STORMWATER REPORT

The Residences at Bel Mont

McLean District - Zone 3
Olmsted Dr., Belmont, MA

PREPARED FOR

Northland Residential Corporation
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PREPARED BY

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Watertown, MA 02471
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April 16, 2021

Executive Summary

The Applicant, Northland Residential Corporation, is proposing to develop the property located within the McLean Hospital Zone 3 Overlay District located at Olmsted Road in Belmont, Massachusetts (the Site). The Project will be comprised of residential housing, consisting of single family and townhouse dwelling units with associated roadways and driveways, as well as multi-family rental housing with subgrade and surface parking areas.

Under existing conditions, the Site is primarily undeveloped woodlands, with one existing building and existing gravel parking area. The site is generally hilly, sloping down from north to south. The Site is uniquely located along a drainage divide, sending water to two separate water bodies. The western portion of the Site generally flows overland and is collected by the drainage system located within Olmsted Road. The Olmsted Road drainage system enters the municipal system and flows west, discharging downstream into Beaver Brook and ultimately entering the Charles River. The eastern portion of the site flows into an intermittent stream located off the eastern property line. This stream is collected by an existing pipe/headwall located at Pleasant Street, where it enters the municipal system and then ultimately discharges in the Boston Harbor.

As proposed, the stormwater management system will comply with Massachusetts Stormwater Standards, the Massachusetts MS4, the TMDL associated with the Upper/Middle Charles River, and the Town of Belmont Stormwater Management and Erosion Control Rules and Regulations. In general, stormwater from the proposed impervious surfaces will be collected by a closed drainage system and piped to subsurface infiltration or detention systems. The infiltration systems have been carefully located around the site to areas where infiltration is feasible. Elsewhere, the stormwater management system will utilize filtration vaults and water quality devices to comply with the required treatment parameters. The applicant will be conducting additional soils test pits and permeability testing within the footprints of the proposed infiltration areas to confirm hydrologic soil grouping and infiltration rates, and if appropriate, making adjustments to the size of the systems.

In general, the proposed stormwater system as documented within this report will:

- Attenuate peak flows using subsurface infiltration and detention systems outfitted with outlet control structures. The proposed stormwater system will reduce peak rates of runoff for the 2, 10, 25- and 100-year storms for all design points.
- Exceed phosphorous removal standards (approximately 76% removal) as required through the Massachusetts MS4 and Charles River Phosphorous TMDL.
- Exceed recharge volume requirements specified within Massachusetts Stormwater Standards.
- Comply with total suspended solids (TSS) removal requirements stated in the Massachusetts MS4 and Massachusetts Stormwater Standards.

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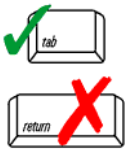
Checklist for Stormwater Report

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

4/29/2021

Signature and Date

Checklist

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

- [X] 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:

- [X] No disturbance to any Wetland Resource Areas
- [X] Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- [ ] Reduced Impervious Area (Redevelopment Only)
- [X] 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

- [X] No new untreated discharges
- [X] Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- [X] 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. Historic geotech and NRCS provided. Applicant is proposing additional test pits within BMP areas prior to construction

☒ 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.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs) Not Applicable

☐ 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.

Standard 6: Critical Areas Not Applicable

☐ 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)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable Not Applicable

☐ 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.

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). Additionally, this report demonstrates compliance with the Massachusetts MS4, the Final TMDL for Nutrients in the Upper/Middle Charles River, the Final Pathogen TMDL for the Charles River Watershed, the Town of Belmont Stormwater Management and Erosion Control Rules and Regulations, and the Town of Belmont Stormwater Management and Erosion Control Bylaw.

Project Description

The Applicant, Northland Residential Corporation, is proposing to construct residential development in Zone 3 adjacent to the McLean Hospital campus, located off Olmsted Drive. As proposed, the Project will entail the construction of fourteen single family or townhome structures, a multifamily apartment building with subgrade and surface parking, ancillary landscape improvements, roadways and driveways, and utility improvements to support this use.

Site Description

The Project Site is a 12.8-acre parcel of land (the Site) located at Olmsted Drive in Belmont, Massachusetts (see Figure 1). The Site is bounded by the McLean Hospital campus to the north, conservation restricted woodlands to the east and south, and residential homes to the west. See Figure 1, Site Locus Map.

According to the National Resources Conservation Service (NRCS), surface soils on the Site include Charlton-Hollis-Rock Outcrop Complex, Pittstown silt loam, Charlton fine sandy loam, and Narragansett-Hollis-Rock. NRCS classifies these on-site soils as Hydrologic Soil Groups (HSG) A and D. VHB has reviewed a geotechnical engineering study prepared by Weidlinger Associates Inc for a previously approved development at the site. (excerpts provided in Appendix C). The geotechnical borings and test pits indicate that soils below a silty/sandy topsoil and subsoil are generally dense sand/gravel underlain by bedrock. Top of bedrock varies throughout the site, but is relatively shallow and generally in the order of 4 to 12 feet below existing grade.

For the purposes of hydrologic modeling, soils at the Site were assigned an HSG rating of A. The Site it is not considered to be within an area of rapid infiltration (soils with a saturated hydraulic conductivity greater than 2.4 inches per hour). The applicant will be performing permeability testing and additional subsurface explorations around the site and within the footprints of

proposed infiltration BMPs prior to construction. The intent of the explorations will be to confirm the hydrologic soil grouping used to evaluate existing rates of stormwater runoff from the site, as well as confirm the infiltration rates at proposed BMP locations for value engineering considerations If appropriate, adjustments will be made either up or down to the systems. At this point, an assumption has been has been made, based on the data available, that proposed infiltration areas will infiltrate at a rate of 1.02 in/hr, consistent with an HSG B soil (sandy loam).

Existing Drainage Conditions

The Site is generally undeveloped woodlands, with an existing building and grass area around, with generally hilly topography. Figure 2 illustrates the existing drainage patterns on the Site. Currently, the Site is divided into seven drainage areas as stormwater runoff flows to four Design Points, which have been identified as DP-1, DP-2, DP-3 and DP-4.

Design Point 1 represents the portion of the Olmsted Road drainage system which captures and directs flows into a closed drainage system which in turn discharges into the municipal drainage system, Beaver Brook and ultimately the Charles River. There is an existing stormwater basin on site (1P), which receives some flows from a portion of Olmsted Drive and some of the pervious area of the site. This basin discharges into a wooded area, and ultimately overland flows into the Olmsted Road drainage system. The area draining towards DP-1 represents the portion of the site within the Charles River watershed and subject to its Nutrient and Pathogen TMDLs.

Design Point 2 represents the portion of the Olmsted Road Drainage system which captures and directs flows into a closed drainage system, which VHB understands from historic site documentation and reports as discharging into the municipal drainage system and ultimately the Boston Harbor.

Design Point 3 represents the portion of the Site which drains into the intermittent stream located off-site, beyond the eastern property line. This intermittent stream appears to terminate at a headwall at Pleasant Street, where flows enter the municipal drainage system and follow the same flow path as Design Point 2.

Design Point 4 represents the portion of the site that discharges into the Uphams Bowl area. A portion of the northwest corner of the site consisting of paved and pervious areas discharges via overland flow into the Uphams Bowl drainage system.

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

Table 1 Existing Conditions Hydrologic Data

Drainage Area	Discharge Location	Design Point	Area (Acres)	Curve Number	Time of Concentration (min)
EX-1A	1P	DP-1	1.2	46	6.0
EX-1B	DP-1	DP-1	4.8	35	11.5
EX-1C	DP-1	DP-1	0.5	89	6.0
EX-2	DP-2	DP-2	1.9	41	6.0
EX-3A	DP-3	DP-3	3.3	38	15.7
EX-3B	DP-3	DP-3	0.3	82	6.0
EX-4	DP-4	DP-4	1.2	55	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 fifteen drainage areas that discharge stormwater to the four existing Design Points. Table 2 below provides a summary of the proposed conditions hydrologic data.

Table 2 Proposed Conditions Hydrologic Data

Drainage Area	Discharge Location	Design Point	Area (Acres)	Curve Number	Time of Concentration (min)
PR-1	DP-1	DP-1	1.5	51	6.0
PR-2	DP-4	DP-4	0.5	46	6.0
PR-3	5P	DP-1	3.3	73	6.0
PR-4	6P	DP-1	2.1	73	6.0
PR-5	1P / 2P / 3P / 4P	DP-3	1.8	90	6.0
PR-6	DP-3	DP-3	0.3	78	6.0
PR-7	3P / 4P	DP-3	1.0	83	6.0
PR-8	DP-3	DP-3	1.0	35	6.0
PR-9	4P	DP-3	0.3	96	6.0
PR-10	6P	DP-1	0.3	85	6.0
PR-11	DP-2	DP-2	0.5	39	6.0
PR-12	2P / 3P / 4P	DP-3	0.1	98	6.0
PR-13	7P / 6P	DP-1	0.2	98	6.0
PR-14	8P / 6P	DP-1	0.2	98	6.0
PR-15	9P	DP-1	0.1	98	6.0

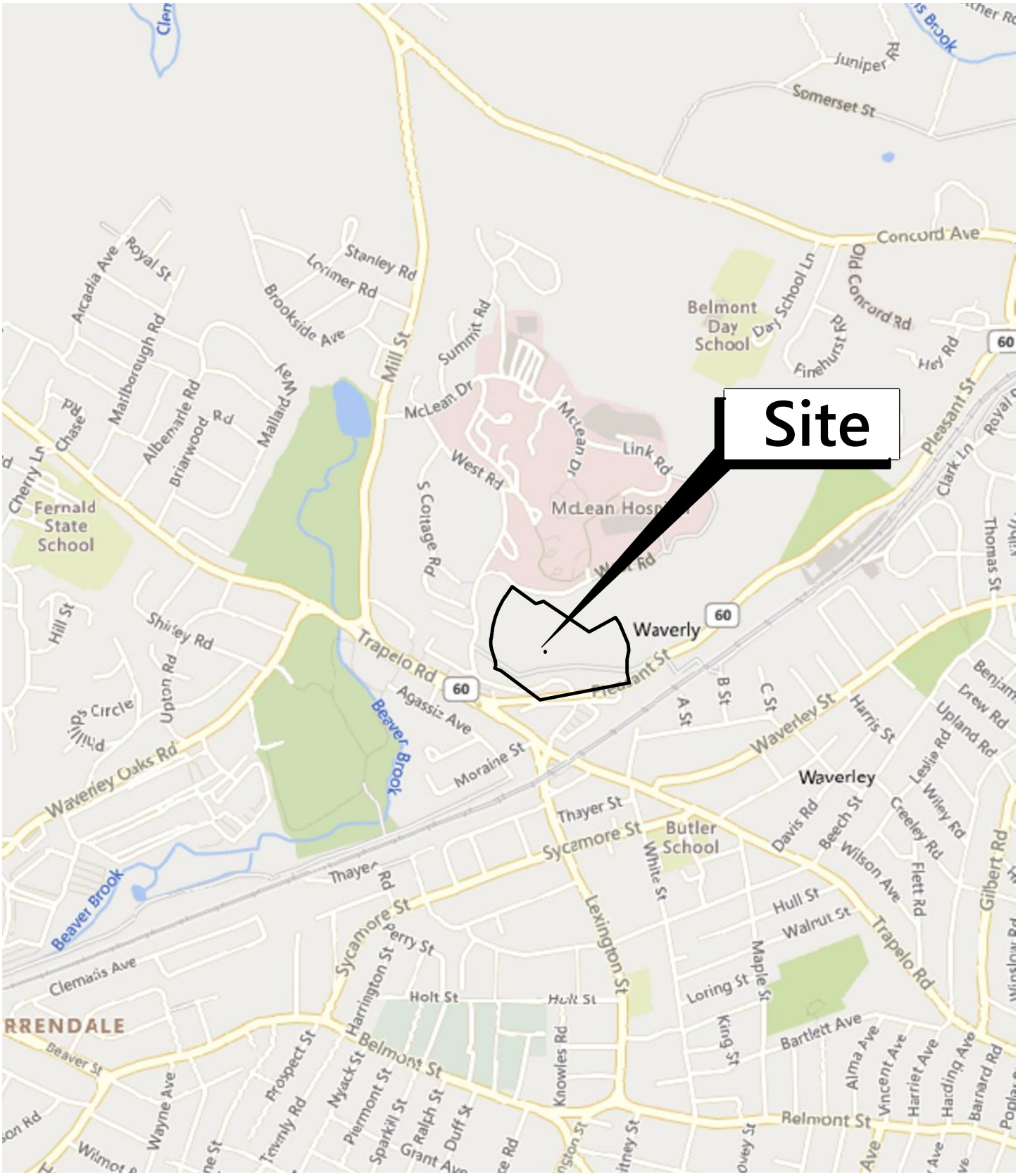
The site design integrates a comprehensive stormwater management system that has been developed in accordance with the Massachusetts Stormwater Handbook and meets the performance standards laid out in the Massachusetts MS4, applicable TMDLs, and the Town of Belmont Stormwater Management Bylaw. The proposed stormwater management system has

been designed to treat the half inch water quality volume, remove at least 90% TSS from proposed pavement areas, and remove greater than 60% of the total phosphorous from the post-construction impervious area of the site. Calculations can be found in the stormwater report appendices.

In general, stormwater from the proposed impervious surfaces will be collected by a closed drainage system and piped to subsurface infiltration or detention systems. These systems and associated outlet control structures will control the peak rates of stormwater leaving the site, and direct water into stormwater filtration vaults. These vaults (the Contech Stormfilter) will contain media filled cartridges that will treat the required water quality volume for phosphorous and TSS before discharging to its design point.

Due to the generally high bedrock elevations across the site, infiltration is limited to the stormwater management system proposed in the multi-family building parking lot, and carefully located subsurface recharge trenches elsewhere around the site.

Figure 1 Site Locus Map



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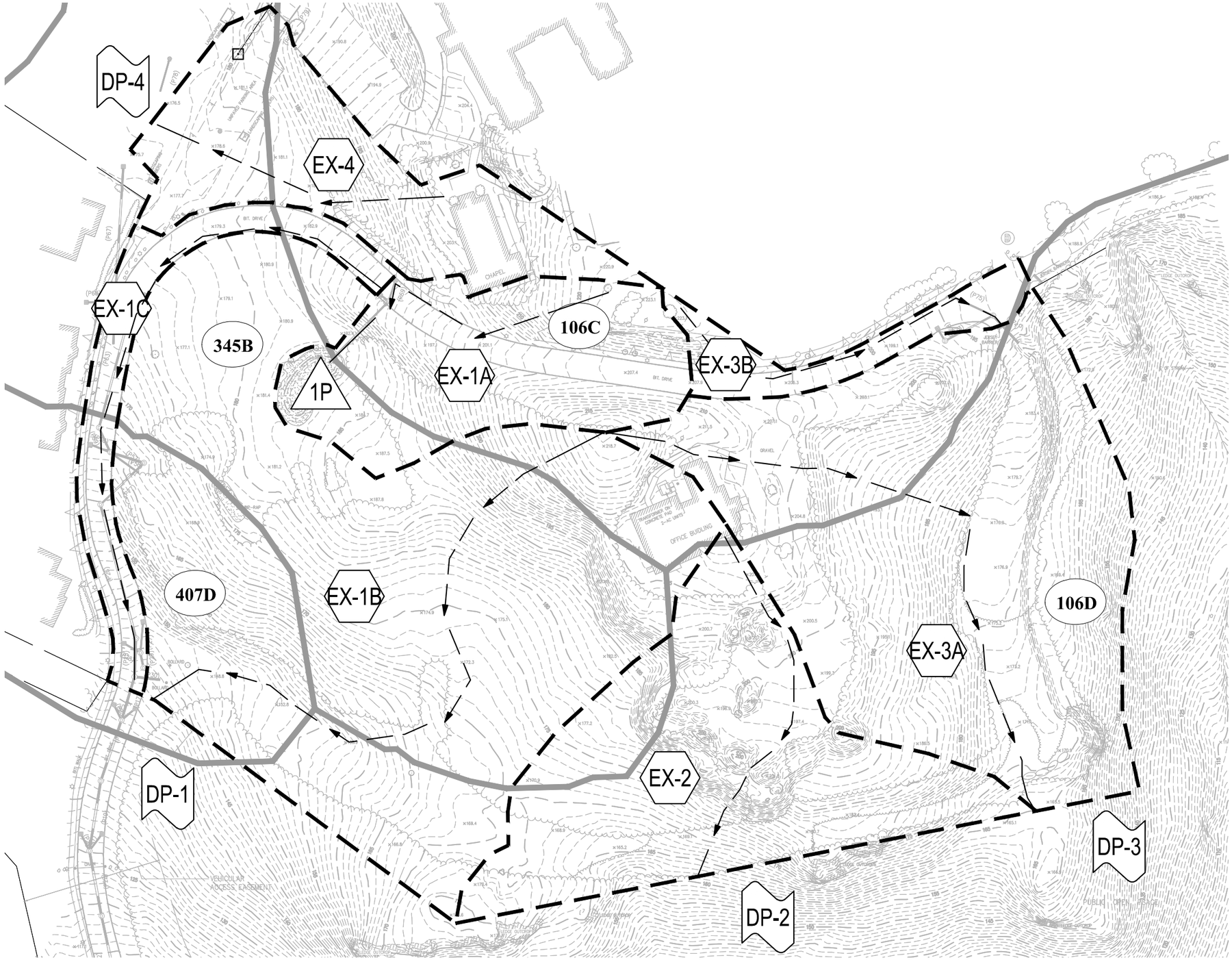
Site Location Map
Residences at Bel Mont
Olmsted Drive
Belmont, MA

Figure 1

3/11/2021

Figure 2 Existing Drainage Area



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

106C	NARRAGANSETT-HOLLIS-ROCK OUTCROP COMPLEX, 3 TO 15 PERCENT SLOPES, HSG A
106D	NARRAGANSETT-HOLLIS-ROCK OUTCROP COMPLEX, 15 TO 25 PERCENT SLOPES, HSG D
345B	PITTSTOWN SILT LOAM, 3 TO 8 PERCENT SLOPES, HSG D
407D	CHARLTON FINE SANDY LOAM, 15 TO 25 PERCENT SLOPES, EXTREMELY STONY, HSG A

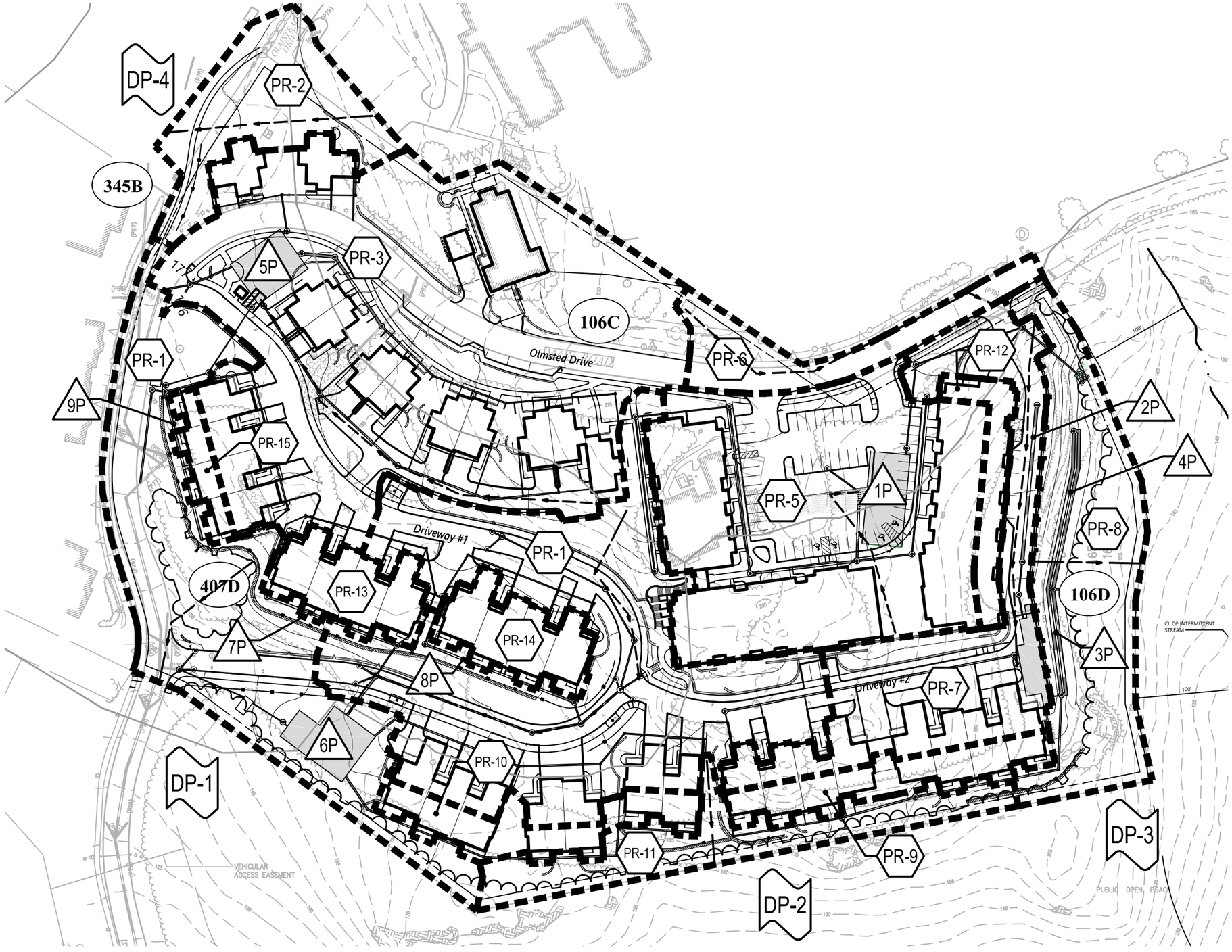
0 50 100 Feet

Existing Drainage Conditions
Residences at Bel Mont
Olmsted Drive
Belmont, MA

Figure 2

4/16/2021

Figure 3 Proposed Drainage Area



Legend

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407D	CHARLTON FINE SANDY LOAM, 15 TO 25 PERCENT SLOPES, EXTREMELY STONY, HSG A

0 50 100 Feet

vhb

Proposed Drainage Conditions
Residences at Bel Mont
Olmsted Drive
Belmont, MA

Figure 3

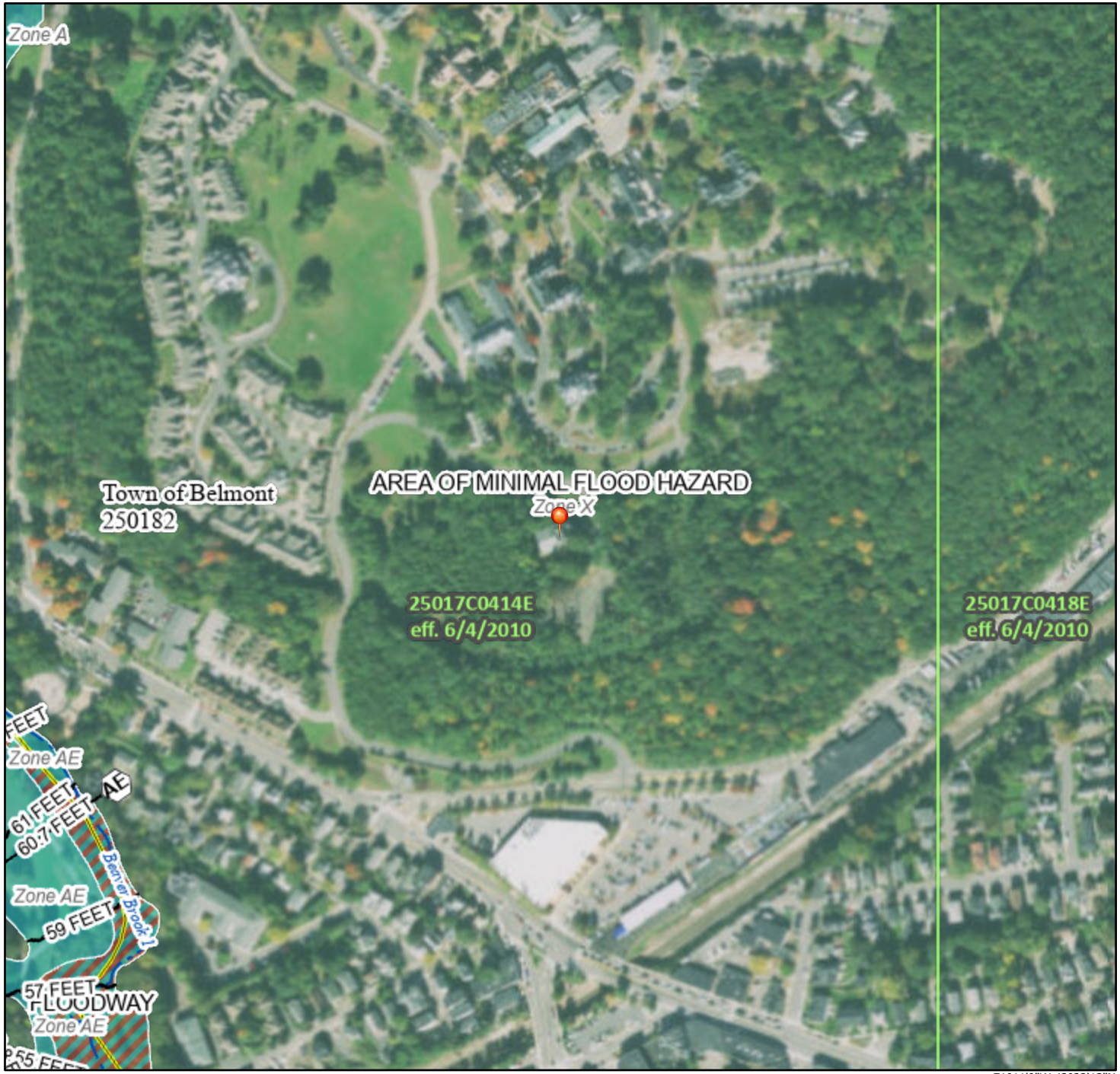
4/16/2021

Figures 4 FEMA Map

National Flood Hazard Layer FIRMette

FEMA

71°11'46"W 42°23'40"N



71°11'9"W 42°23'13"N

Feet 1:6,000

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

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

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

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

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

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

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

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

N

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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 3/11/2021 at 9:53 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

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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. Overflows from BMP's that impound stormwater have been designed with stone to protect downgradient areas from erosion.

Computations and supporting information for the sizing and selection of materials used to protect from scour and erosion are included in Appendix A.

Standard 2: Peak Rate Attenuation

The Project has been designed to comply with Standard 2.

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 3 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 3 Peak Discharge Rates (cfs*)

Design Point	2-year	10-year	25-year	100-year
DP-1				
Existing	1.3	2.3	3.0	5.9
Proposed	0.8	1.7	2.9	5.1
DP-2				
Existing	0.0	0.2	0.7	2.4
Proposed	0.0	0.0	0.1	0.4
DP-3				
Existing	0.6	1.2	1.6	2.9
Proposed	0.5	1.2	1.6	2.5
DP-4				
Existing	0.1	1.1	2.0	3.7
Proposed	0.0	0.1	0.4	1.0

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 12,916 cubic feet.

Recharge of stormwater has been provided through the use of subsurface infiltration systems which have been sized using the Static method. Each infiltration BMP has been designed to drain completely within 72 hours. Table 4 below provides a summary of the proposed infiltration BMPs utilized for the Project.

Table 4 Summary of Recharge Calculations

Infiltration BMP	Provided Recharge Volume (cubic feet)
Infiltration System #1 (1P)	7,425
Infiltration System #2 (2P)	865
Infiltration System #3 (4P)	6,768
Infiltration System #4 (8P)	1,247
Infiltration System #5 (7P)	1,128
Infiltration System #6 (9P)	1,107
Total Provided Recharge	**18,540**
Total Required Recharge	**12,916**

Soil evaluation (including Geotechnical Report excerpts), 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 90% TSS removal of stormwater runoff from all proposed impervious surfaces as well as 44% pretreatment prior to infiltration BMPs where required.

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)

The Project is not considered a LUHPPL.

Standard 6: Critical Areas

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

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

Refer directly to each Standard for applicable computations and supporting information demonstrating compliance with each.

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

The Project will disturb approximately 12.8 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 remaining from previous development which are part of the redevelopment area will be removed or will be incorporated into updated sanitary sewer and separate stormwater sewer systems. The design plans submitted with this report have been designed so that the components included therein are in full compliance with current standards. No statement is made regarding the drainage system in portions of the site not included in the redevelopment project area. The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges.

Local Municipal Rules and Regulations

The proposed stormwater management system is designed to be in compliance with the Town of Belmont Stormwater Management and Erosion Control Rules and Regulations. The system achieves the treatment requirements as stated in the Massachusetts MS4 and the Massachusetts Stormwater Standards, as required by the local bylaw. The design criteria as stated in section 34.6.4.1 of the Belmont Stormwater Management and Erosion Control Bylaw are listed below:

a) Compliance with all applicable provisions of the Stormwater Management Standards, regardless of the proximity of the development to resource areas or their buffer zones, as defined by the Wetlands Protection Act, M.G.L. c. 131, § 40 and its implementing regulations.

The Site stormwater management system meets all Stormwater Management Standards, see appendices and narrative herein for details and calculations.

(b) Erosion and sediment controls must be implemented to prevent adverse impacts during disturbance and construction activities.

The project will employ robust erosion and sedimentation controls throughout the course of construction, and a SWPPP will be filed before construction which will govern the controls during construction. A recommended construction period BMP checklist is included in the appendices of this report, and the site plans show the minimum required erosion and sedimentation controls as well as notes stating minimum required measures to control the site during construction.

(c) There shall be no change to the existing conditions of abutting properties from any increase in volume of stormwater runoff or from erosion, silting, flooding, sedimentation or impacts to wetlands, ground water levels or wells.

The stormwater management system has been designed to reduce peak rates of runoff for the 2, 10, 25- and 100-year storms. No increased rate of stormwater will be directed to any abutters.

(d) When any proposed discharge may have an impact upon streams, wetlands and/or storm sewers, the OCD may require minimization or elimination of this impact based on site conditions and existing stormwater system capacity

All stormwater outfall locations have been designed with stone to avoid erosion and sedimentation, as well as impacts to the intermittent stream located east of the site.

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Appendix A: Standard 1 Computations and Supporting Information

› Stone outlet protection for pipe ends (See Virginia Erosion and Sediment Control Handbook, Chapter 3.18)

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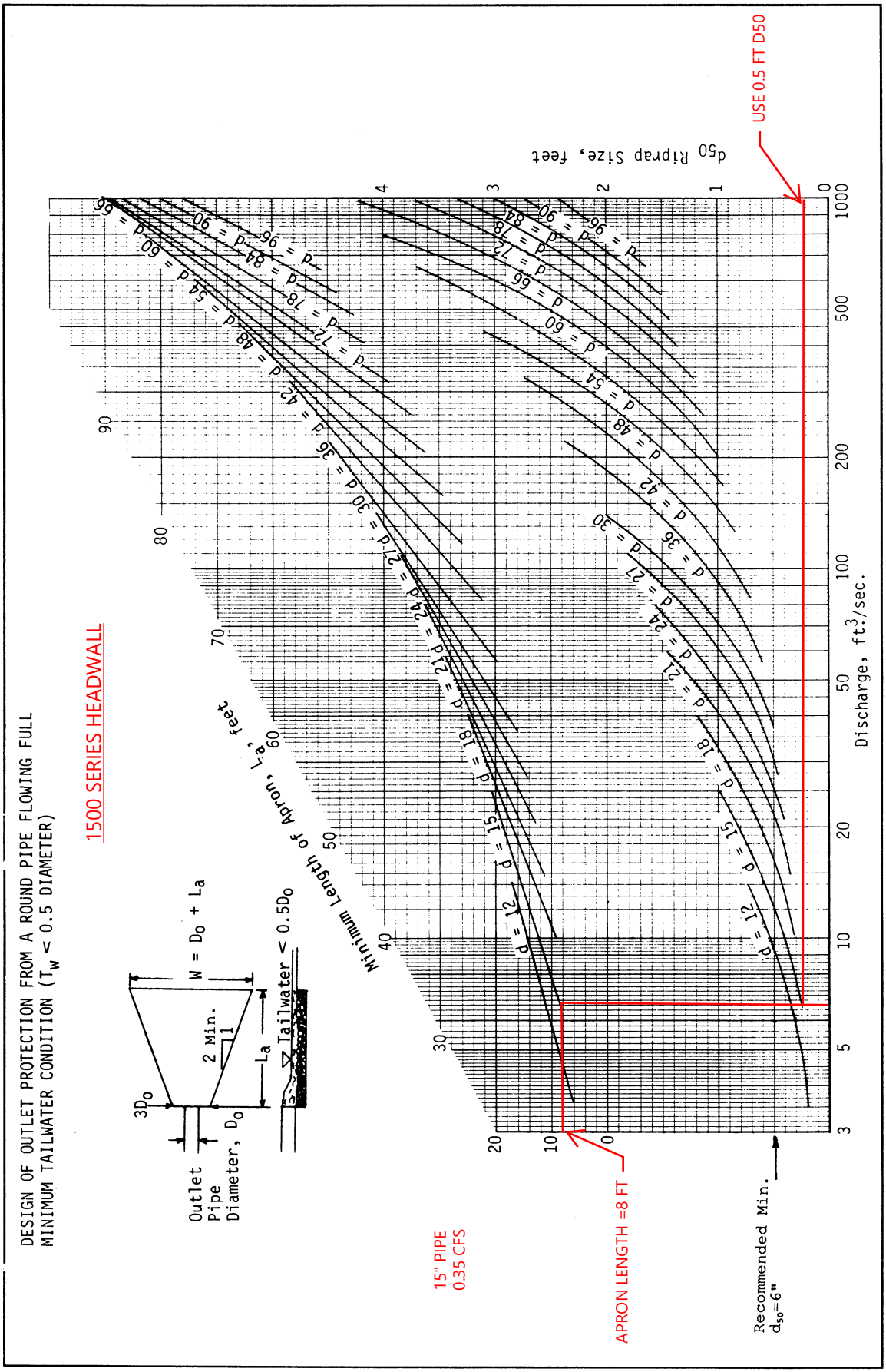
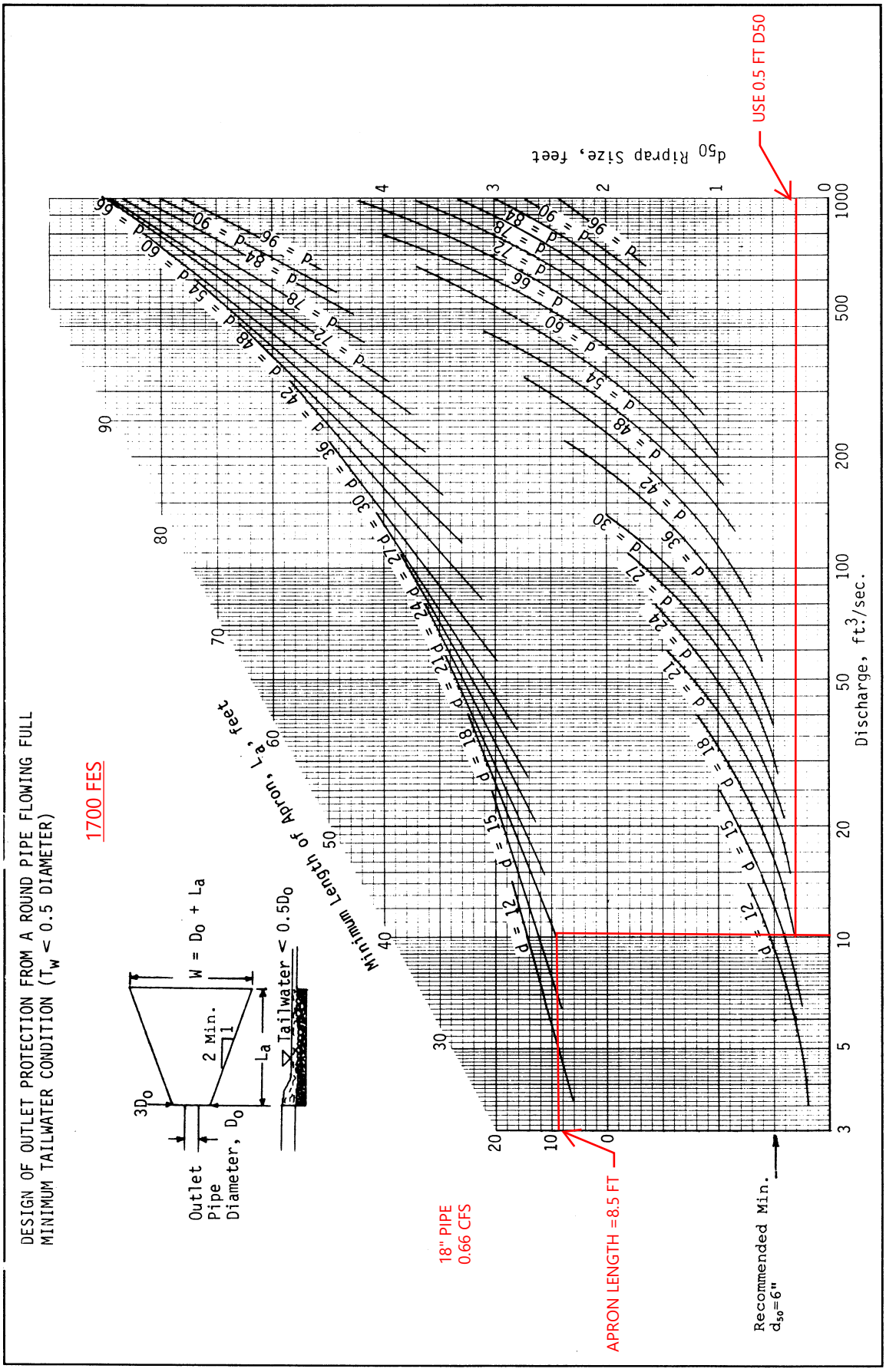


Source: USDA-SCS Plate 3.18-3



Source: USDA-SCS

Plate 3.18-3

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: 3.25, 5.14, 6.31, and 8.13 inches, respectively. Runoff coefficients for the pre- and post-development conditions, as previously shown in Tables 1 and 2 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 Rainfall Data

NOAA Atlas 14, Volume 10, Version 3
Location name: Belmont, Massachusetts, USA*
Latitude: 42.3904°, Longitude: -71.1907°
Elevation: 206.15 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	0.303 (0.236-0.387)	0.373 (0.290-0.477)	0.487 (0.377-0.627)	0.582 (0.448-0.753)	0.713 (0.533-0.968)	0.810 (0.594-1.13)	0.914 (0.653-1.32)	1.04 (0.697-1.53)	1.22 (0.788-1.86)	1.37 (0.867-2.13)
10-min	0.429 (0.334-0.548)	0.528 (0.410-0.676)	0.690 (0.534-0.887)	0.825 (0.635-1.07)	1.01 (0.754-1.37)	1.15 (0.841-1.60)	1.30 (0.925-1.88)	1.47 (0.988-2.16)	1.72 (1.12-2.63)	1.94 (1.23-3.03)
15-min	0.505 (0.393-0.645)	0.621 (0.483-0.795)	0.811 (0.629-1.04)	0.970 (0.747-1.25)	1.19 (0.888-1.61)	1.35 (0.990-1.88)	1.52 (1.09-2.21)	1.73 (1.16-2.55)	2.03 (1.31-3.10)	2.28 (1.44-3.56)
30-min	0.688 (0.535-0.879)	0.849 (0.660-1.09)	1.11 (0.861-1.43)	1.33 (1.02-1.72)	1.63 (1.22-2.22)	1.86 (1.36-2.58)	2.10 (1.50-3.05)	2.38 (1.60-3.52)	2.82 (1.83-4.32)	3.20 (2.02-4.99)
60-min	0.871 (0.678-1.11)	1.08 (0.837-1.38)	1.41 (1.09-1.81)	1.69 (1.30-2.19)	2.08 (1.55-2.83)	2.36 (1.73-3.29)	2.67 (1.92-3.89)	3.04 (2.05-4.49)	3.62 (2.34-5.53)	4.11 (2.60-6.42)
2-hr	1.14 (0.893-1.45)	1.40 (1.10-1.79)	1.83 (1.43-2.34)	2.19 (1.70-2.81)	2.68 (2.02-3.63)	3.04 (2.26-4.23)	3.44 (2.49-5.00)	3.94 (2.66-5.76)	4.72 (3.06-7.15)	5.40 (3.43-8.34)
3-hr	1.33 (1.05-1.69)	1.64 (1.28-2.07)	2.13 (1.67-2.71)	2.54 (1.98-3.25)	3.11 (2.35-4.19)	3.53 (2.62-4.88)	3.98 (2.90-5.77)	4.56 (3.09-6.64)	5.48 (3.56-8.25)	6.28 (3.99-9.64)
6-hr	1.73 (1.37-2.17)	2.11 (1.67-2.66)	2.74 (2.16-3.46)	3.27 (2.56-4.14)	3.99 (3.04-5.33)	4.52 (3.38-6.19)	5.10 (3.72-7.31)	5.83 (3.96-8.41)	6.98 (4.56-10.4)	7.98 (5.09-12.1)
12-hr	2.19 (1.75-2.73)	2.68 (2.13-3.35)	3.48 (2.76-4.37)	4.15 (3.27-5.23)	5.07 (3.88-6.71)	5.74 (4.31-7.79)	6.48 (4.74-9.19)	7.39 (5.04-10.6)	8.81 (5.77-13.0)	10.0 (6.43-15.1)
24-hr	2.62 (2.11-3.25)	3.25 (2.61-4.04)	4.28 (3.42-5.33)	5.14 (4.08-6.43)	6.31 (4.86-8.32)	7.18 (5.42-9.69)	8.13 (5.99-11.5)	9.32 (6.38-13.2)	11.2 (7.35-16.4)	12.8 (8.22-19.1)
2-day	2.99 (2.42-3.68)	3.78 (3.05-4.66)	5.07 (4.08-6.27)	6.14 (4.91-7.63)	7.62 (5.91-9.99)	8.69 (6.63-11.7)	9.89 (7.37-13.9)	11.4 (7.86-16.1)	13.9 (9.19-20.2)	16.2 (10.4-23.9)
3-day	3.28 (2.66-4.02)	4.14 (3.35-5.07)	5.53 (4.46-6.81)	6.69 (5.36-8.27)	8.28 (6.45-10.8)	9.43 (7.22-12.6)	10.7 (8.03-15.1)	12.4 (8.55-17.4)	15.2 (10.0-21.9)	17.6 (11.4-25.9)
4-day	3.56 (2.89-4.35)	4.44 (3.61-5.43)	5.88 (4.76-7.22)	7.07 (5.69-8.73)	8.72 (6.81-11.3)	9.92 (7.61-13.2)	11.3 (8.44-15.7)	13.0 (8.97-18.1)	15.9 (10.5-22.8)	18.4 (11.9-26.9)
7-day	4.31 (3.53-5.24)	5.23 (4.27-6.36)	6.73 (5.48-8.21)	7.97 (6.45-9.78)	9.69 (7.60-12.5)	10.9 (8.42-14.5)	12.3 (9.26-17.0)	14.1 (9.79-19.5)	17.1 (11.3-24.3)	19.7 (12.7-28.5)
10-day	5.01 (4.11-6.06)	5.95 (4.88-7.21)	7.49 (6.12-9.10)	8.76 (7.12-10.7)	10.5 (8.27-13.5)	11.8 (9.10-15.5)	13.2 (9.92-18.1)	15.0 (10.4-20.6)	17.9 (11.9-25.4)	20.4 (13.2-29.5)
20-day	7.01 (5.80-8.43)	8.03 (6.63-9.66)	9.70 (7.98-11.7)	11.1 (9.06-13.4)	13.0 (10.2-16.4)	14.4 (11.1-18.6)	15.9 (11.8-21.2)	17.7 (12.4-24.0)	20.2 (13.5-28.3)	22.3 (14.5-31.8)
30-day	8.66 (7.20-10.4)	9.75 (8.08-11.7)	11.5 (9.52-13.8)	13.0 (10.7-15.7)	15.0 (11.8-18.8)	16.6 (12.7-21.1)	18.1 (13.4-23.8)	19.8 (13.9-26.7)	22.1 (14.8-30.7)	23.9 (15.6-33.9)
45-day	10.7 (8.95-12.8)	11.9 (9.90-14.2)	13.8 (11.4-16.5)	15.3 (12.6-18.4)	17.5 (13.8-21.7)	19.2 (14.7-24.1)	20.8 (15.4-26.9)	22.4 (15.8-30.0)	24.5 (16.5-33.8)	26.0 (17.0-36.6)
60-day	12.5 (10.4-14.8)	13.7 (11.4-16.3)	15.7 (13.0-18.7)	17.3 (14.3-20.7)	19.5 (15.5-24.1)	21.3 (16.4-26.7)	23.0 (17.0-29.5)	24.6 (17.4-32.7)	26.5 (17.9-36.5)	27.9 (18.2-39.1)

[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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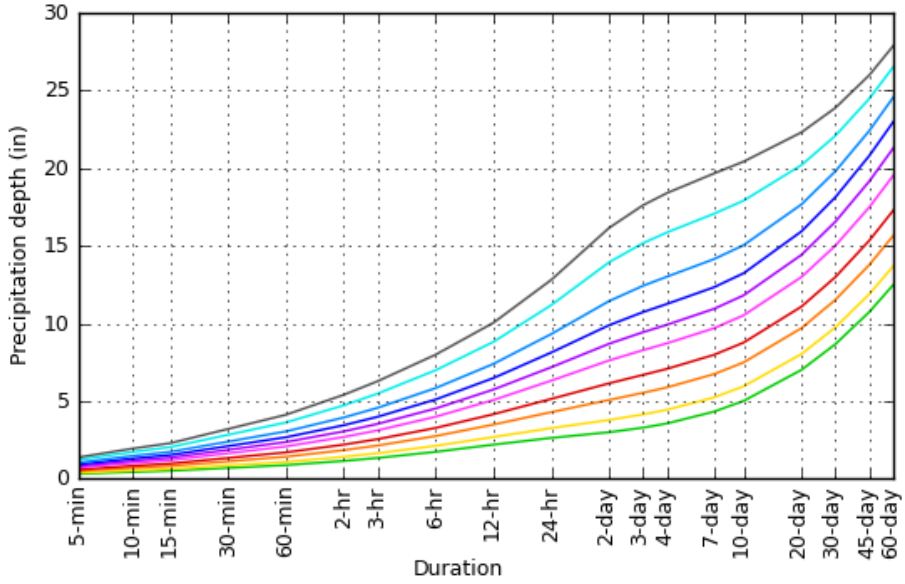
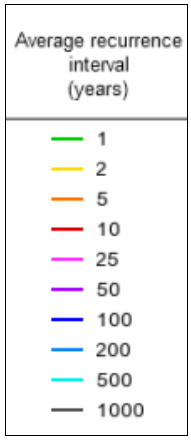
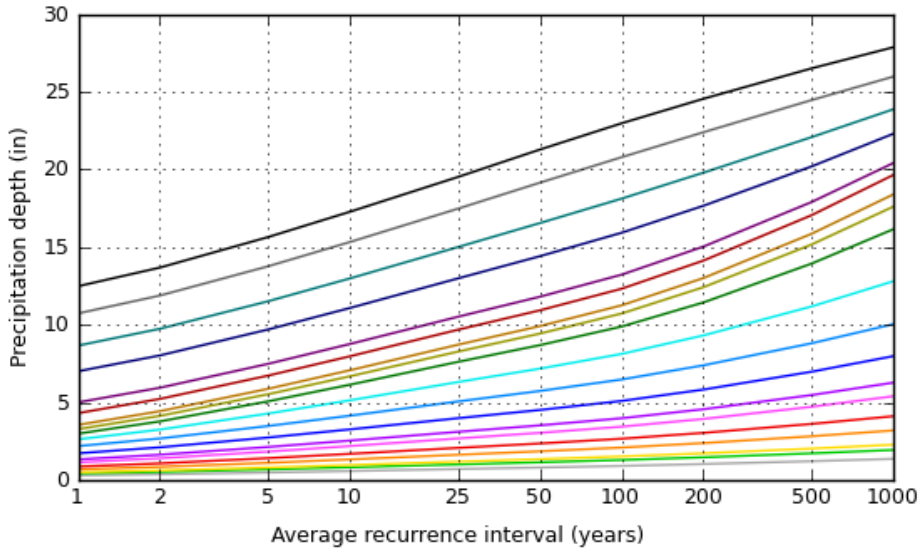
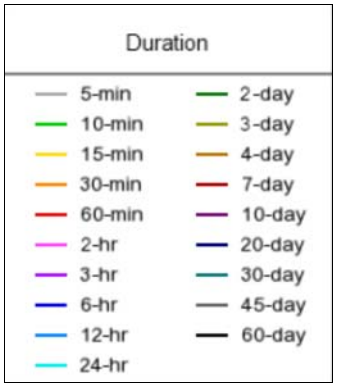
PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 42.3904°, Longitude: -71.1907°









NOAA Atlas 14, Volume 10, Version 3 Created (GMT): Mon Nov 16 14:31:05 2020

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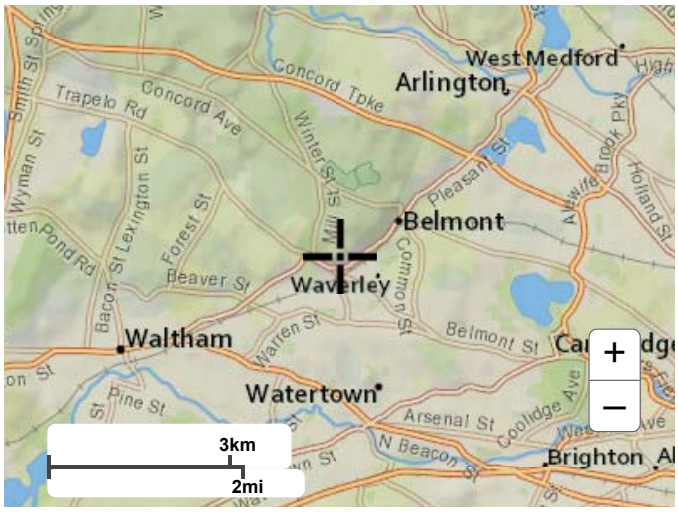
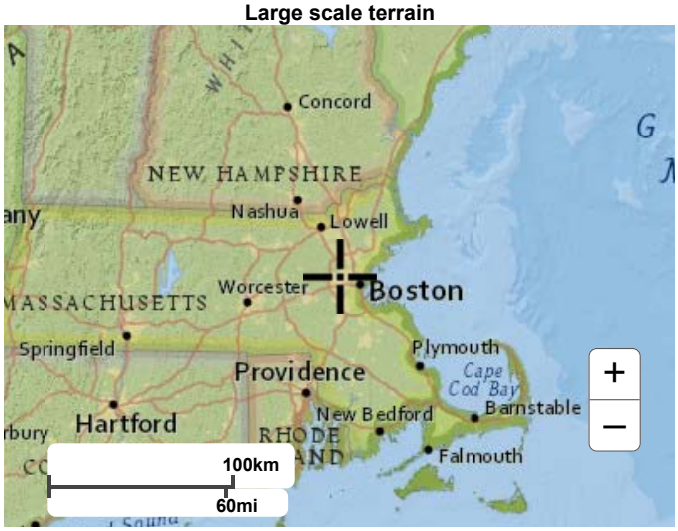
Maps & aerials

Small scale terrain



Large scale terrain



Large scale map

Large scale aerial

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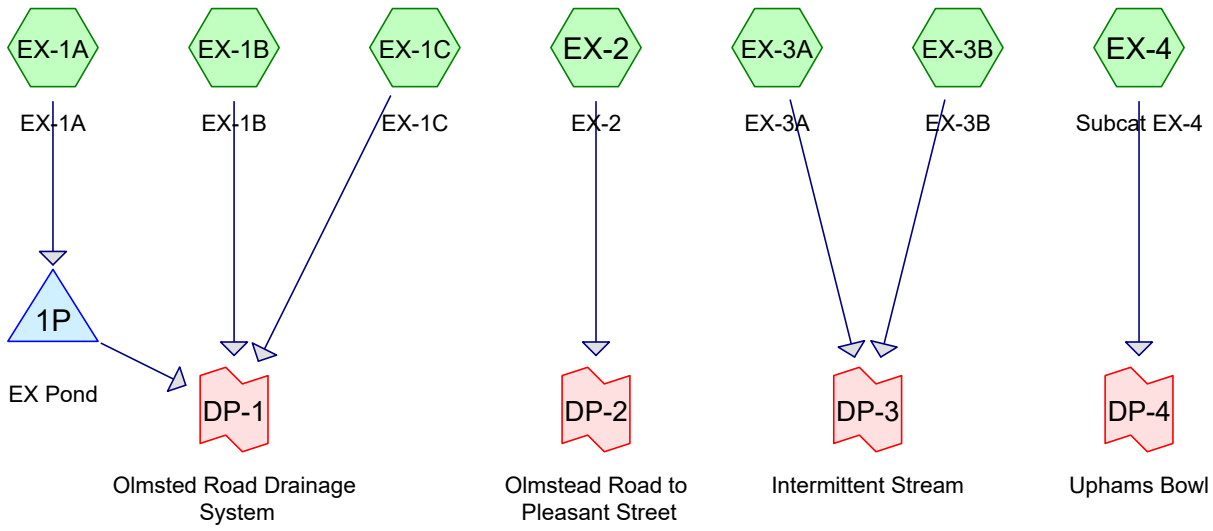
US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

HydroCAD Analysis: Existing Conditions



Subcat Reach Pond Link

Routing Diagram for 13555.04-EX
Prepared by VHB, Printed 4/28/2021

Summary for Subcatchment EX-1A: EX-1A

Runoff = 0.01 cfs @ 14.94 hrs, Volume= 0.007 af, Depth= 0.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr, 24-hr Rainfall=3.25"

Area (sf)	CN	Description
33,349	39	>75% Grass cover, Good, HSG A
8,028	98	Paved parking, HSG A
6	98	Roofs, HSG A
225	98	Unconnected pavement, HSG A
11,759	30	Woods, Good, HSG A
53,368	46	Weighted Average
45,109		84.52% Pervious Area
8,260		15.48% Impervious Area
225		2.73% Unconnected

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

Summary for Subcatchment EX-1B: EX-1B

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr, 24-hr Rainfall=3.25"

Area (sf)	CN	Description
81,668	39	>75% Grass cover, Good, HSG A
295	76	Gravel roads, HSG A
4,571	98	Roofs, HSG A
120,670	30	Woods, Good, HSG A
207,204	35	Weighted Average
202,633		97.79% Pervious Area
4,571		2.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.3	50	0.1600	0.16		**Sheet Flow, First 50 feet of woods** Woods: Light underbrush n= 0.400 P2= 3.25"
0.6	100	0.3300	2.87		**Shallow Concentrated Flow, Next 100 feet of woods** Woodland Kv= 5.0 fps
0.5	55	0.1600	2.00		**Shallow Concentrated Flow, Next 55 feet of woods** Woodland Kv= 5.0 fps
2.3	155	0.0500	1.12		**Shallow Concentrated Flow, Next 155 feet of woods** Woodland Kv= 5.0 fps
0.8	100	0.1000	2.21		**Shallow Concentrated Flow, Next 100 feet of grass** Short Grass Pasture Kv= 7.0 fps
1.7	160	0.0500	1.57		**Shallow Concentrated Flow, Next 160 feet of grass** Short Grass Pasture Kv= 7.0 fps
0.3	50	0.1250	2.47		**Shallow Concentrated Flow, Last 50 feet of grass** Short Grass Pasture Kv= 7.0 fps
11.5	670	Total			

Summary for Subcatchment EX-1C: EX-1C

Runoff = 1.30 cfs @ 12.09 hrs, Volume= 0.093 af, Depth= 2.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr, 24-hr Rainfall=3.25"

Area (ac)	CN	Description
0.079	39	>75% Grass cover, Good, HSG A
0.403	98	Paved parking, HSG A
0.044	98	Unconnected pavement, HSG A
0.526	89	Weighted Average
0.079		15.02% Pervious Area
0.447		84.98% Impervious Area
0.044		9.84% Unconnected

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

Summary for Subcatchment EX-2: EX-2

Runoff = 0.00 cfs @ 22.22 hrs, Volume= 0.002 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr, 24-hr Rainfall=3.25"

Area (sf)	CN	Description
24,449	39	>75% Grass cover, Good, HSG A
16,276	76	Gravel roads, HSG A
94	98	Roofs, HSG A
43,979	30	Woods, Good, HSG A
84,798	41	Weighted Average
84,704		99.89% Pervious Area
94		0.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Use Minimum - Actual calculated Tc is slightly less**

Summary for Subcatchment EX-3A: EX-3A

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr, 24-hr Rainfall=3.25"

Area (sf)	CN	Description
50,551	39	>75% Grass cover, Good, HSG A
13,615	76	Gravel roads, HSG A
1,452	98	Roofs, HSG A
68	98	Unconnected pavement, HSG A
77,052	30	Woods, Good, HSG A
142,738	38	Weighted Average
141,218		98.94% Pervious Area
1,520		1.06% Impervious Area
68		4.47% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	30	0.0430	0.08		**Sheet Flow, First 30 feet of woods** Woods: Light underbrush n= 0.400 P2= 3.25"
2.5	20	0.1700	0.13		**Sheet Flow, Next 20 feet of woods** Woods: Light underbrush n= 0.400 P2= 3.25"
0.2	20	0.1400	1.87		**Shallow Concentrated Flow, Next 20 feet of woods** Woodland Kv= 5.0 fps
0.1	10	0.1000	2.21		**Shallow Concentrated Flow, Next 10 feet of grass** Short Grass Pasture Kv= 7.0 fps
0.0	5	0.0250	2.55		**Shallow Concentrated Flow, Next 5 feet of gravel** Unpaved Kv= 16.1 fps
0.5	35	0.0250	1.11		**Shallow Concentrated Flow, Next 35 feet of grass** Short Grass Pasture Kv= 7.0 fps
0.4	75	0.0400	3.22		**Shallow Concentrated Flow, Next 75 feet of gravel** Unpaved Kv= 16.1 fps
0.2	30	0.3300	2.87		**Shallow Concentrated Flow, Next 30 feet of woods** Woodland Kv= 5.0 fps
1.4	145	0.1250	1.77		**Shallow Concentrated Flow, Next 145 feet of woods** Woodland Kv= 5.0 fps
1.7	80	0.0120	0.77		**Shallow Concentrated Flow, Next 80 feet of grass** Short Grass Pasture Kv= 7.0 fps
2.2	175	0.0360	1.33		**Shallow Concentrated Flow, Next 175 feet of grass** Short Grass Pasture Kv= 7.0 fps
0.1	15	0.2900	3.77		**Shallow Concentrated Flow, Next 15 feet of grass** Short Grass Pasture Kv= 7.0 fps
0.4	25	0.0500	1.12		**Shallow Concentrated Flow, Last 25 feet of woods** Woodland Kv= 5.0 fps
15.7	665	Total			

Summary for Subcatchment EX-3B: EX-3B

Runoff = 0.59 cfs @ 12.09 hrs, Volume= 0.042 af, Depth= 1.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr, 24-hr Rainfall=3.25"

Area (ac)	CN	Description
0.070	39	>75% Grass cover, Good, HSG A
0.234	98	Paved parking, HSG A
0.013	30	Woods, Good, HSG A
0.317	82	Weighted Average
0.083		26.23% Pervious Area
0.234		73.77% Impervious Area

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

Summary for Subcatchment EX-4: Subcat EX-4

Runoff = 0.11 cfs @ 12.35 hrs, Volume= 0.024 af, Depth= 0.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr, 24-hr Rainfall=3.25"

Area (ac)	CN	Adj	Description
0.688	39		>75% Grass cover, Good, HSG A
0.211	98		Paved parking, HSG A
0.091	98		Roofs, HSG A
0.044	98		Unconnected pavement, HSG A
0.157	30		Woods, Good, HSG A
1.191	55	54	Weighted Average, UI Adjusted
0.845			70.96% Pervious Area
0.346			29.04% Impervious Area
0.044			12.65% Unconnected

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

Summary for Pond 1P: EX Pond

Inflow Area = 1.225 ac, 15.48% Impervious, Inflow Depth = 0.06" for 2-yr, 24-hr event
Inflow = 0.01 cfs @ 14.94 hrs, Volume= 0.007 af
Outflow = 0.00 cfs @ 24.08 hrs, Volume= 0.000 af, Atten= 76%, Lag= 548.5 min
Primary = 0.00 cfs @ 24.08 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 178.42' @ 24.08 hrs Surf.Area= 751 sf Storage= 280 cf

Plug-Flow detention time= 699.3 min calculated for 0.000 af (7% of inflow)
Center-of-Mass det. time= 428.0 min (1,501.5 - 1,073.5)

Volume	Invert	Avail.Storage	Storage Description
#1	178.00'	5,867 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
178.00	592	0	0
179.00	973	783	783
180.00	1,389	1,181	1,964
181.00	1,872	1,631	3,594
182.00	2,674	2,273	5,867

Device	Routing	Invert	Outlet Devices
#1	Primary	178.40'	**12.0" Round Culvert** L= 99.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 178.40' / 176.70' S= 0.0172 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Primary	181.40'	**28.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=0.00 cfs @ 24.08 hrs HW=178.42' (Free Discharge)
1=Culvert (Inlet Controls 0.00 cfs @ 0.36 fps)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Link DP-1: Olmsted Road Drainage System

Inflow Area = 6.508 ac, 11.39% Impervious, Inflow Depth = 0.17" for 2-yr, 24-hr event
Inflow = 1.30 cfs @ 12.09 hrs, Volume= 0.094 af
Primary = 1.30 cfs @ 12.09 hrs, Volume= 0.094 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link DP-2: Olmstead Road to Pleasant Street

Inflow Area = 1.947 ac, 0.11% Impervious, Inflow Depth = 0.01" for 2-yr, 24-hr event
Inflow = 0.00 cfs @ 22.22 hrs, Volume= 0.002 af
Primary = 0.00 cfs @ 22.22 hrs, Volume= 0.002 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link DP-3: Intermittent Stream

Inflow Area = 3.594 ac, 7.48% Impervious, Inflow Depth = 0.14" for 2-yr, 24-hr event
Inflow = 0.59 cfs @ 12.09 hrs, Volume= 0.042 af
Primary = 0.59 cfs @ 12.09 hrs, Volume= 0.042 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link DP-4: Uphams Bowl

Inflow Area = 1.191 ac, 29.04% Impervious, Inflow Depth = 0.24" for 2-yr, 24-hr event
Inflow = 0.11 cfs @ 12.35 hrs, Volume= 0.024 af
Primary = 0.11 cfs @ 12.35 hrs, Volume= 0.024 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Subcatchment EX-1A: EX-1A

Runoff = 0.34 cfs @ 12.15 hrs, Volume= 0.055 af, Depth= 0.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr, 24-hr Rainfall=5.14"

Area (sf)	CN	Description
33,349	39	>75% Grass cover, Good, HSG A
8,028	98	Paved parking, HSG A
6	98	Roofs, HSG A
225	98	Unconnected pavement, HSG A
11,759	30	Woods, Good, HSG A
53,368	46	Weighted Average
45,109		84.52% Pervious Area
8,260		15.48% Impervious Area
225		2.73% Unconnected

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

Summary for Subcatchment EX-1B: EX-1B

Runoff = 0.06 cfs @ 15.04 hrs, Volume= 0.040 af, Depth= 0.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr, 24-hr Rainfall=5.14"

Area (sf)	CN	Description
81,668	39	>75% Grass cover, Good, HSG A
295	76	Gravel roads, HSG A
4,571	98	Roofs, HSG A
120,670	30	Woods, Good, HSG A
207,204	35	Weighted Average
202,633		97.79% Pervious Area
4,571		2.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.3	50	0.1600	0.16		**Sheet Flow, First 50 feet of woods** Woods: Light underbrush n= 0.400 P2= 3.25"
0.6	100	0.3300	2.87		**Shallow Concentrated Flow, Next 100 feet of woods** Woodland Kv= 5.0 fps
0.5	55	0.1600	2.00		**Shallow Concentrated Flow, Next 55 feet of woods** Woodland Kv= 5.0 fps
2.3	155	0.0500	1.12		**Shallow Concentrated Flow, Next 155 feet of woods** Woodland Kv= 5.0 fps
0.8	100	0.1000	2.21		**Shallow Concentrated Flow, Next 100 feet of grass** Short Grass Pasture Kv= 7.0 fps
1.7	160	0.0500	1.57		**Shallow Concentrated Flow, Next 160 feet of grass** Short Grass Pasture Kv= 7.0 fps
0.3	50	0.1250	2.47		**Shallow Concentrated Flow, Last 50 feet of grass** Short Grass Pasture Kv= 7.0 fps
11.5	670	Total			

Summary for Subcatchment EX-1C: EX-1C

Runoff = 2.34 cfs @ 12.09 hrs, Volume= 0.171 af, Depth= 3.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr, 24-hr Rainfall=5.14"

Area (ac)	CN	Description
0.079	39	>75% Grass cover, Good, HSG A
0.403	98	Paved parking, HSG A
0.044	98	Unconnected pavement, HSG A
0.526	89	Weighted Average
0.079		15.02% Pervious Area
0.447		84.98% Impervious Area
0.044		9.84% Unconnected

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

Summary for Subcatchment EX-2: EX-2

Runoff = 0.20 cfs @ 12.39 hrs, Volume= 0.050 af, Depth= 0.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr, 24-hr Rainfall=5.14"

Area (sf)	CN	Description
24,449	39	>75% Grass cover, Good, HSG A
16,276	76	Gravel roads, HSG A
94	98	Roofs, HSG A
43,979	30	Woods, Good, HSG A
84,798	41	Weighted Average
84,704		99.89% Pervious Area
94		0.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Use Minimum - Actual calculated Tc is slightly less**

Summary for Subcatchment EX-3A: EX-3A

Runoff = 0.09 cfs @ 12.96 hrs, Volume= 0.053 af, Depth= 0.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr, 24-hr Rainfall=5.14"

Area (sf)	CN	Description
50,551	39	>75% Grass cover, Good, HSG A
13,615	76	Gravel roads, HSG A
1,452	98	Roofs, HSG A
68	98	Unconnected pavement, HSG A
77,052	30	Woods, Good, HSG A
142,738	38	Weighted Average
141,218		98.94% Pervious Area
1,520		1.06% Impervious Area
68		4.47% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	30	0.0430	0.08		**Sheet Flow, First 30 feet of woods** Woods: Light underbrush n= 0.400 P2= 3.25"
2.5	20	0.1700	0.13		**Sheet Flow, Next 20 feet of woods** Woods: Light underbrush n= 0.400 P2= 3.25"
0.2	20	0.1400	1.87		**Shallow Concentrated Flow, Next 20 feet of woods** Woodland Kv= 5.0 fps
0.1	10	0.1000	2.21		**Shallow Concentrated Flow, Next 10 feet of grass** Short Grass Pasture Kv= 7.0 fps
0.0	5	0.0250	2.55		**Shallow Concentrated Flow, Next 5 feet of gravel** Unpaved Kv= 16.1 fps
0.5	35	0.0250	1.11		**Shallow Concentrated Flow, Next 35 feet of grass** Short Grass Pasture Kv= 7.0 fps
0.4	75	0.0400	3.22		**Shallow Concentrated Flow, Next 75 feet of gravel** Unpaved Kv= 16.1 fps
0.2	30	0.3300	2.87		**Shallow Concentrated Flow, Next 30 feet of woods** Woodland Kv= 5.0 fps
1.4	145	0.1250	1.77		**Shallow Concentrated Flow, Next 145 feet of woods** Woodland Kv= 5.0 fps
1.7	80	0.0120	0.77		**Shallow Concentrated Flow, Next 80 feet of grass** Short Grass Pasture Kv= 7.0 fps
2.2	175	0.0360	1.33		**Shallow Concentrated Flow, Next 175 feet of grass** Short Grass Pasture Kv= 7.0 fps
0.1	15	0.2900	3.77		**Shallow Concentrated Flow, Next 15 feet of grass** Short Grass Pasture Kv= 7.0 fps
0.4	25	0.0500	1.12		**Shallow Concentrated Flow, Last 25 feet of woods** Woodland Kv= 5.0 fps
15.7	665	Total			

Summary for Subcatchment EX-3B: EX-3B

Runoff = 1.19 cfs @ 12.09 hrs, Volume= 0.085 af, Depth= 3.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr, 24-hr Rainfall=5.14"

Area (ac)	CN	Description
0.070	39	>75% Grass cover, Good, HSG A
0.234	98	Paved parking, HSG A
0.013	30	Woods, Good, HSG A
0.317	82	Weighted Average
0.083		26.23% Pervious Area
0.234		73.77% Impervious Area

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

Summary for Subcatchment EX-4: Subcat EX-4

Runoff = 1.09 cfs @ 12.11 hrs, Volume= 0.098 af, Depth= 0.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr, 24-hr Rainfall=5.14"

Area (ac)	CN	Adj	Description
0.688	39		>75% Grass cover, Good, HSG A
0.211	98		Paved parking, HSG A
0.091	98		Roofs, HSG A
0.044	98		Unconnected pavement, HSG A
0.157	30		Woods, Good, HSG A
1.191	55	54	Weighted Average, UI Adjusted
0.845			70.96% Pervious Area
0.346			29.04% Impervious Area
0.044			12.65% Unconnected

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

Summary for Pond 1P: EX Pond

Inflow Area = 1.225 ac, 15.48% Impervious, Inflow Depth = 0.54" for 10-yr, 24-hr event
Inflow = 0.34 cfs @ 12.15 hrs, Volume= 0.055 af
Outflow = 0.16 cfs @ 12.58 hrs, Volume= 0.049 af, Atten= 53%, Lag= 25.9 min
Primary = 0.16 cfs @ 12.58 hrs, Volume= 0.049 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 178.62' @ 12.58 hrs Surf.Area= 828 sf Storage= 439 cf

Plug-Flow detention time= 107.7 min calculated for 0.049 af (89% of inflow)
Center-of-Mass det. time= 56.5 min (990.8 - 934.3)

Volume	Invert	Avail.Storage	Storage Description
#1	178.00'	5,867 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
178.00	592	0	0
179.00	973	783	783
180.00	1,389	1,181	1,964
181.00	1,872	1,631	3,594
182.00	2,674	2,273	5,867

Device	Routing	Invert	Outlet Devices
#1	Primary	178.40'	**12.0" Round Culvert** L= 99.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 178.40' / 176.70' S= 0.0172 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Primary	181.40'	**28.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=0.16 cfs @ 12.58 hrs HW=178.62' (Free Discharge)
1=Culvert (Inlet Controls 0.16 cfs @ 1.26 fps)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Link DP-1: Olmsted Road Drainage System

Inflow Area = 6.508 ac, 11.39% Impervious, Inflow Depth = 0.48" for 10-yr, 24-hr event
Inflow = 2.34 cfs @ 12.09 hrs, Volume= 0.260 af
Primary = 2.34 cfs @ 12.09 hrs, Volume= 0.260 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link DP-2: Olmstead Road to Pleasant Street

Inflow Area = 1.947 ac, 0.11% Impervious, Inflow Depth = 0.31" for 10-yr, 24-hr event
Inflow = 0.20 cfs @ 12.39 hrs, Volume= 0.050 af
Primary = 0.20 cfs @ 12.39 hrs, Volume= 0.050 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link DP-3: Intermittent Stream

Inflow Area = 3.594 ac, 7.48% Impervious, Inflow Depth = 0.46" for 10-yr, 24-hr event
Inflow = 1.19 cfs @ 12.09 hrs, Volume= 0.138 af
Primary = 1.19 cfs @ 12.09 hrs, Volume= 0.138 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link DP-4: Uphams Bowl

Inflow Area = 1.191 ac, 29.04% Impervious, Inflow Depth = 0.99" for 10-yr, 24-hr event
Inflow = 1.09 cfs @ 12.11 hrs, Volume= 0.098 af
Primary = 1.09 cfs @ 12.11 hrs, Volume= 0.098 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Subcatchment EX-1A: EX-1A

Runoff = 1.01 cfs @ 12.11 hrs, Volume= 0.102 af, Depth= 1.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr, 24-hr Rainfall=6.31"

Area (sf)	CN	Description
33,349	39	>75% Grass cover, Good, HSG A
8,028	98	Paved parking, HSG A
6	98	Roofs, HSG A
225	98	Unconnected pavement, HSG A
11,759	30	Woods, Good, HSG A
53,368	46	Weighted Average
45,109		84.52% Pervious Area
8,260		15.48% Impervious Area
225		2.73% Unconnected

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

Summary for Subcatchment EX-1B: EX-1B

Runoff = 0.38 cfs @ 12.51 hrs, Volume= 0.126 af, Depth= 0.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr, 24-hr Rainfall=6.31"

Area (sf)	CN	Description
81,668	39	>75% Grass cover, Good, HSG A
295	76	Gravel roads, HSG A
4,571	98	Roofs, HSG A
120,670	30	Woods, Good, HSG A
207,204	35	Weighted Average
202,633		97.79% Pervious Area
4,571		2.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.3	50	0.1600	0.16		**Sheet Flow, First 50 feet of woods** Woods: Light underbrush n= 0.400 P2= 3.25"
0.6	100	0.3300	2.87		**Shallow Concentrated Flow, Next 100 feet of woods** Woodland Kv= 5.0 fps
0.5	55	0.1600	2.00		**Shallow Concentrated Flow, Next 55 feet of woods** Woodland Kv= 5.0 fps
2.3	155	0.0500	1.12		**Shallow Concentrated Flow, Next 155 feet of woods** Woodland Kv= 5.0 fps
0.8	100	0.1000	2.21		**Shallow Concentrated Flow, Next 100 feet of grass** Short Grass Pasture Kv= 7.0 fps
1.7	160	0.0500	1.57		**Shallow Concentrated Flow, Next 160 feet of grass** Short Grass Pasture Kv= 7.0 fps
0.3	50	0.1250	2.47		**Shallow Concentrated Flow, Last 50 feet of grass** Short Grass Pasture Kv= 7.0 fps
11.5	670	Total			

Summary for Subcatchment EX-1C: EX-1C

Runoff = 2.97 cfs @ 12.08 hrs, Volume= 0.221 af, Depth= 5.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr, 24-hr Rainfall=6.31"

Area (ac)	CN	Description
0.079	39	>75% Grass cover, Good, HSG A
0.403	98	Paved parking, HSG A
0.044	98	Unconnected pavement, HSG A
0.526	89	Weighted Average
0.079		15.02% Pervious Area
0.447		84.98% Impervious Area
0.044		9.84% Unconnected

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

Summary for Subcatchment EX-2: EX-2

Runoff = 0.67 cfs @ 12.15 hrs, Volume= 0.107 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr, 24-hr Rainfall=6.31"

Area (sf)	CN	Description
24,449	39	>75% Grass cover, Good, HSG A
16,276	76	Gravel roads, HSG A
94	98	Roofs, HSG A
43,979	30	Woods, Good, HSG A
84,798	41	Weighted Average
84,704		99.89% Pervious Area
94		0.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Use Minimum - Actual calculated Tc is slightly less**

Summary for Subcatchment EX-3A: EX-3A

Runoff = 0.57 cfs @ 12.49 hrs, Volume= 0.131 af, Depth= 0.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr, 24-hr Rainfall=6.31"

Area (sf)	CN	Description
50,551	39	>75% Grass cover, Good, HSG A
13,615	76	Gravel roads, HSG A
1,452	98	Roofs, HSG A
68	98	Unconnected pavement, HSG A
77,052	30	Woods, Good, HSG A
142,738	38	Weighted Average
141,218		98.94% Pervious Area
1,520		1.06% Impervious Area
68		4.47% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	30	0.0430	0.08		**Sheet Flow, First 30 feet of woods** Woods: Light underbrush n= 0.400 P2= 3.25"
2.5	20	0.1700	0.13		**Sheet Flow, Next 20 feet of woods** Woods: Light underbrush n= 0.400 P2= 3.25"
0.2	20	0.1400	1.87		**Shallow Concentrated Flow, Next 20 feet of woods** Woodland Kv= 5.0 fps
0.1	10	0.1000	2.21		**Shallow Concentrated Flow, Next 10 feet of grass** Short Grass Pasture Kv= 7.0 fps
0.0	5	0.0250	2.55		**Shallow Concentrated Flow, Next 5 feet of gravel** Unpaved Kv= 16.1 fps
0.5	35	0.0250	1.11		**Shallow Concentrated Flow, Next 35 feet of grass** Short Grass Pasture Kv= 7.0 fps
0.4	75	0.0400	3.22		**Shallow Concentrated Flow, Next 75 feet of gravel** Unpaved Kv= 16.1 fps
0.2	30	0.3300	2.87		**Shallow Concentrated Flow, Next 30 feet of woods** Woodland Kv= 5.0 fps
1.4	145	0.1250	1.77		**Shallow Concentrated Flow, Next 145 feet of woods** Woodland Kv= 5.0 fps
1.7	80	0.0120	0.77		**Shallow Concentrated Flow, Next 80 feet of grass** Short Grass Pasture Kv= 7.0 fps
2.2	175	0.0360	1.33		**Shallow Concentrated Flow, Next 175 feet of grass** Short Grass Pasture Kv= 7.0 fps
0.1	15	0.2900	3.77		**Shallow Concentrated Flow, Next 15 feet of grass** Short Grass Pasture Kv= 7.0 fps
0.4	25	0.0500	1.12		**Shallow Concentrated Flow, Last 25 feet of woods** Woodland Kv= 5.0 fps
15.7	665	Total			

Summary for Subcatchment EX-3B: EX-3B

Runoff = 1.57 cfs @ 12.09 hrs, Volume= 0.113 af, Depth= 4.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr, 24-hr Rainfall=6.31"

Area (ac)	CN	Description
0.070	39	>75% Grass cover, Good, HSG A
0.234	98	Paved parking, HSG A
0.013	30	Woods, Good, HSG A
0.317	82	Weighted Average
0.083		26.23% Pervious Area
0.234		73.77% Impervious Area

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

Summary for Subcatchment EX-4: Subcat EX-4

Runoff = 2.01 cfs @ 12.10 hrs, Volume= 0.160 af, Depth= 1.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr, 24-hr Rainfall=6.31"

Area (ac)	CN	Adj	Description
0.688	39		>75% Grass cover, Good, HSG A
0.211	98		Paved parking, HSG A
0.091	98		Roofs, HSG A
0.044	98		Unconnected pavement, HSG A
0.157	30		Woods, Good, HSG A
1.191	55	54	Weighted Average, UI Adjusted
0.845			70.96% Pervious Area
0.346			29.04% Impervious Area
0.044			12.65% Unconnected

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

Summary for Pond 1P: EX Pond

Inflow Area = 1.225 ac, 15.48% Impervious, Inflow Depth = 1.00" for 25-yr, 24-hr event
Inflow = 1.01 cfs @ 12.11 hrs, Volume= 0.102 af
Outflow = 0.61 cfs @ 12.36 hrs, Volume= 0.096 af, Atten= 40%, Lag= 14.9 min
Primary = 0.61 cfs @ 12.36 hrs, Volume= 0.096 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 178.85' @ 12.36 hrs Surf.Area= 914 sf Storage= 637 cf

Plug-Flow detention time= 63.6 min calculated for 0.096 af (94% of inflow)
Center-of-Mass det. time= 33.5 min (939.6 - 906.1)

Volume	Invert	Avail.Storage	Storage Description
#1	178.00'	5,867 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
178.00	592	0	0
179.00	973	783	783
180.00	1,389	1,181	1,964
181.00	1,872	1,631	3,594
182.00	2,674	2,273	5,867

Device	Routing	Invert	Outlet Devices
#1	Primary	178.40'	**12.0" Round Culvert** L= 99.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 178.40' / 176.70' S= 0.0172 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Primary	181.40'	**28.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=0.61 cfs @ 12.36 hrs HW=178.85' (Free Discharge)
1=Culvert (Inlet Controls 0.61 cfs @ 1.79 fps)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Link DP-1: Olmsted Road Drainage System

Inflow Area = 6.508 ac, 11.39% Impervious, Inflow Depth = 0.82" for 25-yr, 24-hr event
Inflow = 2.97 cfs @ 12.08 hrs, Volume= 0.443 af
Primary = 2.97 cfs @ 12.08 hrs, Volume= 0.443 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link DP-2: Olmstead Road to Pleasant Street

Inflow Area = 1.947 ac, 0.11% Impervious, Inflow Depth = 0.66" for 25-yr, 24-hr event
Inflow = 0.67 cfs @ 12.15 hrs, Volume= 0.107 af
Primary = 0.67 cfs @ 12.15 hrs, Volume= 0.107 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link DP-3: Intermittent Stream

Inflow Area = 3.594 ac, 7.48% Impervious, Inflow Depth = 0.81" for 25-yr, 24-hr event
Inflow = 1.58 cfs @ 12.09 hrs, Volume= 0.244 af
Primary = 1.58 cfs @ 12.09 hrs, Volume= 0.244 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link DP-4: Uphams Bowl

Inflow Area = 1.191 ac, 29.04% Impervious, Inflow Depth = 1.62" for 25-yr, 24-hr event
Inflow = 2.01 cfs @ 12.10 hrs, Volume= 0.160 af
Primary = 2.01 cfs @ 12.10 hrs, Volume= 0.160 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Subcatchment EX-1A: EX-1A

Runoff = 2.37 cfs @ 12.10 hrs, Volume= 0.195 af, Depth= 1.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr, 24-hr Rainfall=8.13"

Area (sf)	CN	Description
33,349	39	>75% Grass cover, Good, HSG A
8,028	98	Paved parking, HSG A
6	98	Roofs, HSG A
225	98	Unconnected pavement, HSG A
11,759	30	Woods, Good, HSG A
53,368	46	Weighted Average
45,109		84.52% Pervious Area
8,260		15.48% Impervious Area
225		2.73% Unconnected

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

Summary for Subcatchment EX-1B: EX-1B

Runoff = 1.92 cfs @ 12.35 hrs, Volume= 0.336 af, Depth= 0.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr, 24-hr Rainfall=8.13"

Area (sf)	CN	Description
81,668	39	>75% Grass cover, Good, HSG A
295	76	Gravel roads, HSG A
4,571	98	Roofs, HSG A
120,670	30	Woods, Good, HSG A
207,204	35	Weighted Average
202,633		97.79% Pervious Area
4,571		2.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.3	50	0.1600	0.16		**Sheet Flow, First 50 feet of woods** Woods: Light underbrush n= 0.400 P2= 3.25"
0.6	100	0.3300	2.87		**Shallow Concentrated Flow, Next 100 feet of woods** Woodland Kv= 5.0 fps
0.5	55	0.1600	2.00		**Shallow Concentrated Flow, Next 55 feet of woods** Woodland Kv= 5.0 fps
2.3	155	0.0500	1.12		**Shallow Concentrated Flow, Next 155 feet of woods** Woodland Kv= 5.0 fps
0.8	100	0.1000	2.21		**Shallow Concentrated Flow, Next 100 feet of grass** Short Grass Pasture Kv= 7.0 fps
1.7	160	0.0500	1.57		**Shallow Concentrated Flow, Next 160 feet of grass** Short Grass Pasture Kv= 7.0 fps
0.3	50	0.1250	2.47		**Shallow Concentrated Flow, Last 50 feet of grass** Short Grass Pasture Kv= 7.0 fps
11.5	670	Total			

Summary for Subcatchment EX-1C: EX-1C

Runoff = 3.95 cfs @ 12.08 hrs, Volume= 0.299 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr, 24-hr Rainfall=8.13"

Area (ac)	CN	Description
0.079	39	>75% Grass cover, Good, HSG A
0.403	98	Paved parking, HSG A
0.044	98	Unconnected pavement, HSG A
0.526	89	Weighted Average
0.079		15.02% Pervious Area
0.447		84.98% Impervious Area
0.044		9.84% Unconnected

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

Summary for Subcatchment EX-2: EX-2

Runoff = 2.38 cfs @ 12.11 hrs, Volume= 0.228 af, Depth= 1.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr, 24-hr Rainfall=8.13"

Area (sf)	CN	Description
24,449	39	>75% Grass cover, Good, HSG A
16,276	76	Gravel roads, HSG A
94	98	Roofs, HSG A
43,979	30	Woods, Good, HSG A
84,798	41	Weighted Average
84,704		99.89% Pervious Area
94		0.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Use Minimum - Actual calculated Tc is slightly less**

Summary for Subcatchment EX-3A: EX-3A

Runoff = 2.02 cfs @ 12.31 hrs, Volume= 0.305 af, Depth= 1.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr, 24-hr Rainfall=8.13"

Area (sf)	CN	Description
50,551	39	>75% Grass cover, Good, HSG A
13,615	76	Gravel roads, HSG A
1,452	98	Roofs, HSG A
68	98	Unconnected pavement, HSG A
77,052	30	Woods, Good, HSG A
142,738	38	Weighted Average
141,218		98.94% Pervious Area
1,520		1.06% Impervious Area
68		4.47% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	30	0.0430	0.08		**Sheet Flow, First 30 feet of woods** Woods: Light underbrush n= 0.400 P2= 3.25"
2.5	20	0.1700	0.13		**Sheet Flow, Next 20 feet of woods** Woods: Light underbrush n= 0.400 P2= 3.25"
0.2	20	0.1400	1.87		**Shallow Concentrated Flow, Next 20 feet of woods** Woodland Kv= 5.0 fps
0.1	10	0.1000	2.21		**Shallow Concentrated Flow, Next 10 feet of grass** Short Grass Pasture Kv= 7.0 fps
0.0	5	0.0250	2.55		**Shallow Concentrated Flow, Next 5 feet of gravel** Unpaved Kv= 16.1 fps
0.5	35	0.0250	1.11		**Shallow Concentrated Flow, Next 35 feet of grass** Short Grass Pasture Kv= 7.0 fps
0.4	75	0.0400	3.22		**Shallow Concentrated Flow, Next 75 feet of gravel** Unpaved Kv= 16.1 fps
0.2	30	0.3300	2.87		**Shallow Concentrated Flow, Next 30 feet of woods** Woodland Kv= 5.0 fps
1.4	145	0.1250	1.77		**Shallow Concentrated Flow, Next 145 feet of woods** Woodland Kv= 5.0 fps
1.7	80	0.0120	0.77		**Shallow Concentrated Flow, Next 80 feet of grass** Short Grass Pasture Kv= 7.0 fps
2.2	175	0.0360	1.33		**Shallow Concentrated Flow, Next 175 feet of grass** Short Grass Pasture Kv= 7.0 fps
0.1	15	0.2900	3.77		**Shallow Concentrated Flow, Next 15 feet of grass** Short Grass Pasture Kv= 7.0 fps
0.4	25	0.0500	1.12		**Shallow Concentrated Flow, Last 25 feet of woods** Woodland Kv= 5.0 fps
15.7	665	Total			

Summary for Subcatchment EX-3B: EX-3B

Runoff = 2.17 cfs @ 12.09 hrs, Volume= 0.158 af, Depth= 5.98"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr, 24-hr Rainfall=8.13"

Area (ac)	CN	Description
0.070	39	>75% Grass cover, Good, HSG A
0.234	98	Paved parking, HSG A
0.013	30	Woods, Good, HSG A
0.317	82	Weighted Average
0.083		26.23% Pervious Area
0.234		73.77% Impervious Area

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

Summary for Subcatchment EX-4: Subcat EX-4

Runoff = 3.69 cfs @ 12.10 hrs, Volume= 0.274 af, Depth= 2.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr, 24-hr Rainfall=8.13"

Area (ac)	CN	Adj	Description
0.688	39		>75% Grass cover, Good, HSG A
0.211	98		Paved parking, HSG A
0.091	98		Roofs, HSG A
0.044	98		Unconnected pavement, HSG A
0.157	30		Woods, Good, HSG A
1.191	55	54	Weighted Average, UI Adjusted
0.845			70.96% Pervious Area
0.346			29.04% Impervious Area
0.044			12.65% Unconnected

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

Summary for Pond 1P: EX Pond

Inflow Area = 1.225 ac, 15.48% Impervious, Inflow Depth = 1.91" for 100-yr, 24-hr event
Inflow = 2.37 cfs @ 12.10 hrs, Volume= 0.195 af
Outflow = 1.72 cfs @ 12.19 hrs, Volume= 0.189 af, Atten= 28%, Lag= 5.2 min
Primary = 1.72 cfs @ 12.19 hrs, Volume= 0.189 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 179.23' @ 12.19 hrs Surf.Area= 1,070 sf Storage= 1,021 cf

Plug-Flow detention time= 38.2 min calculated for 0.189 af (97% of inflow)
Center-of-Mass det. time= 21.1 min (902.8 - 881.6)

Volume	Invert	Avail.Storage	Storage Description
#1	178.00'	5,867 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
178.00	592	0	0
179.00	973	783	783
180.00	1,389	1,181	1,964
181.00	1,872	1,631	3,594
182.00	2,674	2,273	5,867

Device	Routing	Invert	Outlet Devices
#1	Primary	178.40'	**12.0" Round Culvert** L= 99.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 178.40' / 176.70' S= 0.0172 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Primary	181.40'	**28.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=1.72 cfs @ 12.19 hrs HW=179.23' (Free Discharge)
└**1=Culvert** (Inlet Controls 1.72 cfs @ 2.45 fps)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Link DP-1: Olmsted Road Drainage System

Inflow Area = 6.508 ac, 11.39% Impervious, Inflow Depth = 1.52" for 100-yr, 24-hr event
Inflow = 5.86 cfs @ 12.13 hrs, Volume= 0.824 af
Primary = 5.86 cfs @ 12.13 hrs, Volume= 0.824 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link DP-2: Olmstead Road to Pleasant Street

Inflow Area = 1.947 ac, 0.11% Impervious, Inflow Depth = 1.40" for 100-yr, 24-hr event
Inflow = 2.38 cfs @ 12.11 hrs, Volume= 0.228 af
Primary = 2.38 cfs @ 12.11 hrs, Volume= 0.228 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link DP-3: Intermittent Stream

Inflow Area = 3.594 ac, 7.48% Impervious, Inflow Depth = 1.55" for 100-yr, 24-hr event
Inflow = 2.94 cfs @ 12.26 hrs, Volume= 0.463 af
Primary = 2.94 cfs @ 12.26 hrs, Volume= 0.463 af, Atten= 0%, Lag= 0.0 min

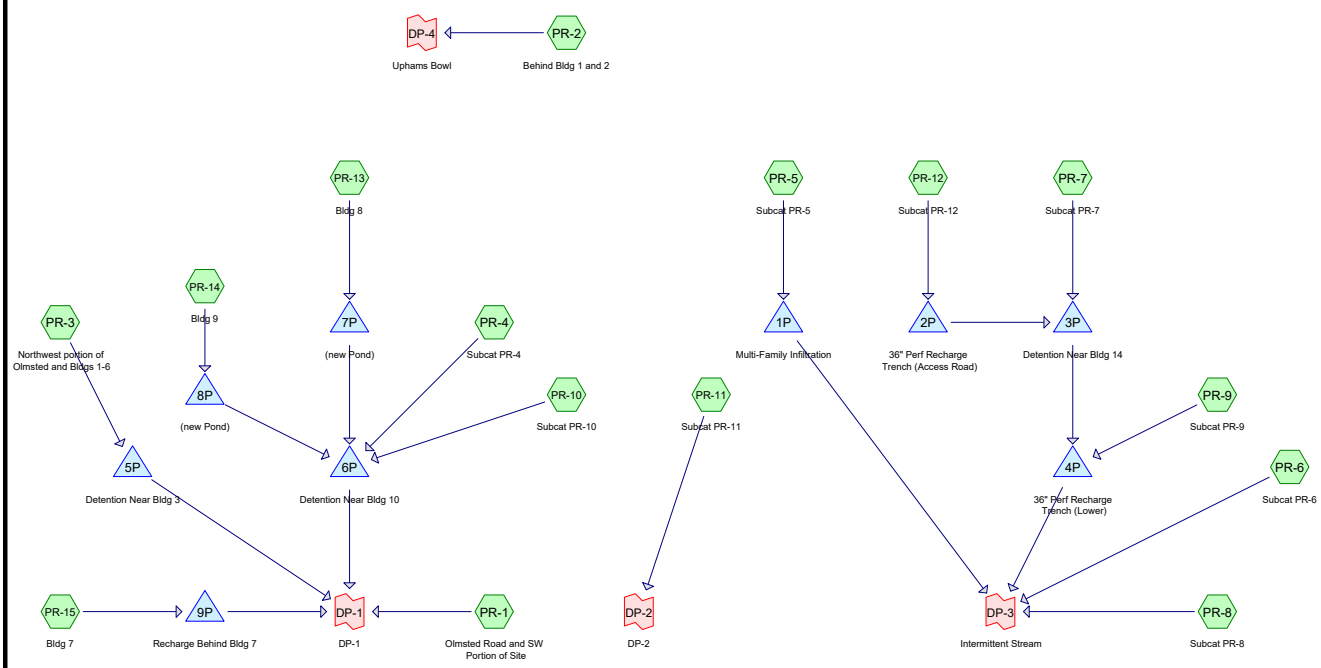
Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link DP-4: Uphams Bowl

Inflow Area = 1.191 ac, 29.04% Impervious, Inflow Depth = 2.76" for 100-yr, 24-hr event
Inflow = 3.69 cfs @ 12.10 hrs, Volume= 0.274 af
Primary = 3.69 cfs @ 12.10 hrs, Volume= 0.274 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

HydroCAD Analysis: Proposed Conditions



Subcat Reach Pond Link

Routing Diagram for 13555.04-PR
Prepared by VHB, Printed 4/29/2021
HydroCAD® 10.10-5a s/n 01038 © 2020 HydroCAD Software Solutions LLC

Summary for Subcatchment PR-1: Olmsted Road and SW Portion of Site

Runoff = 0.04 cfs @ 12.46 hrs, Volume= 748 cf, Depth= 0.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr, 24-hr Rainfall=3.25"

Area (sf)	CN	Adj	Description
33,759	39		>75% Grass cover, Good, HSG A
14,288	98		Paved parking, HSG A
1,045	98		Unconnected pavement, HSG A
15,507	30		Woods, Good, HSG A
64,599	51	50	Weighted Average, UI Adjusted
49,266			76.26% Pervious Area
15,333			23.74% Impervious Area
1,045			6.82% Unconnected

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

Summary for Subcatchment PR-10: Subcat PR-10

Runoff = 0.57 cfs @ 12.09 hrs, Volume= 1,751 cf, Depth= 1.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr, 24-hr Rainfall=3.25"

Area (sf)	CN	Description
2,526	39	>75% Grass cover, Good, HSG A
9,104	98	Roofs, HSG A
44	98	Unconnected pavement, HSG A
11,674	85	Weighted Average
2,526		21.64% Pervious Area
9,148		78.36% Impervious Area
44		0.48% Unconnected

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

Summary for Subcatchment PR-11: Subcat PR-11

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr, 24-hr Rainfall=3.25"

Area (sf)	CN	Adj	Description
15,072	39		>75% Grass cover, Good, HSG A
697	98		Unconnected pavement, HSG A
5,097	30		Woods, Good, HSG A
20,866	39	38	Weighted Average, UI Adjusted
20,169			96.66% Pervious Area
697			3.34% Impervious Area
697			100.00% Unconnected

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

Summary for Subcatchment PR-12: Subcat PR-12

Runoff = 0.51 cfs @ 12.08 hrs, Volume= 1,763 cf, Depth= 3.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr, 24-hr Rainfall=3.25"

Area (ac)	CN	Description
0.161	98	Roofs, HSG A
0.161		100.00% Impervious Area

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

Summary for Subcatchment PR-13: Bldg 8

Runoff = 0.76 cfs @ 12.08 hrs, Volume= 2,651 cf, Depth= 3.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr, 24-hr Rainfall=3.25"

Area (ac)	CN	Description
0.242	98	Roofs, HSG A
0.242		100.00% Impervious Area

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

Summary for Subcatchment PR-14: Bldg 9

Runoff = 0.76 cfs @ 12.08 hrs, Volume= 2,651 cf, Depth= 3.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr, 24-hr Rainfall=3.25"

Area (ac)	CN	Description
0.242	98	Roofs, HSG A
0.242		100.00% Impervious Area

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

Summary for Subcatchment PR-15: Bldg 7

Runoff = 0.29 cfs @ 12.08 hrs, Volume= 1,008 cf, Depth= 3.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr, 24-hr Rainfall=3.25"

Area (ac)	CN	Description
0.092	98	Roofs, HSG A
0.092		100.00% Impervious Area

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

Summary for Subcatchment PR-2: Behind Bldg 1 and 2

Runoff = 0.00 cfs @ 14.94 hrs, Volume= 121 cf, Depth= 0.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr, 24-hr Rainfall=3.25"

Area (sf)	CN	Description
19,297	39	>75% Grass cover, Good, HSG A
1,655	98	Paved parking, HSG A
1,176	98	Roofs, HSG A
479	30	Woods, Good, HSG A
22,607	46	Weighted Average
19,776		87.48% Pervious Area
2,831		12.52% Impervious Area

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

Summary for Subcatchment PR-3: Northwest portion of Olmsted and Bldgs 1-6

Runoff = 3.71 cfs @ 12.10 hrs, Volume= 12,213 cf, Depth= 1.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr, 24-hr Rainfall=3.25"

Area (sf)	CN	Description
54,232	39	>75% Grass cover, Good, HSG A
49,571	98	Paved parking, HSG A
33,018	98	Roofs, HSG A
1,394	98	Unconnected pavement, HSG A
6,186	30	Woods, Good, HSG A
144,401	73	Weighted Average
60,418		41.84% Pervious Area
83,983		58.16% Impervious Area
1,394		1.66% Unconnected

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

Summary for Subcatchment PR-4: Subcat PR-4

Runoff = 2.36 cfs @ 12.10 hrs, Volume= 7,777 cf, Depth= 1.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr, 24-hr Rainfall=3.25"

Area (sf)	CN	Description
38,899	39	>75% Grass cover, Good, HSG A
41,818	98	Paved parking, HSG A
9,104	98	Roofs, HSG A
2,134	98	Unconnected pavement, HSG A
91,955	73	Weighted Average
38,899		42.30% Pervious Area
53,056		57.70% Impervious Area
2,134		4.02% Unconnected

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

Summary for Subcatchment PR-5: Subcat PR-5

Runoff = 4.62 cfs @ 12.09 hrs, Volume= 14,472 cf, Depth= 2.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr, 24-hr Rainfall=3.25"

Area (sf)	CN	Description
10,062	39	>75% Grass cover, Good, HSG A
32,234	98	Paved parking, HSG A
36,111	98	Roofs, HSG A
78,407	90	Weighted Average
10,062		12.83% Pervious Area
68,345		87.17% Impervious Area

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

Summary for Subcatchment PR-6: Subcat PR-6

Runoff = 0.47 cfs @ 12.09 hrs, Volume= 1,484 cf, Depth= 1.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr, 24-hr Rainfall=3.25"

Area (ac)	CN	Description
0.086	39	>75% Grass cover, Good, HSG A
0.208	98	Paved parking, HSG A
0.018	30	Woods, Good, HSG A
0.312	78	Weighted Average
0.104		33.33% Pervious Area
0.208		66.67% Impervious Area

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

Summary for Subcatchment PR-7: Subcat PR-7

Runoff = 1.91 cfs @ 12.09 hrs, Volume= 5,907 cf, Depth= 1.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr, 24-hr Rainfall=3.25"

Area (sf)	CN	Description
11,108	39	>75% Grass cover, Good, HSG A
20,909	98	Paved parking, HSG A
10,149	98	Roofs, HSG A
784	98	Unconnected pavement, HSG A
42,950	83	Weighted Average
11,108		25.86% Pervious Area
31,842		74.14% Impervious Area
784		2.46% Unconnected

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

Summary for Subcatchment PR-8: Subcat PR-8

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr, 24-hr Rainfall=3.25"

Area (ac)	CN	Adj	Description
0.461	39		>75% Grass cover, Good, HSG A
0.004	98		Unconnected pavement, HSG A
0.493	30		Woods, Good, HSG A
0.958	35	34	Weighted Average, UI Adjusted
0.954			99.58% Pervious Area
0.004			0.42% Impervious Area
0.004			100.00% Unconnected

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

Summary for Subcatchment PR-9: Subcat PR-9

Runoff = 0.80 cfs @ 12.08 hrs, Volume= 2,651 cf, Depth= 2.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr, 24-hr Rainfall=3.25"

Area (ac)	CN	Description
0.011	39	>75% Grass cover, Good, HSG A
0.249	98	Roofs, HSG A
0.001	98	Unconnected pavement, HSG A
0.261	96	Weighted Average
0.011		4.21% Pervious Area
0.250		95.79% Impervious Area
0.001		0.40% Unconnected

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

Summary for Pond 1P: Multi-Family Infiltration

Inflow Area = 78,407 sf, 87.17% Impervious, Inflow Depth = 2.21" for 2-yr, 24-hr event
Inflow = 4.62 cfs @ 12.09 hrs, Volume= 14,472 cf
Outflow = 0.14 cfs @ 16.06 hrs, Volume= 7,047 cf, Atten= 97%, Lag= 238.6 min
Discarded = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.14 cfs @ 16.06 hrs, Volume= 7,047 cf

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs

Peak Elev= 194.85' @ 16.06 hrs Surf.Area= 4,095 sf Storage= 10,593 cf

Plug-Flow detention time= 560.0 min calculated for 7,047 cf (49% of inflow)
Center-of-Mass det. time= 446.5 min (1,252.8 - 806.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	191.50'	0 cf	**38.75'W x 105.69'L x 10.00'H Field A** 40,954 cf Overall - 40,954 cf Embedded = 0 cf x 40.0% Voids
#2A	191.50'	33,413 cf	**StormTrap ST2 DoubleTrap 9-0**x 18 Inside #1 Inside= 101.7"W x 108.0"H => 70.76 sf x 15.40'L = 1,089.5 cf Outside= 101.7"W x 120.0"H => 84.79 sf x 15.40'L = 1,305.4 cf 18 Chambers in 3 Rows 25.44' x 92.38' Core + 6.66' Border = 38.75' x 105.69' System
		33,413 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 4	200.25'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#2	Device 3	194.00'	**2.5" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	191.50'	**12.0" Round Culvert** L= 50.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 191.50' / 191.00' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#4	Discarded	191.50'	**1.020 in/hr Exfiltration X 0.50 over Surface area** Conductivity to Groundwater Elevation = 187.00'

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=191.50' (Free Discharge)
↑—**4=Exfiltration** (Passes 0.00 cfs of 0.05 cfs potential flow)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Primary OutFlow Max=0.14 cfs @ 16.06 hrs HW=194.85' (Free Discharge)
↑—**3=Culvert** (Passes 0.14 cfs of 5.04 cfs potential flow)
↑—**2=Orifice/Grate** (Orifice Controls 0.14 cfs @ 4.17 fps)

Summary for Pond 2P: 36" Perf Recharge Trench (Access Road)

Inflow Area = 7,013 sf,100.00% Impervious, Inflow Depth = 3.02" for 2-yr, 24-hr event
Inflow = 0.51 cfs @ 12.08 hrs, Volume= 1,763 cf
Outflow = 0.02 cfs @ 14.36 hrs, Volume= 1,763 cf, Atten= 95%, Lag= 136.5 min
Discarded = 0.02 cfs @ 14.36 hrs, Volume= 1,763 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Peak Elev= 179.99' @ 14.36 hrs Surf.Area= 865 sf Storage= 857 cf

Plug-Flow detention time= 316.0 min calculated for 1,763 cf (100% of inflow)
Center-of-Mass det. time= 316.0 min (1,072.1 - 756.1)

Volume	Invert	Avail.Storage	Storage Description
#1	178.00'	1,334 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 4,325 cf Overall - 990 cf Embedded = 3,335 cf x 40.0% Voids
#2	179.00'	990 cf	**36.0" Round Pipe Storage** Inside #1 L= 140.0'
		2,324 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
178.00	865	0	0
183.00	865	4,325	4,325

Device	Routing	Invert	Outlet Devices
#1	Device 3	181.75'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#2	Device 3	180.00'	**4.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	179.00'	**15.0" Round Culvert** L= 50.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 179.00' / 178.50' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#4	Discarded	178.00'	**1.020 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 167.00' Phase-In= 0.01'

Discarded OutFlow Max=0.02 cfs @ 14.36 hrs HW=179.99' (Free Discharge)
└**4=Exfiltration** (Controls 0.02 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=178.00' (Free Discharge)
└**3=Culvert** (Controls 0.00 cfs)
  ├**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
  └**2=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond 3P: Detention Near Bldg 14

Inflow Area = 49,963 sf, 77.77% Impervious, Inflow Depth = 1.42" for 2-yr, 24-hr event
Inflow = 1.91 cfs @ 12.09 hrs, Volume= 5,907 cf
Outflow = 0.31 cfs @ 12.60 hrs, Volume= 5,043 cf, Atten= 84%, Lag= 30.3 min
Primary = 0.31 cfs @ 12.60 hrs, Volume= 5,043 cf

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 171.83' @ 12.60 hrs Surf.Area= 1,632 sf Storage= 1,937 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= (not calculated: outflow precedes inflow)

Volume	Invert	Avail.Storage	Storage Description
#1A	170.00'	0 cf	**21.79'W x 74.90'L x 10.50'H Field A** 17,137 cf Overall - 17,137 cf Embedded = 0 cf x 40.0% Voids
#2A	170.00'	13,881 cf	**StormTrap ST2 DoubleTrap 9-6** x 4 Inside #1 Inside= 101.7"W x 114.0"H => 74.82 sf x 15.40'L = 1,152.0 cf Outside= 101.7"W x 126.0"H => 89.03 sf x 15.40'L = 1,370.7 cf

8.48' x 61.58' Core + 6.66' Border = 21.79' x 74.90' System

13,881 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	170.00'	**3.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.31 cfs @ 12.60 hrs HW=171.83' (Free Discharge)
↑—**1=Orifice/Grate** (Orifice Controls 0.31 cfs @ 6.28 fps)

Summary for Pond 4P: 36" Perf Recharge Trench (Lower)

Inflow Area = 61,332 sf, 81.11% Impervious, Inflow Depth = 1.51" for 2-yr, 24-hr event
Inflow = 1.03 cfs @ 12.09 hrs, Volume= 7,695 cf
Outflow = 0.16 cfs @ 17.05 hrs, Volume= 7,695 cf, Atten= 84%, Lag= 297.7 min
Discarded = 0.16 cfs @ 17.05 hrs, Volume= 7,695 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Peak Elev= 171.38' @ 17.05 hrs Surf.Area= 3,100 sf Storage= 3,946 cf

Plug-Flow detention time= 261.8 min calculated for 7,695 cf (100% of inflow)
Center-of-Mass det. time= 261.8 min (1,072.8 - 811.0)

Volume	Invert	Avail.Storage	Storage Description
#1	169.00'	4,110 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 13,950 cf Overall - 3,676 cf Embedded = 10,274 cf x 40.0% Voids
#2	170.00'	3,676 cf	**36.0" Round CMP_Round 36"** x 2 Inside #1 L= 260.0'
		7,785 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
169.00	3,100	0	0
173.50	3,100	13,950	13,950

Device	Routing	Invert	Outlet Devices
#1	Discarded	169.00'	**1.020 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 167.00'
#2	Device 3	172.75'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Primary	170.00'	**18.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 170.00' / 169.80' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Discarded OutFlow Max=0.16 cfs @ 17.05 hrs HW=171.38' (Free Discharge)
└**1=Exfiltration** (Controls 0.16 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=169.00' (Free Discharge)
└**3=Culvert** (Controls 0.00 cfs)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 5P: Detention Near Bldg 3

Inflow Area = 144,401 sf, 58.16% Impervious, Inflow Depth = 1.01" for 2-yr, 24-hr event
Inflow = 3.71 cfs @ 12.10 hrs, Volume= 12,213 cf
Outflow = 0.46 cfs @ 13.00 hrs, Volume= 12,452 cf, Atten= 87%, Lag= 54.5 min
Primary = 0.46 cfs @ 13.00 hrs, Volume= 12,452 cf

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 166.22' @ 13.00 hrs Surf.Area= 2,810 sf Storage= 4,294 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 104.6 min (969.0 - 864.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	164.00'	0 cf	**47.23'W x 59.50'L x 14.00'H Field A** 39,342 cf Overall - 39,342 cf Embedded = 0 cf x 40.0% Voids
#2A	164.00'	32,397 cf	**StormTrap ST2 DoubleTrap 13-0**x 12 Inside #1 Inside= 101.7"W x 156.0"H => 101.45 sf x 15.40'L = 1,561.9 cf Outside= 101.7"W x 168.0"H => 118.71 sf x 15.40'L = 1,827.6 cf 12 Chambers in 4 Rows 33.92' x 46.19' Core + 6.66' Border = 47.23' x 59.50' System
		32,397 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	164.00'	**3.5" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.46 cfs @ 13.00 hrs HW=166.22' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 0.46 cfs @ 6.94 fps)

Summary for Pond 6P: Detention Near Bldg 10

Inflow Area = 124,712 sf, 66.78% Impervious, Inflow Depth = 0.95" for 2-yr, 24-hr event
Inflow = 2.93 cfs @ 12.09 hrs, Volume= 9,918 cf
Outflow = 0.27 cfs @ 13.91 hrs, Volume= 9,918 cf, Atten= 91%, Lag= 109.2 min
Primary = 0.27 cfs @ 13.91 hrs, Volume= 9,918 cf

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Peak Elev= 146.42' @ 13.91 hrs Surf.Area= 3,537 sf Storage= 4,583 cf

Plug-Flow detention time= 242.8 min calculated for 9,918 cf (100% of inflow)
Center-of-Mass det. time= 242.8 min (1,097.3 - 854.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	144.50'	0 cf	**47.23'W x 74.90'L x 11.00'H Field A** 38,910 cf Overall - 38,910 cf Embedded = 0 cf x 40.0% Voids
#2A	144.50'	32,186 cf	**StormTrap ST2 DoubleTrap 10-0**x 16 Inside #1 Inside= 101.7"W x 120.0"H => 78.88 sf x 15.40'L = 1,214.5 cf Outside= 101.7"W x 132.0"H => 93.27 sf x 15.40'L = 1,436.0 cf 16 Chambers in 4 Rows 33.92' x 61.58' Core + 6.66' Border = 47.23' x 74.90' System
		32,186 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 3	155.00'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#2	Device 3	145.00'	**3.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	145.00'	**12.0" Round Culvert** L= 50.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 145.00' / 144.50' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.27 cfs @ 13.91 hrs HW=146.42' (Free Discharge)
↑**3=Culvert** (Passes 0.27 cfs of 2.87 cfs potential flow)
↑**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
2=Orifice/Grate (Orifice Controls 0.27 cfs @ 5.49 fps)

Summary for Pond 7P: (new Pond)

Inflow Area = 10,542 sf,100.00% Impervious, Inflow Depth = 3.02" for 2-yr, 24-hr event
Inflow = 0.76 cfs @ 12.08 hrs, Volume= 2,651 cf
Outflow = 0.19 cfs @ 12.45 hrs, Volume= 2,651 cf, Atten= 75%, Lag= 22.2 min
Discarded = 0.03 cfs @ 12.45 hrs, Volume= 2,389 cf
Primary = 0.16 cfs @ 12.45 hrs, Volume= 262 cf

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Peak Elev= 167.56' @ 12.45 hrs Surf.Area= 929 sf Storage= 1,157 cf

Plug-Flow detention time= 299.0 min calculated for 2,651 cf (100% of inflow)
Center-of-Mass det. time= 299.0 min (1,055.1 - 756.1)

Volume	Invert	Avail.Storage	Storage Description
#1	165.00'	1,322 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 3,716 cf Overall - 412 cf Embedded = 3,304 cf x 40.0% Voids
#2	166.00'	412 cf	**24.0" Round CMP_Round 24"** Inside #1 L= 131.0'
		1,733 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
165.00	929	0	0
169.00	929	3,716	3,716

Device	Routing	Invert	Outlet Devices
#1	Primary	167.50'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#2	Discarded	165.00'	**1.020 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 160.00'

Discarded OutFlow Max=0.03 cfs @ 12.45 hrs HW=167.56' (Free Discharge)
↑—**2=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=0.16 cfs @ 12.45 hrs HW=167.56' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 0.16 cfs @ 0.67 fps)

Summary for Pond 8P: (new Pond)

Inflow Area = 10,542 sf, 100.00% Impervious, Inflow Depth = 3.02" for 2-yr, 24-hr event
Inflow = 0.76 cfs @ 12.08 hrs, Volume= 2,651 cf
Outflow = 0.06 cfs @ 13.12 hrs, Volume= 2,651 cf, Atten= 92%, Lag= 62.1 min
Discarded = 0.03 cfs @ 13.12 hrs, Volume= 2,523 cf
Primary = 0.03 cfs @ 13.12 hrs, Volume= 127 cf

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Peak Elev= 171.58' @ 13.12 hrs Surf.Area= 1,035 sf Storage= 1,291 cf

Plug-Flow detention time= 356.5 min calculated for 2,651 cf (100% of inflow)
Center-of-Mass det. time= 356.5 min (1,112.6 - 756.1)

Volume	Invert	Avail.Storage	Storage Description
#1	169.00'	1,480 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 4,140 cf Overall - 440 cf Embedded = 3,700 cf x 40.0% Voids
#2	170.00'	440 cf	**24.0" Round Pipe Storage** Inside #1 L= 140.0'
		1,920 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
169.00	1,035	0	0
173.00	1,035	4,140	4,140

Device	Routing	Invert	Outlet Devices
#1	Primary	171.50'	**15.0" Round Culvert** L= 50.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 171.50' / 170.50' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Discarded	169.00'	**1.020 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 160.00'

Discarded OutFlow Max=0.03 cfs @ 13.12 hrs HW=171.58' (Free Discharge)
└**2=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=0.02 cfs @ 13.12 hrs HW=171.58' (Free Discharge)
└**1=Culvert** (Inlet Controls 0.02 cfs @ 0.76 fps)

Summary for Pond 9P: Recharge Behind Bldg 7

Inflow Area = 4,008 sf,100.00% Impervious, Inflow Depth = 3.02" for 2-yr, 24-hr event
Inflow = 0.29 cfs @ 12.08 hrs, Volume= 1,008 cf
Outflow = 0.03 cfs @ 12.97 hrs, Volume= 1,008 cf, Atten= 91%, Lag= 53.3 min
Discarded = 0.03 cfs @ 12.97 hrs, Volume= 1,008 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Peak Elev= 167.04' @ 12.97 hrs Surf.Area= 910 sf Storage= 379 cf

Plug-Flow detention time= 117.3 min calculated for 1,008 cf (100% of inflow)
Center-of-Mass det. time= 117.2 min (873.3 - 756.1)

Volume	Invert	Avail.Storage	Storage Description
#1	166.00'	1,293 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 3,640 cf Overall - 408 cf Embedded = 3,232 cf x 40.0% Voids
#2	167.00'	408 cf	**24.0" Round Pipe Storage** Inside #1 L= 130.0'
		1,701 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
166.00	910	0	0
170.00	910	3,640	3,640

Device	Routing	Invert	Outlet Devices
#1	Primary	168.50'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#2	Discarded	166.00'	**1.020 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 160.00' Phase-In= 0.01'

Discarded OutFlow Max=0.03 cfs @ 12.97 hrs HW=167.04' (Free Discharge)
└**2=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=166.00' (Free Discharge)
└**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Link DP-1: DP-1

Inflow Area = 337,720 sf, 55.26% Impervious, Inflow Depth = 0.82" for 2-yr, 24-hr event
Inflow = 0.76 cfs @ 13.34 hrs, Volume= 23,118 cf
Primary = 0.76 cfs @ 13.34 hrs, Volume= 23,118 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs

Summary for Link DP-2: DP-2

Inflow Area = 20,866 sf, 3.34% Impervious, Inflow Depth = 0.00" for 2-yr, 24-hr event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs

Summary for Link DP-3: Intermittent Stream

Inflow Area = 195,061 sf, 65.27% Impervious, Inflow Depth = 0.52" for 2-yr, 24-hr event
Inflow = 0.47 cfs @ 12.09 hrs, Volume= 8,531 cf
Primary = 0.47 cfs @ 12.09 hrs, Volume= 8,531 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs

Summary for Link DP-4: Uphams Bowl

Inflow Area = 22,607 sf, 12.52% Impervious, Inflow Depth = 0.06" for 2-yr, 24-hr event
Inflow = 0.00 cfs @ 14.94 hrs, Volume= 121 cf
Primary = 0.00 cfs @ 14.94 hrs, Volume= 121 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs

Summary for Subcatchment PR-1: Olmsted Road and SW Portion of Site

Runoff = 0.85 cfs @ 12.12 hrs, Volume= 4,039 cf, Depth= 0.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr, 24-hr Rainfall=5.14"

Area (sf)	CN	Adj	Description
33,759	39		>75% Grass cover, Good, HSG A
14,288	98		Paved parking, HSG A
1,045	98		Unconnected pavement, HSG A
15,507	30		Woods, Good, HSG A
64,599	51	50	Weighted Average, UI Adjusted
49,266			76.26% Pervious Area
15,333			23.74% Impervious Area
1,045			6.82% Unconnected

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

Summary for Subcatchment PR-10: Subcat PR-10

Runoff = 1.09 cfs @ 12.09 hrs, Volume= 3,403 cf, Depth= 3.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr, 24-hr Rainfall=5.14"

Area (sf)	CN	Description
2,526	39	>75% Grass cover, Good, HSG A
9,104	98	Roofs, HSG A
44	98	Unconnected pavement, HSG A
11,674	85	Weighted Average
2,526		21.64% Pervious Area
9,148		78.36% Impervious Area
44		0.48% Unconnected

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

Summary for Subcatchment PR-11: Subcat PR-11

Runoff = 0.02 cfs @ 12.49 hrs, Volume= 337 cf, Depth= 0.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr, 24-hr Rainfall=5.14"

Area (sf)	CN	Adj	Description
15,072	39		>75% Grass cover, Good, HSG A
697	98		Unconnected pavement, HSG A
5,097	30		Woods, Good, HSG A
20,866	39	38	Weighted Average, UI Adjusted
20,169			96.66% Pervious Area
697			3.34% Impervious Area
697			100.00% Unconnected

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

Summary for Subcatchment PR-12: Subcat PR-12

Runoff = 0.81 cfs @ 12.08 hrs, Volume= 2,865 cf, Depth= 4.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr, 24-hr Rainfall=5.14"

Area (ac)	CN	Description
0.161	98	Roofs, HSG A
0.161		100.00% Impervious Area

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

Summary for Subcatchment PR-13: Bldg 8

Runoff = 1.22 cfs @ 12.08 hrs, Volume= 4,307 cf, Depth= 4.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr, 24-hr Rainfall=5.14"

Area (ac)	CN	Description
0.242	98	Roofs, HSG A
0.242		100.00% Impervious Area

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

Summary for Subcatchment PR-14: Bldg 9

Runoff = 1.22 cfs @ 12.08 hrs, Volume= 4,307 cf, Depth= 4.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr, 24-hr Rainfall=5.14"

Area (ac)	CN	Description
0.242	98	Roofs, HSG A
0.242		100.00% Impervious Area

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

Summary for Subcatchment PR-15: Bldg 7

Runoff = 0.46 cfs @ 12.08 hrs, Volume= 1,637 cf, Depth= 4.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr, 24-hr Rainfall=5.14"

Area (ac)	CN	Description
0.092	98	Roofs, HSG A
0.092		100.00% Impervious Area

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

Summary for Subcatchment PR-2: Behind Bldg 1 and 2

Runoff = 0.14 cfs @ 12.15 hrs, Volume= 1,011 cf, Depth= 0.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr, 24-hr Rainfall=5.14"

Area (sf)	CN	Description
19,297	39	>75% Grass cover, Good, HSG A
1,655	98	Paved parking, HSG A
1,176	98	Roofs, HSG A
479	30	Woods, Good, HSG A
22,607	46	Weighted Average
19,776		87.48% Pervious Area
2,831		12.52% Impervious Area

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

Summary for Subcatchment PR-3: Northwest portion of Olmsted and Bldgs 1-6

Runoff = 9.24 cfs @ 12.09 hrs, Volume= 28,769 cf, Depth= 2.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr, 24-hr Rainfall=5.14"

Area (sf)	CN	Description
54,232	39	>75% Grass cover, Good, HSG A
49,571	98	Paved parking, HSG A
33,018	98	Roofs, HSG A
1,394	98	Unconnected pavement, HSG A
6,186	30	Woods, Good, HSG A
144,401	73	Weighted Average
60,418		41.84% Pervious Area
83,983		58.16% Impervious Area
1,394		1.66% Unconnected

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

Summary for Subcatchment PR-4: Subcat PR-4

Runoff = 5.89 cfs @ 12.09 hrs, Volume= 18,320 cf, Depth= 2.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr, 24-hr Rainfall=5.14"

Area (sf)	CN	Description
38,899	39	>75% Grass cover, Good, HSG A
41,818	98	Paved parking, HSG A
9,104	98	Roofs, HSG A
2,134	98	Unconnected pavement, HSG A
91,955	73	Weighted Average
38,899		42.30% Pervious Area
53,056		57.70% Impervious Area
2,134		4.02% Unconnected

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

Summary for Subcatchment PR-5: Subcat PR-5

Runoff = 8.15 cfs @ 12.09 hrs, Volume= 26,210 cf, Depth= 4.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr, 24-hr Rainfall=5.14"

Area (sf)	CN	Description
10,062	39	>75% Grass cover, Good, HSG A
32,234	98	Paved parking, HSG A
36,111	98	Roofs, HSG A
78,407	90	Weighted Average
10,062		12.83% Pervious Area
68,345		87.17% Impervious Area

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

Summary for Subcatchment PR-6: Subcat PR-6

Runoff = 1.04 cfs @ 12.09 hrs, Volume= 3,206 cf, Depth= 2.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr, 24-hr Rainfall=5.14"

Area (ac)	CN	Description
0.086	39	>75% Grass cover, Good, HSG A
0.208	98	Paved parking, HSG A
0.018	30	Woods, Good, HSG A
0.312	78	Weighted Average
0.104		33.33% Pervious Area
0.208		66.67% Impervious Area

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

Summary for Subcatchment PR-7: Subcat PR-7

Runoff = 3.80 cfs @ 12.09 hrs, Volume= 11,815 cf, Depth= 3.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr, 24-hr Rainfall=5.14"

Area (sf)	CN	Description
11,108	39	>75% Grass cover, Good, HSG A
20,909	98	Paved parking, HSG A
10,149	98	Roofs, HSG A
784	98	Unconnected pavement, HSG A
42,950	83	Weighted Average
11,108		25.86% Pervious Area
31,842		74.14% Impervious Area
784		2.46% Unconnected

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

Summary for Subcatchment PR-8: Subcat PR-8

Runoff = 0.01 cfs @ 15.26 hrs, Volume= 266 cf, Depth= 0.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr, 24-hr Rainfall=5.14"

Area (ac)	CN	Adj	Description
0.461	39		>75% Grass cover, Good, HSG A
0.004	98		Unconnected pavement, HSG A
0.493	30		Woods, Good, HSG A
0.958	35	34	Weighted Average, UI Adjusted
0.954			99.58% Pervious Area
0.004			0.42% Impervious Area
0.004			100.00% Unconnected

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

Summary for Subcatchment PR-9: Subcat PR-9

Runoff = 1.29 cfs @ 12.08 hrs, Volume= 4,426 cf, Depth= 4.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr, 24-hr Rainfall=5.14"

Area (ac)	CN	Description
0.011	39	>75% Grass cover, Good, HSG A
0.249	98	Roofs, HSG A
0.001	98	Unconnected pavement, HSG A
0.261	96	Weighted Average
0.011		4.21% Pervious Area
0.250		95.79% Impervious Area
0.001		0.40% Unconnected

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

Summary for Pond 1P: Multi-Family Infiltration

Inflow Area = 78,407 sf, 87.17% Impervious, Inflow Depth = 4.01" for 10-yr, 24-hr event
Inflow = 8.15 cfs @ 12.09 hrs, Volume= 26,210 cf
Outflow = 0.28 cfs @ 15.62 hrs, Volume= 18,785 cf, Atten= 97%, Lag= 211.9 min
Discarded = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.28 cfs @ 15.62 hrs, Volume= 18,785 cf

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs

Peak Elev= 197.04' @ 15.62 hrs Surf.Area= 4,095 sf Storage= 18,701 cf

Plug-Flow detention time= 684.4 min calculated for 18,785 cf (72% of inflow)
Center-of-Mass det. time= 594.6 min (1,384.4 - 789.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	191.50'	0 cf	**38.75'W x 105.69'L x 10.00'H Field A** 40,954 cf Overall - 40,954 cf Embedded = 0 cf x 40.0% Voids
#2A	191.50'	33,413 cf	**StormTrap ST2 DoubleTrap 9-0**x 18 Inside #1 Inside= 101.7"W x 108.0"H => 70.76 sf x 15.40'L = 1,089.5 cf Outside= 101.7"W x 120.0"H => 84.79 sf x 15.40'L = 1,305.4 cf 18 Chambers in 3 Rows 25.44' x 92.38' Core + 6.66' Border = 38.75' x 105.69' System
		33,413 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 4	200.25'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#2	Device 3	194.00'	**2.5" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	191.50'	**12.0" Round Culvert** L= 50.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 191.50' / 191.00' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#4	Discarded	191.50'	**1.020 in/hr Exfiltration X 0.50 over Surface area** Conductivity to Groundwater Elevation = 187.00'

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=191.50' (Free Discharge)
↑—**4=Exfiltration** (Passes 0.00 cfs of 0.05 cfs potential flow)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Primary OutFlow Max=0.28 cfs @ 15.62 hrs HW=197.04' (Free Discharge)
↑—**3=Culvert** (Passes 0.28 cfs of 6.70 cfs potential flow)
↑—**2=Orifice/Grate** (Orifice Controls 0.28 cfs @ 8.25 fps)

Summary for Pond 2P: 36" Perf Recharge Trench (Access Road)

Inflow Area = 7,013 sf,100.00% Impervious, Inflow Depth = 4.90" for 10-yr, 24-hr event
Inflow = 0.81 cfs @ 12.08 hrs, Volume= 2,865 cf
Outflow = 0.24 cfs @ 12.39 hrs, Volume= 2,865 cf, Atten= 70%, Lag= 18.7 min
Discarded = 0.02 cfs @ 12.39 hrs, Volume= 2,092 cf
Primary = 0.22 cfs @ 12.39 hrs, Volume= 774 cf

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Peak Elev= 180.44' @ 12.39 hrs Surf.Area= 865 sf Storage= 1,126 cf

Plug-Flow detention time= 253.2 min calculated for 2,865 cf (100% of inflow)
Center-of-Mass det. time= 253.2 min (1,000.8 - 747.6)

Volume	Invert	Avail.Storage	Storage Description
#1	178.00'	1,334 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 4,325 cf Overall - 990 cf Embedded = 3,335 cf x 40.0% Voids
#2	179.00'	990 cf	**36.0" Round Pipe Storage** Inside #1 L= 140.0'
		2,324 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
178.00	865	0	0
183.00	865	4,325	4,325

Device	Routing	Invert	Outlet Devices
#1	Device 3	181.75'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#2	Device 3	180.00'	**4.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	179.00'	**15.0" Round Culvert** L= 50.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 179.00' / 178.50' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#4	Discarded	178.00'	**1.020 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 167.00' Phase-In= 0.01'

Discarded OutFlow Max=0.02 cfs @ 12.39 hrs HW=180.44' (Free Discharge)
└**4=Exfiltration** (Controls 0.02 cfs)

Primary OutFlow Max=0.22 cfs @ 12.39 hrs HW=180.44' (Free Discharge)
└**3=Culvert** (Passes 0.22 cfs of 4.21 cfs potential flow)
  ├**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
  └**2=Orifice/Grate** (Orifice Controls 0.22 cfs @ 2.51 fps)

Summary for Pond 3P: Detention Near Bldg 14

Inflow Area = 49,963 sf, 77.77% Impervious, Inflow Depth = 3.02" for 10-yr, 24-hr event
Inflow = 3.80 cfs @ 12.09 hrs, Volume= 12,589 cf
Outflow = 0.46 cfs @ 12.95 hrs, Volume= 13,167 cf, Atten= 88%, Lag= 52.0 min
Primary = 0.46 cfs @ 12.95 hrs, Volume= 13,167 cf

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 173.99' @ 12.95 hrs Surf.Area= 1,632 sf Storage= 5,096 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 129.4 min (939.8 - 810.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	170.00'	0 cf	**21.79'W x 74.90'L x 10.50'H Field A** 17,137 cf Overall - 17,137 cf Embedded = 0 cf x 40.0% Voids
#2A	170.00'	13,881 cf	**StormTrap ST2 DoubleTrap 9-6** x 4 Inside #1 Inside= 101.7"W x 114.0"H => 74.82 sf x 15.40'L = 1,152.0 cf Outside= 101.7"W x 126.0"H => 89.03 sf x 15.40'L = 1,370.7 cf

8.48' x 61.58' Core + 6.66' Border = 21.79' x 74.90' System

13,881 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	170.00'	**3.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.46 cfs @ 12.95 hrs HW=173.99' (Free Discharge)
↑—**1=Orifice/Grate** (Orifice Controls 0.46 cfs @ 9.46 fps)

Summary for Pond 4P: 36" Perf Recharge Trench (Lower)

Inflow Area = 61,332 sf, 81.11% Impervious, Inflow Depth = 3.44" for 10-yr, 24-hr event
Inflow = 1.62 cfs @ 12.09 hrs, Volume= 17,593 cf
Outflow = 0.43 cfs @ 15.64 hrs, Volume= 17,593 cf, Atten= 74%, Lag= 213.1 min
Discarded = 0.21 cfs @ 15.64 hrs, Volume= 15,694 cf
Primary = 0.21 cfs @ 15.64 hrs, Volume= 1,898 cf

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Peak Elev= 172.82' @ 15.64 hrs Surf.Area= 3,100 sf Storage= 6,890 cf

Plug-Flow detention time= 356.8 min calculated for 17,591 cf (100% of inflow)
Center-of-Mass det. time= 356.9 min (1,251.9 - 895.0)

Volume	Invert	Avail.Storage	Storage Description
#1	169.00'	4,110 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 13,950 cf Overall - 3,676 cf Embedded = 10,274 cf x 40.0% Voids
#2	170.00'	3,676 cf	**36.0" Round CMP_Round 36"** x 2 Inside #1 L= 260.0'
		7,785 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
169.00	3,100	0	0
173.50	3,100	13,950	13,950

Device	Routing	Invert	Outlet Devices
#1	Discarded	169.00'	**1.020 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 167.00'
#2	Device 3	172.75'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Primary	170.00'	**18.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 170.00' / 169.80' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Discarded OutFlow Max=0.21 cfs @ 15.64 hrs HW=172.82' (Free Discharge)
└**1=Exfiltration** (Controls 0.21 cfs)

Primary OutFlow Max=0.21 cfs @ 15.64 hrs HW=172.82' (Free Discharge)
└**3=Culvert** (Passes 0.21 cfs of 9.67 cfs potential flow)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 0.21 cfs @ 0.75 fps)

Summary for Pond 5P: Detention Near Bldg 3

Inflow Area = 144,401 sf, 58.16% Impervious, Inflow Depth = 2.39" for 10-yr, 24-hr event
Inflow = 9.24 cfs @ 12.09 hrs, Volume= 28,769 cf
Outflow = 0.76 cfs @ 13.58 hrs, Volume= 28,768 cf, Atten= 92%, Lag= 89.3 min
Primary = 0.76 cfs @ 13.58 hrs, Volume= 28,768 cf

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 169.70' @ 13.58 hrs Surf.Area= 2,810 sf Storage= 12,947 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 202.9 min (1,041.5 - 838.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	164.00'	0 cf	**47.23'W x 59.50'L x 14.00'H Field A** 39,342 cf Overall - 39,342 cf Embedded = 0 cf x 40.0% Voids
#2A	164.00'	32,397 cf	**StormTrap ST2 DoubleTrap 13-0** x 12 Inside #1 Inside= 101.7"W x 156.0"H => 101.45 sf x 15.40'L = 1,561.9 cf Outside= 101.7"W x 168.0"H => 118.71 sf x 15.40'L = 1,827.6 cf 12 Chambers in 4 Rows 33.92' x 46.19' Core + 6.66' Border = 47.23' x 59.50' System
		32,397 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	164.00'	**3.5" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.76 cfs @ 13.58 hrs HW=169.70' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 0.76 cfs @ 11.34 fps)

Summary for Pond 6P: Detention Near Bldg 10

Inflow Area = 124,712 sf, 66.78% Impervious, Inflow Depth = 2.37" for 10-yr, 24-hr event
Inflow = 8.29 cfs @ 12.10 hrs, Volume= 24,619 cf
Outflow = 0.48 cfs @ 14.36 hrs, Volume= 24,619 cf, Atten= 94%, Lag= 135.2 min
Primary = 0.48 cfs @ 14.36 hrs, Volume= 24,619 cf

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Peak Elev= 149.32' @ 14.36 hrs Surf.Area= 3,537 sf Storage= 13,893 cf

Plug-Flow detention time= 376.8 min calculated for 24,616 cf (100% of inflow)
Center-of-Mass det. time= 377.1 min (1,202.5 - 825.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	144.50'	0 cf	**47.23'W x 74.90'L x 11.00'H Field A** 38,910 cf Overall - 38,910 cf Embedded = 0 cf x 40.0% Voids
#2A	144.50'	32,186 cf	**StormTrap ST2 DoubleTrap 10-0**x 16 Inside #1 Inside= 101.7"W x 120.0"H => 78.88 sf x 15.40'L = 1,214.5 cf Outside= 101.7"W x 132.0"H => 93.27 sf x 15.40'L = 1,436.0 cf 16 Chambers in 4 Rows 33.92' x 61.58' Core + 6.66' Border = 47.23' x 74.90' System
		32,186 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 3	155.00'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#2	Device 3	145.00'	**3.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	145.00'	**12.0" Round Culvert** L= 50.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 145.00' / 144.50' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.48 cfs @ 14.36 hrs HW=149.32' (Free Discharge)
└**3=Culvert** (Passes 0.48 cfs of 5.83 cfs potential flow)
  ├**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
  └**2=Orifice/Grate** (Orifice Controls 0.48 cfs @ 9.86 fps)

Summary for Pond 7P: (new Pond)

Inflow Area = 10,542 sf,100.00% Impervious, Inflow Depth = 4.90" for 10-yr, 24-hr event
Inflow = 1.22 cfs @ 12.08 hrs, Volume= 4,307 cf
Outflow = 1.17 cfs @ 12.11 hrs, Volume= 4,307 cf, Atten= 4%, Lag= 1.5 min
Discarded = 0.03 cfs @ 12.11 hrs, Volume= 2,793 cf
Primary = 1.13 cfs @ 12.11 hrs, Volume= 1,514 cf

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Peak Elev= 167.72' @ 12.11 hrs Surf.Area= 929 sf Storage= 1,235 cf

Plug-Flow detention time= 225.6 min calculated for 4,307 cf (100% of inflow)
Center-of-Mass det. time= 225.7 min (973.2 - 747.6)

Volume	Invert	Avail.Storage	Storage Description
#1	165.00'	1,322 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 3,716 cf Overall - 412 cf Embedded = 3,304 cf x 40.0% Voids
#2	166.00'	412 cf	**24.0" Round CMP_Round 24"** Inside #1 L= 131.0'
		1,733 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
165.00	929	0	0
169.00	929	3,716	3,716

Device	Routing	Invert	Outlet Devices
#1	Primary	167.50'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#2	Discarded	165.00'	**1.020 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 160.00'

Discarded OutFlow Max=0.03 cfs @ 12.11 hrs HW=167.72' (Free Discharge)
↑—**2=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=1.13 cfs @ 12.11 hrs HW=167.72' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 1.13 cfs @ 1.31 fps)

Summary for Pond 8P: (new Pond)

Inflow Area = 10,542 sf, 100.00% Impervious, Inflow Depth = 4.90" for 10-yr, 24-hr event
Inflow = 1.22 cfs @ 12.08 hrs, Volume= 4,307 cf
Outflow = 0.78 cfs @ 12.17 hrs, Volume= 4,307 cf, Atten= 36%, Lag= 5.5 min
Discarded = 0.03 cfs @ 12.17 hrs, Volume= 2,925 cf
Primary = 0.75 cfs @ 12.17 hrs, Volume= 1,382 cf

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Peak Elev= 171.96' @ 12.17 hrs Surf.Area= 1,035 sf Storage= 1,489 cf

Plug-Flow detention time= 267.3 min calculated for 4,307 cf (100% of inflow)
Center-of-Mass det. time= 267.4 min (1,014.9 - 747.6)

Volume	Invert	Avail.Storage	Storage Description
#1	169.00'	1,480 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 4,140 cf Overall - 440 cf Embedded = 3,700 cf x 40.0% Voids
#2	170.00'	440 cf	**24.0" Round Pipe Storage** Inside #1 L= 140.0'
		1,920 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
169.00	1,035	0	0
173.00	1,035	4,140	4,140

Device	Routing	Invert	Outlet Devices
#1	Primary	171.50'	**15.0" Round Culvert** L= 50.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 171.50' / 170.50' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Discarded	169.00'	**1.020 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 160.00'

Discarded OutFlow Max=0.03 cfs @ 12.17 hrs HW=171.96' (Free Discharge)
└**2=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=0.75 cfs @ 12.17 hrs HW=171.96' (Free Discharge)
└**1=Culvert** (Inlet Controls 0.75 cfs @ 1.82 fps)

Summary for Pond 9P: Recharge Behind Bldg 7

Inflow Area = 4,008 sf,100.00% Impervious, Inflow Depth = 4.90" for 10-yr, 24-hr event
Inflow = 0.46 cfs @ 12.08 hrs, Volume= 1,637 cf
Outflow = 0.03 cfs @ 13.71 hrs, Volume= 1,637 cf, Atten= 94%, Lag= 97.3 min
Discarded = 0.03 cfs @ 13.71 hrs, Volume= 1,637 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Peak Elev= 167.75' @ 13.71 hrs Surf.Area= 910 sf Storage= 719 cf

Plug-Flow detention time= 223.7 min calculated for 1,637 cf (100% of inflow)
Center-of-Mass det. time= 223.7 min (971.2 - 747.6)

Volume	Invert	Avail.Storage	Storage Description
#1	166.00'	1,293 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 3,640 cf Overall - 408 cf Embedded = 3,232 cf x 40.0% Voids
#2	167.00'	408 cf	**24.0" Round Pipe Storage** Inside #1 L= 130.0'
		1,701 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
166.00	910	0	0
170.00	910	3,640	3,640

Device	Routing	Invert	Outlet Devices
#1	Primary	168.50'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#2	Discarded	166.00'	**1.020 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 160.00' Phase-In= 0.01'

Discarded OutFlow Max=0.03 cfs @ 13.71 hrs HW=167.75' (Free Discharge)
└**2=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=166.00' (Free Discharge)
└**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Link DP-1: DP-1

Inflow Area = 337,720 sf, 55.26% Impervious, Inflow Depth = 2.04" for 10-yr, 24-hr event
Inflow = 1.74 cfs @ 12.14 hrs, Volume= 57,426 cf
Primary = 1.74 cfs @ 12.14 hrs, Volume= 57,426 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs

Summary for Link DP-2: DP-2

Inflow Area = 20,866 sf, 3.34% Impervious, Inflow Depth = 0.19" for 10-yr, 24-hr event
Inflow = 0.02 cfs @ 12.49 hrs, Volume= 337 cf
Primary = 0.02 cfs @ 12.49 hrs, Volume= 337 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs

Summary for Link DP-3: Intermittent Stream

Inflow Area = 195,061 sf, 65.27% Impervious, Inflow Depth = 1.49" for 10-yr, 24-hr event
Inflow = 1.17 cfs @ 12.09 hrs, Volume= 24,156 cf
Primary = 1.17 cfs @ 12.09 hrs, Volume= 24,156 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs

Summary for Link DP-4: Uphams Bowl

Inflow Area = 22,607 sf, 12.52% Impervious, Inflow Depth = 0.54" for 10-yr, 24-hr event
Inflow = 0.14 cfs @ 12.15 hrs, Volume= 1,011 cf
Primary = 0.14 cfs @ 12.15 hrs, Volume= 1,011 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs

Summary for Subcatchment PR-1: Olmsted Road and SW Portion of Site

Runoff = 1.85 cfs @ 12.11 hrs, Volume= 6,988 cf, Depth= 1.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr, 24-hr Rainfall=6.31"

Area (sf)	CN	Adj	Description
33,759	39		>75% Grass cover, Good, HSG A
14,288	98		Paved parking, HSG A
1,045	98		Unconnected pavement, HSG A
15,507	30		Woods, Good, HSG A
64,599	51	50	Weighted Average, UI Adjusted
49,266			76.26% Pervious Area
15,333			23.74% Impervious Area
1,045			6.82% Unconnected

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

Summary for Subcatchment PR-10: Subcat PR-10

Runoff = 1.41 cfs @ 12.09 hrs, Volume= 4,471 cf, Depth= 4.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr, 24-hr Rainfall=6.31"

Area (sf)	CN	Description
2,526	39	>75% Grass cover, Good, HSG A
9,104	98	Roofs, HSG A
44	98	Unconnected pavement, HSG A
11,674	85	Weighted Average
2,526		21.64% Pervious Area
9,148		78.36% Impervious Area
44		0.48% Unconnected

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

Summary for Subcatchment PR-11: Subcat PR-11

Runoff = 0.09 cfs @ 12.34 hrs, Volume= 834 cf, Depth= 0.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr, 24-hr Rainfall=6.31"

Area (sf)	CN	Adj	Description
15,072	39		>75% Grass cover, Good, HSG A
697	98		Unconnected pavement, HSG A
5,097	30		Woods, Good, HSG A
20,866	39	38	Weighted Average, UI Adjusted
20,169			96.66% Pervious Area
697			3.34% Impervious Area
697			100.00% Unconnected

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

Summary for Subcatchment PR-12: Subcat PR-12

Runoff = 1.00 cfs @ 12.08 hrs, Volume= 3,548 cf, Depth= 6.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr, 24-hr Rainfall=6.31"

Area (ac)	CN	Description
0.161	98	Roofs, HSG A
0.161		100.00% Impervious Area

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

Summary for Subcatchment PR-13: Bldg 8

Runoff = 1.50 cfs @ 12.08 hrs, Volume= 5,334 cf, Depth= 6.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr, 24-hr Rainfall=6.31"

Area (ac)	CN	Description
0.242	98	Roofs, HSG A
0.242		100.00% Impervious Area

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

Summary for Subcatchment PR-14: Bldg 9

Runoff = 1.50 cfs @ 12.08 hrs, Volume= 5,334 cf, Depth= 6.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr, 24-hr Rainfall=6.31"

Area (ac)	CN	Description
0.242	98	Roofs, HSG A
0.242		100.00% Impervious Area

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

Summary for Subcatchment PR-15: Bldg 7

Runoff = 0.57 cfs @ 12.08 hrs, Volume= 2,028 cf, Depth= 6.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr, 24-hr Rainfall=6.31"

Area (ac)	CN	Description
0.092	98	Roofs, HSG A
0.092		100.00% Impervious Area

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

Summary for Subcatchment PR-2: Behind Bldg 1 and 2

Runoff = 0.43 cfs @ 12.11 hrs, Volume= 1,884 cf, Depth= 1.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr, 24-hr Rainfall=6.31"

Area (sf)	CN	Description
19,297	39	>75% Grass cover, Good, HSG A
1,655	98	Paved parking, HSG A
1,176	98	Roofs, HSG A
479	30	Woods, Good, HSG A
22,607	46	Weighted Average
19,776		87.48% Pervious Area
2,831		12.52% Impervious Area

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

Summary for Subcatchment PR-3: Northwest portion of Olmsted and Bldgs 1-6

Runoff = 13.01 cfs @ 12.09 hrs, Volume= 40,282 cf, Depth= 3.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr, 24-hr Rainfall=6.31"

Area (sf)	CN	Description
54,232	39	>75% Grass cover, Good, HSG A
49,571	98	Paved parking, HSG A
33,018	98	Roofs, HSG A
1,394	98	Unconnected pavement, HSG A
6,186	30	Woods, Good, HSG A
144,401	73	Weighted Average
60,418		41.84% Pervious Area
83,983		58.16% Impervious Area
1,394		1.66% Unconnected

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

Summary for Subcatchment PR-4: Subcat PR-4

Runoff = 8.29 cfs @ 12.09 hrs, Volume= 25,652 cf, Depth= 3.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr, 24-hr Rainfall=6.31"

Area (sf)	CN	Description
38,899	39	>75% Grass cover, Good, HSG A
41,818	98	Paved parking, HSG A
9,104	98	Roofs, HSG A
2,134	98	Unconnected pavement, HSG A
91,955	73	Weighted Average
38,899		42.30% Pervious Area
53,056		57.70% Impervious Area
2,134		4.02% Unconnected

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

Summary for Subcatchment PR-5: Subcat PR-5

Runoff = 10.32 cfs @ 12.08 hrs, Volume= 33,638 cf, Depth= 5.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr, 24-hr Rainfall=6.31"

Area (sf)	CN	Description
10,062	39	>75% Grass cover, Good, HSG A
32,234	98	Paved parking, HSG A
36,111	98	Roofs, HSG A
78,407	90	Weighted Average
10,062		12.83% Pervious Area
68,345		87.17% Impervious Area

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

Summary for Subcatchment PR-6: Subcat PR-6

Runoff = 1.41 cfs @ 12.09 hrs, Volume= 4,365 cf, Depth= 3.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr, 24-hr Rainfall=6.31"

Area (ac)	CN	Description
0.086	39	>75% Grass cover, Good, HSG A
0.208	98	Paved parking, HSG A
0.018	30	Woods, Good, HSG A
0.312	78	Weighted Average
0.104		33.33% Pervious Area
0.208		66.67% Impervious Area

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

Summary for Subcatchment PR-7: Subcat PR-7

Runoff = 4.99 cfs @ 12.09 hrs, Volume= 15,677 cf, Depth= 4.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr, 24-hr Rainfall=6.31"

Area (sf)	CN	Description
11,108	39	>75% Grass cover, Good, HSG A
20,909	98	Paved parking, HSG A
10,149	98	Roofs, HSG A
784	98	Unconnected pavement, HSG A
42,950	83	Weighted Average
11,108		25.86% Pervious Area
31,842		74.14% Impervious Area
784		2.46% Unconnected

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

Summary for Subcatchment PR-8: Subcat PR-8

Runoff = 0.05 cfs @ 12.46 hrs, Volume= 938 cf, Depth= 0.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr, 24-hr Rainfall=6.31"

Area (ac)	CN	Adj	Description
0.461	39		>75% Grass cover, Good, HSG A
0.004	98		Unconnected pavement, HSG A
0.493	30		Woods, Good, HSG A
0.958	35	34	Weighted Average, UI Adjusted
0.954			99.58% Pervious Area
0.004			0.42% Impervious Area
0.004			100.00% Unconnected

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

Summary for Subcatchment PR-9: Subcat PR-9

Runoff = 1.60 cfs @ 12.08 hrs, Volume= 5,529 cf, Depth= 5.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr, 24-hr Rainfall=6.31"

Area (ac)	CN	Description
0.011	39	>75% Grass cover, Good, HSG A
0.249	98	Roofs, HSG A
0.001	98	Unconnected pavement, HSG A
0.261	96	Weighted Average
0.011		4.21% Pervious Area
0.250		95.79% Impervious Area
0.001		0.40% Unconnected

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

Summary for Pond 1P: Multi-Family Infiltration

Inflow Area = 78,407 sf, 87.17% Impervious, Inflow Depth = 5.15" for 25-yr, 24-hr event
Inflow = 10.32 cfs @ 12.08 hrs, Volume= 33,638 cf
Outflow = 0.35 cfs @ 15.65 hrs, Volume= 26,213 cf, Atten= 97%, Lag= 214.1 min
Discarded = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.35 cfs @ 15.65 hrs, Volume= 26,213 cf

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs

Peak Elev= 198.52' @ 15.65 hrs Surf.Area= 4,095 sf Storage= 24,220 cf

Plug-Flow detention time= 765.4 min calculated for 26,210 cf (78% of inflow)
Center-of-Mass det. time= 686.3 min (1,469.4 - 783.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	191.50'	0 cf	**38.75'W x 105.69'L x 10.00'H Field A** 40,954 cf Overall - 40,954 cf Embedded = 0 cf x 40.0% Voids
#2A	191.50'	33,413 cf	**StormTrap ST2 DoubleTrap 9-0**x 18 Inside #1 Inside= 101.7"W x 108.0"H => 70.76 sf x 15.40'L = 1,089.5 cf Outside= 101.7"W x 120.0"H => 84.79 sf x 15.40'L = 1,305.4 cf 18 Chambers in 3 Rows 25.44' x 92.38' Core + 6.66' Border = 38.75' x 105.69' System
		33,413 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 4	200.25'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#2	Device 3	194.00'	**2.5" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	191.50'	**12.0" Round Culvert** L= 50.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 191.50' / 191.00' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#4	Discarded	191.50'	**1.020 in/hr Exfiltration X 0.50 over Surface area** Conductivity to Groundwater Elevation = 187.00'

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=191.50' (Free Discharge)
↑—**4=Exfiltration** (Passes 0.00 cfs of 0.05 cfs potential flow)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Primary OutFlow Max=0.35 cfs @ 15.65 hrs HW=198.52' (Free Discharge)
↑—**3=Culvert** (Passes 0.35 cfs of 7.63 cfs potential flow)
↑—**2=Orifice/Grate** (Orifice Controls 0.35 cfs @ 10.12 fps)

Summary for Pond 2P: 36" Perf Recharge Trench (Access Road)

Inflow Area = 7,013 sf,100.00% Impervious, Inflow Depth = 6.07" for 25-yr, 24-hr event
Inflow = 1.00 cfs @ 12.08 hrs, Volume= 3,548 cf
Outflow = 0.35 cfs @ 12.34 hrs, Volume= 3,548 cf, Atten= 64%, Lag= 15.2 min
Discarded = 0.03 cfs @ 12.34 hrs, Volume= 2,240 cf
Primary = 0.33 cfs @ 12.34 hrs, Volume= 1,309 cf

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Peak Elev= 180.78' @ 12.34 hrs Surf.Area= 865 sf Storage= 1,328 cf

Plug-Flow detention time= 226.8 min calculated for 3,548 cf (100% of inflow)
Center-of-Mass det. time= 226.9 min (971.3 - 744.4)

Volume	Invert	Avail.Storage	Storage Description
#1	178.00'	1,334 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 4,325 cf Overall - 990 cf Embedded = 3,335 cf x 40.0% Voids
#2	179.00'	990 cf	**36.0" Round Pipe Storage** Inside #1 L= 140.0'
		2,324 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
178.00	865	0	0
183.00	865	4,325	4,325

Device	Routing	Invert	Outlet Devices
#1	Device 3	181.75'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#2	Device 3	180.00'	**4.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	179.00'	**15.0" Round Culvert** L= 50.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 179.00' / 178.50' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#4	Discarded	178.00'	**1.020 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 167.00' Phase-In= 0.01'

Discarded OutFlow Max=0.03 cfs @ 12.34 hrs HW=180.78' (Free Discharge)
└─**4=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=0.33 cfs @ 12.34 hrs HW=180.78' (Free Discharge)
└─**3=Culvert** (Passes 0.33 cfs of 5.01 cfs potential flow)
  ├─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
  └─**2=Orifice/Grate** (Orifice Controls 0.33 cfs @ 3.77 fps)

Summary for Pond 3P: Detention Near Bldg 14

Inflow Area = 49,963 sf, 77.77% Impervious, Inflow Depth = 4.08" for 25-yr, 24-hr event
Inflow = 5.18 cfs @ 12.09 hrs, Volume= 16,985 cf
Outflow = 0.55 cfs @ 13.07 hrs, Volume= 16,865 cf, Atten= 89%, Lag= 58.6 min
Primary = 0.55 cfs @ 13.07 hrs, Volume= 16,865 cf

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 175.57' @ 13.07 hrs Surf.Area= 1,632 sf Storage= 7,411 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 138.6 min (941.0 - 802.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	170.00'	0 cf	**21.79'W x 74.90'L x 10.50'H Field A** 17,137 cf Overall - 17,137 cf Embedded = 0 cf x 40.0% Voids
#2A	170.00'	13,881 cf	**StormTrap ST2 DoubleTrap 9-6** x 4 Inside #1 Inside= 101.7"W x 114.0"H => 74.82 sf x 15.40'L = 1,152.0 cf Outside= 101.7"W x 126.0"H => 89.03 sf x 15.40'L = 1,370.7 cf

8.48' x 61.58' Core + 6.66' Border = 21.79' x 74.90' System

13,881 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	170.00'	**3.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.55 cfs @ 13.07 hrs HW=175.57' (Free Discharge)
↑—**1=Orifice/Grate** (Orifice Controls 0.55 cfs @ 11.24 fps)

Summary for Pond 4P: 36" Perf Recharge Trench (Lower)

Inflow Area = 61,332 sf, 81.11% Impervious, Inflow Depth = 4.38" for 25-yr, 24-hr event
Inflow = 1.99 cfs @ 12.09 hrs, Volume= 22,394 cf
Outflow = 0.61 cfs @ 14.21 hrs, Volume= 22,394 cf, Atten= 69%, Lag= 127.6 min
Discarded = 0.21 cfs @ 14.21 hrs, Volume= 16,636 cf
Primary = 0.39 cfs @ 14.21 hrs, Volume= 5,758 cf

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Peak Elev= 172.86' @ 14.21 hrs Surf.Area= 3,100 sf Storage= 6,949 cf

Plug-Flow detention time= 302.6 min calculated for 22,394 cf (100% of inflow)
Center-of-Mass det. time= 302.6 min (1,198.3 - 895.6)

Volume	Invert	Avail.Storage	Storage Description
#1	169.00'	4,110 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 13,950 cf Overall - 3,676 cf Embedded = 10,274 cf x 40.0% Voids
#2	170.00'	3,676 cf	**36.0" Round CMP_Round 36"** x 2 Inside #1 L= 260.0'
		7,785 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
169.00	3,100	0	0
173.50	3,100	13,950	13,950

Device	Routing	Invert	Outlet Devices
#1	Discarded	169.00'	**1.020 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 167.00'
#2	Device 3	172.75'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Primary	170.00'	**18.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 170.00' / 169.80' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Discarded OutFlow Max=0.21 cfs @ 14.21 hrs HW=172.86' (Free Discharge)
└**1=Exfiltration** (Controls 0.21 cfs)

Primary OutFlow Max=0.39 cfs @ 14.21 hrs HW=172.86' (Free Discharge)
└**3=Culvert** (Passes 0.39 cfs of 9.75 cfs potential flow)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 0.39 cfs @ 0.91 fps)

Summary for Pond 5P: Detention Near Bldg 3

Inflow Area = 144,401 sf, 58.16% Impervious, Inflow Depth = 3.35" for 25-yr, 24-hr event
Inflow = 13.01 cfs @ 12.09 hrs, Volume= 40,282 cf
Outflow = 0.92 cfs @ 13.81 hrs, Volume= 40,283 cf, Atten= 93%, Lag= 103.5 min
Primary = 0.92 cfs @ 13.81 hrs, Volume= 40,283 cf

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 172.37' @ 13.81 hrs Surf.Area= 2,810 sf Storage= 19,606 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 256.3 min (1,085.2 - 828.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	164.00'	0 cf	**47.23'W x 59.50'L x 14.00'H Field A** 39,342 cf Overall - 39,342 cf Embedded = 0 cf x 40.0% Voids
#2A	164.00'	32,397 cf	**StormTrap ST2 DoubleTrap 13-0**x 12 Inside #1 Inside= 101.7"W x 156.0"H => 101.45 sf x 15.40'L = 1,561.9 cf Outside= 101.7"W x 168.0"H => 118.71 sf x 15.40'L = 1,827.6 cf 12 Chambers in 4 Rows 33.92' x 46.19' Core + 6.66' Border = 47.23' x 59.50' System
		32,397 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	164.00'	**3.5" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.92 cfs @ 13.81 hrs HW=172.37' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 0.92 cfs @ 13.81 fps)

Summary for Pond 6P: Detention Near Bldg 10

Inflow Area = 124,712 sf, 66.78% Impervious, Inflow Depth = 3.34" for 25-yr, 24-hr event
Inflow = 12.36 cfs @ 12.09 hrs, Volume= 34,685 cf
Outflow = 0.59 cfs @ 14.67 hrs, Volume= 34,685 cf, Atten= 95%, Lag= 154.3 min
Primary = 0.59 cfs @ 14.67 hrs, Volume= 34,685 cf

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Peak Elev= 151.41' @ 14.67 hrs Surf.Area= 3,537 sf Storage= 20,636 cf

Plug-Flow detention time= 448.3 min calculated for 34,681 cf (100% of inflow)
Center-of-Mass det. time= 448.6 min (1,264.8 - 816.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	144.50'	0 cf	**47.23'W x 74.90'L x 11.00'H Field A** 38,910 cf Overall - 38,910 cf Embedded = 0 cf x 40.0% Voids
#2A	144.50'	32,186 cf	**StormTrap ST2 DoubleTrap 10-0**x 16 Inside #1 Inside= 101.7"W x 120.0"H => 78.88 sf x 15.40'L = 1,214.5 cf Outside= 101.7"W x 132.0"H => 93.27 sf x 15.40'L = 1,436.0 cf 16 Chambers in 4 Rows 33.92' x 61.58' Core + 6.66' Border = 47.23' x 74.90' System
		32,186 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 3	155.00'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#2	Device 3	145.00'	**3.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	145.00'	**12.0" Round Culvert** L= 50.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 145.00' / 144.50' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.59 cfs @ 14.67 hrs HW=151.41' (Free Discharge)
↑**3=Culvert** (Passes 0.59 cfs of 7.26 cfs potential flow)
↑**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
2=Orifice/Grate (Orifice Controls 0.59 cfs @ 12.07 fps)

Summary for Pond 7P: (new Pond)

Inflow Area = 10,542 sf,100.00% Impervious, Inflow Depth = 6.07" for 25-yr, 24-hr event
Inflow = 1.50 cfs @ 12.08 hrs, Volume= 5,334 cf
Outflow = 1.47 cfs @ 12.10 hrs, Volume= 5,334 cf, Atten= 2%, Lag= 0.9 min
Discarded = 0.03 cfs @ 12.10 hrs, Volume= 2,990 cf
Primary = 1.44 cfs @ 12.10 hrs, Volume= 2,344 cf

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Peak Elev= 167.75' @ 12.10 hrs Surf.Area= 929 sf Storage= 1,252 cf

Plug-Flow detention time= 200.6 min calculated for 5,333 cf (100% of inflow)
Center-of-Mass det. time= 200.6 min (945.0 - 744.4)

Volume	Invert	Avail.Storage	Storage Description
#1	165.00'	1,322 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 3,716 cf Overall - 412 cf Embedded = 3,304 cf x 40.0% Voids
#2	166.00'	412 cf	**24.0" Round CMP_Round 24"** Inside #1 L= 131.0'
		1,733 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
165.00	929	0	0
169.00	929	3,716	3,716

Device	Routing	Invert	Outlet Devices
#1	Primary	167.50'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#2	Discarded	165.00'	**1.020 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 160.00'

Discarded OutFlow Max=0.03 cfs @ 12.10 hrs HW=167.75' (Free Discharge)
↑—**2=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=1.43 cfs @ 12.10 hrs HW=167.75' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 1.43 cfs @ 1.42 fps)

Summary for Pond 8P: (new Pond)

Inflow Area = 10,542 sf, 100.00% Impervious, Inflow Depth = 6.07" for 25-yr, 24-hr event
Inflow = 1.50 cfs @ 12.08 hrs, Volume= 5,334 cf
Outflow = 1.36 cfs @ 12.12 hrs, Volume= 5,334 cf, Atten= 9%, Lag= 2.2 min
Discarded = 0.03 cfs @ 12.12 hrs, Volume= 3,115 cf
Primary = 1.33 cfs @ 12.12 hrs, Volume= 2,219 cf

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Peak Elev= 172.13' @ 12.12 hrs Surf.Area= 1,035 sf Storage= 1,560 cf

Plug-Flow detention time= 236.2 min calculated for 5,333 cf (100% of inflow)
Center-of-Mass det. time= 236.2 min (980.6 - 744.4)

Volume	Invert	Avail.Storage	Storage Description
#1	169.00'	1,480 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 4,140 cf Overall - 440 cf Embedded = 3,700 cf x 40.0% Voids
#2	170.00'	440 cf	**24.0" Round Pipe Storage** Inside #1 L= 140.0'
		1,920 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
169.00	1,035	0	0
173.00	1,035	4,140	4,140

Device	Routing	Invert	Outlet Devices
#1	Primary	171.50'	**15.0" Round Culvert** L= 50.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 171.50' / 170.50' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Discarded	169.00'	**1.020 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 160.00'

Discarded OutFlow Max=0.03 cfs @ 12.12 hrs HW=172.13' (Free Discharge)
└**2=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=1.33 cfs @ 12.12 hrs HW=172.13' (Free Discharge)
└**1=Culvert** (Inlet Controls 1.33 cfs @ 2.14 fps)

Summary for Pond 9P: Recharge Behind Bldg 7

Inflow Area = 4,008 sf,100.00% Impervious, Inflow Depth = 6.07" for 25-yr, 24-hr event
Inflow = 0.57 cfs @ 12.08 hrs, Volume= 2,028 cf
Outflow = 0.03 cfs @ 14.04 hrs, Volume= 2,028 cf, Atten= 95%, Lag= 117.4 min
Discarded = 0.03 cfs @ 14.04 hrs, Volume= 2,028 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Peak Elev= 168.21' @ 14.04 hrs Surf.Area= 910 sf Storage= 957 cf

Plug-Flow detention time= 291.8 min calculated for 2,027 cf (100% of inflow)
Center-of-Mass det. time= 291.8 min (1,036.2 - 744.4)

Volume	Invert	Avail.Storage	Storage Description
#1	166.00'	1,293 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 3,640 cf Overall - 408 cf Embedded = 3,232 cf x 40.0% Voids
#2	167.00'	408 cf	**24.0" Round Pipe Storage** Inside #1 L= 130.0'
		1,701 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
166.00	910	0	0
170.00	910	3,640	3,640

Device	Routing	Invert	Outlet Devices
#1	Primary	168.50'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#2	Discarded	166.00'	**1.020 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 160.00' Phase-In= 0.01'

Discarded OutFlow Max=0.03 cfs @ 14.04 hrs HW=168.21' (Free Discharge)
└**2=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=166.00' (Free Discharge)
└**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Link DP-1: DP-1

Inflow Area = 337,720 sf, 55.26% Impervious, Inflow Depth = 2.91" for 25-yr, 24-hr event
Inflow = 2.91 cfs @ 12.11 hrs, Volume= 81,956 cf
Primary = 2.91 cfs @ 12.11 hrs, Volume= 81,956 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs

Summary for Link DP-2: DP-2

Inflow Area = 20,866 sf, 3.34% Impervious, Inflow Depth = 0.48" for 25-yr, 24-hr event
Inflow = 0.09 cfs @ 12.34 hrs, Volume= 834 cf
Primary = 0.09 cfs @ 12.34 hrs, Volume= 834 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs

Summary for Link DP-3: Intermittent Stream

Inflow Area = 195,061 sf, 65.27% Impervious, Inflow Depth = 2.29" for 25-yr, 24-hr event
Inflow = 1.61 cfs @ 12.09 hrs, Volume= 37,274 cf
Primary = 1.61 cfs @ 12.09 hrs, Volume= 37,274 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs

Summary for Link DP-4: Uphams Bowl

Inflow Area = 22,607 sf, 12.52% Impervious, Inflow Depth = 1.00" for 25-yr, 24-hr event
Inflow = 0.43 cfs @ 12.11 hrs, Volume= 1,884 cf
Primary = 0.43 cfs @ 12.11 hrs, Volume= 1,884 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs

Summary for Subcatchment PR-1: Olmsted Road and SW Portion of Site

Runoff = 3.73 cfs @ 12.10 hrs, Volume= 12,541 cf, Depth= 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr, 24-hr Rainfall=8.13"

Area (sf)	CN	Adj	Description
33,759	39		>75% Grass cover, Good, HSG A
14,288	98		Paved parking, HSG A
1,045	98		Unconnected pavement, HSG A
15,507	30		Woods, Good, HSG A
64,599	51	50	Weighted Average, UI Adjusted
49,266			76.26% Pervious Area
15,333			23.74% Impervious Area
1,045			6.82% Unconnected

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

Summary for Subcatchment PR-10: Subcat PR-10

Runoff = 1.92 cfs @ 12.09 hrs, Volume= 6,167 cf, Depth= 6.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr, 24-hr Rainfall=8.13"

Area (sf)	CN	Description
2,526	39	>75% Grass cover, Good, HSG A
9,104	98	Roofs, HSG A
44	98	Unconnected pavement, HSG A
11,674	85	Weighted Average
2,526		21.64% Pervious Area
9,148		78.36% Impervious Area
44		0.48% Unconnected

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

Summary for Subcatchment PR-11: Subcat PR-11

Runoff = 0.39 cfs @ 12.12 hrs, Volume= 1,944 cf, Depth= 1.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr, 24-hr Rainfall=8.13"

Area (sf)	CN	Adj	Description
15,072	39		>75% Grass cover, Good, HSG A
697	98		Unconnected pavement, HSG A
5,097	30		Woods, Good, HSG A
20,866	39	38	Weighted Average, UI Adjusted
20,169			96.66% Pervious Area
697			3.34% Impervious Area
697			100.00% Unconnected

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

Summary for Subcatchment PR-12: Subcat PR-12

Runoff = 1.29 cfs @ 12.08 hrs, Volume= 4,611 cf, Depth= 7.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr, 24-hr Rainfall=8.13"

Area (ac)	CN	Description
0.161	98	Roofs, HSG A
0.161		100.00% Impervious Area

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

Summary for Subcatchment PR-13: Bldg 8

Runoff = 1.93 cfs @ 12.08 hrs, Volume= 6,931 cf, Depth= 7.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr, 24-hr Rainfall=8.13"

Area (ac)	CN	Description
0.242	98	Roofs, HSG A
0.242		100.00% Impervious Area

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

Summary for Subcatchment PR-14: Bldg 9

Runoff = 1.93 cfs @ 12.08 hrs, Volume= 6,931 cf, Depth= 7.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr, 24-hr Rainfall=8.13"

Area (ac)	CN	Description
0.242	98	Roofs, HSG A
0.242		100.00% Impervious Area

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

Summary for Subcatchment PR-15: Bldg 7

Runoff = 0.73 cfs @ 12.08 hrs, Volume= 2,635 cf, Depth= 7.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr, 24-hr Rainfall=8.13"

Area (ac)	CN	Description
0.092	98	Roofs, HSG A
0.092		100.00% Impervious Area

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

Summary for Subcatchment PR-2: Behind Bldg 1 and 2

Runoff = 1.00 cfs @ 12.10 hrs, Volume= 3,595 cf, Depth= 1.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr, 24-hr Rainfall=8.13"

Area (sf)	CN	Description
19,297	39	>75% Grass cover, Good, HSG A
1,655	98	Paved parking, HSG A
1,176	98	Roofs, HSG A
479	30	Woods, Good, HSG A
22,607	46	Weighted Average
19,776		87.48% Pervious Area
2,831		12.52% Impervious Area

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

Summary for Subcatchment PR-3: Northwest portion of Olmsted and Bldgs 1-6

Runoff = 19.11 cfs @ 12.09 hrs, Volume= 59,268 cf, Depth= 4.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr, 24-hr Rainfall=8.13"

Area (sf)	CN	Description
54,232	39	>75% Grass cover, Good, HSG A
49,571	98	Paved parking, HSG A
33,018	98	Roofs, HSG A
1,394	98	Unconnected pavement, HSG A
6,186	30	Woods, Good, HSG A
144,401	73	Weighted Average
60,418		41.84% Pervious Area
83,983		58.16% Impervious Area
1,394		1.66% Unconnected

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

Summary for Subcatchment PR-4: Subcat PR-4

Runoff = 12.17 cfs @ 12.09 hrs, Volume= 37,742 cf, Depth= 4.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr, 24-hr Rainfall=8.13"

Area (sf)	CN	Description
38,899	39	>75% Grass cover, Good, HSG A
41,818	98	Paved parking, HSG A
9,104	98	Roofs, HSG A
2,134	98	Unconnected pavement, HSG A
91,955	73	Weighted Average
38,899		42.30% Pervious Area
53,056		57.70% Impervious Area
2,134		4.02% Unconnected

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

Summary for Subcatchment PR-5: Subcat PR-5

Runoff = 13.66 cfs @ 12.08 hrs, Volume= 45,303 cf, Depth= 6.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr, 24-hr Rainfall=8.13"

Area (sf)	CN	Description
10,062	39	>75% Grass cover, Good, HSG A
32,234	98	Paved parking, HSG A
36,111	98	Roofs, HSG A
78,407	90	Weighted Average
10,062		12.83% Pervious Area
68,345		87.17% Impervious Area

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

Summary for Subcatchment PR-6: Subcat PR-6

Runoff = 1.99 cfs @ 12.09 hrs, Volume= 6,242 cf, Depth= 5.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr, 24-hr Rainfall=8.13"

Area (ac)	CN	Description
0.086	39	>75% Grass cover, Good, HSG A
0.208	98	Paved parking, HSG A
0.018	30	Woods, Good, HSG A
0.312	78	Weighted Average
0.104		33.33% Pervious Area
0.208		66.67% Impervious Area

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

Summary for Subcatchment PR-7: Subcat PR-7

Runoff = 6.86 cfs @ 12.09 hrs, Volume= 21,839 cf, Depth= 6.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr, 24-hr Rainfall=8.13"

Area (sf)	CN	Description
11,108	39	>75% Grass cover, Good, HSG A
20,909	98	Paved parking, HSG A
10,149	98	Roofs, HSG A
784	98	Unconnected pavement, HSG A
42,950	83	Weighted Average
11,108		25.86% Pervious Area
31,842		74.14% Impervious Area
784		2.46% Unconnected

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

Summary for Subcatchment PR-8: Subcat PR-8

Runoff = 0.34 cfs @ 12.29 hrs, Volume= 2,652 cf, Depth= 0.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr, 24-hr Rainfall=8.13"

Area (ac)	CN	Adj	Description
0.461	39		>75% Grass cover, Good, HSG A
0.004	98		Unconnected pavement, HSG A
0.493	30		Woods, Good, HSG A
0.958	35	34	Weighted Average, UI Adjusted
0.954			99.58% Pervious Area
0.004			0.42% Impervious Area
0.004			100.00% Unconnected

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

Summary for Subcatchment PR-9: Subcat PR-9

Runoff = 2.07 cfs @ 12.08 hrs, Volume= 7,248 cf, Depth= 7.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr, 24-hr Rainfall=8.13"

Area (ac)	CN	Description
0.011	39	>75% Grass cover, Good, HSG A
0.249	98	Roofs, HSG A
0.001	98	Unconnected pavement, HSG A
0.261	96	Weighted Average
0.011		4.21% Pervious Area
0.250		95.79% Impervious Area
0.001		0.40% Unconnected

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

Summary for Pond 1P: Multi-Family Infiltration

Inflow Area = 78,407 sf, 87.17% Impervious, Inflow Depth = 6.93" for 100-yr, 24-hr event
Inflow = 13.66 cfs @ 12.08 hrs, Volume= 45,303 cf
Outflow = 0.56 cfs @ 14.96 hrs, Volume= 37,878 cf, Atten= 96%, Lag= 172.3 min
Discarded = 0.15 cfs @ 14.96 hrs, Volume= 2,067 cf
Primary = 0.42 cfs @ 14.96 hrs, Volume= 35,811 cf

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs

Peak Elev= 200.61' @ 14.96 hrs Surf.Area= 4,095 sf Storage= 31,947 cf

Plug-Flow detention time= 816.3 min calculated for 37,878 cf (84% of inflow)
Center-of-Mass det. time= 748.9 min (1,524.4 - 775.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	191.50'	0 cf	**38.75'W x 105.69'L x 10.00'H Field A** 40,954 cf Overall - 40,954 cf Embedded = 0 cf x 40.0% Voids
#2A	191.50'	33,413 cf	**StormTrap ST2 DoubleTrap 9-0**x 18 Inside #1 Inside= 101.7"W x 108.0"H => 70.76 sf x 15.40'L = 1,089.5 cf Outside= 101.7"W x 120.0"H => 84.79 sf x 15.40'L = 1,305.4 cf 18 Chambers in 3 Rows 25.44' x 92.38' Core + 6.66' Border = 38.75' x 105.69' System
		33,413 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 4	200.25'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#2	Device 3	194.00'	**2.5" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	191.50'	**12.0" Round Culvert** L= 50.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 191.50' / 191.00' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#4	Discarded	191.50'	**1.020 in/hr Exfiltration X 0.50 over Surface area** Conductivity to Groundwater Elevation = 187.00'

Discarded OutFlow Max=0.15 cfs @ 14.96 hrs HW=200.61' (Free Discharge)
↑—**4=Exfiltration** (Controls 0.15 cfs)
↑—**1=Broad-Crested Rectangular Weir**(Passes 0.15 cfs of 2.45 cfs potential flow)

Primary OutFlow Max=0.42 cfs @ 14.96 hrs HW=200.61' (Free Discharge)
↑—**3=Culvert** (Passes 0.42 cfs of 8.76 cfs potential flow)
↑—**2=Orifice/Grate** (Orifice Controls 0.42 cfs @ 12.28 fps)

Summary for Pond 2P: 36" Perf Recharge Trench (Access Road)

Inflow Area = 7,013 sf,100.00% Impervious, Inflow Depth = 7.89" for 100-yr, 24-hr event
Inflow = 1.29 cfs @ 12.08 hrs, Volume= 4,611 cf
Outflow = 0.48 cfs @ 12.31 hrs, Volume= 4,611 cf, Atten= 62%, Lag= 13.9 min
Discarded = 0.03 cfs @ 12.31 hrs, Volume= 2,429 cf
Primary = 0.46 cfs @ 12.31 hrs, Volume= 2,182 cf

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Peak Elev= 181.35' @ 12.31 hrs Surf.Area= 865 sf Storage= 1,661 cf

Plug-Flow detention time= 200.5 min calculated for 4,611 cf (100% of inflow)
Center-of-Mass det. time= 200.5 min (941.5 - 741.0)

Volume	Invert	Avail.Storage	Storage Description
#1	178.00'	1,334 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 4,325 cf Overall - 990 cf Embedded = 3,335 cf x 40.0% Voids
#2	179.00'	990 cf	**36.0" Round Pipe Storage** Inside #1 L= 140.0'
		2,324 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
178.00	865	0	0
183.00	865	4,325	4,325

Device	Routing	Invert	Outlet Devices
#1	Device 3	181.75'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#2	Device 3	180.00'	**4.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	179.00'	**15.0" Round Culvert** L= 50.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 179.00' / 178.50' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#4	Discarded	178.00'	**1.020 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 167.00' Phase-In= 0.01'

Discarded OutFlow Max=0.03 cfs @ 12.31 hrs HW=181.35' (Free Discharge)
└**4=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=0.46 cfs @ 12.31 hrs HW=181.35' (Free Discharge)
└**3=Culvert** (Passes 0.46 cfs of 6.14 cfs potential flow)
  ├**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
  └**2=Orifice/Grate** (Orifice Controls 0.46 cfs @ 5.25 fps)

Summary for Pond 3P: Detention Near Bldg 14

Inflow Area = 49,963 sf, 77.77% Impervious, Inflow Depth = 5.77" for 100-yr, 24-hr event
Inflow = 7.21 cfs @ 12.09 hrs, Volume= 24,021 cf
Outflow = 0.67 cfs @ 13.29 hrs, Volume= 24,020 cf, Atten= 91%, Lag= 72.2 min
Primary = 0.67 cfs @ 13.29 hrs, Volume= 24,020 cf

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 178.21' @ 13.29 hrs Surf.Area= 1,632 sf Storage= 11,260 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 184.6 min (978.5 - 793.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	170.00'	0 cf	**21.79'W x 74.90'L x 10.50'H Field A** 17,137 cf Overall - 17,137 cf Embedded = 0 cf x 40.0% Voids
#2A	170.00'	13,881 cf	**StormTrap ST2 DoubleTrap 9-6** x 4 Inside #1 Inside= 101.7"W x 114.0"H => 74.82 sf x 15.40'L = 1,152.0 cf Outside= 101.7"W x 126.0"H => 89.03 sf x 15.40'L = 1,370.7 cf

8.48' x 61.58' Core + 6.66' Border = 21.79' x 74.90' System

13,881 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	170.00'	**3.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.67 cfs @ 13.29 hrs HW=178.21' (Free Discharge)
↑—**1=Orifice/Grate** (Orifice Controls 0.67 cfs @ 13.69 fps)

Summary for Pond 4P: 36" Perf Recharge Trench (Lower)

Inflow Area = 61,332 sf, 81.11% Impervious, Inflow Depth = 6.12" for 100-yr, 24-hr event
Inflow = 2.55 cfs @ 12.09 hrs, Volume= 31,269 cf
Outflow = 0.83 cfs @ 13.06 hrs, Volume= 31,269 cf, Atten= 67%, Lag= 58.7 min
Discarded = 0.22 cfs @ 13.06 hrs, Volume= 18,694 cf
Primary = 0.62 cfs @ 13.06 hrs, Volume= 12,575 cf

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Peak Elev= 172.89' @ 13.06 hrs Surf.Area= 3,100 sf Storage= 7,009 cf

Plug-Flow detention time= 249.9 min calculated for 31,269 cf (100% of inflow)
Center-of-Mass det. time= 249.9 min (1,175.9 - 926.0)

Volume	Invert	Avail.Storage	Storage Description
#1	169.00'	4,110 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 13,950 cf Overall - 3,676 cf Embedded = 10,274 cf x 40.0% Voids
#2	170.00'	3,676 cf	**36.0" Round CMP_Round 36"** x 2 Inside #1 L= 260.0'
		7,785 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
169.00	3,100	0	0
173.50	3,100	13,950	13,950

Device	Routing	Invert	Outlet Devices
#1	Discarded	169.00'	**1.020 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 167.00'
#2	Device 3	172.75'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Primary	170.00'	**18.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 170.00' / 169.80' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Discarded OutFlow Max=0.22 cfs @ 13.06 hrs HW=172.89' (Free Discharge)
└**1=Exfiltration** (Controls 0.22 cfs)

Primary OutFlow Max=0.61 cfs @ 13.06 hrs HW=172.89' (Free Discharge)
└**3=Culvert** (Passes 0.61 cfs of 9.84 cfs potential flow)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 0.61 cfs @ 1.06 fps)

Summary for Pond 5P: Detention Near Bldg 3

Inflow Area = 144,401 sf, 58.16% Impervious, Inflow Depth = 4.93" for 100-yr, 24-hr event
Inflow = 19.11 cfs @ 12.09 hrs, Volume= 59,268 cf
Outflow = 1.15 cfs @ 14.05 hrs, Volume= 59,270 cf, Atten= 94%, Lag= 117.9 min
Primary = 1.15 cfs @ 14.05 hrs, Volume= 59,270 cf

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 177.02' @ 14.05 hrs Surf.Area= 2,810 sf Storage= 31,203 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 328.5 min (1,146.3 - 817.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	164.00'	0 cf	**47.23'W x 59.50'L x 14.00'H Field A** 39,342 cf Overall - 39,342 cf Embedded = 0 cf x 40.0% Voids
#2A	164.00'	32,397 cf	**StormTrap ST2 DoubleTrap 13-0**x 12 Inside #1 Inside= 101.7"W x 156.0"H => 101.45 sf x 15.40'L = 1,561.9 cf Outside= 101.7"W x 168.0"H => 118.71 sf x 15.40'L = 1,827.6 cf 12 Chambers in 4 Rows 33.92' x 46.19' Core + 6.66' Border = 47.23' x 59.50' System
		32,397 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	164.00'	**3.5" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.15 cfs @ 14.05 hrs HW=177.02' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 1.15 cfs @ 17.28 fps)

Summary for Pond 6P: Detention Near Bldg 10

Inflow Area = 124,712 sf, 66.78% Impervious, Inflow Depth = 4.92" for 100-yr, 24-hr event
Inflow = 17.70 cfs @ 12.09 hrs, Volume= 51,184 cf
Outflow = 0.74 cfs @ 15.03 hrs, Volume= 51,183 cf, Atten= 96%, Lag= 176.1 min
Primary = 0.74 cfs @ 15.03 hrs, Volume= 51,183 cf

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Peak Elev= 154.97' @ 15.03 hrs Surf.Area= 3,537 sf Storage= 32,097 cf

Plug-Flow detention time= 547.0 min calculated for 51,183 cf (100% of inflow)
Center-of-Mass det. time= 547.0 min (1,353.4 - 806.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	144.50'	0 cf	**47.23'W x 74.90'L x 11.00'H Field A** 38,910 cf Overall - 38,910 cf Embedded = 0 cf x 40.0% Voids
#2A	144.50'	32,186 cf	**StormTrap ST2 DoubleTrap 10-0**x 16 Inside #1 Inside= 101.7"W x 120.0"H => 78.88 sf x 15.40'L = 1,214.5 cf Outside= 101.7"W x 132.0"H => 93.27 sf x 15.40'L = 1,436.0 cf 16 Chambers in 4 Rows 33.92' x 61.58' Core + 6.66' Border = 47.23' x 74.90' System
		32,186 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 3	155.00'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#2	Device 3	145.00'	**3.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	145.00'	**12.0" Round Culvert** L= 50.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 145.00' / 144.50' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.74 cfs @ 15.03 hrs HW=154.97' (Free Discharge)
└**3=Culvert** (Passes 0.74 cfs of 9.19 cfs potential flow)
  ├**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
  └**2=Orifice/Grate** (Orifice Controls 0.74 cfs @ 15.11 fps)

Summary for Pond 7P: (new Pond)

Inflow Area = 10,542 sf,100.00% Impervious, Inflow Depth = 7.89" for 100-yr, 24-hr event
Inflow = 1.93 cfs @ 12.08 hrs, Volume= 6,931 cf
Outflow = 1.90 cfs @ 12.10 hrs, Volume= 6,931 cf, Atten= 1%, Lag= 0.8 min
Discarded = 0.03 cfs @ 12.10 hrs, Volume= 3,234 cf
Primary = 1.87 cfs @ 12.10 hrs, Volume= 3,697 cf

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Peak Elev= 167.80' @ 12.10 hrs Surf.Area= 929 sf Storage= 1,274 cf

Plug-Flow detention time= 174.4 min calculated for 6,930 cf (100% of inflow)
Center-of-Mass det. time= 174.5 min (915.5 - 741.0)

Volume	Invert	Avail.Storage	Storage Description
#1	165.00'	1,322 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 3,716 cf Overall - 412 cf Embedded = 3,304 cf x 40.0% Voids
#2	166.00'	412 cf	**24.0" Round CMP_Round 24"** Inside #1 L= 131.0'
		1,733 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
165.00	929	0	0
169.00	929	3,716	3,716

Device	Routing	Invert	Outlet Devices
#1	Primary	167.50'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#2	Discarded	165.00'	**1.020 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 160.00'

Discarded OutFlow Max=0.03 cfs @ 12.10 hrs HW=167.80' (Free Discharge)
↑—**2=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=1.87 cfs @ 12.10 hrs HW=167.80' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 1.87 cfs @ 1.56 fps)

Summary for Pond 8P: (new Pond)

Inflow Area = 10,542 sf, 100.00% Impervious, Inflow Depth = 7.89" for 100-yr, 24-hr event
Inflow = 1.93 cfs @ 12.08 hrs, Volume= 6,931 cf
Outflow = 1.83 cfs @ 12.11 hrs, Volume= 6,931 cf, Atten= 5%, Lag= 1.6 min
Discarded = 0.03 cfs @ 12.11 hrs, Volume= 3,354 cf
Primary = 1.80 cfs @ 12.11 hrs, Volume= 3,578 cf

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Peak Elev= 172.25' @ 12.11 hrs Surf.Area= 1,035 sf Storage= 1,611 cf

Plug-Flow detention time= 203.8 min calculated for 6,931 cf (100% of inflow)
Center-of-Mass det. time= 203.8 min (944.8 - 741.0)

Volume	Invert	Avail.Storage	Storage Description
#1	169.00'	1,480 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 4,140 cf Overall - 440 cf Embedded = 3,700 cf x 40.0% Voids
#2	170.00'	440 cf	**24.0" Round Pipe Storage** Inside #1 L= 140.0'
		1,920 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
169.00	1,035	0	0
173.00	1,035	4,140	4,140

Device	Routing	Invert	Outlet Devices
#1	Primary	171.50'	**15.0" Round Culvert** L= 50.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 171.50' / 170.50' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Discarded	169.00'	**1.020 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 160.00'

Discarded OutFlow Max=0.03 cfs @ 12.11 hrs HW=172.25' (Free Discharge)
└**2=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=1.80 cfs @ 12.11 hrs HW=172.25' (Free Discharge)
└**1=Culvert** (Inlet Controls 1.80 cfs @ 2.33 fps)

Summary for Pond 9P: Recharge Behind Bldg 7

Inflow Area = 4,008 sf,100.00% Impervious, Inflow Depth = 7.89" for 100-yr, 24-hr event
Inflow = 0.73 cfs @ 12.08 hrs, Volume= 2,635 cf
Outflow = 0.18 cfs @ 12.46 hrs, Volume= 2,635 cf, Atten= 76%, Lag= 22.4 min
Discarded = 0.03 cfs @ 12.46 hrs, Volume= 2,379 cf
Primary = 0.15 cfs @ 12.46 hrs, Volume= 256 cf

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Peak Elev= 168.56' @ 12.46 hrs Surf.Area= 910 sf Storage= 1,135 cf

Plug-Flow detention time= 305.6 min calculated for 2,635 cf (100% of inflow)
Center-of-Mass det. time= 305.6 min (1,046.6 - 741.0)

Volume	Invert	Avail.Storage	Storage Description
#1	166.00'	1,293 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 3,640 cf Overall - 408 cf Embedded = 3,232 cf x 40.0% Voids
#2	167.00'	408 cf	**24.0" Round Pipe Storage** Inside #1 L= 130.0'
		1,701 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
166.00	910	0	0
170.00	910	3,640	3,640

Device	Routing	Invert	Outlet Devices
#1	Primary	168.50'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#2	Discarded	166.00'	**1.020 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 160.00' Phase-In= 0.01'

Discarded OutFlow Max=0.03 cfs @ 12.46 hrs HW=168.56' (Free Discharge)
└**2=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=0.15 cfs @ 12.46 hrs HW=168.56' (Free Discharge)
└**1=Broad-Crested Rectangular Weir** (Weir Controls 0.15 cfs @ 0.66 fps)

Summary for Link DP-1: DP-1

Inflow Area = 337,720 sf, 55.26% Impervious, Inflow Depth = 4.38" for 100-yr, 24-hr event
Inflow = 5.07 cfs @ 12.10 hrs, Volume= 123,250 cf
Primary = 5.07 cfs @ 12.10 hrs, Volume= 123,250 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs

Summary for Link DP-2: DP-2

Inflow Area = 20,866 sf, 3.34% Impervious, Inflow Depth = 1.12" for 100-yr, 24-hr event
Inflow = 0.39 cfs @ 12.12 hrs, Volume= 1,944 cf
Primary = 0.39 cfs @ 12.12 hrs, Volume= 1,944 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs

Summary for Link DP-3: Intermittent Stream

Inflow Area = 195,061 sf, 65.27% Impervious, Inflow Depth = 3.52" for 100-yr, 24-hr event
Inflow = 2.48 cfs @ 12.10 hrs, Volume= 57,280 cf
Primary = 2.48 cfs @ 12.10 hrs, Volume= 57,280 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs

Summary for Link DP-4: Uphams Bowl

Inflow Area = 22,607 sf, 12.52% Impervious, Inflow Depth = 1.91" for 100-yr, 24-hr event
Inflow = 1.00 cfs @ 12.10 hrs, Volume= 3,595 cf
Primary = 1.00 cfs @ 12.10 hrs, Volume= 3,595 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs

Appendix C: Standard 3 Computations and Supporting Documentation

- NRCS Web Soil Survey
- Required/Provided Recharge Volume Calculations
- 72-hour drawdown analysis

NRCS Mapping

Map Scale: 1:9,630 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 100 200 400 600

Feet: 0 450 900 1800 2700

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 11, 2019—Oct 5, 2019

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
1	Water		1.9	0.4%
36A	Saco mucky silt loam, 0 to 1 percent slopes	B/D	8.8	1.9%
53A	Freetown muck, ponded, 0 to 1 percent slopes	B/D	11.5	2.5%
103C	Charlton-Hollis-Rock outcrop complex, 8 to 15 percent slopes	B	3.5	0.8%
104C	Hollis-Rock outcrop-Charlton complex, 0 to 15 percent slopes	D	5.8	1.2%
106C	Narragansett-Hollis-Rock outcrop complex, 3 to 15 percent slopes	A	66.5	14.4%
106D	Narragansett-Hollis-Rock outcrop complex, 15 to 25 percent slopes	A	77.0	16.7%
253C	Hinckley loamy sand, 8 to 15 percent slopes	A	8.1	1.8%
253D	Hinckley loamy sand, 15 to 25 percent slopes	A	12.1	2.6%
311B	Woodbridge fine sandy loam, 0 to 8 percent slopes, very stony	C/D	0.7	0.1%
317B	Scituate fine sandy loam, 3 to 8 percent slopes, extremely stony	D	4.9	1.1%
325D	Newport channery fine sandy loam, 8 to 25 percent slopes	D	7.1	1.5%
345B	Pittstown silt loam, 3 to 8 percent slopes	D	7.0	1.5%
407D	Charlton fine sandy loam, 15 to 25 percent slopes, extremely stony	A	12.1	2.6%
416B	Narragansett silt loam, 3 to 8 percent slopes, very stony	A	4.0	0.9%
602	Urban land		76.3	16.5%
603	Urban land, wet substratum		1.7	0.4%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
623C	Woodbridge-Urban land complex, 3 to 15 percent slopes	C/D	1.6	0.4%
624B	Haven-Urban land complex, 0 to 8 percent slopes	A	5.2	1.1%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	A	108.1	23.5%
627C	Newport-Urban land complex, 3 to 15 percent slopes	D	10.1	2.2%
631C	Charlton-Urban land-Hollis complex, 3 to 15 percent slopes, rocky	A	19.8	4.3%
654	Udorthents, loamy		7.2	1.6%
Totals for Area of Interest			**461.1**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

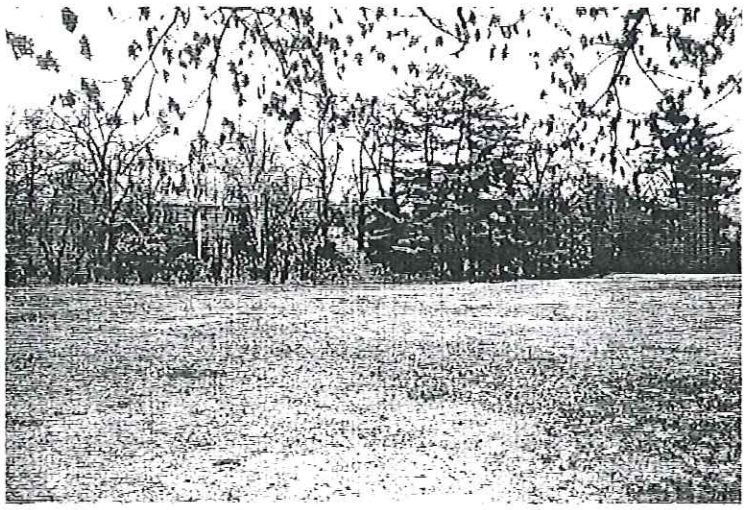
Historic Geotech Report

*** Draft ***

Geotechnical Engineering Study
ARC BELMONT CAMPUS

Belmont, Massachusetts

December 12, 2000



PREPARED FOR:

(ARC) Freedom Development Corporation
Seminole, FL

PREPARED BY:

Weidlinger Associates, Inc.
Cambridge, MA

Project No. 20737

2.2 Proposed Construction

As part of an assisted living campus, three 4 to 6 story buildings are currently proposed with one story of below grade parking. Various paved roadways and parking areas will also be constructed. In the southern portion of the site, a 1:1 slope, expected to consist of bedrock, is proposed adjacent to the new private roadway.

3. SUBSURFACE CONDITIONS

3.1 Subsurface Investigation

Under contract to Weidlinger Associates Inc. (WAI), Carr-Dee Corporation of Medford, MA performed the subsurface investigations at the site. A total of 62 test borings were performed in two phases between April and October of 2000, with depths ranging between 1.5 and 40 feet below grade. Boring locations and depths were defined by Weidlinger. The pilot program, which consisted of 12 borings, was conducted between April 6, 2000 and April 13, 2000. The remainder of the work was conducted between September 18 and October 19, 2000. As-drilled locations of the test borings were surveyed by VHB, and their locations are shown on Figure 2.

Test borings were performed using truck mounted drill rigs, track mounted drill rigs, and a portable tripod hammer, depending on the existing terrain at the boring location. The portable tripod hammer was utilized in locations that were inaccessible to the drill rigs. Borings performed by the truck or track mounted rigs are designated as BOR-#, while those performed by the tripod are designated as TP-#.

BOR-# borings were generally advanced with a wash and drive method using either 3-inch or 4-inch inside diameter flush-joint casing and a roller bit, although 3-3/4-inch inside diameter hollow-stem augers with a plug were occasionally used. Standard penetration tests (SPT) were conducted and split spoon samples were obtained at maximum 5-foot intervals, in accordance with the standard procedures described in ASTM D 1586. Continuous sampling was conducted in the top few feet until the topsoil/subsoil was penetrated, and also where samples were desired for laboratory sieve analyses. Borings were generally advanced until a five-foot rock core run was obtained, except for BOR 2, BOR 6, BOR 7, and BOR 8, which were terminated in the same fashion as the TP borings described below. At BOR 39, a ten-foot core was obtained. BX (1-5/8 inch inside diameter) and NX (2-1/8 inch inside diameter) core barrels were generally used to sample the rock.

TP-# borings were advanced without casing, and continuous sampling with SPT tests were performed. Borings were terminated when the sampler advanced zero inches after 120 blows with the 140-pound hammer, which indicated the estimated top of bedrock.

A WAI engineer visited the site to conduct field permeability tests, obtain samples for laboratory sieve analyses, visually classify soil samples, and verify subsurface information provided by Carr-Dee Corporation. Boring logs prepared by Carr-Dee are presented in Appendix A.

3.2 Subsurface Profiles

The subsurface profile generally consists of 1 to 6 feet of loose to medium dense sandy and silty topsoil/subsoil, underlain by 0 to 33 feet of dense to very dense sand and gravel, underlain by granite or basalt bedrock. The depth of overburden material was greatest at the northwestern portion of the site. Table 1 summarizes the materials encountered in each borehole, with associated thicknesses and depths. Figures 3 and 4 illustrate contour plans for the approximate top of bedrock and soil thickness above bedrock. Figures 5 through 9 show the subsurface profiles at several selected sections, A-A through F-F, which are indicated on Figure 2.

Topsoil/Subsoil: The topsoil/subsoil generally consists of a 1 to 6 foot-thick, loose to medium dense sand and silt with varying amounts of root fibers and gravel. This stratum was typically less than about 2 feet thick. The material was most dense (medium dense to very dense) under or adjacent to the asphalt roadways and parking areas in BOR 1, BOR 2, BOR 17, BOR 19, BOR 36, and BOR 37, where the material was presumably used as fill and compacted.

Sand and Gravel: A dense to very dense (occasionally medium dense) sand and gravel layer underlies the topsoil/subsoil throughout the site, ranging in thickness between 0 and 33 feet. The zero foot thickness exists where the top of bedrock is close to ground surface, and the largest thicknesses exist in the northwestern portion of the site. The material generally consists of very dense fine to coarse sand, with varying amounts of gravel and silt, and occasional cobbles and boulders. "Practical" split spoon refusal was frequently encountered in this material (120 blows for 6 inches). In BOR 13, a five-foot seam of fine sand with a trace of silt and gravel was encountered from a depth of 30 to 35 feet, immediately above the bedrock.

Bedrock: The bedrock generally consists of fine to coarse-grained granite, with varying degrees of fracturing across the site. In BOR 9 and BOR 31, basalt was encountered instead of granite. Top of bedrock ranged from 1.5 to 35 feet below ground surface. In BOR 39, at the proposed location of the 1:1 bedrock slope, the bedrock consists of moderately hard to hard, slightly weathered, moderately to slightly fractured, greenish-gray coarse-grained granite, with closely spaced, moderately dipping joints. The Rock Quality Designation (RQD)[1] for BOR 39 was 32 percent for the top 5-foot core run, and 53% for the bottom 5-foot core run.

[1] RQD is the sum in inches of all pieces of moderately or less weathered rock core 4-inches in length or longer, divided by the length in inches of the core run, expressed as a percentage.

3.3 Groundwater Levels

Groundwater elevations were measured within the borehole at the completion of drilling. When borings were drilled over multiple days, groundwater readings were taken after the groundwater stabilized overnight.

Groundwater was encountered at a depth of 3 to 15 feet in the boreholes on the northwestern portion of the site. Groundwater was generally not encountered in the remainder of the boreholes, except for BOR 1, BOR 8, and BOR 32, where water was encountered at depths of 13.5 feet, 15 feet, and 8.5 feet respectively. It should be noted that groundwater levels encountered during and after construction may be different due to variations in season, rainfall, site features, and other factors different from those existing at the time the measurements were made during drilling. Also, due to a lag time between the drilling and stabilization of the groundwater level, the actual groundwater levels may vary from those observed in the borehole.

An observation well was installed at BOR 12 for long term groundwater monitoring. Appendix B includes water level readings within the well.

3.4 Laboratory Grain-Size Analyses

Soil samples within the sand and gravel stratum from borings BOR 18, BOR 20, BOR 21, and BOR 30 were taken to a laboratory for a grain-size analysis, in accordance with ASTM D 422. GeoTesting Express in Boxborough, MA performed the tests, and the results are presented in Appendix C. In general, the material is a fine to coarse sand and gravel, with approximately 20 to 30 percent fines. The material is classified as an SM-GM, or a silty sand and gravel, using the United Soil Classification System. Using the AASHTO Soil Classification System, the material would be classified into either Groups A-1-b or A-2-4.

3.5 Borehole Permeability Tests

Falling head permeability tests were conducted within BOR 13 and BOR 38 at depths of 19.9 and 15.5 feet respectively, to estimate the mean permeability of the subsurface material at the given depth. Test results indicated that the mean permeability was 3×10^{-3} cm/sec at BOR 13, and 3×10^{-4} cm/sec at BOR 38, as shown in Appendix D. In both boreholes, the material being tested was the sand and gravel layer (very dense, fine to coarse sand and gravel, with little silt).

Permeability values presented are unique to a specific boring location and depth, and are provided only as an indication of the permeability that may be anticipated in the sand and gravel stratum at the site. Variations in the permeability should be expected in the same stratum at different locations and depths. Further testing should be conducted if specific permeability rates are required in designated areas.

Testing procedures were in accordance with the Naval Facilities Design Manual 7.01, dated September 1986, which requires that tests be performed below the static groundwater level. Valid tests could therefore only be conducted in the northwestern portion of the site, where groundwater was typically present.

4. RECOMMENDATIONS

4.1 Foundations

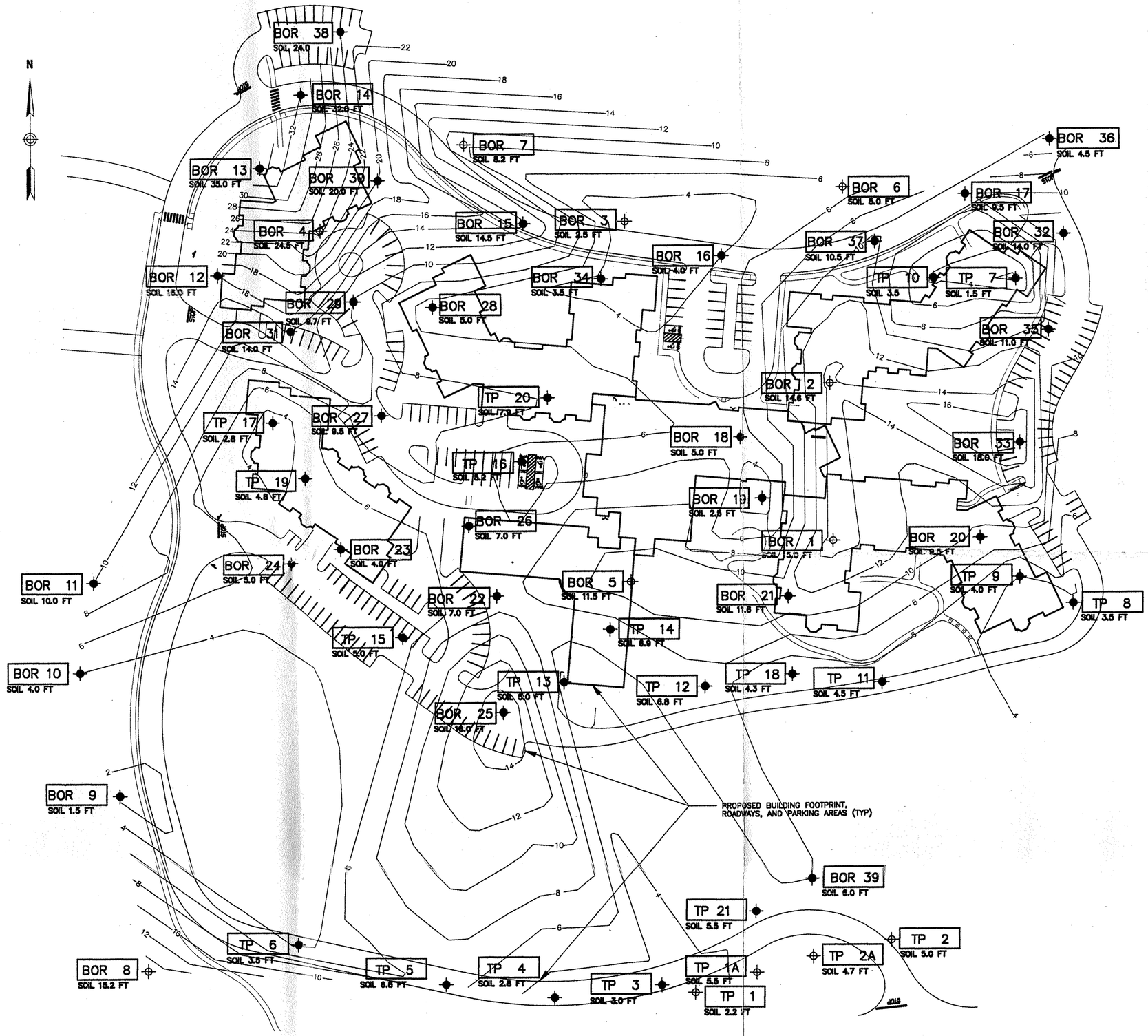
Based on existing site conditions, we recommend that the proposed building walls, columns, and other structural elements be founded on conventional spread or strip reinforced concrete footings, bearing on the dense to very dense sand and gravel or bedrock. Footings should be designed using a maximum net allowable bearing pressure of 5 tons per square foot where the footings bear on the sand and gravel, and 10 tons per square foot where the footings bear on bedrock. If overexcavation is required, footings may be placed on compacted Granular/Structural Fill with a recommended maximum net allowable bearing pressure of 3 tons per square foot. Foundations should be designed and constructed in accordance with the current Massachusetts State Building Code.

The topsoil/subsoil is unsuitable for building foundation support, and must be removed beneath the zone of support for foundations. Excavate topsoil/subsoil beneath footings within a zone defined by a 1:1 (horizontal:vertical) line extending downward and outward from the outside edge of the footing to the top of sand and gravel layer or bedrock. Dewater as necessary to confirm all topsoil and subsoil are removed to allow confirmation of the dense to very dense sand and gravel.

All foundations on undisturbed sand and gravel or compacted Granular/Structural Fill should be located such that the lower edges of adjacent footings do not have a steeper slope than 30 degrees with the horizontal.

Footings should be located a minimum of 4 feet below finish grade for frost protection, except where footings are founded on sound bedrock or at interior locations protected from frost. Interior footings protected from frost may be placed at least 18 inches below the top of any adjacent floor slabs. Protect all footings from exposure to freezing conditions during construction.

Test borings indicate that in some areas bedrock could be above the proposed bottom of foundation, and bedrock excavation may be required within the building area. Where an individual footing bears on both sand and gravel and bedrock, size the footing such that entire footing load can be supported by the sand and gravel stratum. The bedrock should not be considered to provide support in such cases.



NOTES:

1. PROPOSED BUILDING, ROADWAY AND PAVEMENT LAYOUT PROVIDED BY VANASSE HANGEN BRUSTLIN ON OCTOBER 30, 2000.
2. SOIL THICKNESS ABOVE BEDROCK BASED ON SUBSURFACE EXPLORATIONS CONDUCTED IN APRIL, SEPTEMBER AND OCTOBER 2000.
3. ELEVATIONS BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1929.

LEGEND:

TP – INDICATES BORINGS PERFORMED WITH A PORTABLE TRIPOD HAMMER.

BOR – INDICATES BORINGS PERFORMED WITH A DRILL RIG.

⊕ – BORINGS PERFORMED DURING PILOT EXPLORATION PROGRAM IN APRIL 2000.

● – BORINGS PERFORMED DURING FINAL EXPLORATION PROGRAM IN SEPTEMBER AND OCTOBER 2000.

SOIL 5.0 FT –SOIL THICKNESS ABOVE BEDROCK AT BORING LOCATION.

—10— – SOIL THICKNESS CONTOUR LINE (FEET).

WEIDLINGER ASSOCIATES INC
Consulting Engineers
One Broadway, Cambridge MA 02142
(617)–374–0000 fax: (617)374–0010

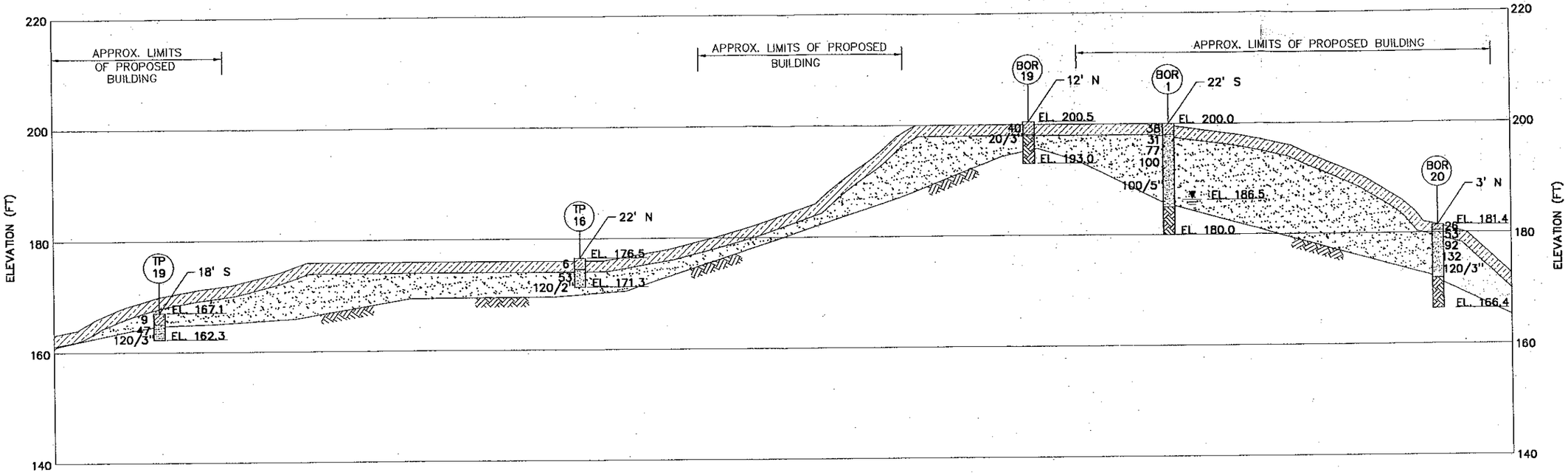
APPROXIMATE SOIL THICKNESS ABOVE BEDROCK CONTOURS

ARC Belmont Campus
Belmont, MA

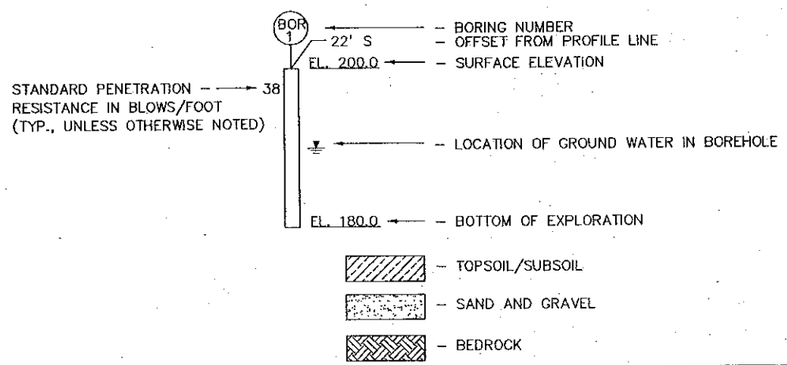
FIGURE 4

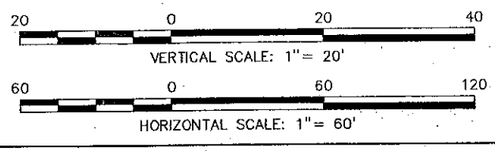
DRAWN BY	LF/AD
CHECKED BY	SJD
SCALE	AS SHOWN
DATE	12 DEC 2000

G:\PROJECTS\20737\FIGURE4.DWG



LEGEND





NOTES:

1. REFER TO FIGURE 2 FOR PLAN LOCATIONS OF BORINGS.
2. ELEVATIONS SHOWN REFERENCED TO NATIONAL GEODETIC VERTICAL DATUM (NGVD) OF 1929.
3. GROUND SURFACE ELEVATIONS AND STRATUM CHANGES SHOWN ARE APPROXIMATIONS, AND ARE INTERPOLATED BASED ON SUBSURFACE EXPLORATIONS CONDUCTED. ACTUAL CONDITIONS MAY VARY FROM THOSE PRESENTED.
4. BORINGS SHOWN MAY BE OFFSET FROM THE PROFILE ILLUSTRATED, AND THEREFORE GROUND SURFACE ELEVATIONS OR STRATUM CHANGES MAY NOT DIRECTLY COINCIDE WITH THOSE SHOWN ON THE PROFILE

WEIDLINGER ASSOCIATES INC
Consulting Engineers
One Broadway, Cambridge MA 02142
(617)-374-0000 fax:(617)374-0010

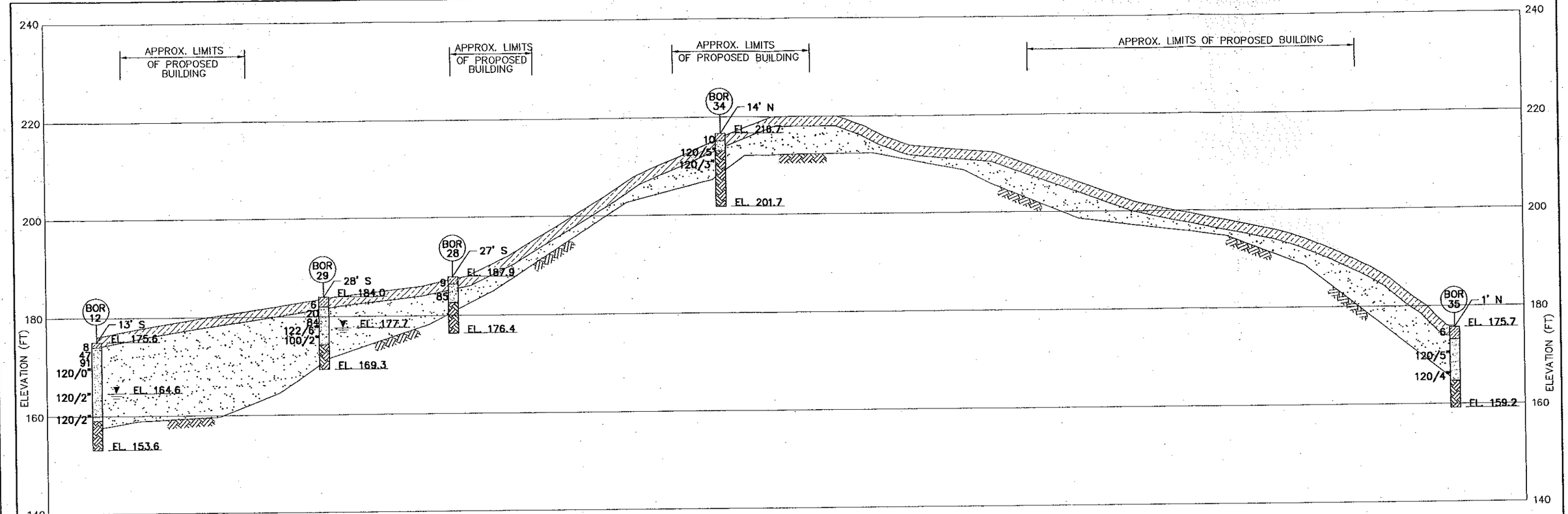
SUBSURFACE PROFILE SECTION A - A'

ARC Belmont Campus
Belmont, MA

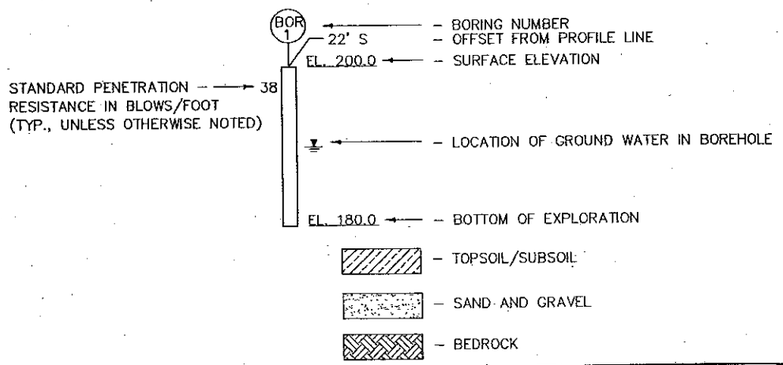
FIGURE 5

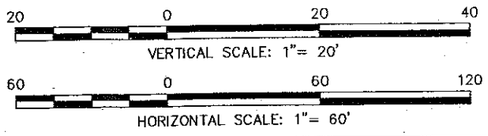
DRAWN BY	LF
CHECKED BY	SJD
SCALE	AS SHOWN
DATE	12 DEC 2000

G:\PROJECTS\20737\FIGURES.DWG



LEGEND





NOTES:

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3. GROUND SURFACE ELEVATIONS AND STRATUM CHANGES SHOWN ARE APPROXIMATIONS, AND ARE INTERPOLATED BASED ON SUBSURFACE EXPLORATIONS CONDUCTED. ACTUAL CONDITIONS MAY VARY FROM THOSE PRESENTED.
4. BORINGS SHOWN MAY BE OFFSET FROM THE PROFILE ILLUSTRATED, AND THEREFORE GROUND SURFACE ELEVATIONS OR STRATUM CHANGES MAY NOT DIRECTLY COINCIDE WITH THOSE SHOWN ON THE PROFILE

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(617)-374-0000 fax:(617)374-0010

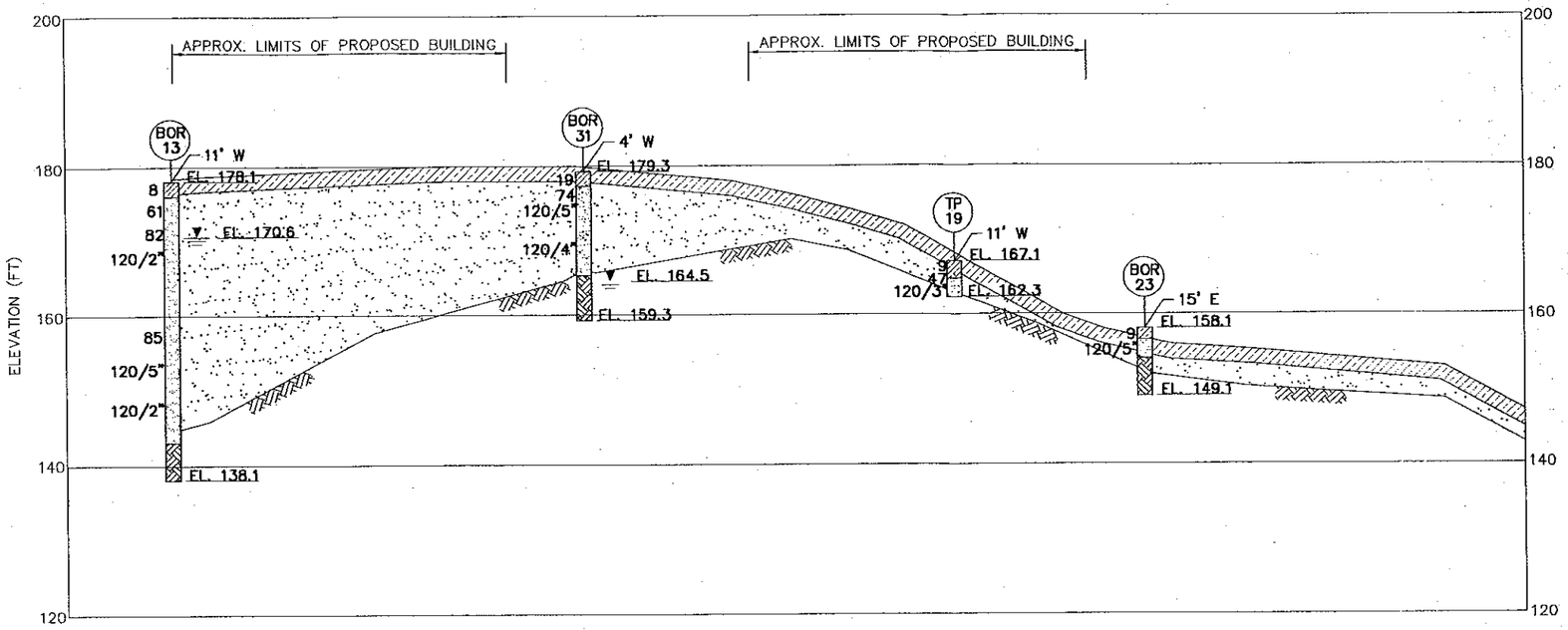
SUBSURFACE PROFILE SECTION B - B

ARC Belmont Campus
Belmont, MA

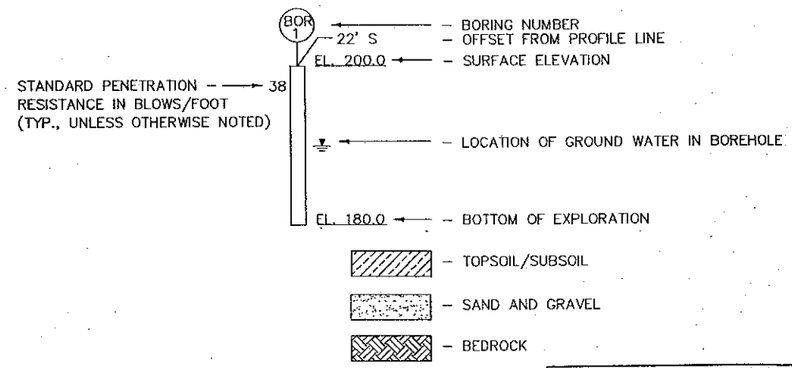
FIGURE 6

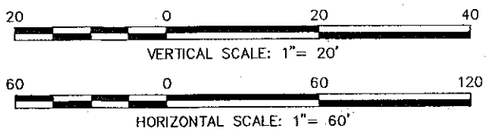
DRAWN BY	LF
CHECKED BY	SJD
SCALE	AS SHOWN
DATE	12 DEC 2000

G:\PROJECTS\2073\FIGURES.DWG



LEGEND





NOTES:

1. REFER TO FIGURE 2 FOR PLAN LOCATIONS OF BORINGS.
2. ELEVATIONS SHOWN REFERENCED TO NATIONAL GEODETIC VERTICAL DATUM (NGVD) OF 1929.
3. GROUND SURFACE ELEVATIONS AND STRATUM CHANGES SHOWN ARE APPROXIMATIONS, AND ARE INTERPOLATED BASED ON SUBSURFACE EXPLORATIONS CONDUCTED. ACTUAL CONDITIONS MAY VARY FROM THOSE PRESENTED.
4. BORINGS SHOWN MAY BE OFFSET FROM THE PROFILE ILLUSTRATED, AND THEREFORE GROUND SURFACE ELEVATIONS OR STRATUM CHANGES MAY NOT DIRECTLY COINCIDE WITH THOSE SHOWN ON THE PROFILE

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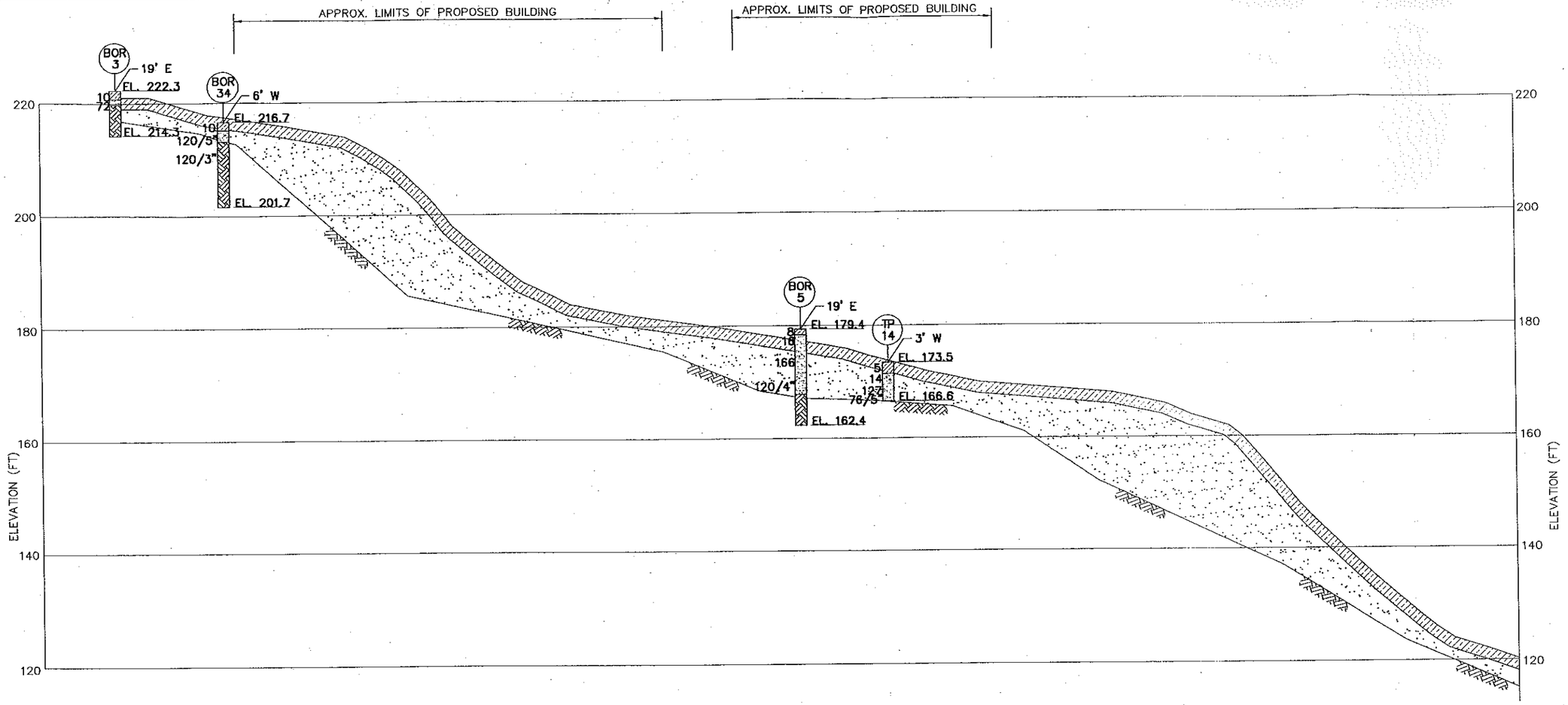
SUBSURFACE PROFILE SECTION C - C

ARC Belmont Campus
Belmont, MA

FIGURE 7

DRAWN BY	LF
CHECKED BY	SJD
SCALE	AS SHOWN
DATE	12 DEC 2000

G:\PROJECTS\20737\FIGURE7.DWG



LEGEND

BOR 1 – BORING NUMBER
22' S – OFFSET FROM PROFILE LINE
EL. 200.0 – SURFACE ELEVATION
STANDARD PENETRATION RESISTANCE IN BLOWS/FOOT (TYP., UNLESS OTHERWISE NOTED) – 38
– LOCATION OF GROUND WATER IN BOREHOLE
EL. 180.0 – BOTTOM OF EXPLORATION
– TOPSOIL/SUBSOIL
– SAND AND GRAVEL
– BEDROCK

20 0 20 40
VERTICAL SCALE: 1"= 20'

60 0 60 120
HORIZONTAL SCALE: 1"= 60'

NOTES:

1. REFER TO FIGURE 2 FOR PLAN LOCATIONS OF BORINGS.
2. ELEVATIONS SHOWN REFERENCED TO NATIONAL GEODETIC VERTICAL DATUM (NGVD) OF 1929.
3. GROUND SURFACE ELEVATIONS AND STRATUM CHANGES SHOWN ARE APPROXIMATIONS, AND ARE INTERPOLATED BASED ON SUBSURFACE EXPLORATIONS CONDUCTED. ACTUAL CONDITIONS MAY VARY FROM THOSE PRESENTED.
4. BORINGS SHOWN MAY BE OFFSET FROM THE PROFILE ILLUSTRATED, AND THEREFORE GROUND SURFACE ELEVATIONS OR STRATUM CHANGES MAY NOT DIRECTLY COINCIDE WITH THOSE SHOWN ON THE PROFILE

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SUBSURFACE PROFILE SECTION D - D

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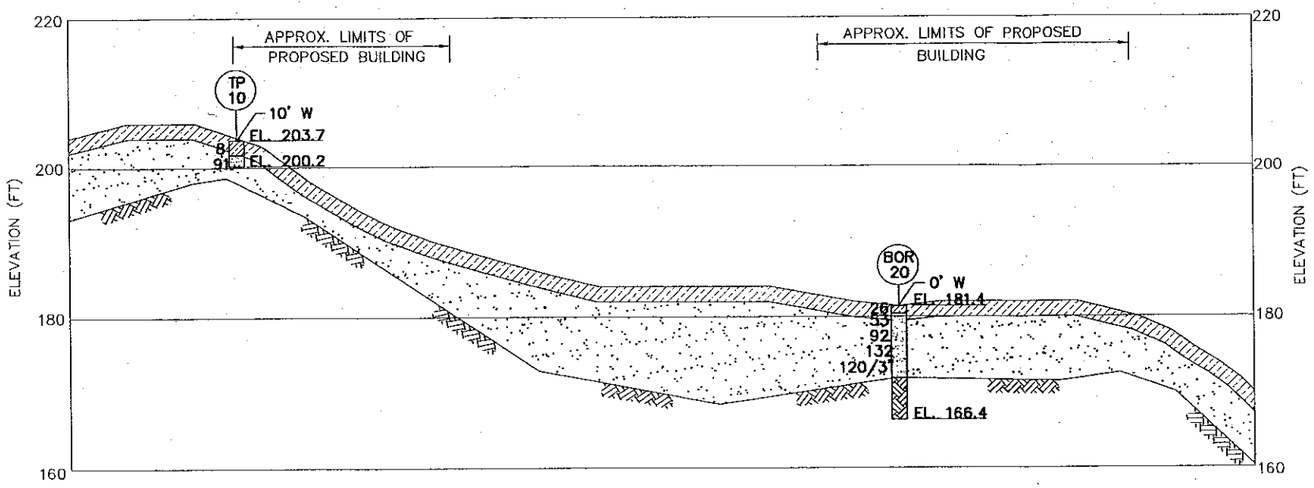
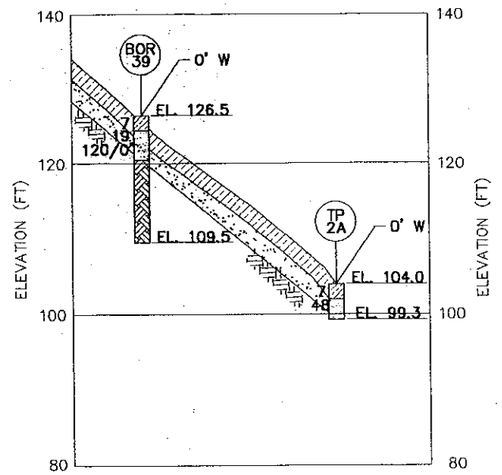
FIGURE 8

DRAWN BY	LF
CHECKED BY	SJD
SCALE	AS SHOWN
DATE	12 DEC 2000

G:\PROJECTS\2073\FIGURE8.DWG

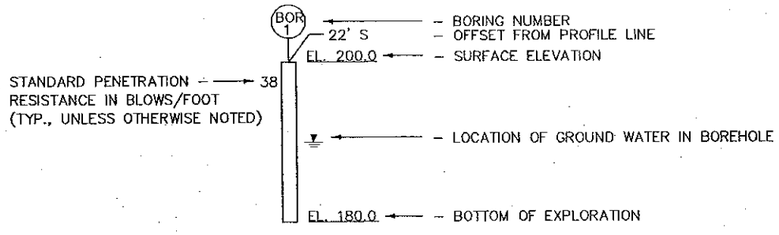


SECTION E - E



SECTION F - F

LEGEND

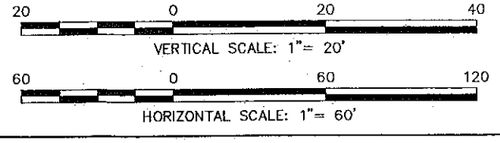


– BORING NUMBER
– OFFSET FROM PROFILE LINE
– SURFACE ELEVATION
– LOCATION OF GROUND WATER IN BOREHOLE
– BOTTOM OF EXPLORATION

– TOPSOIL/SUBSOIL
– SAND AND GRAVEL
– BEDROCK

NOTES:

1. REFER TO FIGURE 2 FOR PLAN LOCATIONS OF BORINGS.
2. ELEVATIONS SHOWN REFERENCED TO NATIONAL GEODETIC VERTICAL DATUM (NGVD) OF 1929.
3. GROUND SURFACE ELEVATIONS AND STRATUM CHANGES SHOWN ARE APPROXIMATIONS, AND ARE INTERPOLATED BASED ON SUBSURFACE EXPLORATIONS CONDUCTED. ACTUAL CONDITIONS MAY VARY FROM THOSE PRESENTED.
4. BORINGS SHOWN MAY BE OFFSET FROM THE PROFILE ILLUSTRATED, AND THEREFORE GROUND SURFACE ELEVATIONS OR STRATUM CHANGES MAY NOT DIRECTLY COINCIDE WITH THOSE SHOWN ON THE PROFILE



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SUBSURFACE PROFILES
SECTION E - E
SECTION F - F

ARC Belmont Campus
Belmont, MA

FIGURE 9

DRAWN BY	LF
CHECKED BY	SJD
SCALE	AS SHOWN
DATE	12 DEC 2000

CARR-DEE CORP.

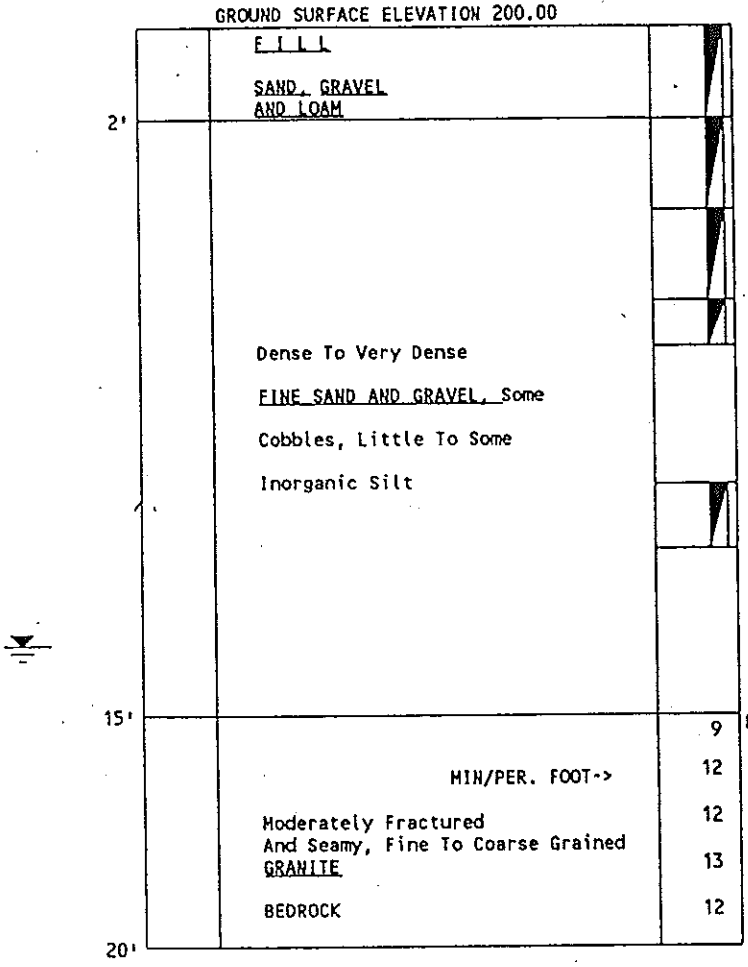
37 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone (781) 391-4500

To: WEIDLINGE ASSOCIATES, INC., CAMBRIDGE, MA Date: 4-12-2000 Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING 1

GROUND SURFACE ELEVATION 200.00



S#1, 0' to 2' (2-16-22-17) RECOVERED 5 in.

S#2, 2' to 4' (12-15-16-35) RECOVERED 15 in.

S#3, 4' to 6' (23-33-44-53) RECOVERED 20 in.

S#4, 6' to 7' (37-100) RECOVERED 7 in.

S#5, 10' to 11'5" (71-56-100/5") RECOVERED 12 in.

RUN 1, 15' to 20' (RECOVERED 48" (80%))

WATER LEVEL 13'6"
SIZE OF AUGERS 3-3/4" I.D., LENGTH 5'0"
SIZE OF CASING NW, LENGTH 15'0"
SIZE OF ROCK CORE BX, LENGTH DRILLED: 5'0"
DRILLER: RENE' DESIMONE, INSPECTOR: ASSAAD EL-HADDAD
DATE STARTED & COMPLETED: 4-6-2000

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

WEIDLINGER ASSOCIATES INC
CONSULTING ENGINEERS

CARR-DEE CORP.

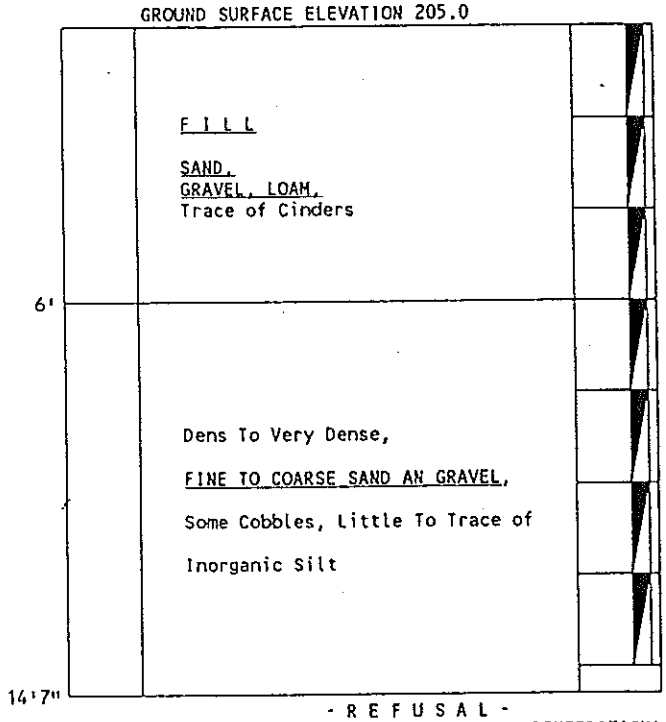
37 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone (781) 391-4500

To: WEIDLINGE ASSOCIATES, INC., CAMBRIDGE, MA Date: 4-12-2000 Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING 2

GROUND SURFACE ELEVATION 205.0



S#1, 0' to 2' (2-3-4-4) RECOVERED 13 in.

S#2, 2' to 4' (20-25-37-16) RECOVERED 3 in.

S#3, 4' to 6' (15-15-16-20) RECOVERED 12 in.

S#4, 6' to 8' (14-15-16-19) RECOVERED 10 in.

S#5, 8' to 10' (14-16-17-19) RECOVERED 6 in.

S#6, 10' to 12' (27-31-44-40) RECOVERED 8 in.

S#7, 12' to 14' (37-58-55-59) RECOVERED 9 in.

NO WATER ENCOUNTERED
SIZE OF CASING, NW, LENGTH 12'0"
DRILLER: RENE' DESIMONE, INSPECTOR: ASSAAD EL-HADDAD
DATE STARTED & COMPLETED: 4-6-2000

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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To: WEIDLINGE ASSOCIATES, INC., CAMBRIDGE, MA Date: 4-12-2000 Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING 3

GROUND SURFACE ELEVATION 222.3

	LOAM, LOAMY SAND, Little Gravel		S#1, 0' to 1'6" (4-4-6) RECOVERED 13 in.
1'6"	Very Dense FINE TO COARSE SAND AND GRAVEL		S#2, 1'6" to 2'6" (21-51) RECOVERED 6 in.
2'6"	BEDROCK (Used Roller Bit)		
3'		8	RUN 1, 3' to 8' (RECOVERED 60" (100%))
	MIN/PER. FOOT->	10	
	Moderately Fractured, Coarse Grained GRANITE	10	
		9	
	BEDROCK	8	
8'			

NO WATER ENCOUNTERED
SIZE OF CASING, NW, LENGTH 3'0"
SIZE OF ROCK CORE BX, LENGTH DRILLED: 5'0"
DRILLER: RENE' DESIMONE
DATE STARTED & COMPLETED: 4-7-2000

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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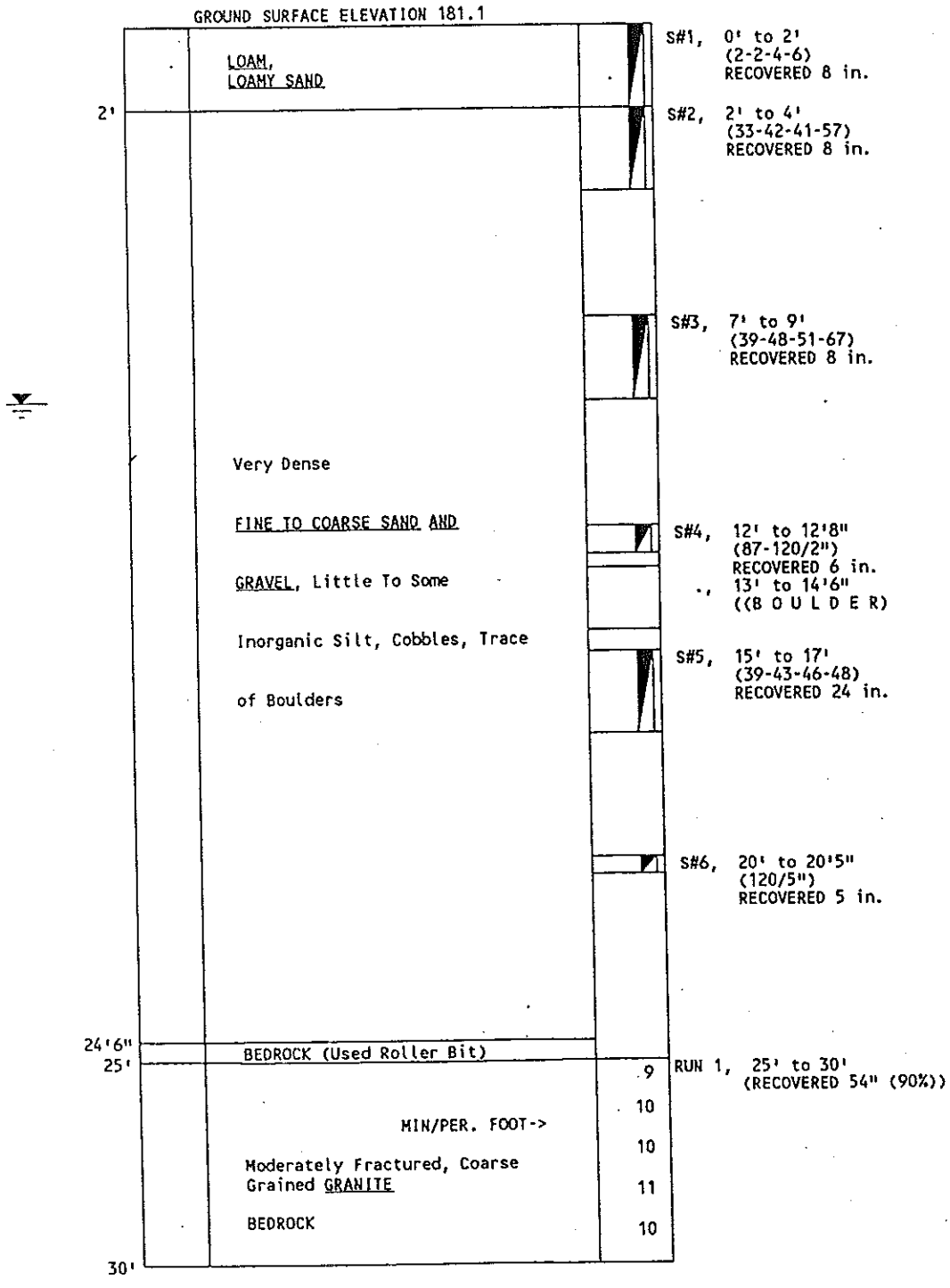
To: WEIDLINGE ASSOCIATES, INC., CAMBRIDGE, MA Date: 4-12-2000 Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING 4



WATER LEVEL 9'
SIZE OF CASING NW, LENGTH 25'0", SIZE OF ROCK CORE BX,LENGTH DRILLED: 5'0"
DRILLER: RENE' DESIMONE, DATE STARTED & COMPLETED: 4-7-2000, 4-10-2000

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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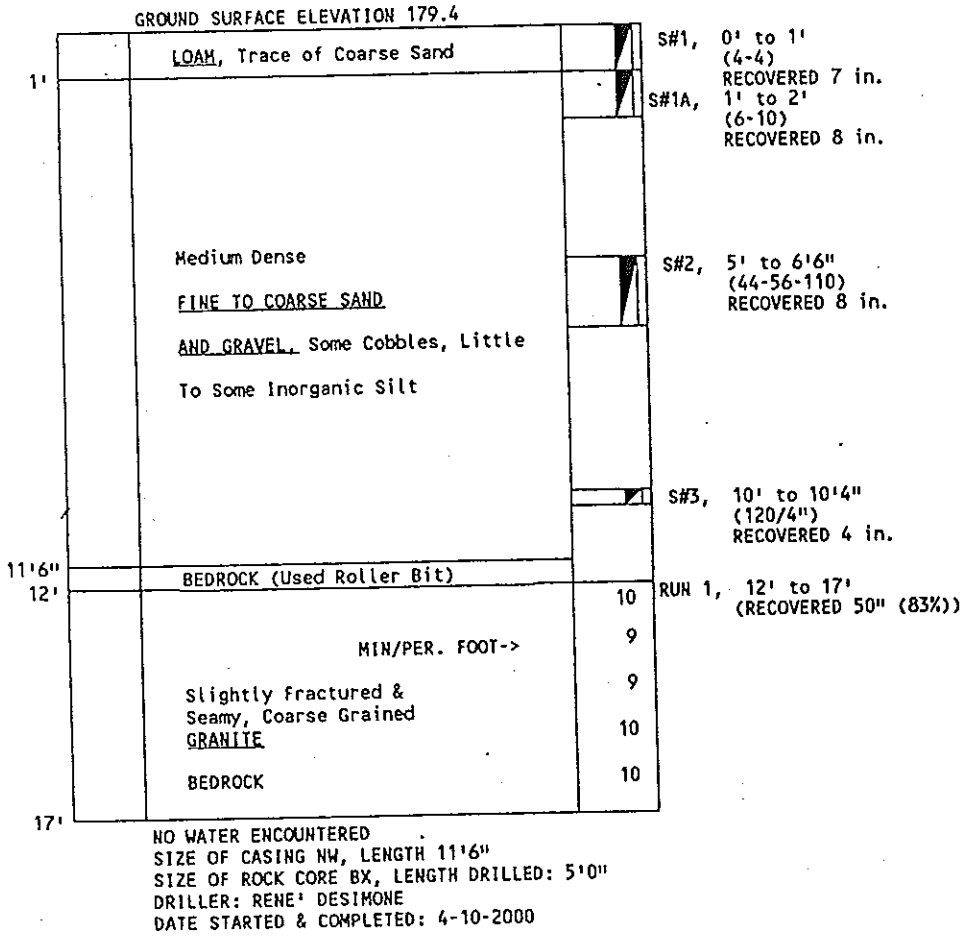
To: WEIDLINGE ASSOCIATES, INC., CAMBRIDGE, MA Date: 4-12-2000 Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING 5



NO WATER ENCOUNTERED
SIZE OF CASING NW, LENGTH 11'6"
SIZE OF ROCK CORE BX, LENGTH DRILLED: 5'0"
DRILLER: RENE' DESIMONE
DATE STARTED & COMPLETED: 4-10-2000

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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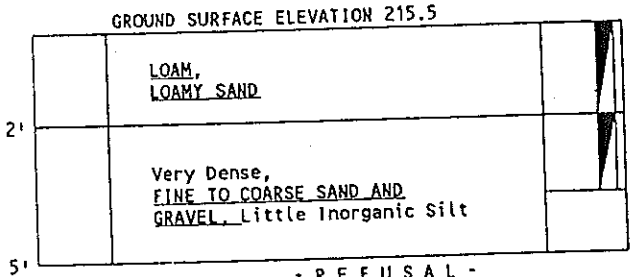
To: WEIDLINGE ASSOCIATES, INC., CAMBRIDGE, MA Date: 4-12-2000 Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING 6

GROUND SURFACE ELEVATION 215.5



S#1, 0' to 2'
(2-4-4-5)
RECOVERED 11 in.

S#2, 2' to 3'8"
(15-17-44-120/2")
RECOVERED 9 in.

- R E F U S A L -
(120 BLOWS, S.S., 140-LB. WGT., NO PENETRATION)

NO WATER ENCOUNTERED
DRILLER: RENE' DESIMONE
DATE STARTED & COMPLETED: 4-10-2000

NOTE: ALTERNATE BORING MADE 5'0" TOWARDS BORING NO. 3, "REFUSAL" ENCOUNTERED AT DEPTH OF 4'6"

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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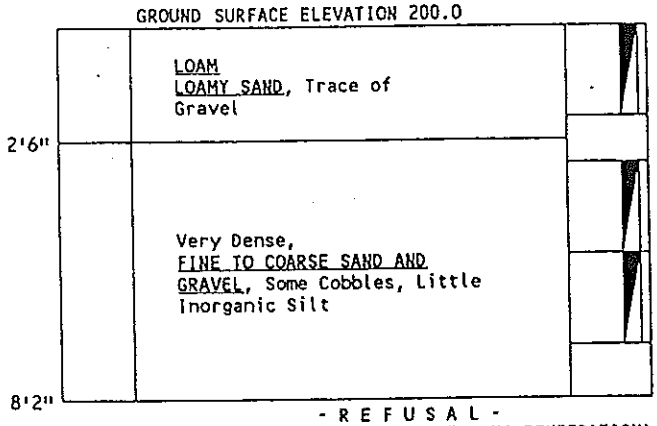
To: WEIDLINGE ASSOCIATES, INC., CAMBRIDGE, MA Date: 4-12-2000 Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING 7

GROUND SURFACE ELEVATION 200.0



S#1, 0' to 2' (4-4-6-6) RECOVERED 10 in.

S#2, 3' to 5' (27-38-44-51) RECOVERED 14 in.

S#3, 5' to 7' (47-52-57-61) RECOVERED 10 in.

- R E F U S A L -
(120 BLOWS, S.S., 140-LB. WGT., NO PENETRATION)

NO WATER ENCOUNTERED
SIZE OF CASING NW, LENGTH 5'0"
DRILLER: RENE' DESIMONE
DATE STARTED & COMPLETED: 4-7-2000

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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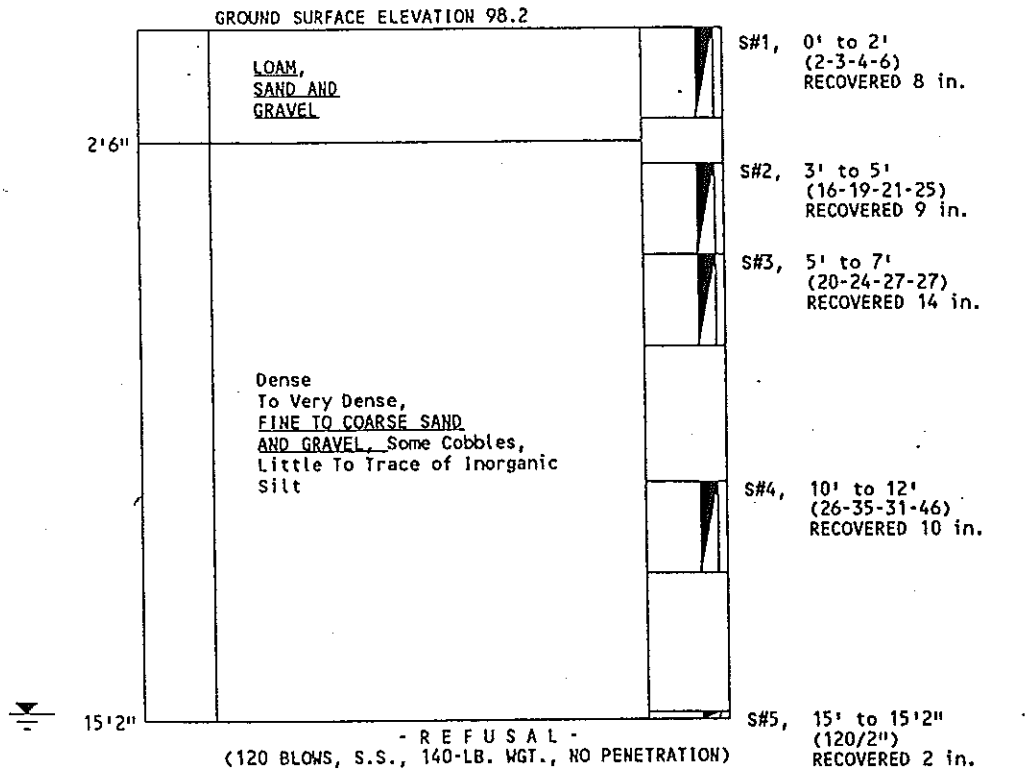
To: WEIDLINGE ASSOCIATES, INC., CAMBRIDGE, MA Date: 4-12-2000 Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING 8



WATER LEVEL 15'
SIZE OF CASING NW, LENGTH 15'0"
DRILLER: RENE' DESIMONE
DATE STARTED & COMPLETED: 4-10-2000

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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To: WEIDLINGER ASSOCIATES, INC., CAMBRIDGE, MA Date: _____ Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING B-9

GROUND SURFACE

	Loamy FINE SAND, Trace of Gravel		S#1, 0' to 1' (3-4) RECOVERED 7 in.
1'	*FINE TO COARSE SAND & GRAVEL,		
1'6"	BEDROCK (USED ROLLER BIT)		S#1A, 1' to 1'6" (43-120/0") RECOVERED 2 in.
2'6"		7	RUN 1, 2'6" to 7'6" (RECOVERED 56" (93%))
		7	
	MIN/PER.FOOT->		
	Gray, Moderately Fractured, Fine Grained BASALT	8	
		8	
	BEDROCK	9	
7'6"			

NO WATER ENCOUNTERED
SIZE OF CASING NW, LENGTH 2'6"
SIZE OF ROCK CORE BX, LENGTH DRILLED: 5'0"
DRILLER: RENE' DESIMONE
DATE STARTED & COMPLETED: 9-28-00

*Trace of Inorganic Silt

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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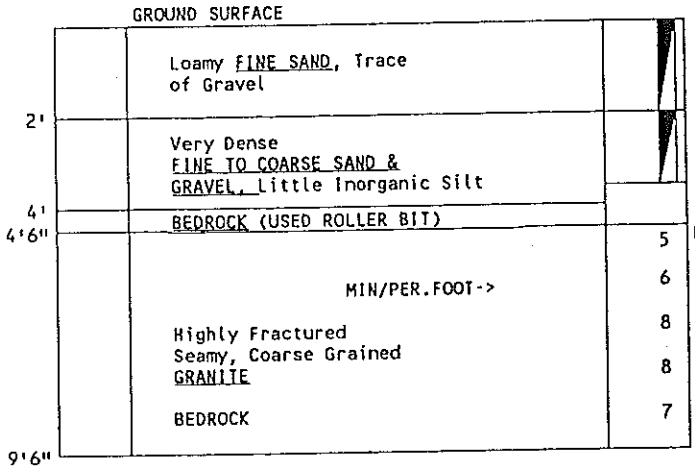
To: WEIDLINGER ASSOCIATES, INC., CAMBRIDGE, MA Date: _____ Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING B-10



NO WATER ENCOUNTERED
SIZE OF CASING NW, LENGTH 4'0"
SIZE OF ROCK CORE BX, LENGTH DRILLED: 5'0"
DRILLER: RENE' DESIMONE, INSPECTOR: SCOTT DIFIORE
DATE STARTED & COMPLETED: 9-29-00

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

WEIDLINGER ASSOCIATES INC
CONSULTING ENGINEERS

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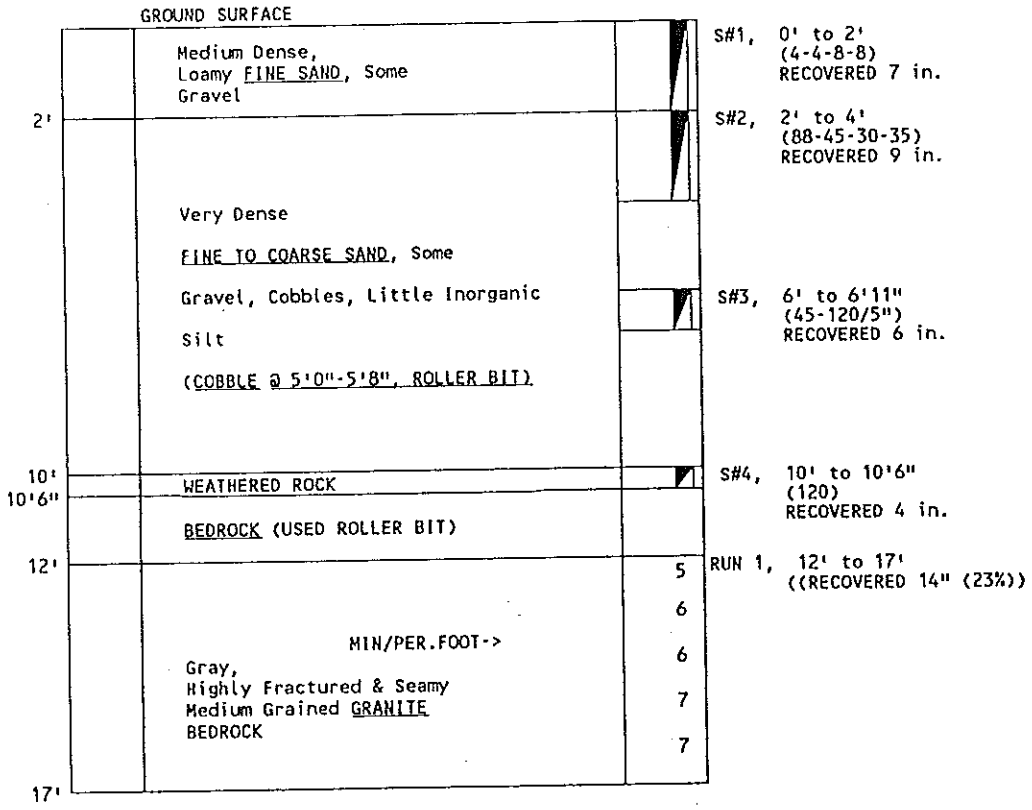
To: WEIDLINGER ASSOCIATES, INC., CAMBRIDGE, MA Date: _____ Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING B-11



NO WATER ENCOUNTERED
SIZE OF CASING NW, LENGTH 12'0"
SIZE OF ROCK CORE BX, LENGTH DRILLED: 5'0"
DRILLER: RENE' DESIMONE, INSPECTOR: SCOTT DIFIORE
DATE STARTED & COMPLETED: 9-29-2000

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

WEIDLINGER ASSOCIATES INC
CONSULTING ENGINEERS

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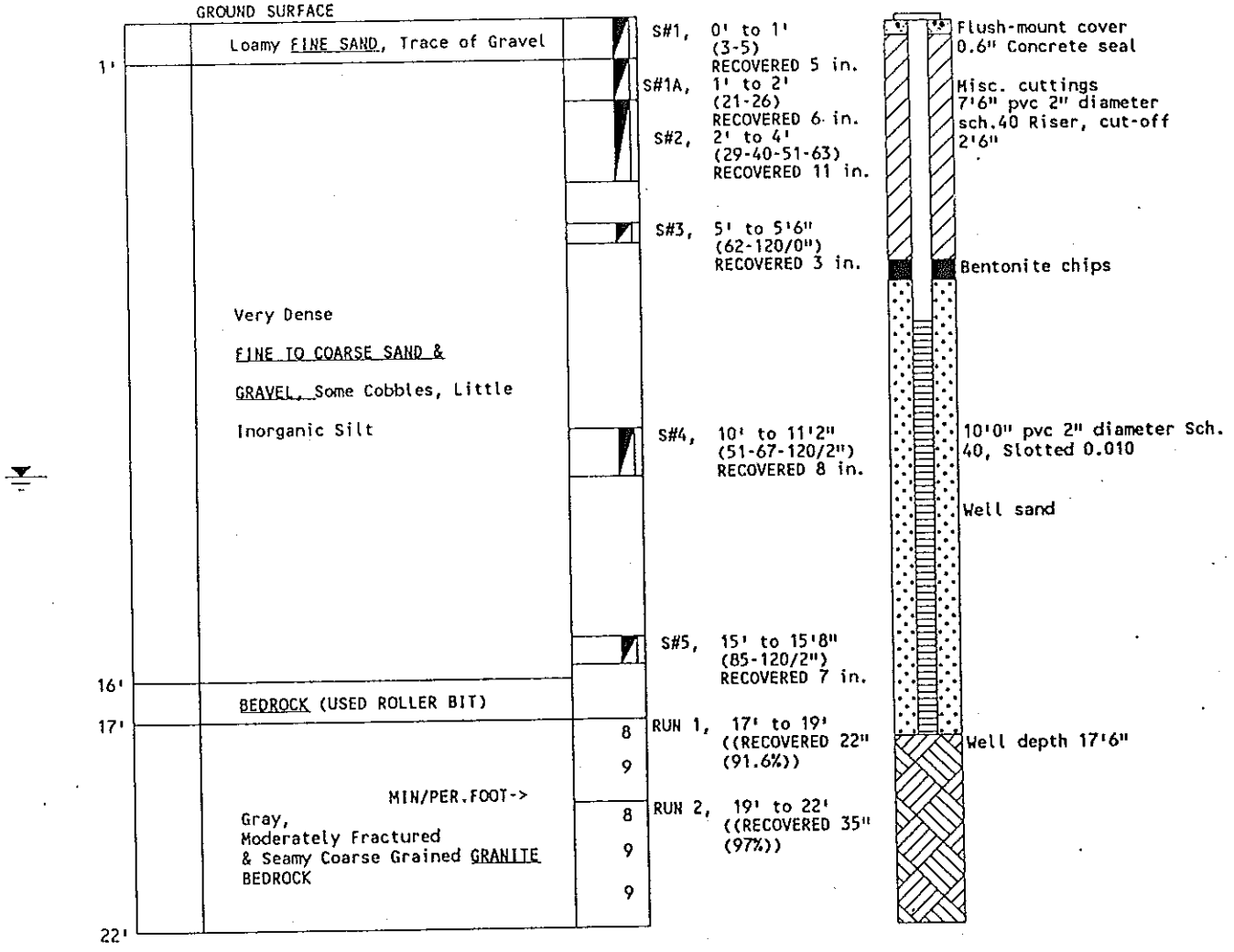
To: WEIDLINGER ASSOCIATES, INC., CAMBRIDGE, MA Date: _____ Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING B-12

MONITORING WELL



WATER LEVEL 11'
SIZE OF AUGERS 3-3/4" I.D., LENGTH 10'0"
SIZE OF ROCK CORE BX, LENGTH DRILLED: 5'0"
SIZE OF CASING NW, LENGTH 17'0"
DRILLER: RENE' DESIMONE, INSPECTOR: SCOTT DIFIORE
DATE STARTED & COMPLETED: 10-4-00, 10-6-00

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

WEIDLINGER ASSOCIATES INC
CONSULTING ENGINEERS

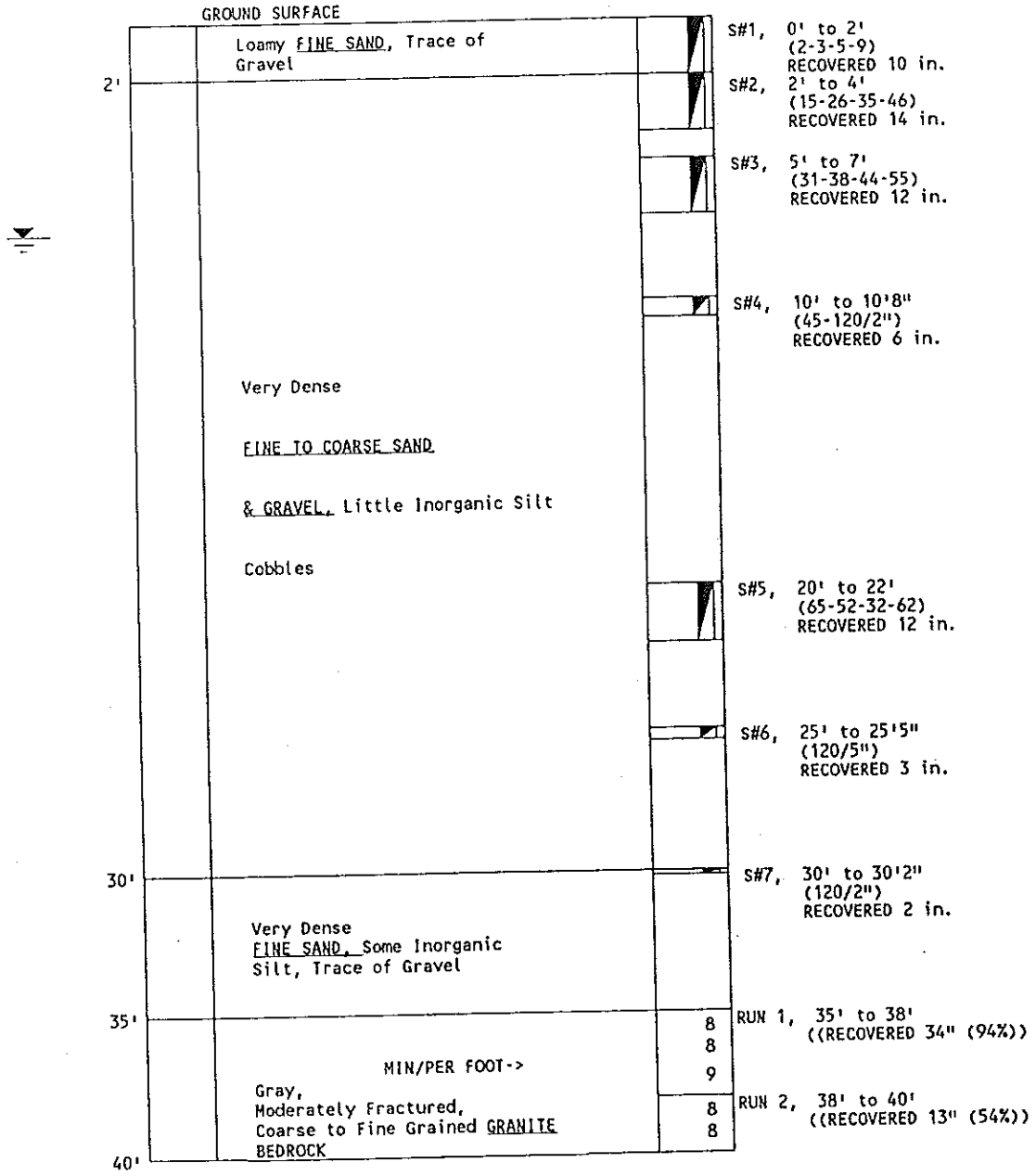
CARR-DEE CORP.

37 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone (781) 391-4500

To: WEIDLINGER ASSOCIATES, INC., CAMBRIDGE, MA Date: _____ Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING B-13



WATER LEVEL 7'6"
SIZE OF CASING NW, LENGTH 35'0"
SIZE OF ROCK CORE BX, LENGTH DRILLED: 5'0"
DRILLER: RENE' DESIMONE, INSPECTOR: SCOTT DIFIORE
DATE STARTED & COMPLETED: 9-28-00, 10-3-00

NOTE: PERMEABILITY TEST TAKEN AT DEPTH OF 20'0", 1 HOUR STANDBY.

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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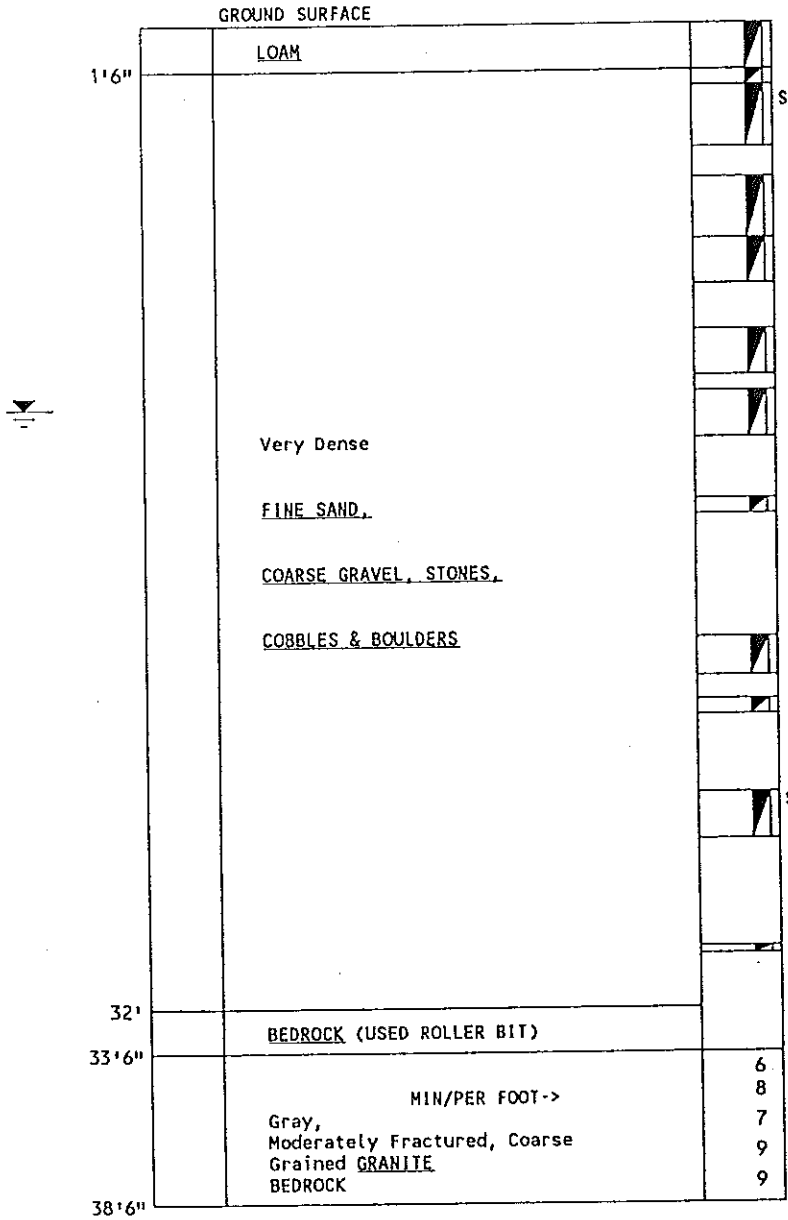
To: WEIDLINGER ASSOCIATES, INC., CAMBRIDGE, MA Date: _____ Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING B-14



S#1, 0' to 1'6"
(1-2-4)
RECOVERED 8 in.

S#1A, 1'6" to 2'
(9)
RECOVERED 3 in.

S#2, 2' to 4'
(23-32-23-68)
RECOVERED 18 in.

S#3, 5' to 7'
(70-40-35-35)
RECOVERED 15 in.

S#4, 7' to 8'6"
(27-49-100)
RECOVERED 7 in.

S#5, 10' to 11'6"
(82-45-100)
RECOVERED 12 in.

S#6, 12' to 13'6"
(47-79-100)
RECOVERED 6 in.

S#7, 15'6" to 16'
(70-100/0")
RECOVERED 3 in.

S#8, 20' to 21'3"
(35-56-100/3")
RECOVERED 8 in.

S#9, 22' to 22'6"
(100/6")
RECOVERED 0 in.

S#10, 25' to 26'6"
(28-61-79)
RECOVERED 8 in.

S#11, 30' to 30'3"
(80/3")
RECOVERED 2 in.

RUN 1, 33'6" to 38'6"
(RECOVERED 60" (100%))

WATER LEVEL 12'6"
SIZE OF CASING NW, LENGTH 30'0"
SIZE OF ROCK CORE BX, LENGTH DRILLED: 5'0"
DRILLERS: RENE' DESIMONE & JOSEPH CENTRELLA
DATE STARTED & COMPLETED: 9-25-00, 9-27-00

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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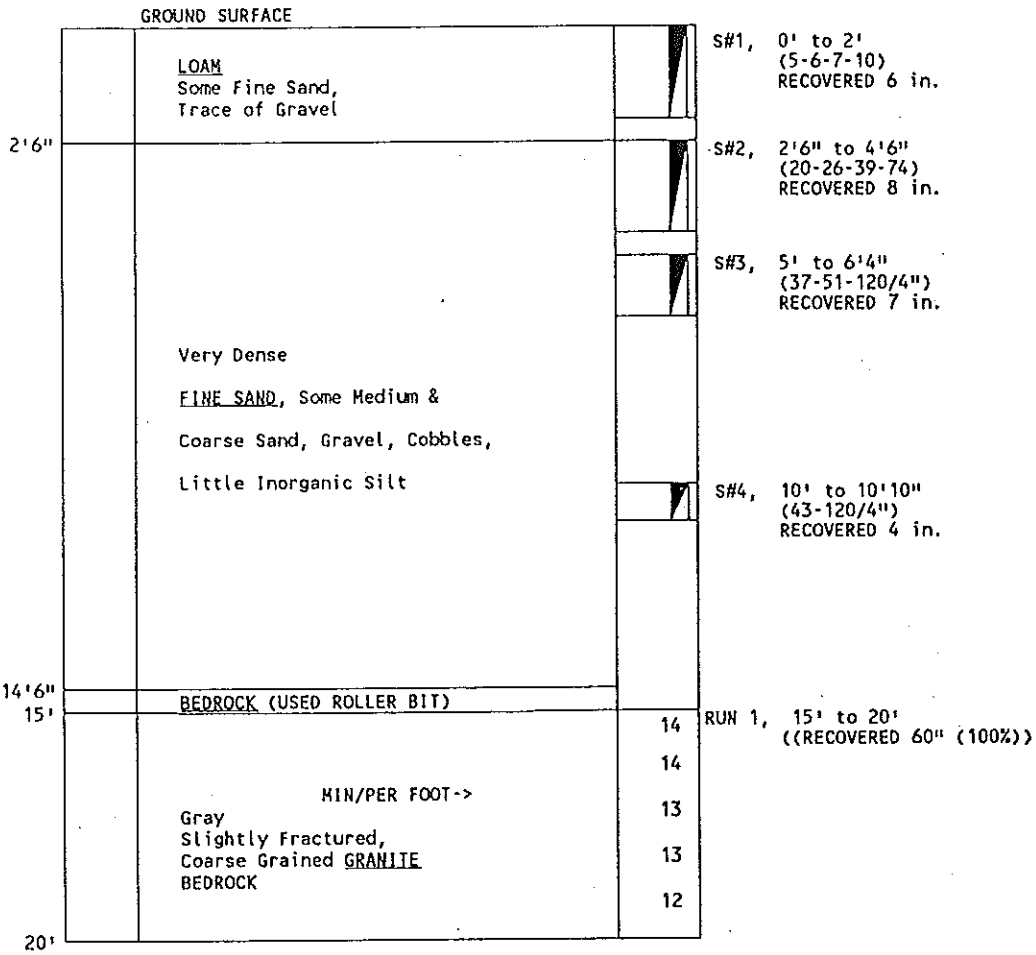
To: WEIDLINGER ASSOCIATES, INC., CAMBRIDGE, MA Date: _____ Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING B-15



NO WATER ENCOUNTERED
SIZE OF AUGERS 3-3/4" I.D., LENGTH 10'0"
SIZE OF CASING NW, LENGTH 14'6"
SIZE OF ROCK CORE BX, LENGTH DRILLED: 5'0"
DRILLER: RENE' DESIMONE
DATE STARTED & COMPLETED: 10-17-00, 10-18-00

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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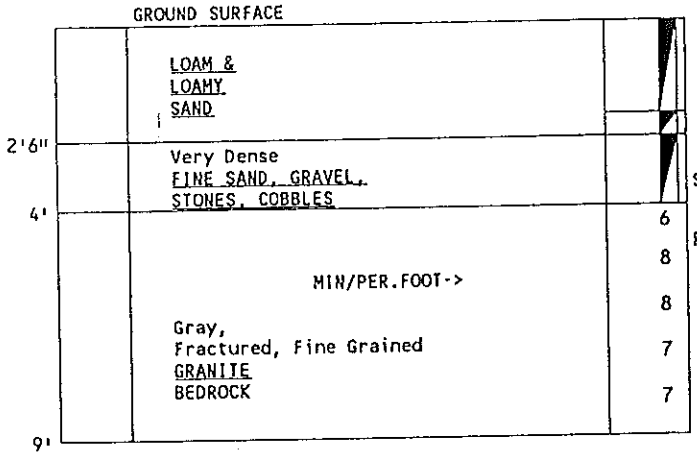
To: WEIDLINGER ASSOCIATES, INC., CAMBRIDGE, MA Date: _____ Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING B-16



S#1, 0' to 2'
(3-6-5-2)
RECOVERED 4 in.

S#2, 2' to 2'6"
(3)
RECOVERED 4 in.

S#2A, 2'6" to 4'
(70-79-100)
RECOVERED 8 in.

RUN 1, 4' to 9'
((RECOVERED 51" (85%))

NO WATER ENCOUNTERED
SIZE OF CASING NW, LENGTH 4'0"
SIZE OF ROCK CORE BX, LENGTH DRILLED: 5'0"
DRILLER: JOSEPH CENTRELLA
DATE STARTED & COMPLETED: 10-2-00

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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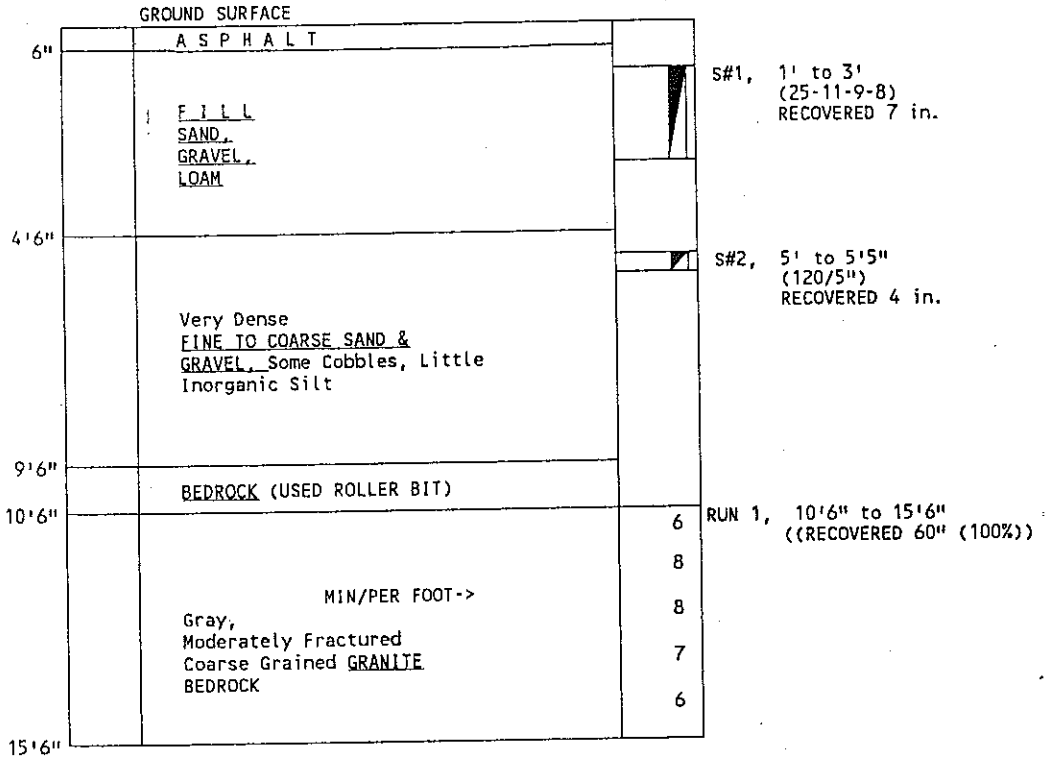
To: WEIDLINGER ASSOCIATES, INC., CAMBRIDGE, MA Date: _____ Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING B-17



NO WATER ENCOUNTERED
SIZE OF AUGERS 3-3/4" I.D., LENGTH 5'0"
SIZE OF CASING HW, LENGTH 9'6"
SIZE OF ROCK CORE NX, LENGTH DRILLED: 5'0"
DRILLER: RENE' DESIMONE
DATE STARTED & COMPLETED: 10-10-00

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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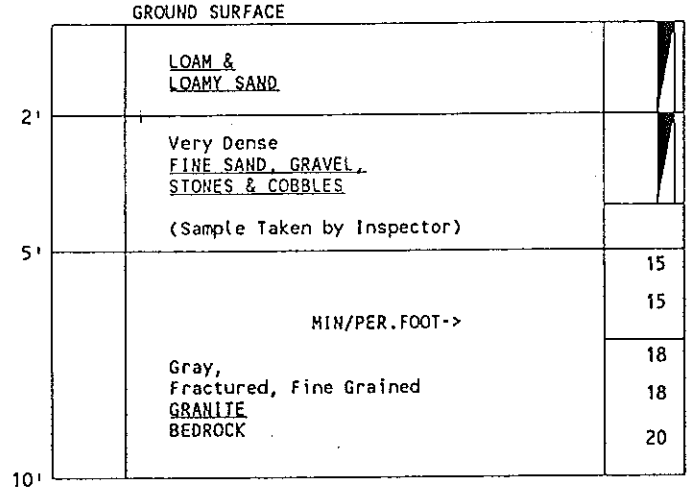
To: WEIDLINGER ASSOCIATES, INC., CAMBRIDGE, MA Date: _____ Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING B-18



NO WATER ENCOUNTERED
DRILLER: JOSEPH CENTRELLA, INSPECTOR: SCOTT DIFIORE
DATE STARTED & COMPLETED: 10-5-00

NOTE: 2.5 O.D SAMPLER WAS USED FOR THIS BORING.

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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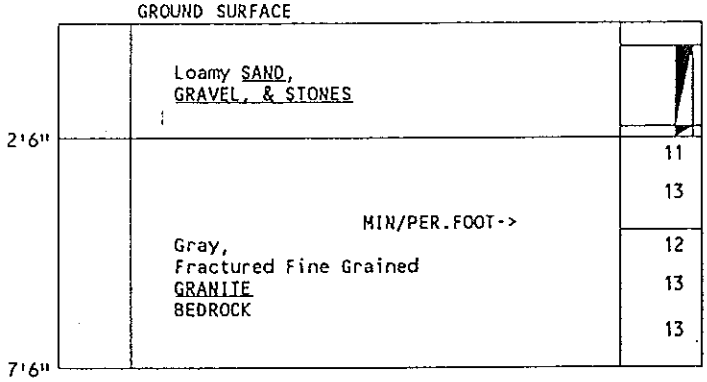
To: WEIDLINGER ASSOCIATES, INC., CAMBRIDGE, MA Date: _____ Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING B-19



S#1, 6" to 2'3"
(6-17-23-100/3")
RECOVERED 12 in.

S#2, 2'3" to 2'6"
(20/3")
RECOVERED 3 in.

RUN 1, 2'6" to 4'6"
((RECOVERED 14" (58%))

RUN 2, 4'6" to 7'6"
((RECOVERED 36" (100%))

NO WATER ENCOUNTERED
DRILLER: JOSEPH CENTRELLA, INSPECTOR: SCOTT DIFIORE
DATE STARTED & COMPLETED: 10-5-00

NOTE: 2.5 O.D SAMPLER WAS USED FOR THIS BORING

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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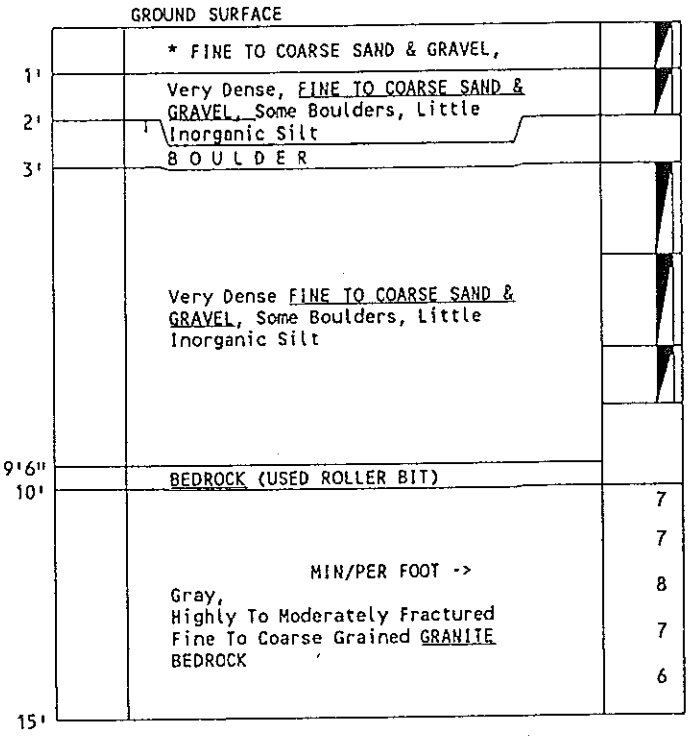
To: WEIDLINGER ASSOCIATES, INC., CAMBRIDGE, MA Date: _____ Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING B-20



NO WATER ENCOUNTERED
SIZE OF AUGERS 3-3/4" I.D., LENGTH 9'6"
SIZE OF CASING HW, LENGTH 9'6", SIZE OF ROCK CORE NX, LENGTH DRILLED: 5'0"
DRILLER: RENE' DESIMONE
DATE STARTED & COMPLETED: 10-12-00, 10-13-00

NOTE: 2.5 O.D SAMPLER WAS USED FOR THIS BORING

*Little Loam.

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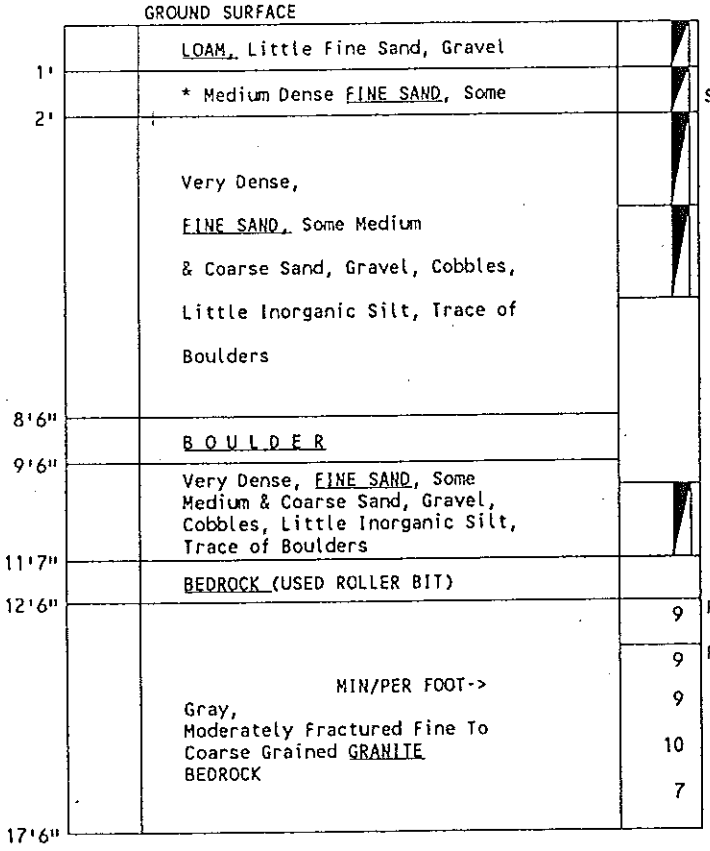
To: WEIDLINGER ASSOCIATES, INC., CAMBRIDGE, MA Date: _____ Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING B-21



NO WATER ENCOUNTERED
SIZE OF AUGERS 3-3/4" I.D., LENGTH 10'0"
SIZE OF CASING NW, LENGTH 11'6", SIZE OF ROCK CORE BX & NX, LENGTH DRILLED: 5'0"
DRILLER: RENE' DESIMONE, INSPECTOR: SCOTT DIFIORE

NOTES: 2.5 OD SAMPLER USED FOR THIS BORING.
SAMPLE NOS. 2 & 3 TAKEN BY INSPECTOR AT SITE.
*Coarse Sand, Little Gravel, Trace of Loam

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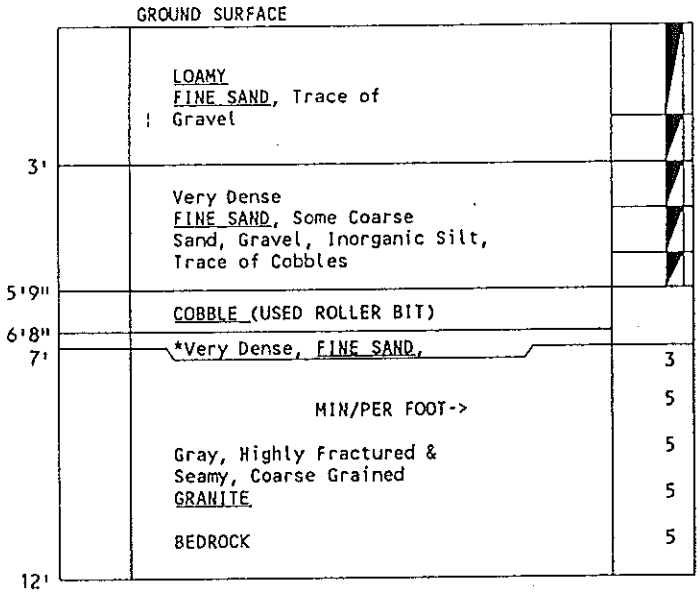
To: WEIDLINGER ASSOCIATES, INC., CAMBRIDGE, MA Date: _____ Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING B-22



NO WATER ENCOUNTERED
SIZE OF CASING NW, LENGTH 7'0"
SIZE OF ROCK CORE BX, LENGTH DRILLED: 5'0"
DRILLER: RENE' DESIMONE, INSPECTOR: SCOTT DIFIORE
DATE STARTED & COMPLETED: 9-18-00

*Some Coarse Sand, Gravel, Inorganic Silt, Trace of Cobbles

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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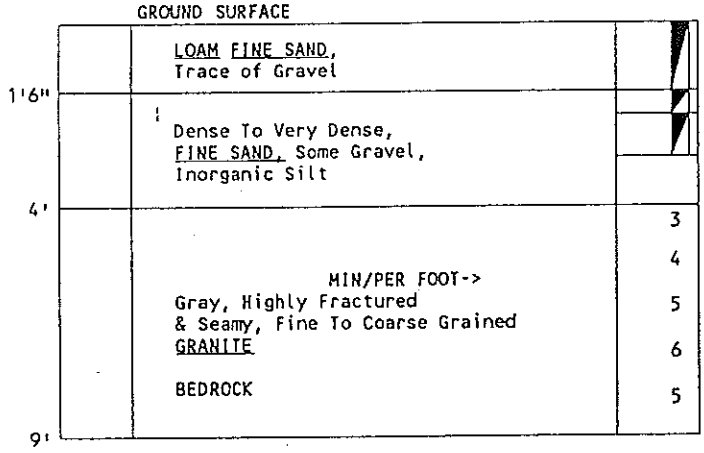
To: WEIDLINGER ASSOCIATES, INC., CAMBRIDGE, MA Date: _____ Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING B-23



S#1, 0' to 1'6" (2-3-6) RECOVERED 5 in.

S#1A, 1'6" to 2' (20) RECOVERED 2 in.

S#2, 2' to 2'11" (33-120/5") RECOVERED 10 in.

RUN 1, 4' to 9' (RECOVERED 36" (60%))

NO WATER ENCOUNTERED
SIZE OF CASING NW, LENGTH 4'0"
SIZE OF ROCK CORE BX, LENGTH DRILLED: 5'0"
DRILLER: RENE' DESIMONE, INSPECTOR: SCOTT DIFIORE
DATE STARTED & COMPLETED: 9-18-00

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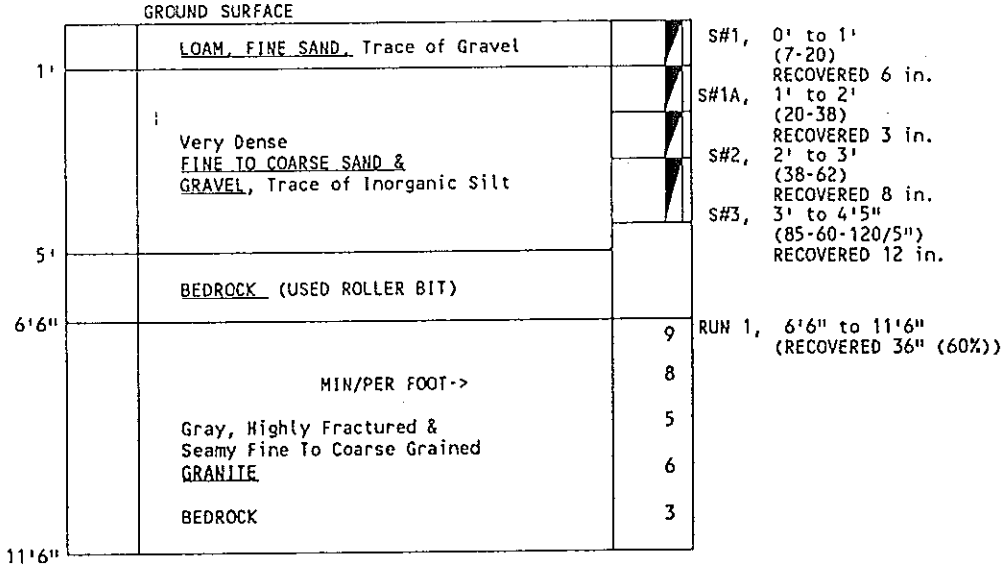
To: WEIDLINGER ASSOCIATES, INC., CAMBRIDGE, MA Date: _____ Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING B-24



NO WATER ENCOUNTERED
SIZE OF CASING NW, LENGTH 6'0"
SIZE OF ROCK CORE 8X, LENGTH DRILLED: 5'0"
DRILLER: RENE' DESIMONE, INSPECTOR: SCOTT DIFIORE
DATE STARTED & COMPLETED: 9-21-00

NOTE: PERMEABILITY TEST TAKEN AT DEPTH OF 3'4" (1 HOUR STAND-BY)

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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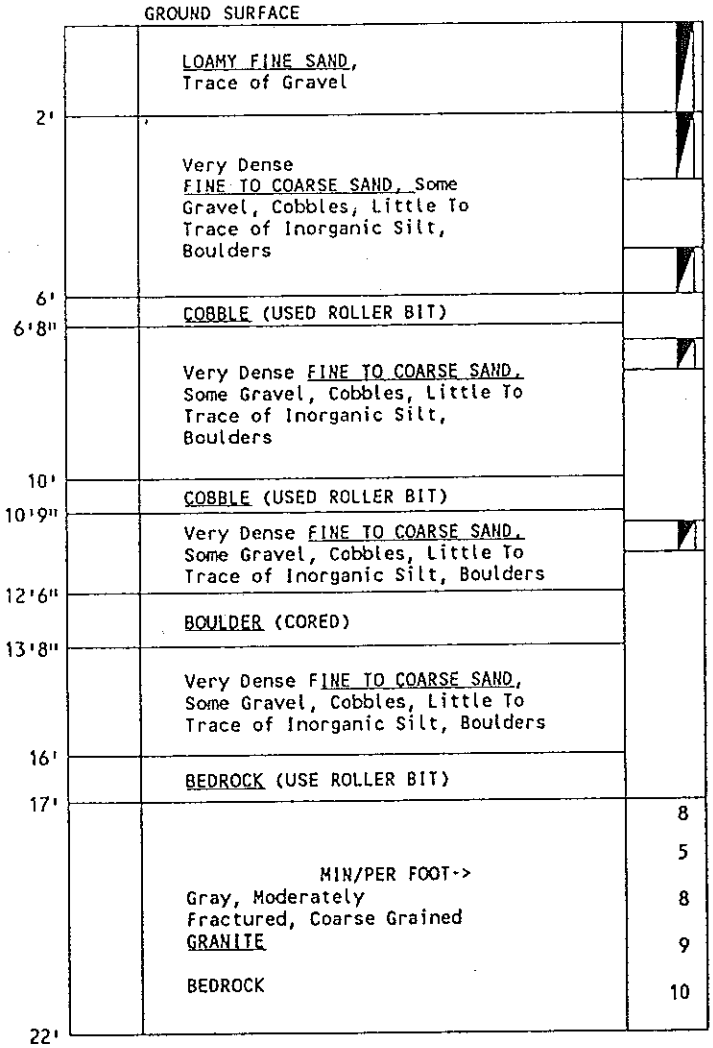
To: WEIDLINGER ASSOCIATES, INC., CAMBRIDGE, MA Date: _____ Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING B-25



NO WATER ENCOUNTERED
SIZE OF CASING NW, LENGTH 15'0"
SIZE OF ROCK CORE BX, LENGTH DRILLED: 5'0"
DRILLER: RENE' DESIMONE, INSPECTOR: SCOTT DIFIORE
DATE STARTED & COMPLETED: 9-19-00

NOTE: PERMEABILITY TEST TAKEN AT DEPTH OF 4'9", (APPROXIMATELY 1 HOUR STAND-BY).

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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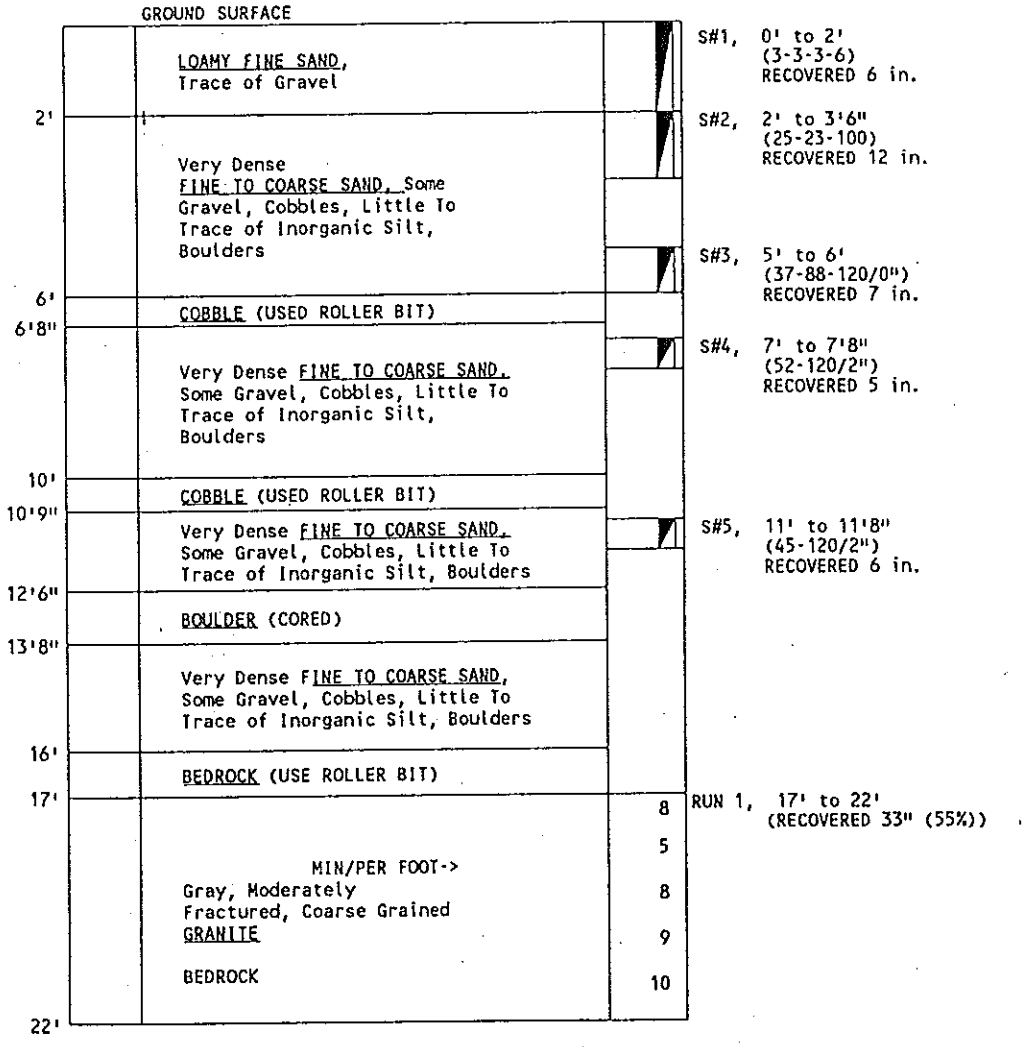
To: WEIDLINGER ASSOCIATES, INC., CAMBRIDGE, MA Date: _____ Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING B-25



NO WATER ENCOUNTERED
SIZE OF CASING NW, LENGTH 15'0"
SIZE OF ROCK CORE BX, LENGTH DRILLED: 5'0"
DRILLER: RENE' DESIMONE, INSPECTOR: SCOTT DIFIORE
DATE STARTED & COMPLETED: 9-19-00

NOTE: PERMEABILITY TEST TAKEN AT DEPTH OF 4'9", (APPROXIMATELY 1 HOUR STAND-BY).

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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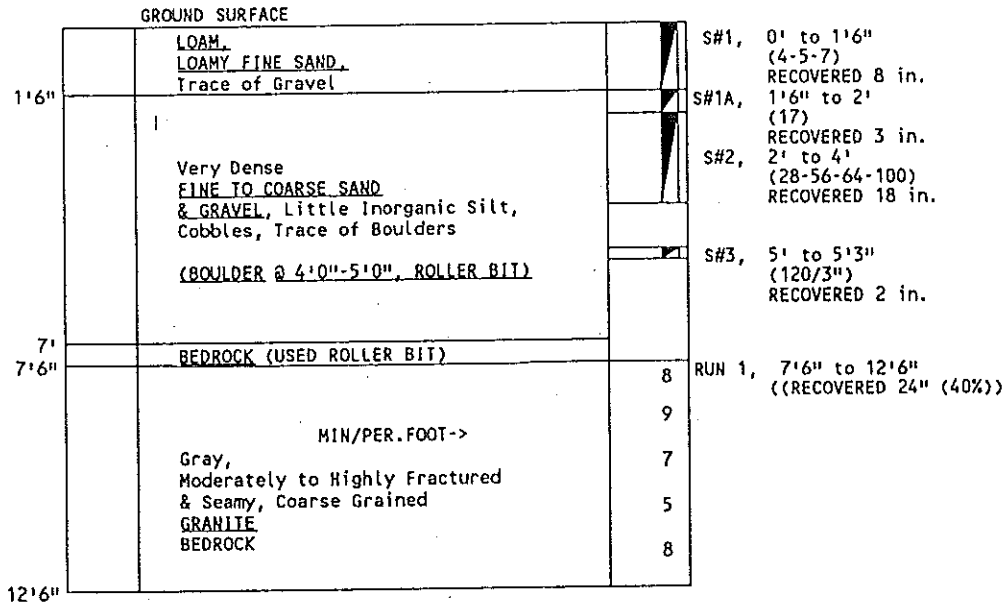
To: WEIDLINGER ASSOCIATES, INC., CAMBRIDGE, MA Date: _____ Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING B-26



NO WATER ENCOUNTERED
SIZE OF CASING NW, LENGTH 7'0"
SIZE OF ROCK CORE BX, LENGTH DRILLED: 5'0"
DRILLER: RENE' DESIMONE
DATE STARTED & COMPLETED: 9-20-00, 9-22-00

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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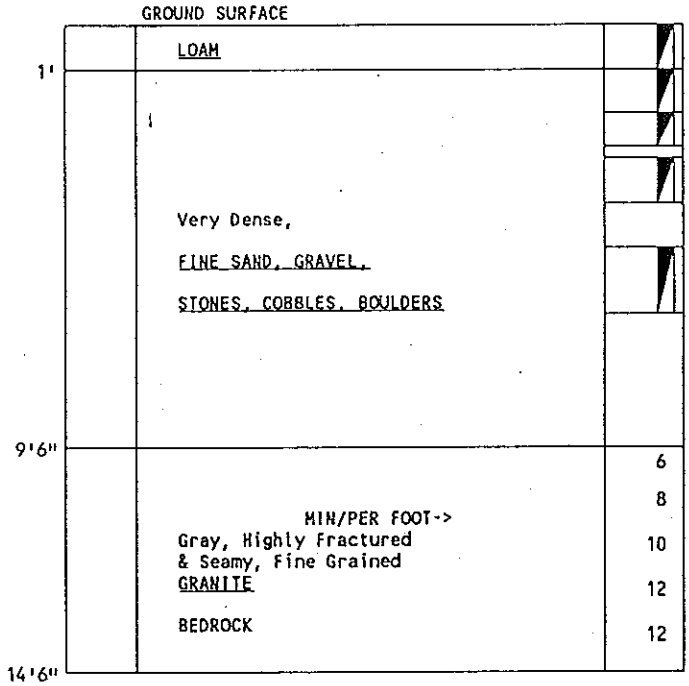
To: WEIDLINGER ASSOCIATES, INC., CAMBRIDGE, MA Date: _____ Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING B-27



NO WATER ENCOUNTERED
SIZE OF CASING NW, LENGTH 9'6"
SIZE OF ROCK CORE BX, LENGTH DRILLED: 5'0"
DRILLER: JOSEPH CENTRELLA, INSPECTOR: SCOTT DIFIORE
DATE STARTED & COMPLETED: 9-19-00

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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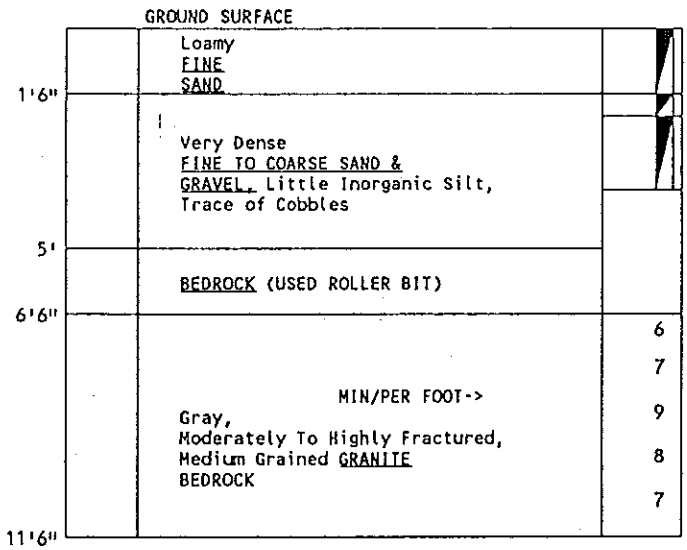
To: WEIDLINGER ASSOCIATES, INC., CAMBRIDGE, MA Date: _____ Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING B-28



S#1, 0' to 1'6"
(3-3-6)
RECOVERED 8 in.

S#1A, 1'6" to 2'
(18)
RECOVERED 2 in.

S#2, 2' to 3'8"
(26-38-47-120/2")
RECOVERED 10 in.

RUN 1, 6'6" to 11'6"
((RECOVERED 25" (41.6%))

NO WATER ENCOUNTERED
SIZE OF CASING NW, LENGTH 6'0"
SIZE OF ROCK CORE BX, LENGTH DRILLED: 5'0"
DRILLER: RENE' DESIMONE
DATE STARTED & COMPLETED: 10-2-00

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

WEIDLINGER ASSOCIATES INC
CONSULTING ENGINEERS

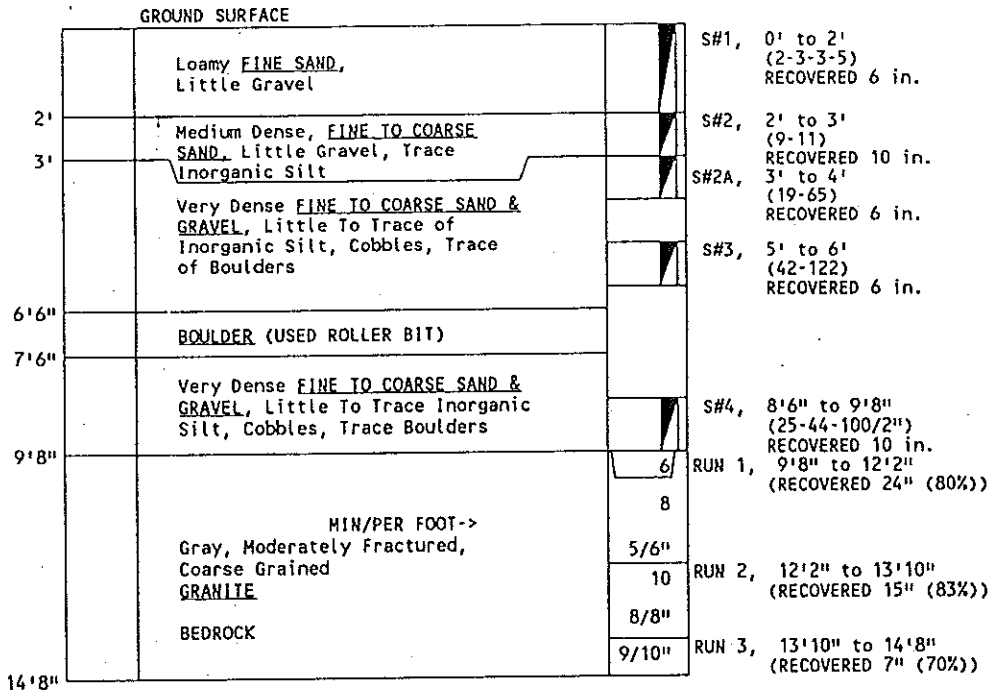
CARR-DEE CORP.

37 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone (781) 391-4500

To: WEIDLINGER ASSOCIATES, INC., CAMBRIDGE, MA Date: _____ Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING B-29



WATER LEVEL 6'3" (PERCHED)
SIZE OF CASING NW, LENGTH 9'6"
SIZE OF ROCK CORE BX, LENGTH DRILLED: 5'0"
DRILLER: RENE' DESIMONE, INSPECTOR: SCOTT DIFIORE
DATE STARTED & COMPLETED: 9-19-00

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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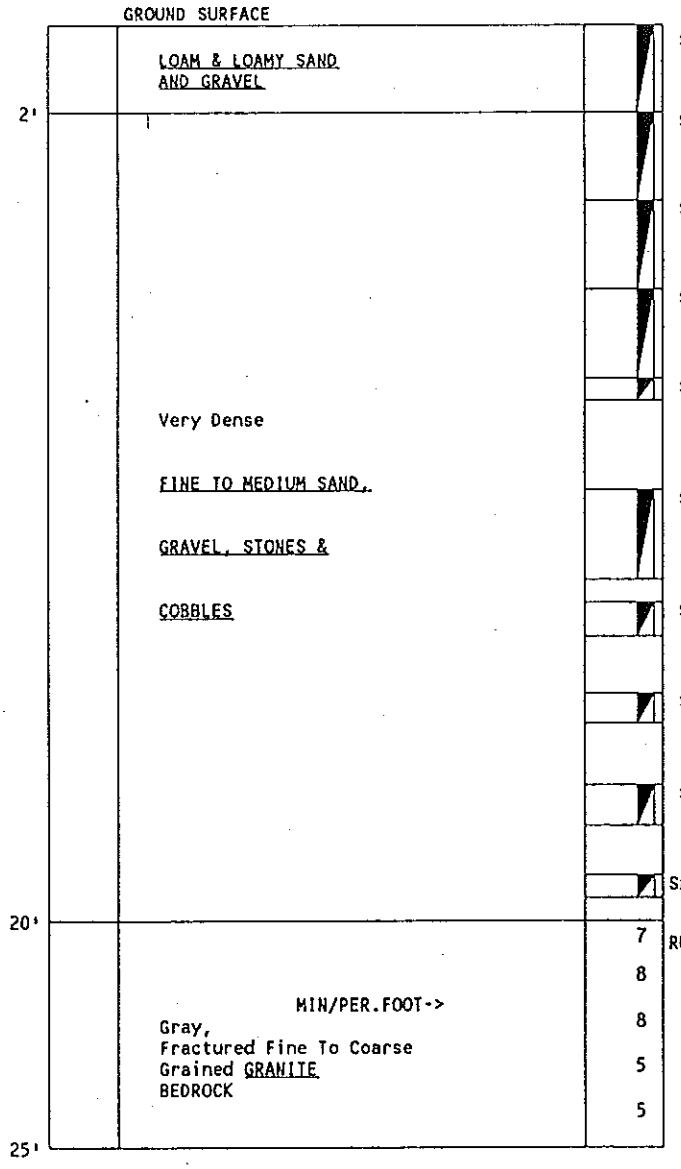
To: WEIDLINGER ASSOCIATES, INC., CAMBRIDGE, MA Date: _____ Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING B-30



S#1, 0' to 2' (5-4-3-6) RECOVERED 15 in.

S#2, 2' to 4' (16-55-48-55) RECOVERED 18 in.

S#3, 4' to 6' (55-90-77-86) RECOVERED 20 in.

S#4, 6' to 8' (44-55-79-89) RECOVERED 18 in.

S#5, 8' to 8'6" (55-100/0") RECOVERED 6 in.

S#6, 10'6" to 12'6" (36-47-50-98) RECOVERED 15 in.

S#7, 13' to 13'9" (70-100/3") RECOVERED 6 in.

S#8, 15' to 15'8" (90-100/2") RECOVERED 0 in.

S#9, 17' to 17'11" (45-100/5") RECOVERED 8 in.

S#10, 19' to 19'6" (100) RECOVERED 4 in.

RUN 1, 20' to 25' ((RECOVERED 48" 80%))

WATER LEVEL 10'
SIZE OF CASING NW, LENGTH 20'0"
SIZE OF ROCK CORE BX, LENGTH DRILLED: 5'0"
DRILLER: JOSEPH CENTRELLA, INSPECTOR: SCOTT DIFIORE
DATE STARTED & COMPLETED: 10-3-00, 10-4-00

NOTES: SAMPLE NOS. 1 THROUGH 6 WERE TAKEN BY INSPECTOR.
2.5 O.D SAMPLER WAS USED FOR THIS BORING.

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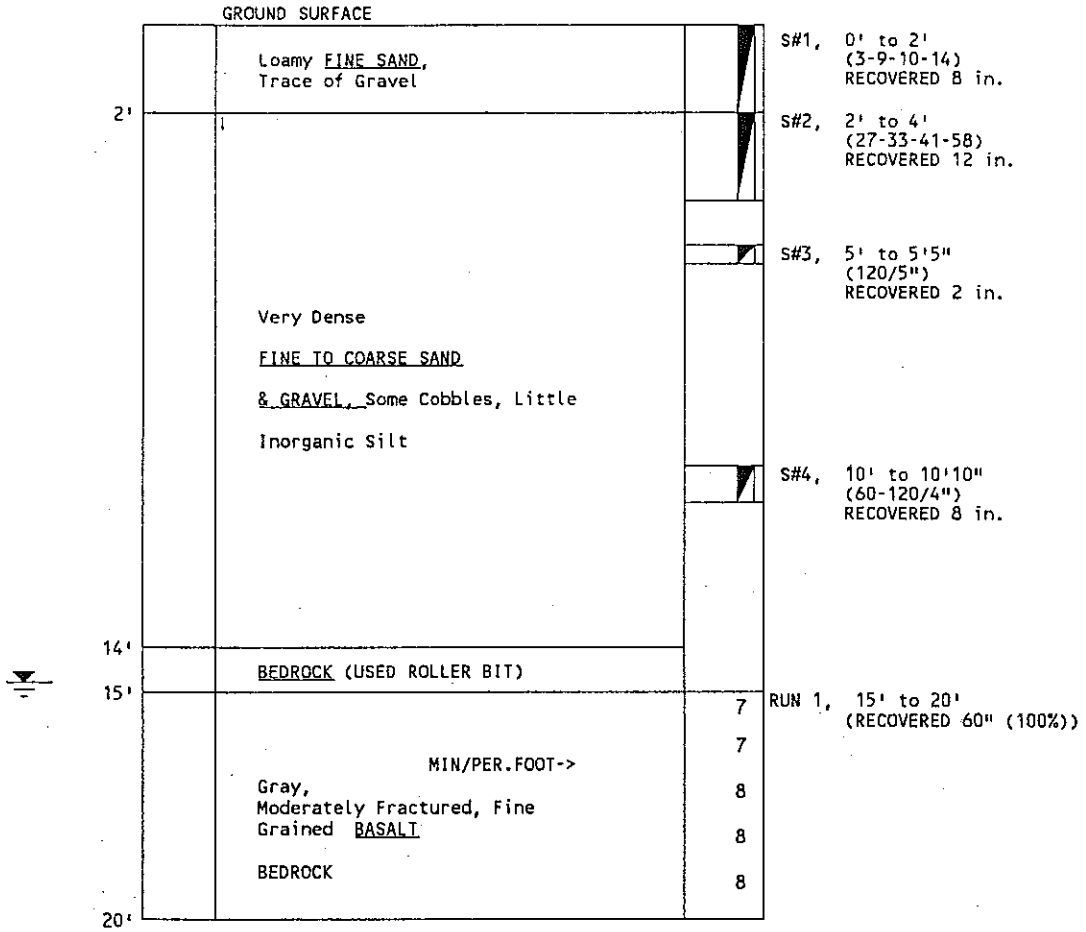
To: WEIDLINGER ASSOCIATES, INC., CAMBRIDGE, MA Date: _____ Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING B-31



WATER LEVEL 14'10"
SIZE OF CASING NW, LENGTH 14.66
SIZE OF ROCK CORE BX, LENGTH DRILLED: 5'0"
DRILLER: RENE' DESIMONE. INSPECTOR: SCOTT DIFIORE
DATE STARTED & COMPLETED: 9-26-00, 9-27-200

NOTE: PERMEABILITY TEST TAKEN AT 10'10", 1 HOUR STANDBY.

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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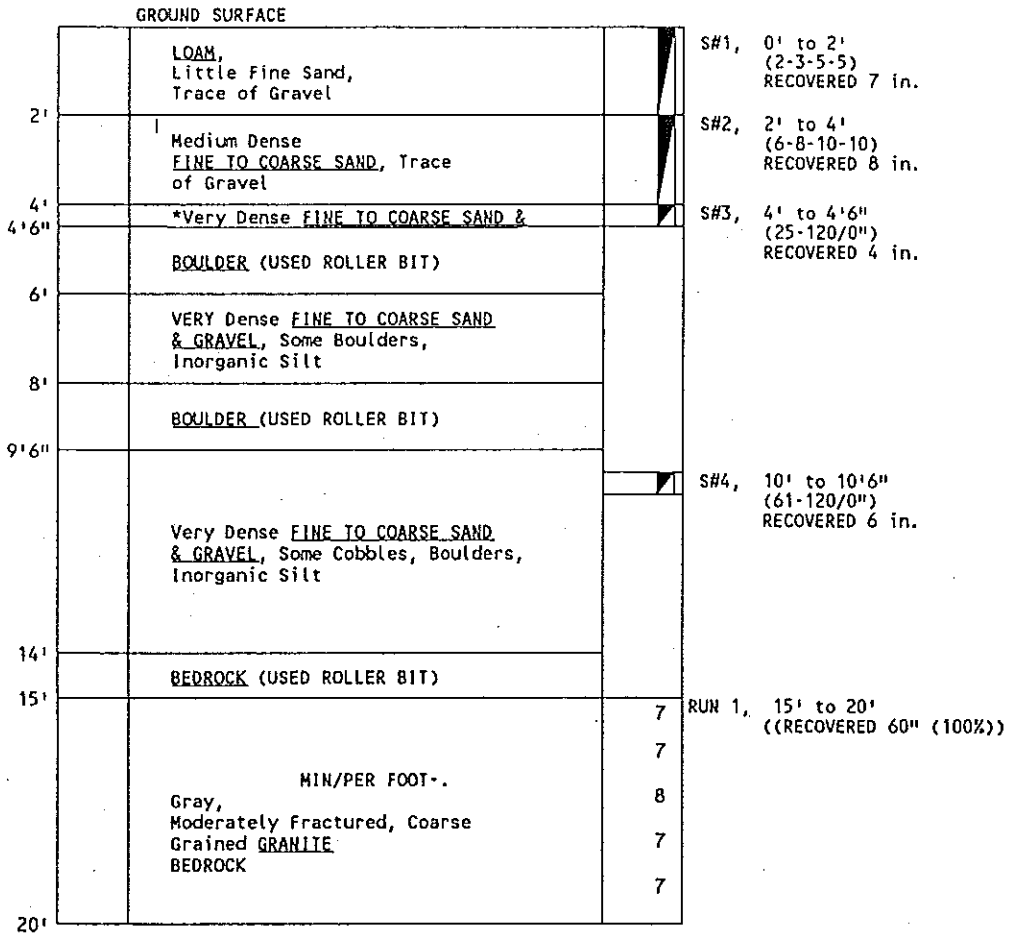
To: WEIDLINGER ASSOCIATES, INC., CAMBRIDGE, MA Date: _____ Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING B-32



WATER LEVEL 8'6" (PERCHED)
SIZE OF CASING HW, LENGTH 14'0"
SIZE OF ROCK CORE NX, LENGTH DRILLED: 5'0"
DRILLER: RENE' DESIMONE
DATE STARTED & COMPLETED: 10-16-00

*GRAVEL, Some Cobbles, Boulders, Inorganic Silt

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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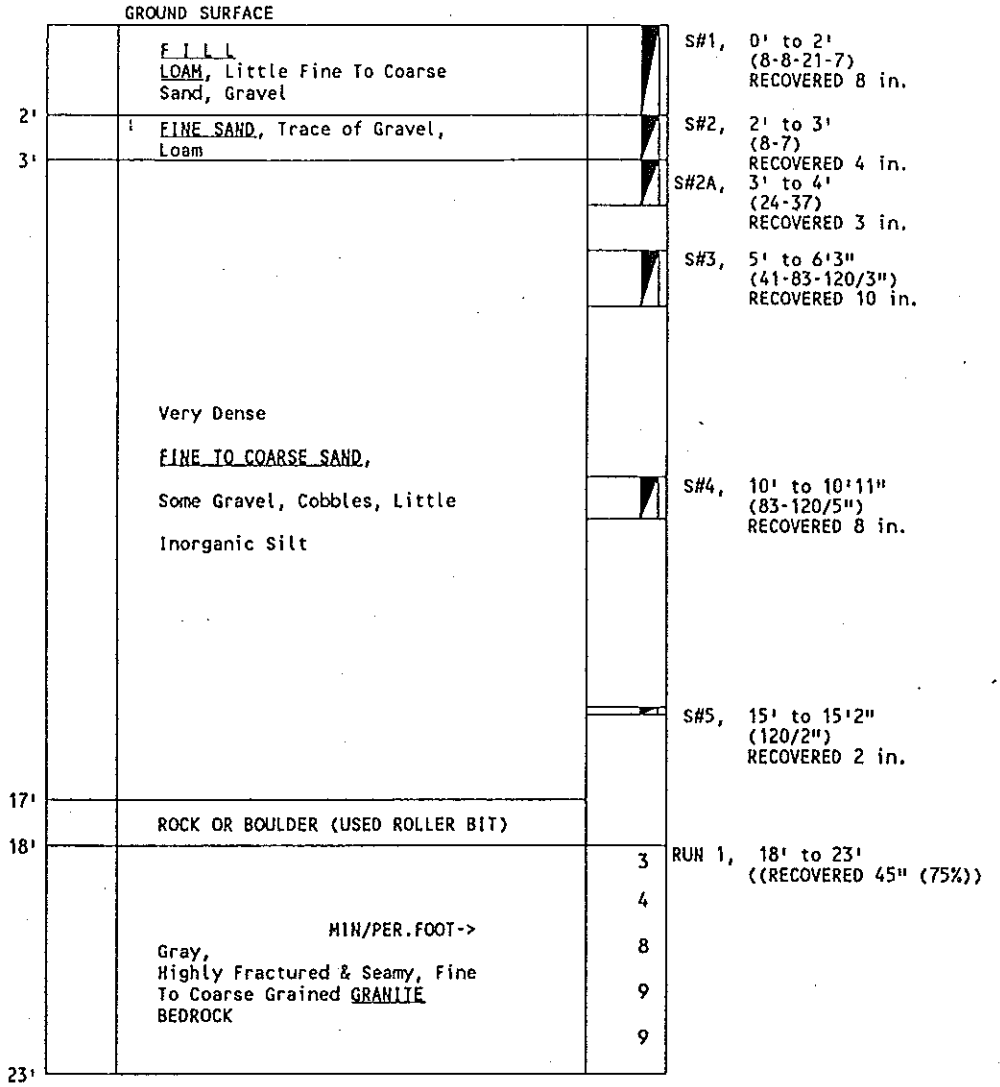
To: WEIDLINGER ASSOCIATES, INC., CAMBRIDGE, MA Date: _____ Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING B-33



NO WATER ENCOUNTERED
SIZE OF AUGERS 3-3/4" I.D., LENGTH 15'0"
SIZE OF CASING HW, LENGTH 17'0" SIZE OF ROCK CORE NX, LENGTH DRILLED: 5'0"
DRILLER: RENE' DESIMONE
DATE STARTED & COMPLETED: 10-13-00

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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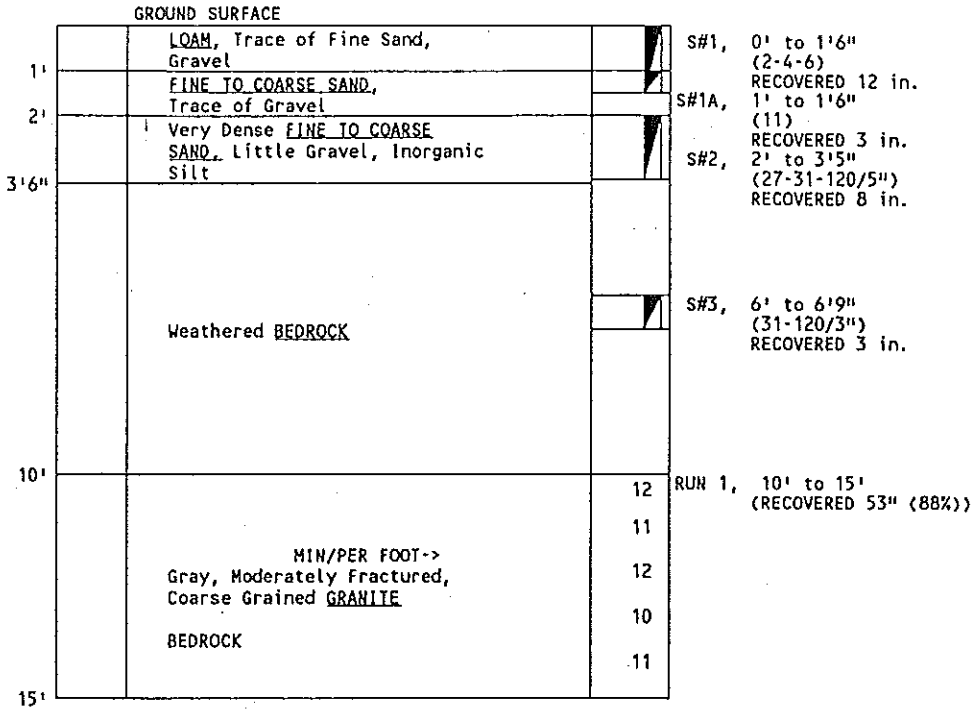
To: WEIDLINGER ASSOCIATES, INC., CAMBRIDGE, MA Date: _____ Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING B-34



NO WATER ENCOUNTERED
SIZE OF CASING NW, LENGTH 6'0"
SIZE OF ROCK CORE BX, LENGTH DRILLED: 5'0"
DRILLER: RENE' DESIMONE
DATE STARTED & COMPLETED: 10-18-00

NOTE: 2.5 O.D SAMPLER USED FOR THIS BORING.

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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CONSULTING ENGINEERS

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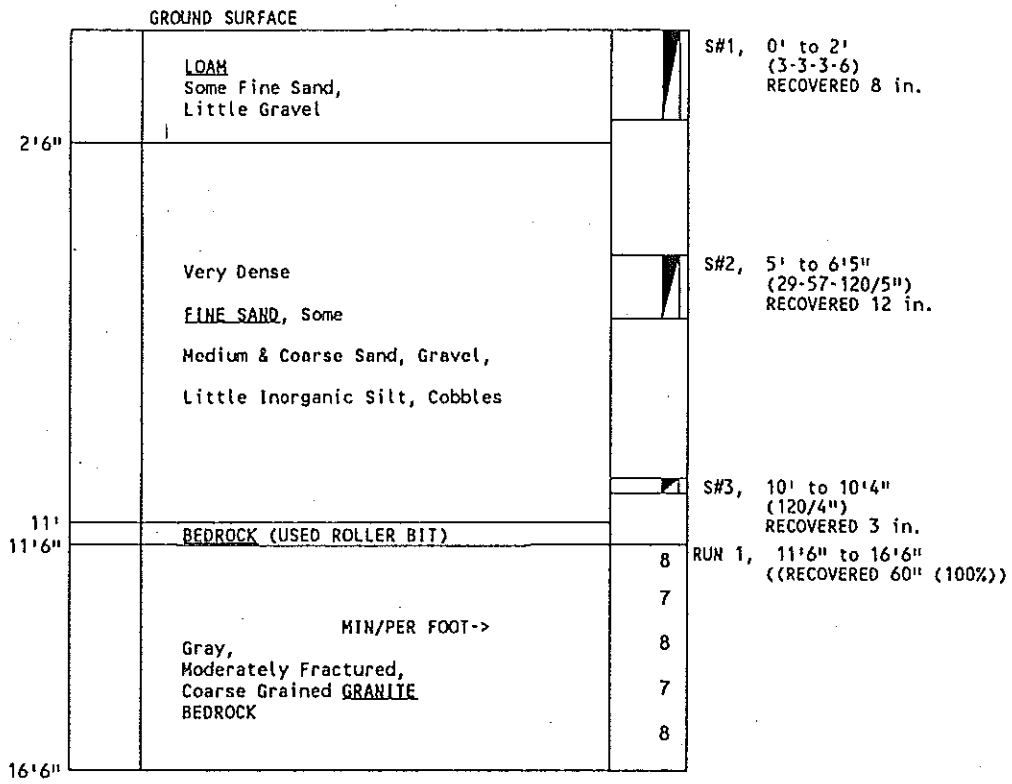
To: WEIDLINGER ASSOCIATES, INC., CAMBRIDGE, MA Date: _____ Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING B-35



NO WATER ENCOUNTERED
SIZE OF AUGERS 3-3/4" I.D., LENGTH 10'0"
SIZE OF CASING HW, LENGTH 11'0"
SIZE OF ROCK CORE NX, LENGTH DRILLED: 5'0"
DRILLER: RENE' DESIMONE
DATE STARTED & COMPLETED: 10-16-00, 10-17-00

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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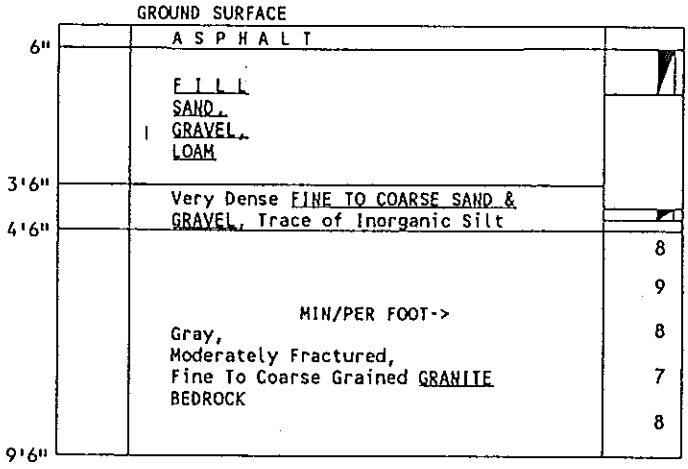
To: WEIDLINGER ASSOCIATES, INC., CAMBRIDGE, MA Date: _____ Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING B-36



S#1, 6" to 1'6"
(37-76-120/0")
RECOVERED 8 in.

S#2, 4' to 4'3"
(120/3")
RECOVERED 2 in.

RUN 1, 4'6" to 9'6"
((RECOVERED 26" (43%))

NO WATER ENCOUNTERED
SIZE OF AUGERS 3-3/4" I.D., LENGTH 4'6"
SIZE OF CASING NW, LENGTH 4'6"
SIZE OF ROCK CORE BX, LENGTH DRILLED: 5'0"
DRILLER: RENE' DESIMONE
DATE STARTED & COMPLETED: 10-10-00

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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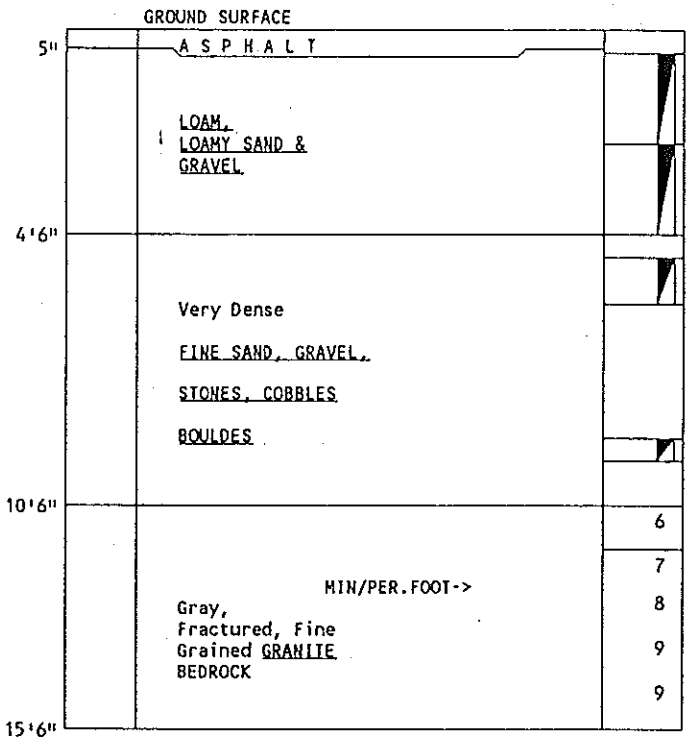
To: WEIDLINGER ASSOCIATES, INC., CAMBRIDGE, MA Date: _____ Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING B-37



S#1, 6" to 2'6"
(12-13-7-6)
RECOVERED 7 in.

S#2, 2'6" to 4'6"
(5-6-12-13)
RECOVERED 4 in.

S#3, 5' to 6'
(98-100)
RECOVERED 3 in.

S#4, 9' to 9'6"
(100)
RECOVERED 3 in.

RUN 1, 10'6" to 11'6"
((RECOVERED 10" (83%))

RUN 2, 11'6" to 15'6"
((RECOVERED 39" (81%))

NO WATER ENCOUNTERED
SIZE OF CASING NW, LENGTH 10'6"
SIZE OF ROCK CORE BX, LENGTH DRILLED: 5'0"
DRILLER: JOSEPH CENTRELLA
DATE STARTED & COMPLETED: 10-4-00

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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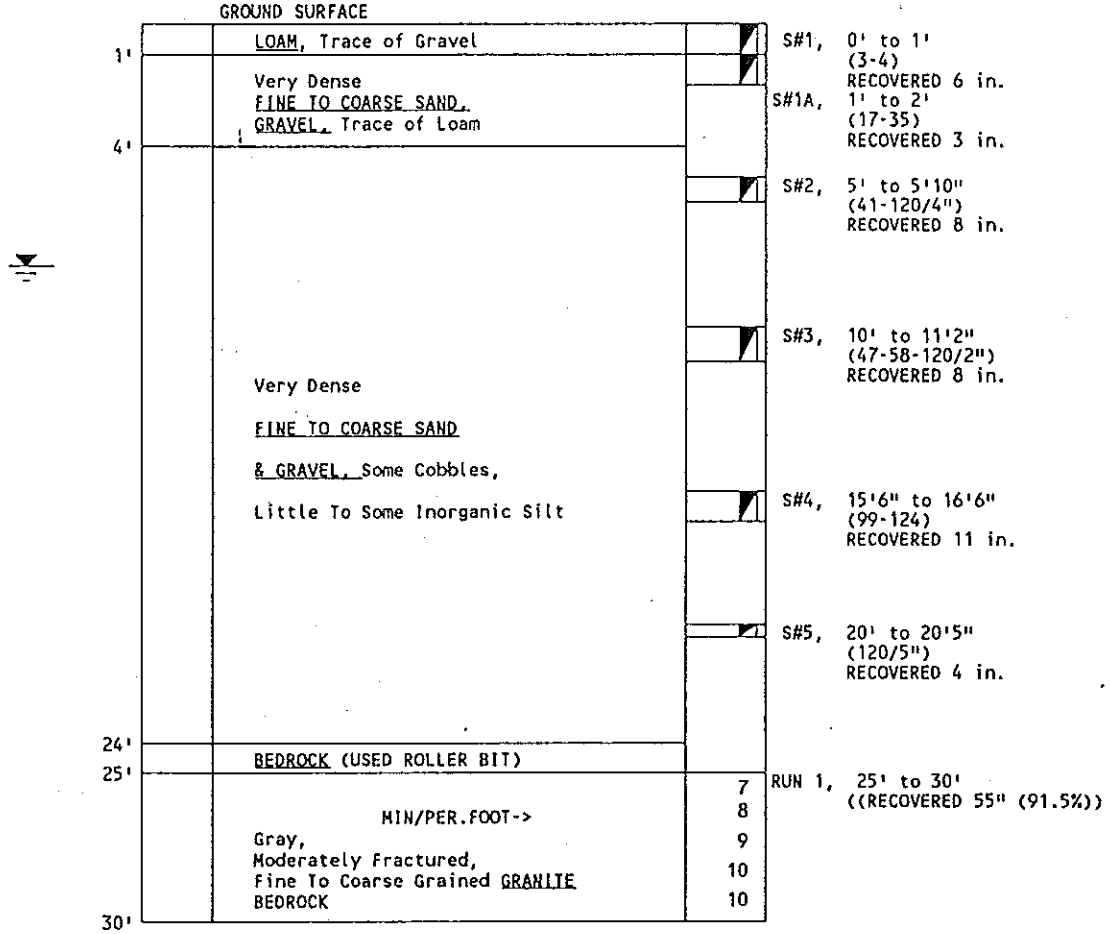
To: WEIDLINGER ASSOCIATES, INC., CAMBRIDGE, MA Date: _____ Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING B-38



WATER LEVEL 8'
SIZE OF AUGERS 3-3/4" I.D., LENGTH 10'0"
SIZE OF CASING NW, LENGTH 24'0"
SIZE OF ROCK CORE BX, LENGTH DRILLED: 5'0"
DRILLER: RENE' DESIMONE, INSPECTOR: SCOTT DIFIORE
DATE STARTED & COMPLETED: 10-5-00, 10-6-00

NOTE: PERMEABILITY TEST TAKEN AT DEPTH OF ~~25'5~~ 15'6", 1 HOUR STANDBY.

AT COMPETION OF BORING.

• WATER LEVEL AT 3' ON MORNING OF 10/6/00, AFTER COMPLETION OF PERMEABILITY TEST AND OVERNIGHT STABILIZATION.

NOTES ADDED BY WEIDLINGER 10/30/00

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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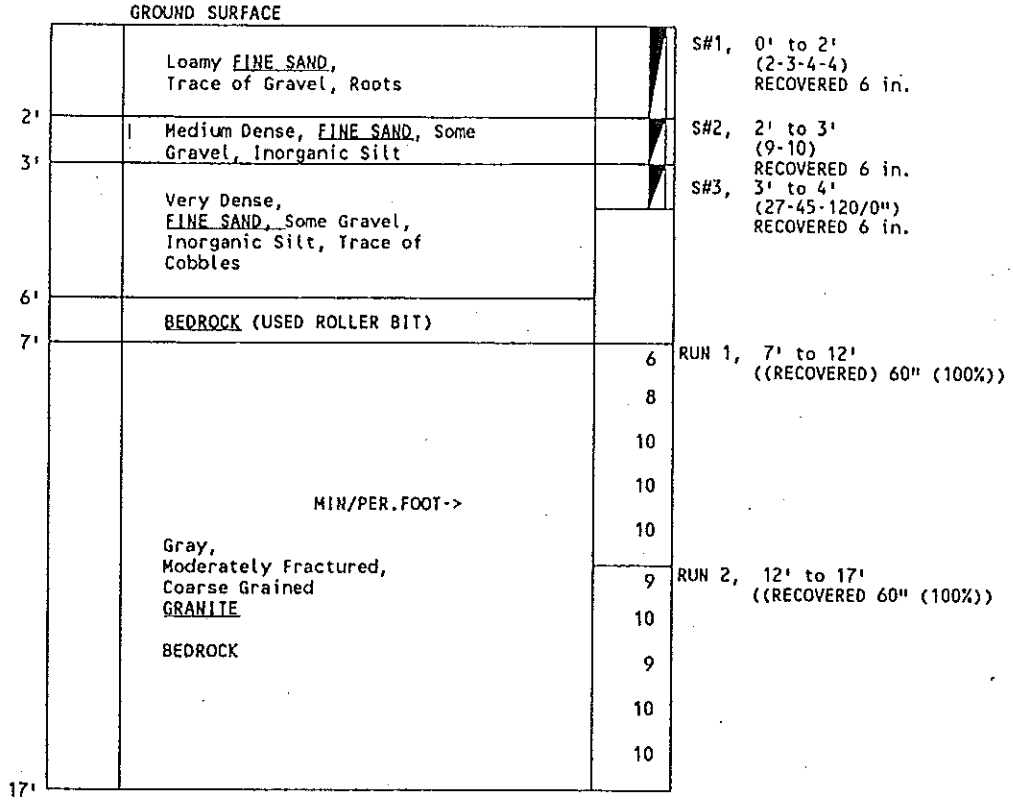
To: WEIDLINGER ASSOCIATES, INC., CAMBRIDGE, MA Date: _____ Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING B-39



NO WATER ENCOUNTERED
SIZE OF CASING HW, LENGTH 6'0"
SIZE OF ROCK CORE NX, LENGTH DRILLED: 10'0"
DRILLER: RENE' DESIMONE, INSPECTOR: SCOTT DIFIORE
DATE STARTED & COMPLETED: 9-22-00, 9-25-00

NOTE: ROCK CORE SAMPLES FOR THIS BORING WERE TAKEN BY INSPECTOR.

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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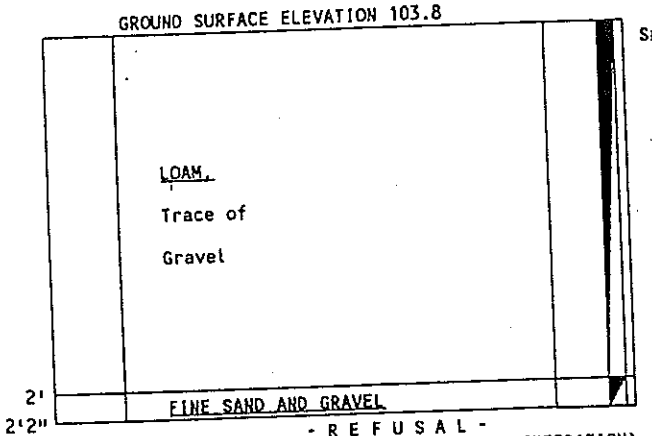
7 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone (781) 391-4500

o: WEIDLINGE ASSOCIATES, INC., CAMBRIDGE, MA Date: 4-12-2000 Job No.: 2000-67

ocation: ARC BELMONT CAMPUS, BELMONT, MA

TEST PIT TP-1



S#1, 0' to 2' (2-2-3-5) RECOVERED 5 in.

S#2, 2' to 2'2" (100/2") RECOVERED 1 in.

(120 BLOWS, S.S., 140-LB. WGT., NO PENETRATION)
NO WATER ENCOUNTERED
DRILLER: RENE' DESIMONE,
DATE STARTED & COMPLETED: 4-11-2000

NOTE: ALTERNATE TP MADE 5'0" TOWARDS TP-1A "REFUSAL" ENCOUNTERED AT DEPTH OF 2'0".

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

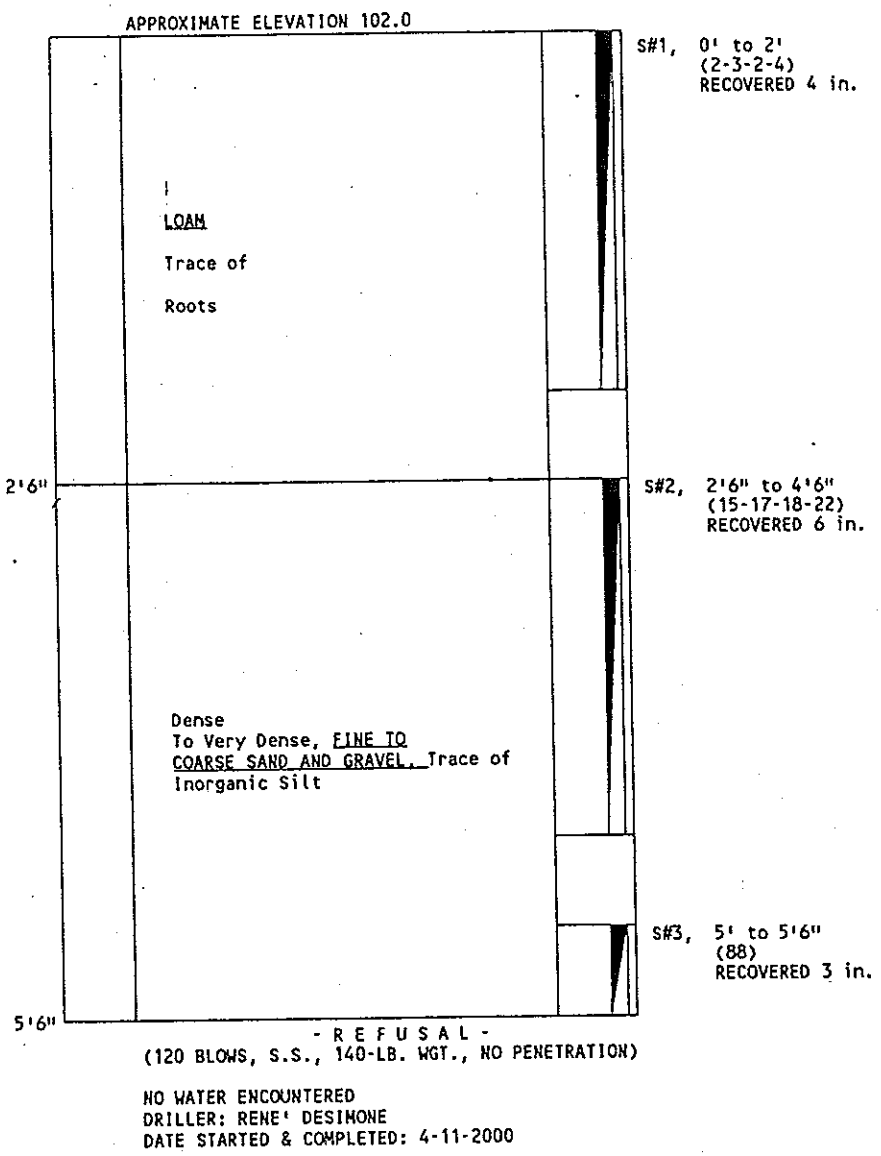
CARR-DEE CORP.

37 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone (781) 391-4500

To: WEIDLINGE ASSOCIATES, INC., CAMBRIDGE, MA Date: 4-12-2000 Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

TEST PIT 1A



NO WATER ENCOUNTERED
DRILLER: RENE' DESIMONE
DATE STARTED & COMPLETED: 4-11-2000

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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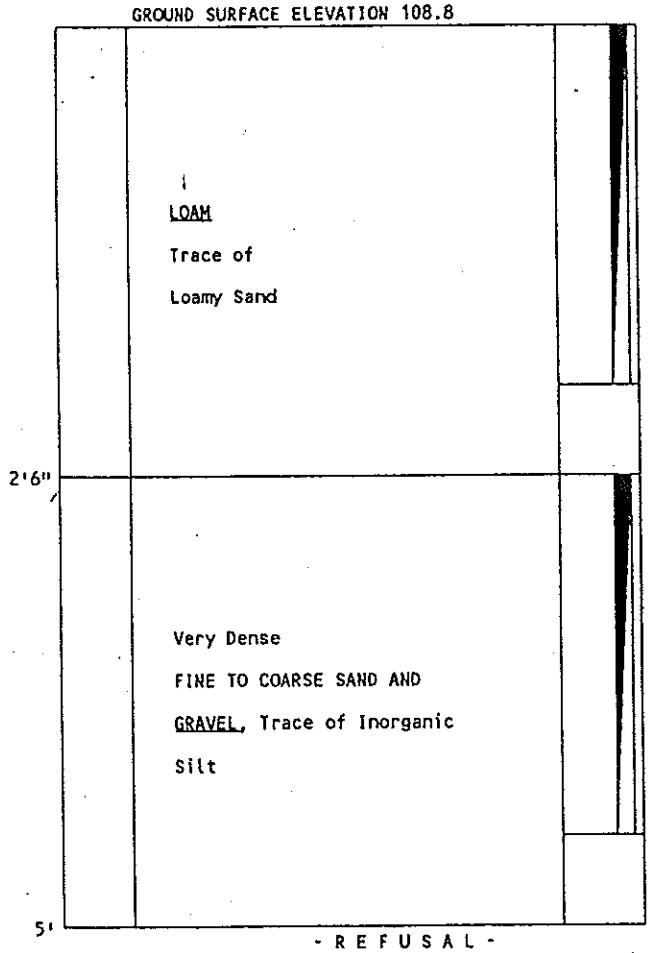
To: WEIDLINGE ASSOCIATES, INC., CAMBRIDGE, MA Date: 4-12-2000 Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

TEST PIT 2

GROUND SURFACE ELEVATION 108.8



- R E F U S A L -
(120 BLOWS, S.S., 140-LB. WGT., NO PENETRATION)

NO WATER ENCOUNTERED
DRILLER: RENE' DESIMONE
DATE STARTED & COMPLETED: 4-11-2000

NOTE: ALTERNATE TP MADE 5'0" TOWARDS TP-2A, "REFUSAL" ENCOUNTERED AT DEPTH OF 4'6"

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

CARR-DEE CORP.

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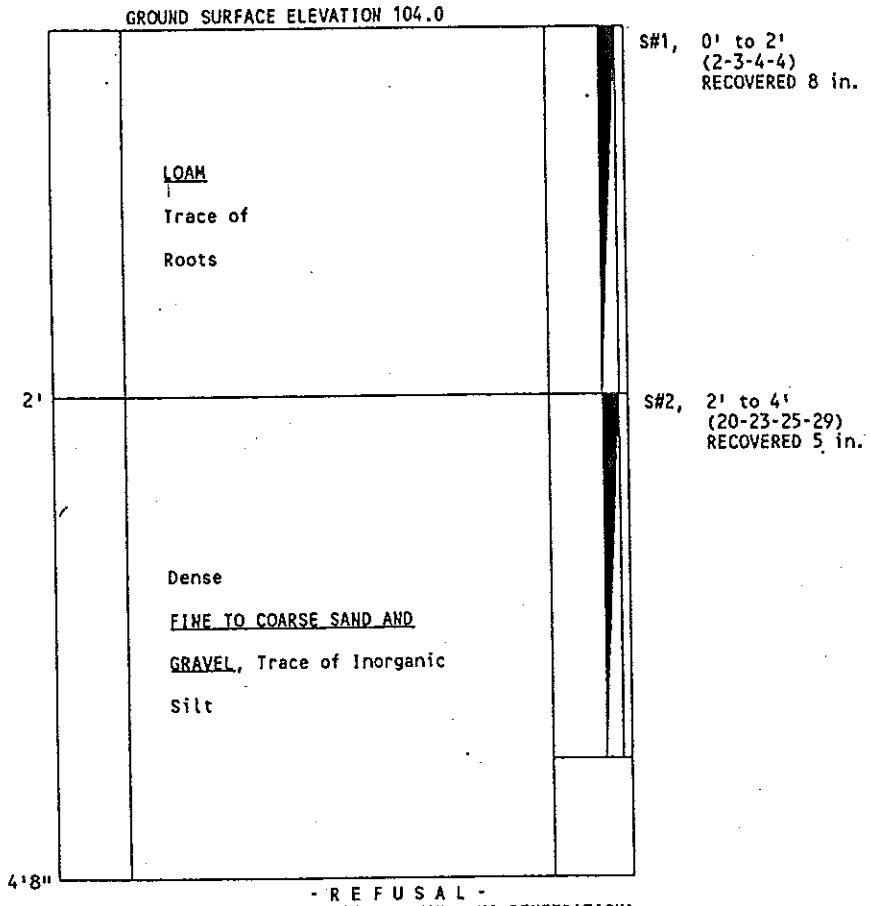
To: WEIDLINGE ASSOCIATES, INC., CAMBRIDGE, MA Date: 4-12-2000 Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

TEST PIT TP-2A



NO WATER ENCOUNTERED
DRILLER: RENE' DESIMONE
DATE STARTED & COMPLETED: 4-11-2000

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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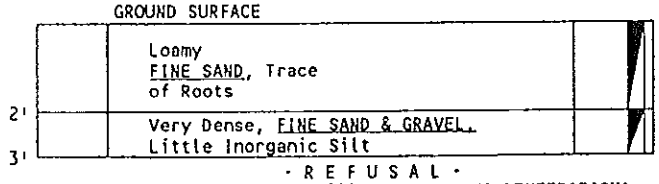
To: WEIDLINGER ASSOCIATES, INC., CAMBRIDGE, MA Date: _____ Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING TP-3



- R E F U S A L -
(120 BLOWS, S.S., 140-LB. WGT., NO PENETRATION)

NO WATER ENCOUNTERED
DRILLER: RENE' DESIMONE
DATE STARTED & COMPLETED: 9-27-00

NOTE: ALTERNATE BORING MADE 8'0" TOWARDS TP-4, "Refusal" encountered at ~~8'0"~~ 3'0"
(Used Open-End Rod with a 300Lb. Weight)

NOTE ADDED BY WEIDLINGER 10/30/00

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

CARR-DEE CORP.

37 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone (617) 391-4500

To: WEIDLINGER ASSOCIATES, INC., CAMBRIDGE, MA Date: _____ Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING TP-4

GROUND SURFACE

	Loamy FINE SAND, Little Gravel	S#1, 0' to 2' (2-3-4-6) RECOVERED 7 in.
2'	*Very Dense FINE TO COARSE SAND &	S#2, 2' to 2'9" (46-88/3") RECOVERED 5 in.
2'9"	- R E F U S A L - (120 BLOWS, S.S., 140-LB. WGT., NO PENETRATION)	

NO WATER ENCOUNTERED
DRILLER: RENE' DESIMONE
DATE STARTED & COMPLETED: 9-27-00

NOTE: ALTERNATE BORING MADE TOWARDS 6'0" TP-5, "Refusal" encountered at 2'4"
(Used Open-End Rod with a 300Lb. Weight)

*GRAVEL, Little Inorganic Silt

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WEIDLINGER ASSOCIATES INC
CONSULTING ENGINEERS

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To: WEIDLINGER ASSOCIATES, INC., CAMBRIDGE, MA Date: _____ Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING TP-5

GROUND SURFACE

	LOAM	S#1,	0' to 1' (2-3) RECOVERED 6 in.
1'	Medium Dense, FINE SAND & INORGANIC SILT, Some Fine Gravel	S#1A,	1' to 2' (7-9) RECOVERED 6 in.
3'		S#2,	2' to 3' (8-10) RECOVERED 9 in.
	Very Dense, FINE SAND & INORGANIC SILT, Some Fine To Coarse Gravel	S#2A,	3' to 4' (57-38) RECOVERED 9 in.
		S#3,	4' to 6' (40-39-50-41) RECOVERED 19 in.
6'9"	- R E F U S A L - (120 BLOWS, S.S., 140-LB. WGT., NO PENETRATION)	S#4,	6' to 6'9" (37-120/3") RECOVERED 4 in.

NO WATER ENCOUNTERED
DRILLER: GERALD SMITH
DATE STARTED & COMPLETED: 9-28-00

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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To: WEIDLINGER ASSOCIATES, INC., CAMBRIDGE, MA Date: _____ Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING TP-6.

GROUND SURFACE

	LOAM	S#1, 0' to 1'6" (4-4-5) RECOVERED 9 in.
1'6"	FINE SAND & INORGANIC SILT, Trace of Fine To Coarse Gravel	S#1A, 1'6" to 2' (11) RECOVERED 6 in.
2'6"	Dense FINE SAND, Some Inorganic Silt, Trace Fine To Coarse Gravel	S#2, 2' to 2'6" (6) RECOVERED 5 in.
3'6"	- R E F U S A L - (120 BLOWS, S.S., 140-LB. WGT., NO PENETRATION)	S#2A, 2'6" to 3'6" (16-16) RECOVERED 11 in.

NO WATER ENCOUNTERED
DRILLER: GERALD SMITH
DATE STARTED & COMPLETED: 9-28-00

NOTE: ALTERNATE BORING MADE 5'0" TOWARDS TP-5
"REFUSAL ENCOUNTERED AT DEPTH OF 4'6".

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

WEIDLINGER ASSOCIATES INC
CONSULTING ENGINEERS

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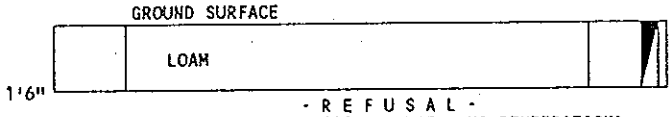
To: WEIDLINGER ASSOCIATES, INC., CAMBRIDGE, MA Date: _____ Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING TP-7



S#1, 0' to 1'6"
(1-2-2-)
RECOVERED 6 in.

- R E F U S A L -
(120 BLOWS, S.S., 140-LB. WGT., NO PENETRATION)

NO WATER ENCOUNTERED
DRILLER: RENE' DESIMONE
DATE STARTED & COMPLETED: 10-19-00

NOTES: ALTERNATE TP MADE 4'6" TOWARDS B-17,
"REFUSAL" ENCOUNTERED AT DEPTH OF 1'0"

BORING FOREMAN REPORTS OUTCROPPING OF ROCK IN
IN IMMEDIATE AREA.

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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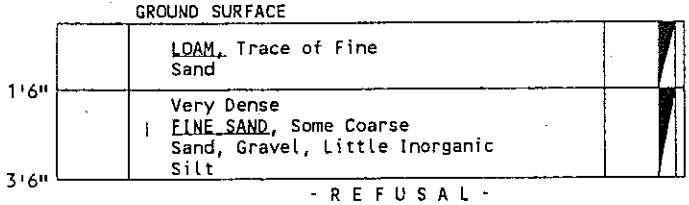
To: WEIDLINGER ASSOCIATES, INC., CAMBRIDGE, MA Date: _____ Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING TP-8



S#1, 0' to 1'6" (1-2-4) RECOVERED 6 in.

S#2, 1'6" to 3'6" (33-41-63-86) RECOVERED 8 in.

- R E F U S A L -

(120 BLOWS, S.S., 140-LB. WGT., NO PENETRATION)

NO WATER ENCOUNTERED
DRILLER: RENE' DESIMONE
DATE STARTED & COMPLETED: 10-4-00

NOTE: ALTERNATE BORING MADE 6'0" TOWARDS TP-9, "REFUSAL ENCOUNTERED AT DEPTH OF 3'10"

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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To: WEIDLINGER ASSOCIATES, INC., CAMBRIDGE, MA Date: _____ Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING TP-9

GROUND SURFACE

	LOAM, Little Fine Sand	S#1, 0' to 2' (1-1-2-3) RECOVERED 6 in.
2'	Very Dense FINE TO COARSE SAND & GRAVEL, Little Inorganic Silt	S#2, 2' to 4' (17-13-49-72) RECOVERED 4 in.
4'		

- R E F U S A L -
(120 BLOWS, S.S., 140-LB. WGT., NO PENETRATION)

NO WATER ENCOUNTERED
DRILLER: RENE' DESIMONE
DATE STARTED & COMPLETED: 10-4-00

NOTE: ALTERNATE BORING MADE 5'0" TOWARDS TP-11,
"REFUSAL ENCOUNTERED AT DEPTH OF 3'3"

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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To: WEIDLINGER ASSOCIATES, INC., CAMBRIDGE, MA Date: _____ Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING TP-10

GROUND SURFACE

	LOAM, Little Gravel	S#1,	0' to 2' (3-4-4-5) RECOVERED 5 in.
2'	Very Dense FINE SAND, Some Medium & Coarse Sand, Gravel, Little Inorganic Silt	S#2,	2' to 3'6" (23-29-62) RECOVERED 7 in.
3'6"	- R E F U S A L - (120 BLOWS, S.S., 140-LB. WGT., NO PENETRATION)		

NO WATER ENCOUNTERED
DRILLER: RENE' DESIMONE
DATE STARTED & COMPLETED: 10-19-00

NOTES: ALTERNATE TP MADE 5'0" TOWARDS B-17, "REFUSAL" ENCOUNTERED AT DEPTH OF 3'0"

BORING FOREMAN REPORTS OUTCROPPING OF ROCK IN IN IMMEDIATE AREA.

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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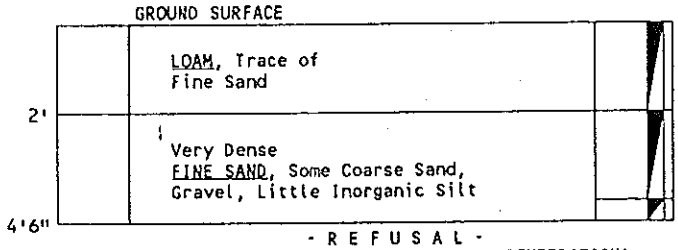
To: WEIDLINGER ASSOCIATES, INC., CAMBRIDGE, MA Date: _____ Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING TP-11



S#1, 0' to 2'
(1-2-4-3)
RECOVERED 7 in.

S#2, 2' to 4'
(7-21-37-66)
RECOVERED 6 in.

S#3, 4' to 4'6"
(74)
RECOVERED 2 in.

(120 BLOWS, S.S., 140-LB. WGT., NO PENETRATION)

NO WATER ENCOUNTERED
DRILLER: RENE' DESIMONE
DATE STARTED & COMPLETED: 10-4-00

NOTE: ALTERNATE TRIAL MADE 5'6" TOWARDS TP-18,
"REFUSAL" ENCOUNTERED AT DEPTH OF 3'10"

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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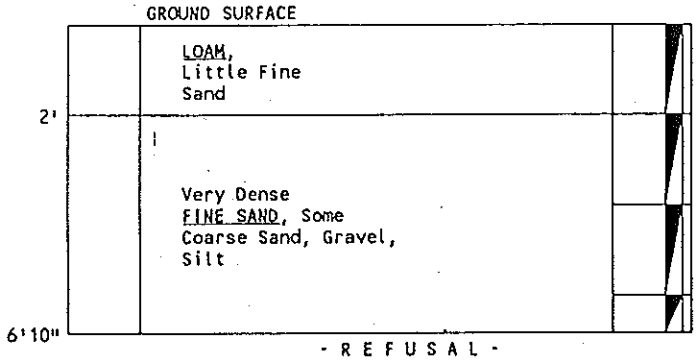
To: WEIDLINGER ASSOCIATES, INC., CAMBRIDGE, MA Date: _____ Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING TP-12



S#1, 0' to 2'
(1-3-3-5)
RECOVERED 6 in.

S#2, 2' to 4'
(20-41-53-68)
RECOVERED 7 in.

S#3, 4' to 6'
(61-78-80-94)
RECOVERED 8 in.

S#4, 6' to 6'10"
(77-105/4")
RECOVERED 4 in.

(120 BLOWS, S.S., 140-LB. WGT., NO PENETRATION)

NO WATER ENCOUNTERED
DRILLER: RENE' DESIMONE
DATE STARTED & COMPLETED: 10-6-00

NOTE: ALTERNATE TRIAL MADE 6'0" TOWARDS TP-14,
"REFUSAL" ENCOUNTERED AT DEPTH OF 6'6"

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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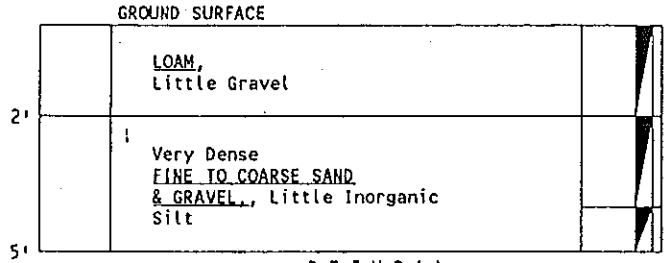
To: WEIDLINGER ASSOCIATES, INC., CAMBRIDGE, MA Date: _____ Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING TP-13



S#1, 0' to 2'
(3-4-6-6)
RECOVERED 5 in.

S#2, 2' to 4'
(37-66-72-61)
RECOVERED 9 in.

S#4, 4' to 5'
(53-81)
RECOVERED 5 in.

(120 BLOWS, S.S., 140-LB. WGT., NO PENETRATION)

NO WATER ENCOUNTERED
DRILLER: RENE' DESIMONE
DATE STARTED & COMPLETED: 10-11-00

NOTE: ALTERNATE TRIAL MADE 6'0" TOWARDS TP-20,
"REFUSAL" ENCOUNTERED AT DEPTH OF 4'3".

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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To: WEIDLINGER ASSOCIATES, INC., CAMBRIDGE, MA Date: _____ Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING TP-14

GROUND SURFACE

	LOAM, Trace of Gravel	S#1,	0' to 2' (2-2-3-4) RECOVERED 5 in.
2'	Medium Dense FINE SAND, Little Coarse Sand, Gravel, Inorganic Silt	S#2,	2' to 4' (6-6-8-9) RECOVERED 8 in.
4'	Very Dense FINE SAND, Some Medium & Coarse Sand, Gravel, Inorganic Silt	S#3,	4' to 6' (25-56-71-90) RECOVERED 10 in.
6'11"		S#4,	6' to 6'11" (81-76/5") RECOVERED 5 in.

- R E F U S A L -
(120 BLOWS, S.S., 140-LB. WGT., NO PENETRATION)

NO WATER ENCOUNTERED
DRILLER: RENE' DESIMONE
DATE STARTED & COMPLETED: 10-11-00

NOTE: ALTERNATE TRIAL MADE 4'0" TOWARDS TP-13, "REFUSAL" ENCOUNTERED AT DEPTH OF 6'6".

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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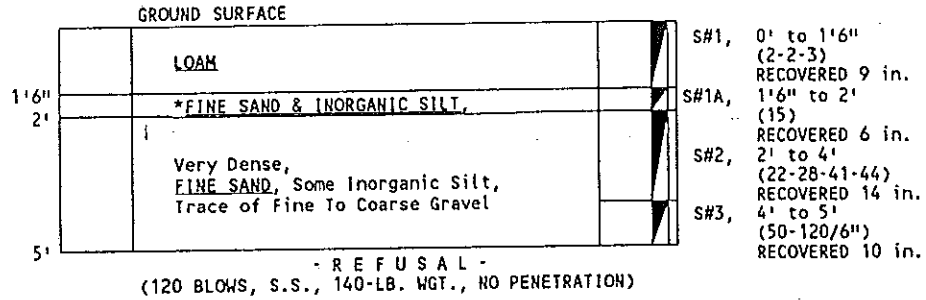
Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING TP-15



(120 BLOWS, S.S., 140-LB. WGT., NO PENETRATION)

NO WATER ENCOUNTERED
DRILLER: GERALD SMITH
DATE STARTED & COMPLETED: 9-28-00

NOTE: ALTERNATE BORING MADE 5'0" TOWARDS BORING NO. B-23,
"REFUSAL" ENCOUNTERED AT DEPTH OF 4'6"

*Trace Fine To Coarse Gravel

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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CONSULTING ENGINEERS

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To: WEIDLINGER ASSOCIATES, INC., CAMBRIDGE, MA Date: _____ Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING TP-16

GROUND SURFACE

	Loamy FINE SAND, Trace of Gravel	S#1,	0' to 2' (2-3-3-5) RECOVERED 8 in.
2'	Very Dense FINE SAND, Some Coarse Sand, Gravel, Inorgaic Silt	S#2,	2' to 4' (21-24-29-87) RECOVERED 10 in.
		S#3,	4' to 5'2" (38-50-120/2") RECOVERED 7 in.
5'2"			

- R E F U S A L -
(120 BLOWS, S.S., 140-LB. WGT., NO PENETRATION)

NO WATER ENCOUNTERED
DRILLER: GERALD SMITH
DATE STARTED & COMPLETED: 10-2-00

NOTE: ALTERNATE BORING MADE 6'0" TOWARDS B-26,
"REFUSAL ENCOUNTERED AT DEPTH OF 3'10"

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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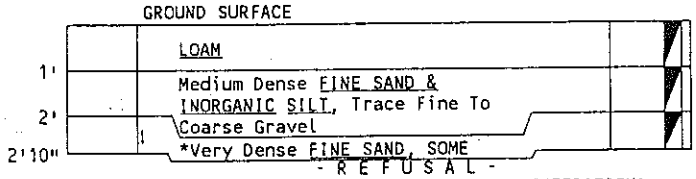
To: WEIDLINGER ASSOCIATES, INC., CAMBRIDGE, MA Date: _____ Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING TP-17



S#1, 0' to 1' (2-2) RECOVERED 10 in.

S#1A, 1' to 2' (7-8) RECOVERED 10 in.

S#2, 2' to 2'10" (41-120/4") RECOVERED 8 in.

(120 BLOWS, S.S., 140-LB. WGT., NO PENETRATION)

NO WATER ENCOUNTERED
DRILLER: GERALD SMITH
DATE STARTED & COMPLETED: 9-28-00

NOTE: ALTERNATE BORING MADE 5'0" TOWARDS BORING NO. B-23, "REFUSAL ENCOUNTERED AT DEPTH OF 3'1".

*Inorganic Silt, Trace of Fine To Coarse Gravel

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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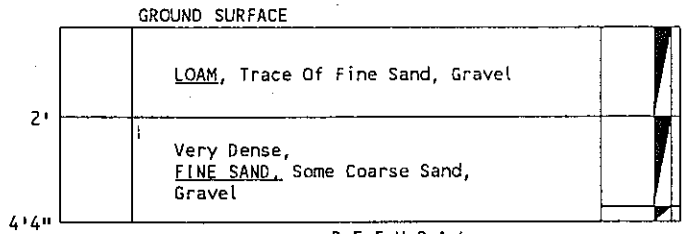
To: WEIDLINGER ASSOCIATES, INC., CAMBRIDGE, MA Date: _____ Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING TP-18



S#1, 0' to 2' (3-4-4-5) RECOVERED 7 in.

S#2, 2' to 4' (19-26-42-69) RECOVERED 10 in.

S#3, 4' to 4'4" (95/4") RECOVERED 2 in.

NO WATER ENCOUNTERED
DRILLER: RENE' DESIMONE
DATE STARTED & COMPLETED: 10-4-00

NOTE: ALTERNATE TRIAL MADE 6'0" TOWARDS TP-12,
"REFUSAL" ENCOUNTERED AT DEPTH OF 3'3"

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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To: WEIDLINGER ASSOCIATES, INC., CAMBRIDGE, MA Date: _____ Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING TP-19

GROUND SURFACE

	LOAM, Little Fine Sand, Gravel	S#1,	0' to 2' (2-4-5-7) RECOVERED 6 in.
2'	Dense To Very Dense FINE TO COARSE SAND & GRAVEL, Little Inorganic Silt	S#2,	2' to 4' (12-15-32-47) RECOVERED 9 in.
		S#3,	4' to 4'9" (62-120/3") RECOVERED 7 in.
4'9"			

- R E F U S A L -
(120 BLOWS, S.S., 140-LB. WGT., NO PENETRATION)

NO WATER ENCOUNTERED
DRILLER: RENE' DESIMONE
DATE STARTED & COMPLETED: 10-11-00

NOTE: ALTERNATE TRIAL MADE 6'0" TOWARDS TP-17,
"REFUSAL" ENCOUNTERED AT DEPTH OF 3'0".

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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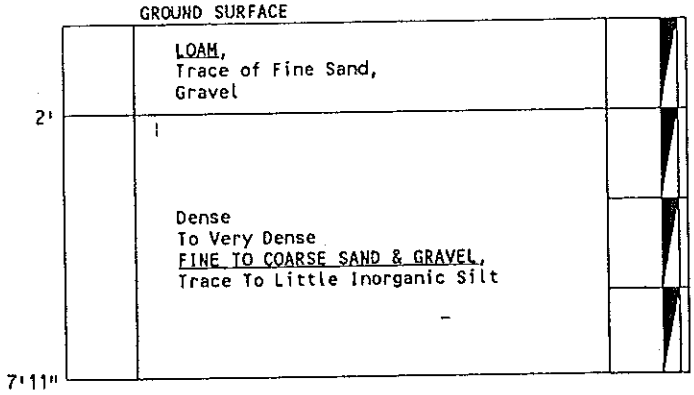
To: WEIDLINGER ASSOCIATES, INC., CAMBRIDGE, MA Date: _____ Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING TP-20



S#1, 0' to 2'
(2-2-2-4)
RECOVERED 6 in.

S#2, 2' to 4'
(11-14-29-31)
RECOVERED 9 in.

S#3, 4' to 6'
(56-51-64-75)
RECOVERED 12 in.

S#4, 6' to 7'11"
(79-81-85-106/5")
RECOVERED 7 in.

NO WATER ENCOUNTERED
DRILLER: RENE' DESIMONE
DATE STARTED & COMPLETED: 10-11-00

NOTE: ALTERNATE TRIAL MADE 4'0" TOWARDS B-34,
"REFUSAL" ENCOUNTERED AT DEPTH OF 6'2".

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

WEIDLINGER ASSOCIATES INC
CONSULTING ENGINEERS

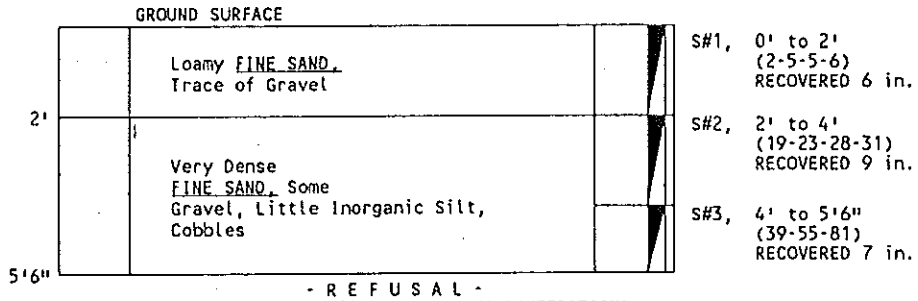
CARR-DEE CORP.

37 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone (781) 391-4500

To: WEIDLINGER ASSOCIATES, INC., CAMBRIDGE, MA Date: _____ Job No.: 2000-67

Location: ARC BELMONT CAMPUS, BELMONT, MA

BORING TP-21



- R E F U S A L -
(120 BLOWS, S.S., 140-LB. WGT., NO PENETRATION)

NO WATER ENCOUNTERED
DRILLER: RENE' DESIMONE
DATE STARTED & COMPLETED: 9-25-00

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

WEIDLINGER ASSOCIATES INC
CONSULTING ENGINEERS

Required/Provided Recharge Volumes and Drawdown Analysis

Recharge Calculations

Project	Residences at Bel Mont	**Project #**	13555.04
Calculated by	JRB	**Date**	4/14/2021
Checked by		**Date**	

REQUIRED RECHARGE VOLUME

Hydrologic Soil Group (HSG)	Area (ft^2)	Inches of Runoff (in)	Volume (ft^3)
A	258,311	0.60	12,916
B	-	0.35	-
C	-	0.25	-
D	-	0.10	-
TOTAL			**12,916**

PROVIDED RECHARGE VOLUME

BASIN #1P:

Multifamily Area Infiltration

Volumes provided below the lowest outlet at elevation: 194.0

Provided Volume:	Bottom Area (ft^2)	Volume (ft^3)
	4,095	**7,425**

Drawdown:	$(V_{Infiltration}/A_{Bottom})$/Rawl's Rate		
	Rawls Recharge Rate:	1.02	(in/hr)
	Drawdown Time:	21	(hours)

BASIN #2P:

Recharge Trench Under Access Road

Volumes provided below the lowest outlet at elevation: 180.0

Provided Volume:	Bottom Area (ft^2)	Volume (ft^3)
	865	**865**

Drawdown:	$(V_{Infiltration}/A_{Bottom})$/Rawl's Rate		
	Rawls Recharge Rate:	1.02	(in/hr)
	Drawdown Time:	12	(hours)

Recharge Calculations

Project	Residences at Bel Mont	**Project #**	13555.04
Calculated by	JRB	**Date**	4/14/2021
Checked by		**Date**	

BASIN #4P:

Recharge Trench at Eastern Toe of Slope

Provided Volume:		**Bottom Area (ft^2)**	**Volume (ft^3)**
		3,100	**6,768**

Drawdown:	$(V_{Infiltration}/A_{Bottom})$/Rawl's Rate		
	Rawls Recharge Rate:	1.02	(in/hr)
	Drawdown Time:	26	(hours)

BASIN #7P:

Recharge Trench Behind Building 8

Provided Volume:		**Bottom Area (ft^2)**	**Volume (ft^3)**
		929	**1,128**

Drawdown:	$(V_{Infiltration}/A_{Bottom})$/Rawl's Rate		
	Rawls Recharge Rate:	1.02	(in/hr)
	Drawdown Time:	14	(hours)

BASIN #8P:

Recharge Trench Behind Building 9

Provided Volume:		**Bottom Area (ft^2)**	**Volume (ft^3)**
		1,035	**1,247**

Drawdown:	$(V_{Infiltration}/A_{Bottom})$/Rawl's Rate		
	Rawls Recharge Rate:	1.02	(in/hr)
	Drawdown Time:	14	(hours)

Recharge Calculations

Project	Residences at Bel Mont	**Project #**	13555.04
Calculated by	JRB	**Date**	4/14/2021
Checked by		**Date**	

BASIN #9P:

Recharge Trench Behind Building 7

Provided Volume:		**Bottom Area (ft^2)**	**Volume (ft^3)**
		910	**1,107**
Drawdown:	$(V_{Infiltration}/A_{Bottom})$/Rawl's Rate		
	Rawls Recharge Rate:	1.02	(in/hr)
	Drawdown Time:	**14**	(hours)

RECHARGE VOLUME SUMMARY

Required Recharge Volume:	**12,916**	**(ft^3)**
Total Recharge Volume Provided:	**18,540**	**(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 shall be stockpiled on standard pavement surfaces so sand and salt may be swept in the spring or removed as snow melts and drains through the stormwater management system. Recommended locations for snow storage are shown on the attached Snow Storage Plan. 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.
- Do not stockpile snow on permeable pavement surfaces. Sand and grit in snow will clog pavement.
- Plow parking areas paved with permeable asphalt pavement carefully. Plow blades should be set approximately 1" higher than usual to avoid scarring the pavement and loosening material that could potentially clog surface pores.
- Do not apply abrasives such as sand or grit on or adjacent to permeable asphalt pavement.
- Monitor application rates of deicing materials on permeable pavement areas and reduce application rate accordingly. Permeable pavements tend to require less deicer per unit area because the water is not required to remain liquid over the entire parking surface area before discharge.
- Do not apply abrasives such as sand or grit on or adjacent to permeable pavers.
- Avoid plowing of areas with permeable pavers.

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: 617-993-2200

POLICE DEPARTMENT

Emergency: **911**

Business: 617-484-1212

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	617-993-2720
Municipality Conservation Commission:	617-993-2667

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,
SORBENT PADS	**50**	26 feet of sock, 50 pads, and five pounds of
LITE-DRI® ABSORBENT	**5**	absorbent (or equivalent)
POUNDS		http://www.forestry-suppliers.com
SHOVEL	**1**	Item # 43210 — Manhole cover pick (or
PRY BAR	**1**	equivalent)
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

Residences at Bel Mont
Olmsted Drive
Belmont, Massachusetts

Owner

McLean Hospital Corp
115 Mill Street
Belmont, MA 02478

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 Infiltration and Detention Systems

- 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.
- 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.

CONTECH®
ENGINEERED SOLUTIONS

StormFilter Inspection and Maintenance Procedures

The Stormwater Management StormFilter®

Maintenance Guidelines

The primary purpose of the Stormwater Management StormFilter® is to filter and prevent pollutants from entering our waterways. Like any effective filtration system, periodically these pollutants must be removed to restore the StormFilter to its full efficiency and effectiveness.

Maintenance requirements and frequency are dependent on the pollutant load characteristics of each site. Maintenance activities may be required in the event of a chemical spill or due to excessive sediment loading from site erosion or extreme storms. It is a good practice to inspect the system after major storm events.

Maintenance Procedures

Although there are many effective maintenance options, we believe the following procedure to be efficient, using common equipment and existing maintenance protocols. The following two-step procedure is recommended::

1. **Inspection**
   - Inspection of the vault interior to determine the need for maintenance.
2. **Maintenance**
   - Cartridge replacement
   - Sediment removal

Inspection and Maintenance Timing

At least one scheduled inspection should take place per year with maintenance following as warranted.

First, an inspection should be done before the winter season. During the inspection the need for maintenance should be determined and, if disposal during maintenance will be required, samples of the accumulated sediments and media should be obtained.

Second, if warranted, a maintenance (replacement of the filter cartridges and removal of accumulated sediments) should be performed during periods of dry weather.

In addition to these two activities, it is important to check the condition of the StormFilter unit after major storms for potential damage caused by high flows and for high sediment accumulation that may be caused by localized erosion in the drainage area. It may be necessary to adjust the inspection/ maintenance schedule depending on the actual operating conditions encountered by the system. In general, inspection activities can be conducted at any time, and maintenance should occur, if warranted, during dryer months in late summer to early fall.

Maintenance Frequency

The primary factor for determining frequency of maintenance for the StormFilter is sediment loading.

A properly functioning system will remove solids from water by trapping particulates in the porous structure of the filter media inside the cartridges. The flow through the system will naturally decrease as more and more particulates are trapped. Eventually the flow through the cartridges will be low enough to require replacement. It may be possible to extend the usable span of the cartridges by removing sediment from upstream trapping devices on a routine as-needed basis, in order to prevent material from being re-suspended and discharged to the StormFilter treatment system.

The average maintenance lifecycle is approximately 1-5 years. Site conditions greatly influence maintenance requirements. StormFilter units located in areas with erosion or active construction may need to be inspected and maintained more often than those with fully stabilized surface conditions.

Regulatory requirements or a chemical spill can shift maintenance timing as well. The maintenance frequency may be adjusted as additional monitoring information becomes available during the inspection program. Areas that develop known problems should be inspected more frequently than areas that demonstrate no problems, particularly after major storms. Ultimately, inspection and maintenance activities should be scheduled based on the historic records and characteristics of an individual StormFilter system or site. It is recommended that the site owner develop a database to properly manage StormFilter inspection and maintenance programs..

Inspection Procedures

The primary goal of an inspection is to assess the condition of the cartridges relative to the level of visual sediment loading as it relates to decreased treatment capacity. It may be desirable to conduct this inspection during a storm to observe the relative flow through the filter cartridges. If the submerged cartridges are severely plugged, then typically large amounts of sediments will be present and very little flow will be discharged from the drainage pipes. If this is the case, then maintenance is warranted and the cartridges need to be replaced.

Warning: In the case of a spill, the worker should abort inspection activities until the proper guidance is obtained. Notify the local hazard control agency and Contech Engineered Solutions immediately.

To conduct an inspection:

Important: Inspection should be performed by a person who is familiar with the operation and configuration of the StormFilter treatment unit and the unit's role, relative to detention or retention facilities onsite.

1. If applicable, set up safety equipment to protect and notify surrounding vehicle and pedestrian traffic.
2. Visually inspect the external condition of the unit and take notes concerning defects/problems.
3. Open the access portals to the vault and allow the system vent.
4. Without entering the vault, visually inspect the inside of the unit, and note accumulations of liquids and solids.
5. Be sure to record the level of sediment build-up on the floor of the vault, in the forebay, and on top of the cartridges. If flow is occurring, note the flow of water per drainage pipe. Record all observations. Digital pictures are valuable for historical documentation.
6. Close and fasten the access portals.
7. Remove safety equipment.
8. If appropriate, make notes about the local drainage area relative to ongoing construction, erosion problems, or high loading of other materials to the system.
9. Discuss conditions that suggest maintenance and make decision as to whether or not maintenance is needed.

Maintenance Decision Tree

The need for maintenance is typically based on results of the inspection. The following Maintenance Decision Tree should be used as a general guide. (Other factors, such as Regulatory Requirements, may need to be considered).

Please note Stormwater Management StormFilter devices installed downstream of, or integrated within, a stormwater storage facility typically have different operational parameters (i.e. draindown time). In these cases, the inspector must understand the relationship between the retention/detention facility and the treatment system by evaluating site specific civil engineering plans, or contacting the engineer of record, and make adjustments to the below guidance as necessary. Sediment deposition depths and patterns within the StormFilter are likely to be quite different compared to systems without upstream storage and therefore shouldn't be used exclusively to evaluate a need for maintenance.

1. Sediment loading on the vault floor.
   a. If >4" of accumulated sediment, maintenance is required.
2. Sediment loading on top of the cartridge.
   a. If >1/4" of accumulation, maintenance is required.
3. Submerged cartridges.
   a. If >4" of static water above cartridge bottom for more than 24 hours after end of rain event, maintenance is required. (Catch basins have standing water in the cartridge bay.)
4. Plugged media.
   a. While not required in all cases, inspection of the media within the cartridge may provide valuable additional information.
   b. If pore space between media granules is absent, maintenance is required.
5. Bypass condition.
   a. If inspection is conducted during an average rain fall event and StormFilter remains in bypass condition (water over the internal outlet baffle wall or submerged cartridges), maintenance is required.
6. Hazardous material release.
   a. If hazardous material release (automotive fluids or other) is reported, maintenance is required.
7. Pronounced scum line.
   a. If pronounced scum line (say ≥ 1/4" thick) is present above top cap, maintenance is required.

Maintenance

Depending on the configuration of the particular system, maintenance personnel will be required to enter the vault to perform the maintenance.

Important: If vault entry is required, OSHA rules for confined space entry must be followed.

Filter cartridge replacement should occur during dry weather. It may be necessary to plug the filter inlet pipe if base flows is occurring.

Replacement cartridges can be delivered to the site or customers facility. Information concerning how to obtain the replacement cartridges is available from Contech Engineered Solutions.

Warning: In the case of a spill, the maintenance personnel should abort maintenance activities until the proper guidance is obtained. Notify the local hazard control agency and Contech Engineered Solutions immediately.

To conduct cartridge replacement and sediment removal maintenance:

1. If applicable, set up safety equipment to protect maintenance personnel and pedestrians from site hazards.
2. Visually inspect the external condition of the unit and take notes concerning defects/problems.
3. Open the doors (access portals) to the vault and allow the system to vent.
4. Without entering the vault, give the inside of the unit, including components, a general condition inspection.
5. Make notes about the external and internal condition of the vault. Give particular attention to recording the level of sediment build-up on the floor of the vault, in the forebay, and on top of the internal components.
6. Using appropriate equipment offload the replacement cartridges (up to 150 lbs. each) and set aside.
7. Remove used cartridges from the vault using one of the following methods:

Method 1:

A. This activity will require that maintenance personnel enter the vault to remove the cartridges from the under drain manifold and place them under the vault opening for lifting (removal). Disconnect each filter cartridge from the underdrain connector by rotating counterclockwise 1/4 of a turn. Roll the loose cartridge, on edge, to a convenient spot beneath the vault access.

   Using appropriate hoisting equipment, attach a cable from the boom, crane, or tripod to the loose cartridge. Contact Contech Engineered Solutions for suggested attachment devices.

B. Remove the used cartridges (up to 250 lbs. each) from the vault.

Important: Care must be used to avoid damaging the cartridges during removal and installation. The cost of repairing components damaged during maintenance will be the responsibility of the owner.

C. Set the used cartridge aside or load onto the hauling truck.

D. Continue steps a through c until all cartridges have been removed.

Method 2:

A. This activity will require that maintenance personnel enter the vault to remove the cartridges from the under drain manifold and place them under the vault opening for lifting (removal). Disconnect each filter cartridge from the underdrain connector by rotating counterclockwise 1/4 of a turn. Roll the loose cartridge, on edge, to a convenient spot beneath the vault access.

B. Unscrew the cartridge cap.

C. Remove the cartridge hood and float.

D. At location under structure access, tip the cartridge on its side.

E. Empty the cartridge onto the vault floor. Reassemble the empty cartridge.

F. Set the empty, used cartridge aside or load onto the hauling truck.

G. Continue steps a through e until all cartridges have been removed.

8. Remove accumulated sediment from the floor of the vault and from the forebay. This can most effectively be accomplished by use of a vacuum truck.
9. Once the sediments are removed, assess the condition of the vault and the condition of the connectors.
10. Using the vacuum truck boom, crane, or tripod, lower and install the new cartridges. Once again, take care not to damage connections.
11. Close and fasten the door.
12. Remove safety equipment.
13. Finally, dispose of the accumulated materials in accordance with applicable regulations. Make arrangements to return the used **empty** cartridges to Contech Engineered Solutions.

Material Disposal

The accumulated sediment found in stormwater treatment and conveyance systems must be handled and disposed of in accordance with regulatory protocols. It is possible for sediments to contain measurable concentrations of heavy metals and organic chemicals (such as pesticides and petroleum products). Areas with the greatest potential for high pollutant loading include industrial areas and heavily traveled roads.

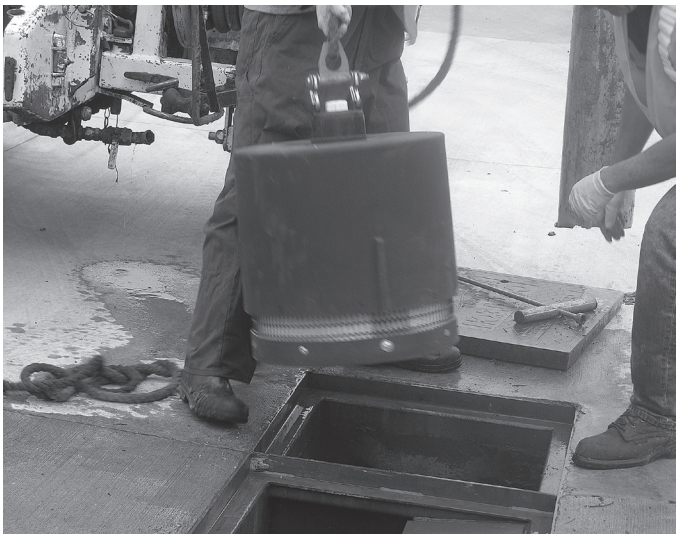
Sediments and water must be disposed of in accordance with all applicable waste disposal regulations. When scheduling maintenance, consideration must be made for the disposal of solid and liquid wastes. This typically requires coordination with a local landfill for solid waste disposal. For liquid waste disposal a number of options are available including a municipal vacuum truck decant facility, local waste water treatment plant or on-site treatment and discharge.

Related Maintenance Activities - Performed on an as-needed basis

StormFilter units are often just one of many structures in a more comprehensive stormwater drainage and treatment system.

In order for maintenance of the StormFilter to be successful, it is imperative that all other components be properly maintained. The maintenance/repair of upstream facilities should be carried out prior to StormFilter maintenance activities.

In addition to considering upstream facilities, it is also important to correct any problems identified in the drainage area. Drainage area concerns may include: erosion problems, heavy oil loading, and discharges of inappropriate materials.



Inspection Report

Date: _____ Personnel: _____

Location: _____ System Size: _____ Months in Service: _____

System Type: Vault ☐ Cast-In-Place ☐ Linear Catch Basin ☐ Manhole ☐ Other: _____

Sediment Thickness in Forebay: _____ Date: _____

Sediment Depth on Vault Floor: _____

Sediment Depth on Cartridge Top(s): _____

Structural Damage: _____

Estimated Flow from Drainage Pipes (if available): _____

Cartridges Submerged: Yes ☐ No ☐ Depth of Standing Water: _____

StormFilter Maintenance Activities (check off if done and give description)

☐ Trash and Debris Removal: _____

☐ Minor Structural Repairs: _____

☐ Drainage Area Report _____

Excessive Oil Loading: Yes ☐ No ☐ Source: _____

Sediment Accumulation on Pavement: Yes ☐ No ☐ Source: _____

Erosion of Landscaped Areas: Yes ☐ No ☐ Source: _____

Items Needing Further Work: _____

Owners should contact the local public works department and inquire about how the department disposes of their street waste residuals.

Other Comments:

_____

_____

_____

_____

_____

_____

_____

_____

Review the condition reports from the previous inspection visits.

StormFilter Maintenance Report

Date: _____ Personnel: _____

Location: _____ System Size: _____

System Type: Vault ☐ Cast-In-Place ☐ Linear Catch Basin ☐ Manhole ☐ Other: _____

List Safety Procedures and Equipment Used: _____

_____

_____

System Observations

Months in Service: _____

Oil in Forebay (if present): Yes ☐ No ☐

Sediment Depth in Forebay (if present): _____

Sediment Depth on Vault Floor: _____

Sediment Depth on Cartridge Top(s): _____

Structural Damage: _____

Drainage Area Report

Excessive Oil Loading: Yes ☐ No ☐ Source: _____

Sediment Accumulation on Pavement: Yes ☐ No ☐ Source: _____

Erosion of Landscaped Areas: Yes ☐ No ☐ Source: _____

StormFilter Cartridge Replacement Maintenance Activities

Remove Trash and Debris: Yes ☐ No ☐ Details: _____

Replace Cartridges: Yes ☐ No ☐ Details: _____

Sediment Removed: Yes ☐ No ☐ Details: _____

Quantity of Sediment Removed (estimate?):

Minor Structural Repairs: Yes ☐ No ☐ Details: _____

Residuals (debris, sediment) Disposal Methods: _____

Notes:

_____

_____

_____

_____

_____

_____

_____

RECYCLED PAPER

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- Site-specific design support is available from our engineers.

CONTECH®
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CDS Guide
Operation, Design, Performance and Maintenance

CDS®

Using patented continuous deflective separation technology, the CDS system screens, separates and traps debris, sediment, and oil and grease from stormwater runoff. The indirect screening capability of the system allows for 100% removal of floatables and neutrally buoyant material without blinding. Flow and screening controls physically separate captured solids, and minimize the re-suspension and release of previously trapped pollutants. Inline units can treat up to 6 cfs, and internally bypass flows in excess of 50 cfs (1416 L/s). Available precast or cast-in-place, offline units can treat flows from 1 to 300 cfs (28.3 to 8495 L/s). The pollutant removal capacity of the CDS system has been proven in lab and field testing.

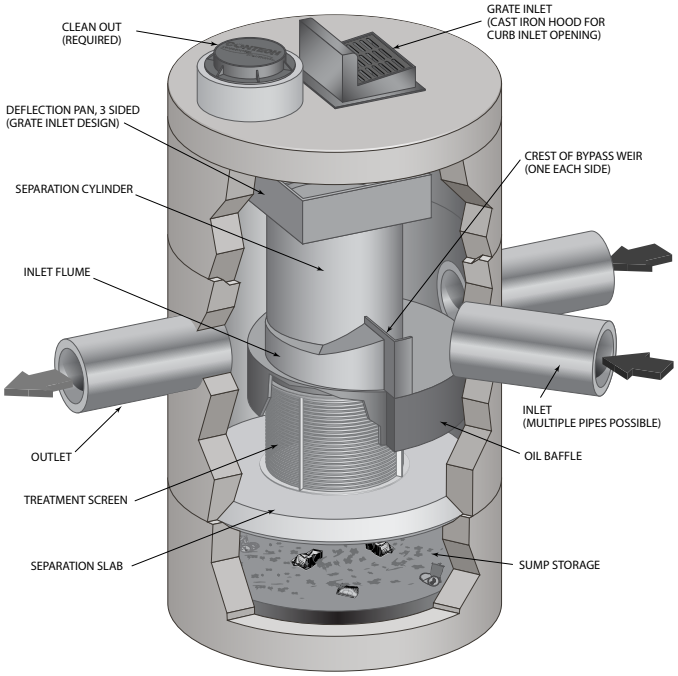
Operation Overview

Stormwater enters the diversion chamber where the diversion weir guides the flow into the unit's separation chamber and pollutants are removed from the flow. All flows up to the system's treatment design capacity enter the separation chamber and are treated.

Swirl concentration and screen deflection force floatables and solids to the center of the separation chamber where 100% of floatables and neutrally buoyant debris larger than the screen apertures are trapped.

Stormwater then moves through the separation screen, under the oil baffle and exits the system. The separation screen remains clog free due to continuous deflection.

During the flow events exceeding the treatment design capacity, the diversion weir bypasses excessive flows around the separation chamber, so captured pollutants are retained in the separation cylinder.



Design Basics

There are three primary methods of sizing a CDS system. The Water Quality Flow Rate Method determines which model size provides the desired removal efficiency at a given flow rate for a defined particle size. The Rational Rainfall Method™ or the and Probabilistic Method is used when a specific removal efficiency of the net annual sediment load is required.

Typically in the Unites States, CDS systems are designed to achieve an 80% annual solids load reduction based on lab generated performance curves for a gradation with an average particle size (d50) of 125 microns (μm). For some regulatory environments, CDS systems can also be designed to achieve an 80% annual solids load reduction based on an average particle size (d50) of 75 microns (μm) or 50 microns (μm).

Water Quality Flow Rate Method

In some cases, regulations require that a specific treatment rate, often referred to as the water quality design flow (WQQ), be treated. This WQQ represents the peak flow rate from either an event with a specific recurrence interval, e.g. the six-month storm, or a water quality depth, e.g. 1/2-inch (13 mm) of rainfall.

The CDS is designed to treat all flows up to the WQQ. At influent rates higher than the WQQ, the diversion weir will direct most flow exceeding the WQQ around the separation chamber. This allows removal efficiency to remain relatively constant in the separation chamber and eliminates the risk of washout during bypass flows regardless of influent flow rates.

Treatment flow rates are defined as the rate at which the CDS will remove a specific gradation of sediment at a specific removal efficiency. Therefore the treatment flow rate is variable, based on the gradation and removal efficiency specified by the design engineer.

Rational Rainfall Method™

Differences in local climate, topography and scale make every site hydraulically unique. It is important to take these factors into consideration when estimating the long-term performance of any stormwater treatment system. The Rational Rainfall Method combines site-specific information with laboratory generated performance data, and local historical precipitation records to estimate removal efficiencies as accurately as possible.

Short duration rain gauge records from across the United States and Canada were analyzed to determine the percent of the total annual rainfall that fell at a range of intensities. US stations' depths were totaled every 15 minutes, or hourly, and recorded in 0.01-inch increments. Depths were recorded hourly with 1-mm resolution at Canadian stations. One trend was consistent at all sites; the vast majority of precipitation fell at low intensities and high intensity storms contributed relatively little to the total annual depth.

These intensities, along with the total drainage area and runoff coefficient for each specific site, are translated into flow rates using the Rational Rainfall Method. Since most sites are relatively small and highly impervious, the Rational Rainfall Method is appropriate. Based on the runoff flow rates calculated for each intensity, operating rates within a proposed CDS system are

determined. Performance efficiency curve determined from full scale laboratory tests on defined sediment PSDs is applied to calculate solids removal efficiency. The relative removal efficiency at each operating rate is added to produce a net annual pollutant removal efficiency estimate.

Probabilistic Rational Method

The Probabilistic Rational Method is a sizing program Contech developed to estimate a net annual sediment load reduction for a particular CDS model based on site size, site runoff coefficient, regional rainfall intensity distribution, and anticipated pollutant characteristics.

The Probabilistic Method is an extension of the Rational Method used to estimate peak discharge rates generated by storm events of varying statistical return frequencies (e.g. 2-year storm event). Under the Rational Method, an adjustment factor is used to adjust the runoff coefficient estimated for the 10-year event, correlating a known hydrologic parameter with the target storm event. The rainfall intensities vary depending on the return frequency of the storm event under consideration. In general, these two frequency dependent parameters (rainfall intensity and runoff coefficient) increase as the return frequency increases while the drainage area remains constant.

These intensities, along with the total drainage area and runoff coefficient for each specific site, are translated into flow rates using the Rational Method. Since most sites are relatively small and highly impervious, the Rational Method is appropriate. Based on the runoff flow rates calculated for each intensity, operating rates within a proposed CDS are determined. Performance efficiency curve on defined sediment PSDs is applied to calculate solids removal efficiency. The relative removal efficiency at each operating rate is added to produce a net annual pollutant removal efficiency estimate.

Treatment Flow Rate

The inlet throat area is sized to ensure that the WQQ passes through the separation chamber at a water surface elevation equal to the crest of the diversion weir. The diversion weir bypasses excessive flows around the separation chamber, thus preventing re-suspension or re-entrainment of previously captured particles.

Hydraulic Capacity

The hydraulic capacity of a CDS system is determined by the length and height of the diversion weir and by the maximum allowable head in the system. Typical configurations allow hydraulic capacities of up to ten times the treatment flow rate. The crest of the diversion weir may be lowered and the inlet throat may be widened to increase the capacity of the system at a given water surface elevation. The unit is designed to meet project specific hydraulic requirements.

Performance

Full-Scale Laboratory Test Results

A full-scale CDS system (Model CDS2020-5B) was tested at the facility of University of Florida, Gainesville, FL. This CDS unit was evaluated under controlled laboratory conditions of influent flow rate and addition of sediment.

Two different gradations of silica sand material (UF Sediment & OK-110) were used in the CDS performance evaluation. The particle size distributions (PSDs) of the test materials were analyzed using standard method "Gradation ASTM D-422 "Standard Test Method for Particle-Size Analysis of Soils" by a certified laboratory.

UF Sediment is a mixture of three different products produced by the U.S. Silica Company: "Sil-Co-Sil 106", "#1 DRY" and "20/40 Oil Frac". Particle size distribution analysis shows that the UF Sediment has a very fine gradation (d50 = 20 to 30 μm) covering a wide size range (Coefficient of Uniformity, C averaged at 10.6). In comparison with the hypothetical TSS gradation specified in the NJDEP (New Jersey Department of Environmental Protection) and NJCAT (New Jersey Corporation for Advanced Technology) protocol for lab testing, the UF Sediment covers a similar range of particle size but with a finer d50 (d50 for NJDEP is approximately 50 μm) (NJDEP, 2003).

The OK-110 silica sand is a commercial product of U.S. Silica Sand. The particle size distribution analysis of this material, also included in Figure 1, shows that 99.9% of the OK-110 sand is finer than 250 microns, with a mean particle size (d50) of 106 microns. The PSDs for the test material are shown in Figure 1.

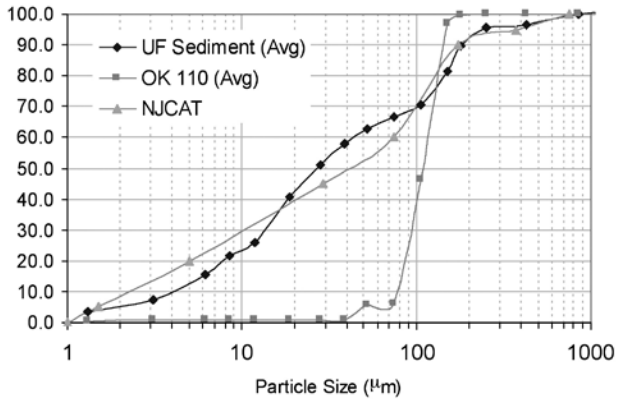


Figure 1. Particle size distributions

Tests were conducted to quantify the performance of a specific CDS unit (1.1 cfs (31.3-L/s) design capacity) at various flow rates, ranging from 1% up to 125% of the treatment design capacity of the unit, using the 2400 micron screen. All tests were conducted with controlled influent concentrations of approximately 200 mg/L. Effluent samples were taken at equal time intervals across the entire duration of each test run. These samples were then processed with a Dekaport Cone sample splitter to obtain representative sub-samples for Suspended Sediment Concentration (SSC) testing using ASTM D3977-97 "Standard Test Methods for Determining Sediment Concentration in Water Samples", and particle size distribution analysis.

Results and Modeling

Based on the data from the University of Florida, a performance model was developed for the CDS system. A regression analysis was used to develop a fitting curve representative of the scattered data points at various design flow rates. This model, which demonstrated good agreement with the laboratory data, can then be used to predict CDS system performance with respect

to SSC removal for any particle size gradation, assuming the particles are inorganic sandy-silt. Figure 2 shows CDS predictive performance for two typical particle size gradations (NJCAT gradation and OK-110 sand) as a function of operating rate.

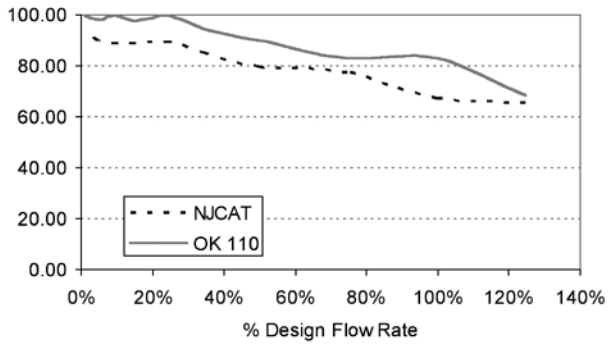


Figure 2. CDS stormwater treatment predictive performance for various particle gradations as a function of operating rate.

Many regulatory jurisdictions set a performance standard for hydrodynamic devices by stating that the devices shall be capable of achieving an 80% removal efficiency for particles having a mean particle size (d50) of 125 microns (e.g. Washington State Department of Ecology — WASDOE - 2008). The model can be used to calculate the expected performance of such a PSD (shown in Figure 3). The model indicates (Figure 4) that the CDS system with 2400 micron screen achieves approximately 80% removal at the design (100%) flow rate, for this particle size distribution (d50 = 125 μm).

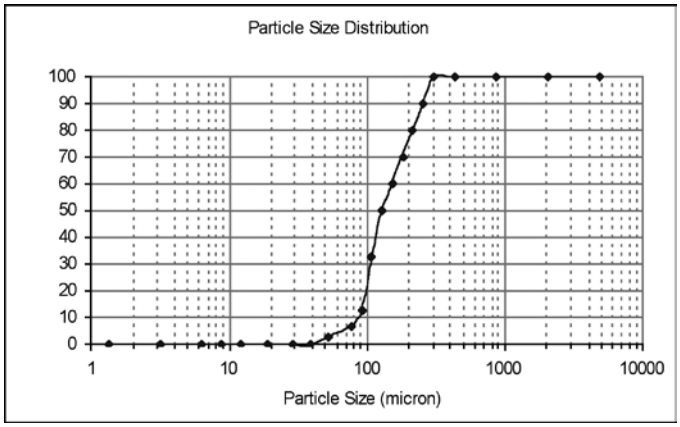


Figure 3. WASDOE PSD

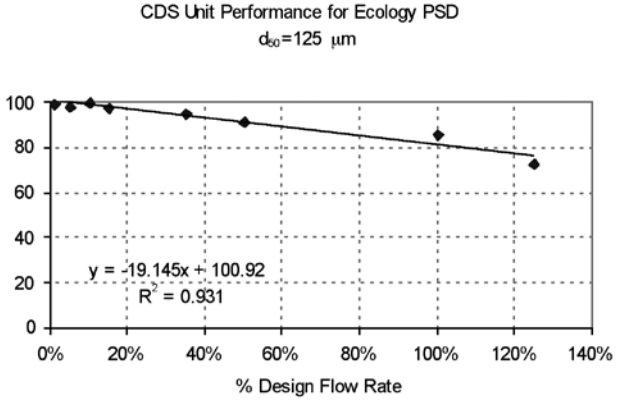


Figure 4. Modeled performance for WASDOE PSD.

Maintenance

The CDS system should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on site activities than the size of the unit. For example, unstable soils or heavy winter sanding will cause the grit chamber to fill more quickly but regular sweeping of paved surfaces will slow accumulation.

Inspection

Inspection is the key to effective maintenance and is easily performed. Pollutant transport and deposition may vary from year to year and regular inspections will help ensure that the system is cleaned out at the appropriate time. At a minimum, inspections should be performed twice per year (e.g. spring and fall) however more frequent inspections may be necessary in climates where winter sanding operations may lead to rapid accumulations, or in equipment washdown areas. Installations should also be inspected more frequently where excessive amounts of trash are expected.

The visual inspection should ascertain that the system components are in working order and that there are no blockages or obstructions in the inlet and separation screen. The inspection should also quantify the accumulation of hydrocarbons, trash, and sediment in the system. Measuring pollutant accumulation can be done with a calibrated dipstick, tape measure or other measuring instrument. If absorbent material is used for enhanced removal of hydrocarbons, the level of discoloration of the sorbent material should also be identified

during inspection. It is useful and often required as part of an operating permit to keep a record of each inspection. A simple form for doing so is provided.

Access to the CDS unit is typically achieved through two manhole access covers. One opening allows for inspection and cleanout of the separation chamber (cylinder and screen) and isolated sump. The other allows for inspection and cleanout of sediment captured and retained outside the screen. For deep units, a single manhole access point would allows both sump cleanout and access outside the screen.

The CDS system should be cleaned when the level of sediment has reached 75% of capacity in the isolated sump or when an appreciable level of hydrocarbons and trash has accumulated. If absorbent material is used, it should be replaced when significant discoloration has occurred. Performance will not be impacted until 100% of the sump capacity is exceeded however it is recommended that the system be cleaned prior to that for easier removal of sediment. The level of sediment is easily determined by measuring from finished grade down to the top of the sediment pile. To avoid underestimating the level of sediment in the chamber, the measuring device must be lowered to the top of the sediment pile carefully. Particles at the top of the pile typically offer less resistance to the end of the rod than consolidated particles toward the bottom of the pile. Once this measurement is recorded, it should be compared to the as-built drawing for the unit to determine weather the height of the sediment pile off the bottom of the sump floor exceeds 75% of the total height of isolated sump.

Cleaning

Cleaning of a CDS systems should be done during dry weather conditions when no flow is entering the system. The use of a vacuum truck is generally the most effective and convenient method of removing pollutants from the system. Simply remove the manhole covers and insert the vacuum hose into the sump. The system should be completely drained down and the sump fully evacuated of sediment. The area outside the screen should also be cleaned out if pollutant build-up exists in this area.

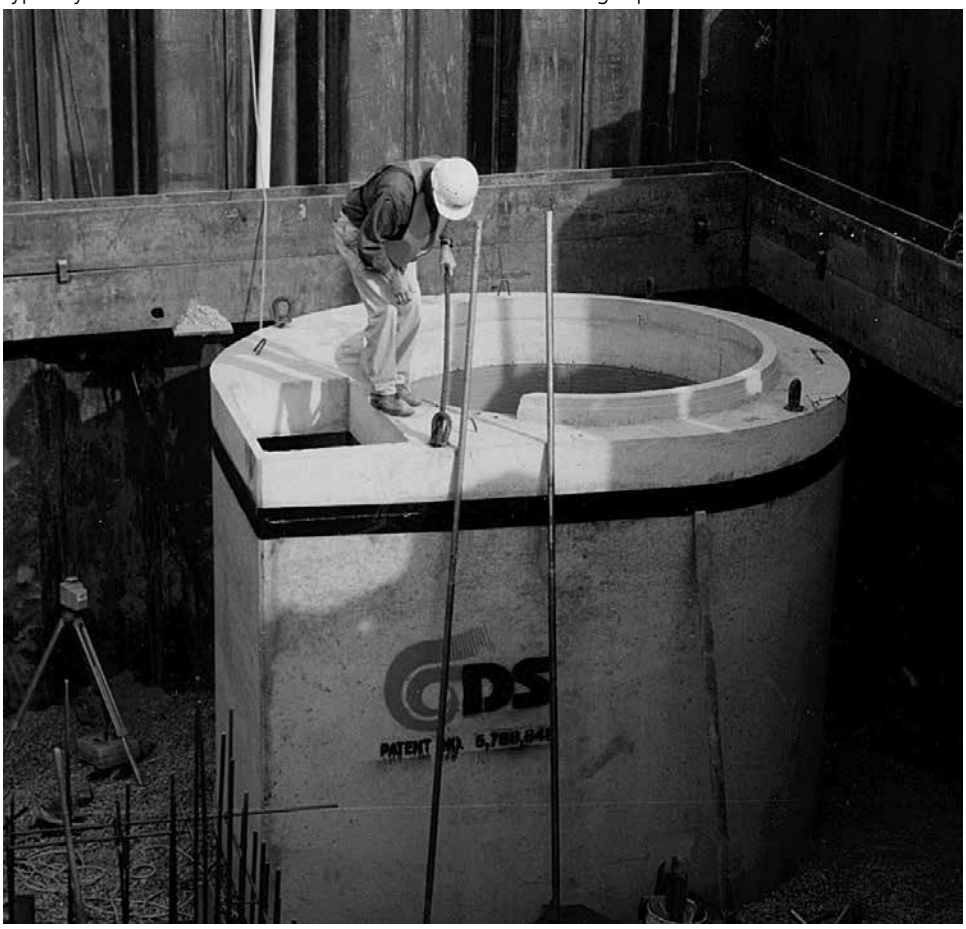
In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, the system should be cleaned out immediately in the event of an oil or gasoline spill. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use absorbent pads since they are usually less expensive to dispose than the oil/water emulsion that may be created by vacuuming the oily layer. Trash and debris can be netted out to separate it from the other pollutants. The screen should be cleaned to ensure it is free of trash and debris.

Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and also to ensure that proper safety precautions have been followed. Confined space entry procedures need to be followed if physical access is required. Disposal of all material removed from the CDS system should be done in accordance with local regulations. In many jurisdictions, disposal of the sediments may be handled in the same manner as the disposal of sediments removed from catch basins or deep sump manholes. Check your local regulations for specific requirements on disposal.

CDS Model	Diameter		Distance from Water Surface to Top of Sediment Pile		Sediment Storage Capacity	
	ft	m	ft	m	y^3	m^3
CDS1515	3	0.9	3.0	0.9	0.5	0.4
CDS2015	4	1.2	3.0	0.9	0.9	0.7
CDS2015	5	1.5	3.0	0.9	1.3	1.0
CDS2020	5	1.5	3.5	1.1	1.3	1.0
CDS2025	5	1.5	4.0	1.2	1.3	1.0
CDS3020	6	1.8	4.0	1.2	2.1	1.6
CDS3025	6	1.8	4.0	1.2	2.1	1.6
CDS3030	6	1.8	4.6	1.4	2.1	1.6
CDS3035	6	1.8	5.0	1.5	2.1	1.6
CDS4030	8	2.4	4.6	1.4	5.6	4.3
CDS4040	8	2.4	5.7	1.7	5.6	4.3
CDS4045	8	2.4	6.2	1.9	5.6	4.3
CDS5640	10	3.0	6.3	1.9	8.7	6.7
CDS5653	10	3.0	7.7	2.3	8.7	6.7
CDS5668	10	3.0	9.3	2.8	8.7	6.7
CDS5678	10	3.0	10.3	3.1	8.7	6.7

Table 1: CDS Maintenance Indicators and Sediment Storage Capacities

Note: To avoid underestimating the volume of sediment in the chamber, carefully lower the measuring device to the top of the sediment pile. Finer silty particles at the top of the pile may be more difficult to feel with a measuring stick. These finer particles typically offer less resistance to the end of the rod than larger particles toward the bottom of the pile.



CDS Inspection & Maintenance Log

CDS Model: _____ Location: _____

Date	Water depth to sediment[1]	Floatable Layer Thickness[2]	Describe Maintenance Performed	Maintenance Personnel	Comments

1. The water depth to sediment is determined by taking two measurements with a stadia rod: one measurement from the manhole opening to the top of the sediment pile and the other from the manhole opening to the water surface. If the difference between these measurements is less than the values listed in table 1 the system should be cleaned out. **Note: to avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile**.

2. For optimum performance, the system should be cleaned out when the floating hydrocarbon layer accumulates to an appreciable thickness. In the event of an oil spill, the system should be cleaned immediately.

SUPPORT

- Drawings and specifications are available at www.ContechES.com.
- Site-specific design support is available from our engineers.

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The product(s) described may be protected by one or more of the following US patents: 5,322,629; 5,624,576; 5,707,527; 5,759,415; 5,788,848; 5,985,157; 6,027,639; 6,350,374; 6,406,218; 6,641,720; 6,511,595; 6,649,048; 6,991,114; 6,998,038; 7,186,058; 7,296,692; 7,297,266; related foreign patents or other patents pending.

cds_manual 3/17 PDF

The Stormwater Management StormFilter®- PhosphoSorb®

Field Performance Summary

A three year field performance evaluation of The Stormwater Management StormFilter® (StormFilter) with PhosphoSorb® media operating at a specific flow rate of 1.67 gpm/ft^2 was completed at a 0.06 acre roadway site in Zigzag, Oregon. The Quality Assurance Project Plan (QAPP) for this evaluation followed the Guidance for Evaluating Emerging Stormwater Treatment Technologies: Technology Assessment Protocol – Ecology (TAPE, 2011). The StormFilter with PhosphoSorb Technical Evaluation Report resulted in a General Use Level Designation from Washington State Department of Ecology for Total Suspended Solids (TSS) and Total Phosphorus removal.

Results of the field performance evaluation for 17 qualified events are provided in Table 1.

Table 1. StormFilter with PhosphoSorb Field Evaluation Results

	Parameter	Sample population (n)	Average Influent (mg/L)	Average Effluent (mg/L)	Average Removal (%)	Aggregate Pollutant Load Reduction [1] (%)
Solids	TSS	17	380	40	88	89
	SSC<500 µm	15	325	40	87	89
	Silt and Clay[2]	16	153	32	78	82
Nutrients	Total Phosphorus	17	0.33	0.07	73	82
	Total Nitrogen	17	1.14	0.57	43	50
Metals	Total Zinc	15	0.129	0.024	78	81
	Dissolved Zinc	7	0.016	0.01	28	32
	Total Copper	15	0.026	0.005	79	82
	Dissolved Copper	7	0.004	0.003	30	28
	Total Aluminum	16	5.85	1.08	83	83
	Total Lead	15	0.009	0.003	64	70

[1] Treatment Efficiency Calculation, Method #2 (TAPE, 2008)
[2] Suspended Solids less than 62.5 microns

Load Reduction

89% TSS

82% Total Phosphorus

50% Total Nitrogen

Data were analyzed using the TAPE bootstrap confidence interval calculator for TSS and Total Phosphorus. The lower 95% confidence interval for TSS removal efficiency was 85%. The lower 95% confidence interval for total phosphorus removal efficiency was 67%. The upper 95% confidence interval for total phosphorus effluent concentration was 0.084 mg/L.

Over the entire 37 month evaluation period, the total effluent volume recorded at the site was 376,244 gallons. A total of 14,060 gallons were bypassed through the system accounting for 4% of the total recorded volume. A total of 26 events contained bypass flow, with 23 of those events producing peak flows exceeding the design treatment capacity of the system. The three events with bypass flows occurring below the design treatment capacity triggered maintenance. During the evaluation period, the system lasted between 10 and 12 months between maintenance events and retained an average of 291 pounds of sediment per maintenance event.

References

Contech Engineered Solutions, LLC. (2015). The Stormwater Management StormFilter® PhosphoSorb® at a Specific Flow Rate of 1.67 gpm/ft^2 General Use Level Designation Technical Evaluation Report. Portland, OR. Author.

Washington State Department of Ecology (Ecology). (2011). Guidance for Evaluating Emerging Stormwater Treatment Technologies: Technology Assessment Protocol – Ecology (TAPE). Olympia, Washington. (Referred to as TAPE, 2011)

Washington State Department of Ecology (Ecology). (2008). Guidance for Evaluating Emerging Stormwater Treatment Technologies: Technology Assessment Protocol – Ecology (TAPE). Olympia, Washington. (Referred to as TAPE, 2008)

Water Quality Volume and Water Quality Flow Calculations

Water Quality Volume Calculations

Project	Residences at Bel Mont	**Project #**	13555.04
Calculated by	JRB	**Date**	4/14/2021
Checked by		**Date**	

BASIN #1P

Runoff from subcatchment PR-5

Water Quality Storm Runoff Depth	(in)	0.5
Total Impervious Area	(ft^2)	68,345

BASIN WQV:

	Runoff Depth to be Treated (in)	Volume (ft^3)
Required Stormwater Standards WQV:	0.5	**2,848**
Phosphorous Treatment Volume:	1.2	**6,835**

Provided Volume:

Elevation	Area (ft^2)	Cumulative Volume (ft^3)
191.5	4,095	0
194.0	4,095	7,425
		7,425

Water Quality Volume Calculations

Project	Residences at Bel Mont	**Project #**	13555.04
Calculated by	JRB	**Date**	4/14/2021
Checked by		**Date**	

BASIN #4P

Runoff from subcatchment PR-7 and PR-9

Water Quality Storm Runoff Depth	(in)	0.5
Total Impervious Area	(ft^2)	42,732

BASIN WQV:

	Runoff Depth to be Treated (in)	Volume (ft^3)
Required Stormwater Standards WQV:	0.5	**1,781**
Phosphorous Treatment Volume:	1.8	**6,410**

Provided Volume:

Elevation	Area (ft^2)	Cumulative Volume (ft^3)
169.0	3,100	0
172.75	3,100	6,768
		6,768

Water Quality Volume Calculations

Project	Residences at Bel Mont	**Project #**	13555.04
Calculated by	JRB	**Date**	4/14/2021
Checked by		**Date**	

BASIN #2P

Runoff from subcatchment PR-12

Water Quality Storm Runoff Depth	(in)	0.5
Total Impervious Area	(ft^2)	7,013

BASIN WQV:

	Runoff Depth to be Treated (in)	Volume (ft^3)
Required Stormwater Standards WQV:	0.5	**292**
Phosphorous Treatment Volume:	1.4	**818**

Provided Volume:	Elevation	Area (ft^2)	Cumulative Volume (ft^3)
Bottom of Stone	178.0	865	
Weir Elevation	180.0	865	865
		Vol provided below weir:	**865**

Water Quality Volume Calculations

Project	Residences at Bel Mont	**Project #**	13555.04
Calculated by	JRB	**Date**	4/14/2021
Checked by		**Date**	

BASIN #7P

Runoff from subcatchment PR-13

Water Quality Storm Runoff Depth	(in)	0.5
Total Impervious Area	(ft^2)	10,542

BASIN WQV:

	Runoff Depth to be Treated (in)	Volume (ft^3)
Required Stormwater Standards WQV:	0.5	**439**
Phosphorous Treatment Volume:	1.2	**1,054**

Provided Volume:	Elevation	Area (ft^2)	Cumulative Volume (ft^3)
Bottom of Stone	165.0	929	
Weir Elevation	167.5	929	1,128
		Vol provided below weir:	**1,128**

Water Quality Volume Calculations

Project	Residences at Bel Mont	**Project #**	13555.04
Calculated by	JRB	**Date**	4/14/2021
Checked by		**Date**	

BASIN #8P

Runoff from subcatchment PR-14

Water Quality Storm Runoff Depth	(in)	0.5
Total Impervious Area	(ft^2)	10,542

BASIN WQV:

	Runoff Depth to be Treated (in)	Volume (ft^3)
Required Stormwater Standards WQV:	0.5	**439**
Phosphorous Treatment Volume:	1.4	**1,230**

Provided Volume:	Elevation	Area (ft^2)	Cumulative Volume (ft^3)
Bottom of Stone	169.0	1,035	
Weir Elevation	171.5	1,035	1,247
		Vol provided below weir:	**1,247**

Water Quality Volume Calculations

Project	Residences at Bel Mont	**Project #**	13555.04
Calculated by	JRB	**Date**	4/14/2021
Checked by		**Date**	

BASIN #9P

Runoff from subcatchment PR-15

Water Quality Storm Runoff Depth	(in)	0.5
Total Impervious Area	(ft^2)	4,008

BASIN WQV:

	Runoff Depth to be Treated (in)	Volume (ft^3)
Required Stormwater Standards WQV:	0.5	**167**
Phosphorous Treatment Volume:	2.0	**668**

Provided Volume:	Elevation	Area (ft^2)	Cumulative Volume (ft^3)
Bottom of Stone	166.0	910	
Weir Elevation	168.5	910	1,107
		Vol provided below weir:	**1,107**

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

Water Quality Flow Conversion

Name: Residences at Bel Mont
Belmont, MA

Proj. No.: **13555.04**
Date: **4/12/2021**
Computed by: **JRB**
Checked by:

MaDEP Standard Method to Convert Required Water Quality Volume to a Discharge Rate

Water Quality Unit	Impervious Area (sf)	Impervious Area (mi^2)	WQV (inches)	Tc (min)	Tc (hrs)	qu (csm/in)	Q (cfs)
Stormfilter #1	**62,204**	0.0022	**0.5**	**6.0**	0.100	**752**	0.84
Stormfilter #2	**83,983**	0.0030	**0.5**	**6.0**	0.100	**752**	1.13

Water Quality Flow (WQF) = Q = (qu) (A) (WQV)

Where: qu = the unit peak discharge (in csm/in)
A = impervious surface drainage area (in square miles)
WQV = water quality volume (in inches)

Provided: Stormfilter 1: 21 cartridges required
Stormfilter 2: 28 cartridges required

Notes:
1. Refer to MaDEP Standard Method to Convert Required Water Quality Volume to a Discharge Rate for Sizing Flow Based Manufactured Proprietary

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:	**Residences at Bel Mont**	Sheet:	**1 of 3**
Project Number:	**13555.04**	Date:	**14-Apr-2021**
Location:	**Belmont MA**	Computed by:	**JRB**
Discharge Point:	**DP-1, DP-3**	Checked by:	
Drainage Area(s):	**PR-1, PR-6, PR-7**		

A	B	C	D	E
BMP*	TSS Removal Rate*	Starting TSS Load**	Amount Removed (C*D)	Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	**25%**	**1.00**	**0.25**	**0.75**
Water Quality Unit	**90%**	**0.75**	**0.68**	**0.08**
	0%	**0.08**	**0.00**	**0.08**
	0%	**0.08**	**0.00**	**0.08**
	0%	**0.08**	**0.00**	**0.08**

* BMP and TSS Removal Rate Values from the MassDEP Stormwater Handbook Vol. 1. Removal rates for proprietary devices will be sized by the manufacturer to achieve a minimum of 90% TSS removal

** Equals remaining load from previous BMP (E)

Treatment Train TSS Removal = **93%**

TSS Removal Calculation Worksheet

VHB, Inc..
101 Walnut Street
Post Office Box 9151
Watertown, MA 02471
(617) 924-1770

Project Name:	**Residences at Bel Mont**	Sheet:	**2 of 3**
Project Number:	**13555.04**	Date:	**14-Apr-2021**
Location:	**Belmont MA**	Computed by:	**JRB**
Discharge Point:	**DP-1, DP-3**	Checked by:	
Drainage Area(s):	**PR-3, PR-4, PR-10**		

A	B	C	D	E
BMP*	TSS Removal Rate*	Starting TSS Load**	Amount Removed (C*D)	Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	**25%**	**1.00**	**0.25**	**0.75**
StormFilter	**89%**	**0.75**	**0.67**	**0.08**
	0%	**0.08**	**0.00**	**0.08**
	0%	**0.08**	**0.00**	**0.08**
	0%	**0.08**	**0.00**	**0.08**

* BMP and TSS Removal Rate Values from the MassDEP Stormwater Handbook Vol. 1. Removal rates for proprietary devices are from manufacturer data.
** Equals remaining load from previous BMP (E)

Treatment Train TSS Removal = **92%**

TSS Removal Calculation Worksheet

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

Project Name:	**Residences at Bel Mont**	Sheet:	**3 of 3**
Project Number:	**13555.04**	Date:	**14-Apr-2021**
Location:	**Belmont MA**	Computed by:	**JRB**
Discharge Point:	**DP-3**	Checked by:	
Drainage Area(s):	**PR-5, PR-7**		

1. Pre-Treatment prior to Infiltration

BMP*	TSS Removal Rate*	Starting TSS Load**	Amount Removed (C*D)	Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	**25%**	**100%**	**25%**	**75%**
Water Quality Unit	**80%**	**75%**	**60%**	**15%**
	0%	**15%**	**0%**	**15%**
		Pre-Treatment TSS Removal =		**85%**

2. Total TSS Removal including Pretreatment 1.

BMP*	TSS Removal Rate*	Starting TSS Load**	Amount Removed (C*D)	Remaining Load (D-E)
Pretreatment	**85%**	**100%**	**85%**	**15%**
Infiltration Trench	**80%**	**15%**	**12%**	**3%**
	0%	**3%**	**0%**	**3%**
	0%	**3%**	**0%**	**3%**

* BMP and TSS Removal Rate Values from the MassDEP Stormwater Handbook Vol. 1.Removal rates for proprietary devices will be sized by the manufacturer to achieve a minimum of 90% TSS removal

** Equals remaining load from previous BMP (E)

Treatment Train TSS Removal = **97%**

Appendix E: Standard 8 Supporting Information

- List of recommended Construction Period BMPs
- Recommended construction period maintenance checklist

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.

- The underside of hay bales should be kept in close contact with the earth and reset as necessary.

- 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.

Residences at Bel Mont, Belmont 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 _____

Appendix F: Local Compliance

- Phosphorous Removal Calculations
- Town of Belmont Stormwater Checklist

Phosphorous Removal Calculations

Computations

Project:	Mclean Zone 3	Project #	13555.04
Location:	Belmont, MA	Sheet	1 of 1
Calculated by:	JRB	Date:	4/15/2021
Checked by:		Date:	
Title	Phosphorous Removal		

Phosphorous Removal Rates		
BMP	**Removal Rate**	**Notes**
Infiltration Trench	80%	1.02 in/hr, 0.5 inches of runoff treated*
Infiltration Trench	86%	1.02 in/hr, 0.6 inches of runoff treated*
Infiltration Trench	96%	1.02 in/hr, 1.0 inches of runoff treated*
Infiltration Trench	97%	1.02 in/hr, 1.2 inches of runoff treated*
Infiltration Trench	98%	1.02 in/hr, 1.4 inches of runoff treated*
Infiltration Trench	99%	1.02 in/hr, 1.8 inches of runoff treated*
Infiltration Trench	100%	1.02 in/hr, 2.0 inches of runoff treated*
Contech Stormfilter	82%	Per Contech Field Performance Study

*Removal Rate from Appendix F, Attachment 3 of Massachusetts MS4

Phosphorous Load Reduction Target: 60%

Phosphorous Loading		
Land Use	**Cover Type**	**PLER (lb/ac/yr)**
Multi-Family and High Density Residential	Impervious	2.32
	Pervious (HSG B)	0.12

Proposed Conditions Phosphorous Loading							
Subcatchment	**Impervious (ac)**	**Pervious (ac)**	**P to BMP (lb/year)**	**BMP**	**Removal Rate**	**Phosphorous after treatment(lb/year)**	
PR-1*	0.4	1.1	1.0	-	0%	1.0	lb/year
PR-2	0.1	0.5	0.2	-	0%	0.2	lb/year
PR-3*	1.9	1.4	4.6	5P	82%	0.8	lb/year
PR-4*	1.2	0.9	2.9	6P	82%	0.5	lb/year
PR-5	1.6	0.2	3.7	1P	97%	0.1	lb/year
PR-6	0.2	0.1	0.5	-	0%	0.5	lb/year
PR-7	0.7	0.3	1.7	4P	99%	0.0	lb/year
PR-8	0.0	1.0	0.1	-	0%	0.1	lb/year
PR-9	0.3	0.0	0.6	4P	99%	0.0	lb/year
PR-10*	0.2	0.1	0.5	6P	82%	0.1	lb/year
PR-11	0.0	0.5	0.1	-	0%	0.1	lb/year
PR-12	0.2	0.0	0.4	2P	98%	0.0	lb/year
PR-13*	0.2	0.0	0.6	7P	97%	0.0	lb/year
PR-14*	0.2	0.0	0.6	8P	98%	0.0	lb/year
PR-15*	0.1	0.0	0.2	9P	100%	0.0	lb/year
* - denotes subcatchment drainining to Charles River via Beaver Brook					**Total**	**3.5**	**lb/year**
Total (ac)	7.3	5.9					

Summary Table - Project Site		
Existing Phosphorous Loading Rate	17.6	lb/year
Proposed Phosphorous Loading Rate	3.5	lb/year
Percent Reduction	**80.2%**	

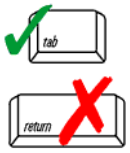
Summary Table - Draining to Charles River		
Existing Phosphorous Loading Rate	10.4	lb/year
Proposed Phosphorous Loading Rate	2.4	lb/year
Percent Reduction	**76.5%**	

Town of Belmont Stormwater Checklist

TOWN OF BELMONT
Checklist for Stormwater Management and Erosion Control 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 Management and Erosion Control Report must be submitted with the building permit application for a project that is covered by the Town of Belmont Stormwater Management and Erosion Control Bylaw. The following checklist is NOT a substitute for the Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management and Erosion Control documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the 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 Report must include:

- The Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Report contains all required submittals.[1] This Checklist is to be used as the cover for the completed 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 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 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. The Report shall also document compliance with the Stormwater Management and Erosion Control Bylaw recognizing the bylaw contains provisions that could be more strict or broader in scope than the Stormwater Management Standards.

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

[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 a permit 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.

TOWN OF BELMONT
Checklist for Stormwater Management and Erosion Control Report

B. Report 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 Report. The checklist is also intended to provide the reviewing authority with a summary of the components necessary for a comprehensive Report that addresses the ten Stormwater Standards.

Note: Because stormwater requirements vary from project to project, it is possible that a complete 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 Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Management and Erosion Control Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan, 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

4/29/2021

Signature and Date

TOWN OF BELMONT
Checklist for Stormwater Management and Erosion Control Report

60-325 - Stormwater Management and Erosion Control Bylaw (excerpt)

F Stormwater Management and Erosion Control

F (1) Regulated Activities

A Stormwater Management and Erosion Control Permit shall be required prior to undertaking any land disturbance that involves:

(a) An alteration that will result in land disturbances of 2,500 square feet of total area or more, or that is part of a common plan for development that will disturb 2,500 square feet or more;
(b) An alteration that will increase the amount of a lot's impervious surface area to more than 25% of the lot's total area; or
(c) Storage or permanent placement of more than 100 cubic yards of excavated material, fill, snow or ice.

F (3) General Requirements

(a) An Operation and Maintenance Plan shall be submitted to the OCD for approval prior to the issuance of a Stormwater Management and Erosion Control Permit. The Operation and Maintenance Plan shall be designed to ensure compliance with the Stormwater Management and Erosion Control Permit, this Bylaw, and the Massachusetts Surface Water Quality Standards, 314 CMR 4.00, in all seasons and throughout the life of the system.

(b) As-built drawings showing all stormwater management systems shall be submitted to the OCD at the completion of a project.

(c) The OCD may require the applicant to contribute to the cost of design, construction, and maintenance of a public or shared stormwater facility in lieu of an onsite stormwater facility where the OCD determines that there are not sufficient site conditions for onsite Best Management Practices that will satisfy the design criteria set forth in Section 34.6.4.1 of this Bylaw and the performance standards set forth in the regulations promulgated under this Bylaw. Funds so contributed may be used to design, construct, and maintain stormwater projects that will improve the quality and quantity of surface waters in Belmont by treating and recharging stormwater from existing impervious surfaces that is now discharged to said waters with inadequate treatment or recharge. The amount of any required contribution to the fund shall be determined by the OCD pursuant to standards established in the Regulations adopted pursuant to this Bylaw.

F (4) Design Criteria (The Report shall consider all of the design criteria below)

All Development shall satisfy the following design criteria:

(a) Compliance with all applicable provisions of the Stormwater Management Standards, regardless of the proximity of the development to resource areas or their buffer zones, as defined by the *Wetlands Protection Act, M.G.L*. c. 131, § 40 and its implementing regulations.
(b) Erosion and sediment controls must be implemented to prevent adverse impacts during disturbance and construction activities.
(c) There shall be no change to the existing conditions of abutting properties from any increase in volume of stormwater runoff or from erosion, silting, flooding, sedimentation or impacts to wetlands, ground water levels or wells.
(d) When any proposed discharge may have an impact upon streams, wetlands and/or storm sewers, the OCD may require minimization or elimination of this impact based on site conditions and existing stormwater system capacity.

TOWN OF BELMONT
Checklist for Stormwater Management and Erosion Control Report

Checklist

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

- [X] New development
- [ ] Redevelopment
- [ ] Mix of New Development and Redevelopment

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:

- [X] No disturbance to any Wetland Resource Areas
- [X] Site Design Practices
- [ ] Reduced Impervious Area (Redevelopment Only)
- [X] 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

- [X] No new untreated discharges
- [X] 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.

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.

☒ Any potential change to the existing conditions of abutting properties from any increase in volume of stormwater runoff have been identified in the Report

☐ The Report provides calculations demonstrating that the post-development discharge volume is equal to or less than the pre-development discharge volume from the 2-year and the 10-year 24-hour storms.

☐ The Report provides a quantitative impact of discharge volumes from the 100-year 24-hour storm. If this evaluation shows that increased off-site flooding result from the discharge volumes from the 100-year 24-hour storms, BMPs also are described in the Report that the applicant will implement and maintained to attenuate these discharges.

☒ Any potential change to the existing conditions of abutting properties from erosion, silting, flooding, or sedimentation have been identified in the Report.

☒ The Report describes the practices and controls that the Applicant will implement and maintain to prevent adverse impacts from erosion, silting, flooding, or sedimentation.

☐ Any potential impacts to wetlands have been identified in the Report. None anticipated

☐ The Report describes the practices and controls that the Applicant will implement and maintain to prevent adverse impacts to wetlands.

Additional Requirements for Projects other than One and Two Family Developments:

☐ Any potential impacts to ground water levels or wells have been identified in the Report, including quantitative projections of changes in the seasonal high water table and quantitative projections of storm-related short-term mounding calculations associated with infiltration BMPs for a 24-hour 10 year design storm. None anticipated

☐ The Report describes the practices and controls that the Applicant will implement and maintain (if required) to prevent adverse impacts to ground water levels or wells for a 24-hour 10 year design storm.

Requirements Specific to Section F (4)(d)

☐ Is stormwater from the pre-development site discharged directly to (check all that apply):

- ☐ A surface water body (specify the water body)
- ☒ The Belmont MS4 (storm sewers)
- ☐ Another MS4 (specify the MS4)
- ☐ Other (specify)

☐ Will stormwater from the post-development site be discharges directly to (check all that apply):

- ☐ A surface water body (specify the water body)
- ☒ The Belmont MS4 (storm sewers)
- ☐ Another MS4 (specify the MS4)
- ☐ Other (specify)

☐ Any potential impacts upon streams, wetlands and/or storm sewers have been identified in the Report. (Explain in Report narrative) None anticipated

- ☐ These will be prevented with mitigating measures that the Applicant will implement and maintain (explain in Report narrative)
- ☐ These will be prevented without mitigating measures (explain in Report narrative)

☐ The Report describes the practices and controls that the Applicant will implement and maintain to prevent any adverse impacts to streams, wetlands and/or storm sewers. None anticipated

Additional Requirements for Projects other than One and Two Family Developments:

☒ If the discharge is to an MS4, a certification that the discharge meets Massachusetts Surface Water Quality Standards and any applicable approved Total Maximum Daily Load (TMDL) waste load allocation is included in the Report.

Standard 3: Recharge

☐ Soil Analysis provided. Historic geotech and NRCS provided. Applicant is proposing additional test pits within BMP areas prior to construction

☒ 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.

☐ 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

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~~ 0.5" 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.

☒ 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.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs) Not Applicable

☐ 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.

Standard 6: Critical Areas Not Applicable

☐ 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.

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable Project meets all stormwater standards

☐ 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.

☒ Adverse impacts due to erosion, sedimentation, or both during disturbance and construction activities are prevented:

☒ With erosion and sediment controls that the Applicant will implemented and maintain (explain in Report narrative) in narrative and on plans

☐ Without erosion and sediment controls (explain in Report narrative)

TOWN OF BELMONT
Checklist for Stormwater Management and Erosion Control Report

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

☐ 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;
- ☐ Party responsible for operation and maintenance; TBD
- ☒ Schedule for implementation of routine and non-routine maintenance tasks;
- ☒ Plan showing the location of all stormwater BMPs maintenance access areas; on design plans
- ☐ Description and delineation of public safety features; N/A
- ☐ Estimated operation and maintenance budget; and TBD
- ☒ 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.