: 4890.00

SHEET NUMBER: 1

ATTACHMENT A

LIMITATIONS

ATTACHMENT A
LIMITATIONS

Explorations

1. The analyses, recommendations, and designs submitted in this memorandum are based in part on the data obtained from subsurface explorations by Sanborn Head. The nature and extent of variations between these explorations may not become evident until construction. If variations then appear evident, it will be necessary to re-evaluate the recommendations of this memorandum.

2. The generalized soil profile described in the text is intended to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized, and have been developed by interpretation of widely spaced explorations and samples; actual soil and bedrock transitions may be more or less gradual than indicated. For specific information, refer to the subsurface exploration logs.

3. Water level readings have been made in the explorations at the times and under the conditions stated on the logs. These data have been reviewed and interpretations have been made in the text of this memorandum. Please note that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature, and other factors differing from those occurring at the time measurements were made.

Review

4. In the event that any changes in the nature, design, or location of the proposed buildings and site features are planned, the conclusions and recommendations contained in this memorandum shall not be considered valid unless the changes are reviewed and conclusions of the memorandum modified or verified in writing by Sanborn Head.

Construction

5. It is recommended that this firm be retained to provide soil engineering services during the excavation and earthwork construction phases of the work. This is to observe compliance with the design concepts, specifications, or recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated prior to the start of construction.

Use of Memorandum

6. This memorandum has been prepared for the exclusive use of Sunrise Senior Living for the proposed Sunrise Senior Living facility in Chestnut Hill, Newton, Massachusetts in accordance with generally accepted soil and foundation engineering practices.

7. This geotechnical engineering memorandum has been prepared for this project by Sanborn Head for design purposes only. Contractors using this memorandum to prepare a bid for site work acknowledge that its scope is limited to design considerations only.

ATTACHMENT B

SUBSURFACE EXPLORATION LOGS

Description and Classification of Soil

1. Density or Consistency: The density or consistency of a soil sample is based on the Standard Penetration Test N-value according to the following table:

Density of Granular Soil	SPT N-Value		Consistency of Cohesive Soil
Very Loose	0-4	<2	Very Soft
Loose	4-10	2-4	Soft
Medium Dense	10-30	4-8	Medium Stiff
Dense	30-50	8-15	Stiff
Very Dense	>50	15-30	Very Stiff
		>30	Hard

The Standard Penetration Resistance, or N-value in blows per foot, is the sum of the blows recorded over the second and third 6-inch interval.

A number followed by "/3" indicates the distance that the sampler advanced. For example "100/4" indicates that 100 blows of a 140 pound hammer falling 30 inches advanced the sampler 4 inches. "WOR/24" indicates the weight of the drilling rods without the hammer caused the sampler to advance 24 inches.

"WOH" indicates the static weight of the 140 pound hammer and the drilling rods attached to the split spoon sampler were sufficient to cause the sampler to advance.

"WOR" indicates the static weight of the drilling rods attached to the split spoon sampler was sufficient to cause the sampler to advance.

2. Color: The color of a soil sample is based on visual observation.

3. Soil Components

A. Description: The components of a soil sample are described by visually estimating the percentage of each component by weight of the total sample using a Modified Burmister System.

i. Major Component: The major soil component is written with upper case letters for granular soil (e.g., SAND, GRAVEL) and a combination of upper and lower case letters for fine grained soil (e.g., Silty CLAY, Clayey SILT).

ii. Minor Component: The minor soil components are written with the first letter of each soil type in upper case, and the remaining letters in lower case (e.g., Gravel, Silt). The minor components are identified and prefaced in the description based on the following percentages:

Preface	Percentage
and	35-50
some	20-35
little	10-20
trace	0-10

iii. Note: The actual percentages of gravel soil may differ from that measured when sampling with a standard split spoon sampler because of the relatively small sampler diameter. Also, it is not possible to identify the presence of boulders and cobbles using a standard split spoon sampler.

B. Definitions

i. Granular Soil: A granular soil sample is defined by the following particle sizes as referenced to a standard sieve:

Material	Description	Standard Sieve Limit	
		Upper	Lower
Boulders	C-sized	--	36 inch
	B-sized	36 inch	24 inch
	A-sized	24 inch	12 inch
Cobbles	--	12 inch	3 inch
Gravel	coarse	3 inch	3/4 inch
	fine	3/4 inch	No. 4
Sand	coarse	No. 4	No. 10
	medium	No. 10	No. 40
	fine	No. 40	No. 200

ii. Fine Grained Soil: The degree of plasticity of fine-grained soils is defined as follows:

Material	Degree of Plasticity	Plasticity Index (PI)	Smallest Thread Diameter (in.)
SILT	Non-Plastic	0	None
Clayey SILT	Slight	1 to 5	1/4
SILT & CLAY	Low	5 to 10	1/8
CLAY & SILT	Medium	10 to 20	1/16
Silty CLAY	High	20 to 40	1/32
CLAY	Very High	40+	1/64

iii. Organic Soil: An organic soil sample is classified by observation of the sample structure as follows:

Material	Description
TOPSOIL	Surficial soils that support plant life and which contain organic matter.
SUBSOIL	Soil underlying the topsoil which may contain roots or plant fibers.
PEAT	Deposits of plant remains in which the original plant fibers or root structure are visible.
ORGANIC SILT	Deposit of plant remains in which the original plant fibers or root structure have decomposed.

iv. Non-Soil Constituents: Non-soil constituents (artificial or anthropogenic material, organic materials, cobbles and boulders) are described as follows:

The following terminology is used to denote size ranges of non-soil constituents such as man-made objects or fill material:

Descriptive Term	Size Range	Comparative Term
Specks	< No. 200 Sieve	Silt and Clay fines
Particles	No. 200 Sieve to No. 4 Sieve	Sand
Fragments	No. 4 Sieve to 3 in.	Gravel
Pieces	3 in. to 12 in.	Cobbles
Blocks	> 12 in.	Boulders

The following terminology is used to describe the frequency that a non-soil constituent is observed by estimating the percentage of the constituent by weight of the total sample:

Descriptor	Percentage
very few	0-5
few	5-10
common	10-20
frequent	20-35
numerous	35-50

4. Moisture Content: The moisture content of a soil sample is based on the observable presence of water according to the following table:

Dry	Moisture is not apparent, dusty.
Moist	No visible water.
Wet	Visible free water.

5. Other Pertinent Characteristics: Pertinent characteristics observed in a soil sample should be noted according to the following table:

Soil Structure Produced by Deposition of Sediments	
Stratified	Random soil deposits of varying components of color.
Varved	Alternating soil deposits of varying thickness (i.e., clays or silts).
Stratum	Soil deposit > 12 inches thick.
Layer	Soil deposit 3 inches to 12 inches thick.
Seam	Soil deposit 1/8 inch to 3 inches thick.
Parting/Lens	Soil deposit <1/8 inch thick.

SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: Sunrise Senior Living
Location: Newton, MA
Project No.: 4890.00

Log of Boring SB-4

Ground Elevation: 192 ± feet
Datum: NAVD 1988

Drilling Method: Truck Mounted CME Drill Rig with Hollow Stem Auger

Sampling Method: 2" O.D. Split Spoon, Automatic Hammer

Drilling Company: Geosearch, Inc.
Foreman: Sean
Date Started: 10/23/20 **Date Finished: 10/23/20**
Logged By: J. McCarthy **Checked By: A. Santamaria**

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time
10/23/20	---	No Groundwater Encountered				

Depth (ft)	Sample Information: Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Stratum: Log	Description	Geologic Description	Remarks
0							-----0'-----		
2									Previously pre-cleared to 2.9 feet under the observation of VHB.
	S-1	3 - 4.5	29 69 80	18/15			-----3'-----	S-1 (3 to 4.5'): Very dense, gray, fine to coarse GRAVEL and Sand, trace Silt. Moist. WEATHERED ROCK.	
4									
	S-2	5 - 7	28 90 55 45	24/17				S-2 (5 to 7'): Very dense, gray, fine to coarse GRAVEL and Sand, trace Silt. Moist. WEATHERED ROCK.	
6									
	S-3	7 - 8.9	37 43 39 70/5"	23/17				S-3A (7 to 8.5'): Very dense, gray, fine to coarse SAND and Gravel, trace Silt. Moist. WEATHERED ROCK.	
8									
	S-4	9 - 9.3	124/4"	4/3			WEATHERED BEDROCK	S-3B (8.5 to 8.9'): Very dense, light brown/gray, fine to coarse SAND, some Gravel, little Silt. Moist. WEATHERED ROCK.	
10								S-4 (9 to 9.3'): Very dense, gray, fine to coarse GRAVEL and Sand, trace Silt. Moist. WEATHERED ROCK.	
	S-5	12 - 12.6	70 33/1"	7/2				S-5 (12 to 12.6'): Very dense, gray, fine to coarse SAND, some Gravel, trace Silt. Moist. WEATHERED ROCK.	
12									
14									
	S-6	15 - 15.3	150/3"	3/3			-----15.2'-----	S-6 (15 to 15.3'): Very dense, gray, fine to coarse SAND, some Gravel, trace Silt. Moist. WEATHERED ROCK.	
16								Boring terminated at 15.2 feet. No refusal encountered.	
18									
20									
22									
24									

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SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: Sunrise Senior Living
Location: Newton, MA
Project No.: 4890.00

Log of Boring SB-5

Ground Elevation: 191 ± feet
Datum: NAVD 1988

Drilling Method: Truck Mounted CME Drill Rig with Hollow Stem Auger

Sampling Method: 2" O.D. Split Spoon, Automatic Hammer

Drilling Company: Geosearch, Inc.
Foreman: Sean
Date Started: 10/22/20 **Date Finished: 10/22/20**
Logged By: J. McCarthy **Checked By: A. Santamaria**

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time
10/22/20	11:10	23'	Ground Surface	22.5'	24.5'	

Depth (ft)	Sample Information: Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Stratum: Log	Description	Geologic Description	Remarks
0							-----0'-----		
4	S-1	5 - 5.2	40/2"	2/1			-----5'----- FILL	S-1 (5 to 5.2'): Very dense, light gray, GRAVEL and Sand, trace Silt. Moist. FILL.	Previously pre-cleared to 5 feet under the observation of VHB.
6	C-1	5.5 - 10.5					-----5.5'----- BOULDER -----7.5'-----		Auger refusal encountered at approximately 5.5 feet. Core barrel used to advance from approximately 5.5 to 10.5 with two boulders encountered. Split spoon sampling resumed at a depth of approximately 10.5 feet.
8							FILL -----8.5'----- BOULDER -----9.5'-----		
10	S-2	10.5 - 12.5	3 17 9 13	24/15				S-2 (10.5 to 12.5'): Medium dense, gray, SILT and Sand, little Gravel. Wet. FILL.	S-2 and S-3 have strong petroleum odor.
12	S-3	12.5 - 14.5	18 31 40 34	24/18				S-3 (12.5 to 14.5'): Very dense, gray, fine to coarse SAND and Silt, some Gravel. Moist.	
14	S-4	14.5 - 16.5	14 28 57 42	24/17				S-4A (14.5 to 15.5'): Very dense, gray, fine to coarse SAND and Silt, some Gravel. Moist. S-4B (15.5 to 16.5'): Very dense, light gray, fine to coarse SAND and Gravel, little Silt. Moist. TILL.	
16	S-5	16.5 - 18.5	48 46 65 50	24/18				S-5 (16.5 to 18.5'): Very dense, light brown, fine to coarse SAND, some Gravel, some Silt. Moist. TILL.	
18	S-6	18.5 - 20.5	25 42 40 38	24/21			GLACIAL TILL	S-6 (18.5 to 20.5'): Very dense, light brown, fine to coarse SAND and Gravel, trace Silt. Moist. TILL.	
20	S-7	20.5 - 22.5	11 28 30 29	24/18				S-7 (20.5 to 22.5'): Very dense, light brown, fine to coarse SAND, some Gravel, little Silt. Moist. TILL.	
22	S-8	22.5 - 24.5	48 32 30 29	24/15				S-8 (22.5 to 24.5'): Very dense, light brown, fine to coarse SAND, some Gravel, little Silt. Wet. TILL.	
24	S-9	24.5 - 26.5	18 18 41 27	24/19				S-9 (24.5 to 26.5'): Very dense, light brown, fine to coarse SAND, some Gravel, little Silt. Wet. TILL.	
26							-----26.5'-----	Boring terminated at 26.5 feet. No refusal encountered.	

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SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: Sunrise Senior Living
Location: Newton, MA
Project No.: 4890.00

Log of Boring SB-7

Ground Elevation: 188 ± feet
Datum: NAVD 1988

Drilling Method: Truck Mounted CME Drill Rig with Hollow Stem Auger

Sampling Method: 2" O.D. Split Spoon, Automatic Hammer

Drilling Company: Geosearch, Inc.

Foreman: Sean

Date Started: 10/21/20 **Date Finished: 10/21/20**

Logged By: C. Disenhof **Checked By: A. Santamaria**

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time
10/21/20	14:48	13'	Ground Surface	11'	13'	None

Depth (ft)	Sample Information: Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Stratum: Log	Description	Geologic Description	Remarks
0							-----0'-----		
2									
4									Previously pre-cleared to 4.5 feet under the observation of VHB.
	S-1	5 - 7	WOH WOH 1 8	24/8			-----5'-----	S-1 (5 to 7'): Very loose, dark brown/gray, fine to coarse SAND, some Gravel, some Silt, few Wood fragments. Moist. FILL.	
6									
	S-2	7 - 9	2 1 3 1	24/6			FILL	S-2 (7 to 9'): Very loose, gray, fine to coarse SAND, some Silt, little Gravel, very few Wood chips. Moist. FILL.	
8									
	S-3	9 - 11	2 3 13 16	24/21			-----9'-----	S-3A (9 to 10.3'): Stiff, gray, CLAY & SILT, trace Gravel, trace Sand, very few Peat particles. Moist. ORGANIC SILT.	
10							ORGANIC SILT	S-3B (10.3 to 11'): Stiff, black, Organic SILT & CLAY, little Gravel, trace Sand, very few Peat particles. Moist. ORGANIC SILT.	
	S-4	11 - 13	14 14 48 48	24/14			-----11'-----	S-4A (11 to 12.5'): Very dense, black, fine GRAVEL, trace Sand, trace Silt. Wet. TILL.	
12								S-4B (12.5 to 13'): Very dense, light gray, fine to coarse SAND, trace Gravel, trace Silt. Wet. TILL.	S-4B: Cobble in spoon tip.
	S-5	13 - 15	29 27 23 3	24/20				S-5 (13 to 15'): Dense, brown/gray, fine to coarse SAND, some Gravel, some Silt, trace Clay. Wet. TILL.	
14							GLACIAL TILL		Redoximorphic features observed in samples S-5 and S-6.
	S-6	15 - 17	17 25 31 28	24/15				S-6 (15 to 17'): Very dense, brown, fine to coarse SAND, some Gravel, little Silt. Wet. TILL.	
16									
	S-7	17 - 17.9	67 41/4"	10/5				S-7 (17 to 17.9'): Very dense, brown, GRAVEL and Sand, little Silt, trace Clay. Wet. TILL.	
18							-----17.9'-----	Boring terminated at 17.9 feet due to refusal on Boulders or Bedrock.	
20									
22									
24									

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SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: Sunrise Senior Living
Location: Newton, MA
Project No.: 4890.00

Log of Boring SB-8

Ground Elevation: 189 ± feet
Datum: NAVD 1988

Drilling Method: Truck Mounted CME Drill Rig with Hollow Stem Auger

Sampling Method: 2" O.D. Split Spoon, Automatic Hammer

Drilling Company: Geosearch, Inc.

Foreman: Sean

Date Started: 10/23/20 **Date Finished: 10/23/20**

Logged By: J. McCarthy **Checked By: A. Santamaria**

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time
10/23/20	10:30	11.5'	Ground Surface	11'	13'	

Depth (ft)	Sample Information: Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Stratum: Log	Description	Geologic Description	Remarks
0							-----0'-----		
2									Previously pre-cleared to 1.5 feet under the observation of VHB.
	S-1	3 - 5	5 5 7 9	24/8			-----3'-----	S-1 (3 to 5'): Medium dense, light brown, fine to coarse SAND, some Gravel, little Silt, few Asphalt particles, very few Brick particles. Moist. FILL.	
4									
	S-2	5 - 7	3 5 6 6	24/4			FILL	S-2 (5 to 7'): Medium dense, brown, fine to coarse SAND, little Gravel, little Silt, very few Asphalt particles, very few Brick particles. Moist. FILL.	
6									
	S-3	7 - 8.3	7 7 61/3"	15/8				S-3 (7 to 8.3'): Very dense, brown/orange, fine to coarse SAND, little Silt, little Gravel. Moist. FILL.	
8							-----8'-----		
	S-4	9 - 11	51 81 88 47	24/24				S-4A (9 to 9.5'): Very dense, brown, fine to coarse SAND, little Silt, little Gravel. Moist. TILL. S-4B (9.5 to 11'): Very dense, gray, fine to coarse GRAVEL and Sand, trace Silt. Moist. TILL.	S-4B: Cobble in spoon tip.
10									
	S-5	11 - 13	33 74 72 49	24/17				S-5 (11 to 13'): Very dense, light brown, fine to coarse SAND and Gravel, little Silt. Wet. TILL.	
12									
	S-6	13 - 15	38 49 56 52	24/20			GLACIAL TILL	S-6 (13 to 15'): Very dense, brown/gray, fine to coarse SAND and Gravel, little Silt. Wet. TILL.	
14									
16									
	S-7	18 - 19.3	59 104 100/3"	15/15				S-7 (18 to 19.3'): Very dense, gray, fine to coarse SAND, some Gravel, little Silt. Wet. TILL.	
18							-----19.3'-----		
								Boring terminated at 19.3 feet. No refusal encountered.	
20									
22									
24									

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SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: Sunrise Senior Living
Location: Newton, MA
Project No.: 4890.00

Log of Boring SB-9

Ground Elevation: 188.5 ± feet
Datum: NAVD 1988

Drilling Method: Truck Mounted CME Drill Rig with Hollow Stem Auger and Truck Mounted Air Hammer
Sampling Method: 2" O.D. Split Spoon, Automatic Hammer
Drilling Company: Geosearch, Inc.
Foreman: Sean
Date Started: 10/21/20 **Date Finished: 10/21/20**
Logged By: C. Disenhof **Checked By: A. Santamaria**

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time
10/21/20	---	No Groundwater Encountered				

Depth (ft)	Sample Information: Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Stratum: Log	Description	Geologic Description	Remarks
0							-----0'-----		
6	S-1	6 - 8	5 7 10 1	24/9			-----6'-----	S-1 (6 to 8'): Medium dense, brown, fine to coarse GRAVEL and Sand, little Silt. Moist. FILL.	Previously pre-cleared to 6 feet under the observation of VHB.
8	S-2	8 - 10	7 3 3 5	24/9			FILL	S-2 (8 to 10'): Loose, brown, fine to coarse SAND and Gravel, little Silt, very few Peat particles, very few Roots, very few Wire fragments. Moist. FILL.	
10	S-3	10 - 12	13 24 32 39	24/19			-----10'-----	S-3 (10 to 12'): Very dense, gray, fine to coarse GRAVEL and Sand, trace Silt. Moist. WEATHERED ROCK.	
12	S-4	12 - 12.5	72/6"	6/3			WEATHERED BEDROCK	S-4 (12 to 12.5'): Very dense, gray, fine to coarse GRAVEL and Sand, trace Silt. Moist. WEATHERED ROCK.	Auger refusal encountered at approximately 12.5 feet. Air hammer used to advance from approximately 12.5 to 16 with competent rock encountered at approximately 15 feet.
16							-----16'-----	Boring terminated at 16 feet. No refusal encountered.	
18									
20									
22									
24									

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SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: Sunrise Senior Living
Location: Newton, MA
Project No.: 4890.00

Log of Boring SB-10

Ground Elevation: 187 ± feet
Datum: NAVD 1988

Drilling Method: Truck Mounted CME Drill Rig with Hollow Stem Auger

Sampling Method: 2" O.D. Split Spoon, Automatic Hammer

Drilling Company: Geosearch, Inc.
Foreman: Sean
Date Started: 10/21/20 **Date Finished: 10/21/20**
Logged By: J. McCarthy **Checked By: A. Santamaria**

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time
10/21/20	---	12'	Ground Surface			

Depth (ft)	Sample Information: Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Stratum: Log	Description	Geologic Description	Remarks
0							-----0'-----		
8	S-1	8 - 10	10 19 45 38	24/14			-----8'----- SAND & GRAVEL	S-1 (8 to 10'): Very dense, brown, fine to coarse SAND and Gravel, trace Silt. Moist.	Previously pre-cleared to 7 feet under the observation of VHB.
10	S-2	10 - 11	52 126	12/9			-----10'-----	S-2 (10 to 11'): Very dense, brown, fine to coarse SAND, some Gravel, trace Silt. Moist. TILL.	Redoximorphic features observed in sample S-2.
12	S-3	12 - 14	29 39 27 23	24/19				S-3 (12 to 14'): Very dense, gray/brown, fine to coarse SAND and Gravel, little Silt. Wet. TILL.	Drilling action indicates cobbles and boulders from approximately 10 to 18 feet.
14	S-4	14 - 16	14 23 26 27	24/17			GLACIAL TILL	S-4 (14 to 16'): Dense, gray, fine to coarse SAND and Gravel, little Silt. Wet. TILL.	
16	S-5	16 - 18	33 39 40 33	24/24				S-5 (16 to 18'): Very dense, gray, fine to coarse GRAVEL and Sand, little Silt. Wet. TILL.	
18							-----18'-----	Boring terminated at 18 feet. No refusal encountered.	
20									
22									
24									

BORING LOG C:\USERS\MRUSSELL\DESKTOP\4890.00.GPJ 2017 SANBORN HEAD V1.GLB 2017 SANBORN HEAD V1.GDT 4/7/21

SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: Sunrise Senior Living
Location: Newton, MA
Project No.: 4890.00

Log of Boring SB-105

Ground Elevation: 191.5 ± feet
Datum: NAVD 1988

Drilling Method: Truck Mounted CME Drill Rig with Hollow Stem Auger

Sampling Method: 2" O.D. Split Spoon, Automatic Hammer

Drilling Company: Geosearch, Inc.
Foreman: P. McClenahan
Date Started: 03/11/21 **Date Finished: 03/11/21**
Logged By: C. Disenhof **Checked By: A. Santamaria**

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time
03/11/21	---	No Groundwater Encountered				

Depth (ft)	Sample Information: Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Stratum: Log	Description	Geologic Description	Remarks
0							-----0'-----		Previously pre-cleared to 3.3 feet under the observation of VHB. Pre-clearing encountered refusal at 3.3 feet.
2									
							-----3.2'-----		
4	S-1	3.7	60/1"	1/1			WEATHERED BEDROCK	S-1 (3.7'): Very dense, green/gray, Rock. Moist.	Initial auger refusal encountered at approximately 3.7 feet. Augering continued for an additional 45 minutes to a final depth of approximately 5 feet.
							-----5'-----		
6								Boring terminated at 5 feet due to auger refusal on Boulder or Bedrock.	
8									
10									
12									
14									
16									
18									
20									
22									
24									

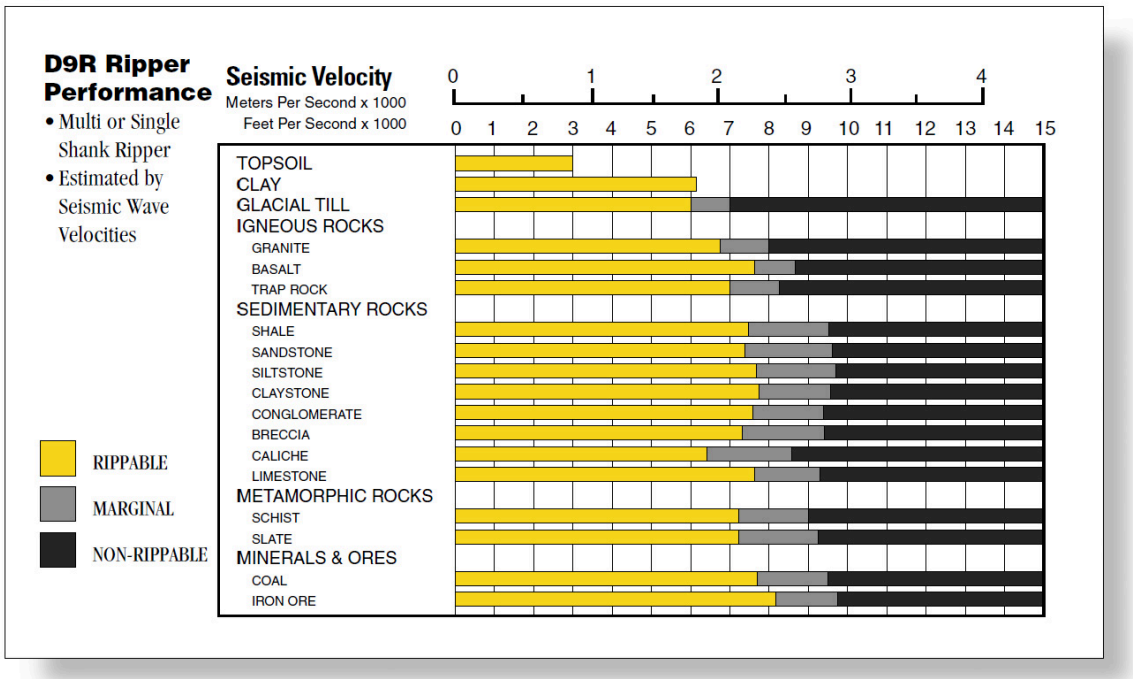
BORING LOG C:\USERS\MRUSSELL\DESKTOP\4890.00.GPJ 2017 SANBORN HEAD V1.GLB 2017 SANBORN HEAD V1.GDT 4/7/21

APPENDIX 1

CATERPILLAR RIPPABILITY CHART

Note: This figure was extracted from the Caterpillar Handbook of Ripping, Caterpillar, Inc., Peoria, Illinois, 12th Edition, February 2000

Rippers



0 10 20 40 Feet

Drawing Title

PROPOSED TEST PIT LOCATIONS

SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: Sunrise Senior Living
Location: Newton, MA
Project No.: 4890.00

Test Pit No. TP-1

Ground Elevation: 187 ± feet
Datum: NAVD 1988

Date: 09/17/21
Time Started: 12:30
Time Finished: 14:15

Logged By: M. Mirakian
Checked By: K. Stetson

Weather: Overcast, 70° F

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Test Pit	Stab. Time
09/17/21	---	4'	Ground Surface	4'	

Excavation Equipment

Contractor: Commonwealth Construction & Utilities, Inc.
Operator: S. Gilkie
Reach: 15 ft
Make: CAT
Model: 420F
Bucket Capacity: 1/2 CY

Depth (ft)	Field Testing Data	Strata Depth (ft)	Geologic Description	Strata Depth (ft)	Excv. Effort	Boulder Qty & Class	Remarks
0		0	Dark brown/gray, fine to coarse SAND, little Silt, little Gravel, trace Cobble, few Brick fragments, few Wood fragments. Moist. FILL. [Gravelly LOAMY SAND].	0	E	1C	Partial Boulder refusal at 3.5 feet.
4		4	Test pit terminated at 4 feet due to groundwater infiltration. NOTES: 1. USDA textural soil classifications are shown in brackets [ ].	4			

Excavation Effort

E	Easy
M	Moderate
D	Difficult

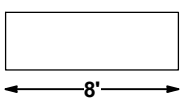
Boulder Size Classification

12" - 24"	A
24" - 36"	B
36" and larger	C

Soil Description
Minor Component Proportions

trace	0 - 10%
little	10 - 20%
some	20 - 35%
and	35 - 50%

Test Pit Plan



North Arrow

SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: Sunrise Senior Living
Location: Newton, MA
Project No.: 4890.00

Test Pit No. TP-2

Ground Elevation: 189 ± feet
Datum: NAVD 1988

Date: 09/17/21
Time Started: 15:00
Time Finished: 15:45

Logged By: M. Mirakian
Checked By: K. Stetson

Weather: Overcast, 70° F

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Test Pit	Stab. Time
09/17/21	---	10'	Ground Surface	10'	

Excavation Equipment

Contractor: Commonwealth Construction & Utilities, Inc.
Operator: S. Gilkie
Reach: 15 ft
Make: CAT
Model: 420F
Bucket Capacity: 1/2 CY

Depth (ft)	Field Testing Data	Strata Depth (ft)	Geologic Description	Strata Depth (ft)	Excv. Effort	Boulder Qty & Class	Remarks
0		0	ASPHALT.	0	E	1B	
		0.3	Brown/tan, SILT & CLAY, little Sand, little Gravel, trace Cobble, trace Boulder, few Metal fragments, few Wood fragments, few Brick fragments. Moist. FILL. [SILT LOAM].	0.3			
2							
4							
6							
		7	Brown/orange, fine to coarse SAND and SILT, little Gravel, trace Cobble, very few Asphalt fragments. Moist. FILL. [SANDY LOAM].	7			Redoximorphic layer begins at approximately 7 feet.
8							
10		10	Test pit terminated at 10 feet due to groundwater infiltration.	10			
			NOTES: 1. USDA textural soil classifications are shown in brackets [ ].				
12							
14							
16							
18							
20							

Excavation Effort

E	Easy
M	Moderate
D	Difficult

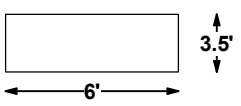
Boulder Size Classification

12" - 24"	A
24" - 36"	B
36" and larger	C

Soil Description
Minor Component Proportions

trace	0 - 10%
little	10 - 20%
some	20 - 35%
and	35 - 50%

Test Pit Plan



North Arrow

SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: Sunrise Senior Living
Location: Newton, MA
Project No.: 4890.00

Test Pit No. TP-3

Ground Elevation: 194 ± feet
Datum: NAVD 1988

Date: 09/17/21
Time Started: 17:00
Time Finished: 17:50

Logged By: M. Mirakian
Checked By: K. Stetson

Weather: Overcast, 70° F

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Test Pit	Stab. Time
09/17/21	---	No Groundwater Encountered			

Excavation Equipment

Contractor: Commonwealth Construction & Utilities, Inc.
Operator: S. Gilkie
Reach: 15 ft
Make: CAT
Model: 420F
Bucket Capacity: 1/2 CY

Depth (ft)	Field Testing Data	Strata Depth (ft)	Geologic Description	Strata Depth (ft)	Excv. Effort	Boulder Qty & Class	Remarks
0		0	ASPHALT.	0	E	1B	Concrete obstruction. Offset 3 feet north.
		0.3	Brown, fine to coarse SAND, little Gravel, trace Silt, trace Boulder, trace Cobble, few Ash particles, few Brick fragments, few Clay pipe pieces, very few Glass fragments, very few Metal pieces. Moist. FILL. [SAND].	0.3			
2							
4							
6							
8							
		8.5	Light brown, fine to coarse SAND, some Silt, trace Gravel, very few Ash particles. Moist. FILL. [SANDY LOAM].	8.5			
10		10	Test pit terminated at 10 feet. No refusal encountered.	10			
			NOTES: 1. USDA textural soil classifications are shown in brackets [ ].				
12							
14							
16							
18							
20							

Excavation Effort

E	Easy
M	Moderate
D	Difficult

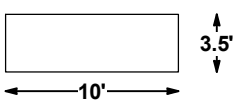
Boulder Size Classification

12" - 24"	A
24" - 36"	B
36" and larger	C

Soil Description
Minor Component Proportions

trace	0 - 10%
little	10 - 20%
some	20 - 35%
and	35 - 50%

Test Pit Plan



North Arrow

SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: Sunrise Senior Living
Location: Newton, MA
Project No.: 4890.00

Test Pit No. TP-4

Ground Elevation: 203 ± feet
Datum: NAVD 1988

Date: 09/17/21
Time Started: 11:00
Time Finished: 12:15

Logged By: M. Mirakian
Checked By: K. Stetson

Weather: Light Rain, 70° F

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Test Pit	Stab. Time
09/17/21	---	No Groundwater Encountered			

Excavation Equipment

Contractor: Commonwealth Construction & Utilities, Inc.
Operator: S. Gilkie
Reach: 15 ft
Make: CAT
Model: 420F
Bucket Capacity: 1/2 CY

Depth (ft)	Field Testing Data	Strata Depth (ft)	Geologic Description	Strata Depth (ft)	Excv. Effort	Boulder Qty & Class	Remarks
0		0	Brown, fine to coarse SAND, little Silt, trace Gravel, trace Cobble, few Organic Roots. Moist. TOPSOIL. [LOAMY SAND].	0			
		1	Brown/tan, fine to coarse SAND, some Gravel, little Silt, trace Cobble, trace Boulder, very few Organic Roots. Moist. [Gravelly LOAMY SAND].	1	E	1B	
2							
		3		3			Refusal at 3.5 feet. Bedrock east side of test pit.
4		4	Tan/gray, fine to coarse SAND, some Gravel, some Cobble, little Silt. Moist. TILL. [Gravelly LOAMY SAND].	4	D		
6		6		6			
		6.5	Test pit terminated at 6.5 due to bedrock refusal.	6.5			Bedrock west side of test pit. Excavator unable to break through bedrock.
8			NOTES: 1. USDA textural soil classifications are shown in brackets [ ].				
10							
12							
14							
16							
18							
20							

Excavation Effort

E	Easy
M	Moderate
D	Difficult

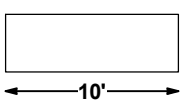
Boulder Size Classification

12" - 24"	A
24" - 36"	B
36" and larger	C

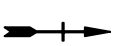
Soil Description
Minor Component Proportions

trace	0 - 10%
little	10 - 20%
some	20 - 35%
and	35 - 50%

Test Pit Plan



North Arrow



Required and Provided Recharge Volumes and 72-Hour Drawdown Analysis

Recharge Calculations

Project	11 Florence - Sunrise Senior	**Project #**	73153.00
Calculated by	DDH	**Date**	3/28/2022
Checked by	GB/JS	**Date**	

REQUIRED RECHARGE VOLUME

Hydrologic Soil Group (HSG)	Area (ft^2)	Inches of Runoff (in)	Volume (ft^3)
A	0	0.60	0
B	49,098	0.35	1,432
C	0	0.25	0
D	0	0.10	0
TOTAL			**1,432**

CAPTURE AREA ADJUSTMENT

Required Recharge Volume (ft^3)	1,432
Total Site Net Impervious Area (ft^2)	49,098
Total Site Impervious Area Draining to Recharge Facilities (ft^2)	38,908
Capture Area Adjustment Factor	1.26
Adjusted Required Recharge Volume (ft^3)	**1,807**

PROVIDED RECHARGE VOLUME

BASIN #1A (P1A):

Loading Area StormTrap SandFilter

Volumes provided below the lowest outlet at elevation: 0.0

Provided Volume:

Elevation	Area (ft^2)	Cumulative Volume (ft^3)
177.5	415	0
180.5	415	617
181.5	415	**903**

Drawdown: $(V_{Infiltration}/A_{Bottom})$/Rawl's Rate

Rawls Recharge Rate:	---	(in/hr)
Drawdown Time:	N/A	(hours)

Recharge Calculations

Project	11 Florence - Sunrise Senior	**Project #**	73153.00
Calculated by	DDH	**Date**	3/28/2022
Checked by	GB/JS	**Date**	

BASIN #1B (P1B):

Garden ADS Stormtech SC-740 Chambers on 6" Crushed Stone Base

Volumes provided below the lowest outlet at elevation: 0.0

Provided Volume:

Elevation	Area (ft^2)	Cumulative Volume (ft^3)
187.0	823	0
189.0	823	1,081
189.5	823	**1,340**

Drawdown: $(V_{Infiltration}/A_{Bottom})$/Rawl's Rate

Rawls Recharge Rate:	**0.27**	(in/hr)
Drawdown Time:	72	(hours)

BASIN #1C (P1C):

Front Yard ADS Stormtech SC-740 Chambers on 6" Crushed Stone Base (P1B)

Volumes provided below the lowest outlet at elevation: 0.0

Provided Volume:

Elevation	Area (ft^2)	Cumulative Volume (ft^3)
184.0	1,293	0
186.0	1,293	1,711
186.5	1,932	**2,262**

Drawdown: $(V_{Infiltration}/A_{Bottom})$/Rawl's Rate

Rawls Recharge Rate:	**1.02**	(in/hr)
Drawdown Time:	**21**	(hours)

RECHARGE VOLUME SUMMARY

Required Recharge Volume:	**1,807**	(ft^3)
Total Recharge Volume Provided:	**3,602**	(ft^3)

Appendix D: Standard 4 Computations and Supporting Information

- Long Term Pollution Prevention Plan
- Water Quality Volume Calculations
- TSS Removal Worksheets

Long Term Pollution Prevention Plan

Long-Term Pollution Prevention Plan

This Long-Term Pollution Prevention Plan has been developed to establish site management practices that improve the quality of stormwater discharges from the Project.

Pollutant Control Approach

Maintenance of Pavement Systems

Standard Asphalt Pavement

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 [semi-annually, annually, monthly, etc with a commercial cleaning unit and dispose of removed material.
- Check loading docks 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.

- The grass vegetation should be cut to a height between three and 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.
- Pet waste provision if applicable.

Management of Snow and Ice

Storage and Disposal

Snow will be plowed off streets. Residents will be responsible for snow removal on driveways. Key practices for the safe storage and disposal of snow include:

- Under no circumstances shall snow be disposed or stored in wetland resource areas.
- Under no circumstances shall snow be disposed or stored in stormwater basins, ponds, rain gardens, swales, channels, or trenches.

Salt and Deicing Chemicals

The amount of salt and deicing chemicals to be used on the site 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 salt and deicing chemicals should be capable of varying the rate of application based on the site specific conditions.
- Specific environmentally sensitive areas should be designated as no and/or reduced salt areas.
- Alternate materials [list alternate materials] should be used in place of standard salt and deicing chemicals in specific environmentally sensitive areas [engineer to identify].
- Sand and salt should be stockpiled under covered storage facilities that prevent precipitation and adjacent runoff from coming in contact with the deicing materials

Spill Prevention and Response Plan

Spill prevention equipment and training will be provided by the property management company.

Initial Notification

In the event of a spill the facility and/or construction manager or supervisor will be notified immediately.

FACILITY MANAGER

Name: TBD Home Phone: _____

Phone: _____ E-mail: _____

CONSTRUCTION MANAGER

Name: TBD Home Phone: _____

Phone: _____ E-mail: _____

The supervisor will first contact the Fire Department and then notify the Police Department, the Public Health Commission and the Conservation Commission. The Fire Department is ultimately responsible for matters of public health and safety and should be notified immediately.

Further Notification

Based on the assessment from the Fire Chief, additional notification to a cleanup contractor may be made. The Department of Environmental Protection (DEP) and the EPA may be notified depending upon the nature and severity of the spill. The Fire Chief will be responsible for determining the level of cleanup and notification required. The attached list of emergency phone numbers shall be posted in the main construction/facility office and readily accessible to all employees. A hazardous waste spill report shall be completed as necessary using the attached form.

Emergency Notification Phone Numbers

1. FACILITY MANAGER

Name: TBD Home Phone: _____

Phone: _____ E-mail: _____

ALTERENATE

Name: _____ Home Phone: _____

Phone: _____ E-mail: _____

2. FIRE DEPARTMENT

Emergency: **911**

Business: (617) 796-2210

POLICE DEPARTMENT

Emergency: **911**

Business: (617)-796-2100

3. CLEANUP CONTRACTOR: TBD

Address: _____

Phone: _____

4. MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION

Emergency: _____

Northeast Region – Woburn Office: 978-694-3200

5. NATIONAL RESPONSE CENTER

Phone: (800) 424-8802

ALTERNATE: U.S. ENVIRONMENTAL PROTECTION AGENCY

Emergency: _____

Business: _____

6. CONSERVATION COMMISSION

Contact: Mary Trudeau

Phone: 617-993-2667

BOARD OF HEALTH

Contact: Wesley Chin

Phone: 617-993-2720

Hazardous Waste / Oil Spill Report

Date _____ Time _____ AM / PM

Exact location (Transformer #) _____

Type of equipment _____ Make _____ Size _____

S / N _____ Weather Conditions _____

On or near Water ☐ Yes If Yes, name of body of Water _____

☐ No

Type of chemical/oil spilled _____

Amount of chemical/oil spilled _____

Cause of Spill _____

Measures taken to contain or clean up spill _____

Amount of chemical/oil recovered _____ Method _____

Material collected as a result of cleanup:

_____ Drums containing _____

_____ Drums containing _____

_____ Drums containing _____

Location and method of debris disposal

_____

Name and address of any person, firm, or corporation suffering damages:

_____

Procedures, method, and precautions instituted to prevent a similar occurrence from recurring:

_____

Spill reported to General Office by _____ Time _____ AM / PM

Spill reported to DEP / National Response Center by _____

DEP Date _____ Time _____ AM / PM Inspector _____

NRC Date _____ Time _____ AM / PM Inspector _____

Additional comments: _____

Assessment - Initial Containment

The supervisor or manager will assess the incident and initiate containment control measures with the appropriate spill containment equipment included in the spill kit kept on-site. A list of recommended spill equipment to be kept on site is included on the following page.

Fire / Police Department	911
Municipality Health Department	(617) 796-1420
Municipality Conservation Commission:	(617) 796-1120

Emergency Response Equipment

The following equipment and materials shall be maintained at all times and stored in a secure area for long-term emergency response need.

Supplies		***Recommended Suppliers***
SORBENT PILLOWS/"PIGS"	**2**	http://www.newpig.com
SORBENT BOOM/SOCK	**25 FEET**	Item # KIT276 — mobile container with two pigs, 26 feet of sock, 50 pads, and five pounds of absorbent (or equivalent)
SORBENT PADS	**50**	
LITE-DRI® ABSORBENT	**5**	
POUNDS		http://www.forestry-suppliers.com
SHOVEL	**1**	Item # 43210 — Manhole cover pick (or equivalent)
PRY BAR	**1**	
GOGGLES	**1 PAIR**	Item # 33934 — Shovel (or equivalent)
GLOVES – HEAVY	**1 PAIR**	Item # 90926 — Gloves (or equivalent)
		Item # 23334 — Goggles (or equivalent)

Stormwater Operation and Maintenance Plan

Project Information

Site

Sunrise of Chestnut Hill
11 Florence Street
Newton, Massachusetts

Owner

Sunrise Development, Inc
7902 Westpark Drive
McLean, VA 22102

Site Supervisor

TBD

Name: _____

Telephone: _____

Cell phone: _____

Email: _____

Description of Stormwater Maintenance Measures

The following Operation and Maintenance (O&M) program is proposed to ensure the continued effectiveness of the stormwater management system. Attached to this plan are a Stormwater Best Management Practices Checklist and Maintenance Figure for use during the long term operation and maintenance of the stormwater management system.

Catch Basins

- All catch basins shall be inspected and cleaned a minimum of at least once per year.
- Sediment (if more than six inches 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 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.

Subsurface Detention Systems/Sand Filters

- The subsurface systems will be inspected at least once each year by removing the manhole/access port covers and determining the thickness of sediment that has accumulated in the sediment removal row (stilling basin).
- If sediment is more than six inches deep, it must be suspended via flushing with clean water and removed using a vactor truck.
- Manufacturer's specifications and instructions for cleaning the sediment removal row is provided as an attachment to this section.
- Emergency overflow pipes will be examined at least once each year and verified that no blockage has occurred.
- System will be observed after rainfalls to see if it is properly draining.

Structural Water Quality Devices

- Inspect devices monthly for the first three months after construction.
- After initial three month period, all water quality units are to be inspected at least four times per year and cleaned a minimum of at least once per year or when sediment reaches 8" in depth.
- Follow manufacturer instructions for inspection and cleaning and contact manufacturer if system is malfunctioning.

Stormwater Outfalls

- Inspect outfall locations monthly for the first three months after construction to ensure proper functioning and correct any areas that have settled or experienced washouts.
- Inspect outfalls annually after initial three month period.
- Annual inspections should be supplemented after large storms, when washouts may occur.
- Maintain vegetation around outfalls to prevent blockages at the outfall.
- Maintain rip rap pad below each outfall and replace any washouts.
- Remove and dispose of any trash or debris at the outfall.

Roof Drain Leaders

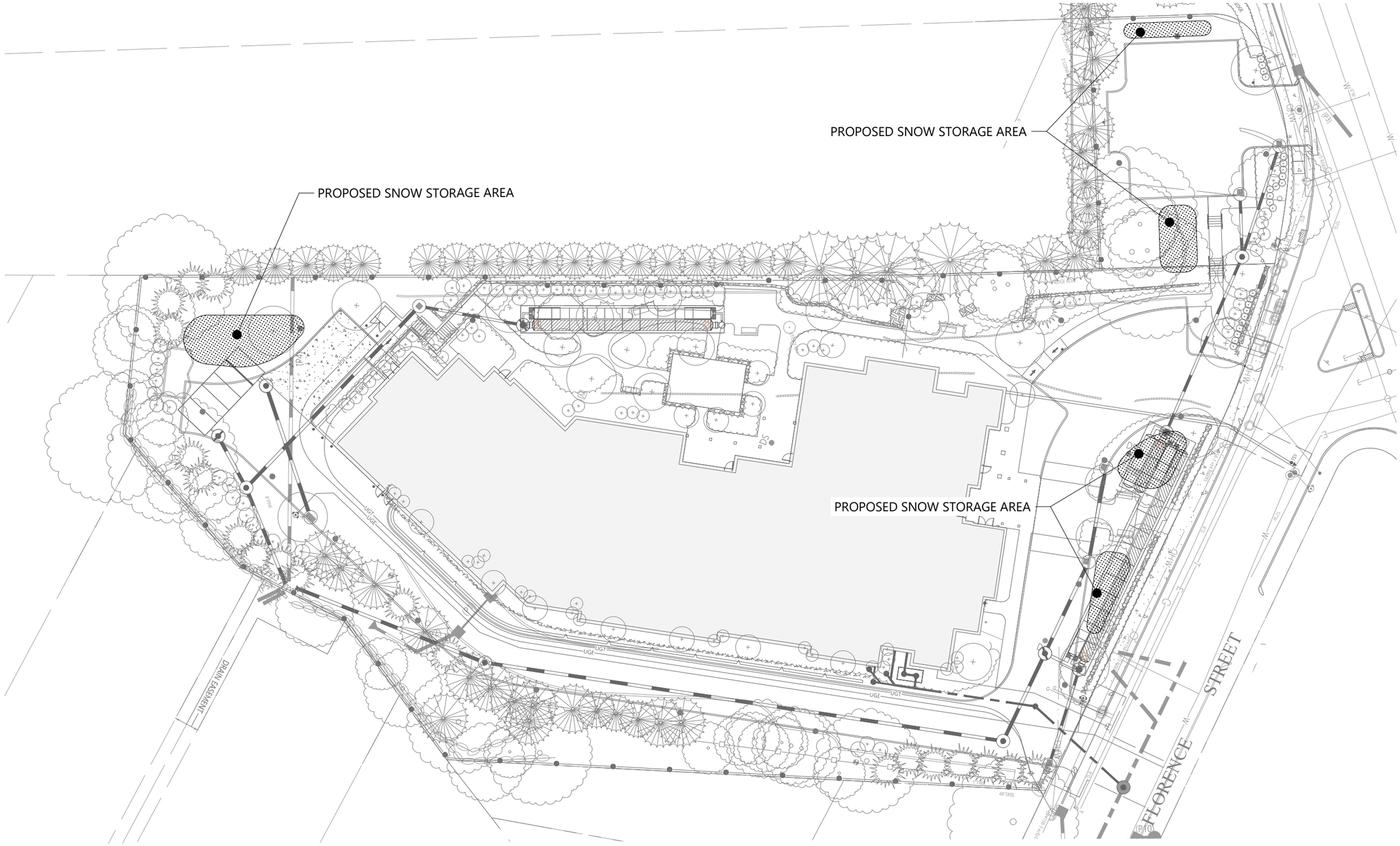
- Perform routine roof inspections quarterly.
- Keep roofs clean and free of debris.
- Keep roof drainage systems clear.
- Keep roof access limited to authorized personnel.
- Clean inlets draining to the subsurface bed twice per year as necessary.

Snow Management Plan

Snow storage areas are shown on the attached Map.

- Snow storage areas will be managed to prevent blockage of storm drain catch basins and stormwater drainage swales. Snow combined with sand and debris may block a storm drainage system, diminishing the infiltration capacity of the system and causing localized flooding.
- Sand and debris deposited on vegetated or paved areas shall be cleared from the site and properly disposed of at the end of the snow season, no later than May 15.
- Snow shall not be dumped into any waterbody, pond, or wetland resource area.

\\vhb.com\gbl\proj\Providence\73153.00\cad\ld\Eng\Snow Plan\73153.00 Snow Plan.dwg



Snow Management Plan

Sunrise of Chestnut Hill

Newton, MA

Source:
Prepared for: **Stormwater Report**
Date: **03.17.2022**

0 20 40 80 Feet

Water Quality Volume Calculations

Site Summary

Project	11 Florence Street - Sunrise Senior	**Project #**	73153.00
Calculated by	DDH	**Date**	3/17/2022
Checked by	GB/JS	**Date**	

Treatment Category	Area to Treatment Category (ac)	Impervious Area to Treatement Category (ac)	P Load of Impervious Area (lb/yr)	P Load Removed (lb/yr)	Average Area Weighted P Reduction (%)	TSS Load of Impervious Area (lb/yr)	TSS Load Removed (lb/yr)	Average Area Weighted TSS Reduction (%)
Structural BMPs	1.7	1.1	2.0	1.8	89%	425	440	100%
Impervious Area Disconnection	-	-	-	-		-	-	
Porous Pavement (w/ underdrain)	-	-	-	-		-	-	
Untreated	0.2	-	-	0	0%	-	0	0%
TOTAL	**1.9**	**1.1**	**2.0**	**1.8**	**89%**	**425**	**440**	**100%**

Untreated Area Calculations

Project	11 Florence Street - Sunrise Senior	Project #	73153.00
Calculated by	DDH	Date	
Checked by	GB/JS	Date	

User Inputs				Load Calculations			
Untreated Area ID	Impervious Area (ft^2)	Pervious Area (ft^2)	Land Use	Impervious TP Loading Rate (lb/ac/yr)	P Load of Impervious Area (lb/yr)	Impervious TSS Loading Rate (lb/ac/yr)	TSS Load of Impervious Area (lb/yr)
Subcatchment 2	-	10,672	Commercial	1.8	0.0	377	0

Structural BMP Calculations

Project	11 Florence - Sunrise Senior	**Project #**	73153.00
Calculated by	DDH	**Date**	
Checked by	GB/JS	**Date**	

User Inputs										**Water Quality Results**														
										Phosphorus							**Total Suspended Solids** (TSS Reduction values can NOT be used for DEP Stormwater Standard 4 Compliance at this time.)							
BMP ID	**BMP Type**	**BMP Soil Type**	**BMP Design Storage Volume (ft^3)**	**Impervious Catchment Area (ft^2)**	**Pervious Catchment Area (ft^2)**	**Catchment Primary Land Use**	**Catchment Primary HSG**	**Runoff Depth from Impervious Area (in)**	**EPA Water Quality Curve**	**Impervious P Loading Rate (lb/ac/yr)**	**Impervious P Load to BMP (lb/yr)**	**Pervious P Loading Rate (lb/ac/yr)**	**Pervious P Load to BMP (lb/yr)**	**Total P Load to BMP (lb/yr)**	**P Removal Credit (%)**	**P Load Reduction (lb/yr)**	**Impervious TSS Loading Rate (lb/ac/yr)**	**Impervious TSS Load to BMP (lb/yr)**	**Pervious TSS Loading Rate (lb/ac/yr)**	**Pervious TSS Load to BMP (lb/yr)**	**Total TSS Load to BMP (lb/yr)**	**TSS Removal Credit (%)**	**TSS Load Reduction (lb/yr)**
	Sand Filter (w/ underdrain)	Sand (8.27 in/hr)	903	9,627	5,924	Commercial	HSG B	1.1	Sand Filter	1.8	0.4	0.1	0.0	0.4	54%	0.2	377	83	29	4	87	99%	87
	Infiltration Basin	Sandy Loam (1.02 in/hr	1,340	13,591	7,928	Commercial	HSG B	1.2	Infiltration Basin	1.8	0.6	0.1	0.0	0.6	98%	0.6	377	118	29	5	123	100%	123
	Infiltration Basin	Sandy Loam (1.02 in/hr	2,262	25,918	9,976	Commercial	HSG B	1.0	Infiltration Basin	1.8	1.1	0.1	0.0	1.1	97%	1.1	377	224	29	7	231	100%	231

Water Quality Volume Calculations

Project	11 Florence - Sunrise Senior	**Project #**	73153.00
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Checked by	GB/JS	**Date**	

BASIN 1a

Runoff from subcatchment area 1a

Water Quality Storm Runoff Depth	(in)	1.0
Total Impervious Area	(ft^2)	9,627

BASIN WQV:

Required Volume:	**Runoff Depth to be Treated (in)**	**Required Volume (ft^3)**
	1.0	**802**

Provided Volume:	**Elevation**	**Area (ft^2)**	**Cumulative Volume (ft^3)**
Bottom of StormTrap	177.5	-	0
	179.5	-	416
	180.5	-	624
Weir Wall Elevation	181.5	-	**916**

** Per MassDEP Treatment Requirement*

Water Quality Volume Calculations

Project	11 Florence - Sunrise Senior	**Project #**	73153.00
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Checked by	GB/JS	**Date**	

BASIN 1b

Runoff from subcatchment area 1b

Water Quality Storm Runoff Depth	(in)	1.0
Total Impervious Area	(ft^2)	13,591

BASIN WQV:

Required Volume:	**Runoff Depth to be Treated (in)**	**Required Volume (ft^3)**
	1.0	**1,133**

Provided Volume:	**Elevation**	**Area (ft^2)**	**Cumulative Volume (ft^3)**
Bottom of Stone	187.0	-	0
	188.0	-	485
	189.0	-	1,081
Weir Wall Elevation	189.5	-	**1,340**

** Per MassDEP Treatment Requirement*

Water Quality Volume Calculations

Project	11 Florence - Sunrise Senior	**Project #**	73153.00
Calculated by	DDH	**Date**	
Checked by	GB/JS	**Date**	

BASIN 1c

Runoff from subcatchment area 1c

Water Quality Storm Runoff Depth	(in)	1.0
Total Impervious Area	(ft^2)	25,918

BASIN WQV:

Required Volume:	**Runoff Depth to be Treated (in)**	**Required Volume (ft^3)**
	1.0	**2,160**

Provided Volume:	**Elevation**	**Area (ft^2)**	**Cumulative Volume (ft^3)**
Bottom of Stone	184.0	-	0
	185.0	-	766
	186.0	-	1,711
Weir Wall Elevetion	186.7	-	**2,262**

** Per MassDEP Treatment Requirement*

Computations

Project:	11 Florence Street - Sunrise Senior	Project #	73153.00
Location:	Newton, MA	Sheet	
Calculated by:	DDH	Date:	03.17.2022
Checked by:	GB/JS	Date:	
Title			

Sedimentation Chamber Sizing (Sand Filter #1)

A_s = -Q/W ln (1-E)

A_s = sedimentation surface area (ft^2)
Q = discharge rate from drainage area (ft^3/s) = WQV/24hr
W = particle settling velocity (0.0004 ft/s recommended for silt)
E = sediment removal efficiency (assume 0.9 or 90%)

WQV =	823	ft^3	Impervious area = 9627 sf
Q =	0.010	ft^3/s	Water Quality depth = 1in
W=	0.0004	ft/s	
E=	0.9		

$A_{s\ Required}$=	**55**	**ft^2**	Sedimentation Chamber
A_s Provided =	**84**	**ft^2**	inside volume 334.5 cf / 4ft tall = 84ft^2

Filter Bed Sizing (Sand Filter #1)

A_f =(WQV x d)/kt(h+d)

A_f = filter bed surface area (ft^2)
WQV = water quality volume (ft^3)
d = filter bed depth (ft)
k = hydraulic conductivity of filter media (ft/day)
t = time of water quality volume to drain from system (24 hours)
h = average height of water above filter bed during water quality design storm

WQV =	823	ft^3	Impervious area = 9627 sf
d =	1.5	ft	Water Quality depth = 1in
k =	4	ft/day	
t =	1	day	
h =	1.5	ft	

A_f Required=	**103**	**ft^2**	
A_f Provided =	**415**	**ft^2**	27.58' x 15.06'

TSS Removal Worksheets

TSS Removal Calculation Worksheet

VHB, Inc..
101 Walnut Street
Post Office Box 9151
Watertown, MA 02471
P 617.924.1770

Project Name:	**11 Florence - Sunrise**	Sheet:	**1 of 3**
Project Number:	**73153.00**	Date:	
Location:	**Newton, MA**	Computed by:	**DDH**
Discharge Point:	**Drainage Easement**	Checked by:	**GB/JS**
Drainage Area(s):	**1a**		

A	B	C	D	E
BMP*	TSS Removal Rate*	Starting TSS Load**	Amount Removed (C*D)	Remaining Load (D-E)
Street Sweeping - 5% (Quarterly)	**5%**	**1.00**	**0.05**	**0.95**
Deep Sump and Hooded Catch Basin	**25%**	**0.95**	**0.24**	**0.71**
Sand Filter	**80%**	**0.71**	**0.57**	**0.14**
	0%	**0.14**	**0.00**	**0.14**
	0%	**0.14**	**0.00**	**0.14**

* BMP and TSS Removal Rate Values from the MassDEP Stormwater Handbook Vol. 1.
Removal rates for proprietary devices are from approved studies and/or manufacturer data (attach study or data source, or remove this sentence if not applicable).
** Equals remaining load from previous BMP (E)
*** Stormceptor sizing calculation gives a TSS removal rate of 87%. To be conservative, 80% removal is used for this calculation (Change name of device and the claimed removal rate shown on the calc. sheet. Remove this sentence if not applicable.

Treatment Train TSS Removal = **86%**

TSS Removal Calculation Worksheet

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101 Walnut Street
Post Office Box 9151
Watertown, MA 02471
P 617.924.1770

Project Name:	**11 Florence - Sunrise**	Sheet:	**2 of 3**
Project Number:	**73153.00**	Date:	
Location:	**Newton, MA**	Computed by:	
Discharge Point:	**Drainage Easement**	Checked by:	
Drainage Area(s):	**1b**		

A	B	C	D	E
BMP*	TSS Removal Rate*	Starting TSS Load**	Amount Removed (C*D)	Remaining Load (D-E)
Street Sweeping - 5% (Quarterly)	**5%**	**1.00**	**0.05**	**0.95**
Deep Sump and Hooded Catch Basin	**25%**	**0.95**	**0.24**	**0.71**
Infiltration Basin	**80%**	**0.71**	**0.57**	**0.14**
	0%	**0.14**	**0.00**	**0.14**
	0%	**0.14**	**0.00**	**0.14**

* BMP and TSS Removal Rate Values from the MassDEP Stormwater Handbook Vol. 1. Removal rates for proprietary devices are from approved studies and/or manufacturer data (attach study or data source, or remove this sentence if not applicable).

** Equals remaining load from previous BMP (E)

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Treatment Train TSS Removal = **86%**

TSS Removal Calculation Worksheet

VHB, Inc..
101 Walnut Street
Post Office Box 9151
Watertown, MA 02471
P 617.924.1770

Project Name:	**11 Florence - Sunrise**	Sheet:	**3 of 3**
Project Number:	**73153.00**	Date:	
Location:	**Newton, MA**	Computed by:	
Discharge Point:	**Drainage Easement**	Checked by:	
Drainage Area(s):	**1c**		

A	B	C	D	E
BMP*	TSS Removal Rate*	Starting TSS Load**	Amount Removed (C*D)	Remaining Load (D-E)
Street Sweeping - 5% (Quarterly)	**5%**	**1.00**	**0.05**	**0.95**
Deep Sump and Hooded Catch Basin	**25%**	**0.95**	**0.24**	**0.71**
Infiltration Basin	**80%**	**0.71**	**0.57**	**0.14**
	0%	**0.14**	**0.00**	**0.14**
	0%	**0.14**	**0.00**	**0.14**

* BMP and TSS Removal Rate Values from the MassDEP Stormwater Handbook Vol. 1.
Removal rates for proprietary devices are from approved studies and/or manufacturer data (attach study or data source, or remove this sentence if not applicable).
** Equals remaining load from previous BMP (E)
*** Stormceptor sizing calculation gives a TSS removal rate of 87%. To be conservative, 80% removal is used for this calculation (Change name of device and the claimed removal rate shown on the calc. sheet. Remove this sentence if not applicable.

Treatment Train TSS Removal = **86%**

Appendix E: Standard 8 Supporting Information

› Recommended construction period pollution prevention and Erosion and Sedimentation Controls

Recommended Construction Period Pollution Prevention and Erosion and Sedimentation Controls

Erosion and Sedimentation Control Measures

The following erosion and sedimentation controls are for use during the earthwork and construction phases of the project. The following controls are provided as recommendations for the site contractor and do not constitute or replace the final Stormwater Pollution Prevention Plan that must be fully implemented by the Contractor and owner in Compliance with EPA NPDES regulations.

Siltsock

Filter socks filled with compost will be placed to trap sediment transported by runoff before it reaches the drainage system or leaves the construction site.

Silt Fencing

In areas where high runoff velocities or high sediment loads are expected, hay bale barriers will be backed up with silt fencing. This semi-permeable barrier made of a synthetic porous fabric will provide additional protection. The silt fences and hay bale barrier will be replaced as determined by periodic field inspections.

Catch Basin Protection

Newly constructed and existing catch basins will be protected with hay bale barriers (where appropriate) or silt sacks throughout construction.

Gravel and Construction Entrance/Exit

A temporary crushed-stone construction entrance/exit will be constructed. A cross slope will be placed in 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 project site.

Diversion Channels

Diversion channels will be used to collect runoff from construction areas and discharge to either sedimentation basins or protected catch basin inlets.

Temporary Sediment Basins

Temporary sediment basins will be designed either as excavations or bermed stormwater detention structures (depending on grading) that will retain runoff for a sufficient period of time to allow suspended soil particles to settle out prior to discharge. These temporary basins will be located based on construction needs as determined by the contractor and outlet devices will be designed to control velocity and sediment. Points of discharge from sediment basins will be stabilized to minimize erosion.

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 flatter. 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 established 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 will also 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 contractor or subcontractor will be responsible for implementing each control shown on the Sedimentation and Erosion Control Plan. In accordance with EPA regulations, the contractor must sign a copy of a certification to verify that a plan has been prepared and that permit regulations are understood.
- The on-site contractor will inspect all sediment and erosion control structures periodically and after each rainfall event. Records of the inspections will be prepared and maintained on-site by the contractor.
- Silt shall be removed from behind barriers if greater than 6-inches deep or as needed.
- Damaged or deteriorated items will be repaired immediately after identification.
- Sediment that is collected in structures shall be disposed of properly and covered if stored on-site.

- Erosion control structures shall remain in place until all disturbed earth has been securely stabilized. After removal of structures, disturbed areas shall be regraded and stabilized as necessary.

The sedimentation and erosion control plan is included in project plan set.

11 Florence – Sunrise of Chestnut Hill, Newton, Massachusetts
Construction Best Management Practices – Maintenance/ Evaluation Checklist

Best Management Practice	Inspection Frequency	Date Inspected	Inspector	Minimum Maintenance and Key Items to Check	Cleaning/Repair Needed (List Items)	Date of Cleaning/Repair	Performed by:
Erosion Control Barriers/Silt Fencing	Weekly and after ½" storm events or greater			Inspect for deterioration or failure. Remove sediment as necessary.	☐**yes** ☐**no**		
Silt Sack Catch Basin Protection	Weekly and after ½" storm events or greater			Inspect for proper operation of catch basin. If clogged, dispose of sediment.	☐**yes** ☐**no**		
Gravel and Construction Entrance/Exit	Weekly and after ½" storm events or greater			Inspect for breakdown of crushed-stone. Reapply stone if necessary to depths specified in construction documents.	☐**yes** ☐**no**		
Vegetative Slope Stabilization	Weekly and after ½" storm events or greater			Inspect for erosion. Correct if necessary.	☐**yes** ☐**no**		
Temporary Sediment Basins	Weekly and after ½" storm events or greater			Inspect for proper function. Correct if necessary.	☐**yes** ☐**no**		
					☐**yes** ☐**no**		

Stormwater Control Manager _____