Stormwater Management Report

The Lanterns at Warren Woods

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Ashland, Massachusetts

PREPARED FOR

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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.

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature

Signature and Date

Checklist

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

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist (continued)

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

☒ No disturbance to any Wetland Resource Areas

☒ Site Design Practices (e.g. clustered development, reduced frontage setbacks)

☐ Reduced Impervious Area (Redevelopment Only)

☐ Minimizing disturbance to existing trees and shrubs

☐ LID Site Design Credit Requested:

- ☐ Credit 1
- ☐ Credit 2
- ☐ Credit 3

☐ Use of "country drainage" versus curb and gutter conveyance and pipe

☐ Bioretention Cells (includes Rain Gardens)

☒ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)

☐ Treebox Filter

☐ Water Quality Swale

☐ Grass Channel

☐ Green Roof

☐ Other (describe): ____________________

Standard 1: No New Untreated Discharges

☒ No new untreated discharges

☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth

☒ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.
☐ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

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

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

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

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

☐ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

☒ Site is comprised solely of C and D soils and/or bedrock at the land surface

☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000

☐ Solid Waste Landfill pursuant to 310 CMR 19.000

☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

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

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

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

Checklist (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 (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)

☐ 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

☐ 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 (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

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

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

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

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

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

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

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

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

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

- ☒ Name of the stormwater management system owners;
- ☐ Party responsible for operation and maintenance;
- ☒ Schedule for implementation of routine and non-routine maintenance tasks;
- ☒ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☒ Description and delineation of public safety features;
- ☐ Estimated operation and maintenance budget; and
- ☒ Operation and Maintenance Log Form.

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

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

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

☐ An Illicit Discharge Compliance Statement is attached;

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

1

Project Summary

The 39 – acre Site is located at 466 Chestnut Street in Ashland, Massachusetts (see Figure 1). The Site is bounded by residential properties to the north, Eliot Street and a few residential properties and open space to the south, the Prospect Heights and Bartlett Street neighborhoods to the east, and Chestnut Street to the west. The Site is currently zoned Residential A (RA) and Office Commercial (CO). All abutting properties are also currently zoned RA. The Site is located within the SuAsCo surface watershed. Wetland resources on the Site include three bordering vegetated wetlands (labeled on the plans Wetland #1, Wetland #2 and Wetland #3). None of the three wetlands are in designated critical, Zone 1 or Zone II or Zone A, or Outstanding Water Resource areas.

The Site is presently unoccupied although it was once partially developed with a series of office buildings that were used for a pre-school, the Ashland Town Hall, and other town uses; and associated paved driveways, parking lot and sidewalks. The buildings have been demolished but the paved surfaces remain. Untreated stormwater runoff from the pavements drain partially to Wetland #3 and offsite towards Chestnut Street. Runoff flow from a portion of the parking lot and razed buildings is discharged from an 18" pipe into Wetland #1, also untreated. In addition to these previously developed areas in the northwest portion of the site, stormwater runoff flows overland from woods and an open field with a farmhouse offsite to Chestnut Street, Eliot Street, Prospect Heights, and to the three bordering vegetated wetlands on the Site.

Proposed development of the site includes the construction of 93 homes for a Senior Residential Community (SRC) including 46 guest parking spaces at various locations along the roads, and a modest amenity area with a building for indoor recreational use. The development will also include utility infrastructure of sanitary sewer, water, gas, electric, and telephone connections to Ashland's existing utilities on Chestnut Street and Eliot Street. Three main roadways (A, B and C) are proposed to provide vehicular access to 14 neighborhood clusters on which a majority of the 93 proposed homes will be built. Sidewalks will be provided on one side of these roads.

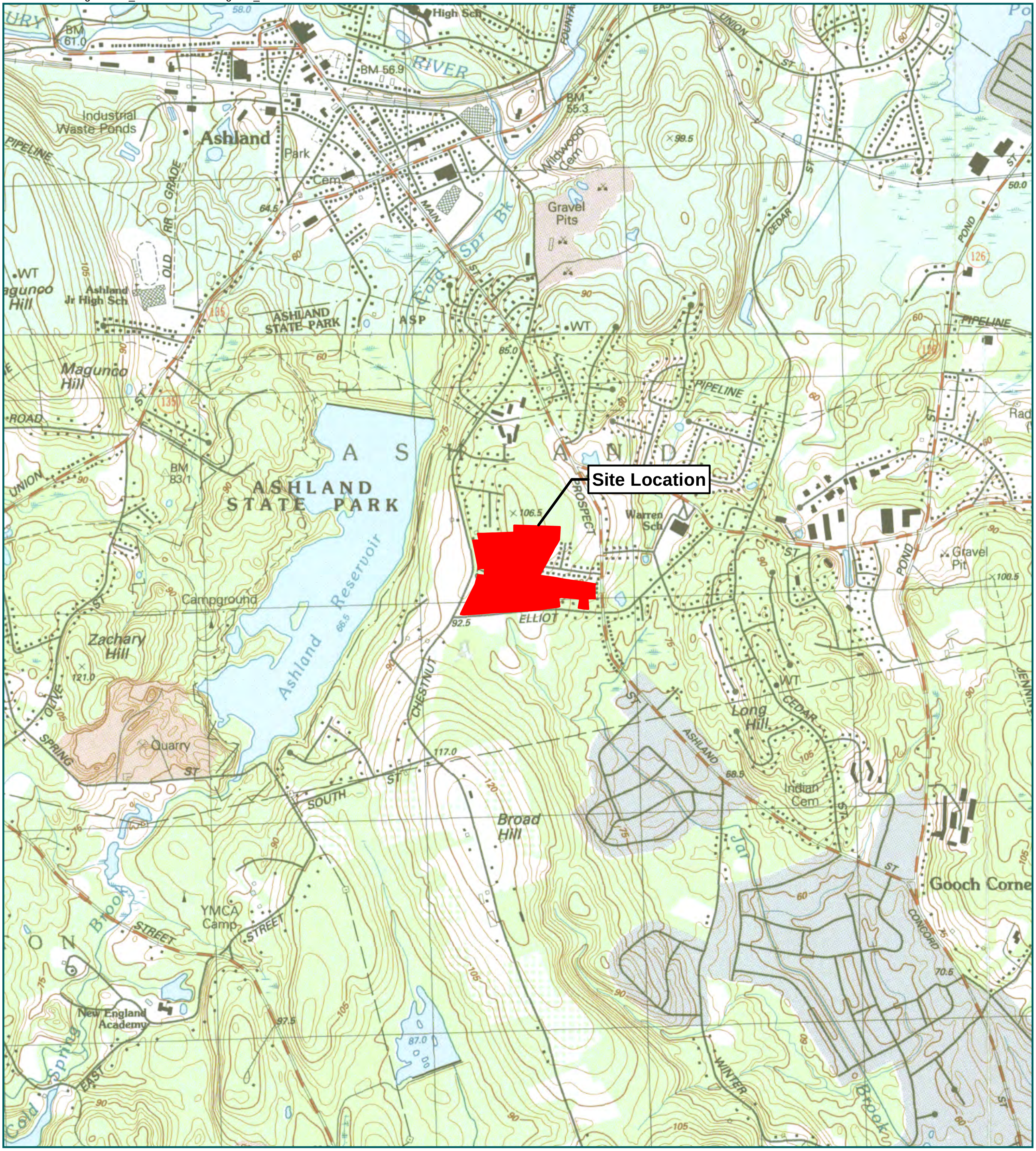
Under proposed conditions, stormwater runoff will be collected in a variety of Best Management Practices (BMPs) including infiltration trenches, deep sump catch basins, detention basins, and gravel wetlands for water quality and quantity control measures to protect the surrounding natural resources from potential stormwater runoff impacts. The proposed stormwater management system is designed to mitigate the increase in impervious area on site. Low impact development stormwater management techniques have been incorporated into the site and are described herein.

A HydroCAD model, using TR-20 methodology, was developed to evaluate the existing and proposed drainage conditions within the Site; and the results of the analyses indicate that the development will not increase peak discharge rates for the 2-year, 10-year, 25-year, and 100-year 24 hour rain events. The existing and proposed conditions peak discharge values are presented in Table 3 at the end of this report.

The Stormwater Management Plan (the Plan), including BMPs for maintaining stormwater runoff quality, was prepared in accordance with the applicable local, state, and federal regulations. Details of the Plan are provided herein, including calculations and modeling reports.

Figure 1: Site Locus Map

Path: \\nhbedata\gislib\MA_Various\Ashland\Figure1_USGS.mxd



Site Location

0 2,000 4,000 Feet

Source: USGS Quadrangles

Figure 1 – USGS Locus Map
The Lanterns at Warren Woods
466 Chestnut Street
Ashland, Massachusetts

2

Existing Conditions

Overview

The approximately 39 –acre Site is partially developed with the remains from three razed buildings including an unused paved parking lot, a former playground area, and a former sporting field; however, the majority of the Site is woodlands or wetlands with generally thick underbrush with the exception of a seven acre open grassed field and farmhouse in the southwestern portion of the site. The grassed field was used from time to time for sports and the farmhouse is presently used as the 4-H house.

Key natural resources in and around the property include three bordering vegetated wetlands, denoted as Wetland #1, #2 and #3 on the Plans and Figures. Wetland #1 hosts two vernal pools. The Town of Ashland enforces a 25′ no disturbance buffer around designated wetlands and a 100′ no disturbance buffer around vernal pools. The Site is not located in any outstanding water resource area or critical area. See Figure 2: Existing Drainage Figure for existing conditions information and the delineation of the existing sub-watersheds on the Site.

The project is not located within the 100-year flood plain as shown on the FEMA Map figure that includes a portion of the FEMA FIRM Panel 25027C0900E, dated July 4, 2011. This figure is included in Appendix A.

Overall, the site generally slopes from north to south as the northern portion rises as much as 60 feet higher than the southeast portion of the site at Wetland #2. There is a fairly prominent ridgeline that starts at a high point of elevation 348 and extends southerly to Wetland #1. This ridgeline causes stormwater runoff to flow toward Wetlands #1 and #3. The southwest corner of the site is comparably flatter than other areas on the property.

There are three main surface cover types: open grass fields, woodlands with thick underbrush, and unconnected impervious surfacing of pavement and buildings. The wetlands cover approximately 2.6 acres, the woods cover approximately 25.9 acres, grasses cover approximately 9.2 acres, and the impervious land covers approximately 1.3 acres. Wetlands #1 and #2 are wooded, while Wetland #3 is in the open field with trees and shrubs only along the Eliot Street border. The impervious cover includes the abandoned parking lots, the existing house and sheds, and concrete walkways that lead to the demolished buildings from the parking lots.

According to the Natural Resources Conservation Service (NRCS), surface soils on the Site include Raynham silt loam, Ridgebury fine sandy loam, Rainbow silt loam, and Broadbrook very fine sandy loam. On-site soils are generally classified as Hydrologic Soil Groups (HSG) C/D and D. Detailed soils information, NRCS soils map and results of on-site subsurface investigations are included in Appendix A. This is consistent with the findings from the on-site geotechnical study, performed by Northeast Geotechnical, Inc., whose findings are included in Appendix A.

Hydrologic Information

For the existing conditions hydrologic analysis, the site was divided into fourteen drainage areas, described below, that contribute to seven design points where peak discharge rates were evaluated (see Figure 2).

Drainage Area EX-1A – 1B This 16.1 acre area largely consists of woodlands with thick underbrush, a large 1.6 acre bordering vegetated wetland (Wetland #1), grass fields, and previously developed land that contains an abandoned parking lot and trails. The runoff flows north to south to Wetland #1. This existing subwatershed area drains to Design Point 1 (DP-1).

Drainage Area EX-2A – 2C This 6.2 acre area largely consists of woodlands with thick underbrush, a 0.6 acre bordering vegetated wetland (Wetland #2), a few buildings and driveways, and grassed fields. This drainage area collects overland runoff from lands offsite, including portions of the neighboring development Prospect Heights. The runoff flows southeast to Wetland #2. This existing subwatershed area drains to Design Point 2 (DP-2).

Drainage Area EX-3A – 3B This 6.1 acre area largely consists of woodlands with thick underbrush, a 0.2 acre bordering vegetated wetland (Wetland #3), a few buildings and driveways, grassed fields, and previously developed land that contains an abandoned parking lot and trails. This drainage area collects overland runoff from lands offsite, including portions of the neighboring abutters along Chestnut Street. The runoff flows south to Wetland #3. This This existing subwatershed area drains to Design Point 3 (DP-3).

Drainage Area EX-4 This 6.1 acre area largely consists of woodlands with thick underbrush. The runoff from this area flows offsite to the existing drainage infrastructure on Eliot Street. This existing subwatershed area drains to Design Point 4 (DP-4).

Drainage Area EX-5 This 6.1 acre area largely consists of woodlands with thick underbrush, a shed, some paved surfaces, and a dirt trail. The runoff from this area flows offsite onto abutting properties southeast of the site. This existing subwatershed area drains to Design Point 5 (DP-5).

Drainage Area EX-6 This 5.2 acre area largely consists of woodlands with thick underbrush. The runoff from this area flows east offsite to the neighboring Prospect Heights development. This existing subwatershed area drains to Design Point 6 (DP-6).

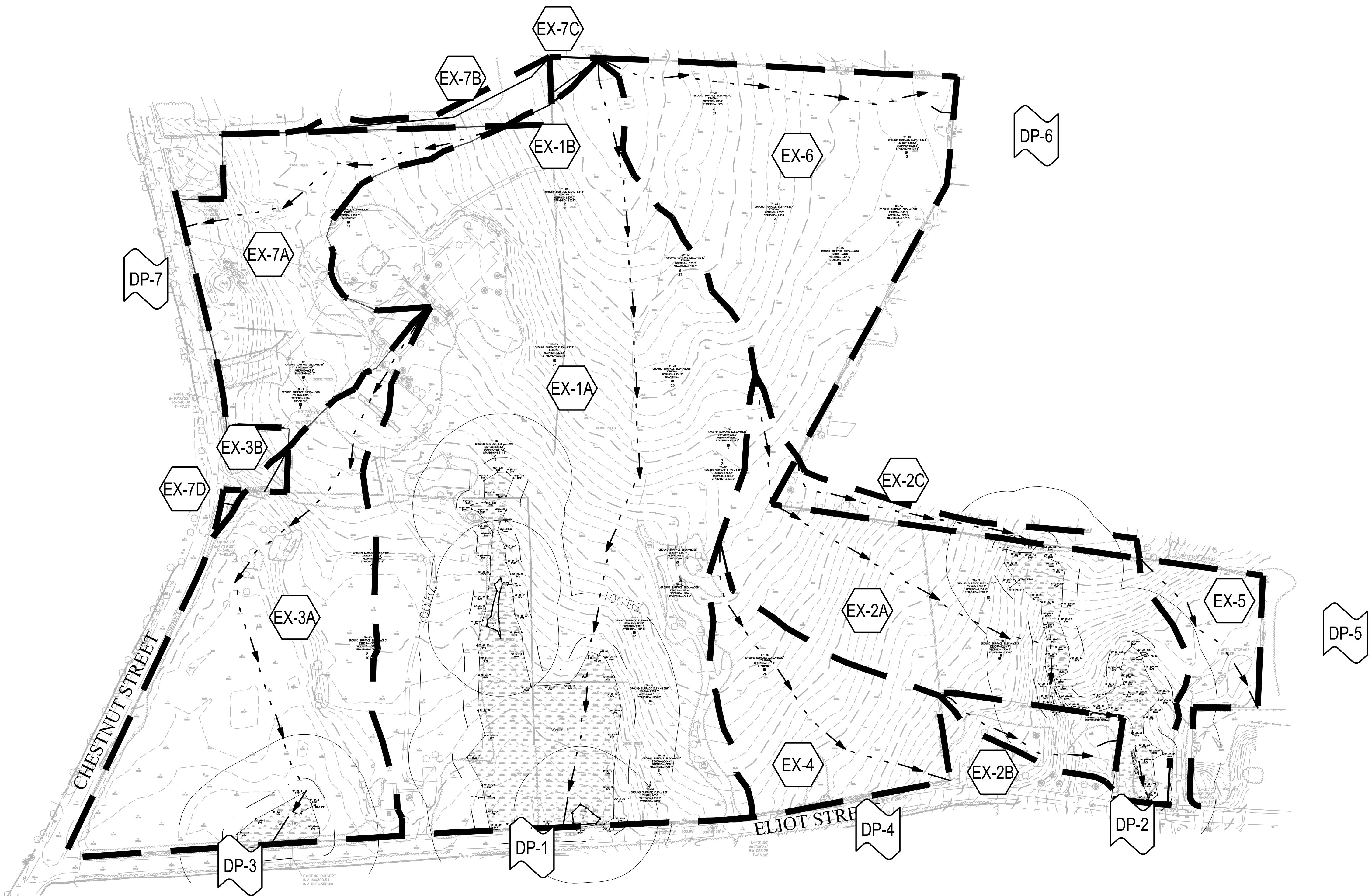
Drainage Area EX-7A – 7D This 16.1 acre area largely consists of woodlands with thick underbrush, grass fields and previously developed land that contains an abandoned parking lot and trails. The runoff flows westward offsite to Chestnut Street. This existing subwatershed area drains to Design Point 7 (DP-7).

Table 1 summarizes the key hydrologic parameters for each drainage area used in the existing conditions analysis.

Table 1
Existing Conditions Hydrologic Data

Description (Drainage Area #)	Discharge Location	Design Point	Area (acres)	Curve Number	Time of Concentration (min)
EX-1A	Wetland #1	DP-1	16.1	79	46.6
EX-1B	Wetland #1	DP-1	0.03	77	15.4
EX-2A	Wetland #2	DP-2	5.0	77	37.1
EX-2B	Wetland #2	DP-2	0.6	80	20.1
EX-2C	Wetland #2	DP-2	0.5	80	7.7
EX-3A	Wetland #3	DP-3	6.0	80	28.3
EX-3B	Wetland #3	DP-3	0.06	79	10.5
EX-4	Eliot Street	DP-4	2.3	77	32.5
EX-5	Offsite (Southeast)	DP-5	1.0	78	16.1
EX-6	Offsite (Northeast)	DP-6	5.2	77	31.1
EX-7A	Chestnut Street	DP-7	3.2	79	23.8
EX-7B	Chestnut Street	DP-7	0.4	78	19.8
EX-7C	Chestnut Street	DP-7	0.1	77	18.3
EX-7D	Chestnut Street	DP-7	0.04	77	15.4

Figure 2: Existing Drainage Areas



LEGEND

1 (hexagon)	SUBCATCHMENT DRAINAGE AREA DESIGNATION
1 (triangle)	WETLAND/POND
1 (design point symbol)	DESIGN POINT
	DRAINAGE AREA BOUNDARY
	TIME OF CONCENTRATION FLOW LINE
100'BZ	100' BUFFER ZONE
4-220 4-219	WETLAND BOUNDARY

0 100 200 Feet

Vanasse Hangen Brustlin, Inc.

Figure 2 July 2015

Existing Conditions Drainage Areas
The Lanterns at Warren Woods
466 Chestnut Street
Ashland, Massachusetts

3

Proposed Conditions

Overview

The Project, construction of 93 homes for a Senior Residential Community and supporting infrastructure, was designed to comply with the Massachusetts Stormwater Management Policy, the Town of Ashland Stormwater Management Regulations adopted on May 28, 2008, and the current Town of Ashland Subdivision of Land Regulations. Existing drainage and grading patterns were maintained to the maximum extent possible. Low impact development stormwater management techniques have been incorporated into the design. These practices are focused on reducing peak runoff rates and treating for water quality, particularly total phosphorous and total nitrogen removal. The project will disturb little more than half of the property including removal of the existing pavements and utility infrastructure remaining from prior development, while preserving the remaining as open space. Two large open space areas of a combined 13.9 acres will be created adjacent to the Ashland owned Warren Woods. A 30' buffer along the perimeter of the site denotes the existing landscape that is protected and cannot be developed per the zoning by-laws. New informal hedgerows will be planted with native shrubs, trees and field grasses next to the maintained existing fieldstone farm walls to maintain the existing New England farm aesthetic.

The proposed development has been designed to collect nearly all surface water runoff generated within the development footprint into four stormwater management basins. Three of the basins are designed for detention up to the 100 year storm and additionally contain gravel wetlands and sediment forebays for water quality treatment purposes. The forth basin is designed for storage only, and will collect runoff from several nearby roofs. Although not shown on the site plans, runoff from the roofs will be collected in roof drain collection systems connected to the closed pipe drainage system in the new streets. The roof drain system will be constructed of perforated drain pipe surrounded by crushed stone, which will function as an infiltration trench for groundwater recharge, as well as for conveyance. Roadway runoff will be collected traditionally in a multiple series of catch basins with 4 foot deep sumps and oil/debris traps.

The collection system has been designed to support the plan for a phased construction build-out of the homes and infrastructure.

Pursuant to Chapter 343 Section 7.6.10.3 of the Town of Ashland Stormwater Management Regulations, Table 2 provides a summary of the areas and percentages of various cover types found throughout the Site for both existing and proposed conditions.

Table 2
Existing and Proposed Ground Cover Areas

Total Lot Area = 39+/- Acres				
Cover Type	**Existing Conditions**		**Proposed Conditions**	
	Square Feet	**Percentage**	**Square Feet**	**Percentage**
Wetlands	112,091	6.5%	112,091	6.5%
Impervious Cover	55,260	3.2%	408,371	23.8%
Grass	401,921	24.6%	847,908	50.6%
Wooded	1,127,975	65.7%	328,877	19.1%
Total	1,697,247	100%	1,697,247	100%

Details of the stormwater management system features are as follows:

Water Quantity and Quality Control

Site Layout

The proposed development on the site has been configured to avoid wetland impacts, to maximize open space, to maintain the natural woods and land cover to the greatest extent possible. The Project and associated stormwater management system has been designed in response to the groundwater conditions, soil conditions and the natural topography. Home elevations and grading with neighborhood clusters have been established such that they generally follow the natural lay of the land; they minimize limits of disturbance at the perimeters; earthwork cuts and fills are balanced; and homes and streets are sufficiently above groundwater. Stormwater will be managed in several smaller basins rather than in one large centralized basin.

Source Control

A comprehensive source control program will be implemented at the site, which includes regular pavement sweeping and catch basin cleaning. Further discussion of the site maintenance is included in the Stormwater Management Regulations Section 5. Stormwater runoff from lawns and yards drain toward the streets and will be collected into the stormwater management system. Manicured lawn areas are very small around each home minimizing the overall use of fertilizers and pesticides. Details of the ongoing Stormwater Management Practices for the developed site are included in the Stormwater Management System Long Term Operation and Maintenance Plan, attached in Appendix C.

Snow Management

Snow will be managed under a maintenance contract between the Home Owner's Association and a local service provider. Snow will typically be piled alongside the roadways and at the ends of common driveways. Snow will not be placed in, or directly adjacent to wetland resource areas or in proposed stormwater basins. The snow stored next to the roadways and on the residential properties will melt and enter the stormwater management system where it will receive proper treatment.

Catch Basins with Sumps and Oil/debris Traps

Catch basins at the site will be constructed with sumps (minimum 4-feet) and oil/debris traps to prevent the discharge of sediments and floating contaminants. Catch basins will be cleaned twice per year.

Surface Detention Basins

Detention Basin 1 is a surface detention basin with a low flow outlet to a stone dissipation pad that allows overflow to undisturbed woods and a flat, broad swale that runs roughly parallel to a fieldstone wall on the property line common with the abutting properties on Bartlett Road and Prospect Heights.

Gravel Wetlands

Gravel Wetland 1-3 are constructed gravel wetlands with a sediment forebay and two treatment cells per gravel wetland. Each gravel wetland contains an Outlet Control Structure containing a weir with two orifices that has been designed to handle overflow from the 2-year, 10-year, 25-year, and the 100-year storm to the three on-site bordering vegetated wetlands. Each gravel wetlands also has overflow stone weirs designed to handle overflow stormwater from the 2-year, 10-year, 25-

year, and the 100-year storms. The gravel wetlands allow for proper total suspended solids, total phosphorous and total nitrogen removal.

Roof Drain Infiltration Trenches

Infiltration Trenches are a network of gently sloped perforated pipes surrounded by stone that will collect stormwater runoff from the rooftops. The perforated pipes will connect directly to the surface detention basin or to the closed drainage network. Although infiltration will be somewhat limiting due to the poor soils classification and groundwater conditions, these infiltration trenches do create real opportunity to infiltrate and recharge clean water prior to discharging into the stormwater basins.

Hydrologic Information

For the proposed conditions hydrologic analysis, the site was divided into seventeen drainage areas (see Figure 3). These areas discharge to the seven design points where peak discharge rates were evaluated for both existing and proposed conditions.

<u>Drainage Areas PR-11 - 14</u> – This 20.7 acre area is comprised of building rooftop, roadways and drives, landscaping, and woodlands. The runoff from PR-13 will first flow into catch basins with sumps and oil/debris traps before discharging to a gravel wetland (Gravel Wetland #1) with an overflow and outlet control structure to Wetland #1. The runoff from PR-11 and PR-14 will first flow into catch basins with sumps and oil/debris traps before discharging to a gravel wetland (Gravel Wetland #3) with an overflow and outlet control structure to Wetland #1. Drainage Area PR-12 consists of an open field with some woodlands and an existing building with drive. The runoff from PR-16 will overflow to Wetland #1 as it does under existing conditions.

<u>Drainage Area PR-21 - 24</u> – This 8.1 acre area will be comprised of building rooftop, roadways and drives, landscaping, and woodland. The runoff from PR-21 will first flow into catch basins with sumps and oil/debris traps before discharging to a gravel wetland (Gravel Wetland #2) with an overflow and outlet control structure to Wetland #2. Drainage Areas PR-22 – 24 will remain vegetated and will overflow to Wetland #2, as they currently do under existing conditions.

<u>Drainage Area PR-31 - 32</u> – This 5.2 acre area will remain vegetated and will overflow to Wetland #2.

<u>Drainage Area PR-41</u> – This 0.8 acre area will remain mostly vegetated, with the addition of a gravel drive and a 1,000 SF of paved roadway and will overflow offsite towards the existing drainage infrastructure on Eliot Street, as it currently does under existing conditions.

Drainage Area PR-51 – This 1.0 acre area will remain vegetated and will overflow offsite to the abutting properties.

Drainage Area PR-61 – 62 – This 2.3 acre area will be comprised of building rooftop and landscaping and existing woodlands. The runoff from PR-62 will be collected by roof drains and area drains before discharging to a surface detention basin (Detention Basin #1) with a culvert that overflow the collected runoff offsite towards the neighboring development called Prospect Heights. The runoff from PR-61 will remain vegetated and will overflow to the abutting properties in Prospect Heights.

Drainage Area PR-71 – 73 – This 2.5 acre area will be comprised of the entrance drive, landscaping and existing woodlands. The runoff will flow overland towards Chestnut Street, as it currently does under existing conditions.

Table 3 summarizes the key hydrologic parameters for each drainage area used in the proposed conditions analyses.

Table 3
Proposed Conditions Hydrologic Data

Description (Drainage Area #)	Discharge Location	Design Point	Area (acres)	Curve Number	Time of Concentration (min)
PR-11	Wetland #1	DP-1	10.9	88	6.7
PR-12	Wetland #1	DP-1	6.2	79	26.3
PR-13	Wetland #1	DP-1	3.5	88	14.8
PR-14	Wetland #1	DP-1	0.03	80	15.4
PR-21	Wetland #2	DP-2	3.6	90	7.4
PR-22	Wetland #2	DP-2	0.6	79	20.1
PR-23	Wetland #2	DP-2	0.5	80	7.7
PR-24	Wetland #2	DP-2	3.3	78	32.1
PR-31	Wetland #3	DP-3	5.2	80	32.6
PR-32	Wetland #3	DP-3	0.06	79	10.5
PR-41	Eliot Street	DP-4	0.8	80	8.4
PR-51	Offsite Southeast	DP-5	1.0	78	16.1
PR-61	Prospect Heights	DP-6	1.4	78	26.2
PR-62	Prospect Heights	DP-6	0.9	89	12.2
PR-71	Chestnut Street	DP-7	2.1	79	20.7
PR-72	Chestnut Street	DP-7	0.4	79	19.8
PR-73	Chestnut Street	DP-7	0.04	77	15.4

The site complies with the total suspended solids removal requirement of the Stormwater Management Policy. The proposed stormwater management system has been designed to treat the half inch Water Quality Volume, and will provide 85% Total Suspended Solids (TSS) removal. The calculated TSS removal rates for discharges from the site are included in Appendix C.

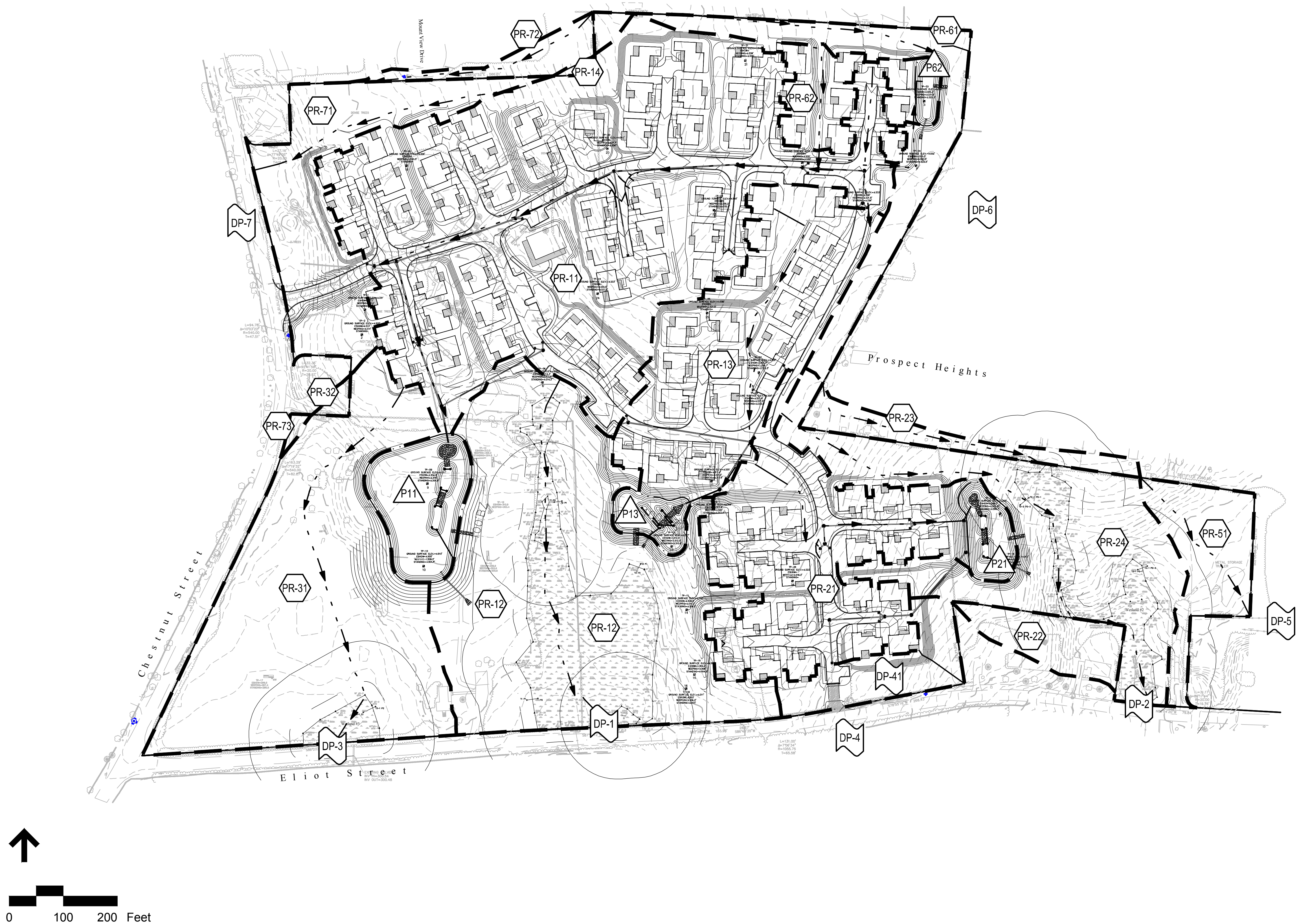
The stormwater management system also meets the 40% total phosphorous (TP) and 30% total nitrogen (TN) removal rates as required per the Town of Ashland Stormwater Management Regulations. As shown in the United States Environmental Protection Agency (US EPA) BMP Performance Curve for a Gravel Wetland for a Medium Density Residential use, the required runoff depth required to treat 40% TP removal is about 0.37 inches. The three gravel wetlands are sized to treat 0.5 inches of runoff, therefore they are treating the necessary amount of stormwater runoff to remove 40% TP. Massachusetts Department of Environmental Protection (MassDEP) stormwater regulations make reference to the University of New Hampshire's (UNH) gravel wetland designs and sites their specifications for water quality. According to the 2012 University of New Hampshire Stormwater Center Biennial Report, a gravel wetland, if properly designed to treat the necessary water quality runoff volume, will remove 50% TN annually. Provided that the proposed gravel wetlands are constructed properly and maintained regularly, the Project will provide the required 40% TP and 30% TN removal. The EPA BMP Performance Curve and the gravel wetland portion of the UNH Biennial report are included in Appendix C.

Northeast Geotechnical, Inc. performed a test pit analysis for the Project on April 7, 2015, attached in Appendix A. Estimated seasonal high groundwater (ESHGW) is assumed to be the "stabilized" and not "weeping" water that was encountered during the test pit exploration due to the wet and weather conditions at the time of the test pit exploration. This "stabilized" groundwater elevations were used for the proposed stormwater management design, per the recommendations of Northeast Geotechnical, Inc. Pursuant to Chapter 343 Section 7.6.10.8 of the Town of Ashland Stormwater Management Regulations, the locations and distances from the proposed ground to the estimated seasonal high groundwater are listed in Table 4.

Table 4
Proposed Surface and Groundwater Elevations (Feet)

Test Pit	Existing Ground Elevation	ESHGW	Existing Separation to ESGHW (ft)	Proposed Ground Elevation	Proposed Separation to ESHGW (ft)
TP-1	321	313	8	322	9
TP-2	320	313	7	320	7
TP-3	333	326	7	332	6
TP-4	332	326	6	332	6
TP-5	333	326	7	334	8
TP-6	321	315	6	321	6
TP-7	329	324	5	328	4
TP-8	329	324	5	328	4
TP-9	311	305	6	312	4
TP-10	310	305	5	312	7
TP-11	325	318	7	328	10
TP-12	325	318	7	323	5
TP-13	317	313	4	317	4
TP-14	316	309	7	316	7
TP-15	312	305	7	312	7
TP-16	311	303	8	311	8
TP-17	305	299	6	303	4
TP-18	303	299	4	305	6

Figure 3: Proposed Drainage Areas



LEGEND

SUBCATCHMENT DRAINAGE AREA DESIGNATION

POND

DESIGN POINT

DRAINAGE AREA BOUNDARY

TIME OF CONCENTRATION FLOW LINE

100'BZ 100' BUFFER ZONE

4-220 4-219 WETLAND BOUNDARY

Vanasse Hangen Brustlin, Inc.

Figure 3 July 2015

Proposed Conditions Drainage Areas
The Lanterns at Warren Woods
466 Chestnut Street
Ashland, Massachusetts

4

Hydrologic/Hydraulic Analysis

Hydrologic Analysis

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 event for Middlesex County; they were 3.1, 4.5, 5.3, and 6.5 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. Detailed printouts of the HydroCAD analyses are included in Appendix H. Table 5 presents a summary of the existing and proposed conditions peak discharge rates. Table 6 summarizes the existing and proposed conditions runoff volumes, as per the Chapter 343 Section 7.6.16.13.c.9 of the Town of Ashland Stormwater Management Regulations.

Table 5
Peak Discharge Rates (cfs*)

Design Point	2-year	10-year	25-year	100-year
Design Point 1: Wetland #1				
Existing	10.6	20.3	26.2	35.3
Proposed	9.7	16.0	22.2	32.2
Design Point 2: Wetland #2				
Existing	3.9	7.8	10.2	13.8
Proposed	3.9	7.5	9.5	13.7
Design Point 3: Wetland #3				
Existing	5.4	10.1	13.0	17.4
Proposed	4.3	8.2	10.5	14.0
Design Point 4: Eliot Street				
Existing	1.6	3.2	4.2	5.8
Proposed	1.1	2.0	2.6	3.5
Design Point 5: Offsite Southeast				
Existing	1.0	1.9	2.5	3.4
Proposed	1.0	1.9	2.5	3.4
Design Point 6: Prospect Heights				
Existing	3.8	7.5	9.8	13.4
Proposed	2.4	4.3	5.4	7.1
Design Point 7: Chestnut Street				
Existing	3.3	6.4	8.3	11.2
Proposed	2.4	4.6	6.0	8.1

* Expressed in cubic feet per second

The results of the analyses indicate that there will be no increase in peak discharge rates between the pre- and post-development conditions for the 2, 10, 25, and 100-year storm events.

Table 6
Stormwater Volume Analysis (ac-ft)

Design Point	2-year	10-year	25-year	100-year
Design Point 1: Wetland #1				
Existing	1.63	3.06	3.94	5.32
Proposed	2.68	4.81	6.08	8.02
Design Point 2: Wetland #2				
Existing	0.67	1.25	1.60	2.15
Proposed	0.89	1.70	2.18	2.92
Design Point 3: Wetland #3				
Existing	0.60	1.16	1.51	2.05
Proposed	0.58	1.07	1.38	1.85
Design Point 4: Eliot Street				
Existing	0.22	0.42	0.55	0.75
Proposed	0.08	0.16	0.20	0.27
Design Point 5: Offsite Southeast				
Existing	0.10	0.19	0.24	0.33
Proposed	0.10	0.19	0.24	0.33
Design Point 6: Prospect Heights				
Existing	0.49	0.95	1.24	1.69
Proposed	0.30	0.52	0.66	0.87
Design Point 7: Chestnut Street				
Existing	0.69	1.30	1.68	2.26
Proposed	0.26	0.50	0.64	0.86

The results of the water volume analysis shows that less runoff volume will be directed offsite to the surrounding streets and neighborhoods for each storm event. Therefore, there are no negative impacts to the abutting properties and offsite features in terms of stormwater runoff volume.

Hydraulic Analysis

The closed drainage system was designed for the 25 –year storm event, in accordance with the Town of Ashland Stormwater Management Regulations.

Drainage pipes were sized using Manning's Equation for full-flow capacity and the Rational Method. Pipe sizing calculations are included in Appendix D of this report.

5

Stormwater Management Regulations

The purpose of the Stormwater Management Plan (the Plan) is to provide long-term protection of natural resources in and around the Site. This is achieved by implementing water quality and quantity control measures designed to decrease the amount of pollutants discharged from the Site, increase the quality of stormwater recharged on the Site, and control discharge rates.

The following sections describe the regulations pertinent to stormwater management and the specific components of the Plan to be implemented.

Stormwater Regulations and Permitting

The following stormwater related regulations and guidelines apply to the proposed site development:

- Massachusetts State Stormwater Management Regulations and Performance Standards included in the Stormwater Handbook, (Department of Environmental Protection February 2008).

- Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System (NPDES) Stormwater Permit for Construction Activities disturbing greater than one acre (EPA, Federal Register, December 8, 1999 and amendments)

- Town of Ashland Chapter 343. Stormwater Management (Conservation Commission of the Town of Ashland, May 28, 2008)

- Town of Ashland Chapter 344 Subdivision of Land (Planning Board of the Town of Ashland, April 29, 1999 and amendments)

Compliance with these regulations is described in the following sections.

Stormwater Management Standards and Guidelines

The methods for compliance with the ten stormwater performance standards developed by the MA DEP are summarized below.

1. ***No new stormwater conveyances may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.***

   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 have been designed to not cause erosion or scour to wetlands or neighboring properties. Outlets from the closed drainage systems have been designed with flared end sections and stone protection to dissipate discharge velocities. Overflows from BMPs have been designed with stone material to protect down gradient areas from erosion.

   Computations and supporting information for the sizing and selection of materials used to protect the downgradient surface from scouring and erosion are included in Appendix D.

2. ***Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. This Standard may be waived for discharges to land subject to coastal storm flowage as defined in 310 CMR 10.04.***

   The Project has been designed to comply with Standard 2.

   The rainfall runoff from the Site under existing and proposed conditions was analyzed for the 2, 10, 25, and 100-year storm events. Rainfall volumes used for this analysis were based on the Natural Resources Conservation Service (NRCS) Type III, 24-hour storm event for Middlesex County. Runoff coefficients for the existing and proposed conditions, as previously shown in Tables 1 and 3, were determined using the NRCS Technical Release 55 (TR-55) methodology as provided in HydroCAD. The HydroCAD model is based on the NRCS Technical Release 20 (TR-20) Model for Project

Formulation Hydrology. The results of the analysis, as demonstrated in Tables 3 and 4, show that there is no increase in peak discharge rates between the existing and proposed conditions at any of the discharge points. All proposed peak discharge rates either meet or are less than existing peak discharge rates. Computations and supporting information regarding the hydrologic modeling are included in Appendix G.

3. ***Loss of annual recharge to ground water shall be eliminated or minimized through the use of infiltration measures including environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type. This Standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook.***

This Massachusetts Stormwater Handbook notes that this standard applies *to the maximum extent practicable* for sites comprised solely of C and D soils. The soils on the Site are glacial tills classified as HSG C/D and D and the Project has been designed to comply with Standard 3 to the maximum extent practicable. This is due largely to the proposed building program. The plan provides 50% open space by tightly clustering homes and minimizing the lawn area around each home; and reduces pavement area by reducing roadway pavement widths below those prescribed under zoning.

Additionally, the project proposes to collect roof runoff in a network of perforated pipes and infiltration trenches. The infiltration trenches provide the best opportunity to recharge the greatest volume of water because these will capture the most frequent and smaller storm events.

4. ***Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This Standard is met when:***

- ***Suitable practices for source control and pollution prevention are identified in a long- term pollution prevention plan, and thereafter are implemented and maintained;***
- ***Structural stormwater best management practices are sized to capture the required water quality volume determined in accordance with the Massachusetts Stormwater Handbook; and***
- ***Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.***

The Project has been designed to comply with Standard 4.

The proposed stormwater management system contains BMPs that have been designed to provide 80% TSS removal of stormwater runoff from proposed impervious surfaces. The treatments of impervious paved surfaces is treated in following type of treatment trains.

- Stormwater runoff from the site roads and driveways is collected in catch basins with deep sumps and oil/debris traps before discharging into sediment forebays sized to treat the first 0.1 inches of runoff. Total 80% TSS removal is provided in the gravel wetlands. Runoff from the impervious paved surfaces is divided between the three gravel wetlands.

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

   The Project is not considered a LUHPPL.

6. ***Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply and stormwater discharges near or to any other critical area require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas as provided in the Massachusetts Stormwater Handbook. A discharge is near a critical area, if there is a strong likelihood of a significant impact occurring to said area, taking into account site-specific factors. Stormwater discharges to Outstanding Resource Waters and Special Resource Waters shall be removed and set back from the receiving water or wetland and receive the highest and best practical method of treatment. A "storm water discharge" as defined in 314 CMR 3.04(2)(a)1 or (b) to an Outstanding Resource Water or Special Resource Water shall comply with 314 CMR 3.00 and 314 CMR 4.00. Stormwater discharges to Zone I or Zone A are prohibited unless essential to the operation of a public***

water supply.

The Project is not located in or near a critical area. No stormwater from the Project will be discharged to or near to a critical area.

7. ***A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural best management practice requirements of Standards 4, 5, and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.***

   The Project as a whole is not treated as a redevelopment. The Project has been designed to comply with the Stormwater Management Standards. Refer to each Standard directly for applicable computations and supporting information demonstrating compliance with each.

8. ***A plan to control construction related impacts including erosion, sedimentation and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented.***

   Recommended erosion and sedimentation control practices are included in Appendix E and will be finalized as part of the Notice of Intent process. A maintenance checklist recommended for evaluating erosion control BMPs is also included.

9. ***A long-term operation and maintenance plan shall be developed and implemented to ensure that stormwater management systems function as designed***

   Recommended practices for operating and maintaining long term stormwater BMPs is included in Appendix C. A recommended checklist for maintenance inspections and follow up is also included.

10. ***All illicit discharges to the stormwater management system are prohibited.***

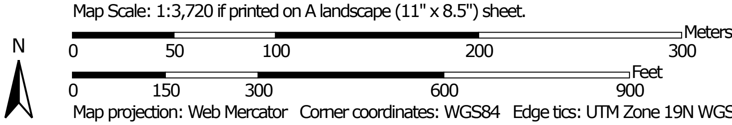
    Storm drainage structures remaining from previous development which are part of the redevelopment area will be removed. The design plans submitted with this report have been designed so that the components included therein are in full compliance with current standards. The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges.

Federal NPDES Construction-Related General Stormwater Permits

The proposed project will result in the disturbance of more than one acre of land and thus requires the preparation and implementation of a Stormwater Pollution Prevention Plan (SWPPP) by the **site contractor** and **owner** in accordance with the Environmental Protection Agency's (EPA's) National Pollutant Discharge Elimination System (NPDES) General Permit Program for Stormwater Discharges from Construction Sites. The SWPPP is not included in this report.

Appendix A:
NRCS Soil Survey Information
On-Site Subsurface Investigation
FEMA Floodway Map

Map Scale: 1:3,720 if printed on A landscape (11" x 8.5") sheet.



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: http://websoilsurvey.nrcs.usda.gov
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 14, Sep 19, 2014

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

Date(s) aerial images were photographed: Sep 12, 2014—Sep 28, 2014

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

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Middlesex County, Massachusetts (MA017)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
30B	Raynham silt loam, 0 to 5 percent slopes	C/D	0.2	0.4%
71B	Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony	D	1.8	4.2%
335B	Rainbow silt loam, 3 to 8 percent slopes	C/D	11.6	26.9%
340B	Broadbrook very fine sandy loam, 3 to 8 percent slopes	D	12.5	29.0%
341B	Broadbrook very fine sandy loam, 3 to 8 percent slopes, very stony	D	17.0	39.6%
Totals for Area of Interest			**43.0**	**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

GEOTECHNICAL ENGINEERING STUDIES
PROPOSED RESIDENTIAL DEVELOPMENT
466 CHESTNUT STREET
ASHLAND, MA

Prepared For:
The Green Company
46 Glen Avenue
Newton, MA 02459

Prepared By:
Northeast Geotechnical, Inc.
166 Raymond Hall Drive
North Attleborough, MA 02760

File No. O189.01
April 24, 2015

NORTHEAST GEOTECHNICAL, INC.
Delivering Practical Engineering Solutions

April 24, 2015 Project No. O189.01

Mr. Rick Maranhas
Executive Vice President
Construction
The Green Company
46 Glen Avenue
Newton, MA 02459

SUBJECT: Geotechnical Engineering Studies
Proposed Residential Development
466 Chestnut Street
Ashland, MA

Dear Rick:

Northeast Geotechnical, Inc. is pleased to present the results of our geotechnical engineering studies performed in support of the referenced project. The Green Company is considering developing a 92-home cluster type development project on a 40± acre site. The project will be developed over a few years.

The objective of our geotechnical engineering services has been to develop geotechnical engineering recommendations for use in design and construction of the project. VHB indicated areas of the site where additional subsurface explorations are needed to support their storm water management design of the site. Based on the results of test pits that we coordinated and observed, we are providing information for VHB's use in support of their storm water management design.

We also coordinated and observed test pits within proposed cut areas of the site to assess the condition of possible cut soils for reuse on the project. This report has been prepared in accordance with our proposal to you dated March 26, 2015.

The attached report contains a summary of our studies and presents our preliminary conclusions and recommendations for use in design and construction of the proposed project. Please feel free to contact Glenn Olson at 508-598-3510 should you have any questions.

Sincerely,
Northeast Geotechnical, Inc.

Glenn A. Olson, P.E.
Principal Engineer

Mark M. Zambernardi, P.E.
Principal Engineer

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1.0 INTRODUCTION AND PROPOSED PROJECT DESCRIPTION

This report summarizes Northeast Geotechnical's engineering studies performed in support of a proposed residential development at 466 Chestnut Street in Ashland, MA. This report is considered a supplement to our Preliminary Geotechnical Engineering Studies report dated March 12, 2015 (the Preliminary Report).

The Preliminary Report was based on our review of a report prepared by Schofield Brothers of New England, Inc. (Schofield) dated February 18, 2015. Schofield's report contains a summary of encountered soil and groundwater conditions at the site and provides an opinion about estimated seasonal high groundwater levels based on conditions observed in the test pits which they observed.

This report is based on information provided by The Green Company as well as the results of a subsurface exploration program we observed in April, 2015 and an associated soils laboratory testing program.

The Green Company is proposing a 92-home cluster type development project on a 40± acre site. The Green Company provided a plan titled "Conceptual Road Grades", dated March 5, 2015 which was prepared by Vanasse, Hangen, Brustlin, Inc. (VHB). The plan shows proposed layout and grading of proposed roadways along with layout of proposed houses with preliminary finish floor elevations. Existing ground surface grading is also shown on the plan.

The Green Company's proposed homes are presently being designed using normal shallow spread footing foundations with a floor slab on grade. No basements are proposed at this time. We also understand that the project will be constructed over a few years and that earthwork will proceed at most times of year. The exception will be that cuts and fills may not be performed during the winter. However, there may be floor slabs-on-grade exposed to freezing temperatures as the houses are framed.

Northeast Geotechnical, Inc. utilized VHB's plan to gain insight into where the proposed cuts and fills are proposed to accomplish the proposed finish grades for the project. It appears that the majority of the cuts are concentrated in the middle to northeast portion of the site in the areas of proposed Drives 1 through 7 off of proposed Road A, and in the area of proposed Drives 8, 10 and 11 to the north of proposed Road B. Also, it appears that some cuts will be performed in the area of proposed Drives 13 and 15 to the west of proposed Road B in the southeast portion of the site.

Mass cuts and fills appear to range up to approximately 10± feet below and 15± feet above existing ground surfaces respectively to accomplish the roadway grading concept and to reach finish floor levels of the proposed houses.

VHB also provided a plan titled "Proposed Test Pit Locations", Figure 1, dated March 2015 for use in this phase of our studies. The referenced plan showed eighteen proposed test pit locations within proposed storm water management areas. VHB requested that the test pits be performed in a manner to develop an opinion regarding: seasonal high groundwater, depth to current groundwater, soil textural classifications, and the presence of bedrock (if encountered). Northeast Geotechnical, Inc.

proposed eight additional test pit locations primarily within proposed cut sections of the site to assess the composition of materials to be potentially reused as structural fill on the project site.

This report is subject to the Limitations and Service Constraints attached as Appendix A to this report.

2.0 SUBSURFACE EXPLORATIONS

A subsurface exploration program was observed by Northeast Geotechnical, Inc. personnel at the site on April 6 through 9, 2015. The subsurface exploration program consisted of twenty six test pits. The test pits were excavated by Silversmith Excavating Company, Inc. using a Caterpillar model 315DL tracked excavator. It should be noted that the test pits were excavated following several days of snow melt.

Schofield survey staked the proposed test pit locations at the site prior to our arrival with the excavator. Test pits were generally excavated at the staked locations as shown on the attached Exploration Location Plan.

The soils encountered in the test pits were visually described by Northeast Geotechnical, Inc. personnel. Northeast Geotechnical, Inc. personnel used U.S.D.A. soil descriptions as indicated on the soil evaluator test pit logs for the eighteen test pits (TP-1 through TP-18) within proposed storm water management areas designated by VHB. Logs of the soil evaluator logged test pits are presented in Appendix B. The remaining test pits, performed primarily within proposed cut areas of the site (TP-19 through TP-26), were described by Northeast Geotechnical, Inc. personnel using Burmister soil descriptions and are presented in Appendix C.

3.0 SUBSURFACE CONDITIONS

The general subsurface conditions consist of a layer of root mat/topsoil overlying subsoil, in turn overlying an intermittent layer of silt and fine sand followed by dense, silty glacial till soils to the depths explored which were up to 10± feet below the existing ground surface. Groundwater was encountered at the time of the subsurface explorations at depths of approximately 5.5± to 8± feet below existing ground surface.

The root mat/topsoil, described as the O and A horizons with a soil texture ranging from silt to a silt loam, appears to be generally 6± to 18± inches thick. Subsoil, described as the B horizon with a soil texture ranging from silt, to silt loam, to loam encountered below the root mat/topsoil ranges from approximately 1± to 2± feet thick. The subsoil generally consists of silt with 10± to 30± percent fine sand, and 5± to 20± percent roots.

Granular fill was encountered in one of the test pits, TP-19, and was observed to extend to approximately 2± feet below ground surface. The granular fill generally consists of fine to coarse sand, 35± to 50± percent fine to coarse gravel, and less than 10± percent silt. The granular fill was encountered in the formerly developed area of the site where Schofield had also encountered fill soils.

An intermittent layer of natural silt and fine sand was encountered below the subsoil layer and is described as the C_1 horizon with a soil texture of loam, silt loam, and sandy loam. The layer appears to range from approximately 1± to 2.5± feet thick. The natural silt and fine sand is primarily comprised of silt and 15± to 50± percent fine sand, and less than 5± percent fine gravel.

Natural glacial till soils were encountered below the materials described in the preceding paragraphs in each of the twenty six test pit explorations performed. The glacial till soils are described as the C as well as the C_2 horizons on the logs with a soil texture of loam, loamy sand, and sandy loam. We observed these natural glacial till soils to be comprised of fine to medium as well as fine to coarse sand, 20± to 45± percent silt, and 10± to 25± percent fine to coarse gravel, less than 10± percent cobbles (i.e. 3± to 6± inches in diameter), mixed with sporadic 6± to 18± inch boulders.

We had interpreted the information provided by Schofield that the glacial till soils may be dense to very dense and comprised of fine to medium (and perhaps coarse) sand, with 15± to 35± percent silt. Our test pit observations and laboratory test results indicate a higher silt content of the glacial till soils along with the presence of gravel, cobbles and boulders.

Bedrock was not encountered to the depths explored in the test pits performed as part of our studies,which were generally 10± feet below ground surface. This observation is consistent with the information provided by Schofield.

As mentioned, test pits excavated as part of our studies were performed following a period of snow melt. Water was observed weeping into the test pits at various depths during our subsurface exploration program. This weeping water was likely the infiltrating water resulting from the snow melt. The weeping water occurred at various depths which gives an indication that water may become temporarily perched within or on the various deposits of natural silty soils. Perched groundwater could therefore be encountered during construction and throughout the design life of the project as surface water runoff infiltrates the site.

Observations of the test pits leads us to the opinion that “stabilized” as opposed to “weeping” groundwater is typically encountered from approximately 5.5± to 8± feet below the existing ground surface. It should be noted that the test pits were performed during a typically wet time of year. Furthermore, our opinion is that the stabilized groundwater levels observed in the test pits are generally typical of seasonal high groundwater levels except where noted on the soil evaluator logs presented in Appendix B.

Groundwater levels at the site will fluctuate due to variations in temperature, precipitation and other factors. Infiltrating storm water runoff or groundwater could become perched within or on top of the natural silt and fine sand as well as within or on the glacial till soils. As a result, the observed perched groundwater conditions are indicative of conditions which may periodically occur during construction and during the design life of the project.

4.0 LABORATORY TESTING

Representative soil samples were obtained from the eighteen test pits logged by Northeast Geotechnical's soil evaluator within proposed storm water management areas for laboratory gradation testing and U.S.D.A. textural classification. In addition, representative soil samples of materials within proposed cut areas were selected for laboratory gradation, natural moisture content, and modified proctor analyses.

Soil samples were submitted to Geotesting Express of Acton, Massachusetts for testing. The test results are included with this report in Appendix D.

5.0 CONCLUSIONS AND RECOMMENDATIONS

The conclusions and recommendations presented herein are subject to the Limitations and Service Constraints presented in Appendix A.

The conclusions and recommendations presented herein are considered supplemental to the preliminary earthwork conclusions and recommendations presented in our Preliminary Geotechnical Engineering Studies report (the Preliminary Report) dated March 12, 2015.

5.1 Site Design

Mass cuts appear to range up to approximately 10± feet below existing ground surface grades within the north to northeast portion of the site. Groundwater was encountered approximately 5.5± to 8± feet below existing ground surface at the time of our subsurface exploration program. Perched water was encountered at shallower depths.

We recommend, if possible, limiting the proposed cuts to proposed finish grades as much as practical to mitigate the impacts groundwater could have on both earthwork and final design conditions.

5.2 Earthwork

The earthwork recommendations presented in the Preliminary Report for the project are still applicable based on our recent studies. However, we have observed a 1± to 2.5± foot primarily silt layer beneath the subsoil layer, and the glacial till soils appear siltier than previously anticipated. Therefore, the natural soils will at times, be more sensitive to moisture and could be more difficult to work with during wet weather and freezing temperatures than originally anticipated.

A modified Poctor test and in-situ moisture content was performed by the soils testing laboratory on two samples of soils anticipated to be encountered during mass cuts. These samples were obtained from test pits TP-21 and TP-23 located within the northerly portion of the site. The Proctor test establishes the soils' moisture-density relationships and provides an indication of the range of moisture contents at which the soils can be adequately compacted. The results of the in-situ moisture content testing indicates the soils were, at the time of the test pits, approximately 6 percent above the soils' optimum moisture contents for compaction.

Therefore, if the soils were excavated today, or in a similar wet conditions, the soils likely would not be able to be adequately compacted unless the soils were allowed to dry or be layered with clean off-site sand and gravel. Recommendations are presented in the Preliminary Report for use of off-site soils and judiciously utilizing the on-site soils. Mass cuts and fills should be performed during dry, warm times of the year as much as possible to effectively utilize the on-site soils and mitigate the amount of fill materials needed to import from off-site.

Management of surface water runoff and control of groundwater by the earthwork contractor will be important factors in maintaining the silt and fine sand and the glacial till soils in reusable conditions. In addition to the recommendations presented in the Preliminary Report, the contractor should consider temporary diversion swales to protect the work areas during mass cuts and fills. The swales should be cut and maintained to divert water from the areas to be cut and areas to be filled.

In addition, groundwater control should be incorporated into the final design as discussed in section 5.4 Foundation Underdrains below.

5.21 Building Area Earthwork

Topsoil, subsoil, and existing fill soils (i.e. unsuitables) are not considered suitable to support foundations or floor slabs on grades. These unsuitables should be removed from the footprint area of the proposed houses including foundation areas and to a minimum distance of 10 feet beyond. In addition, in areas to receive fill to reach proposed bottom of footing elevations, unsuitables should be removed from a one horizontal to one vertical line sloping down and out from the outside edge of bottom of footing to natural granular soils (i.e. the buildings' stress zones). The natural granular soils are considered the silt and fine sand as well as the glacial till soils.

Care should be taken to not overexcavate below the base of unsuitables to mitigate the potential for encountering groundwater. Removal of unsuitables should be performed in areas limited to the proposed building areas and their stress zones to limit the potential for water to infiltrate into the natural soils during inclement weather.

The contractor should consider removal of unsuitables with the use of backhoes having smooth edged buckets or low ground pressure bulldozers rather than large bulldozers. Trucks and other heavy equipment should be prohibited from traveling on the exposed natural ground surface once the unsuitables have been removed. These efforts are intended to limit the potential for disturbance of the natural soils prior to the placement and compaction of structural fill.

Excavations to remove unsuitables to firm natural ground should be immediately backfilled with properly compacted, controlled lifts of structural fill. An initial 12 inch thick layer of off-site clean sand and gravel should be placed immediately as the initial lift of structural fill throughout the proposed building areas.

Structural fill used within proposed building areas should be placed in 12 inch maximum thick lifts and each lift should be compacted by a minimum of six passes of a self-propelled vibratory drum compactor having a minimum weight at the drum of 15,000 pounds. Structural fill should be compacted to at least 95 percent of the fill materials' maximum dry density as determined by ASTM

D-1557. Besides meeting the minimum compaction requirements, each lift of fill should be assessed by the on-site geotechnical engineer to be compacted to a firm and stable condition.

5.22 Pavement Area Earthwork

Paved driveways, secondary roadways and primary roadways are proposed throughout the site. Unsuitables should be stripped from the proposed pavement areas where the surface of these materials is located within four feet (4') from proposed finish pavement grades.

Exposed soils at proposed pavement subgrade elevations should be protected from disturbance resulting from exposure to moisture and construction traffic from the time of excavation to the time of the placement of pavement base course fill. One option is to wait to extend the cut operations to the proposed pavement subgrade elevations only when the base course sand and gravel fill is scheduled to be placed over the subgrade.

Structural fill comprised of either on- or off-site materials should be placed to proposed pavement subgrade levels in controlled, compacted lifts as discussed in Section 5.21 Building Area Earthwork. However, structural fill placed to proposed pavement subgrade elevations (bottom of base course sand and gravel layer) should be compacted to a minimum of 90 percent of the fill materials' maximum dry density as determined by ASTM D1557. The pavement base course layer should be compacted to at least 95 percent of the fill material's maximum dry density.

5.3 Foundations

We understand that the final layout and grading for the project has yet to be completed. Elevations of foundations for the proposed houses will vary across the site.

Provided that the earthwork procedures recommended herein and in the Preliminary Report are performed within the proposed building areas, a shallow foundation system consisting of spread footings should be utilized to support the proposed buildings.

The spread footings are anticipated to bear on natural silt and sand, natural glacial till, or compacted structural fill. Excavations for foundations should be performed using a backhoe with a smooth edged bucket to remove loosened soil disturbed during the excavation process. Excavations for foundations may extend to or below groundwater levels.

The contractor should be prepared to dewater foundation excavations and should therefore limit the size of open excavations to that which can be handled by the contractor's chosen method of dewatering. We anticipate that the dewatering, provided the excavation size is limited, can be handled by using open sumps. The contractor should be required to draw water down so that the base of excavation is dry to allow the on-site geotechnical engineer to verify that the base is firm and stable.

Excavations for foundations should be immediately covered with a a layer of filter fabric consisting of a Mirafi 140N or equivalent followed immediately by a six inch minimum thick lift of off-site ¾-

inch crushed stoneThis crushed stone lift should be compacted by making a minimum of 4 passes with a vibratory plate compactor. . If the excavations terminate in an off-site sand and gravel, the recommended filter fabric may be eliminated.

Foundation excavations performed during the cold weather should be protected from becoming frozen. Foundations should not be poured on frozen ground. Insulation blankets and heat should be considered to maintain foundation subgrades in a non-frozen condition.

The soils adjacent to foundations should likewise be protected from becoming frozen even after foundations are constructed. This is to prevent frost from penetrating below constructed foundations and causing heaving to occur. For this reason, foundation forms should be stripped and foundations and then walls should be backfilled as soon as possible when cold weather is anticipated.

To protect the integrity of the foundation bearing conditions, no utility lines should be allowed to pass beneath or within the stress zone of the footings. Rather, efforts should be made to move utilities or lower footing elevations to satisfy this recommendation.

Provided that the recommendations presented herein are satisfied, the foundations for the proposed buildings may be designed utilizing a maximum allowable bearing capacity of one ton per square foot (1.0 TSF).

5.4 Foundation Underdrains

We anticipate that there will be a benefit to installing foundation underdrains around the perimeter of some of the houses. The locations of the underdrains will be dependent on the final layout and grading plans and proximity to groundwater. We recommend that Northeast Geotechnical, Inc. be afforded the opportunity to review the final layout and grading plans to develop underdrain recommendations.

In general, we anticipate recommending foundation underdrains in areas where cuts below existing grades are performed to achieve finish lower floor levels and for buildings which may have basement levels.

In a general sense, we anticipate foundation underdrains will consist of 4 inch minimum diameter perforated PVC pipe, bedded in ¾ inch washed crushed stone at least 6 inches all around, which is then wrapped in a geotextile filter fabric along the exterior foundation walls of the proposed buildings. The pipe bottoms should be located 6 inches above the bottom of footing elevation.

Underdrain pipes should be laid flat with the perforations down. The underdrain pipes should connect to a solid pipe that daylights to a slope at an elevation lower than the lowest proposed finish grade within the building or to a manhole with a rim elevation lower than the lowest proposed finish grade in the area of the proposed building.

Depending on the magnitude of cuts and proximity to groundwater, other underdrains may be recommended at the toe of cuts or along proposed pavement areas to mitigate negative impacts of groundwater infiltration.

5.5 Floor Slab-On-Grade Support

Slab-on-grade construction is recommended for the ground floor building slabs provided the building areas are prepared as described in the preceding sections of this report and in the Preliminary Report. The floor slabs should bear directly on a 12 inch minimum thick base course sand and gravel layer compacted to at least 95 percent of the fill material's maximum laboratory dry density as determined by ASTM D-1557. Besides meeting the minimum compaction requirements, the base course fill should be compacted to a firm and stable condition.

Base course sand and gravel should conform to the recommended gradation criteria presented in section 4.2 Off-Site Soil Selection of the Preliminary Report for sand and gravel. A moisture barrier should also be installed on top of the base course sand and gravel beneath the floor slabs.

5.6 Pavement Support

We anticipate that pavement subgrade conditions at the site will consist of compacted structural fill, natural silt and fine sand, and natural glacial till soils.

Provided the proposed pavement areas are prepared as recommended in this report and the Preliminary Report, the following minimum pavement sections are recommended:

FLEXIBLE PAVEMENT SECTIONS

	Standard Duty (Driveways and Secondary Roads)	**Heavy Duty (Main Roads)**
Bituminous Pavement		
Finish Course	1.5"	2.0"
Binder Course	2.0"	3.0"
Base Course Sand & Gravel	12"	16"

Pavement base course sand and gravel should meet the recommended gradation criteria for sand and gravel listed in Section 4.2 Off-Site Soil Selection of the Preliminary Report.

Pavement base course fill should be compacted to at least 95 percent of the material's maximum dry density per ASTM D-1557. Besides meeting the minimum compaction requirements, the base course fill should be compacted to a firm and stable condition.

6.0 ADDITIONAL STUDIES AND SERVICES

Northeast Geotechnical, Inc. should be afforded the opportunity to review the design layout and grading plans to perhaps revise and refine some of our conclusions and recommendations presented herein and in the Preliminary Report. We should also be afforded the opportunity to review the foundation and site plans, and earthwork specifications prior to bidding for construction to see that our recommendations have been properly interpreted and included.

Northeast Geotechnical, Inc. should also be retained to provide construction observation and soil testing services during the earthwork construction phases of the project. The purpose of our participation is twofold: to observe that the contractor performs earthwork in general compliance with the recommendations presented in our geotechnical engineering reports, and; to verify our design assumptions in the field. In addition, we can provide engineering input in a timely manner if subsurface conditions are found to vary from those anticipated prior to construction and warrant a design change or a change in earthwork procedures.

FIGURE

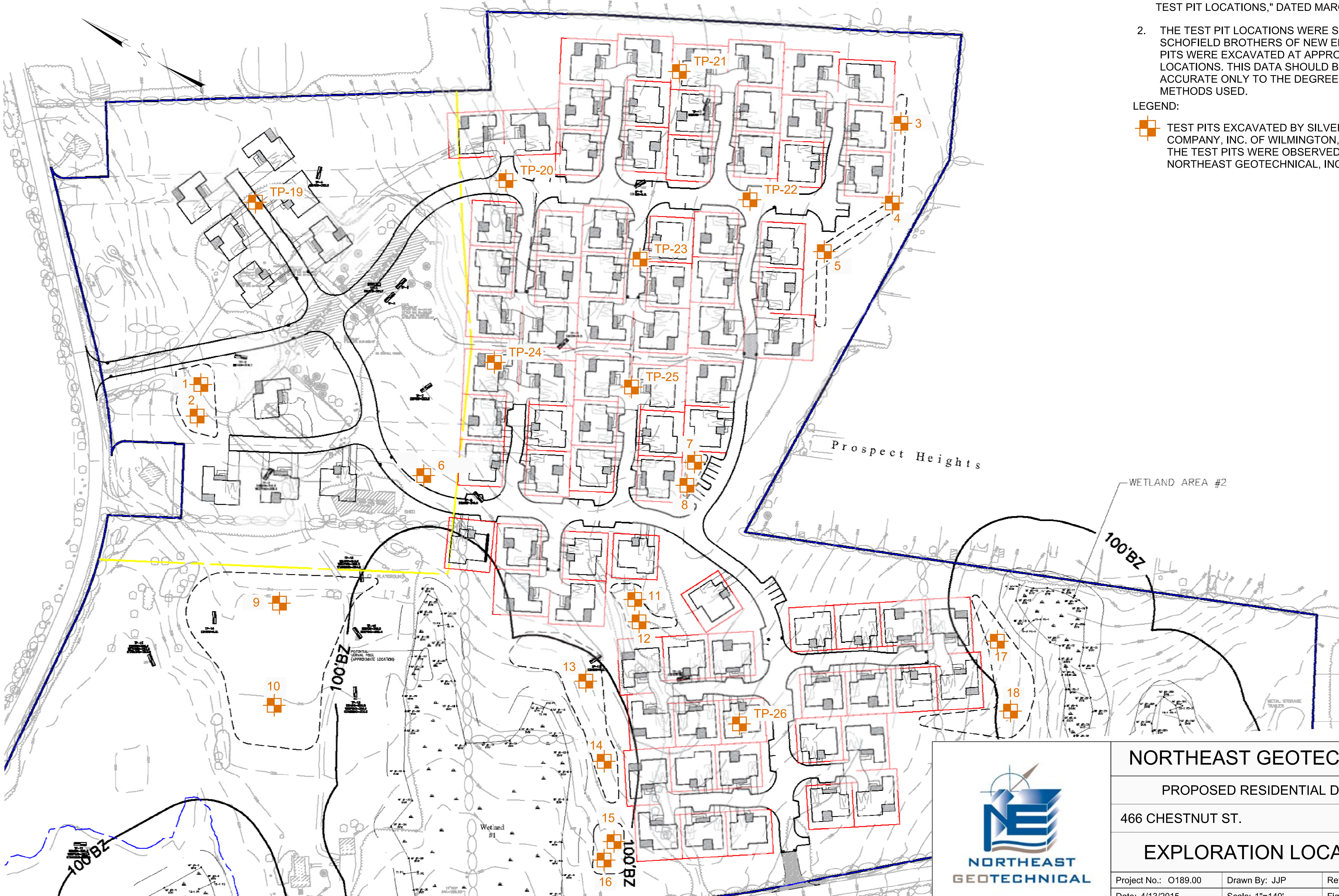
NOTES:

1. BASE MAP DEVELOPED FROM PLANS PROVIDED BY VANASSE HANGEN BRUSTLIN, INC. ENTITLED ``PROPOSED TEST PIT LOCATIONS," DATED MARCH 2015.

2. THE TEST PIT LOCATIONS WERE SURVEY LOCATED BY SCHOFIELD BROTHERS OF NEW ENGLAND, INC. TEST PITS WERE EXCAVATED AT APPROXIMATE STAKED LOCATIONS. THIS DATA SHOULD BE CONSIDERED ACCURATE ONLY TO THE DEGREE IMPLIED BY THE METHODS USED.

LEGEND:

TEST PITS EXCAVATED BY SILVERSMITH EXCAVATING COMPANY, INC. OF WILMINGTON, MA ON APRIL 6-9, 2015. THE TEST PITS WERE OBSERVED AND LOGGED BY NORTHEAST GEOTECHNICAL, INC. PERSONNEL.



NORTHEAST GEOTECHNICAL

NORTHEAST GEOTECHNICAL, INC.		
PROPOSED RESIDENTIAL DEVELOPMENT		
466 CHESTNUT ST.		ASHLAND, MA
EXPLORATION LOCATION PLAN		
Project No.: O189.00	Drawn By: JJP	Reviewed By: G.OLSON, P.E.
Date: 4/13/2015	Scale: 1"=140'	Figure No.: 1

JACK POWERS, 04/23/2015, 00:44:45 | FILE: C:\NORTHEAST\0189.00 ASHLAND\PLANS\018900F01.DWG

APPENDIX A

Limitations and Service Constraints

LIMITATIONS AND SERVICE CONSTRAINTS
Geotechnical Engineering Consulting Services

The opinions, conclusions and recommendations presented in this report are based upon the scope of services, information obtained through the performance of the services, and the schedule as agreed upon by Northeast Geotechnical, Inc. and the party for whom this report was originally prepared. This report is an instrument of professional service and was prepared in accordance with the generally accepted standards and level of skill and care under similar conditions and circumstances established by the geotechnical consulting industry. No representation, warranty, or guarantee, express or implied, is intended or given. To the extent that Northeast Geotechnical, Inc. relied upon any information prepared by other parties not under contract to Northeast Geotechnical, Inc. , Northeast Geotechnical, Inc. makes no representation as to the accuracy or completeness of such information. This report is expressly for the sole and exclusive use of the party for whom this report was originally prepared and/or other specifically named parties have the right to make use of and rely upon this report. Reuse of this report or any portion thereof for other than its intended purpose, or if modified, or if used by third parties, shall be at the user's sole risk.

Furthermore, nothing contained in this document shall relieve any other party of its responsibility to abide by contract documents and applicable laws, codes, regulations, or standards.

<u>Subsurface Explorations and Testing</u>

Results of any observations, subsurface exploration or testing, and any findings presented in this report apply solely to conditions existing at the time when Northeast Geotechnical, Inc.'s exploratory work was performed. It must be recognized that any such observations and exploratory or testing activities are inherently limited and do not represent a conclusive or complete characterization. Conditions in other parts of the project site may vary from those at the locations where data were collected and conditions can change with time. Northeast Geotechnical, Inc.'s ability to interpret exploratory and test results is related to the availability of the data and the extent of the exploratory and testing activities.

The findings, conclusions and recommendations submitted in this report are based, in part, on data obtained from subsurface borings, test pits, and specific, discrete sampling locations. The nature and extent of variation between these test locations, which may be widely spaced, may not become evident until construction. If variations are subsequently encountered, it will be necessary to re-evaluate the conclusions and recommendations of this report.

Correlations and descriptions of subsurface conditions presented in boring logs, test pit logs, subsurface profiles, and other materials are approximate only. Subsurface conditions may vary significantly from those encountered in borings and sampling locations and transitions between subsurface materials may be gradual or highly variable.

Conditions at the time water level measurements and other subsurface observations were made are presented in the boring logs or other sampling forms. This field data has been reviewed and interpretations provided in this report. However, groundwater levels may be variable and may fluctuate due to variation in precipitation, temperature, and other factors. Therefore, groundwater levels at the site at any time may be different than stated in this report.

Review

In the event that any change in the nature, design, or location of the proposed structure(s) is planned, the conclusions and recommendations in this report shall not be considered valid unless the changes are reviewed and the conclusions and recommendations of this report are modified or verified in writing.

Northeast Geotechnical, Inc. should be provided the opportunity for a general review of final design plans and specifications to assess that our recommendations have been properly interpreted and included in the design and construction documents.

Construction

To verify conditions presented in this report and modify recommendations based on field conditions encountered in the field, Northeast Geotechnical, Inc. should be retained to provide geotechnical engineering services during the construction phase of the project. This is to observe compliance with design concepts, specifications, and recommendations contained in this report, and to verify and refine our recommendations as necessary in the event that subsurface conditions differ from those anticipated prior to the start of construction.

APPENDIX B

Soil Evaluator Test Pit Logs (TP-1 through TP-18)

NORTHEAST GEOTECHNICAL, INC.

TEST PIT LOG

Project: Proposed Residential Development
466 Chestnut Street
Ashland, MA

Test Pit/Deep Observation Hole Number: TP-1

Subcontractor: Silversmith Excavating Co., Inc.
Operator: Kevin
Equipment: Cat. 315DL Tracked Escavator
Capacity/Reach: 3/4± C.Y / 15± feet

Date/Weather: 4-6-2015 / Mostly Cloudy, 35 to 45˚F
Northeast Geotechnical Observer: Mark Zambernardi P.E.
Test Pit Location: See Exploration Location Plan
Ground Surface Elevation: 321± feet

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File No. O189.00
Reviewed By: Glenn Olson, P.E.

Depth (in.)	Soil Horizon/Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments		Soil Structure	Soil Consistence (Moist)	Other
			Depth (in.)	Color	Percent		Gravel	Cobbles & Stones			
0-3±	A	10YR 2/1	---	---	---	Silt Loam	---	---	Massive	Friable	
3-25±	B	10YR 6/8	---	---	---	Loam	less than 5%	less than 5%	Massive	Friable	
25-30±	C_1	10YR 7/2	---	---	---	Silt Loam	---	---	Massive	Friable	
30-100±	C_2	2.5Y 6/4	---	---	---	Sandy Loam	25±%	10±%	Granular	Firm	

Groundwater Observed: Yes

Depth Weeping from Pit: 60± inches

Depth Standing Water in Hole: 96± inches

Estimated Depth (Elevation) to High Groundwater: 96± inches (Elevation 313± feet)

Notes:
1. Sample no. S-1 was obtained from about 25± to 30± inches below ground surface.
2. Sample no. S-2 was obtained from about 30± to 100± inches below ground surface.
3. Test pit terminated in natural glacial till at 100± inches (8.3± feet) below ground surface.

NORTHEAST GEOTECHNICAL, INC.

TEST PIT LOG

Project: Proposed Residential Development
466 Chestnut Street
Ashland, MA

Test Pit/Deep Observation Hole Number: TP-2

Subcontractor: Silversmith Excavating Co., Inc.
Operator: Kevin
Equipment: Cat. 315DL Tracked Escavator
Capacity/Reach: 3/4± C.Y / 15± feet

Date/Weather: 4-6-2015 / Mostly Cloudy, 35 to 45˚F
Northeast Geotechnical Observer: Mark Zambernardi P.E.
Test Pit Location: See Exploration Location Plan
Ground Surface Elevation: 320± feet

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Depth (in.)	Soil Horizon/Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments		Soil Structure	Soil Consistence (Moist)	Other
			Depth (in.)	Color	Percent		Gravel	Cobbles & Stones			
0-12±	A	10YR 2/1	---	---	---	Silt Loam	---	---	Massive	Friable	
12-28±	B	10YR 6/8	---	---	---	Silt Loam	less than 5%	less than 5%	Massive	Friable	
28-100±	C	2.5Y 6/4	39±	2.5YR 7/8	less than 5±%	Sandy Loam	20±%	5±%	Granular	Firm	

Groundwater Observed: Yes
Depth Weeping from Pit: 72± inches
Depth Standing Water in Hole: ---

Estimated Depth (Elevation) to High Groundwater: 84± inches (Elevation 313± feet)

Notes:
1. Sample no. S-1 was obtained from about 28± to 100± inches below ground surface.
2. Test pit terminated in natural glacial till at 100± inches (8.3± feet) below ground surface.
3. Estimated depth to high groundwater based on weeping groundwater depths, and the groundwater conditions encountered in nearby test pit no. TP-1.

NORTHEAST GEOTECHNICAL, INC.

TEST PIT LOG

Project: Proposed Residential Development
466 Chestnut Street
Ashland, MA

Test Pit/Deep Observation Hole Number: TP-3

Subcontractor:	Silversmith Excavating Co., Inc.	Date/Weather:	4-7-2015 / Cloudy, Rain, 35 to 45˚F
Operator:	Kevin	Northeast Geotechnical Observer:	Mark Zambernardi P.E.
Equipment:	Cat. 315DL Tracked Escavator	Test Pit Location:	See Exploration Location Plan
Capacity/Reach:	3/4± C.Y / 15± feet	Ground Surface Elevation:	333± feet

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File No. O189.00
Reviewed By: Glenn Olson, P.E.

Depth (in.)	Soil Horizon/Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments		Soil Structure	Soil Consistence (Moist)	Other
			Depth (in.)	Color	Percent		Gravel	Cobbles & Stones			
0-4±	O	10YR 2/1	---	---	---	Silt	---	---	Massive	Friable	
4-10±	A	10YR 2/1	---	---	---	Silt	---	---	Massive	Friable	
10-27±	B	10YR 6/8	---	---	---	Silt	---	---	Massive	Friable	
27-36±	C_1	10YR 8/1	27±	10R 6/8	30±%	Silt Loam	---	---	Massive	Friable	
36-108±	C_2	10YR 6/6 to 7.5YR 6/2	---	---	---	Sandy Loam	20±%	5±%	Granular	Firm	

Groundwater Observed: Yes

Depth Weeping from Pit: 18± inches

Depth Standing Water in Hole: 92± inches

Estimated Depth (Elevation) to High Groundwater: 92± inches (Elevation 326± feet)

Notes:
1. Test pit walls were collapsing while the excavation was open.
2. Sample no. S-1 was obtained from about 27± to 36± inches below ground surface.
3. Sample no. S-2 was obtained from about 36± to 108± inches below ground surface.
4. Redoximorphic features appear to be indicative of a perched water condition.
5. Test pit terminated in natural glacial till at 108± inches (9± feet) below ground surface.

NORTHEAST GEOTECHNICAL, INC.

TEST PIT LOG

Project: Proposed Residential Development
466 Chestnut Street
Ashland, MA

Test Pit/Deep Observation Hole Number: TP-4

Subcontractor: Silversmith Excavating Co., Inc.
Operator: Kevin
Equipment: Cat. 315DL Tracked Escavator
Capacity/Reach: 3/4± C.Y / 15± feet

Date/Weather: 4-7-2015 / Cloudy, Rain, 35 to 45˚F
Northeast Geotechnical Observer: Mark Zambernardi P.E.
Test Pit Location: See Exploration Location Plan
Ground Surface Elevation: 332± feet

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File No. O189.00
Reviewed By: Glenn Olson, P.E.

Depth (in.)	Soil Horizon/Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments		Soil Structure	Soil Consistence (Moist)	Other
			Depth (in.)	Color	Percent		Gravel	Cobbles & Stones			
0-3±	O	10YR 2/1	---	---	---	Silt	---	---	Massive	Friable	
3-12±	A	10YR 2/1	---	---	---	Silt	---	---	Massive	Friable	
12-33±	B	10YR 6/8	---	---	---	Silt	---	---	Massive	Friable	
33-100±	C	10YR 6/6	36±	2.5YR 5/8	20±%	Sandy Loam	25±%	5±%	Granular	Firm	

Groundwater Observed: Yes
Depth Weeping from Pit: 18± inches
Depth Standing Water in Hole: 78± inches

Estimated Depth (Elevation) to High Groundwater: 78± inches (Elevation 326± feet)

Notes:
1. Test pit walls were collapsing while the excavation was open.
2. Sample no. S-1 was obtained from about 33± to 100± inches below ground surface.
3. Test pit terminated in natural glacial till at 100± inches (8.3± feet) below ground surface.
4. Redoximorphic features appeared to be isolated and indicative of a perched water condition.

NORTHEAST GEOTECHNICAL, INC.

TEST PIT LOG

Project: Proposed Residential Development
466 Chestnut Street
Ashland, MA

Test Pit/Deep Observation Hole Number: TP-5

Subcontractor: Silversmith Excavating Co., Inc.
Operator: Kevin
Equipment: Cat. 315DL Tracked Escavator
Capacity/Reach: 3/4± C.Y / 15± feet

Date/Weather: 4-7-2015 / Cloudy, Rain, 35 to 45˚F
Northeast Geotechnical Observer: Mark Zambernardi P.E.
Test Pit Location: See Exploration Location Plan
Ground Surface Elevation: 333± feet

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File No. O189.00
Reviewed By: Glenn Olson, P.E.

Depth (in.)	Soil Horizon/Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments		Soil Structure	Soil Consistence (Moist)	Other
			Depth (in.)	Color	Percent		Gravel	Cobbles & Stones			
0-3±	O	10YR 2/1	---	---	---	Silt	---	---	Massive	Friable	
3-6±	A	10YR 2/1	---	---	---	Silt	---	---	Massive	Friable	
6-36±	B	10YR 6/8	---	---	---	Silt	---	---	Massive	Friable	
36-102±	C	10YR 6/6	36±	2.5YR 5/8	20±%	Sandy Loam	25±%	10±%	Granular	Firm	

Groundwater Observed: Yes

Depth Weeping from Pit: 18± inches

Depth Standing Water in Hole: 84± inches

Estimated Depth (Elevation) to High Groundwater: 84± inches (Elevation 326± feet)

Notes:
1. Test pit walls were collapsing while the excavation was open.
2. Sample no. S-1 was obtained from about 36± to 102± inches below ground surface.
3. Test pit terminated in natural glacial till at 102± inches (8.5± feet) below ground surface.
4. Redoximorphic features appeared to be isolated and indicative of a perched water condition.

NORTHEAST GEOTECHNICAL, INC.

TEST PIT LOG

Project: Proposed Residential Development
466 Chestnut Street
Ashland, MA

Test Pit/Deep Observation Hole Number: TP-6

Subcontractor: Silversmith Excavating Co., Inc.
Operator: Kevin
Equipment: Cat. 315DL Tracked Escavator
Capacity/Reach: 3/4± C.Y / 15± feet

Date/Weather: 4-6-2015 / Mostly Cloudy, 35 to 45˚F
Northeast Geotechnical Observer: Mark Zambernardi P.E.
Test Pit Location: See Exploration Location Plan
Ground Surface Elevation: 321± feet

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File No. O189.00
Reviewed By: Glenn Olson, P.E.

Depth (in.)	Soil Horizon/Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments		Soil Structure	Soil Consistence (Moist)	Other
			Depth (in.)	Color	Percent		Gravel	Cobbles & Stones			
0-9±	A	10YR 2/1	---	---	---	Silt	---	---	Massive	Friable	
9-20±	B	10YR 6/8	---	---	---	Silt Loam	---	---	Massive	Friable	
20-33±	C_1	10YR 6/6	22±	2.5YR 6/8	50±%	Sandy Loam	---	---	Massive	Friable	
33-96±	C_2	2.5Y 6/4	---	---	---	Loam	20±%	5±%	Granular	Firm	

Groundwater Observed: Yes

Depth Weeping from Pit: 42± inches

Depth Standing Water in Hole: 80± inches

Estimated Depth (Elevation) to High Groundwater: 80± inches (Elevation 315± feet)

Notes:
1. Test pit walls were collapsing while the excavation was open.
2. Sample no. S-1 was obtained from about 20± to 33± inches below ground surface.
3. Sample no. S-2 was obtained from about 33± to 96± inches below ground surface.
4. Test pit terminated in natural glacial till at 96± inches (8± feet) below ground surface.
5. Redoximorphic features appear to be indicative of a perched water condition.

NORTHEAST GEOTECHNICAL, INC.

TEST PIT LOG

Project: Proposed Residential Development
466 Chestnut Street
Ashland, MA

Test Pit/Deep Observation Hole Number: TP-7

Subcontractor: Silversmith Excavating Co., Inc.
Operator: Kevin
Equipment: Cat. 315DL Tracked Escavator
Capacity/Reach: 3/4± C.Y / 15± feet

Date/Weather: 4-8-2015 / Sunny, 35-40˚F
Northeast Geotechnical Observer: Mark Zambernardi P.E.
Test Pit Location: See Exploration Location Plan
Ground Surface Elevation: 329± feet

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File No. O189.00
Reviewed By: Glenn Olson, P.E.

Depth (in.)	Soil Horizon/Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments		Soil Structure	Soil Consistence (Moist)	Other
			Depth (in.)	Color	Percent		Gravel	Cobbles & Stones			
0-15±	A	10YR 2/1	---	---	---	Silt	---	---	Massive	Friable	
15-34±	B	10YR 6/8	---	---	---	Silt	---	---	Massive	Friable	
34-46±	C_1	2.5Y 8/1	40±	2.5YR 6/8	25±%	Silt Loam	---	---	Massive	Friable	
46-108±	C_2	2.5Y 6/4	---	---	---	Sandy Loam	25±%	10±%	Granular	Firm	

Groundwater Observed: Yes
Depth Weeping from Pit: 28± inches
Depth Standing Water in Hole: 68± inches

Estimated Depth (Elevation) to High Groundwater: 68± inches (Elevation 324± feet)

Notes:
1. Test pit walls were collapsing while the excavation was open.
2. Sample no. S-1 was obtained from about 34± to 46± inches below ground surface.
3. Sample no. S-2 was obtained from about 46± to 108± inches below ground surface.
4. Test pit terminated in natural glacial till at 108± inches (9± feet) below ground surface.
5. Redoximorphic features appear to be indicative of a perched water condition.

NORTHEAST GEOTECHNICAL, INC.

TEST PIT LOG

Project: Proposed Residential Development
466 Chestnut Street
Ashland, MA

Test Pit/Deep Observation Hole Number: TP-8

Subcontractor: Silversmith Excavating Co., Inc.
Operator: Kevin
Equipment: Cat. 315DL Tracked Escavator
Capacity/Reach: 3/4± C.Y / 15± feet

Date/Weather: 4-8-2015 / Sunny, 35-40˚F
Northeast Geotechnical Observer: Mark Zambernardi P.E.
Test Pit Location: See Exploration Location Plan
Ground Surface Elevation: 329± feet

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File No. O189.00
Reviewed By: Glenn Olson, P.E.

Depth (in.)	Soil Horizon/Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments		Soil Structure	Soil Consistence (Moist)	Other
			Depth (in.)	Color	Percent		Gravel	Cobbles & Stones			
0-16±	A	10YR 2/1	---	---	---	Silt	---	---	Massive	Friable	
16-26±	B	10YR 6/8	---	---	---	Silt	---	---	Massive	Friable	
26-36±	C_1	2.5Y 8/1	36±	2.5YR 6/8	40±%	Silt Loam	---	---	Massive	Friable	
36-100±	C_2	2.5Y 6/4	---	---	---	Sandy Loam	25±%	10±%	Granular	Firm	

Groundwater Observed: Yes

Depth Weeping from Pit: 18± inches

Depth Standing Water in Hole: 62± inches

Estimated Depth (Elevation) to High Groundwater: 62± inches (Elevation 324± feet)

Notes:
1. Test pit walls were collapsing while the excavation was open.
2. Sample no. S-1 was obtained from about 26± to 36± inches below ground surface.
3. Sample no. S-2 was obtained from about 36± to 100± inches below ground surface.
4. Test pit terminated in natural glacial till at 100± inches (8.3± feet) below ground surface.
5. Redoximorphic features appear to be indicative of a perched water condition.

NORTHEAST GEOTECHNICAL, INC.

TEST PIT LOG

Project: Proposed Residential Development
466 Chestnut Street
Ashland, MA

Test Pit/Deep Observation Hole Number: TP-9

Subcontractor:	Silversmith Excavating Co., Inc.	Date/Weather:	4-6-2015 / Mostly Cloudy, 35 to 45˚F	Page:	1 of 1
Operator:	Kevin	Northeast Geotechnical Observer:	Mark Zambernardi P.E.	File No.	O189.00
Equipment:	Cat. 315DL Tracked Escavator	Test Pit Location:	See Exploration Location Plan	Reviewed By:	Glenn Olson, P.E.
Capacity/Reach:	3/4± C.Y / 15± feet	Ground Surface Elevation:	311± feet		

Depth (in.)	Soil Horizon/Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments		Soil Structure	Soil Consistence (Moist)	Other
			Depth (in.)	Color	Percent		Gravel	Cobbles & Stones			
0-7±	Topsoil Fill	10YR 2/1	---	---	---	Silt	---	---	Massive	Friable	
7-11±	Granular Fill	2.5Y 6/4	---	---	---	Sandy Loam	---	---	Granular	Loose	
11-101±	C	2.5Y 6/4	22±	10R 5/8	Less than 5%	Sandy Loam	25±%	10±%	Granular	Firm	

Groundwater Observed: Yes   Depth Weeping from Pit: 24± inches   Depth Standing Water in Hole: 75± inches

Estimated Depth (Elevation) to High Groundwater: 75± inches (Elevation 305± feet)

Notes:
1. Test pit walls were collapsing while the excavation was open.
2. Sample no. S-1 was obtained from about 11± to 101± inches below ground surface.
3. Test pit terminated in natural glacial till at 101± inches (8.4± feet) below ground surface.

NORTHEAST GEOTECHNICAL, INC.

TEST PIT LOG

Project: Proposed Residential Development
466 Chestnut Street
Ashland, MA

Test Pit/Deep Observation Hole Number: TP-10

Subcontractor: Silversmith Excavating Co., Inc.
Operator: Kevin
Equipment: Cat. 315DL Tracked Escavator
Capacity/Reach: 3/4± C.Y / 15± feet

Date/Weather: 4-6 and 4-9-2015 / Mostly Cloudy, 35 to 45˚F
Northeast Geotechnical Observer: Mark Zambernardi P.E.
Test Pit Location: See Exploration Location Plan
Ground Surface Elevation: 310± feet

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File No. O189.00
Reviewed By: Glenn Olson, P.E.

Depth (in.)	Soil Horizon/Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments		Soil Structure	Soil Consistence (Moist)	Other
			Depth (in.)	Color	Percent		Gravel	Cobbles & Stones			
0-6±	A	10YR 2/1	---	---	---	Silt	---	---	Massive	Friable	
6-12±	B	10YR 6/8	---	---	---	Silt Loam	---	---	Massive	Friable	
12-108±	C	10YR 6/6	60±	5YR 6/8	25±%	Sandy Loam	25±%	5±%	Granular	Firm	

Groundwater Observed: Yes
Depth Weeping from Pit: 22± inches
Depth Standing Water in Hole: 80± inches

Estimated Depth (Elevation) to High Groundwater: 60± inches (Elevation 305± feet)

Notes:
1. Test pit walls were collapsing while the excavation was open.
2. Sample no. S-1 was obtained from about 12± to 61± inches below ground surface.
3. Test pit terminated in natural glacial till at 108± inches (9± feet) below ground surface.

NORTHEAST GEOTECHNICAL, INC.

TEST PIT LOG	Project: Proposed Residential Development 466 Chestnut Street Ashland, MA	Test Pit/Deep Observation Hole Number: TP-11

Subcontractor: Silversmith Excavating Co., Inc.
Operator: Kevin
Equipment: Cat. 315DL Tracked Escavator
Capacity/Reach: 3/4± C.Y / 15± feet

Date/Weather: 4-9-2015 / Cloudy, Rain 35-40˚F
Northeast Geotechnical Observer: Mark Zambernardi P.E.
Test Pit Location: See Exploration Location Plan
Ground Surface Elevation: 325± feet

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File No. O189.00
Reviewed By: Glenn Olson, P.E.

Depth (in.)	Soil Horizon/Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments		Soil Structure	Soil Consistence (Moist)	Other
			Depth (in.)	Color	Percent		Gravel	Cobbles & Stones			
0-11±	A	10YR 2/1	---	---	---	Silt	---	---	Massive	Friable	
11-43±	B	10YR 6/8	36±	10R 6/8	less than 5±%	Silt Loam	less than 5±%	---	Massive	Friable	
43-111±	C	2.5Y 6/4	---	---	---	Loamy Sand	20±%	5±%	Granular	Firm	

Groundwater Observed: Yes

Depth Weeping from Pit: 46± inches

Depth Standing Water in Hole: 92± inches

Estimated Depth (Elevation) to High Groundwater: 92± inches (Elevation 318± feet)

Notes:
1. Test pit walls were collapsing while the excavation was open.
2. Sample no. S-1 was obtained from about 43± to 111± inches below ground surface.
3. Test pit terminated in natural glacial till at 111± inches (9.3± feet) below ground surface.

NORTHEAST GEOTECHNICAL, INC.

TEST PIT LOG

Project: Proposed Residential Development
466 Chestnut Street
Ashland, MA

Test Pit/Deep Observation Hole Number: TP-12

Subcontractor: Silversmith Excavating Co., Inc.
Operator: Kevin
Equipment: Cat. 315DL Tracked Escavator
Capacity/Reach: 3/4± C.Y / 15± feet

Date/Weather: 4-9-2015 / Cloudy, Rain 35-40˚F
Northeast Geotechnical Observer: Mark Zambernardi P.E.
Test Pit Location: See Exploration Location Plan
Ground Surface Elevation: 325± feet

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File No. O189.00
Reviewed By: Glenn Olson, P.E.

Depth (in.)	Soil Horizon/Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments		Soil Structure	Soil Consistence (Moist)	Other
			Depth (in.)	Color	Percent		Gravel	Cobbles & Stones			
0-2±	O	10YR 2/1	---	---	---	Silt	---	---	Massive	Friable	
2-10±	A	10YR 2/1	---	---	---	Silt	---	---	Massive	Friable	
10-24±	B	10YR 6/8	---	---	---	Silt	less than 5±%	---	Massive	Friable	
24-112±	C	2.5Y 6/4	---	---	---	Loamy Sand	20±%	5±%	Granular	Firm	

Groundwater Observed: Yes

Depth Weeping from Pit: 60± inches

Depth Standing Water in Hole: 91± inches

Estimated Depth (Elevation) to High Groundwater: 91± inches (Elevation 318± feet)

Notes:
1. Test pit walls were collapsing while the excavation was open.
2. Sample no. S-1 was obtained from about 24± to 112± inches below ground surface.
3. Test pit terminated in natural glacial till at 112± inches (9.3± feet) below ground surface.

NORTHEAST GEOTECHNICAL, INC.

TEST PIT LOG

Project: Proposed Residential Development
466 Chestnut Street
Ashland, MA

Test Pit/Deep Observation Hole Number: TP-13

Subcontractor: Silversmith Excavating Co., Inc.
Operator: Kevin
Equipment: Cat. 315DL Tracked Escavator
Capacity/Reach: 3/4± C.Y / 15± feet

Date/Weather: 4-9-2015 / Cloudy, Rain 35-40˚F
Northeast Geotechnical Observer: Mark Zambernardi P.E.
Test Pit Location: See Exploration Location Plan
Ground Surface Elevation: 317± feet

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Reviewed By: Glenn Olson, P.E.

Depth (in.)	Soil Horizon/Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments		Soil Structure	Soil Consistence (Moist)	Other
			Depth (in.)	Color	Percent		Gravel	Cobbles & Stones			
0-3±	O	10YR 2/1	---	---	---	Silt	---	---	Massive	Friable	
3-23±	A	10YR 2/1	---	---	---	Silt	---	---	Massive	Friable	
23-42±	B	10YR 6/8	---	---	---	Silt	---	---	Massive	Friable	
42-54±	C_1	2.5Y 8/1	---	---	---	Sandy Loam	---	---	Massive	Friable	
54-96±	C_2	2.5Y 6/4	54± inches	10R 6/8	20±%	Sandy Loam	20±%	10±%	Granular	Firm	

Groundwater Observed: Yes

Depth Weeping from Pit: 54± inches

Depth Standing Water in Hole: 75± inches

Estimated Depth (Elevation) to High Groundwater: 54± inches (Elevation 313± feet)

Notes:
1. Test pit walls were collapsing while the excavation was open.
2. Sample no. S-1 was obtained from about 42± to 54± inches below ground surface.
3. Sample no. S-2 was obtained from about 54± to 96± inches below ground surface.
4. Test pit terminated in natural glacial till at 96± inches (8± feet) below ground surface.

NORTHEAST GEOTECHNICAL, INC.

TEST PIT LOG

Project: Proposed Residential Development
466 Chestnut Street
Ashland, MA

Test Pit/Deep Observation Hole Number: TP-14

Subcontractor: Silversmith Excavating Co., Inc.
Operator: Kevin
Equipment: Cat. 315DL Tracked Escavator
Capacity/Reach: 3/4± C.Y / 15± feet

Date/Weather: 4-8-2015 / Cloudy, Rain, 35-40˚F
Northeast Geotechnical Observer: Mark Zambernardi P.E.
Test Pit Location: See Exploration Location Plan
Ground Surface Elevation: 316± feet

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File No. O189.00
Reviewed By: Glenn Olson, P.E.

Depth (in.)	Soil Horizon/Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments		Soil Structure	Soil Consistence (Moist)	Other
			Depth (in.)	Color	Percent		Gravel	Cobbles & Stones			
0-3±	O	10YR 2/1	---	---	---	Silt	---	---	Massive	Friable	
3-16±	A	10YR 2/1	---	---	---	Silt	---	---	Massive	Friable	
16-40±	B	10YR 6/8	---	---	---	Silt Loam	---	---	Massive	Friable	
40-108±	C	2.5Y 6/4	---	---	---	Sandy Loam	20±%	5±%	Granular	Firm	

Groundwater Observed: Yes

Depth Weeping from Pit: 58± inches

Depth Standing Water in Hole: 91± inches

Estimated Depth (Elevation) to High Groundwater: 91± inches (Elevation 309± feet)

Notes:
1. Test pit walls were collapsing while the excavation was open.
2. Sample no. S-1 was obtained from about 40± to 108± inches below ground surface.
3. Test pit terminated in natural glacial till at 108± inches (9± feet) below ground surface.

NORTHEAST GEOTECHNICAL, INC.

TEST PIT LOG	Project: Proposed Residential Development 466 Chestnut Street Ashland, MA	Test Pit/Deep Observation Hole Number: TP-15

Subcontractor:	Silversmith Excavating Co., Inc.	Date/Weather:	4-8-2015 / Cloudy, Rain, 35-40˚F	Page:	1 of 1
Operator:	Kevin	Northeast Geotechnical Observer:	Mark Zambernardi P.E.	File No.	O189.00
Equipment:	Cat. 315DL Tracked Escavator	Test Pit Location:	See Exploration Location Plan	Reviewed By:	Glenn Olson, P.E.
Capacity/Reach:	3/4± C.Y / 15± feet	Ground Surface Elevation:	312± feet		

Depth (in.)	Soil Horizon/Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments		Soil Structure	Soil Consistence (Moist)	Other
			Depth (in.)	Color	Percent		Gravel	Cobbles & Stones			
0-3±	O	10YR 2/1	---	---	---	Silt	---	---	Massive	Friable	
3-12±	A	10YR 2/1	---	---	---	Silt	---	---	Massive	Friable	
12-28±	B	10YR 6/8	---	---	---	Silt	---	---	Massive	Friable	
28-108±	C	2.5Y 6/4	---	---	---	Sandy Loam	20±%	5±%	Granular	Firm	

Groundwater Observed: Yes   Depth Weeping from Pit: 48± inches   Depth Standing Water in Hole: 92± inches

Estimated Depth (Elevation) to High Groundwater: 92± inches (Elevation 305± feet)

Notes:
1. Test pit walls were collapsing while the excavation was open.
2. Sample no. S-1 was obtained from about 28± to 108± inches below ground surface.
3. Test pit terminated in natural glacial till at 108± inches (9± feet) below ground surface.

NORTHEAST GEOTECHNICAL, INC.

TEST PIT LOG

Project: Proposed Residential Development
466 Chestnut Street
Ashland, MA

Test Pit/Deep Observation Hole Number: TP-16

Subcontractor: Silversmith Excavating Co., Inc.
Operator: Kevin
Equipment: Cat. 315DL Tracked Escavator
Capacity/Reach: 3/4± C.Y / 15± feet

Date/Weather: 4-8-2015 / Cloudy, Rain, 35-40˚F
Northeast Geotechnical Observer: Mark Zambernardi P.E.
Test Pit Location: See Exploration Location Plan
Ground Surface Elevation: 311± feet

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File No. O189.00
Reviewed By: Glenn Olson, P.E.

Depth (in.)	Soil Horizon/Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments		Soil Structure	Soil Consistence (Moist)	Other
			Depth (in.)	Color	Percent		Gravel	Cobbles & Stones			
0-3±	O	10YR 2/1	---	---	---	Silt	---	---	Massive	Friable	
3-16±	A	10YR 2/1	---	---	---	Silt	---	---	Massive	Friable	
16-40±	B	10YR 6/8	---	---	---	Silt	---	---	Massive	Friable	
40-102±	C	2.5Y 6/4	---	---	---	Sandy Loam	20±%	5±%	Granular	Firm	

Groundwater Observed: Yes

Depth Weeping from Pit: 58± inches

Depth Standing Water in Hole: 97± inches

Estimated Depth (Elevation) to High Groundwater: 97± inches (Elevation 303± feet)

Notes:
1. Test pit walls were collapsing while the excavation was open.
2. Sample no. S-1 was obtained from about 40± to 102± inches below ground surface.
3. Test pit terminated in natural glacial till at 102± inches (8.5± feet) below ground surface.

NORTHEAST GEOTECHNICAL, INC.

TEST PIT LOG

Project: Proposed Residential Development
466 Chestnut Street
Ashland, MA

Test Pit/Deep Observation Hole Number: TP-17

Subcontractor: Silversmith Excavating Co., Inc.
Operator: Kevin
Equipment: Cat. 315DL Tracked Escavator
Capacity/Reach: 3/4± C.Y / 15± feet

Date/Weather: 4-8-2015 / Sunny, 35-40˚F
Northeast Geotechnical Observer: Mark Zambernardi P.E.
Test Pit Location: See Exploration Location Plan
Ground Surface Elevation: 305± feet

Page: 1 of 1
File No. O189.00
Reviewed By: Glenn Olson, P.E.

Depth (in.)	Soil Horizon/Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments		Soil Structure	Soil Consistence (Moist)	Other
			Depth (in.)	Color	Percent		Gravel	Cobbles & Stones			
0-3±	O	10YR 2/1	---	---	---	Silt	---	---	Massive	Friable	
3-10±	A	10YR 2/1	---	---	---	Silt	---	---	Massive	Friable	
10-36±	B	10YR 6/8	---	---	---	Silt	---	---	Massive	Friable	
36-102±	C	2.5Y 6/4	36±	2.5YR 6/8	less than 5±%	Sandy Loam	20±%	5±%	Granular	Firm	

Groundwater Observed: Yes

Depth Weeping from Pit: 32± inches

Depth Standing Water in Hole: 76± inches

Estimated Depth (Elevation) to High Groundwater: 76± inches (Elevation 299± feet)

Notes:
1. Test pit walls were collapsing while the excavation was open.
2. Sample no. S-1 was obtained from about 36± to 100± inches below ground surface.
3. Test pit terminated in natural glacial till at 102± inches (8.5± feet) below ground surface.

NORTHEAST GEOTECHNICAL, INC.

TEST PIT LOG

Project: Proposed Residential Development
466 Chestnut Street
Ashland, MA

Test Pit/Deep Observation Hole Number: TP-18

Subcontractor: Silversmith Excavating Co., Inc.
Operator: Kevin
Equipment: Cat. 315DL Tracked Escavator
Capacity/Reach: 3/4± C.Y / 15± feet

Date/Weather: 4-8-2015 / Sunny, 35-40˚F
Northeast Geotechnical Observer: Mark Zambernardi P.E.
Test Pit Location: See Exploration Location Plan
Ground Surface Elevation: 303± feet

Page: 1 of 1
File No. O189.00
Reviewed By: Glenn Olson, P.E.

Depth (in.)	Soil Horizon/Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments		Soil Structure	Soil Consistence (Moist)	Other
			Depth (in.)	Color	Percent		Gravel	Cobbles & Stones			
0-3±	O	10YR 2/1	---	---	---	Silt	---	---	Massive	Friable	
3-11±	A	10YR 2/1	---	---	---	Silt	less than 5±%	---	Massive	Friable	
11-33±	B	10YR 6/8	30±	5YR 6/8	less than 5±%	Silt	---	---	Massive	Friable	
33-108±	C	2.5Y 6/4	52±	5YR 7/8	40±%	Sandy Loam	20±%	5±%	Granular	Firm	

Groundwater Observed: Yes

Depth Weeping from Pit: 30± inches

Depth Standing Water in Hole: 87± inches

Estimated Depth (Elevation) to High Groundwater: 52± inches (Elevation 299± feet)

Notes:
1. Test pit walls were collapsing while the excavation was open.
2. Sample no. S-1 was obtained from about 33± to 108± inches below ground surface.
3. Test pit terminated in natural glacial till at 108± inches (9± feet) below ground surface.

APPENDIX C

Test Pit Logs (TP-19 through TP-26)

NORTHEAST GEOTECHNICAL, INC.

TEST PIT LOG

Project:	Proposed Residential Development 466 Chestnut Street Ashland, MA	Test Pit No.: TP-19 Page: 1 of 1 File No.: O189.00 Reviewed By: Glenn Olson, P.E.

Subcontractor:	Silversmith Excavating Co., Inc.	Date/Weather:	4-6-2015 / Mostly Cloudy, 35 to 45˚F
Operator:	Kevin	Northeast Geotechnical Observer:	Mark Zambernardi, P.E.
Equipment:	Cat. 315DL Tracked Excavator	Test Pit Location:	See Exploration Location Plan
Capacity/Reach:	3/4± C.Y / 15± feet	Ground Surface Elevation:	326± feet

Depth	Strata Change	Soil Description (Burmister Identification System)	Excavation Effort	Boulder Count	Note No.
	Topsoil Fill 0.6'±	Damp, black, SILT, some fine Sand, some Roots	E		
1' 2'	Granular Fill 1.8'±	Light brown, fine to coarse SAND, some (+) Silt, little (-) fine to coarse Gravel	E		1
3' 4'	Fine Sand and Silt 4.3'±	Damp, beige to orange, fine SAND and SILT	E		
5' 6' 7' 8'	Glacial Till 8.5'±	Damp to wet, brown, fine to coarse SAND, some Silt, some fine to coarse Gravel, trace Cobbles	M	10±A	2 3
9' 10' 11' 12' 13' 14' 15'		Bottom of test pit in natural glacial till at 8.5± feet			

Notes:
1. Sample no. S-1 obtained from about 0.6± to 1.8± feet below the ground surface.
2. Groundwater was seeping into the test pit at a depth of about 5.5± feet below the ground surface.
3. The test pit was terminated in natural glacial till at a depth of about 8.5± feet below the ground surface.

Test Pit Dimensions		Boulder Classification		Proportions Used	Abbreviations	Excavation Effort
N/S =	10±	Diameter	Class	Trace (T): 0-10%	F = Fine	E = Easy
		6" - 18"	A	Little (Li): 10-20%	M = Medium	M = Moderate
E/W =	4±	18" - 36"	B	Some (So): 20-35%	C = Coarse	D = Difficult
		>36"	C	And: 35-50%	F/M = Fine to Medium	

NORTHEAST GEOTECHNICAL, INC.

TEST PIT LOG

Project:	Proposed Residential Development 466 Chestnut Street Ashland, MA	Test Pit No.:	TP-20
		Page:	1 of 1
		File No.:	O189.00
		Reviewed By:	Glenn Olson, P.E.

Subcontractor:	Silversmith Excavating Co., Inc.	Date/Weather:	4-6-2015 / Mostly Cloudy, 35 to 45˚F
Operator:	Kevin	Northeast Geotechnical Observer:	Mark Zambernardi, P.E.
Equipment:	Cat. 315DL Tracked Excavator	Test Pit Location:	See Exploration Location Plan
Capacity/Reach:	3/4± C.Y / 15± feet	Ground Surface Elevation:	342± feet

Depth	Strata Change	Soil Description (Burmister Identification System)	Excavation Effort	Boulder Count	Note No.
	Forest Mat 0.3'±	Damp, black, SILT, little fine Sand mixed with Roots and Leaves	E		
1'	Topsoil 0.9'±	Damp, dark brown, SILT and fine SAND, trace Roots	E		
	Subsoil 1.8'±	Damp, light brown, SILT and fine SAND, trace Roots	E		
2'					1
3'					
4'					2
5'	Glacial Till	Damp to wet, brown, fine to coarse SAND, some fine to coarse Gravel, little Silt, trace Cobbles	M/D	10±A	
6'					
7'					
8'					3
9'	8.8'±				4
10'		Bottom of test pit in natural glacial till at 8.8± feet			
11'					
12'					
13'					
14'					
15'					

Notes:
1. Sample no. S-1 obtained from about 1.8± to 8.8± feet below the ground surface.
2. Groundwater was seeping into the test pit at a depth of about 4.3± feet below the ground surface.
3. Standing groundwater was observed at a depth of about 8± feet below the ground surface.
4. The test pit was terminated in natural glacial till at a depth of about 8.5± feet below the ground surface.

Test Pit Dimensions		Boulder Classification		Proportions Used	Abbreviations	Excavation Effort
N/S =	**12±**	Diameter	Class	Trace (T): 0-10%	F = Fine	E = Easy
		6" - 18"	A	Little (Li): 10-20%	M = Medium	M = Moderate
E/W =	**4±**	18" - 36"	B	Some (So): 20-35%	C = Coarse	D = Difficult
		>36"	C	And: 35-50%	F/M = Fine to Medium	

NORTHEAST GEOTECHNICAL, INC.

TEST PIT LOG		
Project:	Proposed Residential Development 466 Chestnut Street Ashland, MA	Test Pit No.: TP-21 Page: 1 of 1 File No.: O189.00 Reviewed By: Glenn Olson, P.E.

Subcontractor:	Silversmith Excavating Co., Inc.	Date/Weather:	4-7-2015 / Cloudy, Rain, 35 to 45˚F
Operator:	Kevin	Northeast Geotechnical Observer:	Mark Zambernardi, P.E.
Equipment:	Cat. 315DL Tracked Excavator	Test Pit Location:	See Exploration Location Plan
Capacity/Reach:	3/4± C.Y / 15± feet	Ground Surface Elevation:	342± feet

Depth	Strata Change	Soil Description (Burmister Identification System)	Excavation Effort	Boulder Count	Note No.
	Forest Mat 0.3'±	Damp, black, SILT, little fine Sand mixed with Roots and Leaves	E		
1'	Topsoil 0.8'±	Damp, dark brown, SILT, little fine Sand, little Roots	E		
2'	Subsoil 2.6'±	Damp, light brown, SILT, little fine Sand, trace fine to coarse Gravel, trace Cobbles, trace Roots	E		
3'					1,2
4'					
5'					
6'	Glacial Till	Damp to wet, grayish brown, fine to coarse SAND, some Silt, little (-) fine to coarse Gravel, trace Cobbles	E/M	5±A	
7'					3,4
8'					
9'	9'±				5
10'		Bottom of test pit in natural glacial till/boulders at 9± feet			
11'					
12'					
13'					
14'					
15'					

Notes:
1. Sample no. S-1 obtained from about 2.6± to 9± feet below the ground surface.
2. Groundwater was seeping into the test pit at a depth of about 3± feet below the ground surface.
3. Standing groundwater was observed at a depth of about 7± feet below the ground surface.
4. The test pit walls collapsed while the excavation was open.
5. The test pit was terminated in natural bouldery glacial till at a depth of about 9± feet below the ground surface.

Test Pit Dimensions		Boulder Classification		Proportions Used	Abbreviations	Excavation Effort
N/S =	**10±**	Diameter	Class	Trace (T): 0-10%	F = Fine	E = Easy
		6" - 18"	A	Little (Li): 10-20%	M = Medium	M = Moderate
E/W =	**4±**	18" - 36"	B	Some (So): 20-35%	C = Coarse	D = Difficult
		>36"	C	And: 35-50%	F/M = Fine to Medium	

NORTHEAST GEOTECHNICAL, INC.

TEST PIT LOG

Project:	Proposed Residential Development 466 Chestnut Street Ashland, MA
Test Pit No.:	TP-22
Page:	1 of 1
File No.:	O189.00
Reviewed By:	Glenn Olson, P.E.

Subcontractor:	Silversmith Excavating Co., Inc.	Date/Weather:	4-7-2015 / Cloudy, Rain, 35 to 45˚F
Operator:	Kevin	Northeast Geotechnical Observer:	Mark Zambernardi, P.E.
Equipment:	Cat. 315DL Tracked Excavator	Test Pit Location:	See Exploration Location Plan
Capacity/Reach:	3/4± C.Y / 15± feet	Ground Surface Elevation:	337± feet

Depth	Strata Change	Soil Description (Burmister Identification System)	Excavation Effort	Boulder Count	Note No.
	Forest Mat 0.4'	Damp, black, SILT, little fine Sand mixed with Roots and Leaves	E		
1'	Topsoil 0.9'	Damp, dark brown, SILT, little fine Sand, trace Roots	E		
2'	Subsoil	Wet, light brown, SILT, little fine Sand, trace Roots	E		2
3'	3'				
4'					1
5'					
6'					
7'	Glacial Till	Damp to wet, grayish brown, fine to coarse SAND, some Silt, little fine to coarse Gravel, trace Cobbles	M	10±A	
8'					3,4
9'					
10'	9.8'				5
11'		Bottom of test pit in natural glacial till at 9.8± feet			
12'					
13'					
14'					
15'					

Notes:
1. Sample no. S-1 obtained from about 3± to 9.8± feet below the ground surface.
2. Groundwater was seeping into the test pit at a depth of about 2± feet below the ground surface.
3. Standing groundwater was observed at a depth of about 7± feet below the ground surface.
4. The test pit walls collapsed while the excavation was open.
5. The test pit was terminated in natural glacial till at a depth of about 9.8± feet below the ground surface.

Test Pit Dimensions		Boulder Classification		Proportions Used	Abbreviations	Excavation Effort
		Diameter	Class	Trace (T): 0-10%	F = Fine	E = Easy
N/S =	**10±**	6" - 18"	A	Little (Li): 10-20%	M = Medium	M = Moderate
E/W =	**4±**	18" - 36"	B	Some (So): 20-35%	C = Coarse	D = Difficult
		>36"	C	And: 35-50%	F/M = Fine to Medium	

NORTHEAST GEOTECHNICAL, INC.

TEST PIT LOG	Project: Proposed Residential Development 466 Chestnut Street Ashland, MA	Test Pit No.: TP-23 Page: 1 of 1 File No.: O189.00 Reviewed By: Glenn Olson, P.E.

Subcontractor:	Silversmith Excavating Co., Inc.	Date/Weather:	4-7-2015 / Cloudy, Rain, 35 to 45˚F
Operator:	Kevin	Northeast Geotechnical Observer:	Mark Zambernardi, P.E.
Equipment:	Cat. 315DL Tracked Excavator	Test Pit Location:	See Exploration Location Plan
Capacity/Reach:	3/4± C.Y / 15± feet	Ground Surface Elevation:	340± feet

Depth	Strata Change	Soil Description (Burmister Identification System)	Excavation Effort	Boulder Count	Note No.
1'	Forest Mat 0.3'±	Damp, black, SILT, little fine Sand mixed with Roots and Leaves	E		
	Topsoil 1.1'±	Damp, dark brown, SILT, little fine Sand,	E		
2' 3'	Subsoil 3'±	Damp, light brown, SILT, little fine Sand, trace Roots	E		
4'	Sandy Silt 4.5'±	Damp, grayish brown to beige, SILT, little fine Sand	E		
5' 6' 7' 8' 9' 10'	Glacial Till 10'±	Wet, brown, fine to coarse SAND, some Silt, some (-) fine to coarse Gravel, trace Cobbles	E/M	10±A	1,2 3,4 5
11' 12' 13' 14' 15'		Bottom of test pit in natural glacial till at 10± feet			

Notes:
1. Sample no. S-1 obtained from about 4.5± to 10± feet below the ground surface.
2. Groundwater was seeping into the test pit at a depth of about 4.8± feet below the ground surface.
3. Standing groundwater was observed at a depth of about 7.5± feet below the ground surface.
4. The test pit walls collapsed while the excavation was open.
5. The test pit was terminated in natural glacial till at a depth of about 10± feet below the ground surface.

Test Pit Dimensions	Boulder Classification		Proportions Used	Abbreviations	Excavation Effort
N/S = ±	Diameter	Class	Trace (T): 0-10%	F = Fine	E = Easy
	6" - 18"	A	Little (Li): 10-20%	M = Medium	M = Moderate
E/W = ±	18" - 36"	B	Some (So): 20-35%	C = Coarse	D = Difficult
	>36"	C	And: 35-50%	F/M = Fine to Medium	

NORTHEAST GEOTECHNICAL, INC.

TEST PIT LOG

Project:	Proposed Residential Development 466 Chestnut Street Ashland, MA	Test Pit No.:	TP-24
		Page:	1 of 1
		File No.:	O189.00
		Reviewed By:	Glenn Olson, P.E.

Subcontractor:	Silversmith Excavating Co., Inc.	Date/Weather:	4-7-2015 / Cloudy, Rain, 35 to 45˚F
Operator:	Kevin	Northeast Geotechnical Observer:	Mark Zambernardi, P.E.
Equipment:	Cat. 315DL Tracked Excavator	Test Pit Location:	See Exploration Location Plan
Capacity/Reach:	3/4± C.Y / 15± feet	Ground Surface Elevation:	333± feet

Depth	Strata Change	Soil Description (Burmister Identification System)	Excavation Effort	Boulder Count	Note No.
	Root Mat 0.3'±	Damp, black, SILT, little fine Sand mixed with Roots and Leaves	E		
1'	Topsoil 1.2'±	Damp, dark brown, SILT, some Roots, little fine Sand	E		
2'	Subsoil 2.5'±	Damp, light brown, SILT, little fine Sand, trace Roots	E		2
3'	Sandy Silt 3.5'±	Damp, tan, SILT, some fine Sand	E		
4' 5' 6'	Glacial Till 6'±	Damp, to wet, grayish brown, fine to coarse SAND, some Silt, little fine to coarse Gravel, trace Cobbles	E/M	5±A	1 3,4 5
7' 8' 9' 10' 11' 12' 13' 14' 15'		Bottom of test pit in natural glacial till at 6± feet			

Notes:
1. Sample no. S-1 obtained from about 3.5± to 6± feet below the ground surface.
2. Groundwater was seeping into the test pit at a depth of about 2.5± feet below the ground surface.
3. Standing groundwater was observed at a depth of about 5.5± feet below the ground surface.
4. The test pit walls collapsed while the excavation was open.
5. The test pit was terminated in natural glacial till at a depth of about 6± feet below the ground surface.

Test Pit Dimensions		Boulder Classification		Proportions Used	Abbreviations	Excavation Effort
N/S =	**4±**	Diameter	Class	Trace (T): 0-10%	F = Fine	E = Easy
		6" - 18"	A	Little (Li): 10-20%	M = Medium	M = Moderate
E/W =	**10±**	18" - 36"	B	Some (So): 20-35%	C = Coarse	D = Difficult
		>36"	C	And: 35-50%	F/M = Fine to Medium	

NORTHEAST GEOTECHNICAL, INC.

TEST PIT LOG

Project:	Proposed Residential Development 466 Chestnut Street Ashland, MA
Test Pit No.:	TP-25
Page:	1 of 1
File No.:	O189.00
Reviewed By:	Glenn Olson, P.E.

Subcontractor:	Silversmith Excavating Co., Inc.	Date/Weather:	4-7-2015 / Cloudy, Rain, 35 to 45˚F
Operator:	Kevin	Northeast Geotechnical Observer:	Mark Zambernardi, P.E.
Equipment:	Cat. 315DL Tracked Excavator	Test Pit Location:	See Exploration Location Plan
Capacity/Reach:	3/4± C.Y / 15± feet	Ground Surface Elevation:	336± feet

Depth	Strata Change	Soil Description (Burmister Identification System)	Excavation Effort	Boulder Count	Note No.
	Forest Mat 0.3'±	Damp, black, Silt, little fine Sand mixed with Roots and Leaves	E		
1'	Topsoil 1'±	Damp, dark brown, SILT, some fine Sand, some Roots	E		
2'	Subsoil 2'±	Damp, light brown, SILT, little fine Sand, trace Roots	E		
3'–6'	Glacial Till 6.2'±	Damp to wet, grayish brown, fine to coarse Sand, some fine to coarse Gravel, some Silt, trace Cobbles	E/M	5±A	1, 2
7'		Bottom of test pit in natural glacial till at 6.2± feet			
8'					
9'					
10'					
11'					
12'					
13'					
14'					
15'					

Notes:
1. Groundwater was seeping into the test pit at a depth of about 4.5± feet below the ground surface.
2. The test pit was terminated in natural glacial till at a depth of about 6.2± feet below the ground surface.

Test Pit Dimensions		Boulder Classification		Proportions Used	Abbreviations	Excavation Effort
N/S =	4±	Diameter	Class	Trace (T): 0-10%	F = Fine	E = Easy
		6" - 18"	A	Little (Li): 10-20%	M = Medium	M = Moderate
E/W =	10±	18" - 36"	B	Some (So): 20-35%	C = Coarse	D = Difficult
		>36"	C	And: 35-50%	F/M = Fine to Medium	

NORTHEAST GEOTECHNICAL, INC.

TEST PIT LOG	Project: Proposed Residential Development, 466 Chestnut Street, Ashland, MA	Test Pit No.: TP-26 Page: 1 of 1 File No.: O189.00 Reviewed By: Glenn Olson, P.E.

Subcontractor:	Silversmith Excavating Co., Inc.	Date/Weather:	4-8-2015 / Partly Cloudy, 40˚F
Operator:	Kevin	Northeast Geotechnical Observer:	Mark Zambernardi, P.E.
Equipment:	Cat. 315DL Tracked Excavator	Test Pit Location:	See Exploration Location Plan
Capacity/Reach:	3/4± C.Y / 15± feet	Ground Surface Elevation:	320± feet

Depth	Strata Change	Soil Description (Burmister Identification System)	Excavation Effort	Boulder Count	Note No.
	Root Mat 0.3'±	Damp, black, SILT, trace fine Sand mixed with Roots and Leaves	E		
1'	Topsoil 1.3'±	Damp, dark brown, SILT, little fine Sand, little Roots	E		
2'	Subsoil 2.5'±	Damp, light brown, SILT, some fine Sand, trace Roots	E		
3' 4' 5'	Glacial Till 5'±	Damp to wet, grayish brown, fine to medium SAND, some Silt, little (+) fine to coarse Gravel, trace Cobbles	M	5±A	1 2
6'		Bottom of test pit in natural glacial till at 5± feet			
7'					
8'					
9'					
10'					
11'					
12'					
13'					
14'					
15'					

Notes:
1. Groundwater was seeping into the test pit at a depth of about 3.8± feet below the ground surface.
2. The test pit was terminated in natural glacial till at a depth of about 5± feet below the ground surface.

Test Pit Dimensions	Boulder Classification		Proportions Used	Abbreviations	Excavation Effort
N/S = **10±**	Diameter	Class	Trace (T): 0-10%	F = Fine	E = Easy
	6" - 18"	A	Little (Li): 10-20%	M = Medium	M = Moderate
E/W = **4±**	18" - 36"	B	Some (So): 20-35%	C = Coarse	D = Difficult
	>36"	C	And: 35-50%	F/M = Fine to Medium	

APPENDIX D

Soil Laboratory Test Results

Client:	Northeast Geotechnical, Inc.		
Project:	Proposed Residential Development		
Location:	Ashland, MA	Project No:	GTX-303030
Boring ID: TP-1	Sample Type: bag	Tested By:	jbr
Sample ID: S-1	Test Date: 04/14/15	Checked By:	emm
Depth : 25-30 in	Test Id: 327732		
Test Comment:	---		
Sample Description:	Moist, yellowish brown silt with sand		
Sample Comment:	---		

USDA Textural Classification

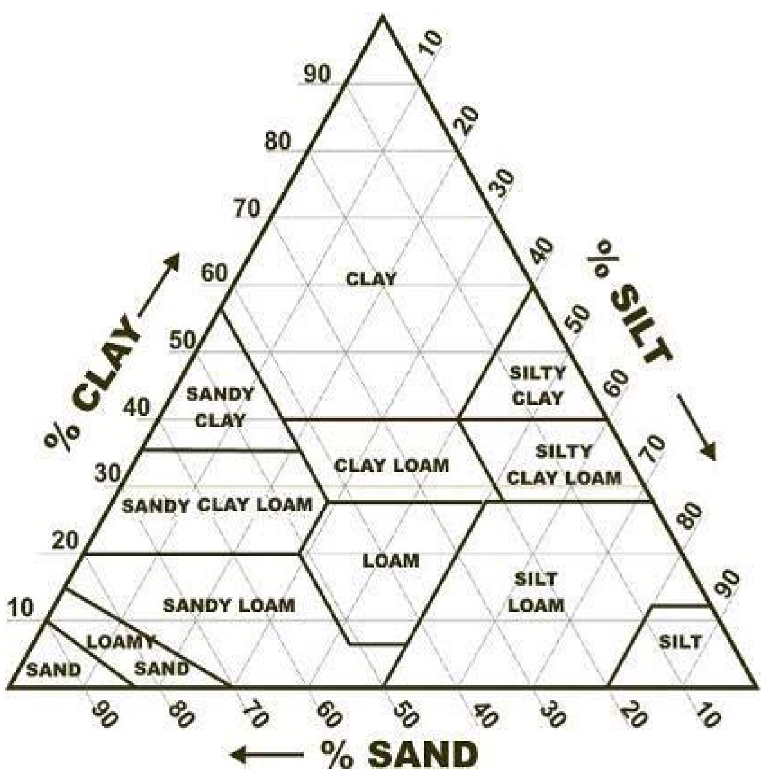
Boring ID	Sample ID	Depth	Sand, %	Silt, %	Clay, %	Classification
TP-1	S-1	25-30 in	33	65	2	Silt Loam

Classifications based only on material passing the #10 sieve

Sand: material passing 2.0 mm and retained on 0.05 mm diameter

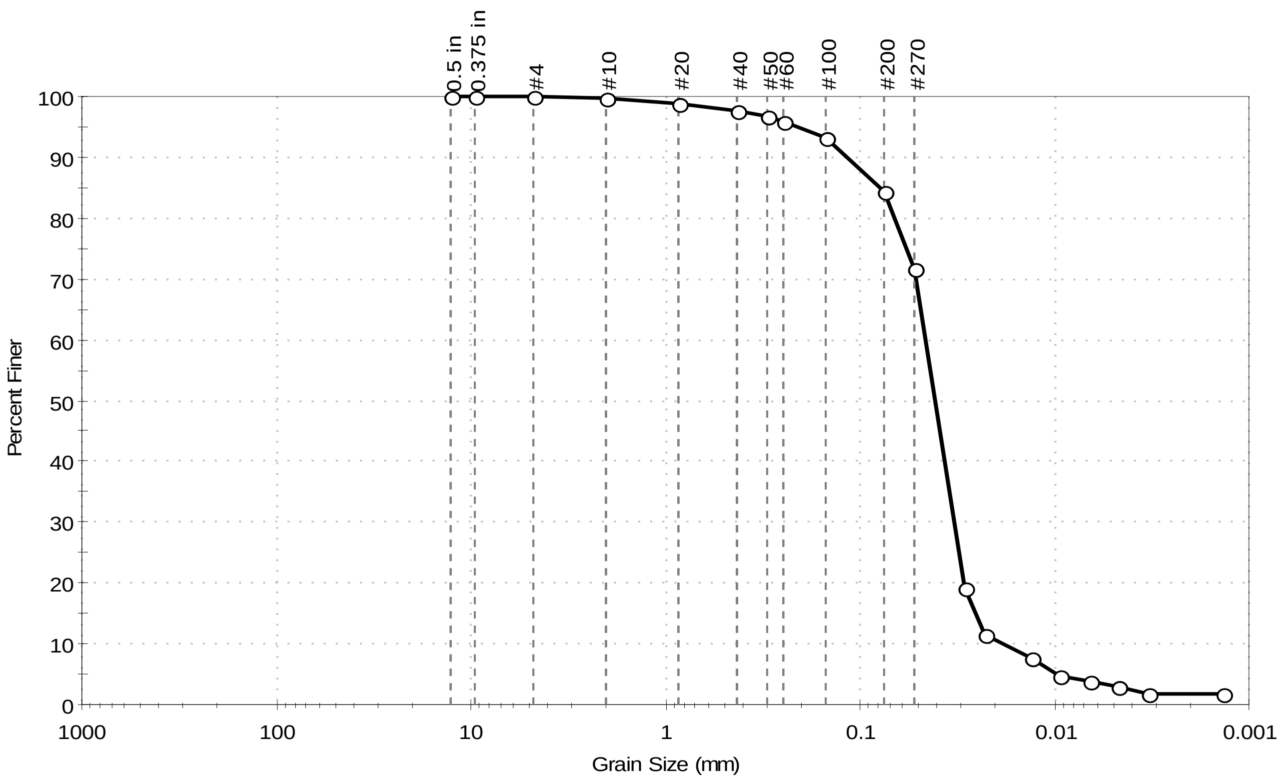
Silt: material passing 0.05 mm and retained on 0.002 mm diameter

Clay: material passing 0.002 mm diameter



Client:	Northeast Geotechnical, Inc.		
Project:	Proposed Residential Development		
Location:	Ashland, MA	Project No:	GTX-303030
Boring ID: TP-1	Sample Type: bag	Tested By:	jbr
Sample ID: S-1	Test Date: 04/15/15	Checked By:	n/a
Depth : 25-30 in	Test Id: 327744		
Test Comment:	---		
Sample Description:	Moist, yellowish brown silt with sand		
Sample Comment:	---		

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.1	15.6	84.3

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.5 in	12.70	100		
0.375 in	9.50	100		
#4	4.75	100		
#10	2.00	100		
#20	0.85	99		
#40	0.42	98		
#50	0.30	97		
#60	0.25	96		
#100	0.15	93		
#200	0.075	84		
#270	0.053	72		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0290	19		
---	0.0227	11		
---	0.0130	8		
---	0.0093	5		
---	0.0066	4		
---	0.0047	3		
---	0.0033	2		
---	0.0014	2		

Coefficients

D_{85} = 0.0796 mm
D_{30} = 0.0329 mm
D_{60} = 0.0464 mm
D_{15} = 0.0255 mm
D_{50} = 0.0414 mm
D_{10} = 0.0185 mm
C_u = 2.508
C_c = 1.261

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Dispersion Device : Apparatus A - Mech Mixer

Dispersion Period : 1 minute

Specific Gravity : 2.65

Separation of Sample: #270 Sieve

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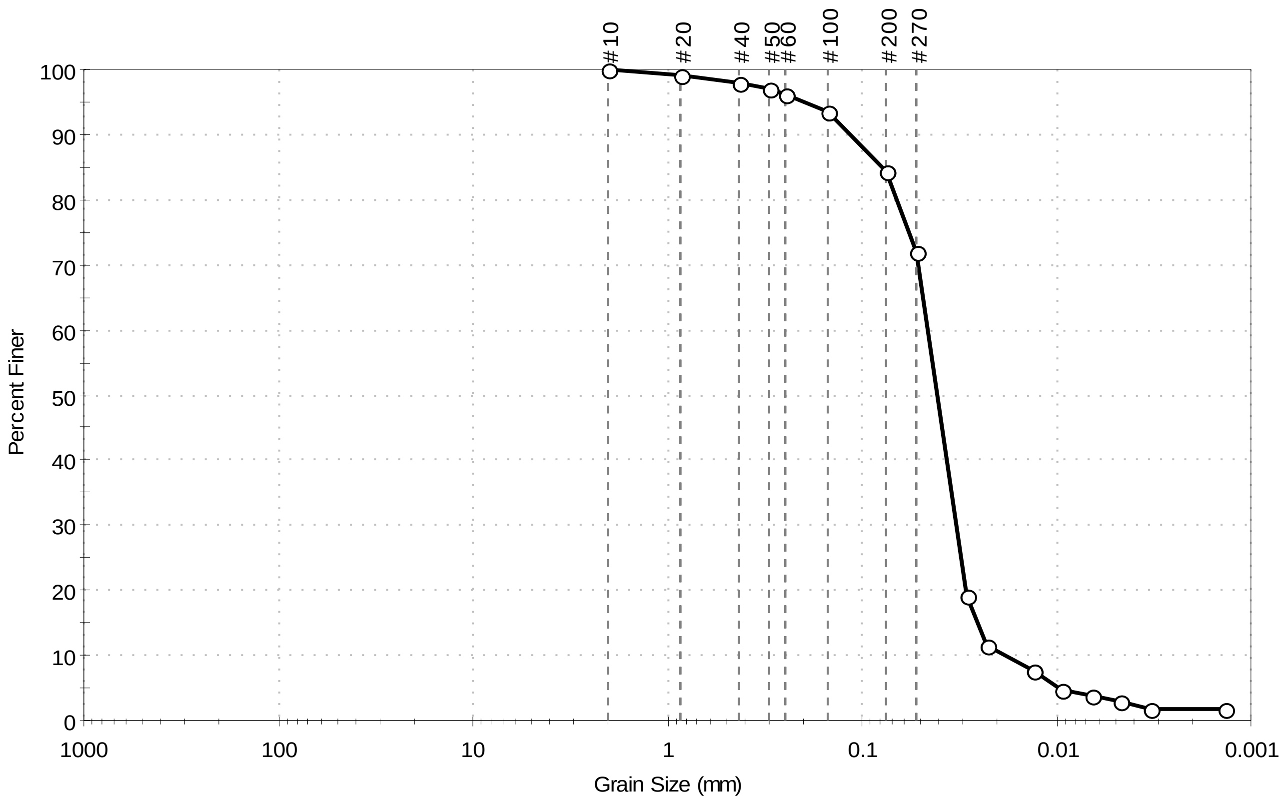
Client:	Northeast Geotechnical, Inc.		
Project:	Proposed Residential Development		
Location:	Ashland, MA	Project No:	GTX-303030
Boring ID: TP-1	Sample Type: bag	Tested By:	jbr
Sample ID: S-1	Test Date: 04/15/15	Checked By:	n/a
Depth : 25-30 in	Test Id: 327744		
Test Comment:	Only minus No. 10 sieve for USDA classification		
Sample Description:	Moist, yellowish brown silt with sand		
Sample Comment:	---		

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.0	15.5	84.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#10	2.00	100		
#20	0.85	99		
#40	0.42	98		
#50	0.30	97		
#60	0.25	96		
#100	0.15	93		
#200	0.075	84		
#270	0.053	72		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0290	19		
---	0.0227	11		
---	0.0130	8		
---	0.0093	5		
---	0.0066	4		
---	0.0047	3		
---	0.0033	2		
---	0.0014	2		

Coefficients

D_{85} = 0.0780 mm D_{30} = 0.0329 mm

D_{60} = 0.0463 mm D_{15} = 0.0255 mm

D_{50} = 0.0413 mm D_{10} = 0.0185 mm

C_u = 2.503 C_c = 1.264

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Dispersion Device : Apparatus A - Mech Mixer

Dispersion Period : 1 minute

Specific Gravity : 2.65

Separation of Sample: #270 Sieve

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Client:	Northeast Geotechnical, Inc.		
Project:	Proposed Residential Development		
Location:	Ashland, MA	Project No:	GTX-303030
Boring ID: TP-2	Sample Type: bag	Tested By:	jbr
Sample ID: S-1	Test Date: 04/14/15	Checked By:	emm
Depth : 28-100 in	Test Id: 327733		
Test Comment:	---		
Sample Description:	Moist, light brown silty sand		
Sample Comment:	---		

USDA Textural Classification

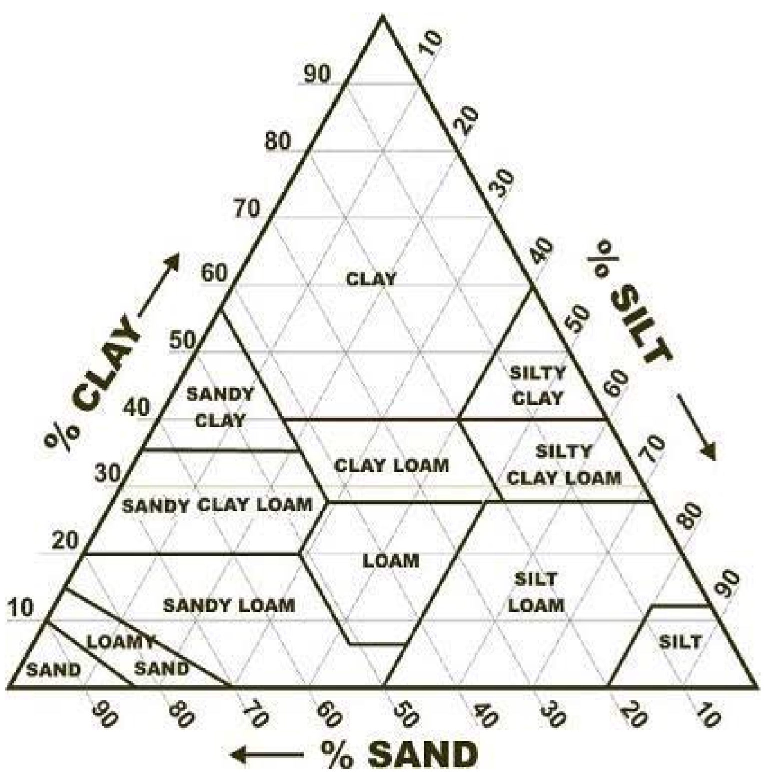
Boring ID	Sample ID	Depth	Sand, %	Silt, %	Clay, %	Classification
TP-2	S-1	28-100 in	64	32	4	Sandy Loam

Classifications based only on material passing the #10 sieve

Sand: material passing 2.0 mm and retained on 0.05 mm diameter

Silt: material passing 0.05 mm and retained on 0.002 mm diameter

Clay: material passing 0.002 mm diameter



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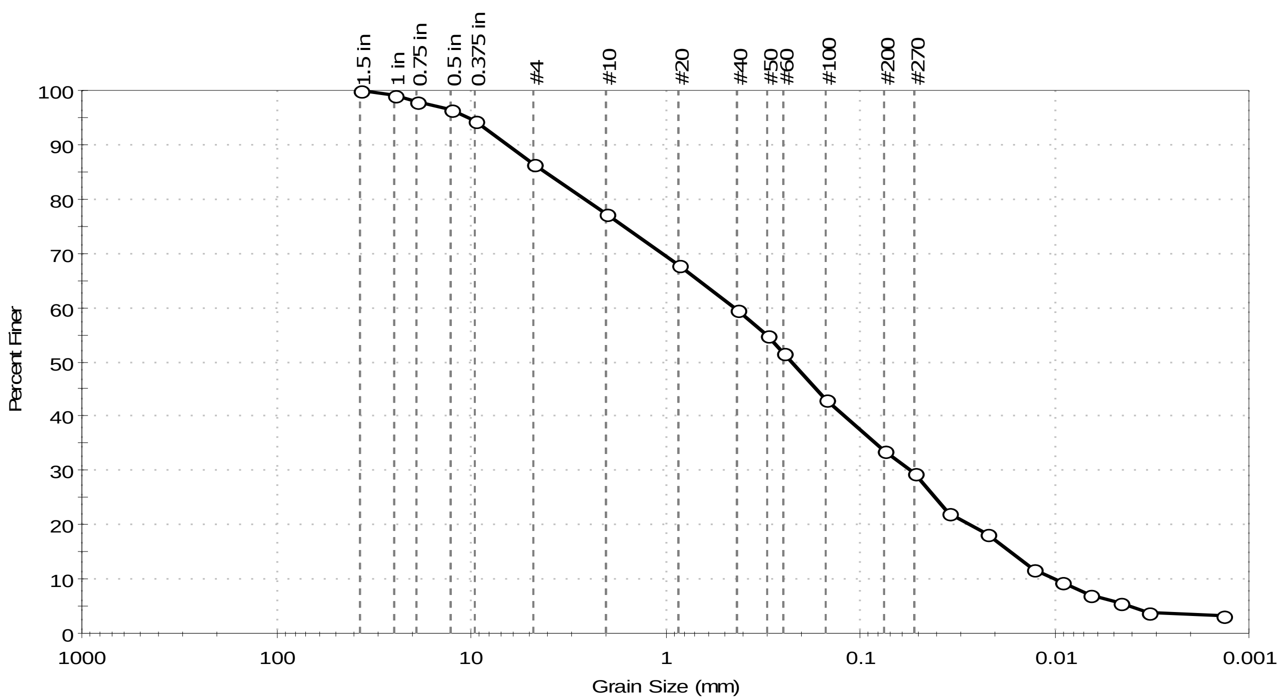
Client:	Northeast Geotechnical, Inc.		
Project:	Proposed Residential Development		
Location:	Ashland, MA	Project No:	GTX-303030
Boring ID: TP-2	Sample Type: bag	Tested By:	jbr
Sample ID: S-1	Test Date: 04/14/15	Checked By:	emm
Depth : 28-100 in	Test Id: 327745		
Test Comment:	---		
Sample Description:	Moist, light brown silty sand		
Sample Comment:	---		

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	13.5	53.0	33.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1.5 in	37.50	100		
1 in	25.00	99		
0.75 in	19.00	98		
0.5 in	12.70	96		
0.375 in	9.50	94		
#4	4.75	86		
#10	2.00	77		
#20	0.85	68		
#40	0.42	60		
#50	0.30	55		
#60	0.25	52		
#100	0.15	43		
#200	0.075	33		
#270	0.053	29		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0351	22		
---	0.0220	18		
---	0.0127	12		
---	0.0092	9		
---	0.0065	7		
---	0.0046	6		
---	0.0033	4		
---	0.0014	3		

Coefficients

D_{85} =4.1212 mm
D_{30} =0.0557 mm
D_{60} =0.4348 mm
D_{15} =0.0167 mm
D_{50} =0.2273 mm
D_{10} =0.0098 mm
C_u =44.367
C_c =0.728

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample / Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

Dispersion Device : Apparatus A - Mech Mixer

Dispersion Period : 1 minute

Specific Gravity : 2.65

Separation of Sample: #270 Sieve

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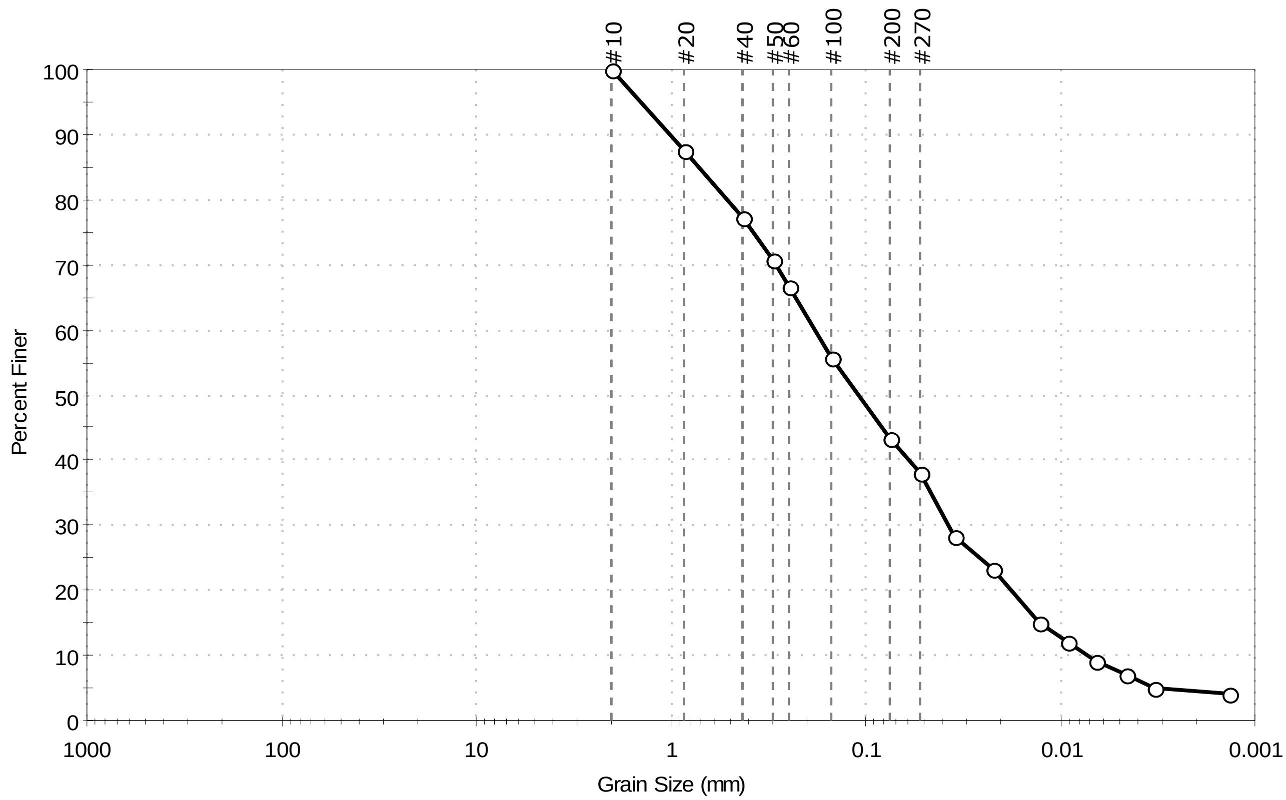
Client:	Northeast Geotechnical, Inc.				
Project:	Proposed Residential Development				
Location:	Ashland, MA			Project No:	GTX-303030
Boring ID:	TP-2	Sample Type:	bag	Tested By:	jbr
Sample ID:	S-1	Test Date:	04/14/15	Checked By:	emm
Depth :	28-100 in	Test Id:	327745		

Test Comment: Only minus No. 10 sieve for USDA classification
Sample Description: Moist, light brown silty sand
Sample Comment: ---

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.0	56.7	43.3

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#10	2.00	100		
#20	0.85	88		
#40	0.42	77		
#50	0.30	71		
#60	0.25	67		
#100	0.15	56		
#200	0.075	43		
#270	0.053	38		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0351	28		
---	0.0220	23		
---	0.0127	15		
---	0.0092	12		
---	0.0065	9		
---	0.0046	7		
---	0.0033	5		
---	0.0014	4		

Coefficients

D_{85} =0.7128 mm D_{30} =0.0379 mm
D_{60} =0.1830 mm D_{15} =0.0126 mm
D_{50} =0.1088 mm D_{10} =0.0072 mm
C_u =25.417 C_c =1.090

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED
Sand/Gravel Hardness : HARD
Dispersion Device : Apparatus A - Mech Mixer
Dispersion Period : 1 minute
Specific Gravity : 2.65
Separation of Sample: #270 Sieve

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Client:	Northeast Geotechnical, Inc.				
Project:	Proposed Residential Development				
Location:	Ashland, MA			Project No:	GTX-303030
Boring ID:	TP-3	Sample Type:	bag	Tested By:	jbr
Sample ID:	S-1	Test Date:	04/14/15	Checked By:	emm
Depth :	27-36 in	Test Id:	327737		
Test Comment:	---				
Sample Description:	Moist, brown silt with sand				
Sample Comment:	---				

USDA Textural Classification

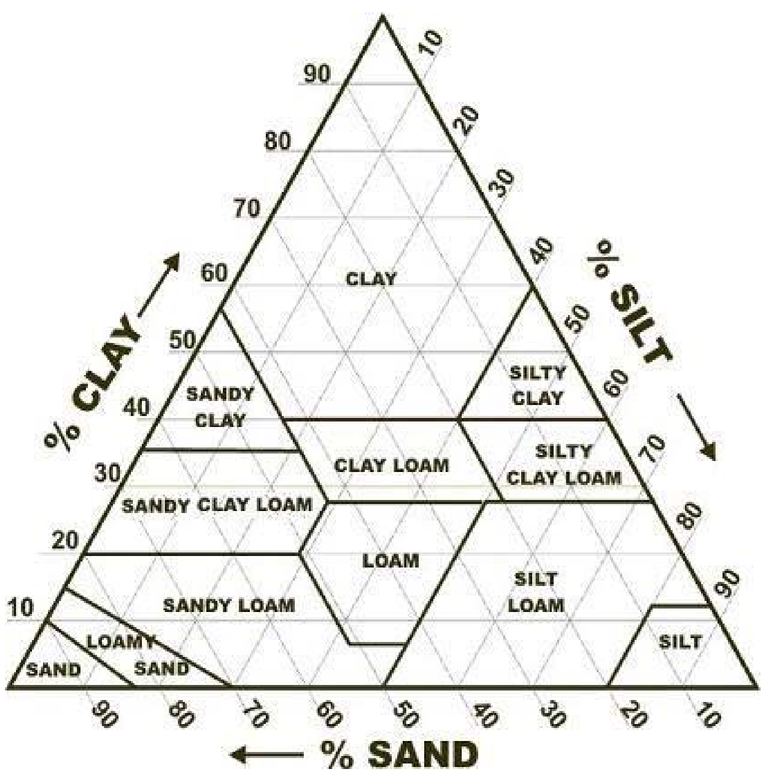
Boring ID	Sample ID	Depth	Sand, %	Silt, %	Clay, %	Classification
TP-3	S-1	27-36 in	40	58	2	Silt Loam

Classifications based only on material passing the #10 sieve

Sand: material passing 2.0 mm and retained on 0.05 mm diameter

Silt: material passing 0.05 mm and retained on 0.002 mm diameter

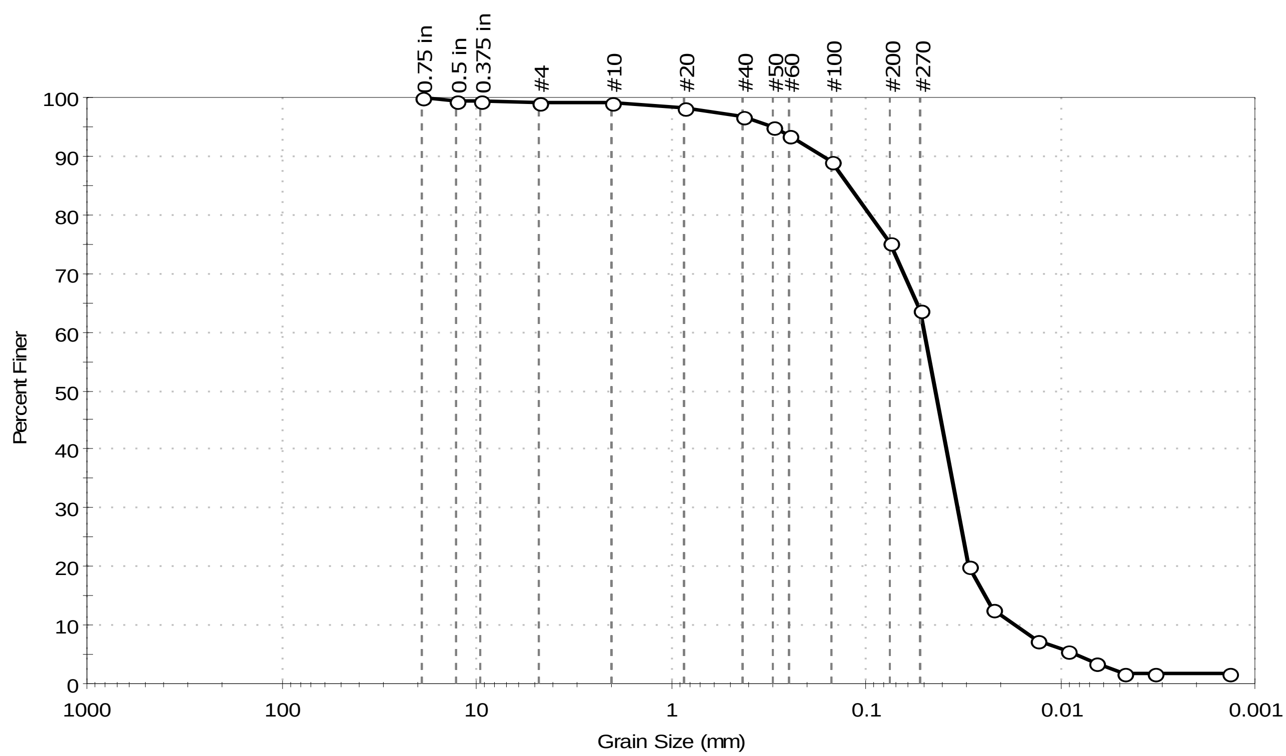
Clay: material passing 0.002 mm diameter



Client:	Northeast Geotechnical, Inc.				
Project:	Proposed Residential Development				
Location:	Ashland, MA			Project No:	GTX-303030
Boring ID:	TP-3	Sample Type:	bag	Tested By:	jbr
Sample ID:	S-1	Test Date:	04/14/15	Checked By:	emm
Depth :	27-36 in	Test Id:	327749		

Test Comment: ---
Sample Description: Moist, brown silt with sand
Sample Comment: ---

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.9	23.8	75.3

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.75 in	19.00	100		
0.5 in	12.70	99		
0.375 in	9.50	99		
#4	4.75	99		
#10	2.00	99		
#20	0.85	98		
#40	0.42	97		
#50	0.30	95		
#60	0.25	94		
#100	0.15	89		
#200	0.075	75		
#270	0.053	64		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0295	20		
---	0.0224	13		
---	0.0131	7		
---	0.0093	5		
---	0.0066	4		
---	0.0047	2		
---	0.0033	2		
---	0.0014	2		

Coefficients

D_{85} =0.1219 mm | D_{30} =0.0336 mm
D_{60} =0.0504 mm | D_{15} =0.0243 mm
D_{50} =0.0440 mm | D_{10} =0.0170 mm
C_u =2.965 | C_c =1.318

Classification

ASTM N/A

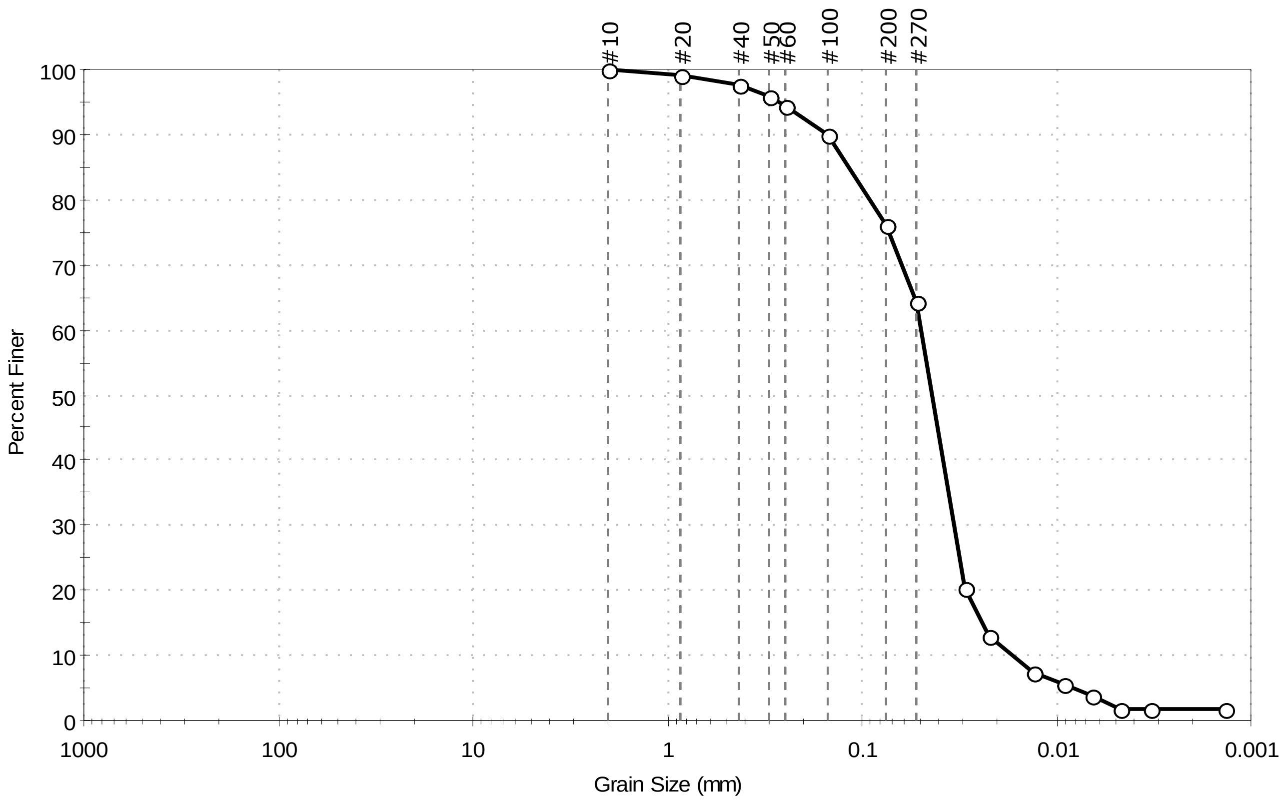
AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---
Sand/Gravel Hardness : ---
Dispersion Device : Apparatus A - Mech Mixer
Dispersion Period : 1 minute
Specific Gravity : 2.65
Separation of Sample: #270 Sieve

Client:	Northeast Geotechnical, Inc.				
Project:	Proposed Residential Development				
Location:	Ashland, MA			Project No:	GTX-303030
Boring ID:	TP-3	Sample Type:	bag	Tested By:	jbr
Sample ID:	S-1	Test Date:	04/14/15	Checked By:	emm
Depth :	27-36 in	Test Id:	327749		
Test Comment:	Only minus No. 10 sieve for USDA classification				
Sample Description:	Moist, brown silt with sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.0	23.9	76.1

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#10	2.00	100		
#20	0.85	99		
#40	0.42	98		
#50	0.30	96		
#60	0.25	94		
#100	0.15	90		
#200	0.075	76		
#270	0.053	64		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0295	20		
---	0.0224	13		
---	0.0131	7		
---	0.0093	6		
---	0.0066	4		
---	0.0047	2		
---	0.0033	2		
---	0.0014	2		

Coefficients

D_{85} =0.1169 mm | D_{30} =0.0335 mm
D_{60} =0.0500 mm | D_{15} =0.0241 mm
D_{50} =0.0437 mm | D_{10} =0.0167 mm
C_u =2.994 | C_c =1.344

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Dispersion Device : Apparatus A - Mech Mixer

Dispersion Period : 1 minute

Specific Gravity : 2.65

Separation of Sample: #270 Sieve

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Client:	Northeast Geotechnical, Inc.				
Project:	Proposed Residential Development				
Location:	Ashland, MA			Project No:	GTX-303030
Boring ID:	TP-4	Sample Type:	bag	Tested By:	jbr
Sample ID:	S-1	Test Date:	04/14/15	Checked By:	emm
Depth :	33-100 in	Test Id:	327738		
Test Comment:	---				
Sample Description:	Moist, brown silty sand				
Sample Comment:	---				

USDA Textural Classification

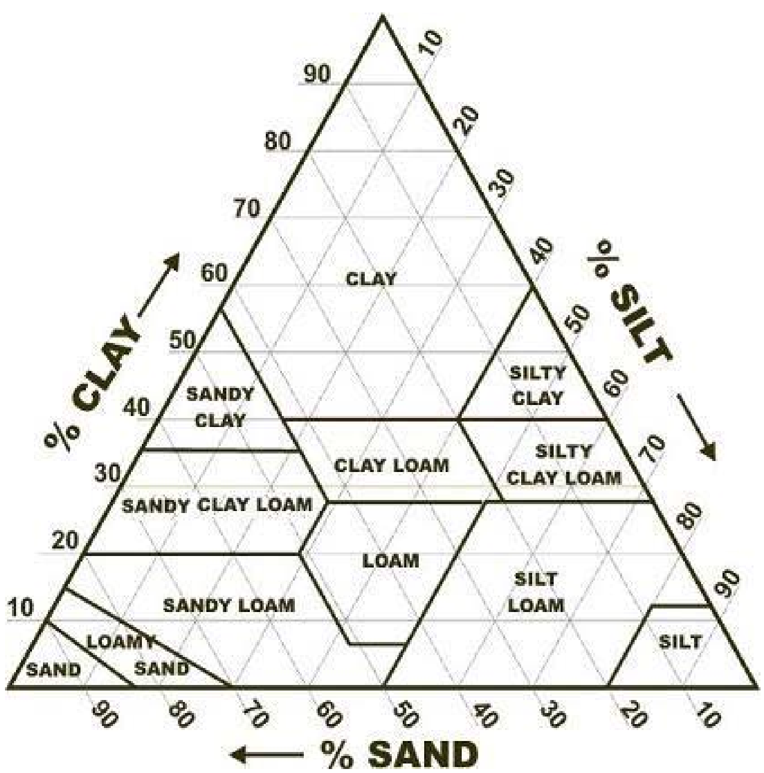
Boring ID	Sample ID	Depth	Sand, %	Silt, %	Clay, %	Classification
TP-4	S-1	33-100 in	50	43	7	Sandy Loam

Classifications based only on material passing the #10 sieve

Sand: material passing 2.0 mm and retained on 0.05 mm diameter

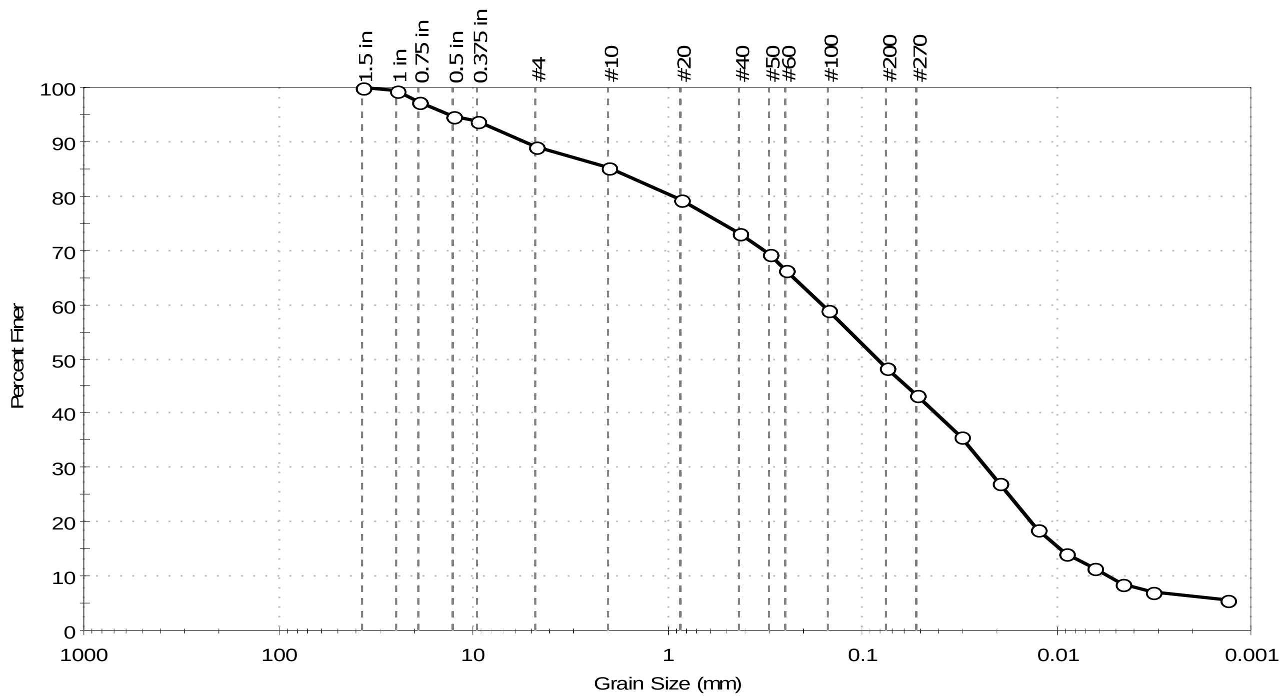
Silt: material passing 0.05 mm and retained on 0.002 mm diameter

Clay: material passing 0.002 mm diameter



Client:	Northeast Geotechnical, Inc.			
Project:	Proposed Residential Development			
Location:	Ashland, MA		Project No:	GTX-303030
Boring ID: TP-4		Sample Type: bag	Tested By:	jbr
Sample ID: S-1		Test Date: 04/14/15	Checked By:	emm
Depth : 33-100 in		Test Id: 327750		
Test Comment:	---			
Sample Description:	Moist, brown silty sand			
Sample Comment:	---			

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	10.9	40.8	48.3

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1.5 in	37.50	100		
1 in	25.00	99		
0.75 in	19.00	97		
0.5 in	12.70	95		
0.375 in	9.50	94		
#4	4.75	89		
#10	2.00	85		
#20	0.85	79		
#40	0.42	73		
#50	0.30	69		
#60	0.25	66		
#100	0.15	59		
#200	0.075	48		
#270	0.053	43		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0314	36		
---	0.0199	27		
---	0.0124	19		
---	0.0089	14		
---	0.0064	11		
---	0.0046	9		
---	0.0033	7		
---	0.0013	6		

Coefficients

D_{85} =1.9258 mm	D_{30} =0.0232 mm
D_{60} =0.1598 mm	D_{15} =0.0094 mm
D_{50} =0.0839 mm	D_{10} =0.0054 mm
C_u =29.593	C_c =0.624

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

Dispersion Device : Apparatus A - Mech Mixer

Dispersion Period : 1 minute

Specific Gravity : 2.65

Separation of Sample: #270 Sieve

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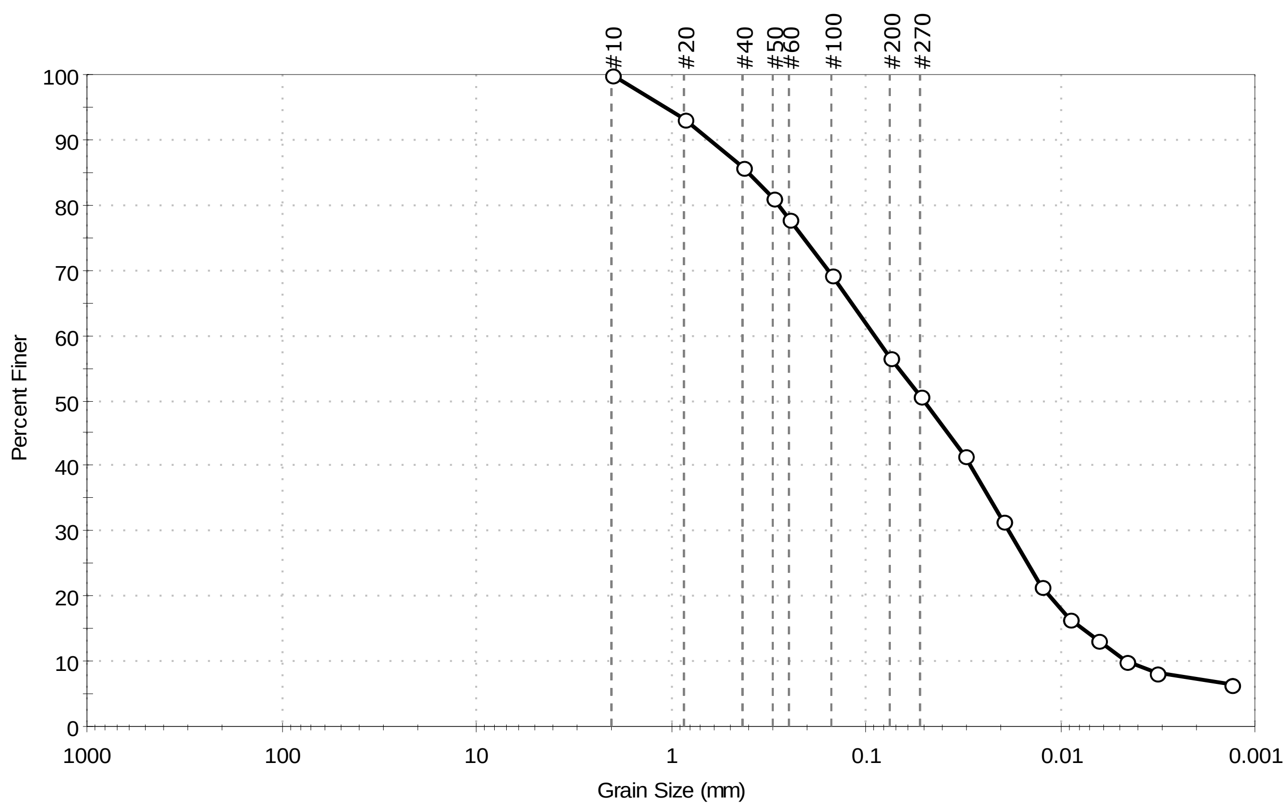
Client:	Northeast Geotechnical, Inc.				
Project:	Proposed Residential Development				
Location:	Ashland, MA			Project No:	GTX-303030
Boring ID:	TP-4	Sample Type:	bag	Tested By:	jbr
Sample ID:	S-1	Test Date:	04/14/15	Checked By:	emm
Depth :	33-100 in	Test Id:	327750		

Test Comment: Only minus No. 10 sieve for USDA classification
Sample Description: Moist, brown silty sand
Sample Comment: ---

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.0	43.4	56.6

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#10	2.00	100		
#20	0.85	93		
#40	0.42	86		
#50	0.30	81		
#60	0.25	78		
#100	0.15	69		
#200	0.075	57		
#270	0.053	51		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0314	41		
---	0.0199	32		
---	0.0124	22		
---	0.0089	17		
---	0.0064	13		
---	0.0046	10		
---	0.0033	8		
---	0.0013	7		

Coefficients

D_{85} = 0.4002 mm	D_{30} = 0.0185 mm
D_{60} = 0.0903 mm	D_{15} = 0.0076 mm
D_{50} = 0.0507 mm	D_{10} = 0.0046 mm
C_u = 19.630	C_c = 0.824

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

Dispersion Device : Apparatus A - Mech Mixer

Dispersion Period : 1 minute

Specific Gravity : 2.65

Separation of Sample: #270 Sieve

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Client:	Northeast Geotechnical, Inc.			
Project:	Proposed Residential Development			
Location:	Ashland, MA		Project No:	GTX-303030
Boring ID: TP-5		Sample Type: bag	Tested By:	jbr
Sample ID: S-1		Test Date: 04/21/15	Checked By:	emm
Depth :	36-100 in	Test Id: 327739		
Test Comment:	---			
Sample Description:	Moist, yellowish brown silty sand			
Sample Comment:	---			

USDA Textural Classification

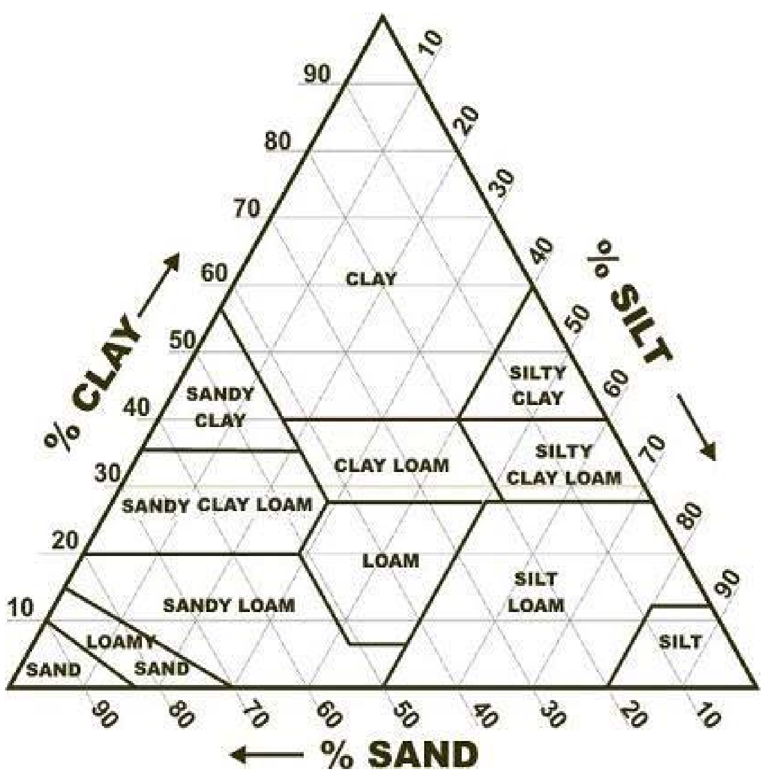
Boring ID	Sample ID	Depth	Sand, %	Silt, %	Clay, %	Classification
TP-5	S-1	36-100 in	64	35	1	Sandy Loam

Classifications based only on material passing the #10 sieve

Sand: material passing 2.0 mm and retained on 0.05 mm diameter

Silt: material passing 0.05 mm and retained on 0.002 mm diameter

Clay: material passing 0.002 mm diameter



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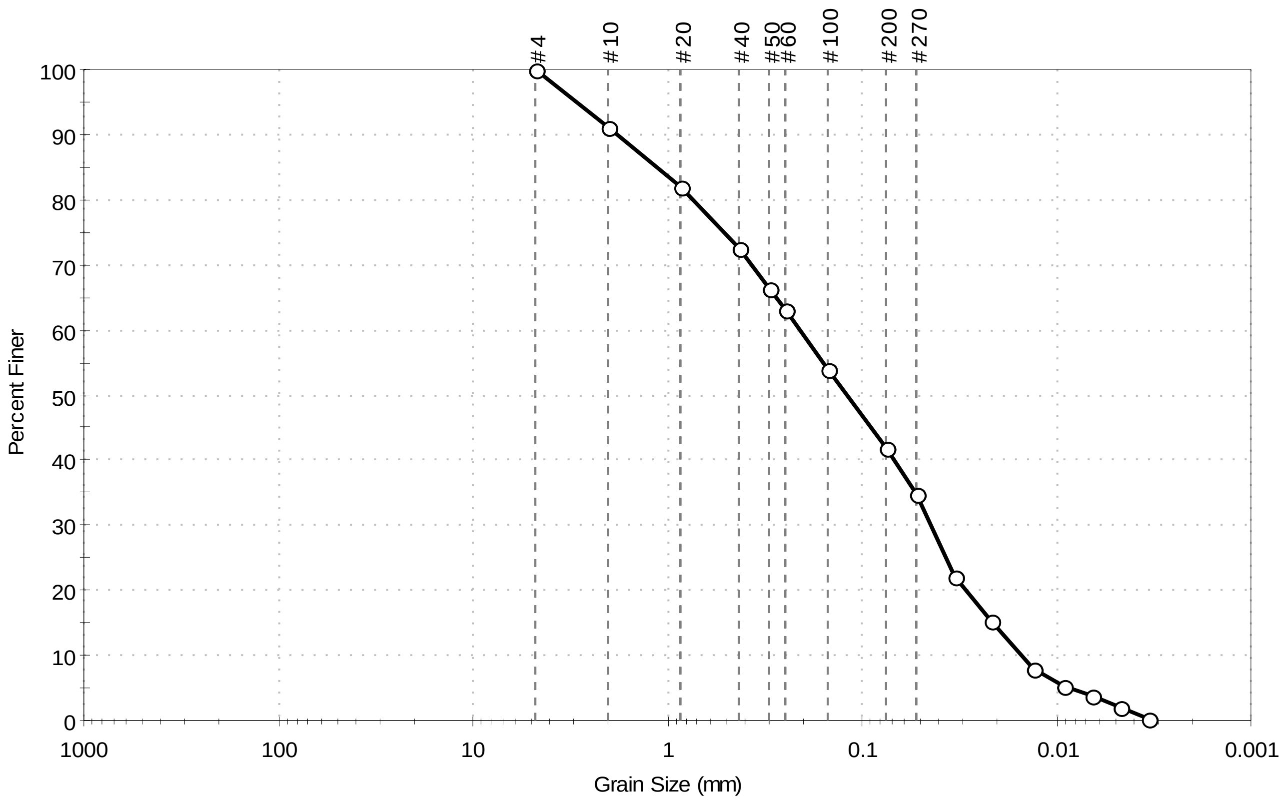
Client:	Northeast Geotechnical, Inc.		
Project:	Proposed Residential Development		
Location:	Ashland, MA	Project No:	GTX-303030
Boring ID: TP-5	Sample Type: bag	Tested By:	jbr
Sample ID: S-1	Test Date: 04/21/15	Checked By:	emm
Depth : 36-100 in	Test Id: 327751		
Test Comment:	---		
Sample Description:	Moist, yellowish brown silty sand		
Sample Comment:	---		

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.0	58.2	41.8

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	91		
#20	0.85	82		
#40	0.42	73		
#50	0.30	66		
#60	0.25	63		
#100	0.15	54		
#200	0.075	42		
#270	0.053	35		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0334	22		
---	0.0219	15		
---	0.0131	8		
---	0.0091	5		
---	0.0066	4		
---	0.0047	2		
---	0.0034	0		

Coefficients

D_{85} = 1.1274 mm D_{30} = 0.0444 mm

D_{60} = 0.2101 mm D_{15} = 0.0214 mm

D_{50} = 0.1198 mm D_{10} = 0.0151 mm

C_u = 13.914 C_c = 0.621

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

Dispersion Device : Apparatus A - Mech Mixer

Dispersion Period : 1 minute

Specific Gravity : 2.65

Separation of Sample: #270 Sieve

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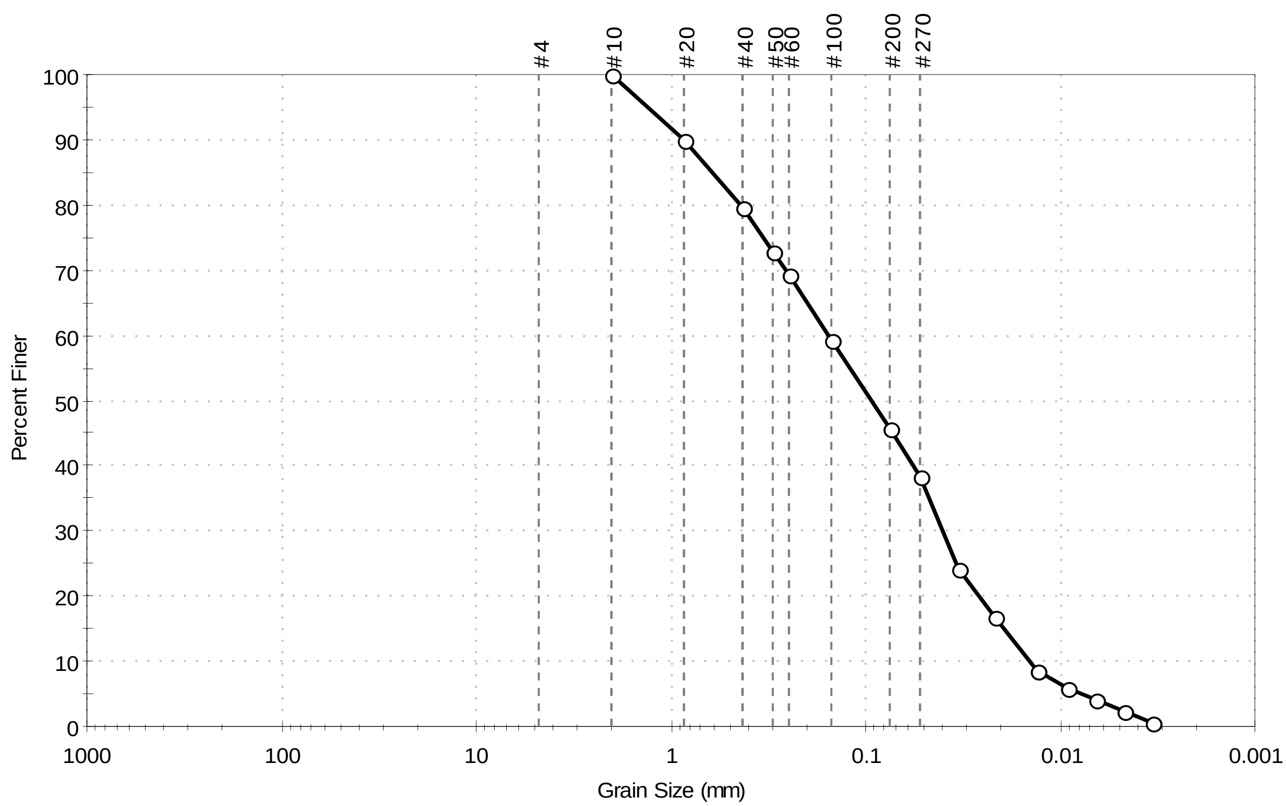
Client:	Northeast Geotechnical, Inc.		
Project:	Proposed Residential Development		
Location:	Ashland, MA	Project No:	GTX-303030
Boring ID: TP-5	Sample Type: bag	Tested By:	jbr
Sample ID: S-1	Test Date: 04/21/15	Checked By:	emm
Depth : 36-100 in	Test Id: 327751		
Test Comment:	Only minus No. 10 sieve for USDA classification		
Sample Description:	Moist, yellowish brown silty sand		
Sample Comment:	---		

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.0	54.1	45.9

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#10	2.00	100		
#20	0.85	90		
#40	0.42	80		
#50	0.30	73		
#60	0.25	69		
#100	0.15	59		
#200	0.075	46		
#270	0.053	38		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0334	24		
---	0.0219	17		
---	0.0131	9		
---	0.0091	6		
---	0.0066	4		
---	0.0047	2		
---	0.0034	0		

Coefficients

D_{85} = 0.6059 mm	D_{30} = 0.0403 mm
D_{60} = 0.1556 mm	D_{15} = 0.0195 mm
D_{50} = 0.0929 mm	D_{10} = 0.0142 mm
C_u = 10.958	C_c = 0.735

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

Dispersion Device : Apparatus A - Mech Mixer

Dispersion Period : 1 minute

Specific Gravity : 2.65

Separation of Sample: #270 Sieve

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Client: Northeast Geotechnical, Inc.
Project: Proposed Residential Development
Location: Ashland, MA
Project No: GTX-303030

Boring ID: TP-6
Sample ID: S-1
Depth : 20-33 in
Sample Type: bag
Test Date: 04/14/15
Test Id: 327736
Tested By: jbr
Checked By: emm

Test Comment: ---
Sample Description: Moist, brown sandy silt
Sample Comment: ---

USDA Textural Classification

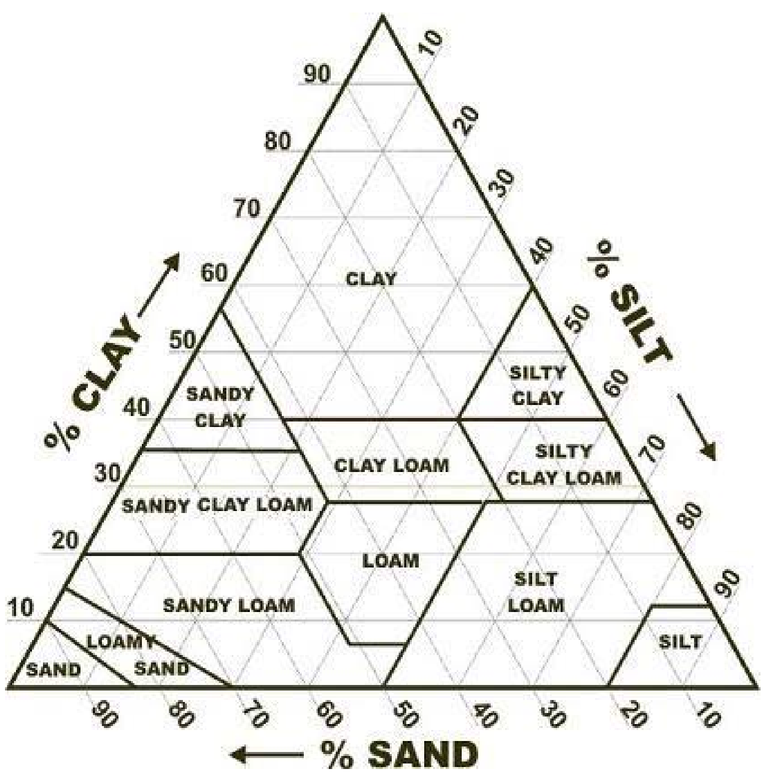
Boring ID	Sample ID	Depth	Sand, %	Silt, %	Clay, %	Classification
TP-6	S-1	20-33 in	62	36	2	Sandy Loam

Classifications based only on material passing the #10 sieve

Sand: material passing 2.0 mm and retained on 0.05 mm diameter

Silt: material passing 0.05 mm and retained on 0.002 mm diameter

Clay: material passing 0.002 mm diameter



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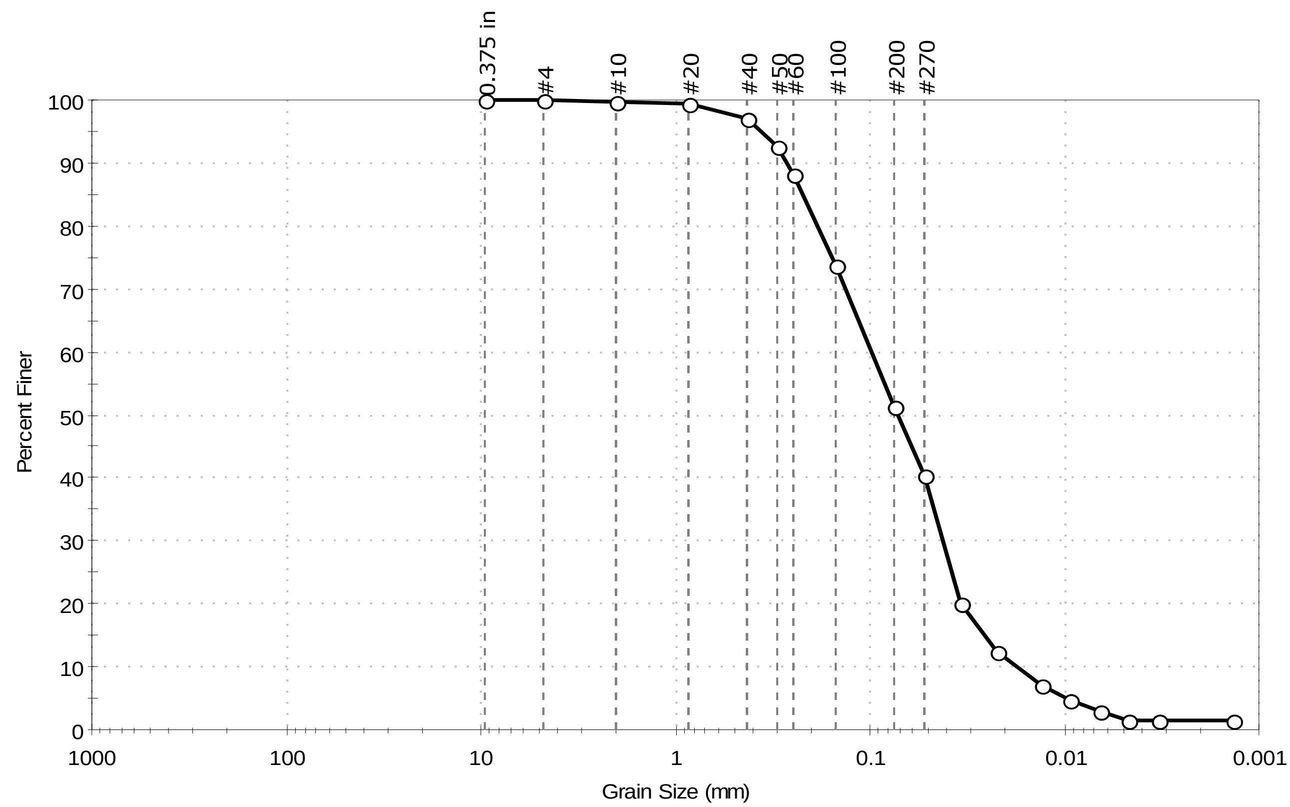
Client:	Northeast Geotechnical, Inc.				
Project:	Proposed Residential Development				
Location:	Ashland, MA			Project No:	GTX-303030
Boring ID:	TP-6	Sample Type:	bag	Tested By:	jbr
Sample ID:	S-1	Test Date:	04/14/15	Checked By:	emm
Depth :	20-33 in	Test Id:	327748		

Test Comment: ---
Sample Description: Moist, brown sandy silt
Sample Comment: ---

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.1	48.4	51.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	100		
#10	2.00	100		
#20	0.85	99		
#40	0.42	97		
#50	0.30	93		
#60	0.25	88		
#100	0.15	74		
#200	0.075	51		
#270	0.053	40		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0342	20		
---	0.0224	12		
---	0.0131	7		
---	0.0093	5		
---	0.0066	3		
---	0.0047	2		
---	0.0033	2		
---	0.0014	2		

Coefficients

D_{85} =0.2231 mm	D_{30} =0.0423 mm
D_{60} =0.0978 mm	D_{15} =0.0259 mm
D_{50} =0.0716 mm	D_{10} =0.0177 mm
C_u =5.525	C_c =1.034

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Dispersion Device : Apparatus A - Mech Mixer

Dispersion Period : 1 minute

Specific Gravity : 2.65

Separation of Sample: #270 Sieve

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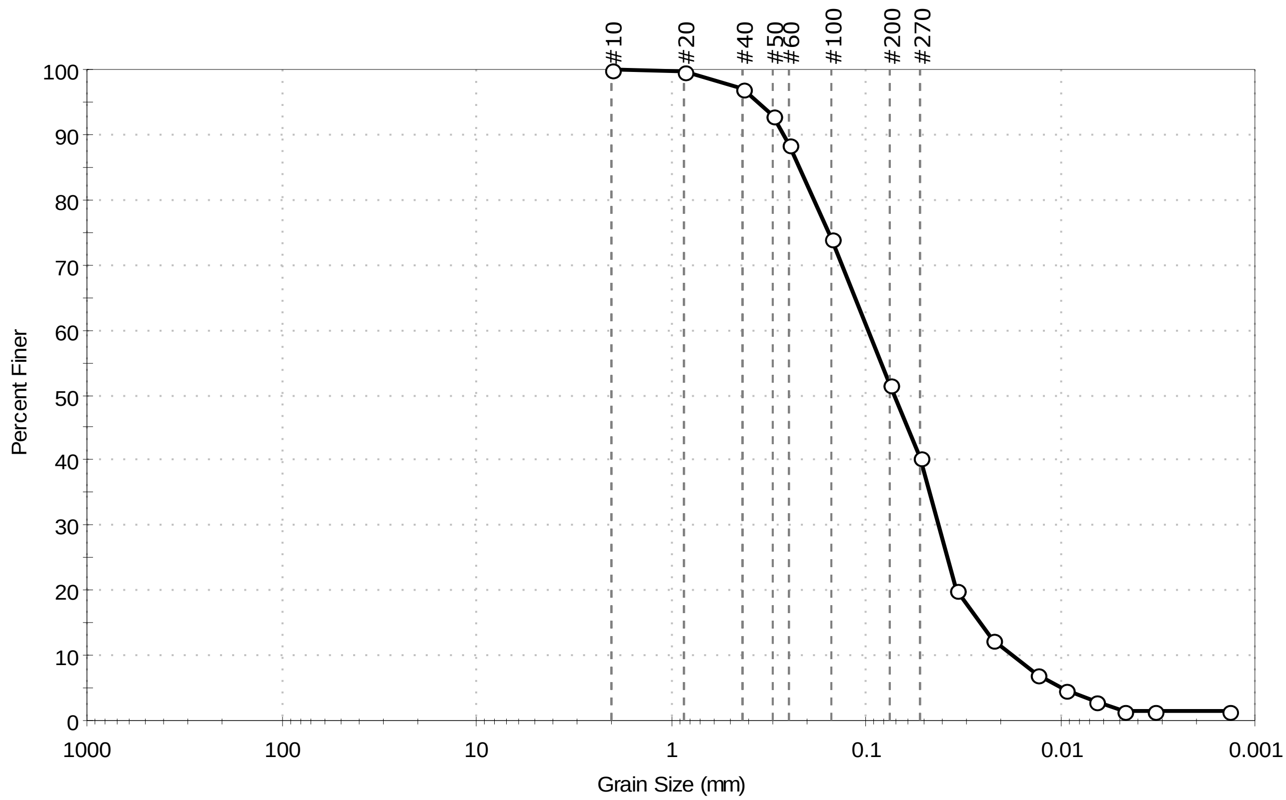
GeoTesting EXPRESS

Client:	Northeast Geotechnical, Inc.				
Project:	Proposed Residential Development				
Location:	Ashland, MA			Project No:	GTX-303030
Boring ID:	TP-6	Sample Type:	bag	Tested By:	jbr
Sample ID:	S-1	Test Date:	04/14/15	Checked By:	emm
Depth :	20-33 in	Test Id:	327748		
Test Comment:	Only minus No. 10 sieve for USDA classification				
Sample Description:	Moist, brown sandy silt				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.0	48.4	51.6

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#10	2.00	100		
#20	0.85	100		
#40	0.42	97		
#50	0.30	93		
#60	0.25	88		
#100	0.15	74		
#200	0.075	52		
#270	0.053	41		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0342	20		
---	0.0224	12		
---	0.0131	7		
---	0.0093	5		
---	0.0066	3		
---	0.0047	2		
---	0.0033	2		
---	0.0014	2		

Coefficients

D_{85} = 0.2217 mm
D_{30} = 0.0423 mm
D_{60} = 0.0974 mm
D_{15} = 0.0259 mm
D_{50} = 0.0714 mm
D_{10} = 0.0177 mm
C_u = 5.503
C_c = 1.038

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Dispersion Device : Apparatus A - Mech Mixer

Dispersion Period : 1 minute

Specific Gravity : 2.65

Separation of Sample: #270 Sieve

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Client:	Northeast Geotechnical, Inc.				
Project:	Proposed Residential Development				
Location:	Ashland, MA			Project No:	GTX-303030
Boring ID:	TP-7	Sample Type:	bag	Tested By:	jbr
Sample ID:	S-1	Test Date:	04/15/15	Checked By:	emm
Depth :	34-46 in	Test Id:	327868		
Test Comment:	---				
Sample Description:	Moist, light brown sandy silt				
Sample Comment:	---				

USDA Textural Classification

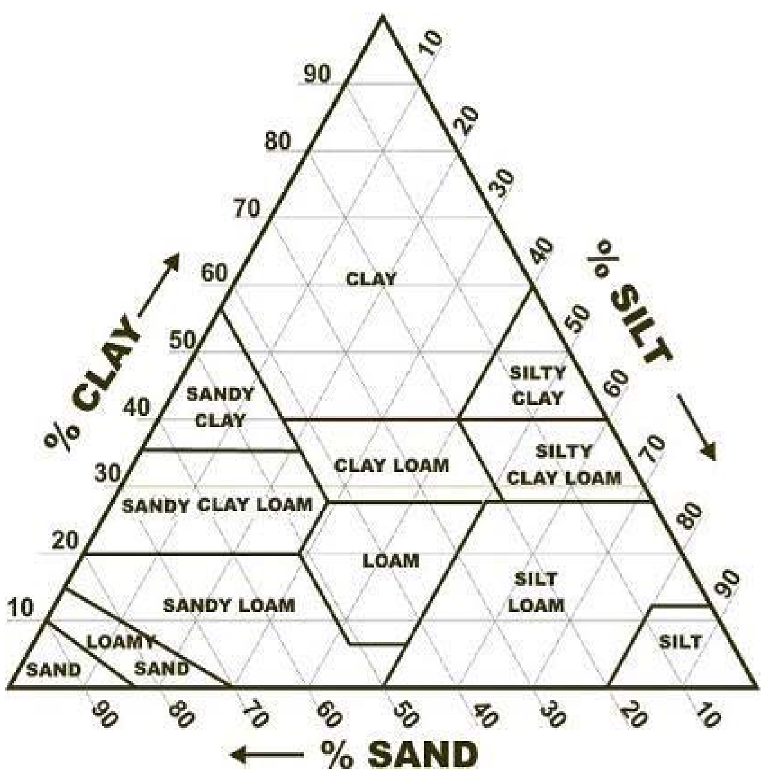
Boring ID	Sample ID	Depth	Sand, %	Silt, %	Clay, %	Classification
TP-7	S-1	34-46 in	45	53	2	Silt Loam

Classifications based only on material passing the #10 sieve

Sand: material passing 2.0 mm and retained on 0.05 mm diameter

Silt: material passing 0.05 mm and retained on 0.002 mm diameter

Clay: material passing 0.002 mm diameter



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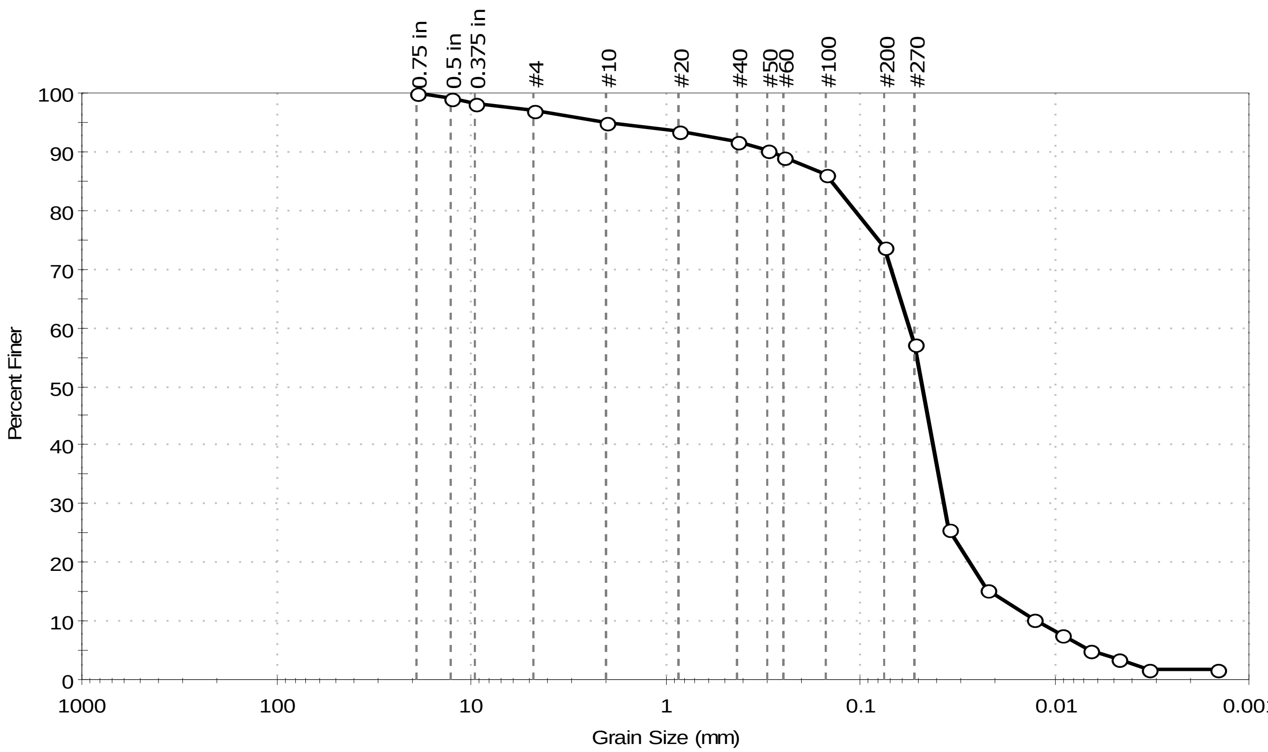
Client:	Northeast Geotechnical, Inc.		
Project:	Proposed Residential Development		
Location:	Ashland, MA	Project No:	GTX-303030
Boring ID:	TP-7	Sample Type: bag	Tested By: jbr
Sample ID:	S-1	Test Date: 04/16/15	Checked By: emm
Depth :	34-46 in	Test Id: 327858	
Test Comment:	---		
Sample Description:	Moist, light brown sandy silt		
Sample Comment:	---		

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	2.9	23.2	73.9

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.75 in	19.00	100		
0.5 in	12.70	99		
0.375 in	9.50	98		
#4	4.75	97		
#10	2.00	95		
#20	0.85	93		
#40	0.42	92		
#50	0.30	90		
#60	0.25	89		
#100	0.15	86		
#200	0.075	74		
#270	0.053	57		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0349	26		
---	0.0220	15		
---	0.0130	10		
---	0.0092	8		
---	0.0066	5		
---	0.0047	3		
---	0.0033	2		
---	0.0015	2		

Coefficients

D_{85} =0.1409 mm D_{30} =0.0370 mm

D_{60} =0.0562 mm D_{15} =0.0211 mm

D_{50} =0.0482 mm D_{10} =0.0125 mm

C_u =4.496 C_c =1.949

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

Dispersion Device : Apparatus A - Mech Mixer

Dispersion Period : 1 minute

Specific Gravity : 2.65

Separation of Sample: #270 Sieve

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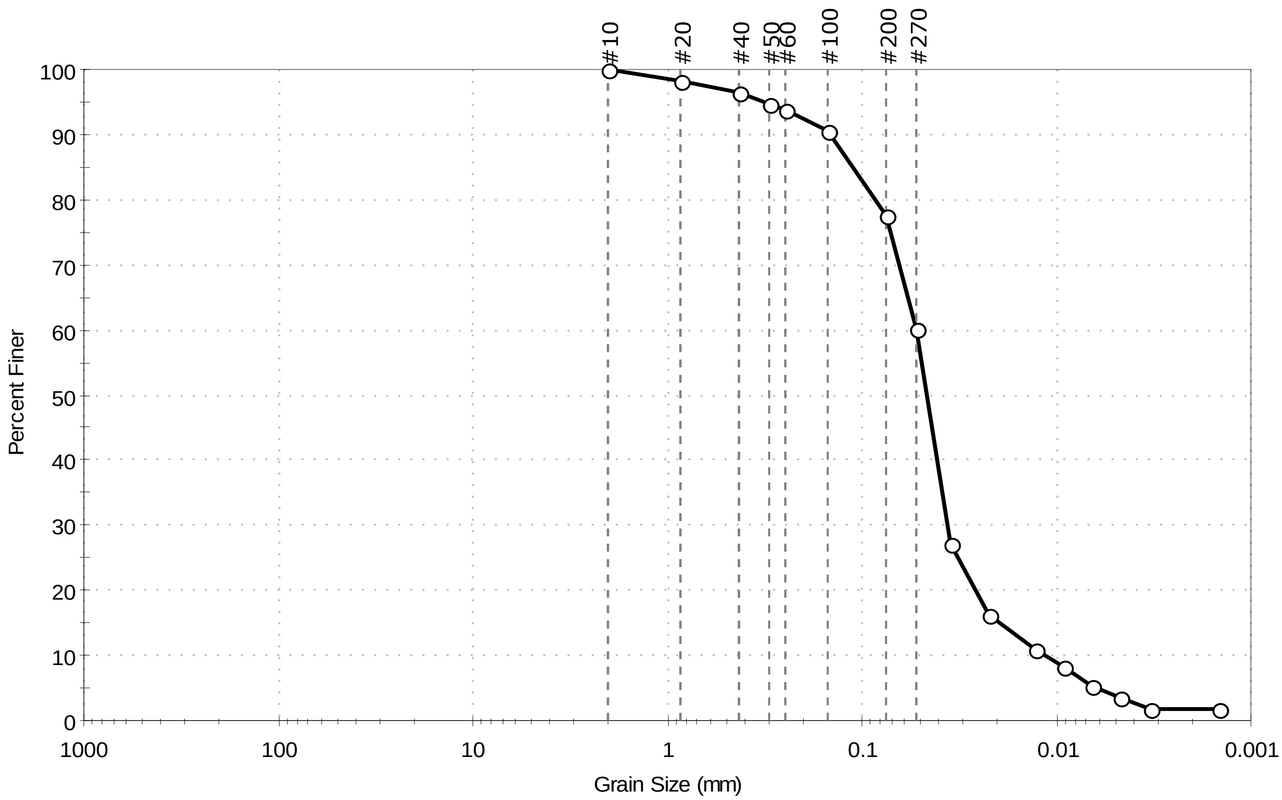
GeoTesting EXPRESS

Client:	Northeast Geotechnical, Inc.		
Project:	Proposed Residential Development		
Location:	Ashland, MA	Project No:	GTX-303030
Boring ID: TP-7	Sample Type: bag	Tested By:	jbr
Sample ID: S-1	Test Date: 04/16/15	Checked By:	emm
Depth : 34-46 in	Test Id: 327858		
Test Comment:	Only minus No. 10 sieve for USDA classification		
Sample Description:	Moist, light brown sandy silt		
Sample Comment:	---		

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.0	22.4	77.6

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#10	2.00	100		
#20	0.85	98		
#40	0.42	96		
#50	0.30	95		
#60	0.25	94		
#100	0.15	91		
#200	0.075	78		
#270	0.053	60		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0349	27		
---	0.0220	16		
---	0.0130	11		
---	0.0092	8		
---	0.0066	5		
---	0.0047	4		
---	0.0033	2		
---	0.0015	2		

Coefficients

D_{85} =0.1115 mm
D_{30} =0.0362 mm
D_{60} =0.0529 mm
D_{15} =0.0194 mm
D_{50} =0.0466 mm
D_{10} =0.0117 mm
C_u =4.521
C_c =2.117

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

Dispersion Device : Apparatus A - Mech Mixer

Dispersion Period : 1 minute

Specific Gravity : 2.65

Separation of Sample: #270 Sieve

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Client:	Northeast Geotechnical, Inc.				
Project:	Proposed Residential Development				
Location:	Ashland, MA			Project No:	GTX-303030
Boring ID:	TP-8	Sample Type:	bag	Tested By:	jbr
Sample ID:	S-2	Test Date:	04/21/15	Checked By:	emm
Depth :	36-100 in	Test Id:	327869		
Test Comment:	---				
Sample Description:	Moist, light brown silty sand				
Sample Comment:	---				

USDA Textural Classification

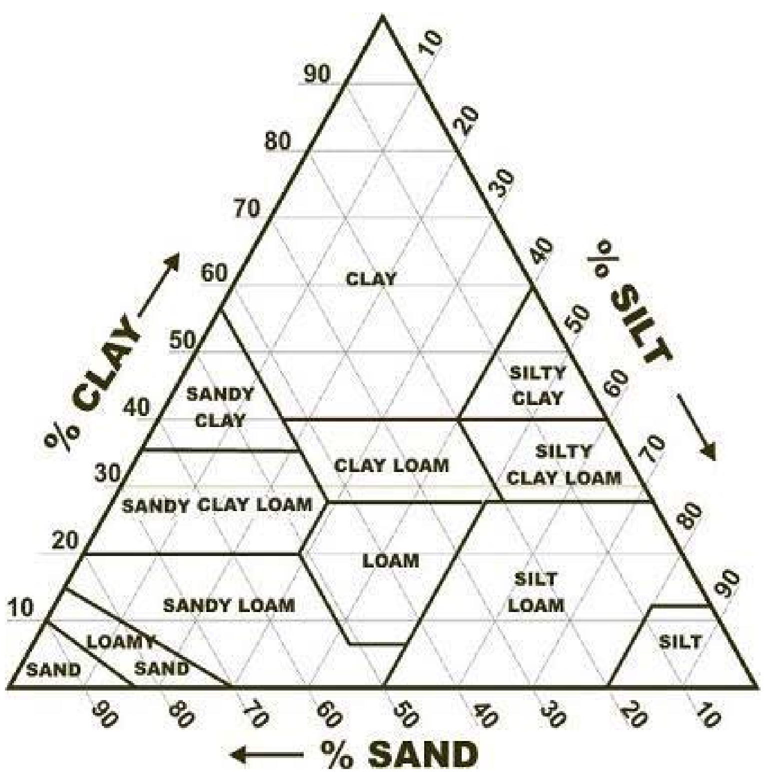
Boring ID	Sample ID	Depth	Sand, %	Silt, %	Clay, %	Classification
TP-8	S-2	36-100 in	64	35	1	Sandy Loam

Classifications based only on material passing the #10 sieve

Sand: material passing 2.0 mm and retained on 0.05 mm diameter

Silt: material passing 0.05 mm and retained on 0.002 mm diameter

Clay: material passing 0.002 mm diameter



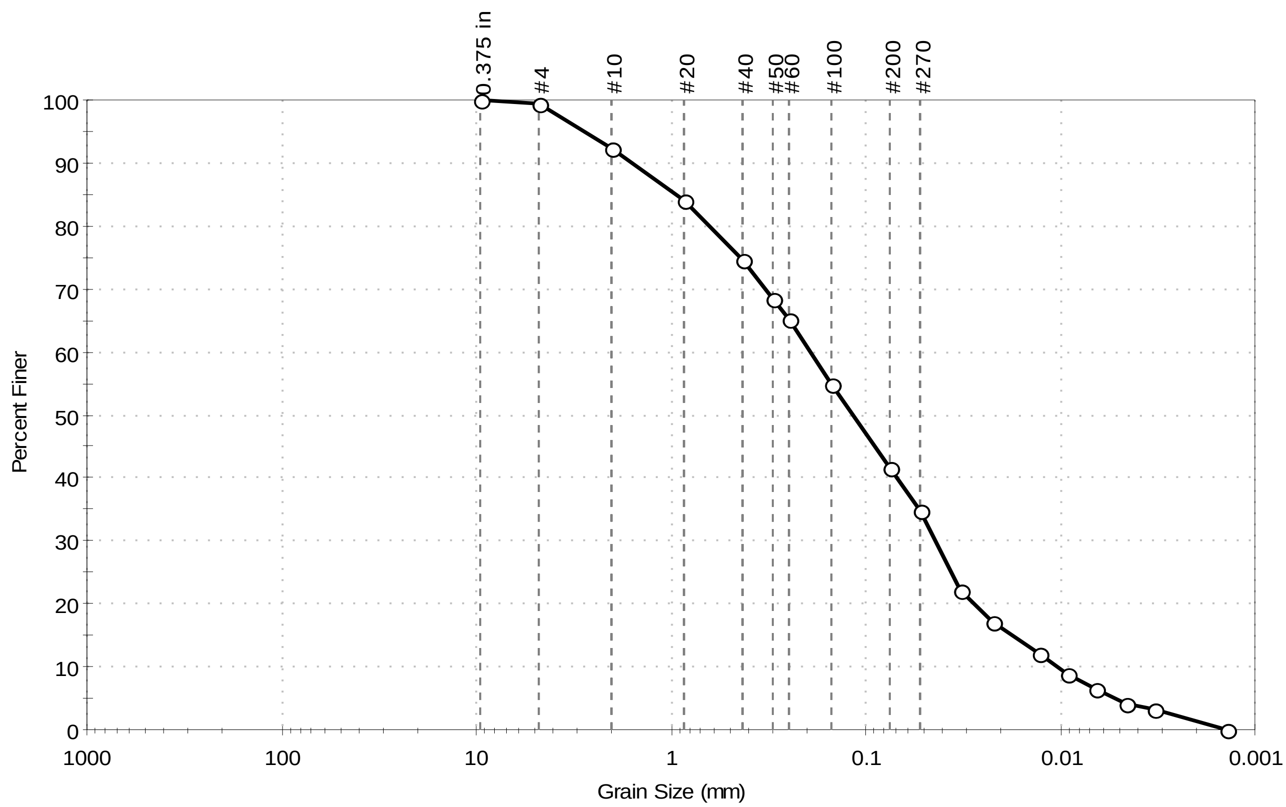
Client:	Northeast Geotechnical, Inc.				
Project:	Proposed Residential Development				
Location:	Ashland, MA			Project No:	GTX-303030
Boring ID:	TP-8	Sample Type:	bag	Tested By:	jbr
Sample ID:	S-2	Test Date:	04/21/15	Checked By:	emm
Depth :	36-100 in	Test Id:	327859		

Test Comment: ---

Sample Description: Moist, light brown silty sand

Sample Comment: ---

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.5	58.0	41.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	100		
#10	2.00	92		
#20	0.85	84		
#40	0.42	75		
#50	0.30	69		
#60	0.25	65		
#100	0.15	55		
#200	0.075	41		
#270	0.053	35		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0326	22		
---	0.0220	17		
---	0.0128	12		
---	0.0092	9		
---	0.0066	6		
---	0.0047	4		
---	0.0033	3		
---	0.0014	0		

Coefficients

D_{85} = 0.9442 mm D_{30} = 0.0443 mm

D_{60} = 0.1940 mm D_{15} = 0.0175 mm

D_{50} = 0.1167 mm D_{10} = 0.0103 mm

C_u = 18.835 C_c = 0.982

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

Dispersion Device : Apparatus A - Mech Mixer

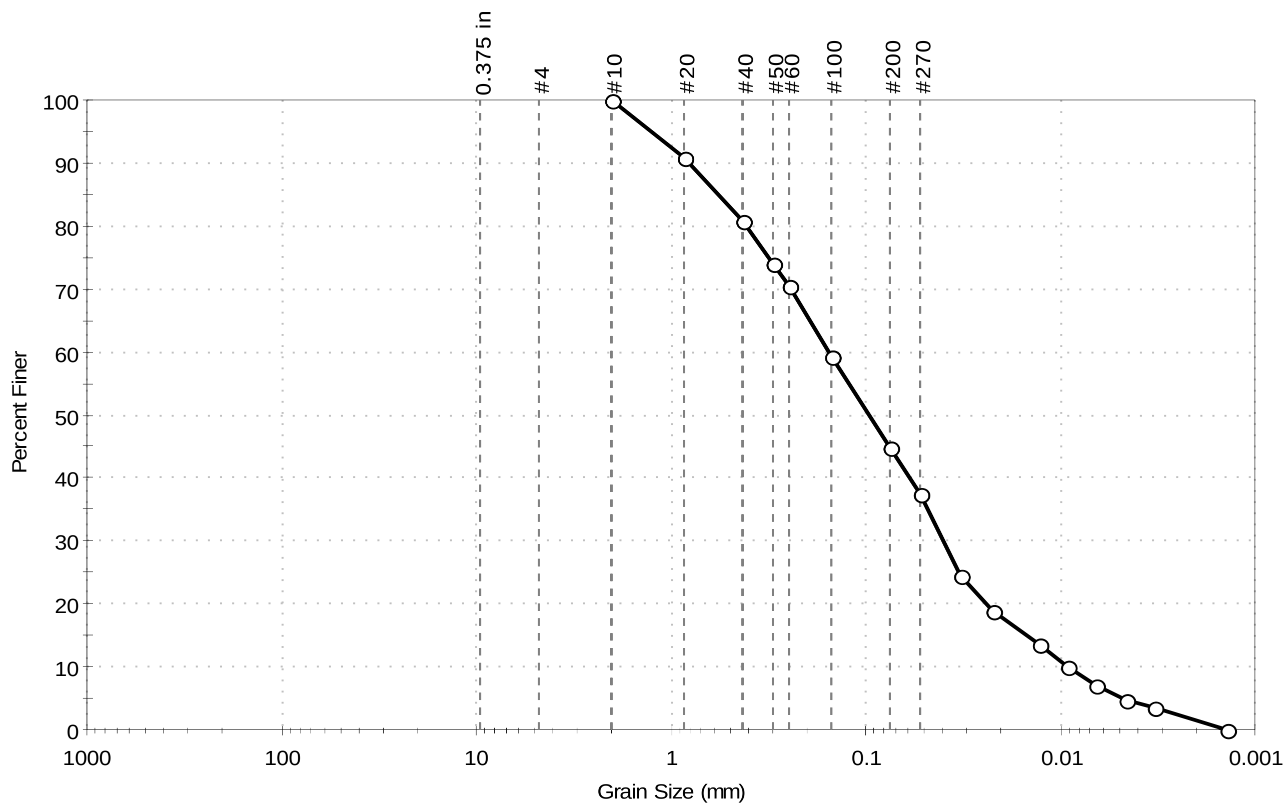
Dispersion Period : 1 minute

Specific Gravity : 2.65

Separation of Sample: #270 Sieve

Client:	Northeast Geotechnical, Inc.			
Project:	Proposed Residential Development			
Location:	Ashland, MA		Project No:	GTX-303030
Boring ID:	TP-8	Sample Type: bag	Tested By:	jbr
Sample ID:	S-2	Test Date: 04/21/15	Checked By:	emm
Depth :	36-100 in	Test Id: 327859		
Test Comment:	Only minus No. 10 sieve for USDA classification			
Sample Description:	Moist, light brown silty sand			
Sample Comment:	---			

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.0	55.1	44.9

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#10	2.00	100		
#20	0.85	91		
#40	0.42	81		
#50	0.30	74		
#60	0.25	70		
#100	0.15	59		
#200	0.075	45		
#270	0.053	38		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0326	25		
---	0.0220	19		
---	0.0128	14		
---	0.0092	10		
---	0.0066	7		
---	0.0047	5		
---	0.0033	3		
---	0.0014	0		

Coefficients

D_{85} = 0.5667 mm | D_{30} = 0.0399 mm

D_{60} = 0.1546 mm | D_{15} = 0.0147 mm

D_{50} = 0.0958 mm | D_{10} = 0.0092 mm

C_u = 16.804 | C_c = 1.119

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

Dispersion Device : Apparatus A - Mech Mixer

Dispersion Period : 1 minute

Specific Gravity : 2.65

Separation of Sample: #270 Sieve

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Client:	Northeast Geotechnical, Inc.				
Project:	Proposed Residential Development				
Location:	Ashland, MA			Project No:	GTX-303030
Boring ID:	TP-9	Sample Type:	bag	Tested By:	jbr
Sample ID:	S-1	Test Date:	04/14/15	Checked By:	emm
Depth :	11-101 in	Test Id:	327734		

Test Comment: ---
Sample Description: Moist, yellowish brown silty sand with gravel
Sample Comment: ---

USDA Textural Classification

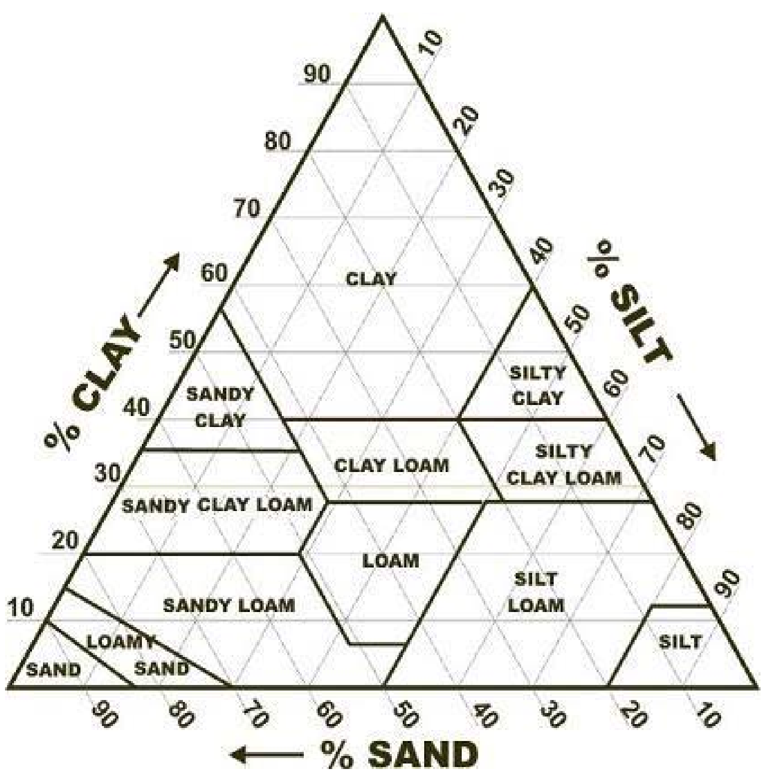
Boring ID	Sample ID	Depth	Sand, %	Silt, %	Clay, %	Classification
TP-9	S-1	11-101 in	65	33	2	Sandy Loam

Classifications based only on material passing the #10 sieve

Sand: material passing 2.0 mm and retained on 0.05 mm diameter

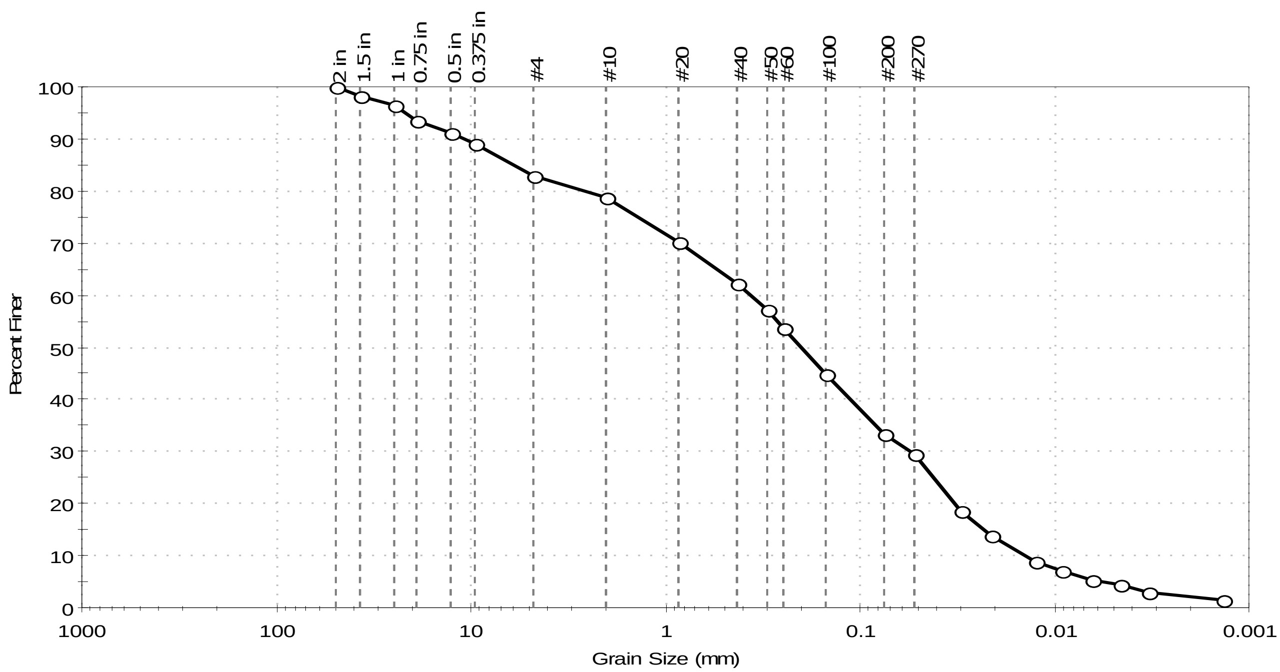
Silt: material passing 0.05 mm and retained on 0.002 mm diameter

Clay: material passing 0.002 mm diameter



Client:	Northeast Geotechnical, Inc.		
Project:	Proposed Residential Development		
Location:	Ashland, MA	Project No:	GTX-303030
Boring ID: TP-9	Sample Type: bag	Tested By:	jbr
Sample ID: S-1	Test Date: 04/14/15	Checked By:	emm
Depth : 11-101 in	Test Id: 327746		
Test Comment:	---		
Sample Description:	Moist, yellowish brown silty sand with gravel		
Sample Comment:	---		

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	17.1	49.6	33.3

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
2 in	50.00	100		
1.5 in	37.50	98		
1 in	25.00	97		
0.75 in	19.00	93		
0.5 in	12.70	91		
0.375 in	9.50	89		
#4	4.75	83		
#10	2.00	79		
#20	0.85	70		
#40	0.42	62		
#50	0.30	57		
#60	0.25	54		
#100	0.15	45		
#200	0.075	33		
#270	0.053	29		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0305	19		
---	0.0213	14		
---	0.0126	9		
---	0.0092	7		
---	0.0065	5		
---	0.0046	4		
---	0.0033	3		
---	0.0013	2		

Coefficients

D_{85} = 6.0351 mm	D_{30} = 0.0558 mm
D_{60} = 0.3654 mm	D_{15} = 0.0235 mm
D_{50} = 0.2035 mm	D_{10} = 0.0142 mm
C_u = 25.732	C_c = 0.600

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample / Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

Dispersion Device : Apparatus A - Mech Mixer

Dispersion Period : 1 minute

Specific Gravity : 2.65

Separation of Sample: #270 Sieve

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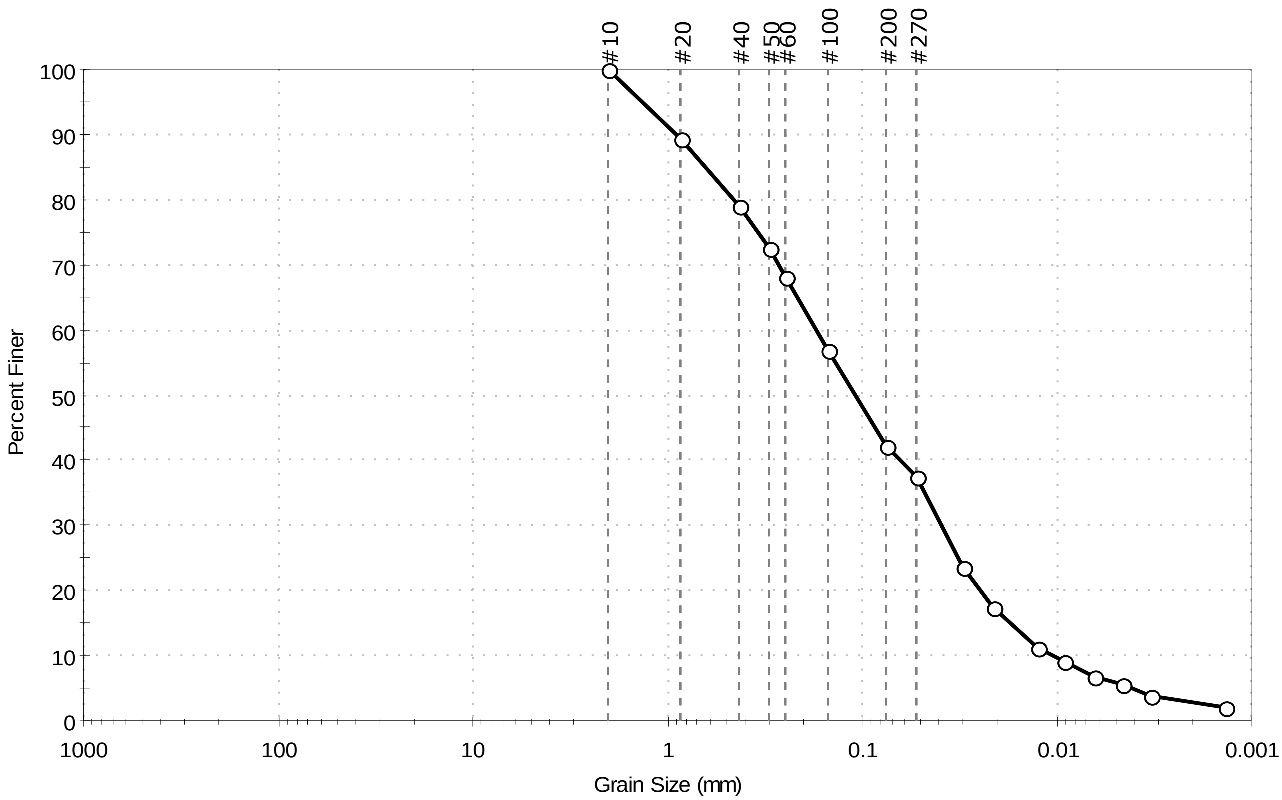
Client:	Northeast Geotechnical, Inc.			
Project:	Proposed Residential Development			
Location:	Ashland, MA		Project No:	GTX-303030
Boring ID: TP-9		Sample Type: bag	Tested By:	jbr
Sample ID: S-1		Test Date: 04/14/15	Checked By:	emm
Depth :	11-101 in	Test Id: 327746		
Test Comment:	Only minus No. 10 sieve for USDA classification			
Sample Description:	Moist, yellowish brown silty sand with gravel			
Sample Comment:	---			

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.0	57.7	42.3

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#10	2.00	100		
#20	0.85	89		
#40	0.42	79		
#50	0.30	73		
#60	0.25	68		
#100	0.15	57		
#200	0.075	42		
#270	0.053	37		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0305	24		
---	0.0213	18		
---	0.0126	11		
---	0.0092	9		
---	0.0065	7		
---	0.0046	6		
---	0.0033	4		
---	0.0013	2		

Coefficients

D_{85} =0.6350 mm D_{30} =0.0393 mm

D_{60} =0.1730 mm D_{15} =0.0172 mm

D_{50} =0.1082 mm D_{10} =0.0105 mm

C_u =16.476 C_c =0.850

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

Dispersion Device : Apparatus A - Mech Mixer

Dispersion Period : 1 minute

Specific Gravity : 2.65

Separation of Sample: #270 Sieve

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Client:	Northeast Geotechnical, Inc.				
Project:	Proposed Residential Development				
Location:	Ashland, MA			Project No:	GTX-303030
Boring ID:	TP-10	Sample Type:	bag	Tested By:	jbr
Sample ID:	S-1	Test Date:	04/14/15	Checked By:	emm
Depth :	12-61 in	Test Id:	327735		
Test Comment:	---				
Sample Description:	Moist, light brown silty sand with gravel				
Sample Comment:	---				

USDA Textural Classification

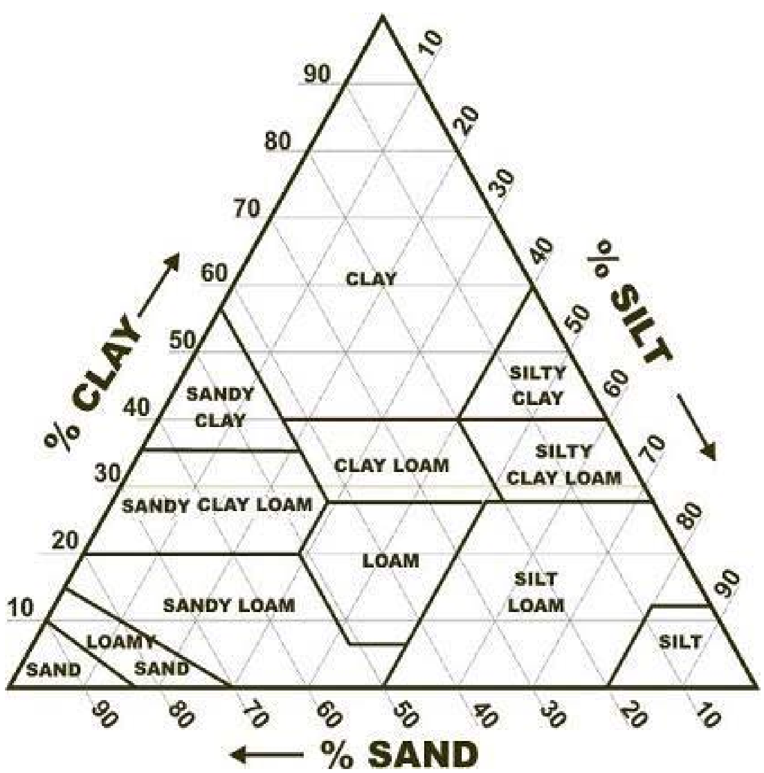
Boring ID	Sample ID	Depth	Sand, %	Silt, %	Clay, %	Classification
TP-10	S-1	12-61 in	63	34	3	Sandy Loam

Classifications based only on material passing the #10 sieve

Sand: material passing 2.0 mm and retained on 0.05 mm diameter

Silt: material passing 0.05 mm and retained on 0.002 mm diameter

Clay: material passing 0.002 mm diameter



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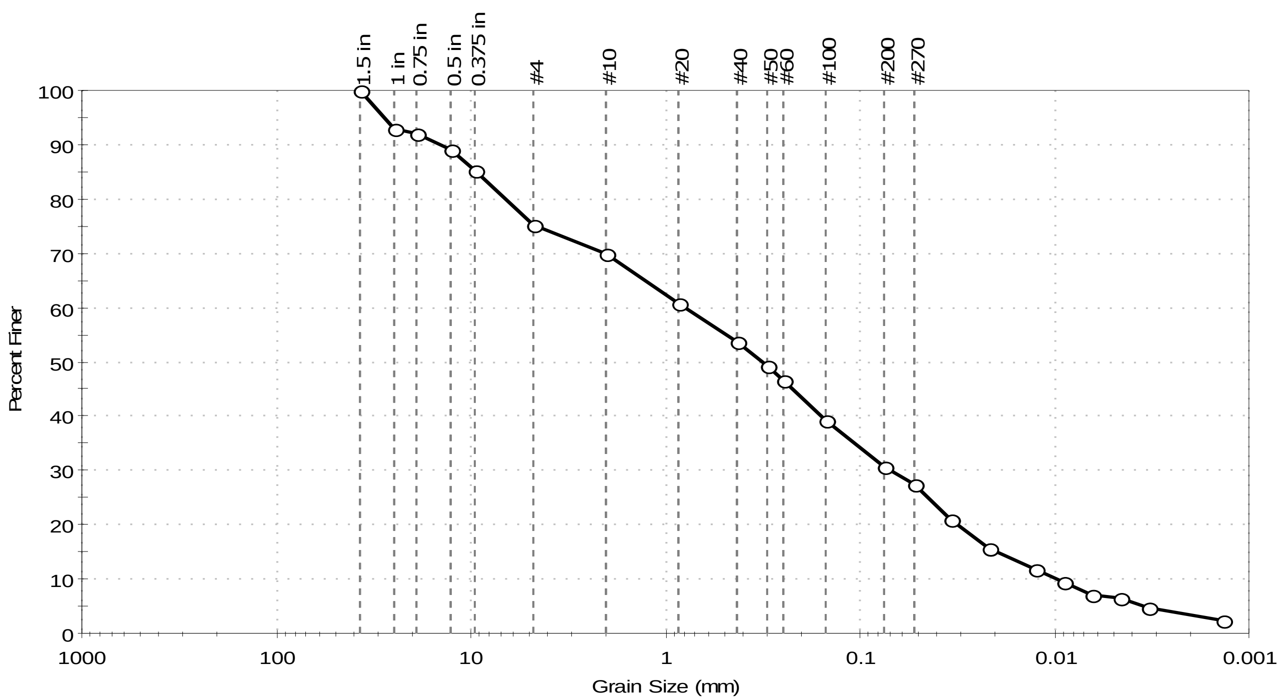
GeoTesting EXPRESS

Client:	Northeast Geotechnical, Inc.				
Project:	Proposed Residential Development				
Location:	Ashland, MA			Project No:	GTX-303030
Boring ID:	TP-10	Sample Type:	bag	Tested By:	jbr
Sample ID:	S-1	Test Date:	04/14/15	Checked By:	emm
Depth :	12-61 in	Test Id:	327747		

Test Comment: ---
Sample Description: Moist, light brown silty sand with gravel
Sample Comment: ---

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	24.7	44.8	30.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1.5 in	37.50	100		
1 in	25.00	93		
0.75 in	19.00	92		
0.5 in	12.70	89		
0.375 in	9.50	85		
#4	4.75	75		
#10	2.00	70		
#20	0.85	61		
#40	0.42	54		
#50	0.30	49		
#60	0.25	46		
#100	0.15	39		
#200	0.075	31		
#270	0.053	27		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0340	21		
---	0.0217	16		
---	0.0127	12		
---	0.0091	9		
---	0.0065	7		
---	0.0046	6		
---	0.0033	5		
---	0.0014	2		

Coefficients

D_{85} =9.3739 mm
D_{30} =0.0708 mm
D_{60} =0.7891 mm
D_{15} =0.0197 mm
D_{50} =0.3165 mm
D_{10} =0.0100 mm
C_u =78.910
C_c =0.635

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample / Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

Dispersion Device : Apparatus A - Mech Mixer

Dispersion Period : 1 minute

Specific Gravity : 2.65

Separation of Sample: #270 Sieve

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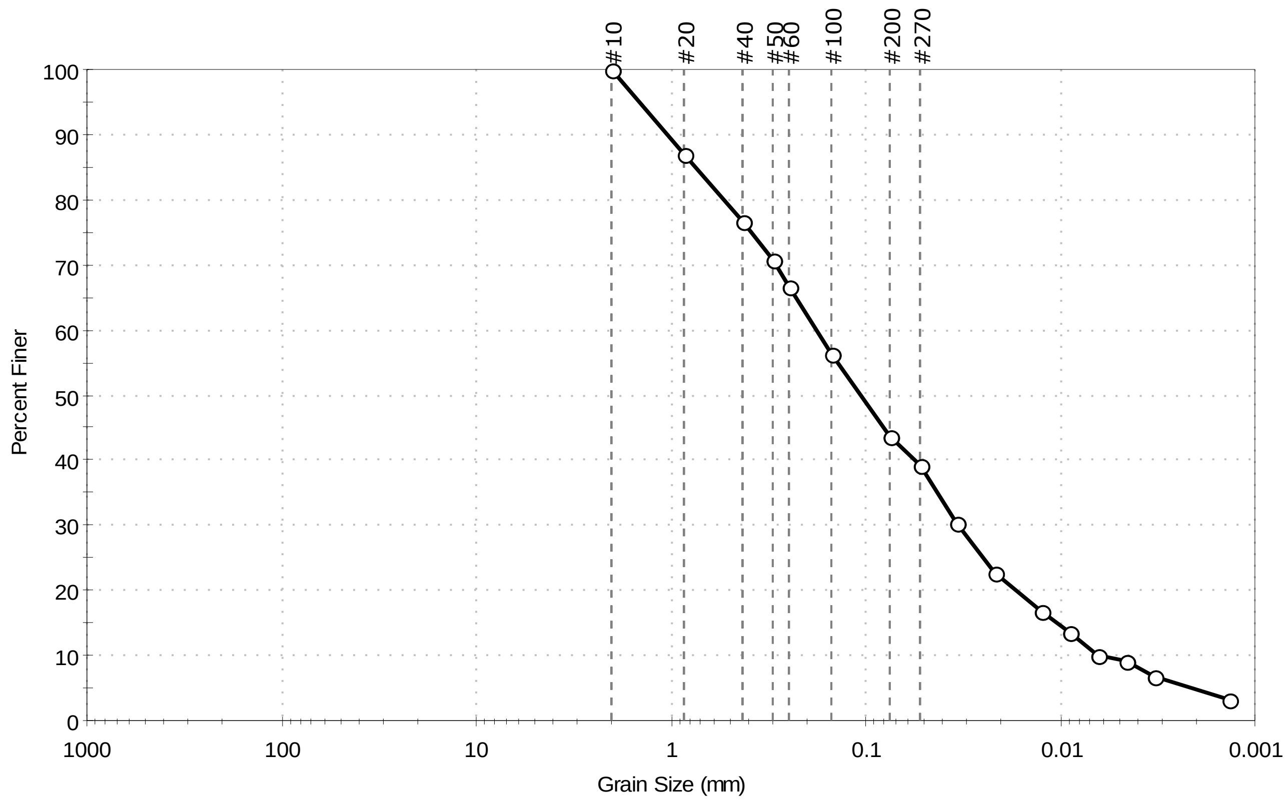
Client:	Northeast Geotechnical, Inc.			
Project:	Proposed Residential Development			
Location:	Ashland, MA		Project No:	GTX-303030
Boring ID: TP-10		Sample Type: bag	Tested By:	jbr
Sample ID: S-1		Test Date: 04/14/15	Checked By:	emm
Depth :	12-61 in	Test Id: 327747		
Test Comment:	Only minus No. 10 sieve for USDA classification			
Sample Description:	Moist, light brown silty sand with gravel			
Sample Comment:	---			

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.0	56.2	43.8

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#10	2.00	100		
#20	0.85	87		
#40	0.42	77		
#50	0.30	71		
#60	0.25	67		
#100	0.15	56		
#200	0.075	44		
#270	0.053	39		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0340	30		
---	0.0217	23		
---	0.0127	17		
---	0.0091	13		
---	0.0065	10		
---	0.0046	9		
---	0.0033	7		
---	0.0014	3		

Coefficients

D_{85} =0.7386 mm D_{30} =0.0333 mm

D_{60} =0.1808 mm D_{15} =0.0105 mm

D_{50} =0.1062 mm D_{10} =0.0062 mm

C_u =29.161 C_c =0.989

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

Dispersion Device : Apparatus A - Mech Mixer

Dispersion Period : 1 minute

Specific Gravity : 2.65

Separation of Sample: #270 Sieve

Client:	Northeast Geotechnical, Inc.		
Project:	Proposed Residential Development		
Location:	Ashland, MA	Project No:	GTX-303030
Boring ID: TP-11	Sample Type: bag	Tested By:	jbr
Sample ID: S-1	Test Date: 04/16/15	Checked By:	emm
Depth : 43-111 in	Test Id: 327870		
Test Comment:	---		
Sample Description:	Moist, light brown silty sand with gravel		
Sample Comment:	---		

USDA Textural Classification

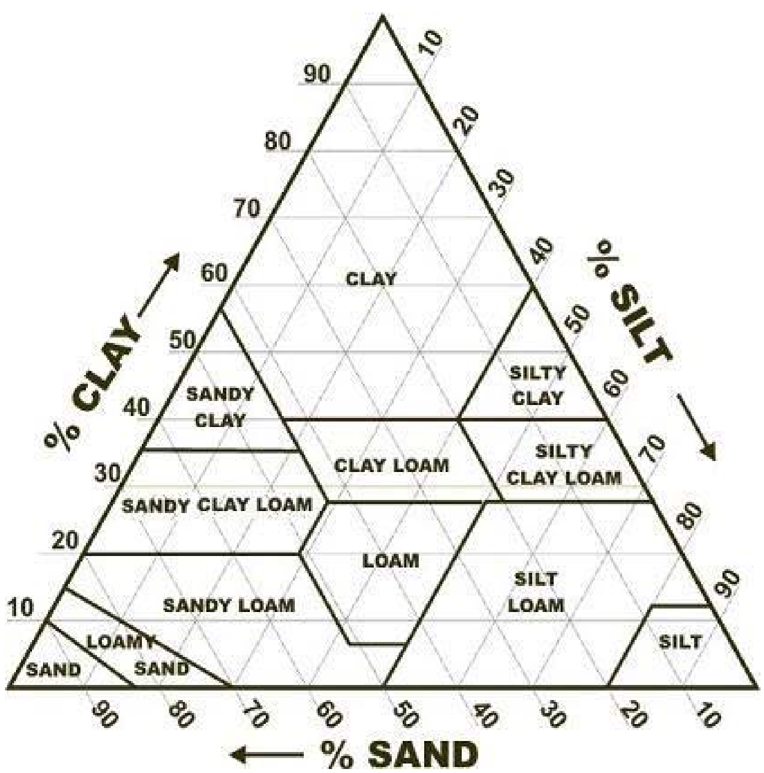
Boring ID	Sample ID	Depth	Sand, %	Silt, %	Clay, %	Classification
TP-11	S-1	43-111 in	80	19	1	Loamy Sand

Classifications based only on material passing the #10 sieve

Sand: material passing 2.0 mm and retained on 0.05 mm diameter

Silt: material passing 0.05 mm and retained on 0.002 mm diameter

Clay: material passing 0.002 mm diameter

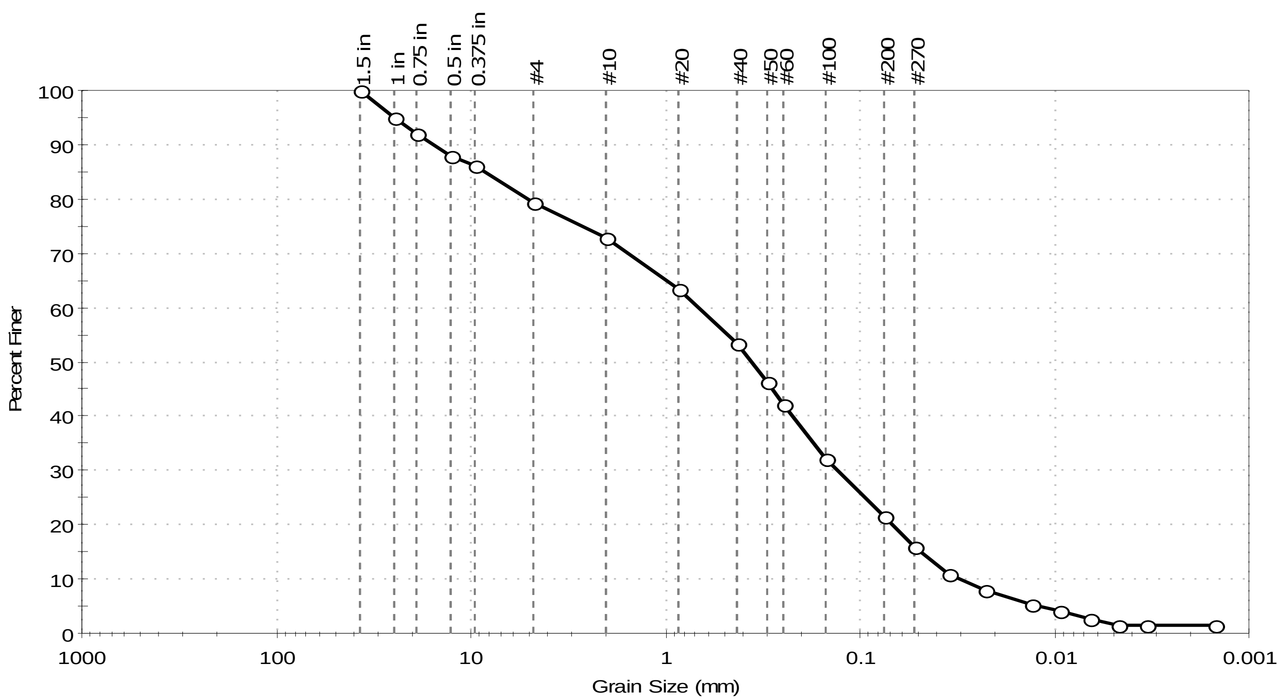


Client: Northeast Geotechnical, Inc.
Project: Proposed Residential Development
Location: Ashland, MA
Project No: GTX-303030

Boring ID: TP-11	Sample Type: bag	Tested By:	jbr
Sample ID: S-1	Test Date: 04/16/15	Checked By:	emm
Depth : 43-111 in	Test Id: 327860		

Test Comment: ---
Sample Description: Moist, light brown silty sand with gravel
Sample Comment: ---

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	20.7	57.8	21.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1.5 in	37.50	100		
1 in	25.00	95		
0.75 in	19.00	92		
0.5 in	12.70	88		
0.375 in	9.50	86		
#4	4.75	79		
#10	2.00	73		
#20	0.85	63		
#40	0.42	53		
#50	0.30	46		
#60	0.25	42		
#100	0.15	32		
#200	0.075	22		
#270	0.053	16		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0352	11		
---	0.0227	8		
---	0.0131	5		
---	0.0093	4		
---	0.0066	3		
---	0.0047	1		
---	0.0033	1		
---	0.0015	1		

Coefficients

D_{85} =8.5192 mm
D_{30} =0.1309 mm
D_{60} =0.6682 mm
D_{15} =0.0489 mm
D_{50} =0.3580 mm
D_{10} =0.0310 mm
C_u =21.555
C_c =0.827

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED
Sand/Gravel Hardness : HARD
Dispersion Device : Apparatus A - Mech Mixer
Dispersion Period : 1 minute
Specific Gravity : 2.65
Separation of Sample: #270 Sieve

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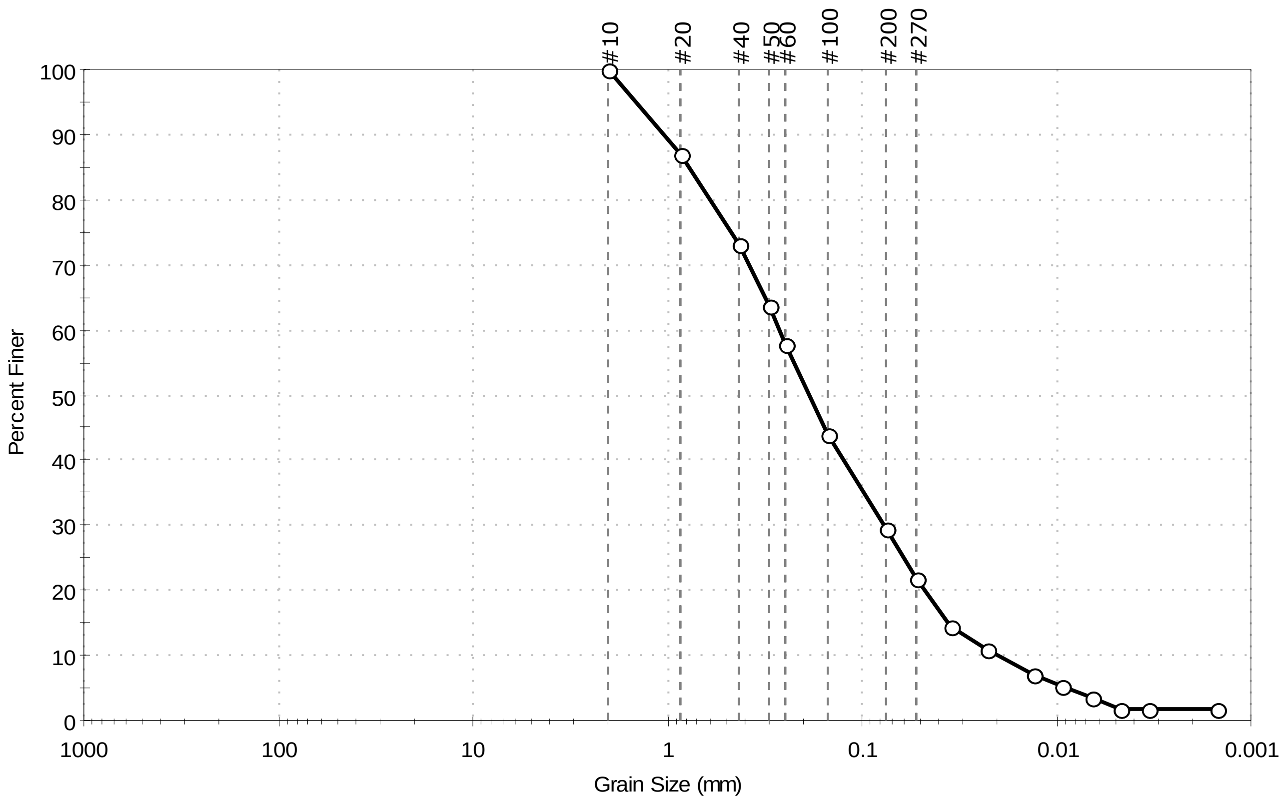
Client:	Northeast Geotechnical, Inc.				
Project:	Proposed Residential Development				
Location:	Ashland, MA			Project No:	GTX-303030
Boring ID:	TP-11	Sample Type:	bag	Tested By:	jbr
Sample ID:	S-1	Test Date:	04/16/15	Checked By:	emm
Depth :	43-111 in	Test Id:	327860		
Test Comment:	Only minus No. 10 sieve for USDA classification				
Sample Description:	Moist, light brown silty sand with gravel				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.0	70.5	29.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#10	2.00	100		
#20	0.85	87		
#40	0.42	73		
#50	0.30	64		
#60	0.25	58		
#100	0.15	44		
#200	0.075	30		
#270	0.053	22		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0352	14		
---	0.0227	11		
---	0.0131	7		
---	0.0093	5		
---	0.0066	4		
---	0.0047	2		
---	0.0033	2		
---	0.0015	2		

Coefficients

D_{85} =0.7695 mm
D_{30} =0.0768 mm
D_{60} =0.2674 mm
D_{15} =0.0364 mm
D_{50} =0.1873 mm
D_{10} =0.0201 mm
C_u =13.303
C_c =1.097

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

Dispersion Device : Apparatus A - Mech Mixer

Dispersion Period : 1 minute

Specific Gravity : 2.65

Separation of Sample: #270 Sieve

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Client:	Northeast Geotechnical, Inc.			
Project:	Proposed Residential Development			
Location:	Ashland, MA		Project No:	GTX-303030
Boring ID: TP-12		Sample Type: bag	Tested By:	jbr
Sample ID: S-1		Test Date: 04/17/15	Checked By:	emm
Depth : 24-112 in		Test Id: 327871		
Test Comment:	---			
Sample Description:	Moist, light brown silty sand with gravel			
Sample Comment:	---			

USDA Textural Classification

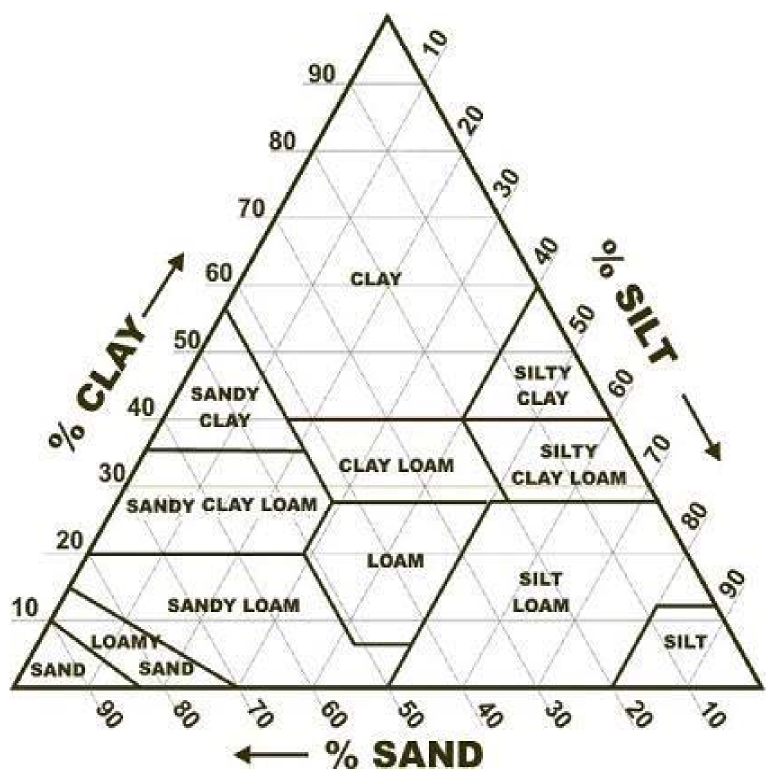
Boring ID	Sample ID	Depth	Sand, %	Silt, %	Clay, %	Classification
TP-12	S-1	24-112 in	78	22	0	Loamy Sand

Classifications based only on material passing the #10 sieve

Sand: material passing 2.0 mm and retained on 0.05 mm diameter

Silt: material passing 0.05 mm and retained on 0.002 mm diameter

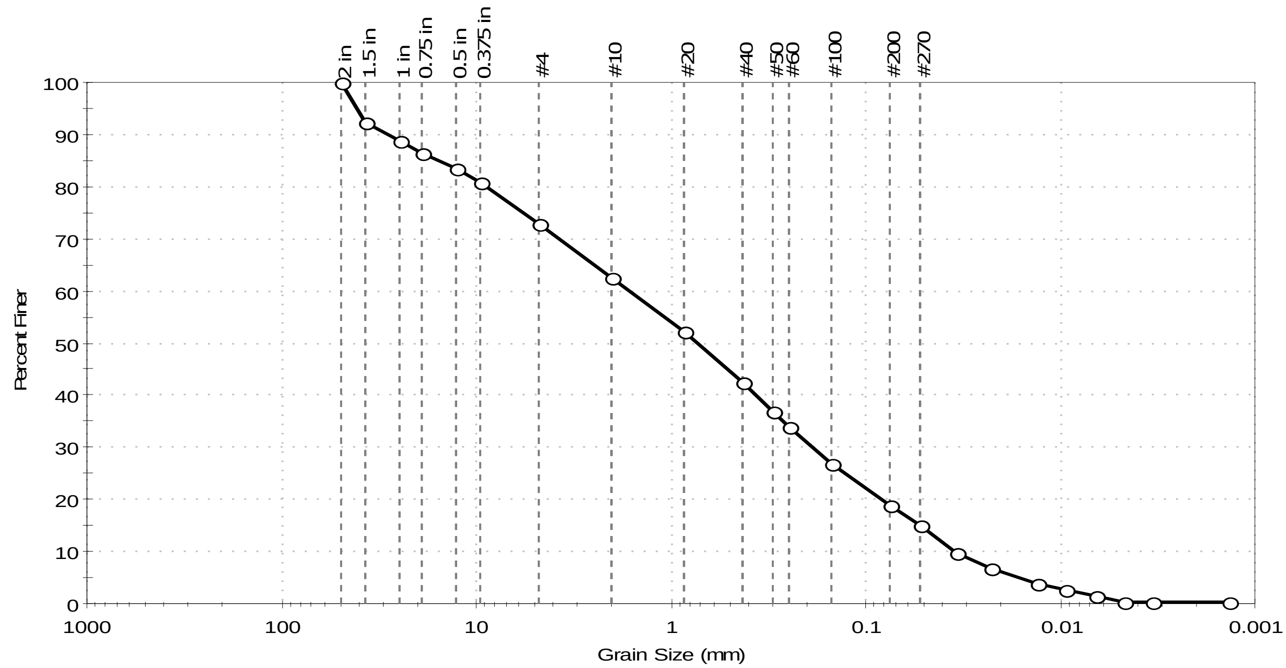
Clay: material passing 0.002 mm diameter



Client: Northeast Geotechnical, Inc.			
Project: Proposed Residential Development			
Location: Ashland, MA		Project No:	GTX-303030
Boring ID: TP-12	Sample Type: bag	Tested By:	jbr
Sample ID: S-1	Test Date: 04/17/15	Checked By:	emm
Depth : 24-112 in	Test Id: 327861		

Test Comment: ---
Sample Description: Moist, light brown silty sand with gravel
Sample Comment: ---

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	27.2	54.0	18.8

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
2 in	50.00	100		
1.5 in	37.50	92		
1 in	25.00	89		
0.75 in	19.00	86		
0.5 in	12.70	84		
0.375 in	9.50	81		
#4	4.75	73		
#10	2.00	63		
#20	0.85	52		
#40	0.42	42		
#50	0.30	37		
#60	0.25	34		
#100	0.15	27		
#200	0.075	19		
#270	0.053	15		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0342	10		
---	0.0227	7		
---	0.0132	4		
---	0.0093	3		
---	0.0067	2		
---	0.0047	0		
---	0.0033	0		
---	0.0014	0		

Coefficients

D_{85} =15.6338 mm
D_{30} =0.1874 mm
D_{60} =1.6183 mm
D_{15} =0.0531 mm
D_{50} =0.7289 mm
D_{10} =0.0349 mm
C_u =46.370
C_c =0.622

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-b (0))

Sample / Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

Dispersion Device : Apparatus A - Mech Mixer

Dispersion Period : 1 minute

Specific Gravity : 2.65

Separation of Sample: #270 Sieve

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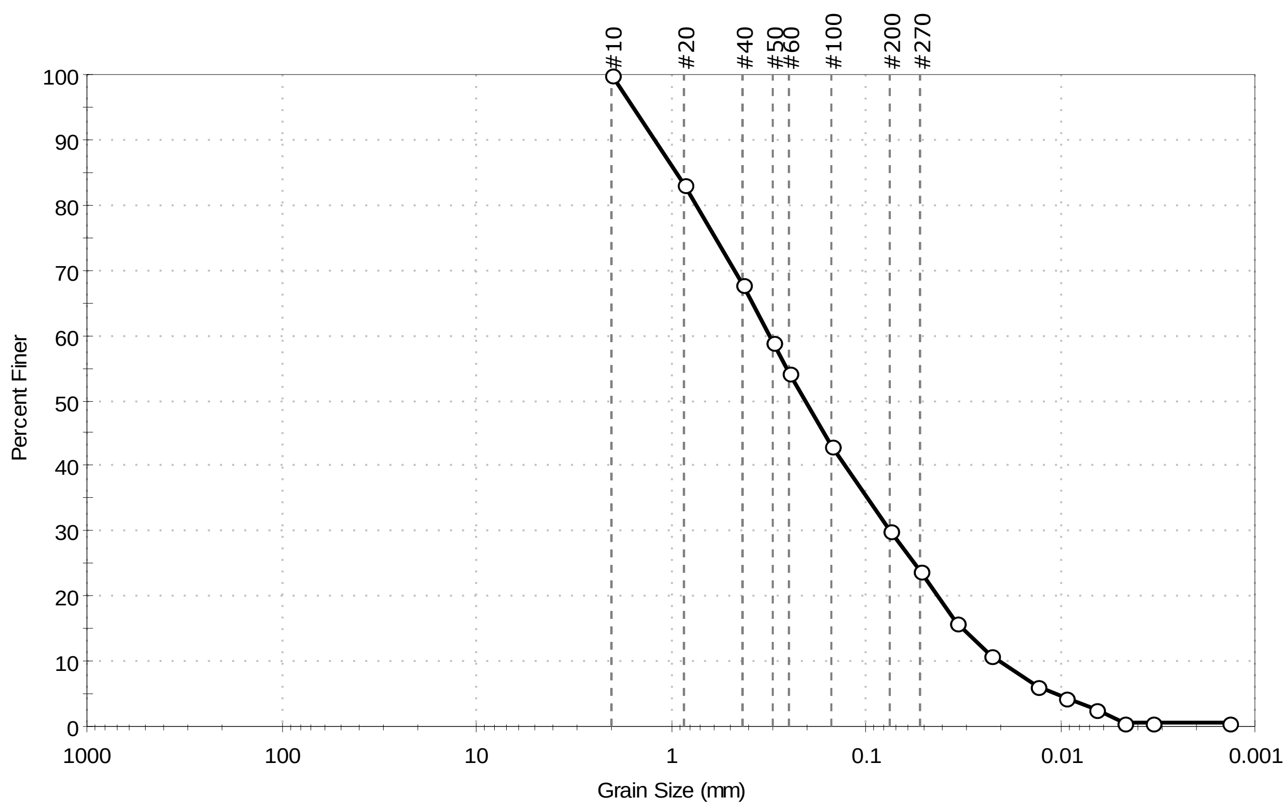
Client:	Northeast Geotechnical, Inc.		
Project:	Proposed Residential Development		
Location:	Ashland, MA	Project No:	GTX-303030
Boring ID: TP-12	Sample Type: bag	Tested By:	jbr
Sample ID: S-1	Test Date: 04/17/15	Checked By:	emm
Depth : 24-112 in	Test Id: 327861		
Test Comment:	Only minus No. 10 sieve for USDA classification		
Sample Description:	Moist, light brown silty sand with gravel		
Sample Comment:	---		

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.0	69.9	30.1

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#10	2.00	100		
#20	0.85	83		
#40	0.42	68		
#50	0.30	59		
#60	0.25	54		
#100	0.15	43		
#200	0.075	30		
#270	0.053	24		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0342	16		
---	0.0227	11		
---	0.0132	6		
---	0.0093	5		
---	0.0067	3		
---	0.0047	1		
---	0.0033	1		
---	0.0014	1		

Coefficients

D_{85} =0.9270 mm D_{30} =0.0745 mm

D_{60} =0.3129 mm D_{15} =0.0314 mm

D_{50} =0.2055 mm D_{10} =0.0203 mm

C_u =15.414 C_c =0.874

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

Dispersion Device : Apparatus A - Mech Mixer

Dispersion Period : 1 minute

Specific Gravity : 2.65

Separation of Sample: #270 Sieve

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Client:	Northeast Geotechnical, Inc.				
Project:	Proposed Residential Development				
Location:	Ashland, MA			Project No:	GTX-303030
Boring ID:	TP-13	Sample Type:	bag	Tested By:	jbr
Sample ID:	S-1	Test Date:	04/16/15	Checked By:	emm
Depth :	42-54 in	Test Id:	327872		
Test Comment:	---				
Sample Description:	Moist, light brown sandy silt				
Sample Comment:	---				

USDA Textural Classification

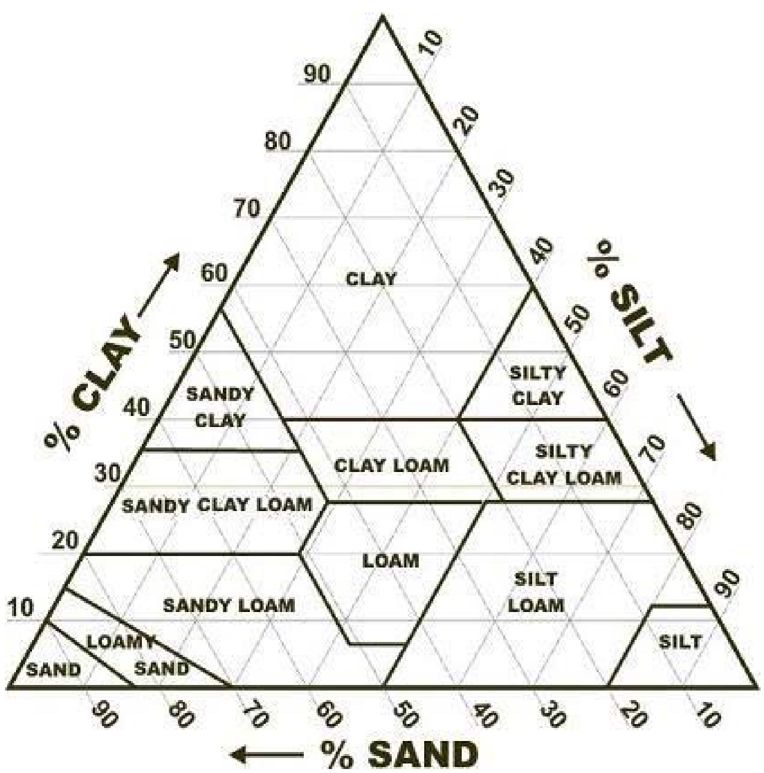
Boring ID	Sample ID	Depth	Sand, %	Silt, %	Clay, %	Classification
TP-13	S-1	42-54 in	55	44	1	Sandy Loam

Classifications based only on material passing the #10 sieve

Sand: material passing 2.0 mm and retained on 0.05 mm diameter

Silt: material passing 0.05 mm and retained on 0.002 mm diameter

Clay: material passing 0.002 mm diameter

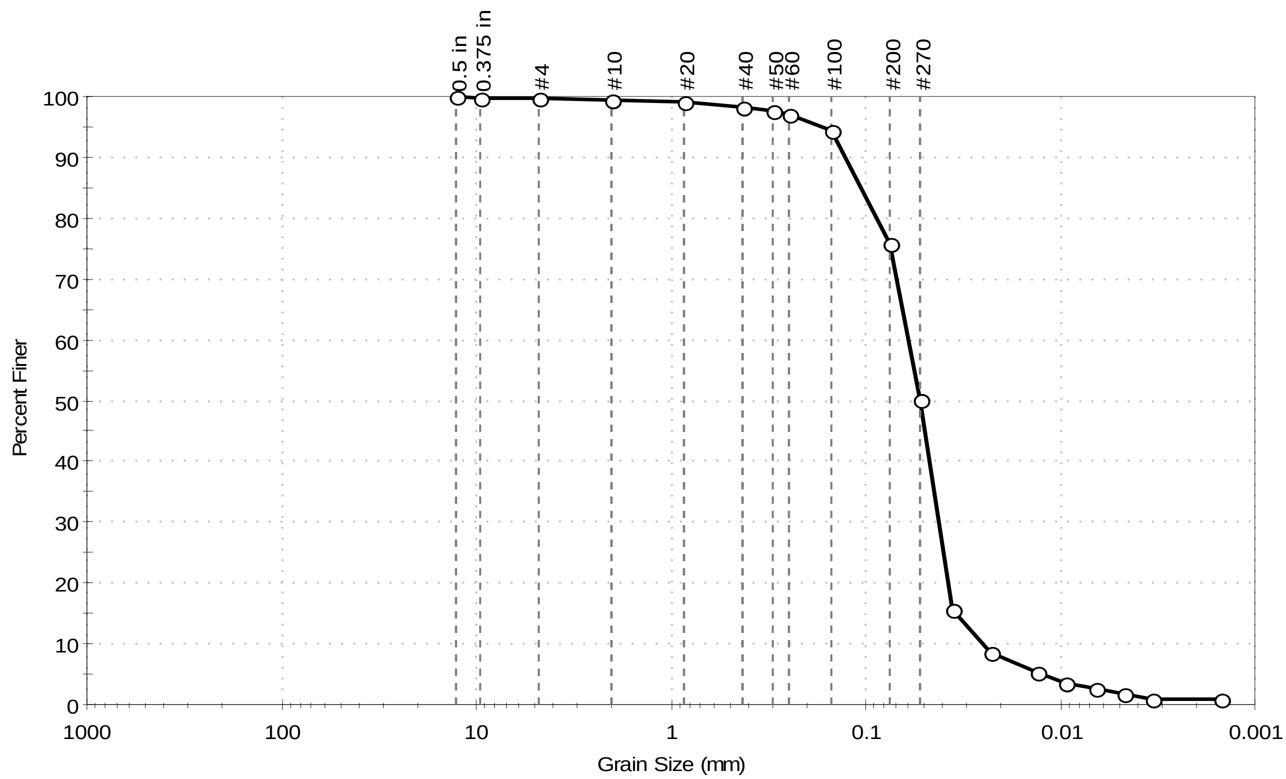


Client:	Northeast Geotechnical, Inc.		
Project:	Proposed Residential Development		
Location:	Ashland, MA	Project No:	GTX-303030

Boring ID:	TP-13	Sample Type:	bag	Tested By:	jbr
Sample ID:	S-1	Test Date:	04/16/15	Checked By:	emm
Depth :	42-54 in	Test Id:	327862		

Test Comment: ---
Sample Description: Moist, light brown silt with sand
Sample Comment: ---

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.3	23.7	76.0

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.5 in	12.70	100		
0.375 in	9.50	100		
#4	4.75	100		
#10	2.00	99		
#20	0.85	99		
#40	0.42	98		
#50	0.30	98		
#60	0.25	97		
#100	0.15	94		
#200	0.075	76		
#270	0.053	50		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0359	16		
---	0.0228	9		
---	0.0130	5		
---	0.0093	3		
---	0.0066	3		
---	0.0047	2		
---	0.0034	1		
---	0.0015	1		

Coefficients

D_{85} = 0.1053 mm
D_{30} = 0.0422 mm
D_{60} = 0.0606 mm
D_{15} = 0.0344 mm
D_{50} = 0.0530 mm
D_{10} = 0.0249 mm
C_u = 2.434
C_c = 1.180

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Dispersion Device : Apparatus A - Mech Mixer

Dispersion Period : 1 minute

Specific Gravity : 2.65

Separation of Sample: #270 Sieve

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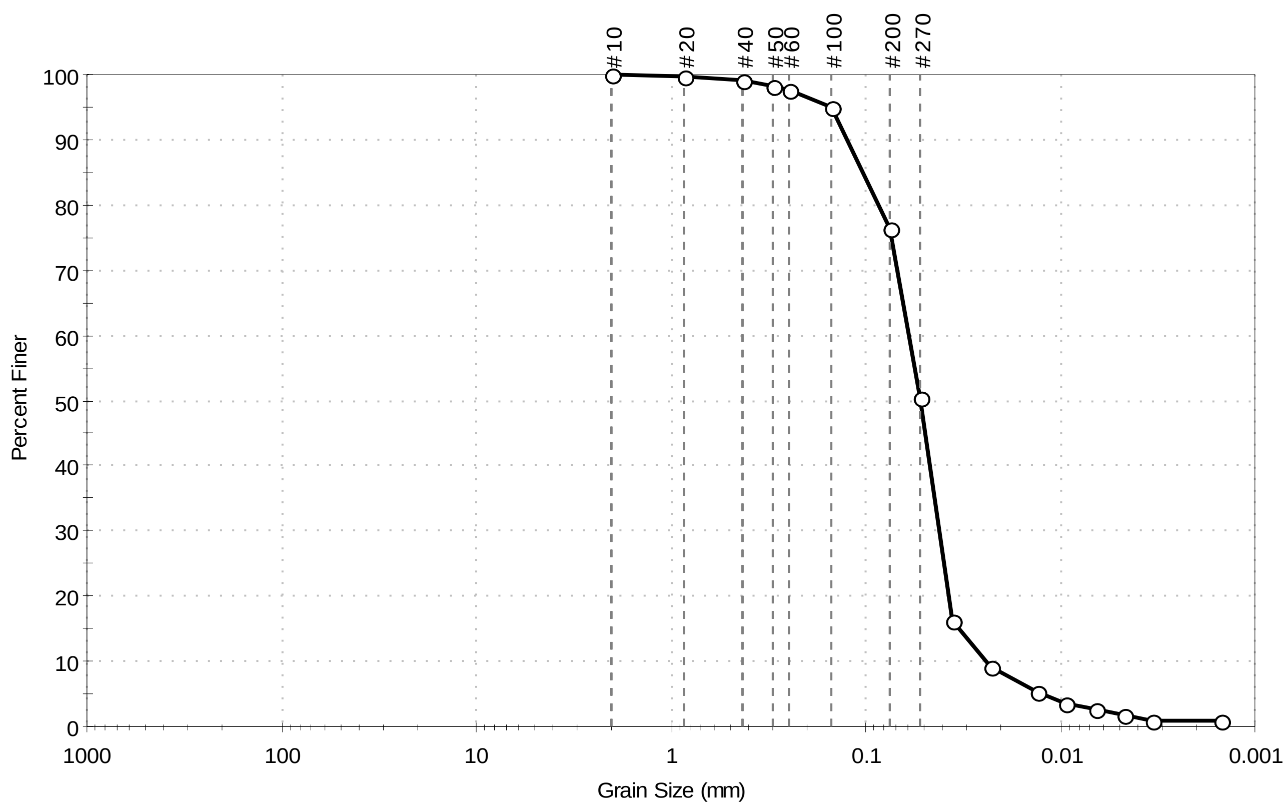
GeoTesting EXPRESS

Client:	Northeast Geotechnical, Inc.		
Project:	Proposed Residential Development		
Location:	Ashland, MA	Project No:	GTX-303030
Boring ID: TP-13	Sample Type: bag	Tested By:	jbr
Sample ID: S-1	Test Date: 04/16/15	Checked By:	emm
Depth : 42-54 in	Test Id: 327862		
Test Comment:	Only minus No. 10 sieve for USDA classification		
Sample Description:	Moist, light brown silt with sand		
Sample Comment:	---		

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.0	23.6	76.4

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#10	2.00	100		
#20	0.85	100		
#40	0.42	99		
#50	0.30	98		
#60	0.25	98		
#100	0.15	95		
#200	0.075	76		
#270	0.053	50		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0359	16		
---	0.0228	9		
---	0.0130	5		
---	0.0093	4		
---	0.0066	3		
---	0.0047	2		
---	0.0034	1		
---	0.0015	1		

Coefficients

D_{85} = 0.1031 mm
D_{30} = 0.0420 mm
D_{60} = 0.0602 mm
D_{15} = 0.0330 mm
D_{50} = 0.0528 mm
D_{10} = 0.0242 mm
C_u = 2.488
C_c = 1.211

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Dispersion Device : Apparatus A - Mech Mixer

Dispersion Period : 1 minute

Specific Gravity : 2.65

Separation of Sample: #270 Sieve

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Client:	Northeast Geotechnical, Inc.		
Project:	Proposed Residential Development		
Location:	Ashland, MA	Project No:	GTX-303030
Boring ID: TP-14	Sample Type: bag	Tested By:	jbr
Sample ID: S-1	Test Date: 04/15/15	Checked By:	emm
Depth : 40-108 in	Test Id: 327873		
Test Comment:	---		
Sample Description:	Moist, light brown silty sand with gravel		
Sample Comment:	---		

USDA Textural Classification

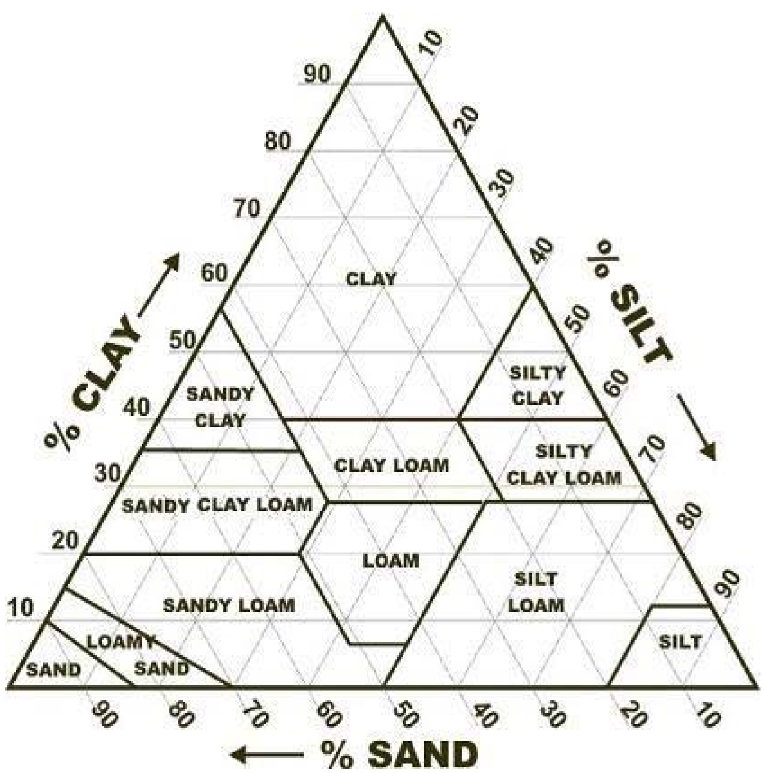
Boring ID	Sample ID	Depth	Sand, %	Silt, %	Clay, %	Classification
TP-14	S-1	40-108 in	69	29	2	Sandy Loam

Classifications based only on material passing the #10 sieve

Sand: material passing 2.0 mm and retained on 0.05 mm diameter

Silt: material passing 0.05 mm and retained on 0.002 mm diameter

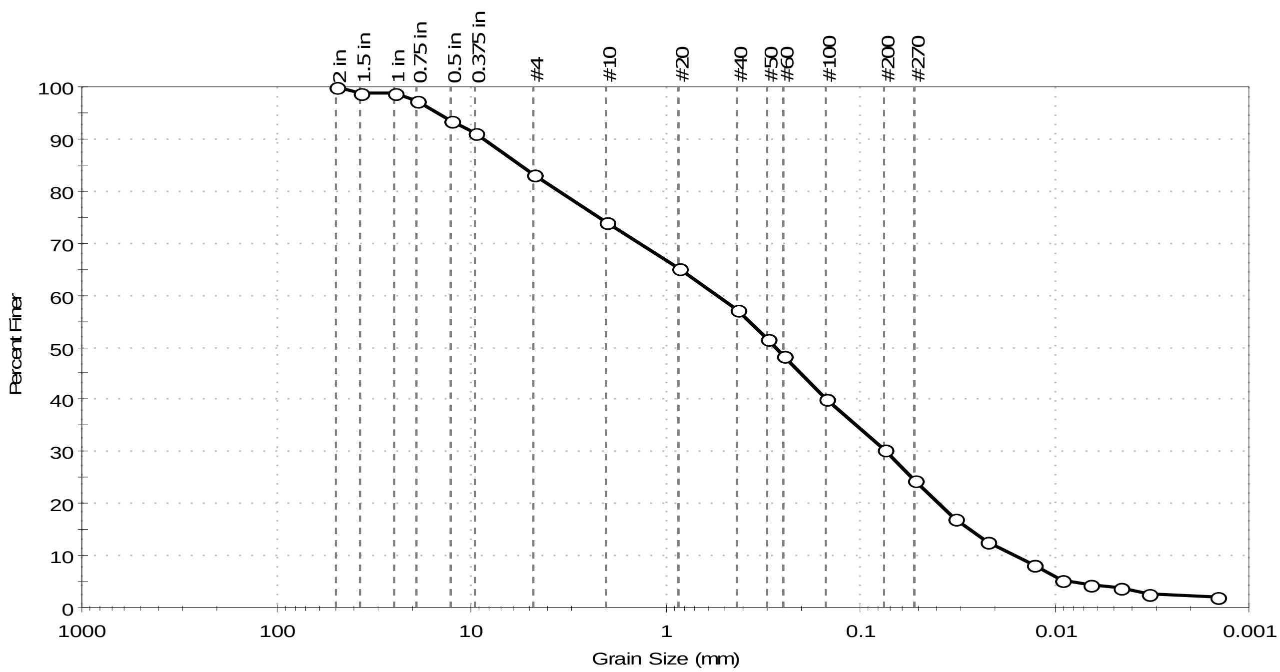
Clay: material passing 0.002 mm diameter



GeoTesting EXPRESS

Client:	Northeast Geotechnical, Inc.				
Project:	Proposed Residential Development				
Location:	Ashland, MA			Project No:	GTX-303030
Boring ID:	TP-14	Sample Type:	bag	Tested By:	jbr
Sample ID:	S-1	Test Date:	04/16/15	Checked By:	emm
Depth :	40-108 in	Test Id:	327863		
Test Comment:	---				
Sample Description:	Moist, light brown silty sand with gravel				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	16.9	52.8	30.3

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
2 in	50.00	100		
1.5 in	37.50	99		
1 in	25.00	99		
0.75 in	19.00	97		
0.5 in	12.70	94		
0.375 in	9.50	91		
#4	4.75	83		
#10	2.00	74		
#20	0.85	65		
#40	0.42	57		
#50	0.30	52		
#60	0.25	48		
#100	0.15	40		
#200	0.075	30		
#270	0.053	24		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0328	17		
---	0.0220	13		
---	0.0130	8		
---	0.0093	5		
---	0.0066	4		
---	0.0047	4		
---	0.0033	3		
---	0.0015	2		

Coefficients

D_{85} =5.5904 mm	D_{30} =0.0736 mm
D_{60} =0.5419 mm	D_{15} =0.0274 mm
D_{50} =0.2742 mm	D_{10} =0.0162 mm
C_u =33.451	C_c =0.617

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

Dispersion Device : Apparatus A - Mech Mixer

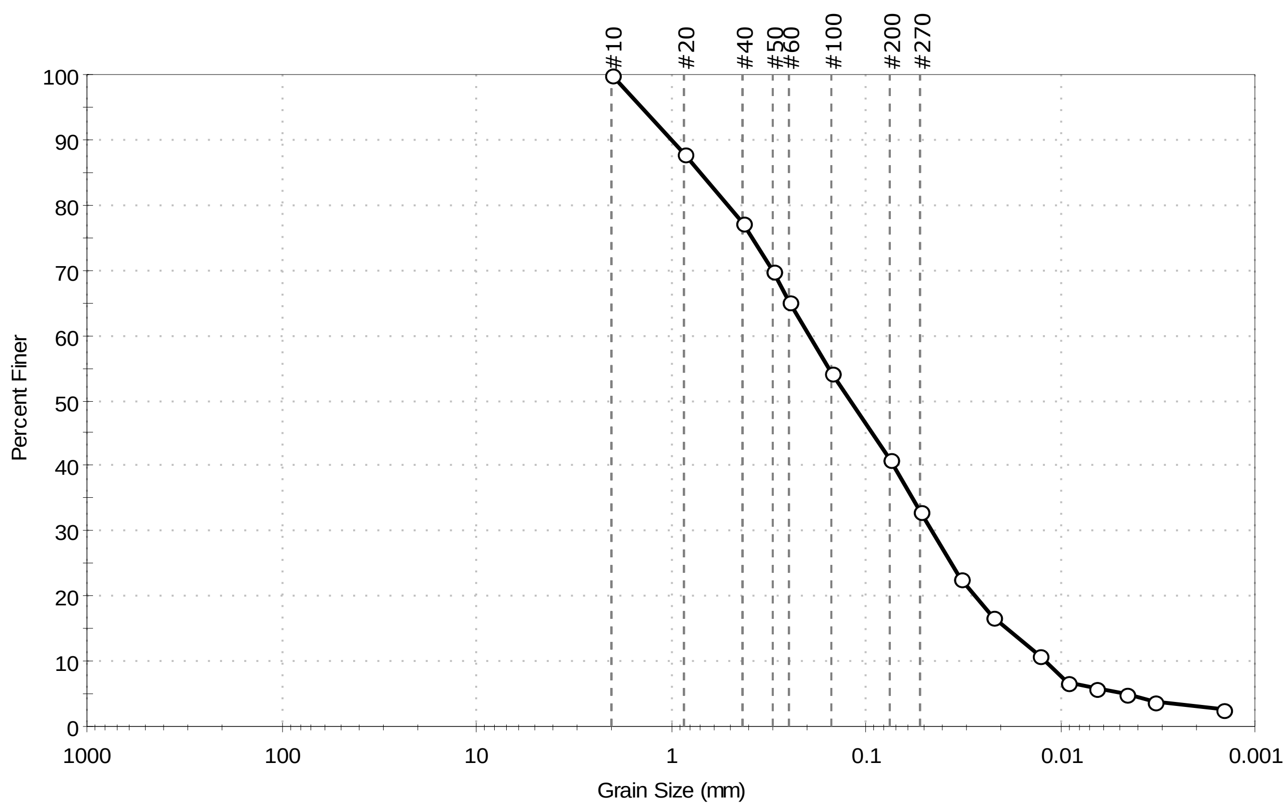
Dispersion Period : 1 minute

Specific Gravity : 2.65

Separation of Sample: #270 Sieve

Client:	Northeast Geotechnical, Inc.		
Project:	Proposed Residential Development		
Location:	Ashland, MA	Project No:	GTX-303030
Boring ID: TP-14	Sample Type: bag	Tested By:	jbr
Sample ID: S-1	Test Date: 04/16/15	Checked By:	emm
Depth : 40-108 in	Test Id: 327863		
Test Comment:	Only minus No. 10 sieve for USDA classification		
Sample Description:	Moist, light brown silty sand with gravel		
Sample Comment:	---		

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.0	59.0	41.0

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#10	2.00	100		
#20	0.85	88		
#40	0.42	77		
#50	0.30	70		
#60	0.25	65		
#100	0.15	54		
#200	0.075	41		
#270	0.053	33		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0328	23		
---	0.0220	17		
---	0.0130	11		
---	0.0093	7		
---	0.0066	6		
---	0.0047	5		
---	0.0033	4		
---	0.0015	3		

Coefficients

D_{85} =0.6979 mm	D_{30} =0.0462 mm
D_{60} =0.1961 mm	D_{15} =0.0188 mm
D_{50} =0.1204 mm	D_{10} =0.0121 mm
C_u =16.207	C_c =0.900

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample / Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

Dispersion Device : Apparatus A - Mech Mixer

Dispersion Period : 1 minute

Specific Gravity : 2.65

Separation of Sample: #270 Sieve

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Client:	Northeast Geotechnical, Inc.				
Project:	Proposed Residential Development				
Location:	Ashland, MA			Project No:	GTX-303030
Boring ID:	TP-15	Sample Type:	bag	Tested By:	jbr
Sample ID:	S-1	Test Date:	04/15/15	Checked By:	emm
Depth :	28-108 in	Test Id:	327874		
Test Comment:	---				
Sample Description:	Moist, light brown silty sand				
Sample Comment:	---				

USDA Textural Classification

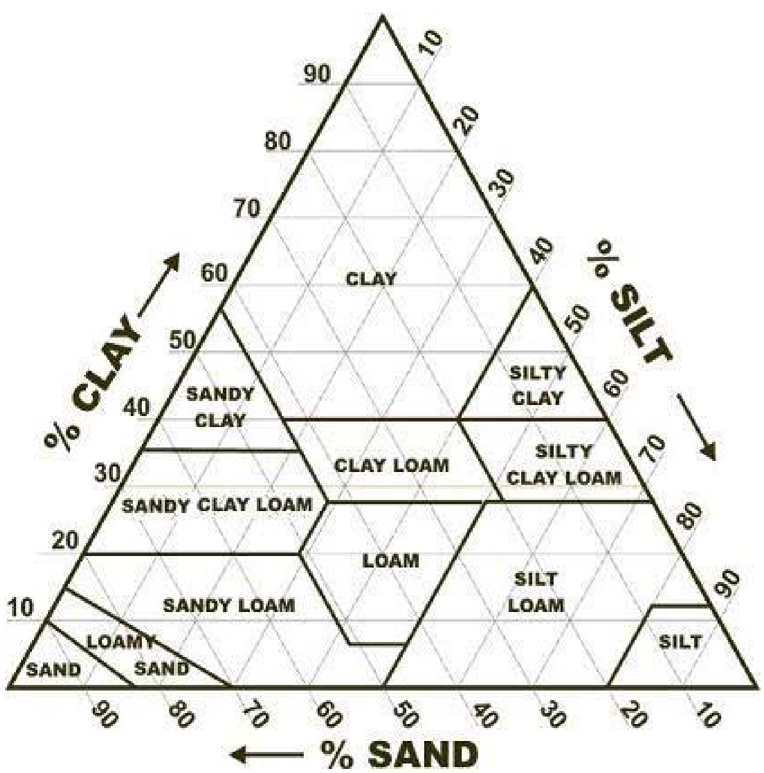
Boring ID	Sample ID	Depth	Sand, %	Silt, %	Clay, %	Classification
TP-15	S-1	28-108 in	69	29	2	Sandy Loam

Classifications based only on material passing the #10 sieve

Sand: material passing 2.0 mm and retained on 0.05 mm diameter

Silt: material passing 0.05 mm and retained on 0.002 mm diameter

Clay: material passing 0.002 mm diameter



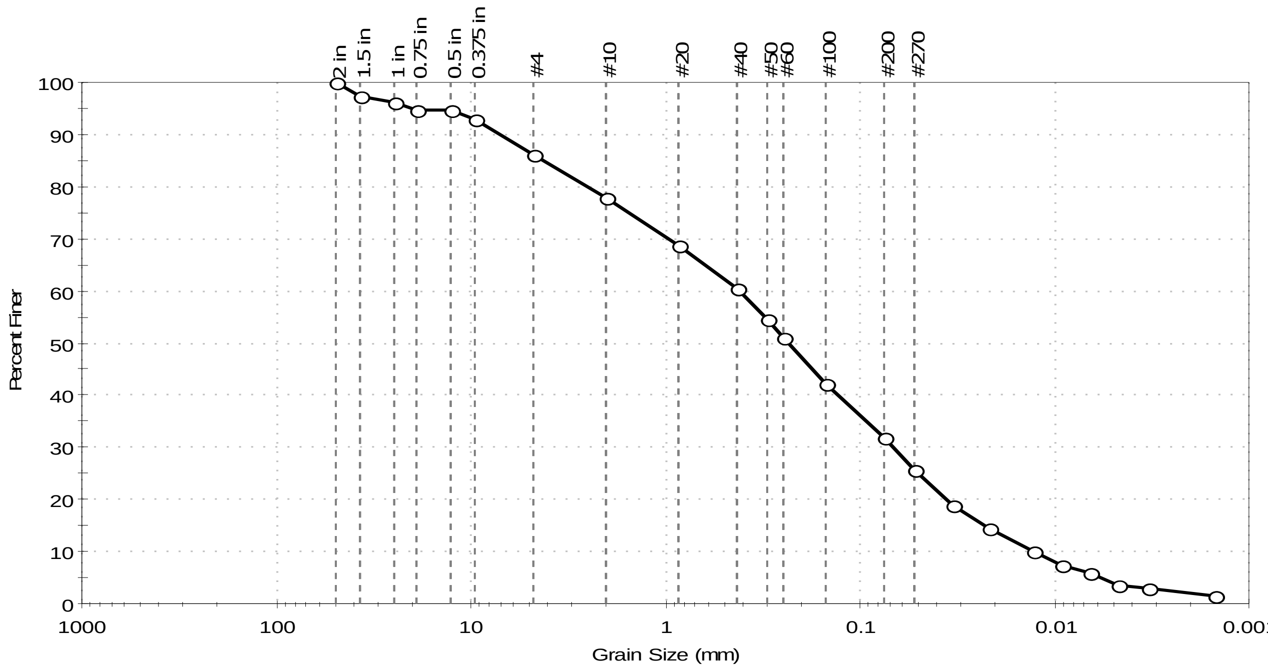
Client:	Northeast Geotechnical, Inc.				
Project:	Proposed Residential Development				
Location:	Ashland, MA			Project No:	GTX-303030
Boring ID:	TP-15	Sample Type:	bag	Tested By:	jbr
Sample ID:	S-1	Test Date:	04/16/15	Checked By:	emm
Depth :	28-108 in	Test Id:	327864		

Test Comment: ---

Sample Description: Moist, light brown silty sand

Sample Comment: ---

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	14.0	54.2	31.8

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
2 in	50.00	100		
1.5 in	37.50	97		
1 in	25.00	96		
0.75 in	19.00	95		
0.5 in	12.70	95		
0.375 in	9.50	93		
#4	4.75	86		
#10	2.00	78		
#20	0.85	69		
#40	0.42	61		
#50	0.30	55		
#60	0.25	51		
#100	0.15	42		
#200	0.075	32		
#270	0.053	26		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0333	19		
---	0.0219	14		
---	0.0129	10		
---	0.0092	7		
---	0.0065	6		
---	0.0047	4		
---	0.0033	3		
---	0.0015	1		

Coefficients

D_{85} =4.2578 mm

D_{30} =0.0677 mm

D_{60} =0.4098 mm

D_{15} =0.0230 mm

D_{50} =0.2341 mm

D_{10} =0.0127 mm

C_u =32.268

C_c =0.881

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample / Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

Dispersion Device : Apparatus A - Mech Mixer

Dispersion Period : 1 minute

Specific Gravity : 2.65

Separation of Sample: #270 Sieve

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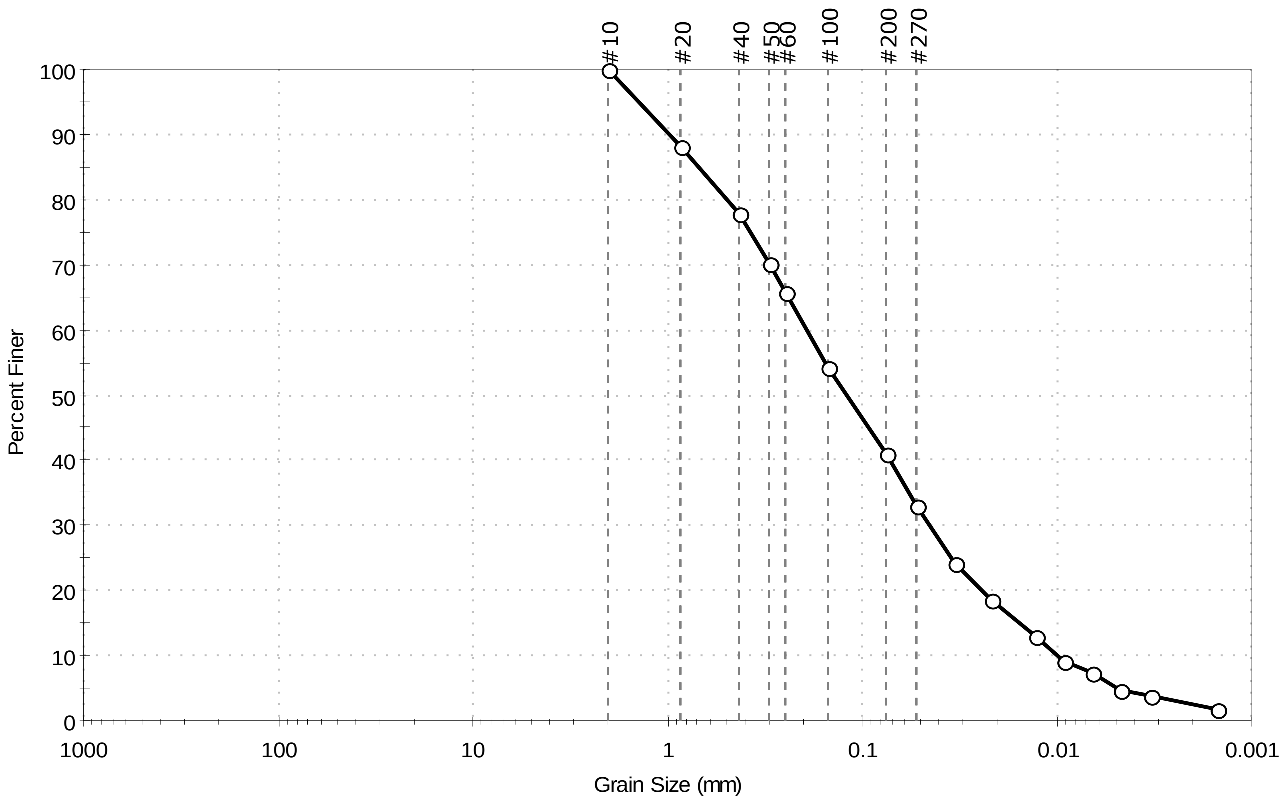
Client:	Northeast Geotechnical, Inc.				
Project:	Proposed Residential Development				
Location:	Ashland, MA			Project No:	GTX-303030
Boring ID:	TP-15	Sample Type:	bag	Tested By:	jbr
Sample ID:	S-1	Test Date:	04/16/15	Checked By:	emm
Depth :	28-108 in	Test Id:	327864		
Test Comment:	Only minus No. 10 sieve for USDA classification				
Sample Description:	Moist, light brown silty sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.0	59.1	40.9

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#10	2.00	100		
#20	0.85	88		
#40	0.42	78		
#50	0.30	70		
#60	0.25	66		
#100	0.15	54		
#200	0.075	41		
#270	0.053	33		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0333	24		
---	0.0219	19		
---	0.0129	13		
---	0.0092	9		
---	0.0065	7		
---	0.0047	5		
---	0.0033	4		
---	0.0015	2		

Coefficients

D_{85} =0.6840 mm	D_{30} =0.0453 mm
D_{60} =0.1931 mm	D_{15} =0.0156 mm
D_{50} =0.1197 mm	D_{10} =0.0098 mm
C_u =19.704	C_c =1.084

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample / Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

Dispersion Device : Apparatus A - Mech Mixer

Dispersion Period : 1 minute

Specific Gravity : 2.65

Separation of Sample: #270 Sieve

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Client:	Northeast Geotechnical, Inc.				
Project:	Proposed Residential Development				
Location:	Ashland, MA			Project No:	GTX-303030
Boring ID:	TP-16	Sample Type:	bag	Tested By:	jbr
Sample ID:	S-1	Test Date:	04/21/15	Checked By:	emm
Depth :	40-102 in	Test Id:	327875		
Test Comment:	---				
Sample Description:	Moist, light brown silty sand with gravel				
Sample Comment:	---				

USDA Textural Classification

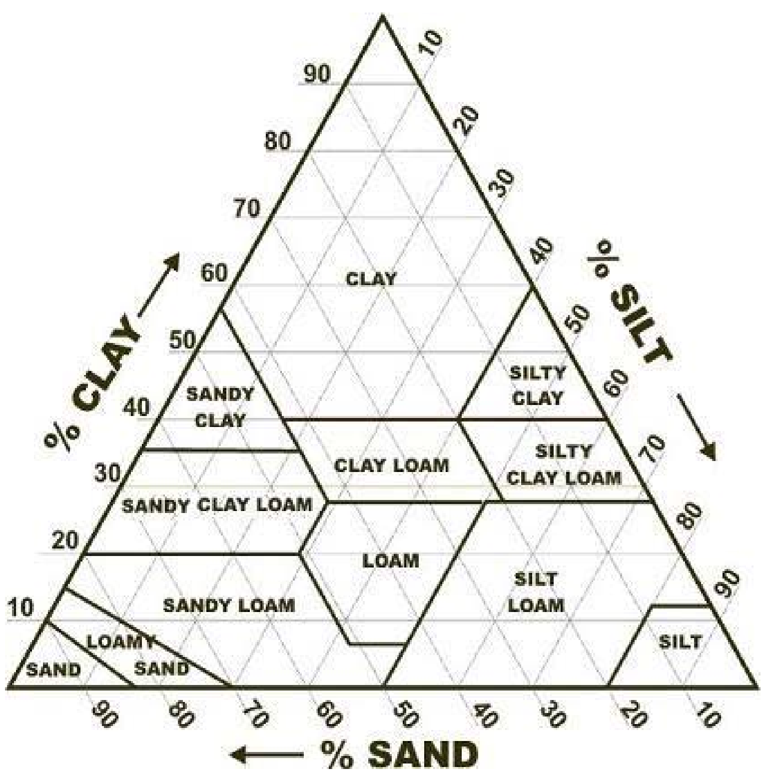
Boring ID	Sample ID	Depth	Sand, %	Silt, %	Clay, %	Classification
TP-16	S-1	40-102 in	70	28	2	Sandy Loam

Classifications based only on material passing the #10 sieve

Sand: material passing 2.0 mm and retained on 0.05 mm diameter

Silt: material passing 0.05 mm and retained on 0.002 mm diameter

Clay: material passing 0.002 mm diameter



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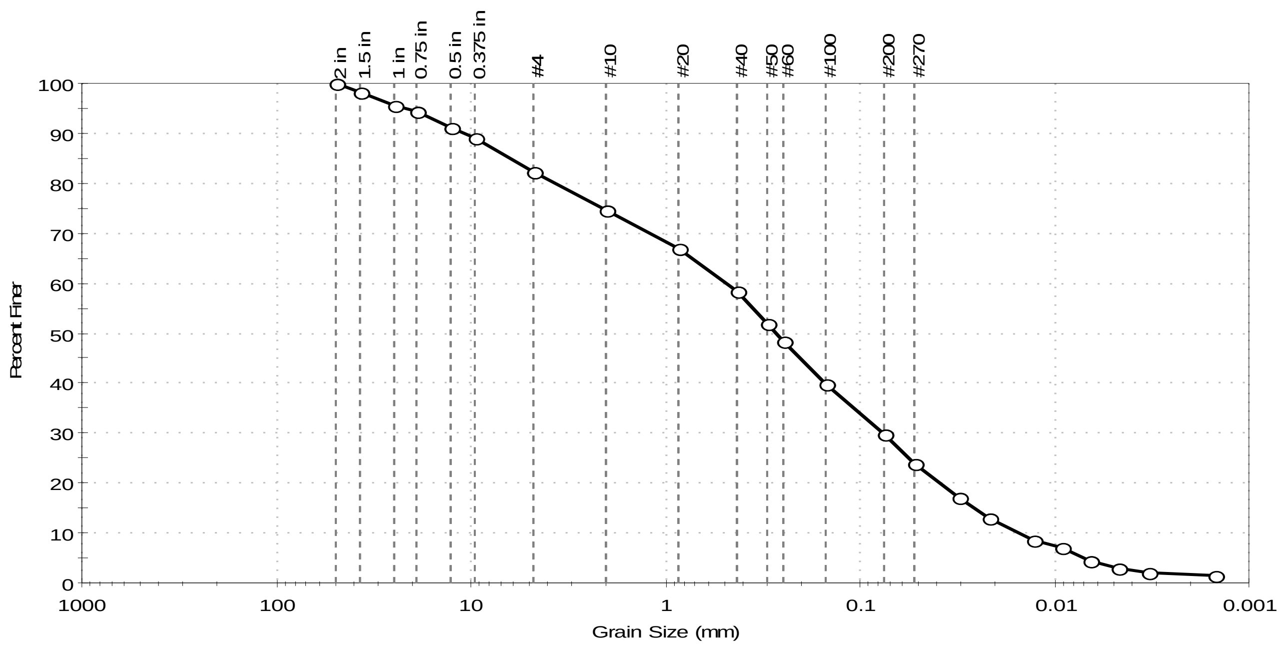
Client:	Northeast Geotechnical, Inc.				
Project:	Proposed Residential Development				
Location:	Ashland, MA			Project No:	GTX-303030
Boring ID:	TP-16	Sample Type:	bag	Tested By:	jbr
Sample ID:	S-1	Test Date:	04/16/15	Checked By:	emm
Depth :	40-102 in	Test Id:	327865		

Test Comment: ---

Sample Description: Moist, light brown silty sand with gravel

Sample Comment: ---

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	17.8	52.3	29.9

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
2 in	50.00	100		
1.5 in	37.50	98		
1 in	25.00	96		
0.75 in	19.00	94		
0.5 in	12.70	91		
0.375 in	9.50	89		
#4	4.75	82		
#4	4.75	82		
#10	2.00	75		
#20	0.85	67		
#40	0.42	58		
#50	0.30	52		
#60	0.25	48		
#100	0.15	40		
#200	0.075	30		
#270	0.053	24		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0307	17		
---	0.0218	13		
---	0.0130	9		
---	0.0092	7		
---	0.0066	4		
---	0.0047	3		
---	0.0033	2		
---	0.0015	1		

Coefficients

D_{85} = 6.2979 mm	D_{30} = 0.0755 mm
D_{60} = 0.4861 mm	D_{15} = 0.0259 mm
D_{50} = 0.2716 mm	D_{10} = 0.0155 mm
C_u = 31.361	C_c = 0.757

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

Dispersion Device : Apparatus A - Mech Mixer

Dispersion Period : 1 minute

Specific Gravity : 2.65

Separation of Sample: #270 Sieve

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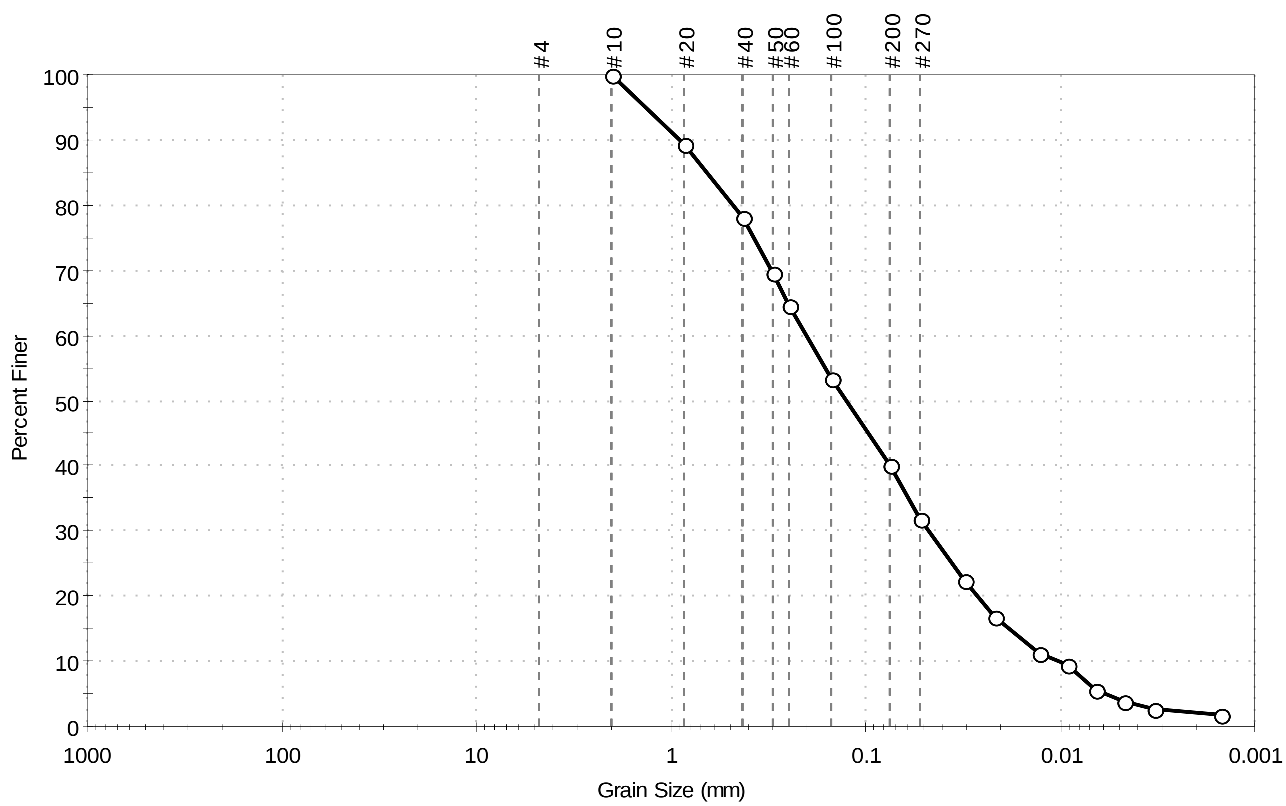
Client:	Northeast Geotechnical, Inc.			
Project:	Proposed Residential Development			
Location:	Ashland, MA		Project No:	GTX-303030
Boring ID: TP-16		Sample Type: bag	Tested By:	jbr
Sample ID: S-1		Test Date: 04/16/15	Checked By:	emm
Depth : 40-102 in		Test Id: 327865		

Test Comment: Only minus No. 10 sieve for USDA classification

Sample Description: Moist, light brown silty sand with gravel

Sample Comment: ---

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.0	60.0	40.0

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#10	2.00	100		
#20	0.85	89		
#40	0.42	78		
#50	0.30	70		
#60	0.25	65		
#100	0.15	53		
#200	0.075	40		
#270	0.053	32		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0307	22		
---	0.0218	17		
---	0.0130	11		
---	0.0092	9		
---	0.0066	6		
---	0.0047	4		
---	0.0033	3		
---	0.0015	2		

Coefficients

D_{85} = 0.6479 mm | D_{30} = 0.0477 mm

D_{60} = 0.2025 mm | D_{15} = 0.0185 mm

D_{50} = 0.1262 mm | D_{10} = 0.0105 mm

C_u = 19.286 | C_c = 1.070

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

Dispersion Device : Apparatus A - Mech Mixer

Dispersion Period : 1 minute

Specific Gravity : 2.65

Separation of Sample: #270 Sieve

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Client:	Northeast Geotechnical, Inc.				
Project:	Proposed Residential Development				
Location:	Ashland, MA			Project No:	GTX-303030
Boring ID:	TP-17	Sample Type:	bag	Tested By:	jbr
Sample ID:	S-1	Test Date:	04/16/15	Checked By:	emm
Depth :	36-102 in	Test Id:	327876		
Test Comment:	---				
Sample Description:	Moist, light brown silty sand				
Sample Comment:	---				

USDA Textural Classification

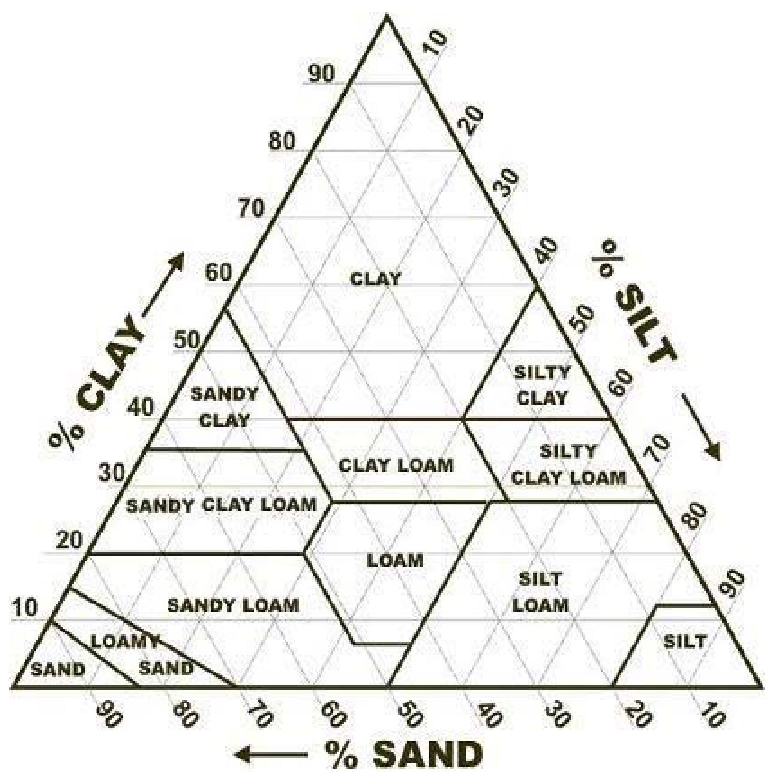
Boring ID	Sample ID	Depth	Sand, %	Silt, %	Clay, %	Classification
TP-17	S-1	36-102 in	58	37	5	Sandy Loam

Classifications based only on material passing the #10 sieve

Sand: material passing 2.0 mm and retained on 0.05 mm diameter

Silt: material passing 0.05 mm and retained on 0.002 mm diameter

Clay: material passing 0.002 mm diameter



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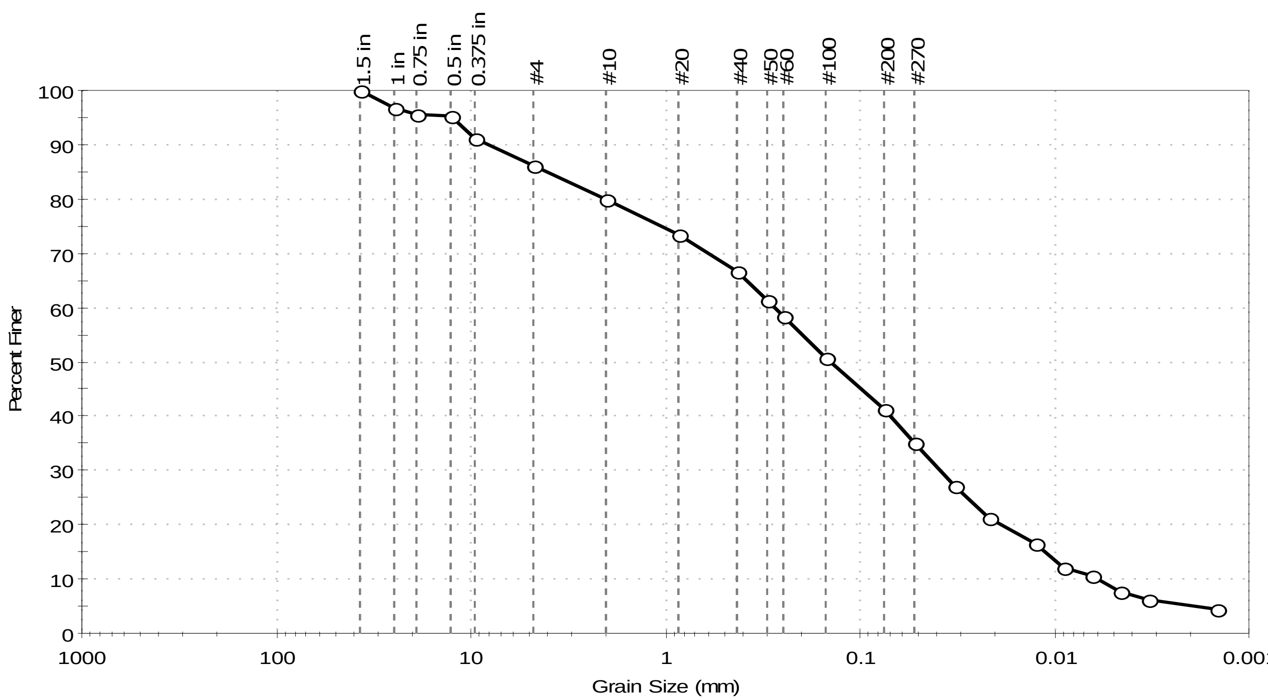
Client:	Northeast Geotechnical, Inc.			
Project:	Proposed Residential Development			
Location:	Ashland, MA		Project No:	GTX-303030
Boring ID:	TP-17	Sample Type: bag	Tested By:	jbr
Sample ID:	S-1	Test Date: 04/16/15	Checked By:	emm
Depth :	36-102 in	Test Id: 327866		

Test Comment: ---
Sample Description: Moist, light brown silty sand
Sample Comment: ---

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	13.9	44.8	41.3

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1.5 in	37.50	100		
1 in	25.00	97		
0.75 in	19.00	95		
0.5 in	12.70	95		
0.375 in	9.50	91		
#4	4.75	86		
#10	2.00	80		
#20	0.85	74		
#40	0.42	67		
#50	0.30	61		
#60	0.25	58		
#100	0.15	51		
#200	0.075	41		
#270	0.053	35		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0323	27		
---	0.0217	21		
---	0.0125	17		
---	0.0091	12		
---	0.0064	11		
---	0.0046	8		
---	0.0033	6		
---	0.0015	5		

Coefficients

D_{85} =4.0436 mm
D_{30} =0.0385 mm
D_{60} =0.2753 mm
D_{15} =0.0111 mm
D_{50} =0.1410 mm
D_{10} =0.0060 mm
C_u =45.883
C_c =0.897

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

Dispersion Device : Apparatus A - Mech Mixer

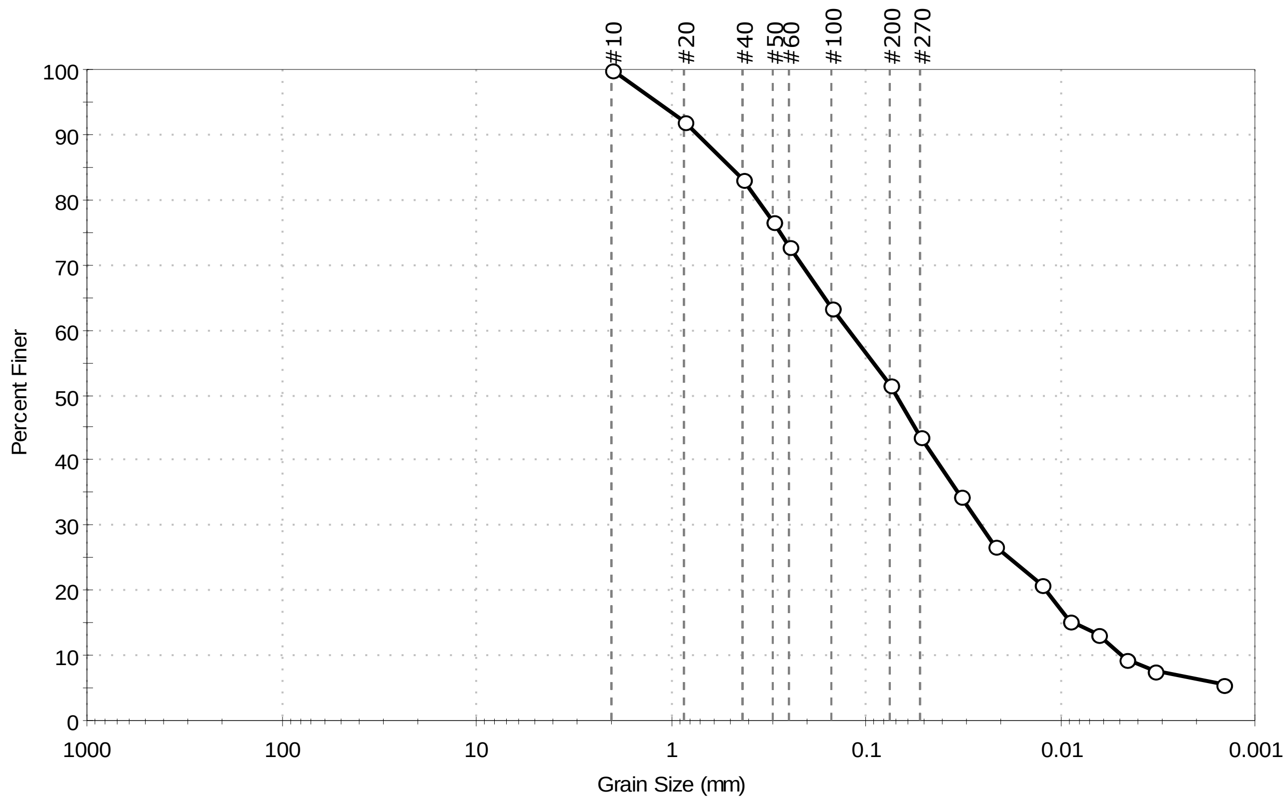
Dispersion Period : 1 minute

Specific Gravity : 2.65

Separation of Sample: #270 Sieve

Client:	Northeast Geotechnical, Inc.				
Project:	Proposed Residential Development				
Location:	Ashland, MA			Project No:	GTX-303030
Boring ID:	TP-17	Sample Type:	bag	Tested By:	jbr
Sample ID:	S-1	Test Date:	04/16/15	Checked By:	emm
Depth :	36-102 in	Test Id:	327866		
Test Comment:	Only minus No. 10 sieve for USDA classification				
Sample Description:	Moist, light brown silty sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.0	48.4	51.6

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#10	2.00	100		
#20	0.85	92		
#40	0.42	83		
#50	0.30	77		
#60	0.25	73		
#100	0.15	64		
#200	0.075	52		
#270	0.053	44		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0323	34		
---	0.0217	27		
---	0.0125	21		
---	0.0091	15		
---	0.0064	13		
---	0.0046	10		
---	0.0033	8		
---	0.0015	6		

Coefficients

D_{85} =0.4880 mm D_{30} =0.0256 mm

D_{60} =0.1222 mm D_{15} =0.0086 mm

D_{50} =0.0698 mm D_{10} =0.0048 mm

C_u =25.458 C_c =1.117

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

Dispersion Device : Apparatus A - Mech Mixer

Dispersion Period : 1 minute

Specific Gravity : 2.65

Separation of Sample: #270 Sieve

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Client:	Northeast Geotechnical, Inc.				
Project:	Proposed Residential Development				
Location:	Ashland, MA			Project No:	GTX-303030
Boring ID:	TP-18	Sample Type:	bag	Tested By:	jbr
Sample ID:	S-1	Test Date:	04/16/15	Checked By:	emm
Depth :	33-108 in	Test Id:	327877		
Test Comment:	---				
Sample Description:	Moist, light brown silty sand				
Sample Comment:	---				

USDA Textural Classification

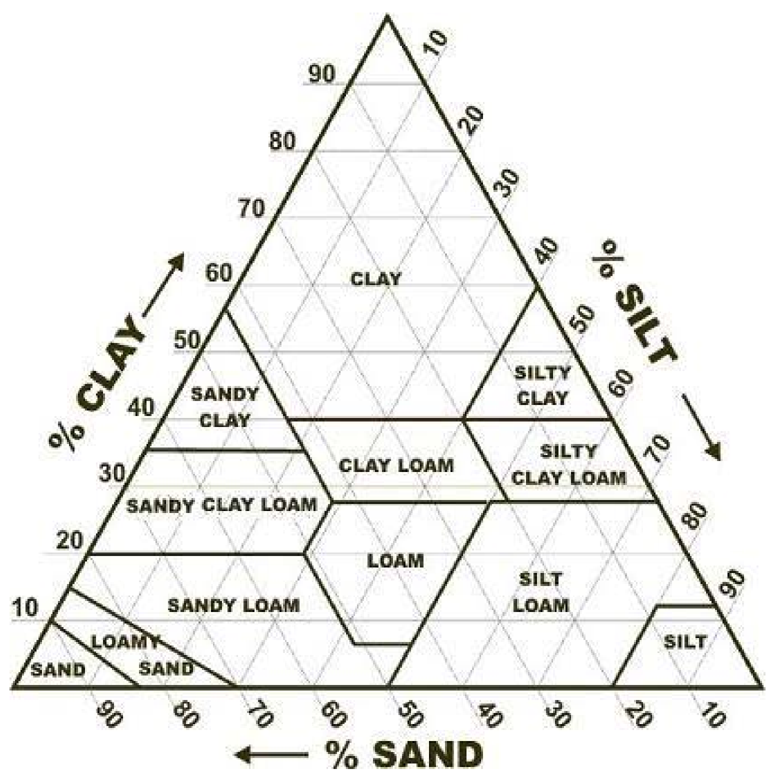
Boring ID	Sample ID	Depth	Sand, %	Silt, %	Clay, %	Classification
TP-18	S-1	33-108 in	60	36	4	Sandy Loam

Classifications based only on material passing the #10 sieve

Sand: material passing 2.0 mm and retained on 0.05 mm diameter

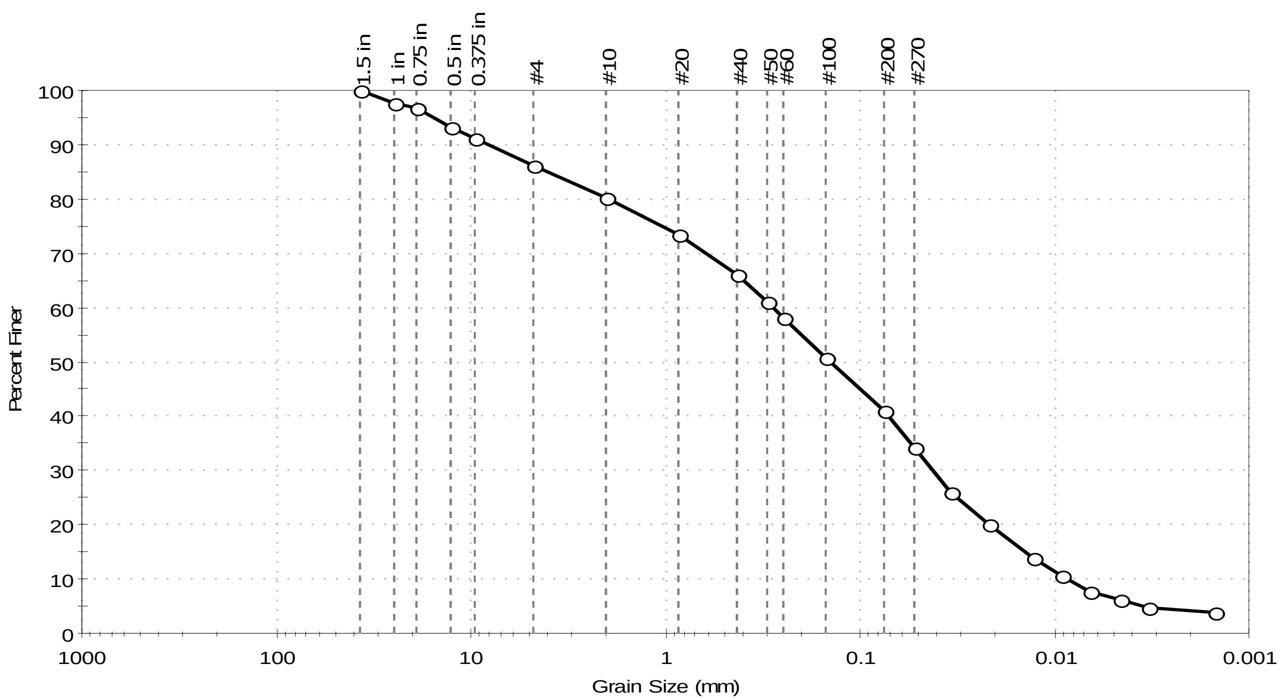
Silt: material passing 0.05 mm and retained on 0.002 mm diameter

Clay: material passing 0.002 mm diameter



Client:	Northeast Geotechnical, Inc.		
Project:	Proposed Residential Development		
Location:	Ashland, MA	Project No:	GTX-303030
Boring ID: TP-18	Sample Type: bag	Tested By:	jbr
Sample ID: S-1	Test Date: 04/16/15	Checked By:	emm
Depth : 33-108 in	Test Id: 327867		
Test Comment:	---		
Sample Description:	Moist, light brown silty sand		
Sample Comment:	---		

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	13.9	45.0	41.1

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1.5 in	37.50	100		
1 in	25.00	98		
0.75 in	19.00	97		
0.5 in	12.70	93		
0.375 in	9.50	91		
#4	4.75	86		
#10	2.00	80		
#20	0.85	73		
#40	0.42	66		
#50	0.30	61		
#60	0.25	58		
#100	0.15	51		
#200	0.075	41		
#270	0.053	34		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0345	26		
---	0.0215	20		
---	0.0127	14		
---	0.0091	11		
---	0.0065	8		
---	0.0046	6		
---	0.0033	5		
---	0.0015	4		

Coefficients

D_{85} =4.0597 mm	D_{30} =0.0425 mm
D_{60} =0.2794 mm	D_{15} =0.0141 mm
D_{50} =0.1432 mm	D_{10} =0.0084 mm
C_u =33.262	C_c =0.770

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

Dispersion Device : Apparatus A - Mech Mixer

Dispersion Period : 1 minute

Specific Gravity : 2.65

Separation of Sample: #270 Sieve

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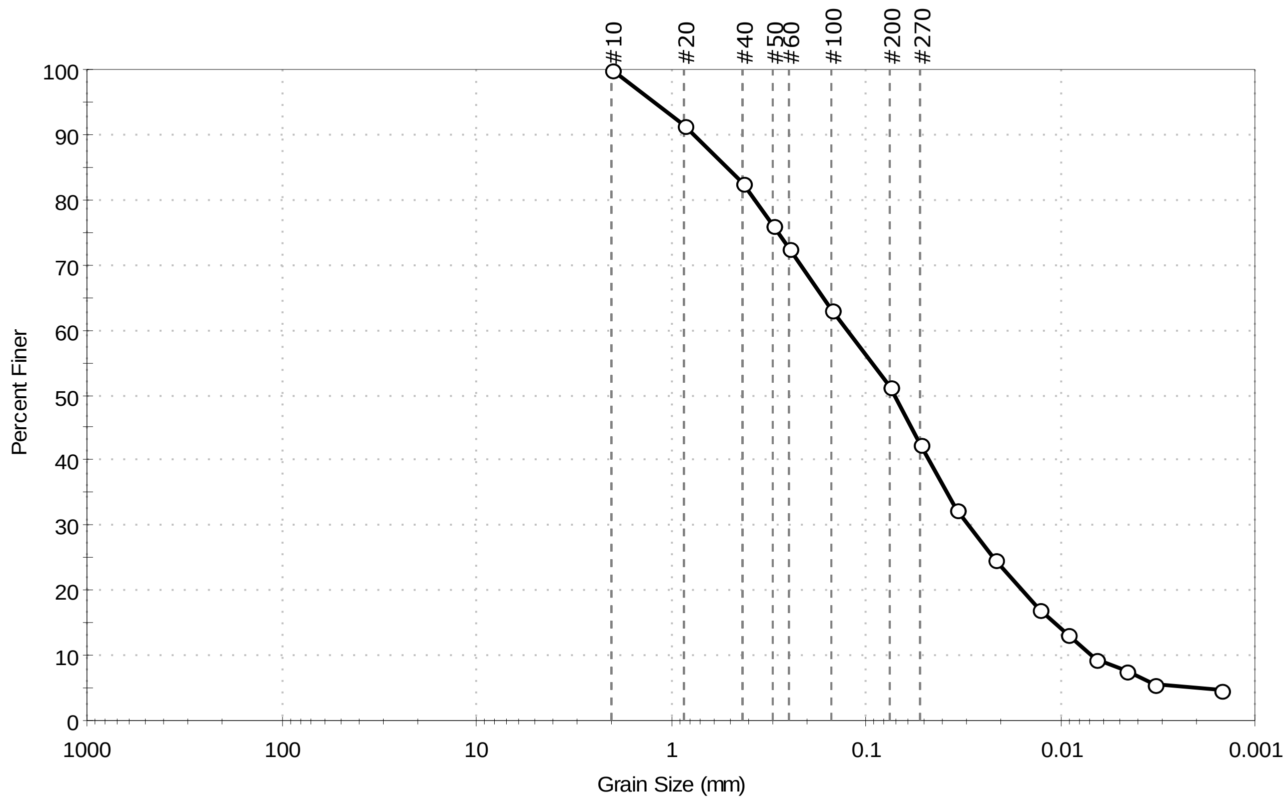
Client:	Northeast Geotechnical, Inc.
Project:	Proposed Residential Development
Location:	Ashland, MA	Project No: GTX-303030

Boring ID:	TP-18	Sample Type:	bag	Tested By:	jbr
Sample ID:	S-1	Test Date:	04/16/15	Checked By:	emm
Depth :	33-108 in	Test Id:	327867		

Test Comment:	Only minus No. 10 sieve for USDA classification
Sample Description:	Moist, light brown silty sand
Sample Comment:	---

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.0	48.8	51.2

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#10	2.00	100		
#20	0.85	91		
#40	0.42	82		
#50	0.30	76		
#60	0.25	72		
#100	0.15	63		
#200	0.075	51		
#270	0.053	43		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0345	33		
---	0.0215	25		
---	0.0127	17		
---	0.0091	13		
---	0.0065	10		
---	0.0046	8		
---	0.0033	6		
---	0.0015	5		

Coefficients

D_{85} =0.5166 mm
D_{30} =0.0294 mm
D_{60} =0.1251 mm
D_{15} =0.0105 mm
D_{50} =0.0714 mm
D_{10} =0.0068 mm
C_u =18.397
C_c =1.016

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample / Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

Dispersion Device : Apparatus A - Mech Mixer

Dispersion Period : 1 minute

Specific Gravity : 2.65

Separation of Sample: #270 Sieve

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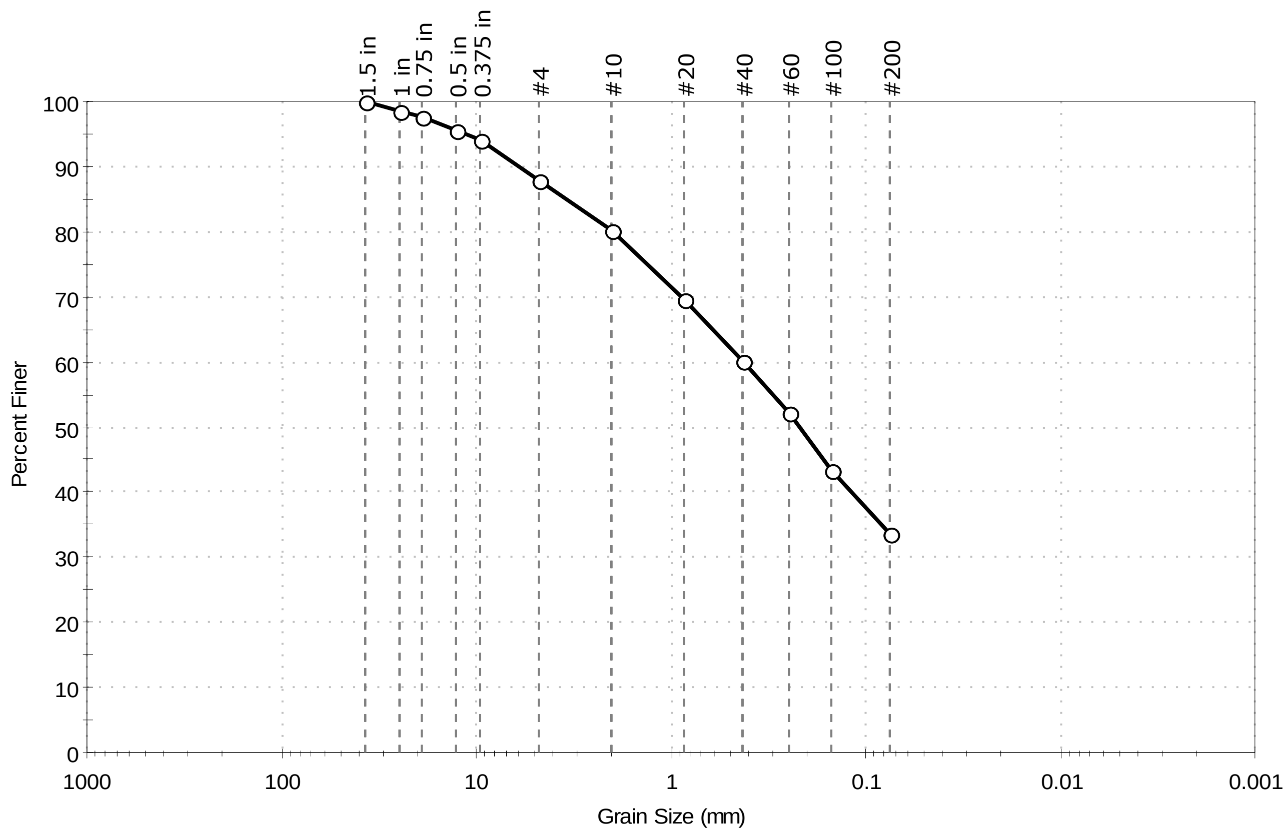
Client:	Northeast Geotechnical, Inc.		
Project:	Proposed Residential Development		
Location:	Ashland, MA	Project No:	GTX-303030

Boring ID:	TP-19	Sample Type:	bag	Tested By:	jbr
Sample ID:	S-1	Test Date:	04/17/15	Checked By:	emm
Depth :	0.6-1.8 ft	Test Id:	327878		

Test Comment: ---
Sample Description: Moist, light brown silty sand
Sample Comment: ---

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	11.9	54.4	33.7

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1.5 in	37.50	100		
1 in	25.00	99		
0.75 in	19.00	98		
0.5 in	12.70	96		
0.375 in	9.50	94		
#4	4.75	88		
#10	2.00	80		
#20	0.85	70		
#40	0.42	60		
#60	0.25	52		
#100	0.15	43		
#200	0.075	34		

Coefficients

D_{85} =3.4099 mm	D_{30} =N/A
D_{60} =0.4167 mm	D_{15} =N/A
D_{50} =0.2212 mm	D_{10} =N/A
C_u =N/A	C_c =N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

GeoTesting EXPRESS

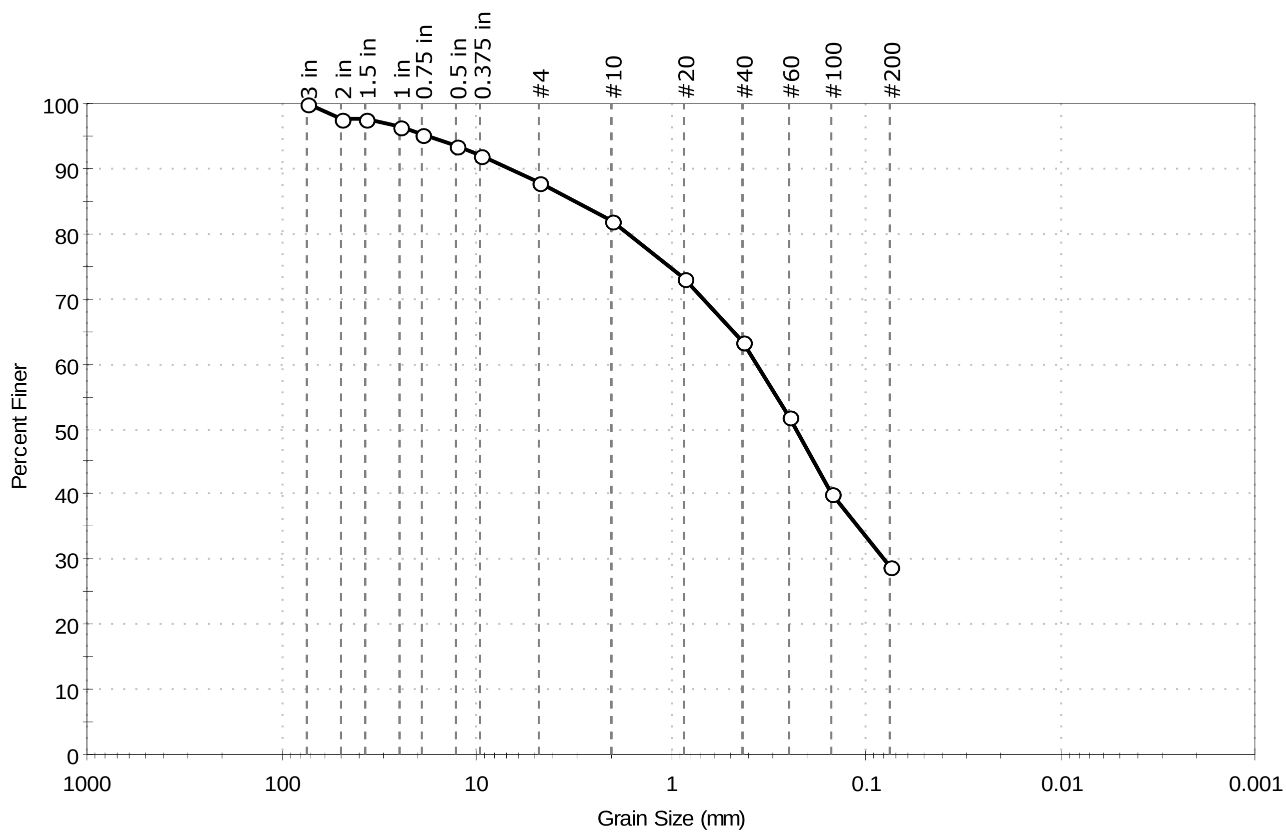
Client:	Northeast Geotechnical, Inc.		
Project:	Proposed Residential Development		
Location:	Ashland, MA	Project No:	GTX-303030
Boring ID: TP-21	Sample Type: bag	Tested By:	jbr
Sample ID: S-1	Test Date: 04/16/15	Checked By:	emm
Depth : 2.6-9 ft	Test Id: 327741		

Test Comment: ---

Sample Description: Moist, light olive brown silty sand

Sample Comment: ---

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	12.1	59.0	28.9

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
3 in	75.00	100		
2 in	50.00	98		
1.5 in	37.50	98		
1 in	25.00	97		
0.75 in	19.00	95		
0.5 in	12.70	94		
0.375 in	9.50	92		
#4	4.75	88		
#10	2.00	82		
#20	0.85	73		
#40	0.42	63		
#60	0.25	52		
#100	0.15	40		
#200	0.075	29		

Coefficients

D_{85} = 3.1361 mm D_{30} = 0.0804 mm

D_{60} = 0.3636 mm D_{15} = N/A

D_{50} = 0.2292 mm D_{10} = N/A

C_u = N/A C_c = N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

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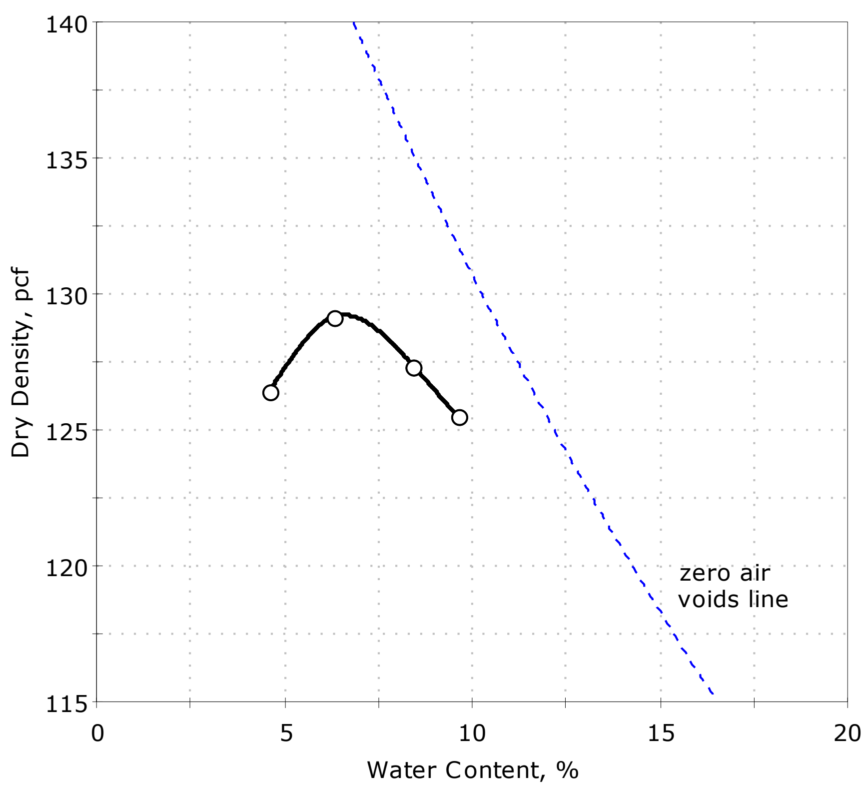
Client:	Northeast Geotechnical, Inc.				
Project:	Proposed Residential Development				
Location:	Ashland, MA			Project No:	GTX-303030
Boring ID:	TP-21	Sample Type:	bag	Tested By:	cwd
Sample ID:	S-1	Test Date:	04/14/15	Checked By:	emm
Depth :	2.6-9 ft	Test Id:	327743		

Test Comment: ---
Sample Description: Moist, light olive brown silty sand
Sample Comment: ---

Compaction Report - ASTM D1557



Data Points	Point 1	Point 2	Point 3	Point 4
Dry density, pcf	126.4	129.2	127.4	125.5
Moisture Content, %	4.6	6.3	8.4	9.6

Method : C
Preparation : DRY
As received Moisture :12 %
Rammer : Mechanical
Zero voids line based on assumed specific gravity of 2.65

Maximum Dry Density= 129.2 pcf
Optimum Moisture= 6.6 %

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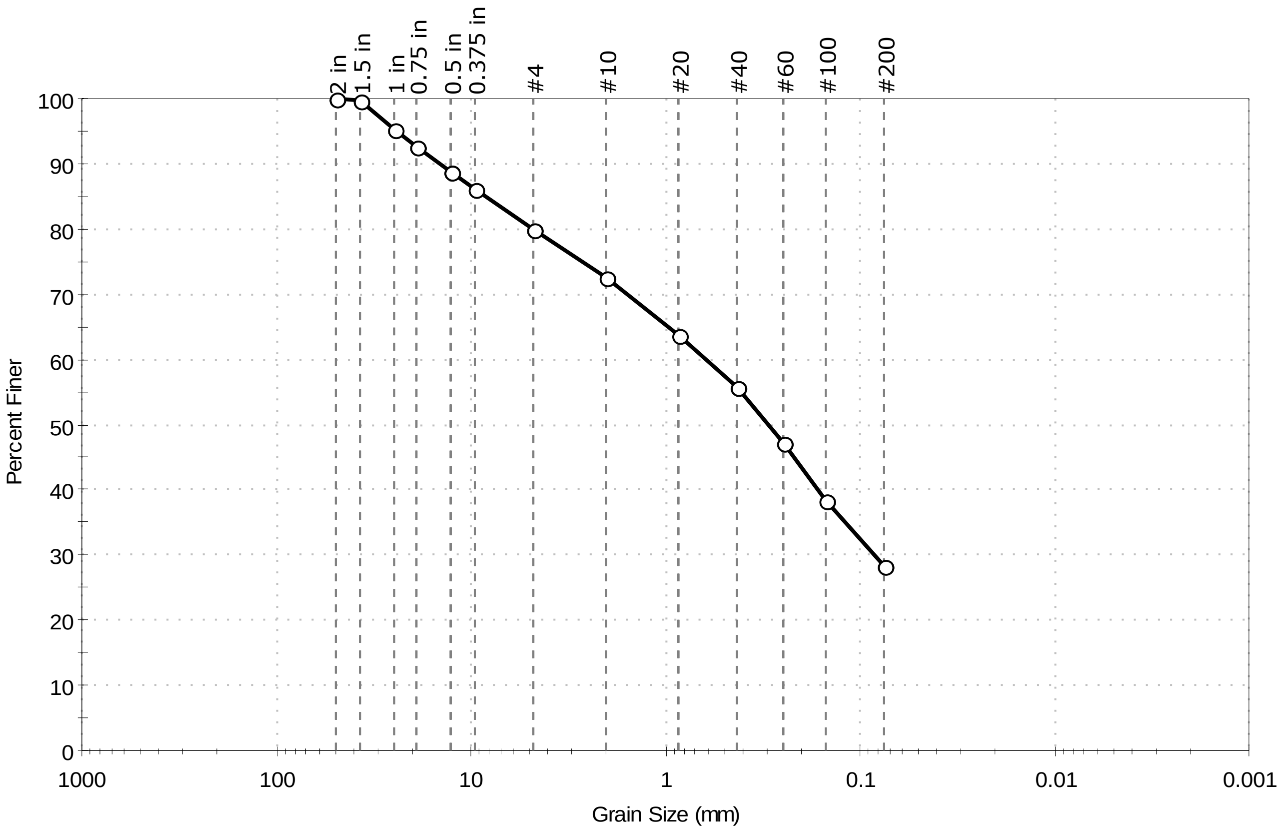
Client:	Northeast Geotechnical, Inc.		
Project:	Proposed Residential Development		
Location:	Ashland, MA	Project No:	GTX-303030

Boring ID:	TP-23	Sample Type:	bag	Tested By:	jbr
Sample ID:	S-1	Test Date:	04/15/15	Checked By:	emm
Depth :	4.5-10 ft	Test Id:	327740		

Test Comment: ---
Sample Description: Moist, light olive brown silty sand with gravel
Sample Comment: ---

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	20.1	51.6	28.3

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
2 in	50.00	100		
1.5 in	37.50	100		
1 in	25.00	95		
0.75 in	19.00	93		
0.5 in	12.70	89		
0.375 in	9.50	86		
#4	4.75	80		
#10	2.00	73		
#20	0.85	64		
#40	0.42	56		
#60	0.25	47		
#100	0.15	38		
#200	0.075	28		

Coefficients

D_{85} = 8.4082 mm	D_{30} = 0.0844 mm
D_{60} = 0.6126 mm	D_{15} = N/A
D_{50} = 0.2957 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample / Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

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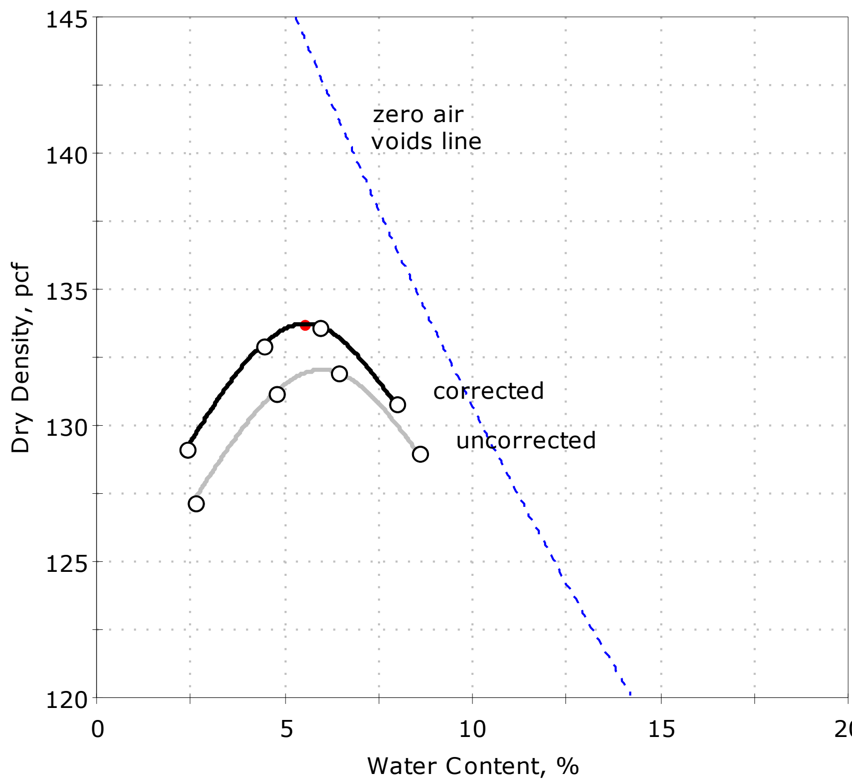
Client:	Northeast Geotechnical, Inc.				
Project:	Proposed Residential Development				
Location:	Ashland, MA			Project No:	GTX-303030
Boring ID:	TP-23	Sample Type:	bag	Tested By:	cwd
Sample ID:	S-1	Test Date:	04/14/15	Checked By:	emm
Depth :	4.5-10 ft	Test Id:	327742		

Test Comment: ---
Sample Description: Moist, light olive brown silty sand with gravel
Sample Comment: ---

Compaction Report - ASTM D1557



Data Points	Point 1	Point 2	Point 3	Point 4
Dry density, pcf	127.2	131.2	132.0	129.0
Moisture Content, %	2.6	4.8	6.4	8.6

Method : C
Preparation : DRY
As received Moisture :11 %
Rammer : Mechanical
Zero voids line based on assumed specific gravity of 2.65

Maximum Dry Density= 132.0 pcf
Optimum Moisture= 6.0 %

Oversize Correction (7.4% > 3/4 inch Sieve)
Corrected Maximum Dry Density= 133.7 pcf
Corrected Optimum Moisture= 5.5 %
Assumed Average Bulk Specific Gravity = 2.55

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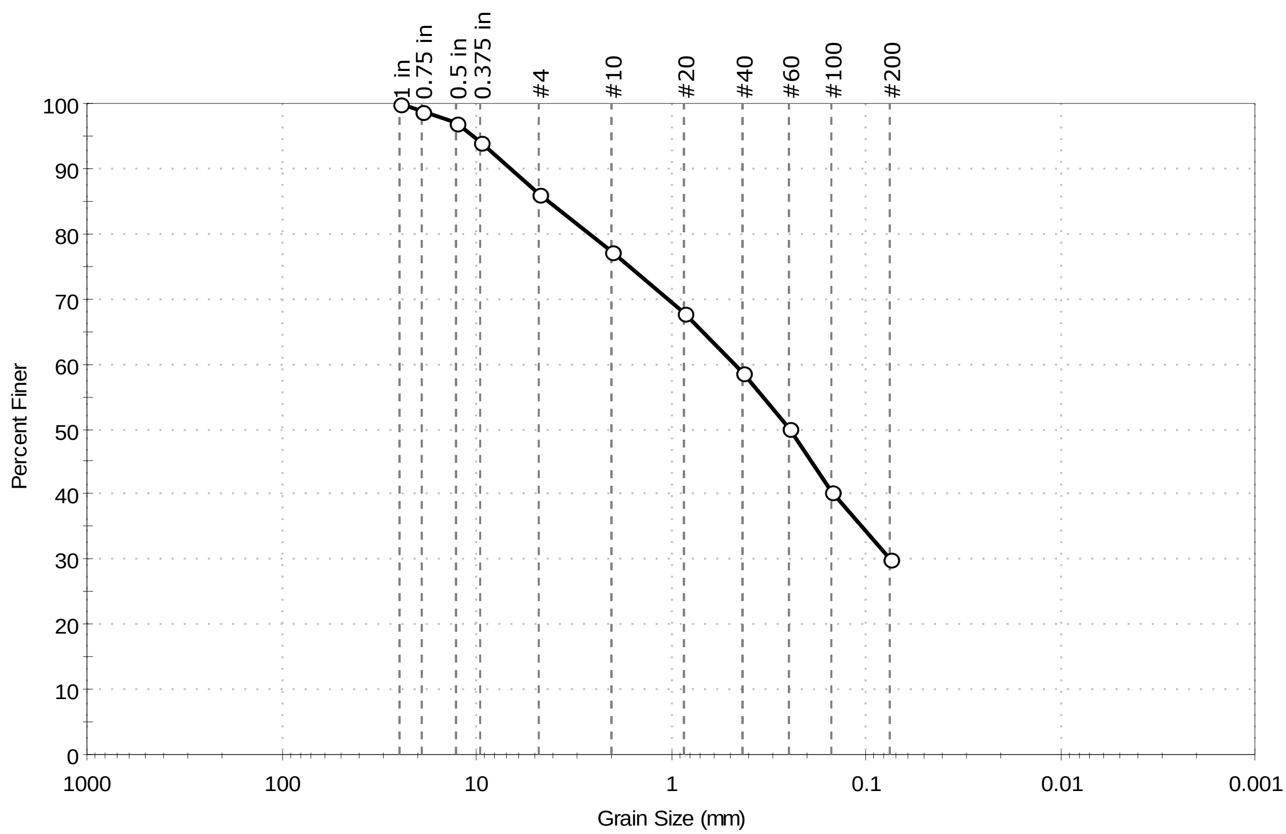
Client:	Northeast Geotechnical, Inc.		
Project:	Proposed Residential Development		
Location:	Ashland, MA	Project No:	GTX-303030
Boring ID: TP-24	Sample Type: bag	Tested By:	jbr
Sample ID: S-1	Test Date: 04/16/15	Checked By:	emm
Depth : 3.5-6 ft	Test Id: 327879		
Test Comment:	---		
Sample Description:	Moist, yellowish brown silty sand		
Sample Comment:	---		

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	13.7	56.3	30.0

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1 in	25.00	100		
0.75 in	19.00	99		
0.5 in	12.70	97		
0.375 in	9.50	94		
#4	4.75	86		
#10	2.00	77		
#20	0.85	68		
#40	0.42	59		
#60	0.25	50		
#100	0.15	41		
#200	0.075	30		

Coefficients

D_{85} = 4.2050 mm	D_{30} = 0.0752 mm
D_{60} = 0.4652 mm	D_{15} = N/A
D_{50} = 0.2467 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample / Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

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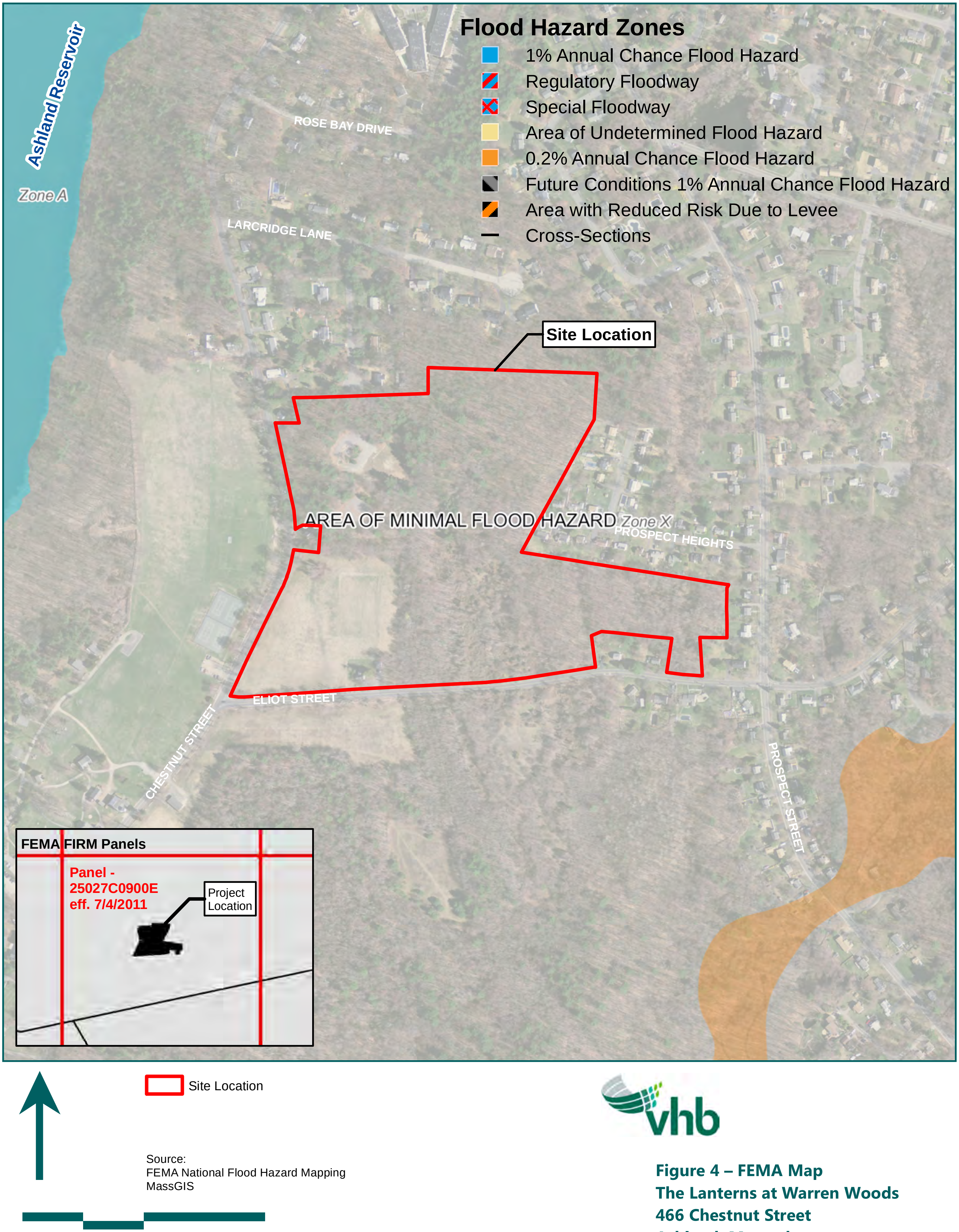
Path: \\nhbedata\gislib\MA_Various\Ashland\Figure4_FEMA.mxd



Source:
FEMA National Flood Hazard Mapping
MassGIS

Figure 4 – FEMA Map
The Lanterns at Warren Woods
466 Chestnut Street
Ashland, Massachusetts

Appendix B:
TSS Removal Worksheet
TN and TP Removal

Appendix B: TSS Removal Worksheet TN and TP Removal

TSS Removal Calculation Worksheet

VHB

Vanasse Hangen Brustlin, Inc.
Consulting Engineers and Planners
101 Walnut Street
Watertown, MA 02471
(617) 924-1770

Project Name: **The Lanterns**
Project Number: **13050.00**
Location: **Ashland, MA**
Discharge Point: **DP-1, DP-2, DP-3**
Drainage Area(s): **PR-11, 12, 13, 14, 21, 22, 23, 24, 31, 32**

Date: **July 2015**
Computed by: **PTM**
Checked by: **KSS**

A	B	C	D	E
BMP*	TSS Removal Rate*	Starting TSS Load**	Amount Removed (C*D)	Remaining Load (D-E)
Street Sweeping - 0%	**0%**	**1.00**	**0.00**	**1.00**
Deep Sump and Hooded Catch Basin	**25%**	**1.00**	**0.25**	**0.75**
Gravel Wetland	**80%**	**0.75**	**0.60**	**0.15**
	0%	**0.15**	**0.00**	**0.15**
	0%	**0.15**	**0.00**	**0.15**

Treatment Train TSS Removal = **85%**

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

Subsurface Gravel Wetland

Subsurface Gravel Wetland systems continue to offer superior treatment for common stormwater pollutants and unparalleled treatment of nutrients.

About the Subsurface Gravel Wetland

The subsurface gravel wetland has been around for almost 15 years but enjoyed little implementation until the UNHSC pioneering studies. It approximates the look and function of a natural wetland, effectively removing sediments and other pollutants commonly found in runoff while enhancing the visual appeal of the landscape by adding buffers or greenscape to urban areas. The subsurface gravel wetland evaluated at UNHSC for 8 years is a horizontal-flow filtration system and should not be confused with stormwater wetlands that function more like ponds. Instead, the subsurface gravel wetland includes a dense root mat, crushed stone, and an anaerobic microbe rich environment for improving water quality. Like other filtration systems, it demonstrates a tremendous capacity to reduce peak flow and improve water quality. By design, the subsurface gravel wetland by itself is not intended for infiltration of stormwater.

Implementation

Subsurface gravel wetlands can be used in many regions, with the exception of those that are too arid to support a wetland system. These systems have demonstrated exceptional water quality treatment, in particular for nutrients, for a range of land uses including commuter parking, high density commercial use, and major transportation corridors. Subsurface gravel wetland systems can be space intensive but can be easily retro-fitted into dry ponds. Like any system that relies on infiltration or filtration, subsurface gravel wetland systems should be lined and outfitted with subdrains that discharge to the surface if they are to be used in pollution hotspots. Dissolved oxygen levels may fluctuate within biologically active subsurface systems like the subsurface gravel wetland, yet if this is a problem for local receiving waters, then it can easily be dealt with by introducing turbulence and aeration into the outlet design. While subsurface gravel wetlands are more expensive than other LID systems, they represent a dramatic performance improvement over ponds. Subsurface gravel wetlands are especially effective at removing nitrogen and have been used for some time in wastewater treatment.

Application

Subsurface gavel wetlands use is increasing, especially in areas where impaired waters exist or where higher standards are necessary. The State of New Jersey has provided loans and grants for subsurface gravel wetland

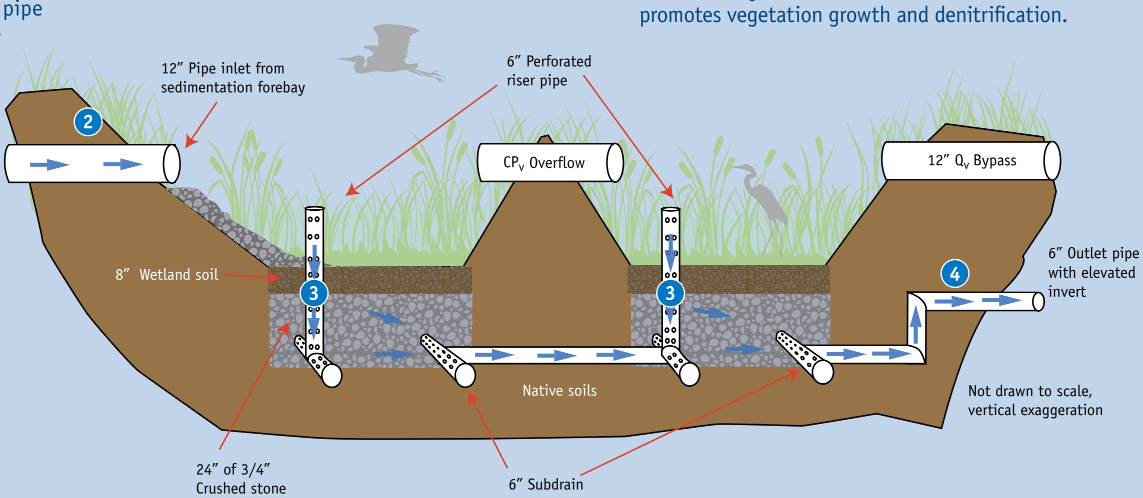
FAST FACTS

CATEGORY / BMP TYPE Stormwater Wetland, Low Impact Development Design **UNIT OPERATIONS & PROCESSES** Hydrologic (Flow Alteration)	Water Quality: Physical (Sedimentation, Filtration), Biological (Vegetative Uptake, Microbial Mediation), & Chemical (Sorption) **BASIC DIMENSIONS** Filter Basin Footprint: 15 ft long X 32 ft wide	Forebay Footprint: 10 ft long X 32 ft wide Total Area: 5,450 sf **SPECIFICATIONS** Catchment Area: 1 acre Water Quality Flow: 1 cfs Water Quality Volume: 3,300 cf	**INSTALLATION COST** $22,500 per acre treated **MAINTENANCE** Maintenance Sensitivity: Medium Inspections: 1-4 times per year Sediment Removal: High

How the System Works

WATER QUALITY TREATMENT PROCESS ▼

1. Runoff flows into a pretreatment forebay to remove settleables and gross solids.
2. Runoff exits the forebay through two stacked horizontal pipes (primary and secondary spillways). The lower pipe is a 6 inch pipe with a 1 inch orifice and the top pipe is a 12 inch pipe and into the treatment cells.
3. Hydraulic riser inlets conduct water to the subsurface gravel layer. There, biological treatment occurs through the uptake of pollutants by vegetation and anaerobic microbial activity within the gravel and soil. Physical and chemical treatment—the trapping of contaminants—occurs on and within the gravel filter media and root mat. Other UOPs include sedimentation, transformation through reduction/oxidation, and sorption with organic matter and mineral complexes.
4. Treated runoff exits to the surface via an outlet pipe that includes an orifice control elevated four inches below the wetland surface. This insures that the soil is nearly continuously saturated—a condition that promotes vegetation growth and denitrification.



installations. In addition the New Hampshire Department of Transportation employs them at park and rides. These systems work well in retrofit applications such as the Berry Brook project in Dover, NH.

System Performance

Cost & Maintenance

Subsurface gravel wetland installation cost was $22,500 per impervious acre. Removal of system biomass (vegetation) should occur at least once every three growing seasons. The dense vegetation has been observed to have little problems with invasive plants. Maintenance activities include the removal of accumulated sediment biomass in the forebay and treatment cells. Research has demonstrated the value of biomass removal for long-term nutrient uptake. Without this practice, nitrogen rerelease will begin to occur. Maintenance is critical to ensure that influent (runoff) can remain well-aerated before it enters the denitrifying environment of the subsurface. Forebay maintenance of vegetation prevents the reintroduction of pollutants, particularly nitrogen and phosphorus and reduces maintenance on the treatment cells.

Cold Climate

The subsurface gravel wetland's water quality treatment and water quantity control capacity remained strong in all seasons. The gravel wetland's primary flow path is subsurface and enters the system through perferated riser pipes such that freezing of the wetland surface does not impact routing. Nitrate removal declines during the winter season while removal of other pollutants remained high in cold climates.

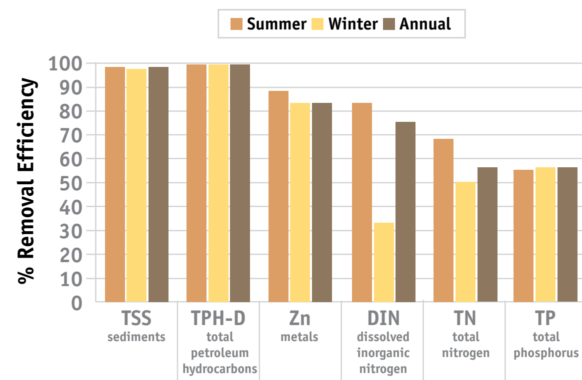
Water Quality Treatment

The subsurface gravel wetland does an exceptional job of removing nearly all of the pollutants commonly associated with stormwater treatment performance assessments. Subsurface gravel wetlands consistently exceed EPA's recommended level of removal for total suspended solids and meets regional ambient water quality criteria for nutrients, heavy metals, and petroleum hydrocarbons. The chart at the middle right reflects the subsurface gravel wetland's performance in removing total suspended solids, total petroleum hydrocarbons, zinc, dissolved inorganic nitrogen, total nitrogen, and total phosphorus. Values represent results recorded over 8 years, with the data further divided into summer and winter components. Additional sites are being monitored for long-term performance including high-use commercial uses. Of particular importance for coldwater fisheries, the mean July temperature of runoff leaving the system was 66.0 degrees F—12 degrees lower than the retention pond.

Water Quantity Control

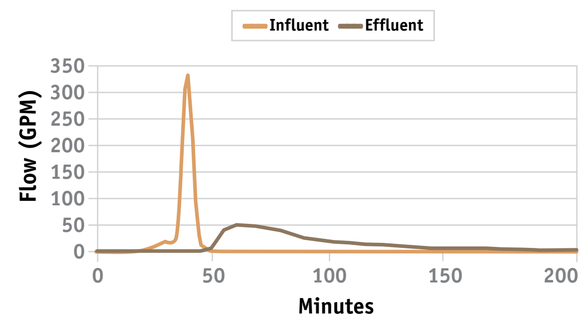
Like other filtration systems, the subsurface gravel wetland exhibits tremendous capacity to reduce peak flows ~87%. The figure above illustrates effective peak flow reduction and long lag times for the range of seasons monitored.

POLLUTANT REMOVAL: 2004–2010



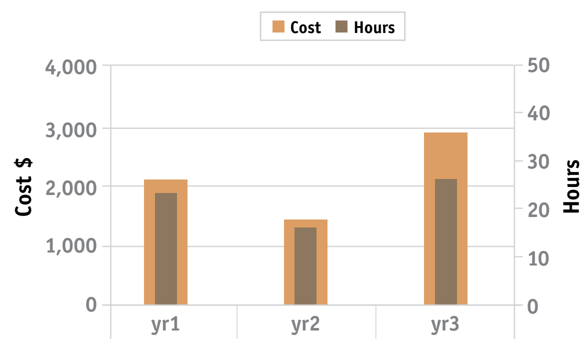
Median Annual Influent Event Mean Concentrations (EMC) in mg/L					
61	644 ug/L	0.04	0.3	1.1	0.06

HYDRAULIC PERFORMANCE



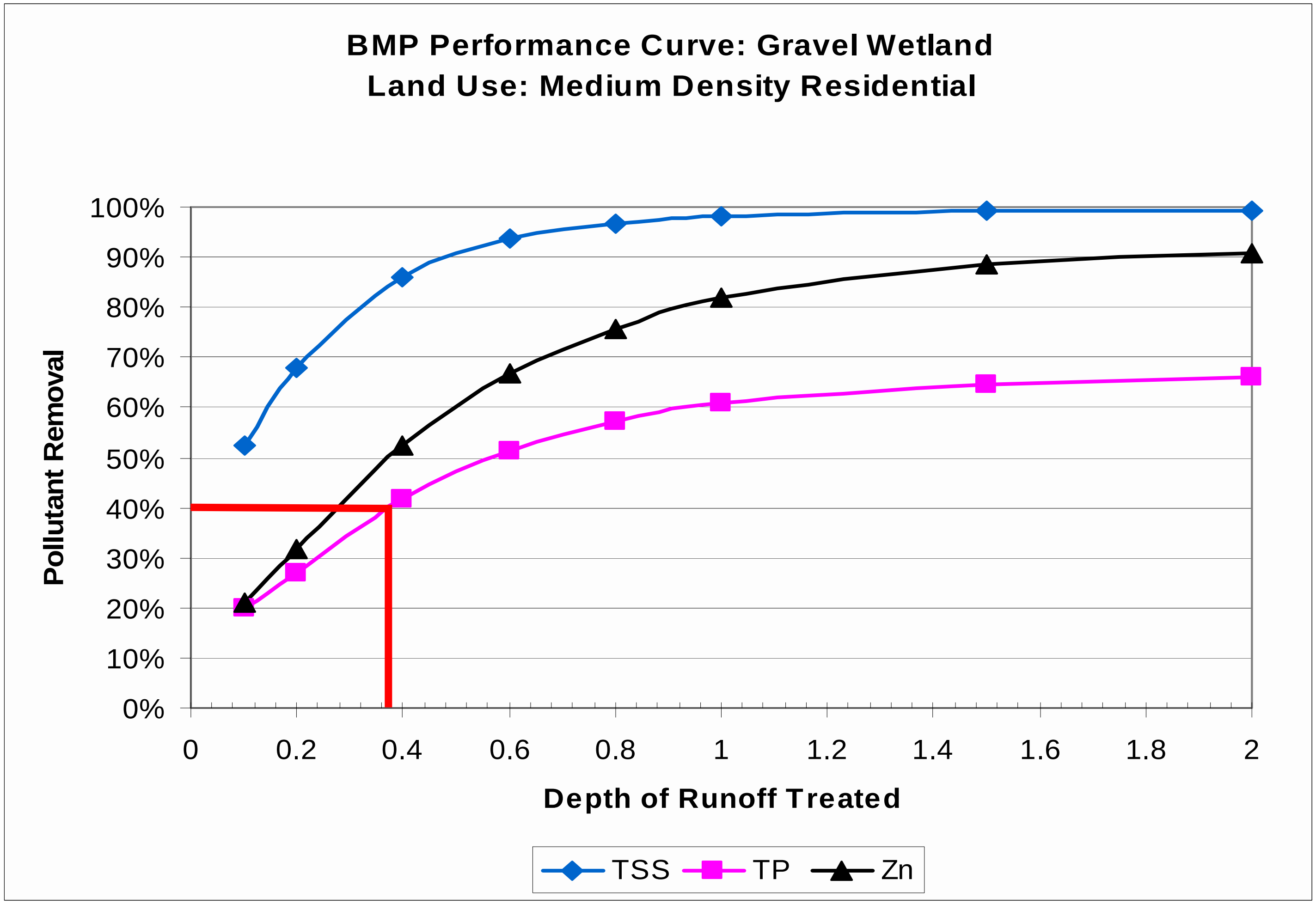
	Winter	Summer	Annual Average
Average Peak Flow Reduction	91%	93%	92%
Average Lag Time (minutes)	419	367	391

GRAVEL WETLAND



SYSTEM DESIGN ▼

This subsurface gravel wetland was designed by UNHSC. Its rectangular footprint occupies 5,450 square feet and can accommodate runoff from up to one acre of impervious surface. It includes a pretreatment forebay, followed by two flow-through treatment basins. (Other pretreatment approaches may be used.) Each treatment basin is lined and topped with two feet of gravel and 8 inches of wetland soil. The system is designed to retain and filter the water quality volume (WQv) 10 percent in the forebay and 45 percent above each treatment cell. It can detain a channel protection volume (CPv), and release it over 24 to 48 hours. The conveyance protection volume (Q10) is bypassed. For small, frequent storms, each treatment basin filters 100 percent of the influent it receives. For larger storms that do not exceed the design volume, some stormwater bypasses the first treatment basin and is only processed by the second. When storms exceed the design volume, the first inch of rain (first flush) is treated, while the excess is routed to conveyance structures or receiving waters. The treatment cells host a diverse mix of native wetland grasses, reeds, herbaceous plants, and shrubs.



Source: Stormwater Best Management Practices (BMP) Performance Analysis Report - US EPA , March 2010

Appendix C:

Long Term Stormwater Operation and Maintenance Measures

Project Information

Site

Project Name:	The Lanterns at Warren Woods
Address or Locus:	466 Chestnut Street
City, State & Zip:	Ashland, MA 01721

Developer

Client Name:	Pickwick Development Corp. c/o The Green Companies
Client Address:	46 Glen Avenue
Client City, State & Zip:	Newton, MA 02459
Client Telephone No.:	(617) 696-0020
Client Cell Phone:	N/A
Client E-Mail:	dcaligaris@greencos.com

Site Supervisor

Site Manager Name:	TBD
Site Manager Address:	TBD
Site Manager City, State & Zip:	TBD
Site Manager Telephone No.:	TBD
Site Manager Cell Phone:	TBD
Site Manager E-Mail:	TBD

As part of the Notice of Intent process, a long term stormwater maintenance plan will be developed, and will include measures such as those described below.

Long Term Stormwater Maintenance Measures –

The following maintenance program is proposed to ensure the continued effectiveness of the structural water quality controls previously described.

- Inspect stormwater basins once annually, in the spring, for cracking or erosion of side slopes, embankments, and accumulated sediment. Necessary sediment removal, earth repair, and/or reseeding will be performed immediately upon identification.
- Inspect sediment traps/forebays monthly for erosion of side slopes and accumulated sediment. Necessary sediment removal, earth repair and/or reseeding shall be performed immediately upon identification. Clean traps/ forebays approximately four times per year or as needed.
- Clean all catch basins twice annually to remove accumulated sand, sediment, and floatable products or as needed based on use.
- Paved areas will be swept, at a minimum, two times per year.
- Routinely pick up and remove litter from the parking areas, islands and perimeter landscape areas in addition to regular pavement sweeping.
- Routinely inspect all dumpster and compactor locations for spills. Remove all trash litter from the enclosure and dispose of properly.

Pavement Systems

Standard Asphalt Pavement

- Sweep or vacuum standard asphalt pavement areas at least four times per year with a commercial cleaning unit and properly dispose of removed material.
- Recommended sweeping schedule:
  - Oct/ Nov
  - Feb/ Mar
  - Apr/ May
  - Aug/ Sep
- More frequent sweeping of paved surfaces will result in less accumulation in catch basins, less cleaning of subsurface structures, and less disposal costs.

Structural Stormwater Management Devices

Catch Basins

- All catch basins shall be inspected and cleaned a minimum of at least twice 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.

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.

Vegetated Stormwater Management Devices

Gravel Wetland

Initial Post-Construction Inspection

- Gravel Wetlands shall be visually inspected for a period of one year following installation, to ensure proper function and that vegetation is healthy and developing.

Long-Term Maintenance

- Inlet and outlet areas should be checked for scouring or other erosion and the sediment forebay and treatment cells should be checked for excessive sedimentation.
- Confirm that the drawdown time of the gravel wetland treatment cells is less than 72 hours.
- Vegetation shall be maintained, and accumulated trash and debris shall be removed.

Inspections and Cleanings

- Inspect the treatment cells at a minimum one time per year for sediment build up, erosion and vegetative conditions. Any sediment build up interfering with plan growth shall be removed and the vegetation restored immediately.
- Inspect the gravel wetlands for invasive species (Phragmites, Purple Loosestrife). Any invasive species encountered shall be removed immediately.
- Inspect outlet control structures every year for erosion build up and clogging. Any sediment or blockage should be removed.
- Test the pH levels of the soils within the gravel wetland bottoms at a minimum of one time per year. If the pH is below 5.2, limestone should be applied to increase it; if the pH is above 8.0, iron sulfate and sulfur should be added to reduce it.
- Plant growth within the gravel wetland should be cut back at the end of every growing season. Cuttings must be removed and properly disposed of. Gravel wetlands should not be mowed at any time.
- The use of fertilizers shall be avoided in the gravel wetlands as excessive nutrients may be discharged to adjacent wetlands and surface waters.

Detention Basin

Initial Post-Construction Inspection

- Detention basins should be inspected after every major storm for the first few months to ensure proper stabilization and function.

Long-Term Maintenance

- The grass on the side slopes and in the buffer areas should be mowed, and grass clippings, organic matter, and accumulated trash and debris removed, at least twice during the growing season.
- Eroded or barren spots should be reseeded immediately after inspection to prevent additional erosion and accumulation of sediment.
- Sediment should be removed from the basin as necessary. Removal procedures should not take place until the floor of the basin is thoroughly dry.

Inspections and Cleaning

- Detention basins should be inspected at least twice a year to ensure proper stabilization and function.
- Light equipment, which will not compact the underlying soil, should be used to remove the top layer.

Vegetated Areas Maintenance

Although not a structural component of the drainage system, the maintenance of vegetated areas may affect the functioning of stormwater management practices. This includes the health/density of vegetative cover and activities such as the application and disposal of lawn and garden care products, disposal of leaves and yard trimmings.

- 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.

Long Term Best Management Practices Checklist

- The Long-Term BMP Maintenance/Evaluation Checklist is attached.

DETENTION BASIN MAINTENANCE REQUIREMENTS

MAINTAIN VEGETATION AND REMOVE TRASH AND DEBRIS AND SEDIMENT.

DETENTION BASINS SHALL BE INSPECTED TWICE DURING THE FIRST YEAR AND ANNUALLY THEREAFTER FOR SEDIMENT BUILDUP, EROSION, VEGETATIVE CONDITIONS, ETC.

STORMWATER OUTFALL MAINTENANCE REQUIREMENTS

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 WHERE APPLICABLE AND REPLACE ANY WASHOUTS.

REMOVE AND LEGALLY DISPOSE OF ANY TRASH OR DEBRIS AT THE OUTFALL.

GRAVEL WETLAND MAINTENANCE REQUIREMENTS

MAINTAIN VEGETATION AND REMOVE TRASH AND DEBRIS AND SEDIMENT.

EXAMINE THE OUTLET STRUCTURE FOR EVIDENCE OF CLOGGING OR OUTFLOW RELEASE VELOCITIES THAT ARE GREATER THAN DESIGN FLOW. REMOVE ANY SEDIMENT OR DEBRIS FROM THE OUTLET CONTROL STRUCTURE.

THE INFLOW LOCATIONS SHOULD BE INSPECTED ANNUALLY FOR CLOGGING. SEDIMENT BUILD UP IS A COMMON PROBLEM WHERE RUNOFF LEAVES AN IMPERVIOUS SURFACE AND ENTERS A VEGETATIVE OR EARTHEN SURFACE. ANY BUILT-UP SEDIMENT SHOULD BE REMOVED TO PREVENT RUNOFF FROM BYPASSING THE FACILITY.
THE OVERFLOW STRUCTURE SHOULD BE INSPECTED ANNUALLY TO ENSURE THAT IT IS PROPERLY FUNCTIONING.

DEEP SUMP CATCH BASIN MAINTENANCE REQUIREMENTS

ALL CATCH BASINS SHALL BE INSPECTED AT LEAST TWO TIMES PER YEAR 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

CARE SHOULD BE TAKEN NOT TO DISLODGE THE OUTLET HOOD WHEN CLEANING

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.

OUTLET CONTROL STRUCTURE MAINTENANCE REQUIREMENTS

ALL OUTLET CONTROL STRUCTURES SHALL BE INSPECTED AT LEAST TWICE A YEAR BY REMOVING THE FRAMES AND GRATES AND DETERMINING THE THICKNESS OF SEDIMENT THAT HAS ACCUMULATED.

IF SEDIMENT IS MORE THAN SIX INCHES DEEP, IT MUST BE REMOVED USING A VACTOR TRUCK.

ONE INSPECTION AND CLEANOUT (IF SEDIMENT DEPTHS WARRANT) SHOULD OCCUR IN MARCH AFTER SNOWFALL EVENTS HAVE CEASED.

DURING COLDER PERIODS, THE INLET GRATES MUST BE KEPT FREE OF SNOW AND ICE.

DURING WARMER PERIODS, THE INLET GRATES MUST BE KEPT FREE OF LEAVES, LITTER, SAND, AND DEBRIS.

LEGEND

CB	DEEP SUMP CATCH BASIN WITH HOOD
OCS	OUTLET CONTROL STRUCTURE
GW	GRAVEL WETLAND
FES	STORMWATER OUTFALL
DB	DETENTION BASIN

0 100 200 400 Feet

Vanasse Hangen Brustlin, Inc.

July 2015

Operations and Maintenance Manual
BMP Location Map
The Lanterns at Warren Woods
Ashland, Massachusetts

The Lanterns at Warren Woods, Ashland, Massachusetts
Long Term Best Management Practices – Maintenance/ Evaluation Checklist

Best Management Practice	Inspection Frequency	Date Inspected	Inspector	Minimum Maintenance and Key Items to Check	Cleaning/Repair Needed ☐yes ☐no (List Items)	Date of Cleaning/Repair	Performed by
Gravel Wetland	Bi-annually			• Maintain vegetation • Examine the outlet structure for evidence of clogging or outflow release velocities that are greater than design flow. Remove any sediment or debris from the outlet control structure. • Remove trash and debris and sediment. • The inflow locations should be inspected annually for clogging. Sediment build up is a common problem where runoff leaves an impervious surface and enters a vegetative or earthen surface. Any built-up sediment should be removed to prevent runoff from bypassing the facility. • The overflow structure should be inspected annually to ensure that it is properly functioning.	☐yes ☐no		
Deep Sump and Hooded Catch basin	Bi-annually			• All catch basins shall be inspected and cleaned a minimum of at least twice per year. One clean out should occur in March after snowfall events have ceased, to remove deicing sands from the BMPs. • 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.	☐yes ☐no		
Sedimentation Trap/Forebay	Bi-annually			• Remove and repair sediment and erosion • Maintain vegetation • Clear any clogging at the inlets	☐yes ☐no		
Street Sweeping	Quarterly			• Sweep or vacuum pavement surfaces at least four times a year with a commercial cleaning unit and dispose of removed materials. Sweeping should be conducted in March, after the snowy season but before significant spring rain events. Vacuum regenerative air sweeping is preferred.	☐yes ☐no		
Outlet Control Structures	Bi-annually			• The outlet control structures associated with the gravel wetlands shall be inspected at least twice a year by removing the frames and grates and determining the thickness of sediment that has accumulated. • If sediment is more than six inches deep, it must be removed using a vactor truck. • One inspection and cleanout (if sediment depths warrant) should occur in March after snowfall events have ceased.	☐yes ☐no		
Detention Basin	Bi-annually			• Remove and repair sediment and erosion • Inspect and remove trash • Maintain vegetation. • Detention basins shall be inspected twice during for the first year and annually thereafter for sediment buildup, erosion, vegetative conditions, etc.	☐yes ☐no		

Stormwater Control Manager ________________________________

Inspection Date: ____/____/____ Inspection Performed By: ________________________

Catch Basins – Inspect 2 times per year, clean when sediment depth >6 inches or at least once per year					
Catch Basin	Inspected (Y/N)	Sediment Depth (inches)	Cleaning needed (Y/N)	Date Cleaned	Comments (Trash, Oil, Pet waste, Lawn Debris, Damaged)
CB-A1				/ /	
CB-A2				/ /	
CB-A3				/ /	
CB-A4				/ /	
CB-A5				/ /	
CB A6				/ /	
CB A7				/ /	
CB A8				/ /	
CB A9				/ /	
CB-A10				/ /	
CB-A11				/ /	
CB-A12				/ /	
CB-A13				/ /	
CB-A14				/ /	
CB-B3				/ /	
CB-B4				/ /	
CB-C1				/ /	
CB-C2				/ /	
CB-C3				/ /	
CB-C4				/ /	
CB-C5				/ /	
CB-C6				/ /	
CB-C7				/ /	

Inspection Date: ____/____/____ Inspection Performed By: ________________________

Outfalls – Inspect 2 times per year, replace any dislodged rip-rap, remove excess vegetation, remove any debris					
Outfall	Inspected (Y/N)	Sediment Depth (inches)	Cleaning needed (Y/N)	Date Cleaned	Comments (Trash, Oil, Pet waste, Lawn Debris, Damage)
FES-A3				/ /	
FES-B3				/ /	
FES-C3				/ /	
FES-D2				/ /	

Outlet Control Structures – Inspect 2 times per year, clean when sediment depth >6 inches or at least once per year					
Outlet	Inspected (Y/N)	Sediment Depth (inches)	Cleaning needed (Y/N)	Date Cleaned	Comments (Trash, Oil, Pet waste, Lawn Debris, Damage)
OCS-A1				/ /	
OCS-B1				/ /	
OCS-C1				/ /	

Gravel Wetlands – Inspect twice per year. Remove sediment from basin. Inspect and clean sediment forebay and treatment cells associated with basins at least twice per year.					
Basin	Inspected (Y/N)	Sediment Depth (inches)	Cleaning needed (Y/N)	Date Cleaned	Comments (Trash, Oil, Pet waste, Lawn Debris, Damage)
Basin 1				/ /	
Basin 2				/ /	
Basin 3				/ /	

Detention Basins – Inspect twice per year. Remove trash and sediment from basin.					
Basin	Inspected (Y/N)	Sediment Depth (inches)	Cleaning needed (Y/N)	Date Cleaned	Comments (Trash, Oil, Pet waste, Lawn Debris, Damage)
Basin 4				/ /	

Appendix D:
Hydraulic Analysis

Drainage Pipe Sizing Calculations

25-Year Storm Event

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

Storm Drainage Computations

Name:	The Laterns at Warren Woods Ashland, MA	Proj. No.:	13050.00	Design Parameters:	
		Date:	6/28/2015	25 Year Storm	Boston, MA
Client:	The Green Company	Computed by:	WM		
		Checked by:	PTM	k_e=	0.5

DESCRIPTION	LOCATION		AREA	C	C x A	SUM	FLOW TIME (MIN)		i*	DESIGN					CAPACITY		PROFILE						
	FROM	TO	(AC.)			C x A	PIPE	CONC TIME		Q cfs	V fps	n	PIPE SIZE	SLOPE	Q full ft^3/s	V full ft/s	LENGTH ft	FALL ft	RIM	INV UPPER	INV LOWER	W.S.E. ft	Freeboard ft
	CB-A1	DMH-A1	0.31	0.56	0.18	0.18	0.06	5.0	6.0	1.1	3.3	0.012	12	0.0085	3.6	4.5	12	0.10	334.0	331.8	331.7	331.7	2.3
	CB-A2	DMH-A1	0.18	0.61	0.11	0.11	0.07	5.0	6.0	0.7	2.9	0.012	12	0.0085	3.6	4.5	12	0.10	334.0	331.8	331.7	331.7	2.3
	DMH-A1	DMH-A2	--	--	--	0.28	0.32	5.0	6.0	1.7	3.1	0.012	12	0.0050	2.7	3.5	60	0.30	334.2	331.6	331.3	331.5	2.7
	DMH-A2	DMH-A3	--	--	--	0.28	0.60	5.0	6.0	1.7	3.2	0.012	12	0.0053	2.8	3.6	114	0.60	335.1	331.2	330.6	331.1	4.0
	CB-A3	DMH-A3	0.43	0.59	0.25	0.25	0.05	5.0	6.0	1.5	4.5	0.012	12	0.0151	4.7	6.0	13	0.20	336.2	332.2	332.0	331.9	4.3
	CB-A4	DMH-A3	0.09	0.59	0.05	0.05	0.08	5.0	6.0	0.3	2.6	0.012	12	0.0151	4.7	6.0	13	0.20	336.2	332.2	332.0	332.1	4.1
	DMH-A3	DMH-A4	--	--	--	0.59	0.53	5.0	6.0	3.5	3.8	0.012	15	0.0050	4.9	4.0	121	0.60	336.6	330.4	329.8	330.2	6.4
	CB-A5	DMH-A4	0.33	0.58	0.19	0.19	0.69	5.0	6.0	1.1	3.8	0.012	12	0.0120	4.2	5.4	158	1.90	335.9	331.9	330.0	331.7	4.2
	AD-A1	DMH-A4	0.68	0.54	0.36	0.36	--	--	--	--	--	0.012	--	--	--	--	--	--	--	--	--	--	--
	DMH-A4	DMH-A5	--	--	--	1.14	0.83	5.0	6.0	6.9	4.6	0.012	18	0.0050	8.1	4.6	229	1.15	338.6	329.5	328.4	329.2	9.4
	CB-A6	DMH-A5	0.29	0.58	0.17	0.17	0.75	5.0	6.0	1.0	3.5	0.012	12	0.0105	4.0	5.0	158	1.65	334.5	330.5	328.9	330.3	4.1
	AD-A2	DMH-A5	0.47	0.52	0.25	0.25	--	--	--	--	--	0.012	--	--	--	--	--	--	--	--	--	--	--
	DMH-A5	DMH-A6	--	--	--	1.56	0.40	5.0	6.0	9.3	8.4	0.012	18	0.0231	17.3	9.8	202	4.65	336.9	328.3	323.6	327.4	9.5
	CB-A7	DMH-A6	0.74	0.55	0.40	0.40	0.06	5.0	6.0	2.4	4.7	0.012	12	0.0122	4.3	5.4	16	0.20	328.2	324.2	324.0	323.9	4.3
	CB-A8	DMH-A6	0.15	0.60	0.09	0.09	0.06	5.0	6.0	0.6	3.3	0.012	12	0.0161	4.9	6.2	12	0.20	328.2	324.2	324.0	324.1	4.1
	AD-A3	DMH-A6	0.84	0.42	0.36	0.36	--	--	--	--	--	0.012	--	--	--	--	--	--	--	--	--	--	--
	DMH-A6	DMH-A7	--	--	--	2.41	0.36	5.0	6.0	14.4	10.9	0.012	18	0.0323	20.4	11.6	234	7.55	328.1	323.5	316.0	322.0	6.1
	AD-A4	DMH-A7	0.55	0.61	0.34	0.34	--	--	--	--	--	0.012	--	--	--	--	--	--	--	--	--	--	--
	CB-A9	DMH-A8	0.05	0.65	0.03	0.03	0.13	5.0	6.0	0.2	1.7	0.012	12	0.0074	3.3	4.2	14	0.10	318.2	316.0	315.9	316.0	2.2
	CB-A10	DMH-A8	0.77	0.55	0.42	0.42	0.06	5.0	6.0	2.5	4.0	0.012	12	0.0074	3.3	4.2	14	0.10	318.2	316.0	315.9	315.8	2.4
	RD	DMH-A8	0.16	0.90	0.15	0.15	--	--	--	--	--	0.012	--	--	--	--	--	--	--	--	--	--	--
	DMH-A8	DMH-A7	--	--	--	0.60	0.17	5.0	6.0	3.6	4.0	0.012	15	0.0060	5.4	4.4	42	0.25	319.2	315.8	315.6	315.6	3.6
	DMH-A7	DMH-A9	--	--	--	3.35	0.39	5.0	6.0	20.1	6.9	0.012	24	0.0072	20.8	6.6	159	1.15	322.3	315.5	314.3	314.9	7.4
	CB-A11	DMH-A9	0.12	0.60	0.07	0.07	0.05	5.0	6.0	0.4	3.5	0.012	12	0.0268	6.3	8.0	11	0.30	319.9	315.9	315.6	315.8	4.1
	CB-A12	DMH-A9	0.24	0.62	0.15	0.15	0.04	5.0	6.0	0.9	4.5	0.012	12	0.0268	6.3	8.0	11	0.30	319.9	315.9	315.6	315.6	4.3
	DMH-A9	DMH-A10	--	--	--	3.56	0.28	5.0	6.0	21.4	7.2	0.012	24	0.0079	21.8	6.9	121	0.95	320.1	314.2	313.3	313.6	6.5
	CB-A13	DMH-A11	0.99	0.37	0.37	0.37	0.05	5.0	6.0	2.2	4.8	0.012	12	0.0138	4.5	5.8	15	0.20	323.3	319.3	319.1	319.0	4.3
	CB-A14	DMH-A11	0.35	0.58	0.20	0.20	0.06	5.0	6.0	1.2	4.0	0.012	12	0.0133	4.4	5.7	15	0.20	323.3	319.3	319.1	319.1	4.2
	AD-A5	DMH-A11	1.30	0.59	0.77	0.77	--	--	--	--	--	0.012	--	--	--	--	--	--	--	--	--	--	--
	DMH-A11	DMH-A10	--	--	--	1.34	0.43	5.0	6.0	8.0	8.2	0.012	15	0.0227	10.5	8.6	214	4.85	323.5	318.9	314.0	318.0	5.5
	RD	DMH-A10	0.49	0.90	0.44	0.44	--	--	--	--	--	0.012	--	--	--	--	--	--	--	--	--	--	--
	DMH-A10	FES-A1	--	--	--	5.34	0.10	5.0	6.0	32.0	10.6	0.012	24	0.0172	32.1	10.2	67	1.15	318.0	313.2	312.0	311.7	6.3

Storm Drainage Computations

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

Name: The Laterns at Warren Woods
Ashland, MA
Client: The Green Company

Proj. No.: **13050.00**
Date: **6/28/2015**
Computed by: **WM**
Checked by: **PTM**

Design Parameters:
25 Year Storm Boston, MA
k_e= **0.5**

DESCRIPTION	LOCATION FROM	LOCATION TO	AREA (AC.)	C	C x A	SUM C x A	FLOW TIME (MIN) PIPE	FLOW TIME (MIN) CONC TIME	i*	DESIGN Q cfs	DESIGN V fps	DESIGN n	DESIGN PIPE SIZE	DESIGN SLOPE	CAPACITY Q full ft^3/s	CAPACITY V full ft/s	PROFILE LENGTH ft	PROFILE FALL ft	PROFILE RIM	PROFILE INV UPPER	PROFILE INV LOWER	PROFILE W.S.E. ft	PROFILE Freeboard ft
	CB-B1	DMH-B1	0.28	0.53	0.15	0.15	0.05	5.0	6.0	0.9	3.9	0.012	12	0.0171	5.1	6.4	12	0.20	329.4	325.4	325.2	325.2	4.2
	CB-B2	DMH-B1	0.21	0.48	0.10	0.10	0.06	5.0	6.0	0.6	3.4	0.012	12	0.0171	5.1	6.4	12	0.20	329.4	325.4	325.2	325.3	4.1
	DMH-B1	DMH-B2	--	--	--	0.25	0.48	5.0	6.0	1.5	5.1	0.012	12	0.0212	5.6	7.2	146	3.10	329.4	325.1	322.0	324.8	4.6
	AD-B1	DMH-B2	1.29	0.53	0.69	0.69	--	--	--	--	--	0.012	--	--	--	--	--	--	--	--	--	--	--
	CB-B3	DMH-B3	0.25	0.63	0.16	0.16	0.07	5.0	6.0	0.9	3.1	0.012	12	0.0076	3.4	4.3	13	0.10	325.3	323.1	323.0	323.0	2.3
	CB-B4	DMH-B3	0.51	0.57	0.29	0.29	0.06	5.0	6.0	1.8	3.7	0.012	12	0.0078	3.4	4.3	13	0.10	325.3	323.1	323.0	322.9	2.4
	AD-B2	DMH-B3	0.39	0.49	0.19	0.19	--	--	--	--	--	0.012	--	--	--	--	--	--	--	--	--	--	--
	DMH-B3	DMH-B2	--	--	--	0.64	0.97	5.0	6.0	3.9	3.9	0.012	15	0.0050	5.0	4.0	228	1.15	325.6	322.9	321.8	322.7	2.9
	DMH-B2	DMH-B4	--	--	--	1.58	0.26	5.0	6.0	9.5	6.8	0.012	18	0.0124	12.6	7.2	105	1.30	327.8	321.5	320.2	320.9	6.9
	DMH-B4	FES-B1	--	--	--	1.58	0.17	5.0	6.0	9.5	7.3	0.012	18	0.0152	14.0	7.9	72	1.10	325.8	320.1	319.0	319.4	6.4
	CB-C1	DMH-C1	0.61	0.52	0.32	0.32	0.30	5.0	6.0	1.9	4.5	0.012	12	0.0126	4.3	5.5	79	1.00	308.8	306.5	305.5	306.3	2.5
	RD	DMH-C1	0.49	0.90	0.44	0.44	--	--	--	--	--	0.012	--	--	--	--	--	--	--	--	--	--	--
	DMH-C1	DMH-C2	--	--	--	0.76	0.40	5.0	6.0	4.5	4.3	0.012	15	0.0054	5.1	4.2	102	0.55	313.0	305.3	304.7	305.0	8.0
	CB-C2	DMH-C2	0.06	0.60	0.04	0.04	0.08	5.0	6.0	0.2	2.5	0.012	12	0.0238	5.9	7.6	13	0.30	311.4	307.4	307.1	307.3	4.1
	CB-C3	DMH-C2	0.08	0.58	0.05	0.05	0.08	5.0	6.0	0.3	2.7	0.012	12	0.0238	5.9	7.6	13	0.30	311.4	307.4	307.1	307.3	4.1
	DMH-C2	DMH-C3	--	--	--	0.84	0.20	5.0	6.0	5.0	4.1	0.012	18	0.0050	8.1	4.6	50	0.25	311.2	304.5	304.2	304.2	7.0
	RD	DMH-C3	0.38	0.90	0.34	0.34	--	--	--	--	--	0.012	--	--	--	--	--	--	--	--	--	--	--
	DMH-C3	DMH-C4	--	--	--	1.18	0.54	5.0	6.0	7.1	4.7	0.012	18	0.0052	8.2	4.6	154	0.80	308.3	304.1	303.3	303.8	4.5
	DMH-C4	DMH-C5	--	--	--	1.18	0.21	5.0	6.0	7.1	4.7	0.012	18	0.0051	8.2	4.6	58	0.30	307.4	303.2	302.9	302.9	4.5
	CB-C4	DMH-C6	0.71	0.45	0.32	0.32	0.04	5.0	6.0	1.9	5.0	0.012	12	0.0167	5.0	6.4	12	0.20	316.9	312.9	312.7	312.6	4.3
	CB-C5	DMH-C6	0.11	0.36	0.04	0.04	0.09	5.0	6.0	0.2	2.3	0.012	12	0.0167	5.0	6.4	12	0.20	316.9	312.9	312.7	312.8	4.1
	DMH-C6	DMH-C7	--	--	--	0.36	0.10	5.0	6.0	2.1	5.6	0.012	12	0.0210	5.6	7.1	33	0.70	317.1	312.6	311.9	312.2	4.9
	RD	DMH-C7	0.16	0.90	0.15	0.15	--	--	--	--	--	0.012	--	--	--	--	--	--	--	--	--	--	--
	DMH-C7	DMH-C8	--	--	--	0.50	0.46	5.0	6.0	3.0	6.0	0.012	12	0.0203	5.5	7.0	168	3.40	317.7	311.8	308.4	311.4	6.3
	CB-C6	DMH-C8	0.13	0.59	0.07	0.07	0.04	5.0	6.0	0.4	4.4	0.012	12	0.0512	8.7	11.1	12	0.60	315.1	311.0	310.4	310.8	4.3
	CB-C7	DMH-C8	0.34	0.60	0.20	0.20	0.03	5.0	6.0	1.2	6.2	0.012	12	0.0512	8.7	11.1	12	0.60	315.1	311.0	310.4	310.5	4.6
	DMH-C8	DMH-C5	--	--	--	0.78	0.16	5.0	6.0	4.7	9.7	0.012	12	0.0537	8.9	11.4	91	4.90	315.2	308.3	303.4	307.1	8.1
	RD	DMH-C5	0.16	0.90	0.15	0.15	--	--	--	--	--	0.012	--	--	--	--	--	--	--	--	--	--	--
	DMH-C5	FES-C1	--	--	--	2.10	0.05	5.0	6.0	12.6	9.9	0.012	18	0.0286	19.2	10.9	28	0.80	309.0	302.8	302.0	301.6	7.4

Outfall Sizing Calculations

Apron and Rip-Rap Sizing Calculations

Project Name: The Lanterns | **Proj. No.:** 13050.00

Date: July 2015

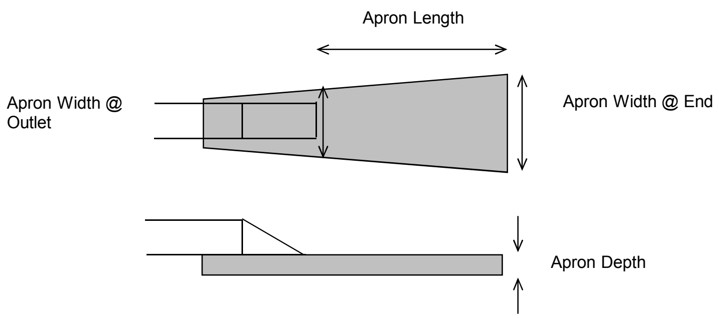
Project Location: Ashland, MA | **Calculated by:** PTM

Checked by: KSS

Sources: Massachusetts Erosion and Sediment Control Guidelines for Urban and Suburban Areas
Massachusetts Department of Environmental Protection - Reprinted 2003 (pp. 118-120)

Erosion and Sediment Control Handbook - Third Edition 1992 (Chapter 3.18)
Virginia Department of Conservation and Recreation (DCR)

Attachments: Virginia DCR Erosion and Sediment Control Handbook Plate 3.18-3



Apron Width at Outlet ($3D_o$): Width = 3 x pipe dia. (or width of channel)

Apron Length (La): Length = From Virginia DCR Handbook - Plate 3.18-3 — if Tw depth is < 1/2 dia.
Length = From Virginia DCR Handbook - Plate 3.18-4 — if Tw dwpth is >= 1/2 dia.

Apron Width at End (W): Width = dia. + apron length — if Tw depth is < 1/2 dia.
Width = dia. + 0.4 x apron length — if Tw dwpth is >= 1/2 dia.
or apron width = channel width if a well defined channel exists

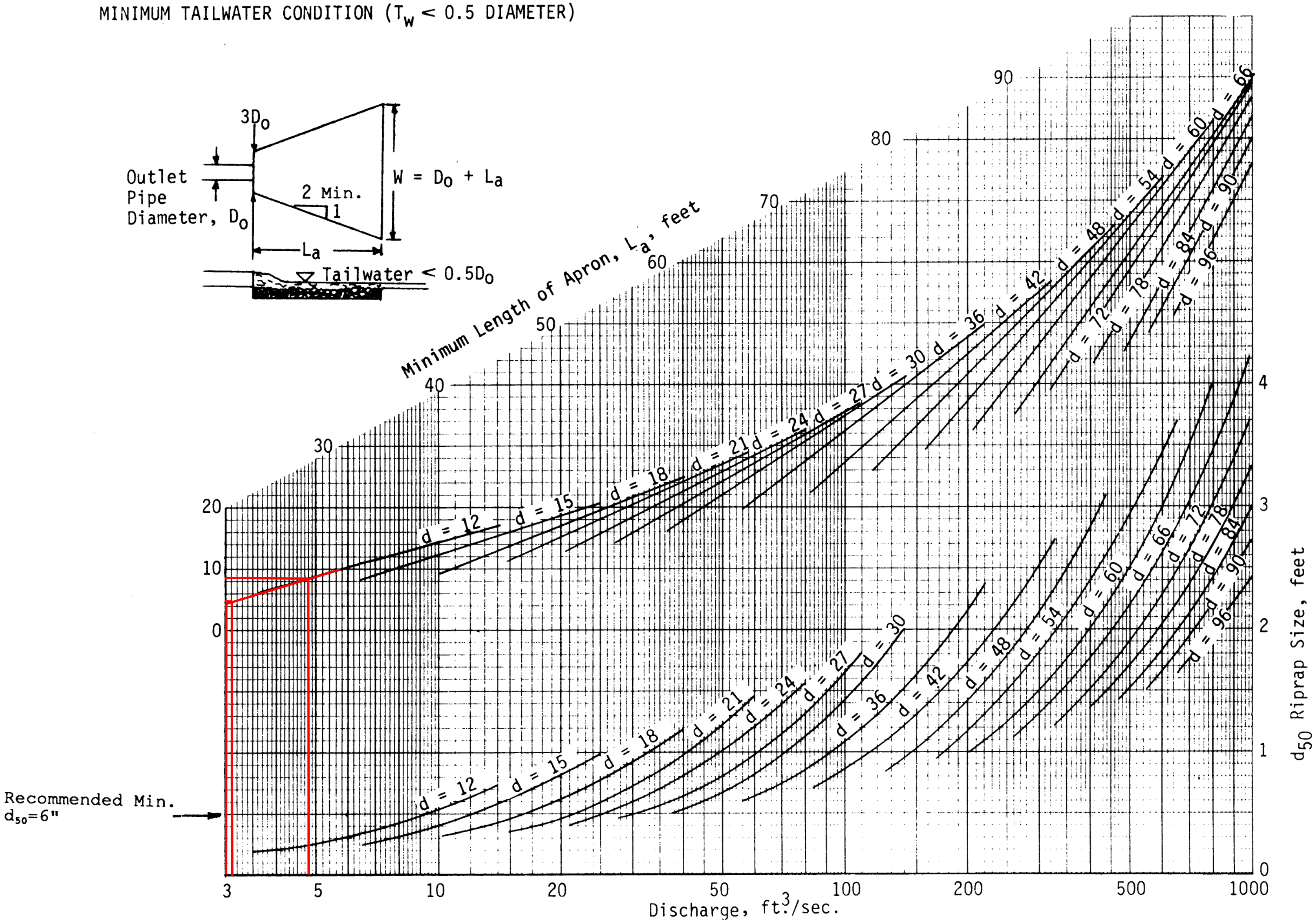
Rock Riprap: Median Diameter (d_{50}) = From Virginia DCR Handbook - Plate 3.18-3 or 4
Largest stone dia = 1.5 x d_{50}

Apron Depth: 6" or 1.5 x largest stone dia

Design Element	Outlet Description			
	FES-B3[1]	FES-C3[2]	FES-A3[3]	FES-D2[4]
Design Storm (yr):	100	100	100	100
Defined Channel (yes/no)	no	no	no	no
Pipe Dia (D_o), in	12.0	12.0	12.0	12.0
Tail Water (Tw), ft	0.00	0.00	0.00	0.00
Flow (Q), cfs	2.6	3.1	4.8	3.2
Apron Width ($3D_o$) (outlet), ft	3.0	3.0	3.0	3.0
Apron Length (La), ft	4.0	4.0	8.5	4.5
Apron Width (W) (end), ft	**5.0**	**5.0**	**9.5**	**5.5**
Median Stone Dia. (d_{50}), ft	0.5	0.5	0.5	1.5
Median Stone Dia. (d_{50}), in	6.0	6.0	6.0	18.0
Largest Stone Dia., ft	0.75	0.75	0.75	2.25
Largest Stone Dia., in	9.0	9.0	9.0	27.0
Apron Depth, ft	1.13	1.13	1.13	3.38
Apron Depth, in	13.5	13.5	13.5	40.5

[1,2,3,4] Flows calculated using 100- year design storm in HydroCAD. Results for 10-year design storm are included in this report.

DESIGN OF OUTLET PROTECTION FROM A ROUND PIPE FLOWING FULL
MINIMUM TAILWATER CONDITION (T_w < 0.5 DIAMETER)



Velocity Over Overflow Weirs

Project Name: The Lanterns **Proj. No.:** 13050.00

Date: July 2015

Project Location: Ashland, MA **Calculated by:** PTM

Checked by: KSS

Flows and Velocities over the auxiliary spillways (weirs).

Storage Area	Elev of Weir (feet)	Peak Water Surface Elevation (feet) 2-year	10-year	100-year	Overflows over Weir 2-year	10-year	100-year	Overflow Q (cfs) 2-year	10-year	100-year	Overflow V (ft/s) 2-year	10-year	100-year
Gravel Wetland 1	319	318.27	319.10	319.50	**no**	**yes**	**yes**	-	0.6	7.4	-	0.8	1.8
Gravel Wetland 2	306	303.49	304.58	305.76	**no**	**no**	**no**	-	-	-	-	-	-
Gravel Wetland 3	315.5	313.34	314.24	315.50	**no**	**no**	**no**	-	-	-	-	-	-
Detention Basin 1	334.5	332.59	332.81	333.11	**no**	**no**	**no**	-	-	-	-	-	-

The maximum weir overflow velocity for the gravel wetlands is 1.8 fps during the 100-year event.
This velocity is not typically erosive to vegetative cover in good condition.
The spillway of the gravel wetlands have been designed with stone material to protect down gradient areas from erosion.

Permissible Velocities for Vegetated Spillways [1]

Vegetative Cover	Permissible Velocity [2] *(ft/s)* — Erosion Resistant Soils [3], Slope of Exit Channel *0-5%*	Erosion Resistant Soils [3], Slope of Exit Channel *5-10%*	Easily Erodible Soils [4], Slope of Exit Channel *0-5%*	Easily Erodible Soils [4], Slope of Exit Channel *5-10%*
Bermuda Grass Bahiagrass	8	7	6	5
Buffalograss Kentucky Bluegrass Smooth Bromegrass Tall Fescue Reed Canary Grass	7	6	5	4
Sod Forming Grass-Legume Mixtures	5	4	4	3
Lespedeza Weeping Lovegrass Yellow Bluestem Native Grass Mixtures	3.5	3.5	2.5	2.5

[1] SCS-TP-61
[2] Increase values 25 percent when the anticipated average use of the spillway is not more frequent than once in 10 years.
[3] Those with a high clay content and high plasticity. Typical soil textures are silty clay, sandy clay, and clay.
[4] Those with a high content of fine sand or silty and lower plasticity or non-plastic. Typical soil textures are fine sand, silt, sandy loam, and silty loam.

Source - USDA-SCS Engineering Field Manual

Water Quality Volume Calculations

Water Quality Volume Calculations

Project Name:	The Lanterns	**Proj. No.:**	13050.00
Project Location:	Ashland, MA	**Date:**	July 2015
		Calculated by:	PTM
		Checked by:	KSS

Gravel Wetland #1

Sediment Forebay WQV:
10% of Water Quality Storm

Water Quality Storm Runoff Depth (inches)= **0.5**
Total Impervious Area (sq.ft.) = **27,749**

Required*:

Runoff Depth to be Treated (in.)	Required Volume (cu.ft.)
0.05	**116**

Provided:

Elevation	Area (s.f.)	Cumulative Volume (cu.ft.)
316.5	100	0
317	191	73
318	390	**363**

Gravel Wetland Treatment Cell:
Two Cells Treat 45% of Water Qaulity Storm Each

Total Impervious Area (sq.ft.) = **27,749**

Required*:

Runoff Depth to be Treated (in.)	Required Volume (cu.ft.)
0.225	**520**

Provided:
(First Cell)

Elevation	Area (s.f.)	Cumulative Volume (cu.ft.)
315	281	0
316	662	472
317	1100	**1353**

Provided:
(Second Cell)

Elevation	Area (s.f.)	Cumulative Volume (cu.ft.)
315	451	0
316	876	664
317	1357	**1780**

Freeboard:

	100-year WSE (from HydroCAD)	319.50
Required:	Maximum Basin Elevation	320.50
	Freeboard	**1.00**

* Per 2008 Massachusetts DEP Treatment Requirement

Gravel Wetland #2

Sediment Forebay WQV:

10% of Water Quality Storm

	Water Quality Storm Runoff Depth (inches)=		**0.5**
	Total Impervious Area (sq.ft.) =		**39,125**
Required*:			
	Runoff Depth to be Treated (in.)		Required Volume (cu.ft.)
	0.05		**163**
Provided:			
	Elevation	Area (s.f.)	Cumulative Volume (cu.ft.)
	300	169	0
	301	346	**258**

Gravel Wetland Treatment Cell:

Two Cells Treat 45% of Water Qaulity Storm Each

	Total Impervious Area (sq.ft.) =		**39,125**
Required*:			
	Runoff Depth to be Treated (in.)		Required Volume (cu.ft.)
	0.225		**734**
Provided:			
(First Cell)	Elevation	Area (s.f.)	Cumulative Volume (cu.ft.)
	299	357	0
	300	632	495
	301	962	**1292**
Provided:			
(Second Cell)	Elevation	Area (s.f.)	Cumulative Volume (cu.ft.)
	299	357	0
	300	632	495
	301	962	**1292**

Freeboard:

	100-year WSE (from HydroCAD)	305.76
Required:	Maximum Basin Elevation	306.76
	Freeboard	**1.00**

* Per 2008 Massachusetts DEP Treatment Requirement

Gravel Wetland #3

Sediment Forebay WQV:
10% of Water Quality Storm

Water Quality Storm Runoff Depth (inches)=	**0.5**
Total Impervious Area (sq.ft.) =	**105,650**

Required*:

Runoff Depth to be Treated (in.)	Required Volume (cu.ft.)
0.05	**440**

Provided:

Elevation	Area (s.f.)	Cumulative Volume (cu.ft.)
309	244	0
310	447	346
311	707	**923**

Gravel Wetland Treatment Cell:
Two Cells Treat 45% of Water Qaulity Storm Each

Total Impervious Area (sq.ft.) =	**105,650**

Required*:

Runoff Depth to be Treated (in.)	Required Volume (cu.ft.)
0.225	**1981**

Provided:

(First Cell)

Elevation	Area (s.f.)	Cumulative Volume (cu.ft.)
309	850	0
310	1242	1046
311	1691	**2513**

Provided:

(Second Cell)

Elevation	Area (s.f.)	Cumulative Volume (cu.ft.)
309	691	0
310	1084	888
311	1533	**2196**

Freeboard:

Required:

100-year WSE (from HydroCAD)	315.50
Maximum Basin Elevation	316.50
Freeboard	**1.00**

* Per 2008 Massachusetts DEP Treatment Requirement

Water Volume Impact Analysis

Water Volume Impact Analysis

Project Name: The Lanterns
Project No: 13050.00
Project Location: Ashland, MA
Date July 2015
Calculated by: PTM
Checked by: KSS

Discharge Location	Volume (acre-feet.)			
	2-year	10-year	25-year	100-year
DP 1 - Wetland 1				
Existing	1.626	3.061	3.944	5.319
Proposed	2.679	4.808	6.076	8.019
% increase/decrease	*64.76%*	*57.07%*	*54.06%*	*50.76%*
DP 2 - Wetland 2				
Existing	0.671	1.247	1.599	2.146
Proposed	0.888	1.695	2.179	2.925
% increase/decrease	*32.34%*	*35.93%*	*36.27%*	*36.30%*
DP 3 - Wetland 3				
Existing	0.603	1.161	1.506	2.048
Proposed	0.578	1.074	1.377	1.848
% increase/decrease	*-4.15%*	*-7.49%*	*-8.57%*	*-9.77%*
DP 4 - Eliot Street				
Existing	0.219	0.425	0.553	0.753
Proposed	0.085	0.158	0.203	0.273
% increase/decrease	*-61.19%*	*-62.82%*	*-63.29%*	*-63.75%*
DP 5 - Prospect Heights				
Existing	0.098	0.187	0.243	0.329
Proposed	0.098	0.187	0.243	0.329
% increase/decrease	*0.00%*	*0.00%*	*0.00%*	*0.00%*

Water Volume Impact Analysis

Project Name: The Lanterns
Project No: 13050.00
Project Location: Ashland, MA
Date July 2015
Calculated by: PTM

Discharge Location	Volume (acre-feet.)			
	2-year	**10-year**	**25-year**	**100-year**
DP 6 - Offsite Southeast				
Existing	0.492	0.953	1.240	1.690
Proposed	0.295	0.522	0.658	0.869
% increase/decrease	*-40.04%*	*-45.23%*	*-46.94%*	*-48.58%*
DP 7 - Chestnut Street				
Existing	0.691	1.302	1.678	2.264
Proposed	0.263	0.496	0.639	0.862
% increase/decrease	*-61.94%*	*-61.90%*	*-61.92%*	*-61.93%*

Peak Rate Impact Analysis

Peak Rate Attenuation Evaluation

Project Name: The Lanterns
Project Location: Ashland, MA

Project No: 13050.00
Date July 2015
Calculated by: PTM
Checked by: KSS

Discharge Location	**Peak Rate (cfs)**			
	2-year	**10-year**	**25-year**	**100-year**
DP 1 - Wetland 1				
Existing	10.59	20.32	26.23	35.31
Proposed	9.71	16.03	22.18	32.21
% increase/decrease	*-8.31%*	*-21.11%*	*-15.44%*	*-8.78%*
DP 2 - Wetland 2				
Existing	3.94	7.80	10.16	13.80
Proposed	3.94	7.47	9.51	13.69
% increase/decrease	*0.00%*	*-4.23%*	*-6.40%*	*-0.80%*
DP 3 - Wetland 3				
Existing	5.39	10.14	13.01	17.39
Proposed	4.33	8.18	10.49	14.03
% increase/decrease	*-19.67%*	*-19.33%*	*-19.37%*	*-19.32%*
DP 4 - Eliot Street				
Existing	1.62	3.25	4.24	5.78
Proposed	1.09	2.05	2.63	3.51
% increase/decrease	*-32.72%*	*-36.92%*	*-37.97%*	*-39.27%*
DP 5 - Prospect Heights				
Existing	0.99	1.94	2.52	3.41
Proposed	0.99	1.94	2.52	3.41
% increase/decrease	*0.00%*	*0.00%*	*0.00%*	*0.00%*

Peak Rate Attenuation Evaluation

Project Name: The Lanterns **Project No:** 13050.00

Project Location: Ashland, MA **Date** July 2015

Calculated by: PTM

Discharge Location	**Peak Rate (cfs)**			
	2-year	**10-year**	**25-year**	**100-year**
DP 6 - Offsite Southeast				
Existing	3.76	7.51	9.81	13.37
Proposed	2.37	4.28	5.40	7.08
% increase/decrease	*-36.97%*	*-43.01%*	*-44.95%*	*-47.05%*
DP 7 - Chestnut Street				
Existing	3.32	6.41	8.28	11.15
Proposed	2.41	4.64	5.99	8.06
% increase/decrease	*-27.41%*	*-27.61%*	*-27.66%*	*-27.71%*

Recharge Calculations

Recharge Calculations

Project Name: The Lanterns **Proj. No.:** 13050.05
Date: July 2015
Project Location: Ashland, MA **Calculated by:** PTM

Proposed Impervious Surface Summary

Net Proposed Impervious Areas by Hydrologic Soil Group (HSG) in acres

Subcatchment	HSG A	HSG B	HSG C	HSG D	Total Area
PR-11				4.94	4.94
PR-12				0.05	0.05
PR-13				1.58	1.58
PR-14				0.00	0.00
PR-21				2.09	2.09
PR-22				0.03	0.03
PR-23				0.00	0.00
PR-24				0.00	0.00
PR-31				0.03	0.03
PR-32				0.00	0.00
PR-41				0.06	0.06
PR-51				0.03	0.03
PR-61				0.00	0.00
PR-62				0.48	0.48
PR-71				0.11	0.11
PR-72				0.01	0.01
PR-73				0.00	0.00
TOTAL	**0.00**	**0.00**	**0.00**	**9.41**	**9.41**

Required Recharge Volume (Cubic Feet)

HSG	Area (acres)	Recharge Depth* (in.)	Volume (c.f.)
A	0.0	0.60	0
B	0.0	0.35	0
C	0.0	0.25	0
D	9.4	0.10	3,417
TOTAL			**3,417**

Assumptions:

* Massachusetts DEP Infiltration requirement: HSG A = 0.60 in; HSG B = 0.35 in; HSG C = 0.25 in; HSG D = 0.10 in.

Capture Area Adjustment

Required Recharge Volume	3,417	c.f.
Total Site Impervious Area	9.41	acres
Total Site Impervious Area Draining to Recharge Facilities	9.09	acres
Capture Area Adjustment Factor	1.04	-

Adjusted Required Recharge Volume: 3,538 c.f.

Appendix E: Erosion and Sedimentation Control Measures

As part of the Notice of Intent process, an erosion and sedimentation control plan will be developed, and will include measures such as those described below.

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.

Straw Wattles, Compost Berms and Straw Bale Barriers

Straw bale barriers, straw wattles and compost berms will be placed to trap sediment transported by runoff before it reaches the drainage system or leaves the construction site. The bales, wattles and berms will be set at least four inches into the existing ground to minimize undercutting by runoff.

Silt Fencing

In areas where high runoff velocities or high sediment loads are expected, straw 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 straw bale barrier will be replaced as determined by periodic field inspections.

Catch Basin Protection

Newly constructed and existing catch basins will be protected with straw 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 straw bales and straw wattles 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.

The sedimentation and erosion control plan is included in project plan set; a reduced version and Erosion Control Maintenance checklist is included here for quick reference.

Refer to the plans for full proposed erosion and sedimentation control.

Construction Best Management Practices - Maintenance/Evaluation Checklist

The Lantern at Warren Woods, Ashland, 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 ☐yes ☐no (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		
Gravel Construction Entrance	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		
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		
Diversion Channels	Weekly and after ½" storm events or greater			Inspect for proper function. Correct if necessary.	☐yes ☐no		
Temporary Sedimentation Basins	Weekly and after ½" storm events or greater			Inspect for proper function. Correct if necessary.	☐yes ☐no		
Vegetated Slope Stabilization	Weekly and after ½" storm events or greater			Inspect for erosion. Correct if necessary.	☐yes ☐no		

Stormwater Control Manager ____

Appendix F:
Earth Removal/Fill Calculations

Memorandum

To:	Ashland Conservation Commission	Date:	July 9, 2015
		Project #:	13050.00
From:	Wesley Mize, EIT Curtis Quitzau, P.E.	Re:	Earthwork Summary

This memorandum has been prepared to summarize the estimated earthwork cut and fill quantities for the proposed 39-acre, 93 home Senior Residential Community (SRC) development proposal at 466 Chestnut Street in Ashland, Massachusetts. Supporting calculations and figure are attached.

The objective of the site grading is to achieve a balanced site and not export any excess cut material from the project site. Based upon the information and recommendations contained within the Geotechnical Report prepared by Northeast Geotechnical, Inc., soils on the site are generally glacial tills overlain by approximately 6″ to 18″ of topsoil. Construction will require an import of approximately 12,000 cubic yards of gravel because gravel is not expected to be found/generated on the site. Gravel borrow meeting MassDOT material specification M1.03.0 is needed as base material beneath building slabs and pavements. The gravel will be obtained from a local supplier.

The following methods and adjustments were used to estimate rough earthwork quantities:

- Earthwork volumes were calculated using AutoCAD Civil 3D volume surfaces to compare the proposed finish grade surface to an adjusted existing ground surface to account for topsoil stripped and reused.
- Within the limit of work, the existing topsoil (assumed average depth of 8″) is to be stripped and 6″ is to be reused in proposed lawn and planted areas (assumed to be 25% of the total stripped area) located between homes, adjacent to roadways, etc.
- Excess topsoil material will be used on-site in nonstructural fill areas such as in yards and stormwater basin fill slopes.
- 10″ of excavation is required at home slabs with an average footprint size of 2,047 SF.
- 15″ of roadway material was accounted for (1″ bituminous top course, 2″ bituminous binder course and 12″ compacted gravel base course).
- No adjustments made for utilities.

Using the above methods and adjustments, the calculations indicate the site is within 200 cubic yards of a balance, which is within 0.5% of the overall quantity of material being handled and is therefore considered balanced for the methods described above. It is expected that site grades in the last two phases of construction, and around the exterior of stormwater basin #3, may be refined slightly in order to achieve the no export objective.

The attached figure graphically shows cuts and fills throughout the site. Cuts are illustrated in gradations of reds, and fills in gradations of greens.

Computations

Project:	The Laterns at Warren Woods	Project #	13050
Location:	Ashland, MA	Sheet	1/1
Calculated by:	WNM	Date:	7/9/2015
Checked by:	CRQ	Date:	
Title	Earthwork Calculations		

A. Site Grading

Cut Volume	-32900	CY
Fill Volume	48000	CY
	15100	CY (Fill)

B. Homes

Average Home Footprint Size	2047	SF
Excavation of Slabs	-0.83	FT (Cut)
	-1705.83	CF (Cut)
	27	CF/CY
	-63.179	CY (Cut)/Home
	93	Homes
	-5875.65	CY (Cut)

C. Drives

Area	163700	SF
Pavement and Subbase Depth	-1.25	FT
	-204625	CF (Cut)
	27	CF/CY
	-7578.70	CY (Cut)

D. Excess Topsoil

Stripped Topsoil Area	933400	SF
Approximate Proposed Topsoil Areas	25%	
	233350	SF
Depth of Unused Topsoil	-0.17	FT
	-38891.7	CF
	27	CF/CY
	-1440.43	CY (Cut)

E. Summary

Net Volume (A+B+C+D)	205.22	CY (Fill)
Say	**200**	**CY (Fill)**

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Elevations Table			
Number	**Minimum Elevation**	**Maximum Elevation**	**Color**
1	-9.000	-6.000	
2	-6.000	-3.000	
3	-3.000	0.000	
4	0.000	3.000	
5	3.000	6.000	
6	6.000	9.000	
7	9.000	12.000	

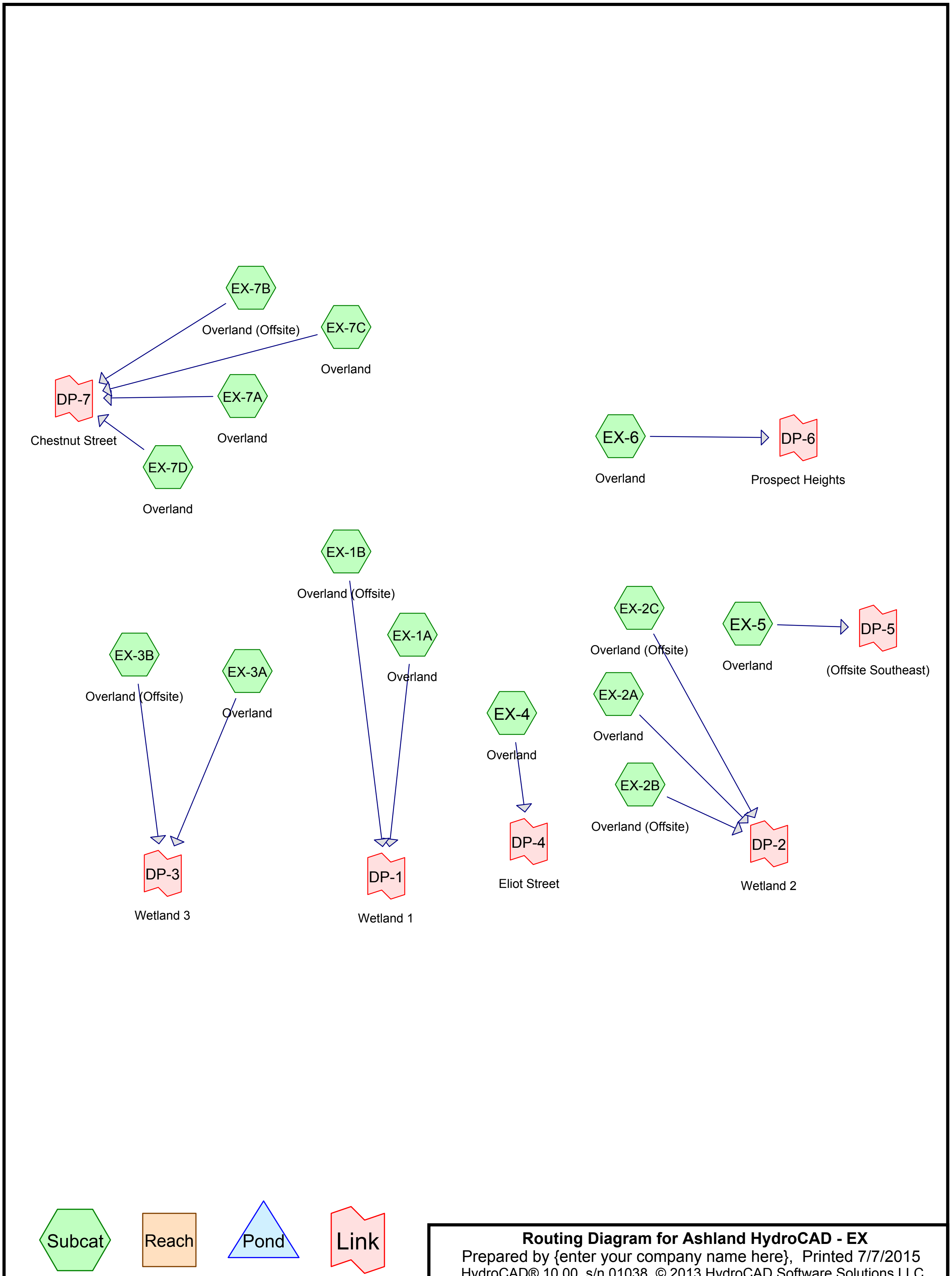
Vanasse Hangen Brustlin, Inc.

Figure 1 July 2015

Preliminary Earthwork Volume
The Lanterns at Warren Woods
466 Chestnut Street
Ashland, Massachusetts

Appendix G:
Hydrologic Analysis

HydroCAD Analysis: Existing Conditions



Routing Diagram for Ashland HydroCAD - EX
Prepared by {enter your company name here}, Printed 7/7/2015
HydroCAD® 10.00 s/n 01038 © 2013 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
9.878	80	>75% Grass cover, Good, HSG D (EX-1A, EX-2A, EX-2B, EX-2C, EX-3A, EX-3B, EX-4, EX-5, EX-6, EX-7A, EX-7B)
0.259	73	Brush, Good, HSG D (EX-1A, EX-3A, EX-4)
0.153	89	Dirt roads, HSG D (EX-1A, EX-5)
0.047	96	Gravel surface, HSG D (EX-1A, EX-7A)
0.748	98	Paved parking, HSG D (EX-1A, EX-7A, EX-7B)
0.298	98	Unconnected pavement, HSG D (EX-1A, EX-2B, EX-3A, EX-7A)
0.073	98	Unconnected roofs, HSG D (EX-1A, EX-2B, EX-2C, EX-3A, EX-5)
0.183	80	Wetland (Grass, HSG D) (EX-3A)
2.391	77	Wetlands (Woods, Good, HSG D) (EX-1A, EX-2A)
26.507	77	Woods, Good, HSG D (EX-1A, EX-1B, EX-2A, EX-2B, EX-2C, EX-3A, EX-3B, EX-4, EX-5, EX-6, EX-7A, EX-7B, EX-7C, EX-7D)
40.535	**78**	**TOTAL AREA**

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentEX-1A: Overland Runoff Area=700,254 sf 3.74% Impervious Runoff Depth=1.26"
Flow Length=1,047' Tc=46.6 min CN=79 Runoff=10.58 cfs 1.691 af

SubcatchmentEX-1B: Overland (Offsite) Runoff Area=1,506 sf 0.00% Impervious Runoff Depth=1.14"
Flow Length=87' Slope=0.0520 '/' Tc=15.4 min CN=77 Runoff=0.03 cfs 0.003 af

SubcatchmentEX-2A: Overland Runoff Area=219,089 sf 0.00% Impervious Runoff Depth=1.14"
Flow Length=1,156' Tc=37.1 min CN=77 Runoff=3.32 cfs 0.478 af

SubcatchmentEX-2B: Overland (Offsite) Runoff Area=25,532 sf 5.37% Impervious Runoff Depth=1.26"
Flow Length=348' Tc=20.1 min UI Adjusted CN=79 Runoff=0.57 cfs 0.062 af

SubcatchmentEX-2C: Overland (Offsite) Runoff Area=22,499 sf 0.88% Impervious Runoff Depth=1.33"
Flow Length=455' Tc=7.7 min CN=80 Runoff=0.75 cfs 0.057 af

SubcatchmentEX-3A: Overland Runoff Area=262,200 sf 3.68% Impervious Runoff Depth=1.33"
Flow Length=1,029' Tc=28.3 min CN=80 Runoff=5.35 cfs 0.665 af

SubcatchmentEX-3B: Overland (Offsite) Runoff Area=2,738 sf 0.00% Impervious Runoff Depth=1.26"
Flow Length=85' Tc=10.5 min CN=79 Runoff=0.08 cfs 0.007 af

SubcatchmentEX-4: Overland Runoff Area=100,432 sf 0.00% Impervious Runoff Depth=1.14"
Flow Length=938' Tc=32.5 min CN=77 Runoff=1.62 cfs 0.219 af

SubcatchmentEX-5: Overland Runoff Area=42,742 sf 0.32% Impervious Runoff Depth=1.20"
Flow Length=335' Tc=16.1 min CN=78 Runoff=0.99 cfs 0.098 af

SubcatchmentEX-6: Overland Runoff Area=228,216 sf 0.00% Impervious Runoff Depth=1.14"
Flow Length=627' Tc=31.1 min CN=77 Runoff=3.76 cfs 0.498 af

SubcatchmentEX-7A: Overland Runoff Area=139,122 sf 7.62% Impervious Runoff Depth=1.26"
Flow Length=591' Tc=23.8 min CN=79 Runoff=2.90 cfs 0.336 af

SubcatchmentEX-7B: Overland (Offsite) Runoff Area=16,179 sf 3.75% Impervious Runoff Depth=1.20"
Flow Length=489' Tc=19.8 min CN=78 Runoff=0.34 cfs 0.037 af

SubcatchmentEX-7C: Overland Runoff Area=3,572 sf 0.00% Impervious Runoff Depth=1.14"
Flow Length=100' Slope=0.0350 '/' Tc=18.3 min CN=77 Runoff=0.07 cfs 0.008 af

SubcatchmentEX-7D: Overland Runoff Area=1,620 sf 0.00% Impervious Runoff Depth=1.14"
Flow Length=25' Slope=0.0120 '/' Tc=15.4 min CN=77 Runoff=0.04 cfs 0.004 af

Link DP-1: Wetland 1 Inflow=10.59 cfs 1.694 af
Primary=10.59 cfs 1.694 af

Link DP-2: Wetland 2 Inflow=3.94 cfs 0.597 af
Primary=3.94 cfs 0.597 af

Link DP-3: Wetland 3	Inflow=5.39 cfs 0.671 af Primary=5.39 cfs 0.671 af
Link DP-4: Eliot Street	Inflow=1.62 cfs 0.219 af Primary=1.62 cfs 0.219 af
Link DP-5: (Offsite Southeast)	Inflow=0.99 cfs 0.098 af Primary=0.99 cfs 0.098 af
Link DP-6: Prospect Heights	Inflow=3.76 cfs 0.498 af Primary=3.76 cfs 0.498 af
Link DP-7: Chestnut Street	Inflow=3.32 cfs 0.384 af Primary=3.32 cfs 0.384 af

Total Runoff Area = 40.535 ac Runoff Volume = 4.162 af Average Runoff Depth = 1.23"
97.24% Pervious = 39.416 ac 2.76% Impervious = 1.119 ac

Summary for Subcatchment EX-1A: Overland

Runoff = 10.58 cfs @ 12.68 hrs, Volume= 1.691 af, Depth= 1.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

	Area (sf)	CN	Description
	632	98	Unconnected roofs, HSG D
	5,471	89	Dirt roads, HSG D
	1,653	96	Gravel surface, HSG D
	22,224	98	Paved parking, HSG D
	3,317	98	Unconnected pavement, HSG D
*	77,096	77	Wetlands (Woods, Good, HSG D)
	3,442	73	Brush, Good, HSG D
	153,369	80	>75% Grass cover, Good, HSG D
	433,050	77	Woods, Good, HSG D
	700,254	79	Weighted Average
	674,081		96.26% Pervious Area
	26,173		3.74% Impervious Area
	3,949		15.09% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.9	50	0.0160	0.03		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
7.4	172	0.0060	0.39		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
3.9	110	0.0090	0.47		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.1	70	0.0430	1.04		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.7	65	0.0160	0.63		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
8.6	580	0.0500	1.12		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
46.6	1,047	Total			

Summary for Subcatchment EX-1B: Overland (Offsite)

Runoff = 0.03 cfs @ 12.23 hrs, Volume= 0.003 af, Depth= 1.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
1,506	77	Woods, Good, HSG D
1,506		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	50	0.0520	0.06		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.5	37	0.0520	1.14		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
15.4	87	Total			

Summary for Subcatchment EX-2A: Overland

Runoff = 3.32 cfs @ 12.56 hrs, Volume= 0.478 af, Depth= 1.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

	Area (sf)	CN	Description
*	27,039	77	Wetlands (Woods, Good, HSG D)
	4,000	80	>75% Grass cover, Good, HSG D
	188,050	77	Woods, Good, HSG D
	219,089	77	Weighted Average
	219,089		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.9	50	0.0330	0.05		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.6	66	0.1200	1.73		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
2.5	120	0.0250	0.79		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
5.3	353	0.0500	1.12		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
2.1	185	0.0880	1.48		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.8	55	0.0500	1.12		**Shallow Concentrated Flow, Wetland** Woodland Kv= 5.0 fps
0.3	30	0.1333	1.83		**Shallow Concentrated Flow, Wetland** Woodland Kv= 5.0 fps
0.5	44	0.0800	1.41		**Shallow Concentrated Flow, Wetland** Woodland Kv= 5.0 fps
7.1	253	0.0140	0.59		**Shallow Concentrated Flow, Wetlands** Woodland Kv= 5.0 fps
37.1	1,156	Total			

Summary for Subcatchment EX-2B: Overland (Offsite)

Runoff = 0.57 cfs @ 12.29 hrs, Volume= 0.062 af, Depth= 1.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Adj	Description
1,040	98		Unconnected roofs, HSG D
331	98		Unconnected pavement, HSG D
12,989	80		>75% Grass cover, Good, HSG D
11,172	77		Woods, Good, HSG D
25,532	80	79	Weighted Average, UI Adjusted
24,161			94.63% Pervious Area
1,371			5.37% Impervious Area
1,371			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.5	50	0.0400	0.05		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.2	19	0.1000	1.58		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.6	135	0.0430	1.45		**Shallow Concentrated Flow, Woods** Short Grass Pasture Kv= 7.0 fps
0.4	59	0.1520	2.73		**Shallow Concentrated Flow, Woods** Short Grass Pasture Kv= 7.0 fps
1.4	85	0.0410	1.01		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
20.1	348	Total			

Summary for Subcatchment EX-2C: Overland (Offsite)

Runoff = 0.75 cfs @ 12.11 hrs, Volume= 0.057 af, Depth= 1.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
198	98	Unconnected roofs, HSG D
21,719	80	>75% Grass cover, Good, HSG D
582	77	Woods, Good, HSG D
22,499	80	Weighted Average
22,301		99.12% Pervious Area
198		0.88% Impervious Area
198		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	50	0.0600	0.23		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
4.0	405	0.0580	1.69		**Shallow Concentrated Flow, Woods** Short Grass Pasture Kv= 7.0 fps
7.7	455	Total			

Summary for Subcatchment EX-3A: Overland

Runoff = 5.35 cfs @ 12.42 hrs, Volume= 0.665 af, Depth= 1.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

	Area (sf)	CN	Description
	1,180	98	Unconnected roofs, HSG D
	8,460	98	Unconnected pavement, HSG D
*	7,956	80	Wetland (Grass, HSG D)
	3,132	73	Brush, Good, HSG D
	212,160	80	>75% Grass cover, Good, HSG D
	29,312	77	Woods, Good, HSG D
	262,200	80	Weighted Average
	252,560		96.32% Pervious Area
	9,640		3.68% Impervious Area
	9,640		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.2	38	0.0150	0.12		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
2.5	12	0.0090	0.08		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
2.4	97	0.0090	0.66		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
0.1	16	0.0090	1.93		**Shallow Concentrated Flow, Pavement** Paved Kv= 20.3 fps
0.5	106	0.0340	3.74		**Shallow Concentrated Flow, Pavement** Paved Kv= 20.3 fps
0.2	20	0.0500	1.57		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
2.1	92	0.0220	0.74		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.3	24	0.0910	1.51		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.8	100	0.1000	2.21		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
0.5	47	0.0420	1.43		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
1.3	83	0.0240	1.08		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
8.4	224	0.0040	0.44		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
1.5	65	0.0100	0.70		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
2.5	105	0.0100	0.70		**Shallow Concentrated Flow, Wetland** Short Grass Pasture Kv= 7.0 fps
28.3	1,029	Total			

Summary for Subcatchment EX-3B: Overland (Offsite)

Runoff = 0.08 cfs @ 12.15 hrs, Volume= 0.007 af, Depth= 1.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
1,717	80	>75% Grass cover, Good, HSG D
1,021	77	Woods, Good, HSG D
2,738	79	Weighted Average
2,738		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	48	0.1300	0.08		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.2	2	0.1300	0.16		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
0.3	35	0.1050	2.27		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
10.5	85	Total			

Summary for Subcatchment EX-4: Overland

Runoff = 1.62 cfs @ 12.47 hrs, Volume= 0.219 af, Depth= 1.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
4,690	73	Brush, Good, HSG D
2,570	80	>75% Grass cover, Good, HSG D
93,172	77	Woods, Good, HSG D
100,432	77	Weighted Average
100,432		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.6	50	0.0300	0.04		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.6	66	0.1200	1.73		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
7.7	515	0.0500	1.12		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
5.6	307	0.0330	0.91		**Shallow Concentrated Flow, Wetland** Woodland Kv= 5.0 fps
32.5	938	Total			

Summary for Subcatchment EX-5: Overland

Runoff = 0.99 cfs @ 12.23 hrs, Volume= 0.098 af, Depth= 1.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
136	98	Unconnected roofs, HSG D
1,200	89	Dirt roads, HSG D
4,534	80	>75% Grass cover, Good, HSG D
36,872	77	Woods, Good, HSG D
42,742	78	Weighted Average
42,606		99.68% Pervious Area
136		0.32% Impervious Area
136		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	10	0.0350	0.13		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
8.9	40	0.1200	0.07		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.6	66	0.1200	1.73		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
4.7	180	0.0160	0.63		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.6	39	0.0460	1.07		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
16.1	335	Total			

Summary for Subcatchment EX-6: Overland

Runoff = 3.76 cfs @ 12.47 hrs, Volume= 0.498 af, Depth= 1.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
766	80	>75% Grass cover, Good, HSG D
227,450	77	Woods, Good, HSG D
228,216	77	Weighted Average
228,216		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.1	50	0.0280	0.04		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
1.9	98	0.0300	0.87		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
3.3	206	0.0440	1.05		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
6.8	273	0.0180	0.67		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
31.1	627	Total			

Summary for Subcatchment EX-7A: Overland

Runoff = 2.90 cfs @ 12.35 hrs, Volume= 0.336 af, Depth= 1.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
384	96	Gravel surface, HSG D
9,749	98	Paved parking, HSG D
854	98	Unconnected pavement, HSG D
13,258	80	>75% Grass cover, Good, HSG D
114,877	77	Woods, Good, HSG D
139,122	79	Weighted Average
128,519		92.38% Pervious Area
10,603		7.62% Impervious Area
854		8.05% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.2	50	0.0700	0.06		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
1.6	110	0.0540	1.16		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
2.9	138	0.0250	0.79		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
3.3	124	0.0160	0.63		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.1	14	0.1430	1.89		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.8	40	0.0250	0.79		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.7	67	0.1040	1.61		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.2	48	0.0180	0.67		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
23.8	591	Total			

Summary for Subcatchment EX-7B: Overland (Offsite)

Runoff = 0.34 cfs @ 12.29 hrs, Volume= 0.037 af, Depth= 1.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
606	98	Paved parking, HSG D
3,197	80	>75% Grass cover, Good, HSG D
12,376	77	Woods, Good, HSG D
16,179	78	Weighted Average
15,573		96.25% Pervious Area
606		3.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.1	50	0.0600	0.06		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.7	55	0.0700	1.32		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.6	71	0.0700	1.85		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
1.6	125	0.0640	1.26		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.5	23	0.0100	0.70		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
0.3	40	0.0150	2.49		**Shallow Concentrated Flow, Pavement** Paved Kv= 20.3 fps
0.3	23	0.0330	1.27		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
1.7	102	0.0400	1.00		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
19.8	489	Total			

Summary for Subcatchment EX-7C: Overland

Runoff = 0.07 cfs @ 12.26 hrs, Volume= 0.008 af, Depth= 1.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
3,572	77	Woods, Good, HSG D
3,572		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.4	50	0.0350	0.05		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.9	50	0.0350	0.94		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
18.3	100	Total			

Summary for Subcatchment EX-7D: Overland

Runoff = 0.04 cfs @ 12.23 hrs, Volume= 0.004 af, Depth= 1.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
1,620	77	Woods, Good, HSG D
1,620		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.4	25	0.0120	0.03		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"

Summary for Link DP-1: Wetland 1

Inflow Area = 16.110 ac, 3.73% Impervious, Inflow Depth = 1.26" for 2-Year event
Inflow = 10.59 cfs @ 12.68 hrs, Volume= 1.694 af
Primary = 10.59 cfs @ 12.68 hrs, Volume= 1.694 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Link DP-2: Wetland 2

Inflow Area = 6.132 ac, 0.59% Impervious, Inflow Depth = 1.17" for 2-Year event
Inflow = 3.94 cfs @ 12.49 hrs, Volume= 0.597 af
Primary = 3.94 cfs @ 12.49 hrs, Volume= 0.597 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Link DP-3: Wetland 3

Inflow Area = 6.082 ac, 3.64% Impervious, Inflow Depth = 1.32" for 2-Year event
Inflow = 5.39 cfs @ 12.42 hrs, Volume= 0.671 af
Primary = 5.39 cfs @ 12.42 hrs, Volume= 0.671 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Link DP-4: Eliot Street

Inflow Area =	2.306 ac,	0.00% Impervious,	Inflow Depth =	1.14"	for 2-Year event	
Inflow =	1.62 cfs @	12.47 hrs,	Volume=	0.219 af		
Primary =	1.62 cfs @	12.47 hrs,	Volume=	0.219 af,	Atten= 0%,	Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Link DP-5: (Offsite Southeast)

Inflow Area =	0.981 ac,	0.32% Impervious,	Inflow Depth =	1.20"	for 2-Year event	
Inflow =	0.99 cfs @	12.23 hrs,	Volume=	0.098 af		
Primary =	0.99 cfs @	12.23 hrs,	Volume=	0.098 af,	Atten= 0%,	Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Link DP-6: Prospect Heights

Inflow Area =	5.239 ac,	0.00% Impervious,	Inflow Depth =	1.14"	for 2-Year event	
Inflow =	3.76 cfs @	12.47 hrs,	Volume=	0.498 af		
Primary =	3.76 cfs @	12.47 hrs,	Volume=	0.498 af,	Atten= 0%,	Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Link DP-7: Chestnut Street

Inflow Area =	3.684 ac,	6.98% Impervious,	Inflow Depth =	1.25"	for 2-Year event	
Inflow =	3.32 cfs @	12.34 hrs,	Volume=	0.384 af		
Primary =	3.32 cfs @	12.34 hrs,	Volume=	0.384 af,	Atten= 0%,	Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentEX-1A: Overland Runoff Area=700,254 sf 3.74% Impervious Runoff Depth=2.38"
Flow Length=1,047' Tc=46.6 min CN=79 Runoff=20.30 cfs 3.184 af

SubcatchmentEX-1B: Overland (Offsite) Runoff Area=1,506 sf 0.00% Impervious Runoff Depth=2.21"
Flow Length=87' Slope=0.0520 '/' Tc=15.4 min CN=77 Runoff=0.07 cfs 0.006 af

SubcatchmentEX-2A: Overland Runoff Area=219,089 sf 0.00% Impervious Runoff Depth=2.21"
Flow Length=1,156' Tc=37.1 min CN=77 Runoff=6.63 cfs 0.927 af

SubcatchmentEX-2B: Overland (Offsite) Runoff Area=25,532 sf 5.37% Impervious Runoff Depth=2.38"
Flow Length=348' Tc=20.1 min UI Adjusted CN=79 Runoff=1.10 cfs 0.116 af

SubcatchmentEX-2C: Overland (Offsite) Runoff Area=22,499 sf 0.88% Impervious Runoff Depth=2.46"
Flow Length=455' Tc=7.7 min CN=80 Runoff=1.41 cfs 0.106 af

SubcatchmentEX-3A: Overland Runoff Area=262,200 sf 3.68% Impervious Runoff Depth=2.46"
Flow Length=1,029' Tc=28.3 min CN=80 Runoff=10.07 cfs 1.235 af

SubcatchmentEX-3B: Overland (Offsite) Runoff Area=2,738 sf 0.00% Impervious Runoff Depth=2.38"
Flow Length=85' Tc=10.5 min CN=79 Runoff=0.15 cfs 0.012 af

SubcatchmentEX-4: Overland Runoff Area=100,432 sf 0.00% Impervious Runoff Depth=2.21"
Flow Length=938' Tc=32.5 min CN=77 Runoff=3.25 cfs 0.425 af

SubcatchmentEX-5: Overland Runoff Area=42,742 sf 0.32% Impervious Runoff Depth=2.29"
Flow Length=335' Tc=16.1 min CN=78 Runoff=1.94 cfs 0.187 af

SubcatchmentEX-6: Overland Runoff Area=228,216 sf 0.00% Impervious Runoff Depth=2.21"
Flow Length=627' Tc=31.1 min CN=77 Runoff=7.51 cfs 0.965 af

SubcatchmentEX-7A: Overland Runoff Area=139,122 sf 7.62% Impervious Runoff Depth=2.38"
Flow Length=591' Tc=23.8 min CN=79 Runoff=5.56 cfs 0.632 af

SubcatchmentEX-7B: Overland (Offsite) Runoff Area=16,179 sf 3.75% Impervious Runoff Depth=2.29"
Flow Length=489' Tc=19.8 min CN=78 Runoff=0.67 cfs 0.071 af

SubcatchmentEX-7C: Overland Runoff Area=3,572 sf 0.00% Impervious Runoff Depth=2.21"
Flow Length=100' Slope=0.0350 '/' Tc=18.3 min CN=77 Runoff=0.15 cfs 0.015 af

SubcatchmentEX-7D: Overland Runoff Area=1,620 sf 0.00% Impervious Runoff Depth=2.21"
Flow Length=25' Slope=0.0120 '/' Tc=15.4 min CN=77 Runoff=0.07 cfs 0.007 af

Link DP-1: Wetland 1 Inflow=20.32 cfs 3.190 af
Primary=20.32 cfs 3.190 af

Link DP-2: Wetland 2 Inflow=7.80 cfs 1.149 af
Primary=7.80 cfs 1.149 af

Link DP-3: Wetland 3	Inflow=10.14 cfs 1.247 af Primary=10.14 cfs 1.247 af
Link DP-4: Eliot Street	Inflow=3.25 cfs 0.425 af Primary=3.25 cfs 0.425 af
Link DP-5: (Offsite Southeast)	Inflow=1.94 cfs 0.187 af Primary=1.94 cfs 0.187 af
Link DP-6: Prospect Heights	Inflow=7.51 cfs 0.965 af Primary=7.51 cfs 0.965 af
Link DP-7: Chestnut Street	Inflow=6.41 cfs 0.725 af Primary=6.41 cfs 0.725 af

Total Runoff Area = 40.535 ac Runoff Volume = 7.888 af Average Runoff Depth = 2.34"
97.24% Pervious = 39.416 ac 2.76% Impervious = 1.119 ac

Summary for Subcatchment EX-1A: Overland

Runoff = 20.30 cfs @ 12.64 hrs, Volume= 3.184 af, Depth= 2.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

	Area (sf)	CN	Description
	632	98	Unconnected roofs, HSG D
	5,471	89	Dirt roads, HSG D
	1,653	96	Gravel surface, HSG D
	22,224	98	Paved parking, HSG D
	3,317	98	Unconnected pavement, HSG D
*	77,096	77	Wetlands (Woods, Good, HSG D)
	3,442	73	Brush, Good, HSG D
	153,369	80	>75% Grass cover, Good, HSG D
	433,050	77	Woods, Good, HSG D
	700,254	79	Weighted Average
	674,081		96.26% Pervious Area
	26,173		3.74% Impervious Area
	3,949		15.09% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.9	50	0.0160	0.03		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
7.4	172	0.0060	0.39		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
3.9	110	0.0090	0.47		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.1	70	0.0430	1.04		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.7	65	0.0160	0.63		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
8.6	580	0.0500	1.12		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
46.6	1,047	Total			

Summary for Subcatchment EX-1B: Overland (Offsite)

Runoff = 0.07 cfs @ 12.21 hrs, Volume= 0.006 af, Depth= 2.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
1,506	77	Woods, Good, HSG D
1,506		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	50	0.0520	0.06		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.5	37	0.0520	1.14		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
15.4	87	Total			

Summary for Subcatchment EX-2A: Overland

Runoff = 6.63 cfs @ 12.53 hrs, Volume= 0.927 af, Depth= 2.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

	Area (sf)	CN	Description
*	27,039	77	Wetlands (Woods, Good, HSG D)
	4,000	80	>75% Grass cover, Good, HSG D
	188,050	77	Woods, Good, HSG D
	219,089	77	Weighted Average
	219,089		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.9	50	0.0330	0.05		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.6	66	0.1200	1.73		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
2.5	120	0.0250	0.79		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
5.3	353	0.0500	1.12		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
2.1	185	0.0880	1.48		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.8	55	0.0500	1.12		**Shallow Concentrated Flow, Wetland** Woodland Kv= 5.0 fps
0.3	30	0.1333	1.83		**Shallow Concentrated Flow, Wetland** Woodland Kv= 5.0 fps
0.5	44	0.0800	1.41		**Shallow Concentrated Flow, Wetland** Woodland Kv= 5.0 fps
7.1	253	0.0140	0.59		**Shallow Concentrated Flow, Wetlands** Woodland Kv= 5.0 fps
37.1	1,156	Total			

Summary for Subcatchment EX-2B: Overland (Offsite)

Runoff = 1.10 cfs @ 12.28 hrs, Volume= 0.116 af, Depth= 2.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Adj	Description
1,040	98		Unconnected roofs, HSG D
331	98		Unconnected pavement, HSG D
12,989	80		>75% Grass cover, Good, HSG D
11,172	77		Woods, Good, HSG D
25,532	80	79	Weighted Average, UI Adjusted
24,161			94.63% Pervious Area
1,371			5.37% Impervious Area
1,371			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.5	50	0.0400	0.05		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.2	19	0.1000	1.58		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.6	135	0.0430	1.45		**Shallow Concentrated Flow, Woods** Short Grass Pasture Kv= 7.0 fps
0.4	59	0.1520	2.73		**Shallow Concentrated Flow, Woods** Short Grass Pasture Kv= 7.0 fps
1.4	85	0.0410	1.01		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
20.1	348	Total			

Summary for Subcatchment EX-2C: Overland (Offsite)

Runoff = 1.41 cfs @ 12.11 hrs, Volume= 0.106 af, Depth= 2.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
198	98	Unconnected roofs, HSG D
21,719	80	>75% Grass cover, Good, HSG D
582	77	Woods, Good, HSG D
22,499	80	Weighted Average
22,301		99.12% Pervious Area
198		0.88% Impervious Area
198		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	50	0.0600	0.23		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
4.0	405	0.0580	1.69		**Shallow Concentrated Flow, Woods** Short Grass Pasture Kv= 7.0 fps
7.7	455	Total			

Summary for Subcatchment EX-3A: Overland

Runoff = 10.07 cfs @ 12.39 hrs, Volume= 1.235 af, Depth= 2.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

	Area (sf)	CN	Description
	1,180	98	Unconnected roofs, HSG D
	8,460	98	Unconnected pavement, HSG D
*	7,956	80	Wetland (Grass, HSG D)
	3,132	73	Brush, Good, HSG D
	212,160	80	>75% Grass cover, Good, HSG D
	29,312	77	Woods, Good, HSG D
	262,200	80	Weighted Average
	252,560		96.32% Pervious Area
	9,640		3.68% Impervious Area
	9,640		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.2	38	0.0150	0.12		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
2.5	12	0.0090	0.08		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
2.4	97	0.0090	0.66		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
0.1	16	0.0090	1.93		**Shallow Concentrated Flow, Pavement** Paved Kv= 20.3 fps
0.5	106	0.0340	3.74		**Shallow Concentrated Flow, Pavement** Paved Kv= 20.3 fps
0.2	20	0.0500	1.57		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
2.1	92	0.0220	0.74		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.3	24	0.0910	1.51		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.8	100	0.1000	2.21		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
0.5	47	0.0420	1.43		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
1.3	83	0.0240	1.08		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
8.4	224	0.0040	0.44		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
1.5	65	0.0100	0.70		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
2.5	105	0.0100	0.70		**Shallow Concentrated Flow, Wetland** Short Grass Pasture Kv= 7.0 fps
28.3	1,029	Total			

Summary for Subcatchment EX-3B: Overland (Offsite)

Runoff = 0.15 cfs @ 12.15 hrs, Volume= 0.012 af, Depth= 2.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
1,717	80	>75% Grass cover, Good, HSG D
1,021	77	Woods, Good, HSG D
2,738	79	Weighted Average
2,738		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	48	0.1300	0.08		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.2	2	0.1300	0.16		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
0.3	35	0.1050	2.27		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
10.5	85	Total			

Summary for Subcatchment EX-4: Overland

Runoff = 3.25 cfs @ 12.46 hrs, Volume= 0.425 af, Depth= 2.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
4,690	73	Brush, Good, HSG D
2,570	80	>75% Grass cover, Good, HSG D
93,172	77	Woods, Good, HSG D
100,432	77	Weighted Average
100,432		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.6	50	0.0300	0.04		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.6	66	0.1200	1.73		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
7.7	515	0.0500	1.12		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
5.6	307	0.0330	0.91		**Shallow Concentrated Flow, Wetland** Woodland Kv= 5.0 fps
32.5	938	Total			

Summary for Subcatchment EX-5: Overland

Runoff = 1.94 cfs @ 12.22 hrs, Volume= 0.187 af, Depth= 2.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
136	98	Unconnected roofs, HSG D
1,200	89	Dirt roads, HSG D
4,534	80	>75% Grass cover, Good, HSG D
36,872	77	Woods, Good, HSG D
42,742	78	Weighted Average
42,606		99.68% Pervious Area
136		0.32% Impervious Area
136		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	10	0.0350	0.13		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
8.9	40	0.1200	0.07		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.6	66	0.1200	1.73		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
4.7	180	0.0160	0.63		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.6	39	0.0460	1.07		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
16.1	335	Total			

Summary for Subcatchment EX-6: Overland

Runoff = 7.51 cfs @ 12.44 hrs, Volume= 0.965 af, Depth= 2.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
766	80	>75% Grass cover, Good, HSG D
227,450	77	Woods, Good, HSG D
228,216	77	Weighted Average
228,216		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.1	50	0.0280	0.04		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
1.9	98	0.0300	0.87		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
3.3	206	0.0440	1.05		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
6.8	273	0.0180	0.67		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
31.1	627	Total			

Summary for Subcatchment EX-7A: Overland

Runoff = 5.56 cfs @ 12.34 hrs, Volume= 0.632 af, Depth= 2.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
384	96	Gravel surface, HSG D
9,749	98	Paved parking, HSG D
854	98	Unconnected pavement, HSG D
13,258	80	>75% Grass cover, Good, HSG D
114,877	77	Woods, Good, HSG D
139,122	79	Weighted Average
128,519		92.38% Pervious Area
10,603		7.62% Impervious Area
854		8.05% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.2	50	0.0700	0.06		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
1.6	110	0.0540	1.16		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
2.9	138	0.0250	0.79		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
3.3	124	0.0160	0.63		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.1	14	0.1430	1.89		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.8	40	0.0250	0.79		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.7	67	0.1040	1.61		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.2	48	0.0180	0.67		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
23.8	591	Total			

Summary for Subcatchment EX-7B: Overland (Offsite)

Runoff = 0.67 cfs @ 12.28 hrs, Volume= 0.071 af, Depth= 2.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
606	98	Paved parking, HSG D
3,197	80	>75% Grass cover, Good, HSG D
12,376	77	Woods, Good, HSG D
16,179	78	Weighted Average
15,573		96.25% Pervious Area
606		3.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.1	50	0.0600	0.06		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.7	55	0.0700	1.32		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.6	71	0.0700	1.85		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
1.6	125	0.0640	1.26		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.5	23	0.0100	0.70		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
0.3	40	0.0150	2.49		**Shallow Concentrated Flow, Pavement** Paved Kv= 20.3 fps
0.3	23	0.0330	1.27		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
1.7	102	0.0400	1.00		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
19.8	489	Total			

Summary for Subcatchment EX-7C: Overland

Runoff = 0.15 cfs @ 12.26 hrs, Volume= 0.015 af, Depth= 2.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
3,572	77	Woods, Good, HSG D
3,572		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.4	50	0.0350	0.05		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.9	50	0.0350	0.94		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
18.3	100	Total			

Summary for Subcatchment EX-7D: Overland

Runoff = 0.07 cfs @ 12.21 hrs, Volume= 0.007 af, Depth= 2.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
1,620	77	Woods, Good, HSG D
1,620		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.4	25	0.0120	0.03		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"

Summary for Link DP-1: Wetland 1

Inflow Area = 16.110 ac, 3.73% Impervious, Inflow Depth = 2.38" for 10-Year event
Inflow = 20.32 cfs @ 12.64 hrs, Volume= 3.190 af
Primary = 20.32 cfs @ 12.64 hrs, Volume= 3.190 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Link DP-2: Wetland 2

Inflow Area = 6.132 ac, 0.59% Impervious, Inflow Depth = 2.25" for 10-Year event
Inflow = 7.80 cfs @ 12.49 hrs, Volume= 1.149 af
Primary = 7.80 cfs @ 12.49 hrs, Volume= 1.149 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Link DP-3: Wetland 3

Inflow Area = 6.082 ac, 3.64% Impervious, Inflow Depth = 2.46" for 10-Year event
Inflow = 10.14 cfs @ 12.39 hrs, Volume= 1.247 af
Primary = 10.14 cfs @ 12.39 hrs, Volume= 1.247 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Link DP-4: Eliot Street

Inflow Area = 2.306 ac, 0.00% Impervious, Inflow Depth = 2.21" for 10-Year event
Inflow = 3.25 cfs @ 12.46 hrs, Volume= 0.425 af
Primary = 3.25 cfs @ 12.46 hrs, Volume= 0.425 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Link DP-5: (Offsite Southeast)

Inflow Area = 0.981 ac, 0.32% Impervious, Inflow Depth = 2.29" for 10-Year event
Inflow = 1.94 cfs @ 12.22 hrs, Volume= 0.187 af
Primary = 1.94 cfs @ 12.22 hrs, Volume= 0.187 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Link DP-6: Prospect Heights

Inflow Area = 5.239 ac, 0.00% Impervious, Inflow Depth = 2.21" for 10-Year event
Inflow = 7.51 cfs @ 12.44 hrs, Volume= 0.965 af
Primary = 7.51 cfs @ 12.44 hrs, Volume= 0.965 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Link DP-7: Chestnut Street

Inflow Area = 3.684 ac, 6.98% Impervious, Inflow Depth = 2.36" for 10-Year event
Inflow = 6.41 cfs @ 12.32 hrs, Volume= 0.725 af
Primary = 6.41 cfs @ 12.32 hrs, Volume= 0.725 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentEX-1A: Overland Runoff Area=700,254 sf 3.74% Impervious Runoff Depth=3.06"
Flow Length=1,047' Tc=46.6 min CN=79 Runoff=26.20 cfs 4.101 af

SubcatchmentEX-1B: Overland (Offsite) Runoff Area=1,506 sf 0.00% Impervious Runoff Depth=2.88"
Flow Length=87' Slope=0.0520 '/' Tc=15.4 min CN=77 Runoff=0.09 cfs 0.008 af

SubcatchmentEX-2A: Overland Runoff Area=219,089 sf 0.00% Impervious Runoff Depth=2.88"
Flow Length=1,156' Tc=37.1 min CN=77 Runoff=8.66 cfs 1.205 af

SubcatchmentEX-2B: Overland (Offsite) Runoff Area=25,532 sf 5.37% Impervious Runoff Depth=3.06"
Flow Length=348' Tc=20.1 min UI Adjusted CN=79 Runoff=1.41 cfs 0.150 af

SubcatchmentEX-2C: Overland (Offsite) Runoff Area=22,499 sf 0.88% Impervious Runoff Depth=3.16"
Flow Length=455' Tc=7.7 min CN=80 Runoff=1.80 cfs 0.136 af

SubcatchmentEX-3A: Overland Runoff Area=262,200 sf 3.68% Impervious Runoff Depth=3.16"
Flow Length=1,029' Tc=28.3 min CN=80 Runoff=12.91 cfs 1.583 af

SubcatchmentEX-3B: Overland (Offsite) Runoff Area=2,738 sf 0.00% Impervious Runoff Depth=3.06"
Flow Length=85' Tc=10.5 min CN=79 Runoff=0.19 cfs 0.016 af

SubcatchmentEX-4: Overland Runoff Area=100,432 sf 0.00% Impervious Runoff Depth=2.88"
Flow Length=938' Tc=32.5 min CN=77 Runoff=4.24 cfs 0.553 af

SubcatchmentEX-5: Overland Runoff Area=42,742 sf 0.32% Impervious Runoff Depth=2.97"
Flow Length=335' Tc=16.1 min CN=78 Runoff=2.52 cfs 0.243 af

SubcatchmentEX-6: Overland Runoff Area=228,216 sf 0.00% Impervious Runoff Depth=2.88"
Flow Length=627' Tc=31.1 min CN=77 Runoff=9.81 cfs 1.256 af

SubcatchmentEX-7A: Overland Runoff Area=139,122 sf 7.62% Impervious Runoff Depth=3.06"
Flow Length=591' Tc=23.8 min CN=79 Runoff=7.17 cfs 0.815 af

SubcatchmentEX-7B: Overland (Offsite) Runoff Area=16,179 sf 3.75% Impervious Runoff Depth=2.97"
Flow Length=489' Tc=19.8 min CN=78 Runoff=0.87 cfs 0.092 af

SubcatchmentEX-7C: Overland Runoff Area=3,572 sf 0.00% Impervious Runoff Depth=2.88"
Flow Length=100' Slope=0.0350 '/' Tc=18.3 min CN=77 Runoff=0.19 cfs 0.020 af

SubcatchmentEX-7D: Overland Runoff Area=1,620 sf 0.00% Impervious Runoff Depth=2.88"
Flow Length=25' Slope=0.0120 '/' Tc=15.4 min CN=77 Runoff=0.09 cfs 0.009 af

Link DP-1: Wetland 1 Inflow=26.23 cfs 4.110 af
Primary=26.23 cfs 4.110 af

Link DP-2: Wetland 2 Inflow=10.16 cfs 1.491 af
Primary=10.16 cfs 1.491 af

Link DP-3: Wetland 3 Inflow=13.01 cfs 1.599 af
Primary=13.01 cfs 1.599 af

Link DP-4: Eliot Street Inflow=4.24 cfs 0.553 af
Primary=4.24 cfs 0.553 af

Link DP-5: (Offsite Southeast) Inflow=2.52 cfs 0.243 af
Primary=2.52 cfs 0.243 af

Link DP-6: Prospect Heights Inflow=9.81 cfs 1.256 af
Primary=9.81 cfs 1.256 af

Link DP-7: Chestnut Street Inflow=8.28 cfs 0.935 af
Primary=8.28 cfs 0.935 af

Total Runoff Area = 40.535 ac Runoff Volume = 10.186 af Average Runoff Depth = 3.02"
97.24% Pervious = 39.416 ac 2.76% Impervious = 1.119 ac

Summary for Subcatchment EX-1A: Overland

Runoff = 26.20 cfs @ 12.64 hrs, Volume= 4.101 af, Depth= 3.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.30"

	Area (sf)	CN	Description
	632	98	Unconnected roofs, HSG D
	5,471	89	Dirt roads, HSG D
	1,653	96	Gravel surface, HSG D
	22,224	98	Paved parking, HSG D
	3,317	98	Unconnected pavement, HSG D
*	77,096	77	Wetlands (Woods, Good, HSG D)
	3,442	73	Brush, Good, HSG D
	153,369	80	>75% Grass cover, Good, HSG D
	433,050	77	Woods, Good, HSG D
	700,254	79	Weighted Average
	674,081		96.26% Pervious Area
	26,173		3.74% Impervious Area
	3,949		15.09% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.9	50	0.0160	0.03		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
7.4	172	0.0060	0.39		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
3.9	110	0.0090	0.47		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.1	70	0.0430	1.04		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.7	65	0.0160	0.63		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
8.6	580	0.0500	1.12		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
46.6	1,047	Total			

Summary for Subcatchment EX-1B: Overland (Offsite)

Runoff = 0.09 cfs @ 12.21 hrs, Volume= 0.008 af, Depth= 2.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
1,506	77	Woods, Good, HSG D
1,506		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	50	0.0520	0.06		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.5	37	0.0520	1.14		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
15.4	87	Total			

Summary for Subcatchment EX-2A: Overland

Runoff = 8.66 cfs @ 12.50 hrs, Volume= 1.205 af, Depth= 2.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.30"

	Area (sf)	CN	Description
*	27,039	77	Wetlands (Woods, Good, HSG D)
	4,000	80	>75% Grass cover, Good, HSG D
	188,050	77	Woods, Good, HSG D
	219,089	77	Weighted Average
	219,089		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.9	50	0.0330	0.05		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.6	66	0.1200	1.73		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
2.5	120	0.0250	0.79		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
5.3	353	0.0500	1.12		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
2.1	185	0.0880	1.48		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.8	55	0.0500	1.12		**Shallow Concentrated Flow, Wetland** Woodland Kv= 5.0 fps
0.3	30	0.1333	1.83		**Shallow Concentrated Flow, Wetland** Woodland Kv= 5.0 fps
0.5	44	0.0800	1.41		**Shallow Concentrated Flow, Wetland** Woodland Kv= 5.0 fps
7.1	253	0.0140	0.59		**Shallow Concentrated Flow, Wetlands** Woodland Kv= 5.0 fps
37.1	1,156	Total			

Summary for Subcatchment EX-2B: Overland (Offsite)

Runoff = 1.41 cfs @ 12.27 hrs, Volume= 0.150 af, Depth= 3.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Adj	Description
1,040	98		Unconnected roofs, HSG D
331	98		Unconnected pavement, HSG D
12,989	80		>75% Grass cover, Good, HSG D
11,172	77		Woods, Good, HSG D
25,532	80	79	Weighted Average, UI Adjusted
24,161			94.63% Pervious Area
1,371			5.37% Impervious Area
1,371			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.5	50	0.0400	0.05		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.2	19	0.1000	1.58		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.6	135	0.0430	1.45		**Shallow Concentrated Flow, Woods** Short Grass Pasture Kv= 7.0 fps
0.4	59	0.1520	2.73		**Shallow Concentrated Flow, Woods** Short Grass Pasture Kv= 7.0 fps
1.4	85	0.0410	1.01		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
20.1	348	Total			

Summary for Subcatchment EX-2C: Overland (Offsite)

Runoff = 1.80 cfs @ 12.11 hrs, Volume= 0.136 af, Depth= 3.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
198	98	Unconnected roofs, HSG D
21,719	80	>75% Grass cover, Good, HSG D
582	77	Woods, Good, HSG D
22,499	80	Weighted Average
22,301		99.12% Pervious Area
198		0.88% Impervious Area
198		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	50	0.0600	0.23		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
4.0	405	0.0580	1.69		**Shallow Concentrated Flow, Woods** Short Grass Pasture Kv= 7.0 fps
7.7	455	Total			

Summary for Subcatchment EX-3A: Overland

Runoff = 12.91 cfs @ 12.39 hrs, Volume= 1.583 af, Depth= 3.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.30"

	Area (sf)	CN	Description
	1,180	98	Unconnected roofs, HSG D
	8,460	98	Unconnected pavement, HSG D
*	7,956	80	Wetland (Grass, HSG D)
	3,132	73	Brush, Good, HSG D
	212,160	80	>75% Grass cover, Good, HSG D
	29,312	77	Woods, Good, HSG D
	262,200	80	Weighted Average
	252,560		96.32% Pervious Area
	9,640		3.68% Impervious Area
	9,640		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.2	38	0.0150	0.12		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
2.5	12	0.0090	0.08		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
2.4	97	0.0090	0.66		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
0.1	16	0.0090	1.93		**Shallow Concentrated Flow, Pavement** Paved Kv= 20.3 fps
0.5	106	0.0340	3.74		**Shallow Concentrated Flow, Pavement** Paved Kv= 20.3 fps
0.2	20	0.0500	1.57		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
2.1	92	0.0220	0.74		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.3	24	0.0910	1.51		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.8	100	0.1000	2.21		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
0.5	47	0.0420	1.43		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
1.3	83	0.0240	1.08		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
8.4	224	0.0040	0.44		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
1.5	65	0.0100	0.70		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
2.5	105	0.0100	0.70		**Shallow Concentrated Flow, Wetland** Short Grass Pasture Kv= 7.0 fps
28.3	1,029	Total			

Summary for Subcatchment EX-3B: Overland (Offsite)

Runoff = 0.19 cfs @ 12.15 hrs, Volume= 0.016 af, Depth= 3.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
1,717	80	>75% Grass cover, Good, HSG D
1,021	77	Woods, Good, HSG D
2,738	79	Weighted Average
2,738		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	48	0.1300	0.08		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.2	2	0.1300	0.16		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
0.3	35	0.1050	2.27		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
10.5	85	Total			

Summary for Subcatchment EX-4: Overland

Runoff = 4.24 cfs @ 12.46 hrs, Volume= 0.553 af, Depth= 2.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
4,690	73	Brush, Good, HSG D
2,570	80	>75% Grass cover, Good, HSG D
93,172	77	Woods, Good, HSG D
100,432	77	Weighted Average
100,432		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.6	50	0.0300	0.04		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.6	66	0.1200	1.73		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
7.7	515	0.0500	1.12		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
5.6	307	0.0330	0.91		**Shallow Concentrated Flow, Wetland** Woodland Kv= 5.0 fps
32.5	938	Total			

Summary for Subcatchment EX-5: Overland

Runoff = 2.52 cfs @ 12.22 hrs, Volume= 0.243 af, Depth= 2.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
136	98	Unconnected roofs, HSG D
1,200	89	Dirt roads, HSG D
4,534	80	>75% Grass cover, Good, HSG D
36,872	77	Woods, Good, HSG D
42,742	78	Weighted Average
42,606		99.68% Pervious Area
136		0.32% Impervious Area
136		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	10	0.0350	0.13		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
8.9	40	0.1200	0.07		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.6	66	0.1200	1.73		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
4.7	180	0.0160	0.63		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.6	39	0.0460	1.07		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
16.1	335	Total			

Summary for Subcatchment EX-6: Overland

Runoff = 9.81 cfs @ 12.44 hrs, Volume= 1.256 af, Depth= 2.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
766	80	>75% Grass cover, Good, HSG D
227,450	77	Woods, Good, HSG D
228,216	77	Weighted Average
228,216		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.1	50	0.0280	0.04		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
1.9	98	0.0300	0.87		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
3.3	206	0.0440	1.05		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
6.8	273	0.0180	0.67		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
31.1	627	Total			

Summary for Subcatchment EX-7A: Overland

Runoff = 7.17 cfs @ 12.33 hrs, Volume= 0.815 af, Depth= 3.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
384	96	Gravel surface, HSG D
9,749	98	Paved parking, HSG D
854	98	Unconnected pavement, HSG D
13,258	80	>75% Grass cover, Good, HSG D
114,877	77	Woods, Good, HSG D
139,122	79	Weighted Average
128,519		92.38% Pervious Area
10,603		7.62% Impervious Area
854		8.05% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.2	50	0.0700	0.06		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
1.6	110	0.0540	1.16		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
2.9	138	0.0250	0.79		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
3.3	124	0.0160	0.63		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.1	14	0.1430	1.89		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.8	40	0.0250	0.79		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.7	67	0.1040	1.61		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.2	48	0.0180	0.67		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
23.8	591	Total			

Summary for Subcatchment EX-7B: Overland (Offsite)

Runoff = 0.87 cfs @ 12.27 hrs, Volume= 0.092 af, Depth= 2.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
606	98	Paved parking, HSG D
3,197	80	>75% Grass cover, Good, HSG D
12,376	77	Woods, Good, HSG D
16,179	78	Weighted Average
15,573		96.25% Pervious Area
606		3.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.1	50	0.0600	0.06		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.7	55	0.0700	1.32		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.6	71	0.0700	1.85		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
1.6	125	0.0640	1.26		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.5	23	0.0100	0.70		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
0.3	40	0.0150	2.49		**Shallow Concentrated Flow, Pavement** Paved Kv= 20.3 fps
0.3	23	0.0330	1.27		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
1.7	102	0.0400	1.00		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
19.8	489	Total			

Summary for Subcatchment EX-7C: Overland

Runoff = 0.19 cfs @ 12.26 hrs, Volume= 0.020 af, Depth= 2.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
3,572	77	Woods, Good, HSG D
3,572		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.4	50	0.0350	0.05		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.9	50	0.0350	0.94		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
18.3	100	Total			

Summary for Subcatchment EX-7D: Overland

Runoff = 0.09 cfs @ 12.21 hrs, Volume= 0.009 af, Depth= 2.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
1,620	77	Woods, Good, HSG D
1,620		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.4	25	0.0120	0.03		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"

Summary for Link DP-1: Wetland 1

Inflow Area = 16.110 ac, 3.73% Impervious, Inflow Depth = 3.06" for 25-Year event
Inflow = 26.23 cfs @ 12.64 hrs, Volume= 4.110 af
Primary = 26.23 cfs @ 12.64 hrs, Volume= 4.110 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Link DP-2: Wetland 2

Inflow Area = 6.132 ac, 0.59% Impervious, Inflow Depth = 2.92" for 25-Year event
Inflow = 10.16 cfs @ 12.49 hrs, Volume= 1.491 af
Primary = 10.16 cfs @ 12.49 hrs, Volume= 1.491 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Link DP-3: Wetland 3

Inflow Area = 6.082 ac, 3.64% Impervious, Inflow Depth = 3.16" for 25-Year event
Inflow = 13.01 cfs @ 12.39 hrs, Volume= 1.599 af
Primary = 13.01 cfs @ 12.39 hrs, Volume= 1.599 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Link DP-4: Eliot Street

Inflow Area = 2.306 ac, 0.00% Impervious, Inflow Depth = 2.88" for 25-Year event
Inflow = 4.24 cfs @ 12.46 hrs, Volume= 0.553 af
Primary = 4.24 cfs @ 12.46 hrs, Volume= 0.553 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Link DP-5: (Offsite Southeast)

Inflow Area = 0.981 ac, 0.32% Impervious, Inflow Depth = 2.97" for 25-Year event
Inflow = 2.52 cfs @ 12.22 hrs, Volume= 0.243 af
Primary = 2.52 cfs @ 12.22 hrs, Volume= 0.243 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Link DP-6: Prospect Heights

Inflow Area = 5.239 ac, 0.00% Impervious, Inflow Depth = 2.88" for 25-Year event
Inflow = 9.81 cfs @ 12.44 hrs, Volume= 1.256 af
Primary = 9.81 cfs @ 12.44 hrs, Volume= 1.256 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Link DP-7: Chestnut Street

Inflow Area = 3.684 ac, 6.98% Impervious, Inflow Depth = 3.05" for 25-Year event
Inflow = 8.28 cfs @ 12.32 hrs, Volume= 0.935 af
Primary = 8.28 cfs @ 12.32 hrs, Volume= 0.935 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentEX-1A: Overland Runoff Area=700,254 sf 3.74% Impervious Runoff Depth=4.13"
Flow Length=1,047' Tc=46.6 min CN=79 Runoff=35.27 cfs 5.532 af

SubcatchmentEX-1B: Overland (Offsite) Runoff Area=1,506 sf 0.00% Impervious Runoff Depth=3.92"
Flow Length=87' Slope=0.0520 '/' Tc=15.4 min CN=77 Runoff=0.12 cfs 0.011 af

SubcatchmentEX-2A: Overland Runoff Area=219,089 sf 0.00% Impervious Runoff Depth=3.92"
Flow Length=1,156' Tc=37.1 min CN=77 Runoff=11.81 cfs 1.643 af

SubcatchmentEX-2B: Overland (Offsite) Runoff Area=25,532 sf 5.37% Impervious Runoff Depth=4.13"
Flow Length=348' Tc=20.1 min UI Adjusted CN=79 Runoff=1.90 cfs 0.202 af

SubcatchmentEX-2C: Overland (Offsite) Runoff Area=22,499 sf 0.88% Impervious Runoff Depth=4.24"
Flow Length=455' Tc=7.7 min CN=80 Runoff=2.40 cfs 0.182 af

SubcatchmentEX-3A: Overland Runoff Area=262,200 sf 3.68% Impervious Runoff Depth=4.24"
Flow Length=1,029' Tc=28.3 min CN=80 Runoff=17.26 cfs 2.124 af

SubcatchmentEX-3B: Overland (Offsite) Runoff Area=2,738 sf 0.00% Impervious Runoff Depth=4.13"
Flow Length=85' Tc=10.5 min CN=79 Runoff=0.26 cfs 0.022 af

SubcatchmentEX-4: Overland Runoff Area=100,432 sf 0.00% Impervious Runoff Depth=3.92"
Flow Length=938' Tc=32.5 min CN=77 Runoff=5.78 cfs 0.753 af

SubcatchmentEX-5: Overland Runoff Area=42,742 sf 0.32% Impervious Runoff Depth=4.02"
Flow Length=335' Tc=16.1 min CN=78 Runoff=3.41 cfs 0.329 af

SubcatchmentEX-6: Overland Runoff Area=228,216 sf 0.00% Impervious Runoff Depth=3.92"
Flow Length=627' Tc=31.1 min CN=77 Runoff=13.37 cfs 1.711 af

SubcatchmentEX-7A: Overland Runoff Area=139,122 sf 7.62% Impervious Runoff Depth=4.13"
Flow Length=591' Tc=23.8 min CN=79 Runoff=9.65 cfs 1.099 af

SubcatchmentEX-7B: Overland (Offsite) Runoff Area=16,179 sf 3.75% Impervious Runoff Depth=4.02"
Flow Length=489' Tc=19.8 min CN=78 Runoff=1.18 cfs 0.125 af

SubcatchmentEX-7C: Overland Runoff Area=3,572 sf 0.00% Impervious Runoff Depth=3.92"
Flow Length=100' Slope=0.0350 '/' Tc=18.3 min CN=77 Runoff=0.26 cfs 0.027 af

SubcatchmentEX-7D: Overland Runoff Area=1,620 sf 0.00% Impervious Runoff Depth=3.92"
Flow Length=25' Slope=0.0120 '/' Tc=15.4 min CN=77 Runoff=0.13 cfs 0.012 af

Link DP-1: Wetland 1 Inflow=35.31 cfs 5.543 af
Primary=35.31 cfs 5.543 af

Link DP-2: Wetland 2 Inflow=13.80 cfs 2.027 af
Primary=13.80 cfs 2.027 af

Link DP-3: Wetland 3	Inflow=17.39 cfs 2.146 af Primary=17.39 cfs 2.146 af
Link DP-4: Eliot Street	Inflow=5.78 cfs 0.753 af Primary=5.78 cfs 0.753 af
Link DP-5: (Offsite Southeast)	Inflow=3.41 cfs 0.329 af Primary=3.41 cfs 0.329 af
Link DP-6: Prospect Heights	Inflow=13.37 cfs 1.711 af Primary=13.37 cfs 1.711 af
Link DP-7: Chestnut Street	Inflow=11.15 cfs 1.262 af Primary=11.15 cfs 1.262 af

Total Runoff Area = 40.535 ac Runoff Volume = 13.771 af Average Runoff Depth = 4.08"
97.24% Pervious = 39.416 ac 2.76% Impervious = 1.119 ac

Summary for Subcatchment EX-1A: Overland

Runoff = 35.27 cfs @ 12.63 hrs, Volume= 5.532 af, Depth= 4.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

	Area (sf)	CN	Description
	632	98	Unconnected roofs, HSG D
	5,471	89	Dirt roads, HSG D
	1,653	96	Gravel surface, HSG D
	22,224	98	Paved parking, HSG D
	3,317	98	Unconnected pavement, HSG D
*	77,096	77	Wetlands (Woods, Good, HSG D)
	3,442	73	Brush, Good, HSG D
	153,369	80	>75% Grass cover, Good, HSG D
	433,050	77	Woods, Good, HSG D
	700,254	79	Weighted Average
	674,081		96.26% Pervious Area
	26,173		3.74% Impervious Area
	3,949		15.09% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.9	50	0.0160	0.03		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
7.4	172	0.0060	0.39		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
3.9	110	0.0090	0.47		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.1	70	0.0430	1.04		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.7	65	0.0160	0.63		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
8.6	580	0.0500	1.12		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
46.6	1,047	Total			

Summary for Subcatchment EX-1B: Overland (Offsite)

Runoff = 0.12 cfs @ 12.21 hrs, Volume= 0.011 af, Depth= 3.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
1,506	77	Woods, Good, HSG D
1,506		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	50	0.0520	0.06		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.5	37	0.0520	1.14		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
15.4	87	Total			

Summary for Subcatchment EX-2A: Overland

Runoff = 11.81 cfs @ 12.50 hrs, Volume= 1.643 af, Depth= 3.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

	Area (sf)	CN	Description
*	27,039	77	Wetlands (Woods, Good, HSG D)
	4,000	80	>75% Grass cover, Good, HSG D
	188,050	77	Woods, Good, HSG D
	219,089	77	Weighted Average
	219,089		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.9	50	0.0330	0.05		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.6	66	0.1200	1.73		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
2.5	120	0.0250	0.79		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
5.3	353	0.0500	1.12		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
2.1	185	0.0880	1.48		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.8	55	0.0500	1.12		**Shallow Concentrated Flow, Wetland** Woodland Kv= 5.0 fps
0.3	30	0.1333	1.83		**Shallow Concentrated Flow, Wetland** Woodland Kv= 5.0 fps
0.5	44	0.0800	1.41		**Shallow Concentrated Flow, Wetland** Woodland Kv= 5.0 fps
7.1	253	0.0140	0.59		**Shallow Concentrated Flow, Wetlands** Woodland Kv= 5.0 fps
37.1	1,156	Total			

Summary for Subcatchment EX-2B: Overland (Offsite)

Runoff = 1.90 cfs @ 12.27 hrs, Volume= 0.202 af, Depth= 4.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Adj	Description
1,040	98		Unconnected roofs, HSG D
331	98		Unconnected pavement, HSG D
12,989	80		>75% Grass cover, Good, HSG D
11,172	77		Woods, Good, HSG D
25,532	80	79	Weighted Average, UI Adjusted
24,161			94.63% Pervious Area
1,371			5.37% Impervious Area
1,371			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.5	50	0.0400	0.05		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.2	19	0.1000	1.58		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.6	135	0.0430	1.45		**Shallow Concentrated Flow, Woods** Short Grass Pasture Kv= 7.0 fps
0.4	59	0.1520	2.73		**Shallow Concentrated Flow, Woods** Short Grass Pasture Kv= 7.0 fps
1.4	85	0.0410	1.01		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
20.1	348	Total			

Summary for Subcatchment EX-2C: Overland (Offsite)

Runoff = 2.40 cfs @ 12.11 hrs, Volume= 0.182 af, Depth= 4.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
198	98	Unconnected roofs, HSG D
21,719	80	>75% Grass cover, Good, HSG D
582	77	Woods, Good, HSG D
22,499	80	Weighted Average
22,301		99.12% Pervious Area
198		0.88% Impervious Area
198		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	50	0.0600	0.23		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
4.0	405	0.0580	1.69		**Shallow Concentrated Flow, Woods** Short Grass Pasture Kv= 7.0 fps
7.7	455	Total			

Summary for Subcatchment EX-3A: Overland

Runoff = 17.26 cfs @ 12.39 hrs, Volume= 2.124 af, Depth= 4.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

	Area (sf)	CN	Description
	1,180	98	Unconnected roofs, HSG D
	8,460	98	Unconnected pavement, HSG D
*	7,956	80	Wetland (Grass, HSG D)
	3,132	73	Brush, Good, HSG D
	212,160	80	>75% Grass cover, Good, HSG D
	29,312	77	Woods, Good, HSG D
	262,200	80	Weighted Average
	252,560		96.32% Pervious Area
	9,640		3.68% Impervious Area
	9,640		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.2	38	0.0150	0.12		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
2.5	12	0.0090	0.08		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
2.4	97	0.0090	0.66		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
0.1	16	0.0090	1.93		**Shallow Concentrated Flow, Pavement** Paved Kv= 20.3 fps
0.5	106	0.0340	3.74		**Shallow Concentrated Flow, Pavement** Paved Kv= 20.3 fps
0.2	20	0.0500	1.57		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
2.1	92	0.0220	0.74		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.3	24	0.0910	1.51		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.8	100	0.1000	2.21		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
0.5	47	0.0420	1.43		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
1.3	83	0.0240	1.08		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
8.4	224	0.0040	0.44		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
1.5	65	0.0100	0.70		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
2.5	105	0.0100	0.70		**Shallow Concentrated Flow, Wetland** Short Grass Pasture Kv= 7.0 fps
28.3	1,029	Total			

Summary for Subcatchment EX-3B: Overland (Offsite)

Runoff = 0.26 cfs @ 12.14 hrs, Volume= 0.022 af, Depth= 4.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
1,717	80	>75% Grass cover, Good, HSG D
1,021	77	Woods, Good, HSG D
2,738	79	Weighted Average
2,738		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	48	0.1300	0.08		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.2	2	0.1300	0.16		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
0.3	35	0.1050	2.27		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
10.5	85	Total			

Summary for Subcatchment EX-4: Overland

Runoff = 5.78 cfs @ 12.46 hrs, Volume= 0.753 af, Depth= 3.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
4,690	73	Brush, Good, HSG D
2,570	80	>75% Grass cover, Good, HSG D
93,172	77	Woods, Good, HSG D
100,432	77	Weighted Average
100,432		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.6	50	0.0300	0.04		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.6	66	0.1200	1.73		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
7.7	515	0.0500	1.12		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
5.6	307	0.0330	0.91		**Shallow Concentrated Flow, Wetland** Woodland Kv= 5.0 fps
32.5	938	Total			

Summary for Subcatchment EX-5: Overland

Runoff = 3.41 cfs @ 12.22 hrs, Volume= 0.329 af, Depth= 4.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
136	98	Unconnected roofs, HSG D
1,200	89	Dirt roads, HSG D
4,534	80	>75% Grass cover, Good, HSG D
36,872	77	Woods, Good, HSG D
42,742	78	Weighted Average
42,606		99.68% Pervious Area
136		0.32% Impervious Area
136		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	10	0.0350	0.13		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
8.9	40	0.1200	0.07		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.6	66	0.1200	1.73		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
4.7	180	0.0160	0.63		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.6	39	0.0460	1.07		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
16.1	335	Total			

Summary for Subcatchment EX-6: Overland

Runoff = 13.37 cfs @ 12.41 hrs, Volume= 1.711 af, Depth= 3.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
766	80	>75% Grass cover, Good, HSG D
227,450	77	Woods, Good, HSG D
228,216	77	Weighted Average
228,216		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.1	50	0.0280	0.04		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
1.9	98	0.0300	0.87		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
3.3	206	0.0440	1.05		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
6.8	273	0.0180	0.67		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
31.1	627	Total			

Summary for Subcatchment EX-7A: Overland

Runoff = 9.65 cfs @ 12.32 hrs, Volume= 1.099 af, Depth= 4.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
384	96	Gravel surface, HSG D
9,749	98	Paved parking, HSG D
854	98	Unconnected pavement, HSG D
13,258	80	>75% Grass cover, Good, HSG D
114,877	77	Woods, Good, HSG D
139,122	79	Weighted Average
128,519		92.38% Pervious Area
10,603		7.62% Impervious Area
854		8.05% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.2	50	0.0700	0.06		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
1.6	110	0.0540	1.16		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
2.9	138	0.0250	0.79		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
3.3	124	0.0160	0.63		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.1	14	0.1430	1.89		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.8	40	0.0250	0.79		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.7	67	0.1040	1.61		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.2	48	0.0180	0.67		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
23.8	591	Total			

Summary for Subcatchment EX-7B: Overland (Offsite)

Runoff = 1.18 cfs @ 12.26 hrs, Volume= 0.125 af, Depth= 4.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
606	98	Paved parking, HSG D
3,197	80	>75% Grass cover, Good, HSG D
12,376	77	Woods, Good, HSG D
16,179	78	Weighted Average
15,573		96.25% Pervious Area
606		3.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.1	50	0.0600	0.06		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.7	55	0.0700	1.32		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.6	71	0.0700	1.85		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
1.6	125	0.0640	1.26		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.5	23	0.0100	0.70		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
0.3	40	0.0150	2.49		**Shallow Concentrated Flow, Pavement** Paved Kv= 20.3 fps
0.3	23	0.0330	1.27		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
1.7	102	0.0400	1.00		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
19.8	489	Total			

Summary for Subcatchment EX-7C: Overland

Runoff = 0.26 cfs @ 12.26 hrs, Volume= 0.027 af, Depth= 3.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
3,572	77	Woods, Good, HSG D
3,572		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.4	50	0.0350	0.05		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.9	50	0.0350	0.94		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
18.3	100	Total			

Summary for Subcatchment EX-7D: Overland

Runoff = 0.13 cfs @ 12.21 hrs, Volume= 0.012 af, Depth= 3.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
1,620	77	Woods, Good, HSG D
1,620		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.4	25	0.0120	0.03		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"

Summary for Link DP-1: Wetland 1

Inflow Area = 16.110 ac, 3.73% Impervious, Inflow Depth = 4.13" for 100-Year event
Inflow = 35.31 cfs @ 12.63 hrs, Volume= 5.543 af
Primary = 35.31 cfs @ 12.63 hrs, Volume= 5.543 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Link DP-2: Wetland 2

Inflow Area = 6.132 ac, 0.59% Impervious, Inflow Depth = 3.97" for 100-Year event
Inflow = 13.80 cfs @ 12.48 hrs, Volume= 2.027 af
Primary = 13.80 cfs @ 12.48 hrs, Volume= 2.027 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Link DP-3: Wetland 3

Inflow Area = 6.082 ac, 3.64% Impervious, Inflow Depth = 4.23" for 100-Year event
Inflow = 17.39 cfs @ 12.39 hrs, Volume= 2.146 af
Primary = 17.39 cfs @ 12.39 hrs, Volume= 2.146 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Link DP-4: Eliot Street

Inflow Area =	2.306 ac,	0.00% Impervious, Inflow Depth = 3.92"	for 100-Year event	
Inflow =	5.78 cfs @	12.46 hrs, Volume=	0.753 af	
Primary =	5.78 cfs @	12.46 hrs, Volume=	0.753 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Link DP-5: (Offsite Southeast)

Inflow Area =	0.981 ac,	0.32% Impervious, Inflow Depth = 4.02"	for 100-Year event	
Inflow =	3.41 cfs @	12.22 hrs, Volume=	0.329 af	
Primary =	3.41 cfs @	12.22 hrs, Volume=	0.329 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Link DP-6: Prospect Heights

Inflow Area =	5.239 ac,	0.00% Impervious, Inflow Depth = 3.92"	for 100-Year event	
Inflow =	13.37 cfs @	12.41 hrs, Volume=	1.711 af	
Primary =	13.37 cfs @	12.41 hrs, Volume=	1.711 af,	Atten= 0%, Lag= 0.0 min

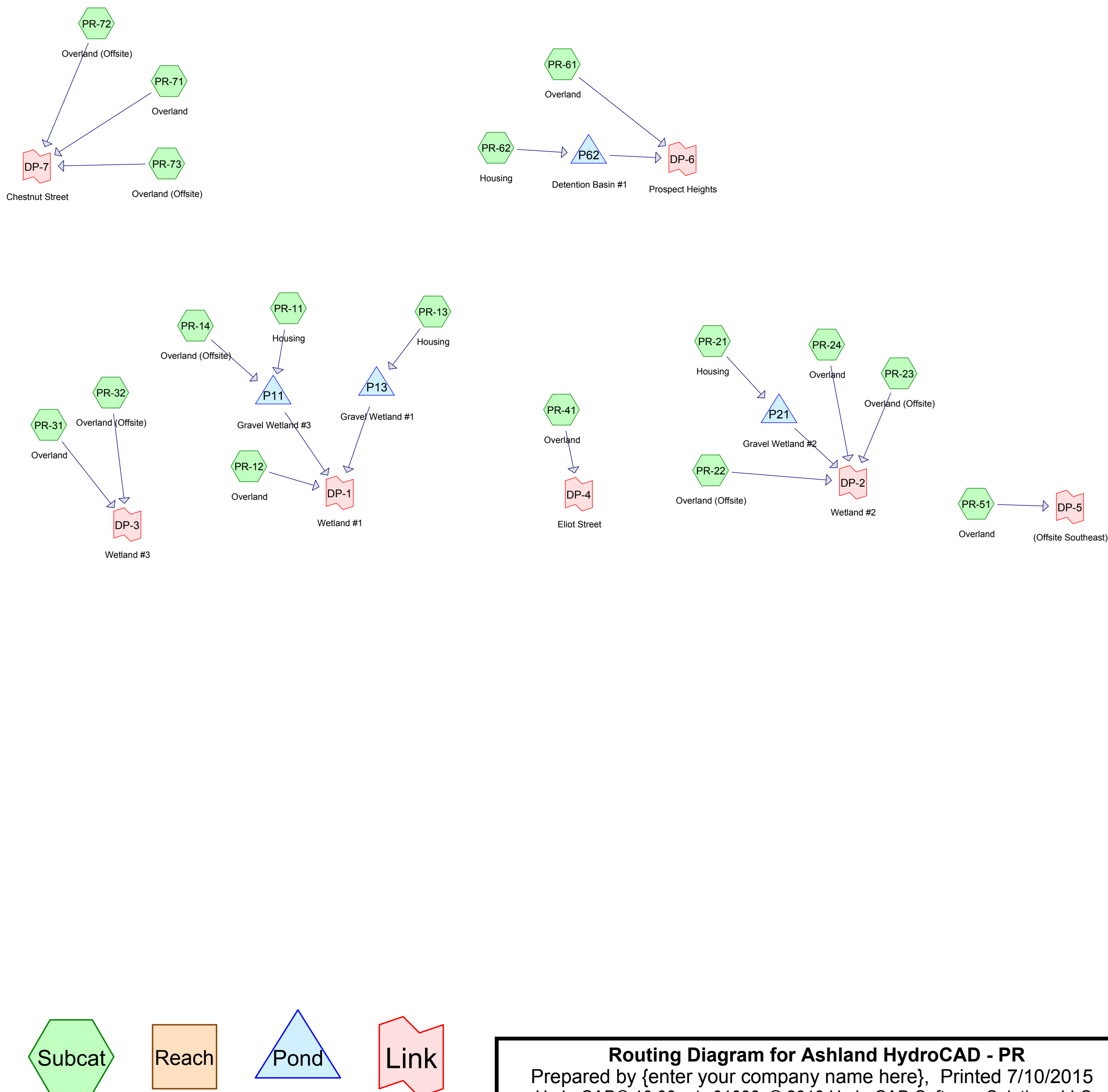
Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Link DP-7: Chestnut Street

Inflow Area =	3.684 ac,	6.98% Impervious, Inflow Depth = 4.11"	for 100-Year event	
Inflow =	11.15 cfs @	12.30 hrs, Volume=	1.262 af	
Primary =	11.15 cfs @	12.30 hrs, Volume=	1.262 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

HydroCAD Analysis: Proposed Conditions



Routing Diagram for Ashland HydroCAD - PR
Prepared by {enter your company name here}, Printed 7/10/2015
HydroCAD® 10.00 s/n 01038 © 2013 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
15.210	80	>75% Grass cover, Good, HSG D (PR-11, PR-13, PR-21, PR-22, PR-31, PR-32, PR-62, PR-71)
0.055	73	Brush, Good, HSG D (PR-31, PR-41)
4.074	98	Paved parking, HSG D (PR-11, PR-13, PR-21, PR-71)
0.008	98	Unconnected pavement, HSG D (PR-22)
5.182	98	Unconnected roofs, HSG D (PR-11, PR-13, PR-21, PR-22, PR-31, PR-62)
0.183	80	Wetland (Grass, HSG D) (PR-31)
1.034	77	Woods, Good, HSG D (PR-11, PR-22, PR-31, PR-32)
0.028	89	dirt drive (PR-51)
5.109	80	grass (PR-12, PR-23, PR-24, PR-41, PR-51, PR-61, PR-72)
0.026	96	gravel drive (PR-41)
0.086	98	pavement (PR-12, PR-41, PR-72)
0.021	98	roof (PR-12, PR-23, PR-51)
2.391	77	wetland - woods (PR-12, PR-24)
7.056	77	woods (PR-12, PR-23, PR-24, PR-41, PR-51, PR-61, PR-71, PR-72, PR-73)
0.071	80	woods (PR-14)
40.535	**83**	**TOTAL AREA**

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentPR-11: Housing Runoff Area=475,007 sf 45.31% Impervious Runoff Depth=1.91"
Flow Length=1,594' Tc=6.7 min CN=88 Runoff=23.74 cfs 1.733 af

SubcatchmentPR-12: Overland Runoff Area=267,695 sf 0.89% Impervious Runoff Depth=1.26"
Flow Length=701' Tc=26.3 min CN=79 Runoff=5.33 cfs 0.646 af

SubcatchmentPR-13: Housing Runoff Area=154,430 sf 44.45% Impervious Runoff Depth=1.91"
Flow Length=678' Tc=14.8 min CN=88 Runoff=6.02 cfs 0.563 af

SubcatchmentPR-14: Overland (Offsite) Runoff Area=3,104 sf 0.00% Impervious Runoff Depth=1.33"
Flow Length=87' Slope=0.0520 '/' Tc=15.4 min CN=80 Runoff=0.08 cfs 0.008 af

SubcatchmentPR-21: Housing Runoff Area=158,766 sf 57.34% Impervious Runoff Depth=2.08"
Flow Length=556' Tc=7.4 min CN=90 Runoff=8.37 cfs 0.631 af

SubcatchmentPR-22: Overland (Offsite) Runoff Area=25,532 sf 5.37% Impervious Runoff Depth=1.26"
Flow Length=348' Tc=20.1 min UI Adjusted CN=79 Runoff=0.57 cfs 0.062 af

SubcatchmentPR-23: Overland (Offsite) Runoff Area=22,499 sf 0.88% Impervious Runoff Depth=1.33"
Flow Length=455' Tc=7.7 min CN=80 Runoff=0.75 cfs 0.057 af

SubcatchmentPR-24: Overland Runoff Area=144,766 sf 0.00% Impervious Runoff Depth=1.20"
Flow Length=999' Tc=32.1 min CN=78 Runoff=2.49 cfs 0.332 af

SubcatchmentPR-31: Overland Runoff Area=225,357 sf 0.52% Impervious Runoff Depth=1.33"
Flow Length=760' Tc=32.6 min CN=80 Runoff=4.30 cfs 0.571 af

SubcatchmentPR-32: Overland (Offsite) Runoff Area=2,738 sf 0.00% Impervious Runoff Depth=1.26"
Flow Length=85' Tc=10.5 min CN=79 Runoff=0.08 cfs 0.007 af

SubcatchmentPR-41: Overland Runoff Area=33,639 sf 3.96% Impervious Runoff Depth=1.33"
Flow Length=105' Tc=8.4 min CN=80 Runoff=1.09 cfs 0.085 af

SubcatchmentPR-51: Overland Runoff Area=42,742 sf 0.32% Impervious Runoff Depth=1.20"
Flow Length=335' Tc=16.1 min CN=78 Runoff=0.99 cfs 0.098 af

SubcatchmentPR-61: Overland Runoff Area=61,371 sf 0.00% Impervious Runoff Depth=1.20"
Flow Length=512' Tc=26.2 min CN=78 Runoff=1.16 cfs 0.141 af

SubcatchmentPR-62: Housing Runoff Area=38,898 sf 54.33% Impervious Runoff Depth=2.08"
Flow Length=668' Tc=12.2 min CN=90 Runoff=1.76 cfs 0.154 af

SubcatchmentPR-71: Overland Runoff Area=92,973 sf 5.33% Impervious Runoff Depth=1.26"
Flow Length=503' Tc=20.7 min CN=79 Runoff=2.05 cfs 0.224 af

SubcatchmentPR-72: Overland (Offsite) Runoff Area=14,564 sf 4.16% Impervious Runoff Depth=1.26"
Flow Length=489' Tc=19.8 min CN=79 Runoff=0.33 cfs 0.035 af

Subcatchment PR-73: Overland (Offsite) Runoff Area=1,620 sf 0.00% Impervious Runoff Depth=1.14"
Flow Length=25' Slope=0.0120 '/' Tc=15.4 min CN=77 Runoff=0.04 cfs 0.004 af

Pond P11: Gravel Wetland #3 Peak Elev=313.34' Storage=37,952 cf Inflow=23.79 cfs 1.741 af
Outflow=2.84 cfs 1.535 af

Pond P13: Gravel Wetland #1 Peak Elev=318.27' Storage=10,238 cf Inflow=6.02 cfs 0.563 af
Outflow=1.75 cfs 0.498 af

Pond P21: Gravel Wetland #2 Peak Elev=303.49' Storage=15,705 cf Inflow=8.37 cfs 0.631 af
Outflow=0.79 cfs 0.437 af

Pond P62: Detention Basin #1 Peak Elev=332.59' Storage=1,211 cf Inflow=1.76 cfs 0.154 af
Outflow=1.25 cfs 0.154 af

Link DP-1: Wetland #1 Inflow=9.71 cfs 2.679 af
Primary=9.71 cfs 2.679 af

Link DP-2: Wetland #2 Inflow=3.94 cfs 0.888 af
Primary=3.94 cfs 0.888 af

Link DP-3: Wetland #3 Inflow=4.33 cfs 0.578 af
Primary=4.33 cfs 0.578 af

Link DP-4: Eliot Street Inflow=1.09 cfs 0.085 af
Primary=1.09 cfs 0.085 af

Link DP-5: (Offsite Southeast) Inflow=0.99 cfs 0.098 af
Primary=0.99 cfs 0.098 af

Link DP-6: Prospect Heights Inflow=2.37 cfs 0.295 af
Primary=2.37 cfs 0.295 af

Link DP-7: Chestnut Street Inflow=2.41 cfs 0.263 af
Primary=2.41 cfs 0.263 af

Total Runoff Area = 40.535 ac Runoff Volume = 5.353 af Average Runoff Depth = 1.58"
76.88% Pervious = 31.164 ac 23.12% Impervious = 9.371 ac

Summary for Subcatchment PR-11: Housing

Runoff = 23.74 cfs @ 12.10 hrs, Volume= 1.733 af, Depth= 1.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
105,642	98	Paved parking, HSG D
109,581	98	Unconnected roofs, HSG D
250,927	80	>75% Grass cover, Good, HSG D
8,857	77	Woods, Good, HSG D
475,007	88	Weighted Average
259,784		54.69% Pervious Area
215,223		45.31% Impervious Area
109,581		50.92% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	50	0.0170	1.10		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 3.10"
1.1	150	0.0133	2.34		**Shallow Concentrated Flow, pavement** Paved Kv= 20.3 fps
0.4	62	0.0161	2.58		**Shallow Concentrated Flow, pavement** Paved Kv= 20.3 fps
0.0	12	0.0085	4.94	3.88	**Pipe Channel, pipe flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011 Concrete pipe, straight & clean
0.3	60	0.0050	3.79	2.98	**Pipe Channel, pipe flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
0.5	114	0.0053	3.90	3.07	**Pipe Channel, Pipe Flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
0.5	120	0.0050	3.79	2.98	**Pipe Channel, Pipe Flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
1.0	228	0.0050	3.79	2.98	**Pipe Channel, ipe flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
0.4	201	0.0266	8.74	6.87	**Pipe Channel, pipe flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
0.4	234	0.0322	9.62	7.56	**Pipe Channel, pipe flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
0.7	166	0.0051	3.83	3.01	**Pipe Channel, pipe flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
0.4	87	0.0057	4.05	3.18	**Pipe Channel, pipe flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25'

n= 0.011					
0.2	110	0.0090	8.07	25.36	**Pipe Channel, pipe flow** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.011
6.7	1,594	Total			

Summary for Subcatchment PR-12: Overland

Runoff = 5.33 cfs @ 12.38 hrs, Volume= 0.646 af, Depth= 1.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

	Area (sf)	CN	Description
*	564	98	roof
*	1,821	98	pavement
*	119,319	80	grass
*	68,895	77	woods
*	77,096	77	wetland - woods
	267,695	79	Weighted Average
	265,310		99.11% Pervious Area
	2,385		0.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	6	0.3300	0.29		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
0.9	7	0.0450	0.14		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
12.4	37	0.0450	0.05		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
12.7	651	0.0290	0.85		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
26.3	701	Total			

Summary for Subcatchment PR-13: Housing

Runoff = 6.02 cfs @ 12.20 hrs, Volume= 0.563 af, Depth= 1.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
27,749	98	Paved parking, HSG D
40,892	98	Unconnected roofs, HSG D
85,789	80	>75% Grass cover, Good, HSG D
154,430	88	Weighted Average
85,789		55.55% Pervious Area
68,641		44.45% Impervious Area
40,892		59.57% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	50	0.0466	0.20		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
0.2	16	0.0625	1.75		**Shallow Concentrated Flow, grass** Short Grass Pasture Kv= 7.0 fps
0.0	6	0.3300	4.02		**Shallow Concentrated Flow, grass** Short Grass Pasture Kv= 7.0 fps
2.3	123	0.0160	0.89		**Shallow Concentrated Flow, grass** Short Grass Pasture Kv= 7.0 fps
0.6	52	0.0400	1.40		**Shallow Concentrated Flow, grass** Short Grass Pasture Kv= 7.0 fps
0.1	8	0.1250	2.47		**Shallow Concentrated Flow, grass** Short Grass Pasture Kv= 7.0 fps
6.5	192	0.0050	0.49		**Shallow Concentrated Flow, grass** Short Grass Pasture Kv= 7.0 fps
0.6	54	0.0050	1.54	0.13	**Pipe Channel, pipe flow** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.013 Corrugated PE, smooth interior
0.2	105	0.0138	7.31	8.97	**Pipe Channel, pipe flow** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.011
0.2	72	0.0152	7.67	9.41	**Pipe Channel, pipe flow** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.011
14.8	678	Total			

Summary for Subcatchment PR-14: Overland (Offsite)

Runoff = 0.08 cfs @ 12.22 hrs, Volume= 0.008 af, Depth= 1.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

	Area (sf)	CN	Description
*	3,104	80	woods
	3,104		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	50	0.0520	0.06		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.5	37	0.0520	1.14		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
15.4	87	Total			

Summary for Subcatchment PR-21: Housing

Runoff = 8.37 cfs @ 12.10 hrs, Volume= 0.631 af, Depth= 2.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
51,916	98	Unconnected roofs, HSG D
39,125	98	Paved parking, HSG D
67,725	80	>75% Grass cover, Good, HSG D
158,766	90	Weighted Average
67,725		42.66% Pervious Area
91,041		57.34% Impervious Area
51,916		57.02% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	50	0.0500	0.21		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
0.4	46	0.0650	1.78		**Shallow Concentrated Flow, grass** Short Grass Pasture Kv= 7.0 fps
0.1	16	0.3333	4.04		**Shallow Concentrated Flow, grass** Short Grass Pasture Kv= 7.0 fps
1.3	75	0.0200	0.99		**Shallow Concentrated Flow, grass** Short Grass Pasture Kv= 7.0 fps
0.1	25	0.0200	2.87		**Shallow Concentrated Flow, pavement** Paved Kv= 20.3 fps
0.1	12	0.0050	3.79	2.98	**Pipe Channel, pipe flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
0.1	33	0.0050	3.79	2.98	**Pipe Channel, pipe flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
0.7	168	0.0050	3.79	2.98	**Pipe Channel, pipe flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
0.4	91	0.0051	3.83	3.01	**Pipe Channel, pipe flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
0.2	40	0.0050	3.79	2.98	**Pipe Channel, pipe flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
7.4	556	Total			

Summary for Subcatchment PR-22: Overland (Offsite)

Runoff = 0.57 cfs @ 12.29 hrs, Volume= 0.062 af, Depth= 1.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Adj	Description
1,040	98		Unconnected roofs, HSG D
331	98		Unconnected pavement, HSG D
12,989	80		>75% Grass cover, Good, HSG D
11,172	77		Woods, Good, HSG D
25,532	80	79	Weighted Average, UI Adjusted
24,161			94.63% Pervious Area
1,371			5.37% Impervious Area
1,371			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.5	50	0.0400	0.05		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.2	19	0.1000	1.58		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.6	135	0.0430	1.45		**Shallow Concentrated Flow, Woods** Short Grass Pasture Kv= 7.0 fps
0.4	59	0.1520	2.73		**Shallow Concentrated Flow, Woods** Short Grass Pasture Kv= 7.0 fps
1.4	85	0.0410	1.01		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
20.1	348	Total			

Summary for Subcatchment PR-23: Overland (Offsite)

Runoff = 0.75 cfs @ 12.11 hrs, Volume= 0.057 af, Depth= 1.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

	Area (sf)	CN	Description
*	198	98	roof
*	21,719	80	grass
*	582	77	woods
	22,499	80	Weighted Average
	22,301		99.12% Pervious Area
	198		0.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	50	0.0600	0.23		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
4.0	405	0.0580	1.69		**Shallow Concentrated Flow, Woods** Short Grass Pasture Kv= 7.0 fps
7.7	455	Total			

Summary for Subcatchment PR-24: Overland

Runoff = 2.49 cfs @ 12.47 hrs, Volume= 0.332 af, Depth= 1.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

	Area (sf)	CN	Description
*	34,871	80	grass
*	82,856	77	woods
*	27,039	77	wetland - woods
	144,766	78	Weighted Average
	144,766		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	11	0.3330	0.33		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
13.8	39	0.0385	0.05		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
1.0	60	0.0417	1.02		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.1	87	0.0747	1.37		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
2.7	255	0.0500	1.57		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
12.9	547	0.0200	0.71		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
32.1	999	Total			

Summary for Subcatchment PR-31: Overland

Runoff = 4.30 cfs @ 12.47 hrs, Volume= 0.571 af, Depth= 1.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

	Area (sf)	CN	Description
	1,180	98	Unconnected roofs, HSG D
*	7,956	80	Wetland (Grass, HSG D)
	190,213	80	>75% Grass cover, Good, HSG D
	24,006	77	Woods, Good, HSG D
	2,002	73	Brush, Good, HSG D
	225,357	80	Weighted Average
	224,177		99.48% Pervious Area
	1,180		0.52% Impervious Area
	1,180		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	20	0.0500	0.18		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
14.0	30	0.0220	0.04		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
1.4	62	0.0220	0.74		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.3	24	0.0910	1.51		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.8	100	0.1000	2.21		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
0.5	47	0.0420	1.43		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
1.3	83	0.0240	1.08		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
8.4	224	0.0040	0.44		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
1.5	65	0.0100	0.70		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
2.5	105	0.0100	0.70		**Shallow Concentrated Flow, Wetland** Short Grass Pasture Kv= 7.0 fps
32.6	760	Total			

Summary for Subcatchment PR-32: Overland (Offsite)

Runoff = 0.08 cfs @ 12.15 hrs, Volume= 0.007 af, Depth= 1.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
1,717	80	>75% Grass cover, Good, HSG D
1,021	77	Woods, Good, HSG D
2,738	79	Weighted Average
2,738		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	48	0.1300	0.08		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.2	2	0.1300	0.16		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
0.3	35	0.1050	2.27		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
10.5	85	Total			

Summary for Subcatchment PR-41: Overland

Runoff = 1.09 cfs @ 12.12 hrs, Volume= 0.085 af, Depth= 1.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

	Area (sf)	CN	Description
*	1,149	96	gravel drive
*	1,331	98	pavement
*	14,404	80	grass
*	16,357	77	woods
	398	73	Brush, Good, HSG D
	33,639	80	Weighted Average
	32,308		96.04% Pervious Area
	1,331		3.96% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	10	0.0100	0.08		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
0.9	20	0.3300	0.37		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
0.8	9	0.0770	0.18		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
3.8	11	0.0770	0.05		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.8	55	0.0500	1.12		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
8.4	105	Total			

Summary for Subcatchment PR-51: Overland

Runoff = 0.99 cfs @ 12.23 hrs, Volume= 0.098 af, Depth= 1.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

	Area (sf)	CN	Description
*	136	98	roof
*	1,200	89	dirt drive
*	4,534	80	grass
*	36,872	77	woods
	42,742	78	Weighted Average
	42,606		99.68% Pervious Area
	136		0.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	10	0.0350	0.13		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
8.9	40	0.1200	0.07		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.6	66	0.1200	1.73		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
4.7	180	0.0160	0.63		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.6	39	0.0460	1.07		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
16.1	335	Total			

Summary for Subcatchment PR-61: Overland

Runoff = 1.16 cfs @ 12.38 hrs, Volume= 0.141 af, Depth= 1.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

	Area (sf)	CN	Description
*	24,517	80	grass
*	36,854	77	woods
	61,371	78	Weighted Average
	61,371		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.5	50	0.0400	0.05		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
9.7	462	0.0250	0.79		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
26.2	512	Total			

Summary for Subcatchment PR-62: Housing

Runoff = 1.76 cfs @ 12.16 hrs, Volume= 0.154 af, Depth= 2.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
21,132	98	Unconnected roofs, HSG D
17,766	80	>75% Grass cover, Good, HSG D
38,898	90	Weighted Average
17,766		45.67% Pervious Area
21,132		54.33% Impervious Area
21,132		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	50	0.0500	0.21		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
0.2	15	0.0500	1.57		**Shallow Concentrated Flow, grass** Short Grass Pasture Kv= 7.0 fps
0.1	18	0.3333	4.04		**Shallow Concentrated Flow, grass** Short Grass Pasture Kv= 7.0 fps
3.6	185	0.0150	0.86		**Shallow Concentrated Flow, grass** Short Grass Pasture Kv= 7.0 fps
4.3	400	0.0050	1.54	0.13	**Pipe Channel, pipe flow** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.013 Corrugated PE, smooth interior
12.2	668	Total			

Summary for Subcatchment PR-71: Overland

Runoff = 2.05 cfs @ 12.30 hrs, Volume= 0.224 af, Depth= 1.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

	Area (sf)	CN	Description
*	52,577	77	woods
	35,443	80	>75% Grass cover, Good, HSG D
	4,953	98	Paved parking, HSG D
	92,973	79	Weighted Average
	88,020		94.67% Pervious Area
	4,953		5.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.2	50	0.0700	0.06		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.1	5	0.0700	1.32		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.3	24	0.0400	1.40		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
1.3	84	0.0240	1.08		**Shallow Concentrated Flow, Sheet Flow** Short Grass Pasture Kv= 7.0 fps
0.6	52	0.0380	1.36		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
3.0	115	0.0086	0.65		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
0.4	31	0.0320	1.25		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
0.3	45	0.1110	2.33		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
0.2	21	0.1190	1.72		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.3	76	0.0390	0.99		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
20.7	503	Total			

Summary for Subcatchment PR-72: Overland (Offsite)

Runoff = 0.33 cfs @ 12.29 hrs, Volume= 0.035 af, Depth= 1.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

	Area (sf)	CN	Description
*	606	98	pavement
*	3,197	80	grass
*	10,761	77	woods
	14,564	79	Weighted Average
	13,958		95.84% Pervious Area
	606		4.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.1	50	0.0600	0.06		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.7	55	0.0700	1.32		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.6	71	0.0700	1.85		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
1.6	125	0.0640	1.26		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.5	23	0.0100	0.70		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
0.3	40	0.0150	2.49		**Shallow Concentrated Flow, Pavement** Paved Kv= 20.3 fps
0.3	23	0.0330	1.27		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
1.7	102	0.0400	1.00		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
19.8	489	Total			

Summary for Subcatchment PR-73: Overland (Offsite)

Runoff = 0.04 cfs @ 12.23 hrs, Volume= 0.004 af, Depth= 1.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

	Area (sf)	CN	Description
*	1,620	77	woods
	1,620		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.4	25	0.0120	0.03		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"

Summary for Pond P11: Gravel Wetland #3

Inflow Area = 10.976 ac, 45.02% Impervious, Inflow Depth = 1.90" for 2-Year event
Inflow = 23.79 cfs @ 12.10 hrs, Volume= 1.741 af
Outflow = 2.84 cfs @ 12.82 hrs, Volume= 1.535 af, Atten= 88%, Lag= 43.1 min
Primary = 2.84 cfs @ 12.82 hrs, Volume= 1.535 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 313.34' @ 12.82 hrs Surf.Area= 30,345 sf Storage= 37,952 cf

Plug-Flow detention time= 202.2 min calculated for 1.534 af (88% of inflow)
Center-of-Mass det. time= 147.5 min (964.7 - 817.2)

Volume	Invert	Avail.Storage	Storage Description
#1	309.00'	126,295 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
309.00	1,785	0	0
310.00	2,773	2,279	2,279
311.00	3,931	3,352	5,631
312.00	5,345	4,638	10,269
313.00	29,625	17,485	27,754
314.00	31,741	30,683	58,437
315.00	33,915	32,828	91,265
316.00	36,144	35,030	126,295

Device	Routing	Invert	Outlet Devices
#1	Primary	309.00'	**12.0" Round Culvert** L= 56.6' RCP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 309.00' / 308.40' S= 0.0106 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Device 1	309.00'	**8.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	311.75'	**10.0" Vert. Orifice/Grate** C= 0.600
#4	Device 2	313.00'	**12.0" Round Culvert X 0.00** L= 20.0' RCP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 313.00' / 312.80' S= 0.0100 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#5	Primary	315.50'	**4.0' long x 8.0' 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) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Primary OutFlow Max=2.84 cfs @ 12.82 hrs HW=313.34' (Free Discharge)
- **1=Culvert** (Passes 2.84 cfs of 6.54 cfs potential flow)
  - **2=Orifice/Grate** (Passes 0.00 cfs of 3.36 cfs potential flow)
    - **4=Culvert** (Controls 0.00 cfs)
  - **3=Orifice/Grate** (Orifice Controls 2.84 cfs @ 5.22 fps)
- **5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P13: Gravel Wetland #1

Inflow Area = 3.545 ac, 44.45% Impervious, Inflow Depth = 1.91" for 2-Year event
Inflow = 6.02 cfs @ 12.20 hrs, Volume= 0.563 af
Outflow = 1.75 cfs @ 12.66 hrs, Volume= 0.498 af, Atten= 71%, Lag= 27.4 min
Primary = 1.75 cfs @ 12.66 hrs, Volume= 0.498 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 318.27' @ 12.66 hrs Surf.Area= 7,608 sf Storage= 10,238 cf

Plug-Flow detention time= 136.5 min calculated for 0.498 af (88% of inflow)
Center-of-Mass det. time= 82.1 min (906.6 - 824.5)

Volume	Invert	Avail.Storage	Storage Description
#1	315.00'	25,384 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
315.00	732	0	0
316.00	1,538	1,135	1,135
317.00	2,713	2,126	3,261
318.00	7,244	4,979	8,239
319.00	8,596	7,920	16,159
320.00	9,854	9,225	25,384

Device	Routing	Invert	Outlet Devices
#1	Primary	315.00'	**12.0" Round Culvert** L= 20.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 315.00' / 314.80' S= 0.0100 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Device 1	316.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	316.85'	**8.0" Vert. Orifice/Grate** C= 0.600
#4	Device 2	318.00'	**12.0" Round Culvert X 0.00** L= 10.0' RCP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 318.00' / 317.90' S= 0.0100 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#5	Primary	319.00'	**8.0' long x 4.0' 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) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=1.75 cfs @ 12.66 hrs HW=318.27' (Free Discharge)
└─**1=Culvert** (Passes 1.75 cfs of 7.71 cfs potential flow)
  └─**2=Orifice/Grate** (Passes 0.00 cfs of 1.34 cfs potential flow)
    └─**4=Culvert** (Controls 0.00 cfs)
  └─**3=Orifice/Grate** (Orifice Controls 1.75 cfs @ 5.02 fps)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P21: Gravel Wetland #2

Inflow Area = 3.645 ac, 57.34% Impervious, Inflow Depth = 2.08" for 2-Year event
Inflow = 8.37 cfs @ 12.10 hrs, Volume= 0.631 af
Outflow = 0.79 cfs @ 13.06 hrs, Volume= 0.437 af, Atten= 91%, Lag= 57.1 min
Primary = 0.79 cfs @ 13.06 hrs, Volume= 0.437 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 303.49' @ 13.06 hrs Surf.Area= 8,814 sf Storage= 15,705 cf

Plug-Flow detention time= 302.6 min calculated for 0.437 af (69% of inflow)
Center-of-Mass det. time= 208.5 min (1,017.9 - 809.4)

Volume	Invert	Avail.Storage	Storage Description
#1	299.00'	41,844 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
299.00	714	0	0
300.00	1,434	1,074	1,074
301.00	2,271	1,853	2,927
302.00	3,362	2,817	5,743
303.00	8,208	5,785	11,528
304.00	9,442	8,825	20,353
305.00	10,731	10,087	30,440
306.00	12,077	11,404	41,844

Device	Routing	Invert	Outlet Devices
#1	Primary	299.00'	**12.0" Round Culvert** L= 28.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 299.00' / 298.70' S= 0.0107 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Device 1	299.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	302.55'	**6.0" Vert. Orifice/Grate** C= 0.600
#4	Device 2	305.00'	**12.0" Round Culvert** L= 6.0' RCP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 305.00' / 304.90' S= 0.0167 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#5	Primary	306.00'	**4.0' long x 8.0' 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) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Primary OutFlow Max=0.79 cfs @ 13.06 hrs HW=303.49' (Free Discharge)
└─**1=Culvert** (Passes 0.79 cfs of 9.07 cfs potential flow)
  └─**2=Orifice/Grate** (Passes 0.00 cfs of 1.95 cfs potential flow)
    └─**4=Culvert** (Controls 0.00 cfs)
  └─**3=Orifice/Grate** (Orifice Controls 0.79 cfs @ 4.00 fps)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P62: Detention Basin #1

Inflow Area = 0.893 ac, 54.33% Impervious, Inflow Depth = 2.08" for 2-Year event
Inflow = 1.76 cfs @ 12.16 hrs, Volume= 0.154 af
Outflow = 1.25 cfs @ 12.30 hrs, Volume= 0.154 af, Atten= 29%, Lag= 8.0 min
Primary = 1.25 cfs @ 12.30 hrs, Volume= 0.154 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 332.59' @ 12.30 hrs Surf.Area= 2,265 sf Storage= 1,211 cf

Plug-Flow detention time= 40.1 min calculated for 0.154 af (100% of inflow)
Center-of-Mass det. time= 40.3 min (854.2 - 813.9)

Volume	Invert	Avail.Storage	Storage Description
#1	332.00'	8,890 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
332.00	1,844	0	0
333.00	2,559	2,202	2,202
334.00	3,330	2,945	5,146
335.00	4,158	3,744	8,890

Device	Routing	Invert	Outlet Devices
#1	Primary	332.00'	**12.0" Round Culvert** L= 25.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 332.00' / 331.75' S= 0.0100 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Primary	334.50'	**4.0' long x 8.0' 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) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Primary OutFlow Max=1.25 cfs @ 12.30 hrs HW=332.59' (Free Discharge)
1=Culvert (Barrel Controls 1.25 cfs @ 3.74 fps)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Link DP-1: Wetland #1

Inflow Area = 20.667 ac, 31.80% Impervious, Inflow Depth = 1.56" for 2-Year event
Inflow = 9.71 cfs @ 12.41 hrs, Volume= 2.679 af
Primary = 9.71 cfs @ 12.41 hrs, Volume= 2.679 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link DP-2: Wetland #2

Inflow Area = 8.071 ac, 26.34% Impervious, Inflow Depth > 1.32" for 2-Year event
Inflow = 3.94 cfs @ 12.44 hrs, Volume= 0.888 af
Primary = 3.94 cfs @ 12.44 hrs, Volume= 0.888 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link DP-3: Wetland #3

Inflow Area = 5.236 ac, 0.52% Impervious, Inflow Depth = 1.32" for 2-Year event
Inflow = 4.33 cfs @ 12.47 hrs, Volume= 0.578 af
Primary = 4.33 cfs @ 12.47 hrs, Volume= 0.578 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link DP-4: Eliot Street

Inflow Area = 0.772 ac, 3.96% Impervious, Inflow Depth = 1.33" for 2-Year event
Inflow = 1.09 cfs @ 12.12 hrs, Volume= 0.085 af
Primary = 1.09 cfs @ 12.12 hrs, Volume= 0.085 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link DP-5: (Offsite Southeast)

Inflow Area = 0.981 ac, 0.32% Impervious, Inflow Depth = 1.20" for 2-Year event
Inflow = 0.99 cfs @ 12.23 hrs, Volume= 0.098 af
Primary = 0.99 cfs @ 12.23 hrs, Volume= 0.098 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link DP-6: Prospect Heights

Inflow Area = 2.302 ac, 21.08% Impervious, Inflow Depth = 1.54" for 2-Year event
Inflow = 2.37 cfs @ 12.34 hrs, Volume= 0.295 af
Primary = 2.37 cfs @ 12.34 hrs, Volume= 0.295 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link DP-7: Chestnut Street

Inflow Area = 2.506 ac, 5.09% Impervious, Inflow Depth = 1.26" for 2-Year event
Inflow = 2.41 cfs @ 12.30 hrs, Volume= 0.263 af
Primary = 2.41 cfs @ 12.30 hrs, Volume= 0.263 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentPR-11: Housing Runoff Area=475,007 sf 45.31% Impervious Runoff Depth=3.20"
Flow Length=1,594' Tc=6.7 min CN=88 Runoff=39.19 cfs 2.904 af

SubcatchmentPR-12: Overland Runoff Area=267,695 sf 0.89% Impervious Runoff Depth=2.38"
Flow Length=701' Tc=26.3 min CN=79 Runoff=10.28 cfs 1.217 af

SubcatchmentPR-13: Housing Runoff Area=154,430 sf 44.45% Impervious Runoff Depth=3.20"
Flow Length=678' Tc=14.8 min CN=88 Runoff=9.96 cfs 0.944 af

SubcatchmentPR-14: Overland (Offsite) Runoff Area=3,104 sf 0.00% Impervious Runoff Depth=2.46"
Flow Length=87' Slope=0.0520 '/' Tc=15.4 min CN=80 Runoff=0.15 cfs 0.015 af

SubcatchmentPR-21: Housing Runoff Area=158,766 sf 57.34% Impervious Runoff Depth=3.40"
Flow Length=556' Tc=7.4 min CN=90 Runoff=13.43 cfs 1.031 af

SubcatchmentPR-22: Overland (Offsite) Runoff Area=25,532 sf 5.37% Impervious Runoff Depth=2.38"
Flow Length=348' Tc=20.1 min UI Adjusted CN=79 Runoff=1.10 cfs 0.116 af

SubcatchmentPR-23: Overland (Offsite) Runoff Area=22,499 sf 0.88% Impervious Runoff Depth=2.46"
Flow Length=455' Tc=7.7 min CN=80 Runoff=1.41 cfs 0.106 af

SubcatchmentPR-24: Overland Runoff Area=144,766 sf 0.00% Impervious Runoff Depth=2.29"
Flow Length=999' Tc=32.1 min CN=78 Runoff=4.89 cfs 0.635 af

SubcatchmentPR-31: Overland Runoff Area=225,357 sf 0.52% Impervious Runoff Depth=2.46"
Flow Length=760' Tc=32.6 min CN=80 Runoff=8.11 cfs 1.061 af

SubcatchmentPR-32: Overland (Offsite) Runoff Area=2,738 sf 0.00% Impervious Runoff Depth=2.38"
Flow Length=85' Tc=10.5 min CN=79 Runoff=0.15 cfs 0.012 af

SubcatchmentPR-41: Overland Runoff Area=33,639 sf 3.96% Impervious Runoff Depth=2.46"
Flow Length=105' Tc=8.4 min CN=80 Runoff=2.05 cfs 0.158 af

SubcatchmentPR-51: Overland Runoff Area=42,742 sf 0.32% Impervious Runoff Depth=2.29"
Flow Length=335' Tc=16.1 min CN=78 Runoff=1.94 cfs 0.187 af

SubcatchmentPR-61: Overland Runoff Area=61,371 sf 0.00% Impervious Runoff Depth=2.29"
Flow Length=512' Tc=26.2 min CN=78 Runoff=2.27 cfs 0.269 af

SubcatchmentPR-62: Housing Runoff Area=38,898 sf 54.33% Impervious Runoff Depth=3.40"
Flow Length=668' Tc=12.2 min CN=90 Runoff=2.83 cfs 0.253 af

SubcatchmentPR-71: Overland Runoff Area=92,973 sf 5.33% Impervious Runoff Depth=2.38"
Flow Length=503' Tc=20.7 min CN=79 Runoff=3.94 cfs 0.423 af

SubcatchmentPR-72: Overland (Offsite) Runoff Area=14,564 sf 4.16% Impervious Runoff Depth=2.38"
Flow Length=489' Tc=19.8 min CN=79 Runoff=0.63 cfs 0.066 af

Subcatchment PR-73: Overland (Offsite) Runoff Area=1,620 sf 0.00% Impervious Runoff Depth=2.21"
Flow Length=25' Slope=0.0120 '/' Tc=15.4 min CN=77 Runoff=0.07 cfs 0.007 af

Pond P11: Gravel Wetland #3 Peak Elev=314.24' Storage=66,095 cf Inflow=39.30 cfs 2.919 af
Outflow=3.78 cfs 2.713 af

Pond P13: Gravel Wetland #1 Peak Elev=319.10' Storage=17,044 cf Inflow=9.96 cfs 0.944 af
Outflow=2.95 cfs 0.878 af

Pond P21: Gravel Wetland #2 Peak Elev=304.58' Storage=26,044 cf Inflow=13.43 cfs 1.031 af
Outflow=1.26 cfs 0.838 af

Pond P62: Detention Basin #1 Peak Elev=332.81' Storage=1,732 cf Inflow=2.83 cfs 0.253 af
Outflow=2.08 cfs 0.253 af

Link DP-1: Wetland #1 Inflow=16.03 cfs 4.808 af
Primary=16.03 cfs 4.808 af

Link DP-2: Wetland #2 Inflow=7.47 cfs 1.695 af
Primary=7.47 cfs 1.695 af

Link DP-3: Wetland #3 Inflow=8.18 cfs 1.074 af
Primary=8.18 cfs 1.074 af

Link DP-4: Eliot Street Inflow=2.05 cfs 0.158 af
Primary=2.05 cfs 0.158 af

Link DP-5: (Offsite Southeast) Inflow=1.94 cfs 0.187 af
Primary=1.94 cfs 0.187 af

Link DP-6: Prospect Heights Inflow=4.28 cfs 0.522 af
Primary=4.28 cfs 0.522 af

Link DP-7: Chestnut Street Inflow=4.64 cfs 0.496 af
Primary=4.64 cfs 0.496 af

Total Runoff Area = 40.535 ac Runoff Volume = 9.406 af Average Runoff Depth = 2.78"
76.88% Pervious = 31.164 ac 23.12% Impervious = 9.371 ac

Summary for Subcatchment PR-11: Housing

Runoff = 39.19 cfs @ 12.10 hrs, Volume= 2.904 af, Depth= 3.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
105,642	98	Paved parking, HSG D
109,581	98	Unconnected roofs, HSG D
250,927	80	>75% Grass cover, Good, HSG D
8,857	77	Woods, Good, HSG D
475,007	88	Weighted Average
259,784		54.69% Pervious Area
215,223		45.31% Impervious Area
109,581		50.92% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	50	0.0170	1.10		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 3.10"
1.1	150	0.0133	2.34		**Shallow Concentrated Flow, pavement** Paved Kv= 20.3 fps
0.4	62	0.0161	2.58		**Shallow Concentrated Flow, pavement** Paved Kv= 20.3 fps
0.0	12	0.0085	4.94	3.88	**Pipe Channel, pipe flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011 Concrete pipe, straight & clean
0.3	60	0.0050	3.79	2.98	**Pipe Channel, pipe flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
0.5	114	0.0053	3.90	3.07	**Pipe Channel, Pipe Flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
0.5	120	0.0050	3.79	2.98	**Pipe Channel, Pipe Flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
1.0	228	0.0050	3.79	2.98	**Pipe Channel, ipe flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
0.4	201	0.0266	8.74	6.87	**Pipe Channel, pipe flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
0.4	234	0.0322	9.62	7.56	**Pipe Channel, pipe flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
0.7	166	0.0051	3.83	3.01	**Pipe Channel, pipe flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
0.4	87	0.0057	4.05	3.18	**Pipe Channel, pipe flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25'

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
n= 0.011					
0.2	110	0.0090	8.07	25.36	**Pipe Channel, pipe flow** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.011
6.7	1,594	Total			

Summary for Subcatchment PR-12: Overland

Runoff = 10.28 cfs @ 12.36 hrs, Volume= 1.217 af, Depth= 2.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

	Area (sf)	CN	Description
*	564	98	roof
*	1,821	98	pavement
*	119,319	80	grass
*	68,895	77	woods
*	77,096	77	wetland - woods
	267,695	79	Weighted Average
	265,310		99.11% Pervious Area
	2,385		0.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	6	0.3300	0.29		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
0.9	7	0.0450	0.14		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
12.4	37	0.0450	0.05		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
12.7	651	0.0290	0.85		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
26.3	701	Total			

Summary for Subcatchment PR-13: Housing

Runoff = 9.96 cfs @ 12.20 hrs, Volume= 0.944 af, Depth= 3.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
27,749	98	Paved parking, HSG D
40,892	98	Unconnected roofs, HSG D
85,789	80	>75% Grass cover, Good, HSG D
154,430	88	Weighted Average
85,789		55.55% Pervious Area
68,641		44.45% Impervious Area
40,892		59.57% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	50	0.0466	0.20		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
0.2	16	0.0625	1.75		**Shallow Concentrated Flow, grass** Short Grass Pasture Kv= 7.0 fps
0.0	6	0.3300	4.02		**Shallow Concentrated Flow, grass** Short Grass Pasture Kv= 7.0 fps
2.3	123	0.0160	0.89		**Shallow Concentrated Flow, grass** Short Grass Pasture Kv= 7.0 fps
0.6	52	0.0400	1.40		**Shallow Concentrated Flow, grass** Short Grass Pasture Kv= 7.0 fps
0.1	8	0.1250	2.47		**Shallow Concentrated Flow, grass** Short Grass Pasture Kv= 7.0 fps
6.5	192	0.0050	0.49		**Shallow Concentrated Flow, grass** Short Grass Pasture Kv= 7.0 fps
0.6	54	0.0050	1.54	0.13	**Pipe Channel, pipe flow** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.013 Corrugated PE, smooth interior
0.2	105	0.0138	7.31	8.97	**Pipe Channel, pipe flow** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.011
0.2	72	0.0152	7.67	9.41	**Pipe Channel, pipe flow** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.011
14.8	678	Total			

Summary for Subcatchment PR-14: Overland (Offsite)

Runoff = 0.15 cfs @ 12.21 hrs, Volume= 0.015 af, Depth= 2.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

	Area (sf)	CN	Description
*	3,104	80	woods
	3,104		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	50	0.0520	0.06		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.5	37	0.0520	1.14		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
15.4	87	Total			

Summary for Subcatchment PR-21: Housing

Runoff = 13.43 cfs @ 12.10 hrs, Volume= 1.031 af, Depth= 3.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
51,916	98	Unconnected roofs, HSG D
39,125	98	Paved parking, HSG D
67,725	80	>75% Grass cover, Good, HSG D
158,766	90	Weighted Average
67,725		42.66% Pervious Area
91,041		57.34% Impervious Area
51,916		57.02% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	50	0.0500	0.21		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
0.4	46	0.0650	1.78		**Shallow Concentrated Flow, grass** Short Grass Pasture Kv= 7.0 fps
0.1	16	0.3333	4.04		**Shallow Concentrated Flow, grass** Short Grass Pasture Kv= 7.0 fps
1.3	75	0.0200	0.99		**Shallow Concentrated Flow, grass** Short Grass Pasture Kv= 7.0 fps
0.1	25	0.0200	2.87		**Shallow Concentrated Flow, pavement** Paved Kv= 20.3 fps
0.1	12	0.0050	3.79	2.98	**Pipe Channel, pipe flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
0.1	33	0.0050	3.79	2.98	**Pipe Channel, pipe flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
0.7	168	0.0050	3.79	2.98	**Pipe Channel, pipe flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
0.4	91	0.0051	3.83	3.01	**Pipe Channel, pipe flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
0.2	40	0.0050	3.79	2.98	**Pipe Channel, pipe flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
7.4	556	Total			

Summary for Subcatchment PR-22: Overland (Offsite)

Runoff = 1.10 cfs @ 12.28 hrs, Volume= 0.116 af, Depth= 2.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Adj	Description
1,040	98		Unconnected roofs, HSG D
331	98		Unconnected pavement, HSG D
12,989	80		>75% Grass cover, Good, HSG D
11,172	77		Woods, Good, HSG D
25,532	80	79	Weighted Average, UI Adjusted
24,161			94.63% Pervious Area
1,371			5.37% Impervious Area
1,371			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.5	50	0.0400	0.05		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.2	19	0.1000	1.58		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.6	135	0.0430	1.45		**Shallow Concentrated Flow, Woods** Short Grass Pasture Kv= 7.0 fps
0.4	59	0.1520	2.73		**Shallow Concentrated Flow, Woods** Short Grass Pasture Kv= 7.0 fps
1.4	85	0.0410	1.01		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
20.1	348	Total			

Summary for Subcatchment PR-23: Overland (Offsite)

Runoff = 1.41 cfs @ 12.11 hrs, Volume= 0.106 af, Depth= 2.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

	Area (sf)	CN	Description
*	198	98	roof
*	21,719	80	grass
*	582	77	woods
	22,499	80	Weighted Average
	22,301		99.12% Pervious Area
	198		0.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	50	0.0600	0.23		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
4.0	405	0.0580	1.69		**Shallow Concentrated Flow, Woods** Short Grass Pasture Kv= 7.0 fps
7.7	455	Total			

Summary for Subcatchment PR-24: Overland

Runoff = 4.89 cfs @ 12.45 hrs, Volume= 0.635 af, Depth= 2.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

	Area (sf)	CN	Description
*	34,871	80	grass
*	82,856	77	woods
*	27,039	77	wetland - woods
	144,766	78	Weighted Average
	144,766		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	11	0.3330	0.33		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
13.8	39	0.0385	0.05		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
1.0	60	0.0417	1.02		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.1	87	0.0747	1.37		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
2.7	255	0.0500	1.57		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
12.9	547	0.0200	0.71		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
32.1	999	Total			

Summary for Subcatchment PR-31: Overland

Runoff = 8.11 cfs @ 12.46 hrs, Volume= 1.061 af, Depth= 2.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

	Area (sf)	CN	Description
	1,180	98	Unconnected roofs, HSG D
*	7,956	80	Wetland (Grass, HSG D)
	190,213	80	>75% Grass cover, Good, HSG D
	24,006	77	Woods, Good, HSG D
	2,002	73	Brush, Good, HSG D
	225,357	80	Weighted Average
	224,177		99.48% Pervious Area
	1,180		0.52% Impervious Area
	1,180		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	20	0.0500	0.18		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
14.0	30	0.0220	0.04		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
1.4	62	0.0220	0.74		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.3	24	0.0910	1.51		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.8	100	0.1000	2.21		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
0.5	47	0.0420	1.43		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
1.3	83	0.0240	1.08		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
8.4	224	0.0040	0.44		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
1.5	65	0.0100	0.70		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
2.5	105	0.0100	0.70		**Shallow Concentrated Flow, Wetland** Short Grass Pasture Kv= 7.0 fps
32.6	760	Total			

Summary for Subcatchment PR-32: Overland (Offsite)

Runoff = 0.15 cfs @ 12.15 hrs, Volume= 0.012 af, Depth= 2.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
1,717	80	>75% Grass cover, Good, HSG D
1,021	77	Woods, Good, HSG D
2,738	79	Weighted Average
2,738		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	48	0.1300	0.08		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.2	2	0.1300	0.16		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
0.3	35	0.1050	2.27		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
10.5	85	Total			

Summary for Subcatchment PR-41: Overland

Runoff = 2.05 cfs @ 12.12 hrs, Volume= 0.158 af, Depth= 2.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

	Area (sf)	CN	Description
*	1,149	96	gravel drive
*	1,331	98	pavement
*	14,404	80	grass
*	16,357	77	woods
	398	73	Brush, Good, HSG D
	33,639	80	Weighted Average
	32,308		96.04% Pervious Area
	1,331		3.96% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	10	0.0100	0.08		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
0.9	20	0.3300	0.37		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
0.8	9	0.0770	0.18		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
3.8	11	0.0770	0.05		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.8	55	0.0500	1.12		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
8.4	105	Total			

Summary for Subcatchment PR-51: Overland

Runoff = 1.94 cfs @ 12.22 hrs, Volume= 0.187 af, Depth= 2.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

	Area (sf)	CN	Description
*	136	98	roof
*	1,200	89	dirt drive
*	4,534	80	grass
*	36,872	77	woods
	42,742	78	Weighted Average
	42,606		99.68% Pervious Area
	136		0.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	10	0.0350	0.13		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
8.9	40	0.1200	0.07		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.6	66	0.1200	1.73		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
4.7	180	0.0160	0.63		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.6	39	0.0460	1.07		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
16.1	335	Total			

Summary for Subcatchment PR-61: Overland

Runoff = 2.27 cfs @ 12.37 hrs, Volume= 0.269 af, Depth= 2.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

	Area (sf)	CN	Description
*	24,517	80	grass
*	36,854	77	woods
	61,371	78	Weighted Average
	61,371		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.5	50	0.0400	0.05		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
9.7	462	0.0250	0.79		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
26.2	512	Total			

Summary for Subcatchment PR-62: Housing

Runoff = 2.83 cfs @ 12.16 hrs, Volume= 0.253 af, Depth= 3.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

	Area (sf)	CN	Description
	21,132	98	Unconnected roofs, HSG D
	17,766	80	>75% Grass cover, Good, HSG D
	38,898	90	Weighted Average
	17,766		45.67% Pervious Area
	21,132		54.33% Impervious Area
	21,132		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	50	0.0500	0.21		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
0.2	15	0.0500	1.57		**Shallow Concentrated Flow, grass** Short Grass Pasture Kv= 7.0 fps
0.1	18	0.3333	4.04		**Shallow Concentrated Flow, grass** Short Grass Pasture Kv= 7.0 fps
3.6	185	0.0150	0.86		**Shallow Concentrated Flow, grass** Short Grass Pasture Kv= 7.0 fps
4.3	400	0.0050	1.54	0.13	**Pipe Channel, pipe flow** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.013 Corrugated PE, smooth interior
12.2	668	Total			

Summary for Subcatchment PR-71: Overland

Runoff = 3.94 cfs @ 12.29 hrs, Volume= 0.423 af, Depth= 2.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

	Area (sf)	CN	Description
*	52,577	77	woods
	35,443	80	>75% Grass cover, Good, HSG D
	4,953	98	Paved parking, HSG D
	92,973	79	Weighted Average
	88,020		94.67% Pervious Area
	4,953		5.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.2	50	0.0700	0.06		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.1	5	0.0700	1.32		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.3	24	0.0400	1.40		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
1.3	84	0.0240	1.08		**Shallow Concentrated Flow, Sheet Flow** Short Grass Pasture Kv= 7.0 fps
0.6	52	0.0380	1.36		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
3.0	115	0.0086	0.65		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
0.4	31	0.0320	1.25		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
0.3	45	0.1110	2.33		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
0.2	21	0.1190	1.72		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.3	76	0.0390	0.99		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
20.7	503	Total			

Summary for Subcatchment PR-72: Overland (Offsite)

Runoff = 0.63 cfs @ 12.28 hrs, Volume= 0.066 af, Depth= 2.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

	Area (sf)	CN	Description
*	606	98	pavement
*	3,197	80	grass
*	10,761	77	woods
	14,564	79	Weighted Average
	13,958		95.84% Pervious Area
	606		4.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.1	50	0.0600	0.06		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.7	55	0.0700	1.32		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.6	71	0.0700	1.85		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
1.6	125	0.0640	1.26		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.5	23	0.0100	0.70		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
0.3	40	0.0150	2.49		**Shallow Concentrated Flow, Pavement** Paved Kv= 20.3 fps
0.3	23	0.0330	1.27		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
1.7	102	0.0400	1.00		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
19.8	489	Total			

Summary for Subcatchment PR-73: Overland (Offsite)

Runoff = 0.07 cfs @ 12.21 hrs, Volume= 0.007 af, Depth= 2.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

	Area (sf)	CN	Description
*	1,620	77	woods
	1,620		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.4	25	0.0120	0.03		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"

Summary for Pond P11: Gravel Wetland #3

Inflow Area = 10.976 ac, 45.02% Impervious, Inflow Depth = 3.19" for 10-Year event
Inflow = 39.30 cfs @ 12.10 hrs, Volume= 2.919 af
Outflow = 3.78 cfs @ 12.99 hrs, Volume= 2.713 af, Atten= 90%, Lag= 53.4 min
Primary = 3.78 cfs @ 12.99 hrs, Volume= 2.713 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 314.24' @ 12.99 hrs Surf.Area= 32,261 sf Storage= 66,095 cf

Plug-Flow detention time= 233.8 min calculated for 2.713 af (93% of inflow)
Center-of-Mass det. time= 196.6 min (999.1 - 802.6)

Volume	Invert	Avail.Storage	Storage Description
#1	309.00'	126,295 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
309.00	1,785	0	0
310.00	2,773	2,279	2,279
311.00	3,931	3,352	5,631
312.00	5,345	4,638	10,269
313.00	29,625	17,485	27,754
314.00	31,741	30,683	58,437
315.00	33,915	32,828	91,265
316.00	36,144	35,030	126,295

Device	Routing	Invert	Outlet Devices
#1	Primary	309.00'	**12.0" Round Culvert** L= 56.6' RCP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 309.00' / 308.40' S= 0.0106 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Device 1	309.00'	**8.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	311.75'	**10.0" Vert. Orifice/Grate** C= 0.600
#4	Device 2	313.00'	**12.0" Round Culvert X 0.00** L= 20.0' RCP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 313.00' / 312.80' S= 0.0100 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#5	Primary	315.50'	**4.0' long x 8.0' 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) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Primary OutFlow Max=3.78 cfs @ 12.99 hrs HW=314.24' (Free Discharge)
- **1=Culvert** (Passes 3.78 cfs of 7.26 cfs potential flow)
  - **2=Orifice/Grate** (Passes 0.00 cfs of 3.72 cfs potential flow)
    - **4=Culvert** (Controls 0.00 cfs)
  - **3=Orifice/Grate** (Orifice Controls 3.78 cfs @ 6.93 fps)
- **5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P13: Gravel Wetland #1

Inflow Area = 3.545 ac, 44.45% Impervious, Inflow Depth = 3.20" for 10-Year event
Inflow = 9.96 cfs @ 12.20 hrs, Volume= 0.944 af
Outflow = 2.95 cfs @ 12.64 hrs, Volume= 0.878 af, Atten= 70%, Lag= 26.6 min
Primary = 2.95 cfs @ 12.64 hrs, Volume= 0.878 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 319.10' @ 12.64 hrs Surf.Area= 8,725 sf Storage= 17,044 cf

Plug-Flow detention time= 124.8 min calculated for 0.878 af (93% of inflow)
Center-of-Mass det. time= 88.0 min (897.9 - 809.9)

Volume	Invert	Avail.Storage	Storage Description
#1	315.00'	25,384 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
315.00	732	0	0
316.00	1,538	1,135	1,135
317.00	2,713	2,126	3,261
318.00	7,244	4,979	8,239
319.00	8,596	7,920	16,159
320.00	9,854	9,225	25,384

Device	Routing	Invert	Outlet Devices
#1	Primary	315.00'	**12.0" Round Culvert** L= 20.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 315.00' / 314.80' S= 0.0100 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Device 1	316.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	316.85'	**8.0" Vert. Orifice/Grate** C= 0.600
#4	Device 2	318.00'	**12.0" Round Culvert X 0.00** L= 10.0' RCP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 318.00' / 317.90' S= 0.0100 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#5	Primary	319.00'	**8.0' long x 4.0' 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) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=2.95 cfs @ 12.64 hrs HW=319.10' (Free Discharge)
↑—**1=Culvert** (Passes 2.33 cfs of 8.92 cfs potential flow)
  ↑—**2=Orifice/Grate** (Passes 0.00 cfs of 1.60 cfs potential flow)
    ↑—**4=Culvert** (Controls 0.00 cfs)
  └—**3=Orifice/Grate** (Orifice Controls 2.33 cfs @ 6.67 fps)
└—**5=Broad-Crested Rectangular Weir** (Weir Controls 0.62 cfs @ 0.76 fps)

Summary for Pond P21: Gravel Wetland #2

Inflow Area = 3.645 ac, 57.34% Impervious, Inflow Depth = 3.40" for 10-Year event
Inflow = 13.43 cfs @ 12.10 hrs, Volume= 1.031 af
Outflow = 1.26 cfs @ 13.02 hrs, Volume= 0.838 af, Atten= 91%, Lag= 54.8 min
Primary = 1.26 cfs @ 13.02 hrs, Volume= 0.838 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 304.58' @ 13.02 hrs Surf.Area= 10,189 sf Storage= 26,044 cf

Plug-Flow detention time= 301.4 min calculated for 0.838 af (81% of inflow)
Center-of-Mass det. time= 228.8 min (1,024.5 - 795.7)

Volume	Invert	Avail.Storage	Storage Description
#1	299.00'	41,844 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
299.00	714	0	0
300.00	1,434	1,074	1,074
301.00	2,271	1,853	2,927
302.00	3,362	2,817	5,743
303.00	8,208	5,785	11,528
304.00	9,442	8,825	20,353
305.00	10,731	10,087	30,440
306.00	12,077	11,404	41,844

Device	Routing	Invert	Outlet Devices
#1	Primary	299.00'	**12.0" Round Culvert** L= 28.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 299.00' / 298.70' S= 0.0107 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Device 1	299.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	302.55'	**6.0" Vert. Orifice/Grate** C= 0.600
#4	Device 2	305.00'	**12.0" Round Culvert** L= 6.0' RCP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 305.00' / 304.90' S= 0.0167 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#5	Primary	306.00'	**4.0' long x 8.0' 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) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Primary OutFlow Max=1.26 cfs @ 13.02 hrs HW=304.58' (Free Discharge)
1=Culvert (Passes 1.26 cfs of 10.29 cfs potential flow)
2=Orifice/Grate (Passes 0.00 cfs of 2.18 cfs potential flow)
4=Culvert (Controls 0.00 cfs)
3=Orifice/Grate (Orifice Controls 1.26 cfs @ 6.42 fps)
5=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond P62: Detention Basin #1

Inflow Area = 0.893 ac, 54.33% Impervious, Inflow Depth = 3.40" for 10-Year event
Inflow = 2.83 cfs @ 12.16 hrs, Volume= 0.253 af
Outflow = 2.08 cfs @ 12.28 hrs, Volume= 0.253 af, Atten= 27%, Lag= 7.2 min
Primary = 2.08 cfs @ 12.28 hrs, Volume= 0.253 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 332.81' @ 12.28 hrs Surf.Area= 2,424 sf Storage= 1,732 cf

Plug-Flow detention time= 32.8 min calculated for 0.253 af (100% of inflow)
Center-of-Mass det. time= 33.0 min (833.1 - 800.1)

Volume	Invert	Avail.Storage	Storage Description
#1	332.00'	8,890 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
332.00	1,844	0	0
333.00	2,559	2,202	2,202
334.00	3,330	2,945	5,146
335.00	4,158	3,744	8,890

Device	Routing	Invert	Outlet Devices
#1	Primary	332.00'	**12.0" Round Culvert** L= 25.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 332.00' / 331.75' S= 0.0100 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Primary	334.50'	**4.0' long x 8.0' 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) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Primary OutFlow Max=2.08 cfs @ 12.28 hrs HW=332.81' (Free Discharge)
1=Culvert (Barrel Controls 2.08 cfs @ 4.16 fps)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Link DP-1: Wetland #1

Inflow Area = 20.667 ac, 31.80% Impervious, Inflow Depth = 2.79" for 10-Year event
Inflow = 16.03 cfs @ 12.38 hrs, Volume= 4.808 af
Primary = 16.03 cfs @ 12.38 hrs, Volume= 4.808 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link DP-2: Wetland #2

Inflow Area = 8.071 ac, 26.34% Impervious, Inflow Depth > 2.52" for 10-Year event
Inflow = 7.47 cfs @ 12.41 hrs, Volume= 1.695 af
Primary = 7.47 cfs @ 12.41 hrs, Volume= 1.695 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link DP-3: Wetland #3

Inflow Area = 5.236 ac, 0.52% Impervious, Inflow Depth = 2.46" for 10-Year event
Inflow = 8.18 cfs @ 12.46 hrs, Volume= 1.074 af
Primary = 8.18 cfs @ 12.46 hrs, Volume= 1.074 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link DP-4: Eliot Street

Inflow Area =	0.772 ac,	3.96% Impervious,	Inflow Depth = 2.46"	for 10-Year event
Inflow =	2.05 cfs @	12.12 hrs, Volume=	0.158 af	
Primary =	2.05 cfs @	12.12 hrs, Volume=	0.158 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link DP-5: (Offsite Southeast)

Inflow Area =	0.981 ac,	0.32% Impervious,	Inflow Depth = 2.29"	for 10-Year event
Inflow =	1.94 cfs @	12.22 hrs, Volume=	0.187 af	
Primary =	1.94 cfs @	12.22 hrs, Volume=	0.187 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link DP-6: Prospect Heights

Inflow Area =	2.302 ac,	21.08% Impervious,	Inflow Depth = 2.72"	for 10-Year event
Inflow =	4.28 cfs @	12.33 hrs, Volume=	0.522 af	
Primary =	4.28 cfs @	12.33 hrs, Volume=	0.522 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link DP-7: Chestnut Street

Inflow Area =	2.506 ac,	5.09% Impervious,	Inflow Depth = 2.37"	for 10-Year event
Inflow =	4.64 cfs @	12.28 hrs, Volume=	0.496 af	
Primary =	4.64 cfs @	12.28 hrs, Volume=	0.496 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentPR-11: Housing Runoff Area=475,007 sf 45.31% Impervious Runoff Depth=3.95"
Flow Length=1,594' Tc=6.7 min CN=88 Runoff=48.04 cfs 3.594 af

SubcatchmentPR-12: Overland Runoff Area=267,695 sf 0.89% Impervious Runoff Depth=3.06"
Flow Length=701' Tc=26.3 min CN=79 Runoff=13.26 cfs 1.568 af

SubcatchmentPR-13: Housing Runoff Area=154,430 sf 44.45% Impervious Runoff Depth=3.95"
Flow Length=678' Tc=14.8 min CN=88 Runoff=12.23 cfs 1.168 af

SubcatchmentPR-14: Overland (Offsite) Runoff Area=3,104 sf 0.00% Impervious Runoff Depth=3.16"
Flow Length=87' Slope=0.0520 '/' Tc=15.4 min CN=80 Runoff=0.20 cfs 0.019 af

SubcatchmentPR-21: Housing Runoff Area=158,766 sf 57.34% Impervious Runoff Depth=4.17"
Flow Length=556' Tc=7.4 min CN=90 Runoff=16.31 cfs 1.265 af

SubcatchmentPR-22: Overland (Offsite) Runoff Area=25,532 sf 5.37% Impervious Runoff Depth=3.06"
Flow Length=348' Tc=20.1 min UI Adjusted CN=79 Runoff=1.41 cfs 0.150 af

SubcatchmentPR-23: Overland (Offsite) Runoff Area=22,499 sf 0.88% Impervious Runoff Depth=3.16"
Flow Length=455' Tc=7.7 min CN=80 Runoff=1.80 cfs 0.136 af

SubcatchmentPR-24: Overland Runoff Area=144,766 sf 0.00% Impervious Runoff Depth=2.97"
Flow Length=999' Tc=32.1 min CN=78 Runoff=6.35 cfs 0.822 af

SubcatchmentPR-31: Overland Runoff Area=225,357 sf 0.52% Impervious Runoff Depth=3.16"
Flow Length=760' Tc=32.6 min CN=80 Runoff=10.40 cfs 1.361 af

SubcatchmentPR-32: Overland (Offsite) Runoff Area=2,738 sf 0.00% Impervious Runoff Depth=3.06"
Flow Length=85' Tc=10.5 min CN=79 Runoff=0.19 cfs 0.016 af

SubcatchmentPR-41: Overland Runoff Area=33,639 sf 3.96% Impervious Runoff Depth=3.16"
Flow Length=105' Tc=8.4 min CN=80 Runoff=2.63 cfs 0.203 af

SubcatchmentPR-51: Overland Runoff Area=42,742 sf 0.32% Impervious Runoff Depth=2.97"
Flow Length=335' Tc=16.1 min CN=78 Runoff=2.52 cfs 0.243 af

SubcatchmentPR-61: Overland Runoff Area=61,371 sf 0.00% Impervious Runoff Depth=2.97"
Flow Length=512' Tc=26.2 min CN=78 Runoff=2.95 cfs 0.348 af

SubcatchmentPR-62: Housing Runoff Area=38,898 sf 54.33% Impervious Runoff Depth=4.17"
Flow Length=668' Tc=12.2 min CN=90 Runoff=3.44 cfs 0.310 af

SubcatchmentPR-71: Overland Runoff Area=92,973 sf 5.33% Impervious Runoff Depth=3.06"
Flow Length=503' Tc=20.7 min CN=79 Runoff=5.09 cfs 0.545 af

SubcatchmentPR-72: Overland (Offsite) Runoff Area=14,564 sf 4.16% Impervious Runoff Depth=3.06"
Flow Length=489' Tc=19.8 min CN=79 Runoff=0.81 cfs 0.085 af

Subcatchment PR-73: Overland (Offsite) Runoff Area=1,620 sf 0.00% Impervious Runoff Depth=2.88"
Flow Length=25' Slope=0.0120 '/' Tc=15.4 min CN=77 Runoff=0.09 cfs 0.009 af

Pond P11: Gravel Wetland #3 Peak Elev=314.74' Storage=82,672 cf Inflow=48.17 cfs 3.612 af
Outflow=4.22 cfs 3.406 af

Pond P13: Gravel Wetland #1 Peak Elev=319.30' Storage=18,803 cf Inflow=12.23 cfs 1.168 af
Outflow=5.70 cfs 1.103 af

Pond P21: Gravel Wetland #2 Peak Elev=305.15' Storage=32,105 cf Inflow=16.31 cfs 1.265 af
Outflow=1.54 cfs 1.072 af

Pond P62: Detention Basin #1 Peak Elev=332.93' Storage=2,025 cf Inflow=3.44 cfs 0.310 af
Outflow=2.54 cfs 0.310 af

Link DP-1: Wetland #1 Inflow=22.18 cfs 6.076 af
Primary=22.18 cfs 6.076 af

Link DP-2: Wetland #2 Inflow=9.51 cfs 2.179 af
Primary=9.51 cfs 2.179 af

Link DP-3: Wetland #3 Inflow=10.49 cfs 1.377 af
Primary=10.49 cfs 1.377 af

Link DP-4: Eliot Street Inflow=2.63 cfs 0.203 af
Primary=2.63 cfs 0.203 af

Link DP-5: (Offsite Southeast) Inflow=2.52 cfs 0.243 af
Primary=2.52 cfs 0.243 af

Link DP-6: Prospect Heights Inflow=5.40 cfs 0.658 af
Primary=5.40 cfs 0.658 af

Link DP-7: Chestnut Street Inflow=5.99 cfs 0.639 af
Primary=5.99 cfs 0.639 af

Total Runoff Area = 40.535 ac Runoff Volume = 11.841 af Average Runoff Depth = 3.51"
76.88% Pervious = 31.164 ac 23.12% Impervious = 9.371 ac

Summary for Subcatchment PR-11: Housing

Runoff = 48.04 cfs @ 12.09 hrs, Volume= 3.594 af, Depth= 3.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
105,642	98	Paved parking, HSG D
109,581	98	Unconnected roofs, HSG D
250,927	80	>75% Grass cover, Good, HSG D
8,857	77	Woods, Good, HSG D
475,007	88	Weighted Average
259,784		54.69% Pervious Area
215,223		45.31% Impervious Area
109,581		50.92% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	50	0.0170	1.10		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 3.10"
1.1	150	0.0133	2.34		**Shallow Concentrated Flow, pavement** Paved Kv= 20.3 fps
0.4	62	0.0161	2.58		**Shallow Concentrated Flow, pavement** Paved Kv= 20.3 fps
0.0	12	0.0085	4.94	3.88	**Pipe Channel, pipe flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011 Concrete pipe, straight & clean
0.3	60	0.0050	3.79	2.98	**Pipe Channel, pipe flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
0.5	114	0.0053	3.90	3.07	**Pipe Channel, Pipe Flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
0.5	120	0.0050	3.79	2.98	**Pipe Channel, Pipe Flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
1.0	228	0.0050	3.79	2.98	**Pipe Channel, ipe flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
0.4	201	0.0266	8.74	6.87	**Pipe Channel, pipe flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
0.4	234	0.0322	9.62	7.56	**Pipe Channel, pipe flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
0.7	166	0.0051	3.83	3.01	**Pipe Channel, pipe flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
0.4	87	0.0057	4.05	3.18	**Pipe Channel, pipe flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25'

n= 0.011					
0.2	110	0.0090	8.07	25.36	**Pipe Channel, pipe flow** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.011
6.7	1,594	Total			

Summary for Subcatchment PR-12: Overland

Runoff = 13.26 cfs @ 12.36 hrs, Volume= 1.568 af, Depth= 3.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.30"

	Area (sf)	CN	Description
*	564	98	roof
*	1,821	98	pavement
*	119,319	80	grass
*	68,895	77	woods
*	77,096	77	wetland - woods
	267,695	79	Weighted Average
	265,310		99.11% Pervious Area
	2,385		0.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	6	0.3300	0.29		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
0.9	7	0.0450	0.14		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
12.4	37	0.0450	0.05		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
12.7	651	0.0290	0.85		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
26.3	701	Total			

Summary for Subcatchment PR-13: Housing

Runoff = 12.23 cfs @ 12.19 hrs, Volume= 1.168 af, Depth= 3.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
27,749	98	Paved parking, HSG D
40,892	98	Unconnected roofs, HSG D
85,789	80	>75% Grass cover, Good, HSG D
154,430	88	Weighted Average
85,789		55.55% Pervious Area
68,641		44.45% Impervious Area
40,892		59.57% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	50	0.0466	0.20		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
0.2	16	0.0625	1.75		**Shallow Concentrated Flow, grass** Short Grass Pasture Kv= 7.0 fps
0.0	6	0.3300	4.02		**Shallow Concentrated Flow, grass** Short Grass Pasture Kv= 7.0 fps
2.3	123	0.0160	0.89		**Shallow Concentrated Flow, grass** Short Grass Pasture Kv= 7.0 fps
0.6	52	0.0400	1.40		**Shallow Concentrated Flow, grass** Short Grass Pasture Kv= 7.0 fps
0.1	8	0.1250	2.47		**Shallow Concentrated Flow, grass** Short Grass Pasture Kv= 7.0 fps
6.5	192	0.0050	0.49		**Shallow Concentrated Flow, grass** Short Grass Pasture Kv= 7.0 fps
0.6	54	0.0050	1.54	0.13	**Pipe Channel, pipe flow** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.013 Corrugated PE, smooth interior
0.2	105	0.0138	7.31	8.97	**Pipe Channel, pipe flow** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.011
0.2	72	0.0152	7.67	9.41	**Pipe Channel, pipe flow** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.011
14.8	678	Total			

Summary for Subcatchment PR-14: Overland (Offsite)

Runoff = 0.20 cfs @ 12.21 hrs, Volume= 0.019 af, Depth= 3.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.30"

	Area (sf)	CN	Description
*	3,104	80	woods
	3,104		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	50	0.0520	0.06		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.5	37	0.0520	1.14		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
15.4	87	Total			

Summary for Subcatchment PR-21: Housing

Runoff = 16.31 cfs @ 12.10 hrs, Volume= 1.265 af, Depth= 4.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
51,916	98	Unconnected roofs, HSG D
39,125	98	Paved parking, HSG D
67,725	80	>75% Grass cover, Good, HSG D
158,766	90	Weighted Average
67,725		42.66% Pervious Area
91,041		57.34% Impervious Area
51,916		57.02% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	50	0.0500	0.21		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
0.4	46	0.0650	1.78		**Shallow Concentrated Flow, grass** Short Grass Pasture Kv= 7.0 fps
0.1	16	0.3333	4.04		**Shallow Concentrated Flow, grass** Short Grass Pasture Kv= 7.0 fps
1.3	75	0.0200	0.99		**Shallow Concentrated Flow, grass** Short Grass Pasture Kv= 7.0 fps
0.1	25	0.0200	2.87		**Shallow Concentrated Flow, pavement** Paved Kv= 20.3 fps
0.1	12	0.0050	3.79	2.98	**Pipe Channel, pipe flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
0.1	33	0.0050	3.79	2.98	**Pipe Channel, pipe flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
0.7	168	0.0050	3.79	2.98	**Pipe Channel, pipe flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
0.4	91	0.0051	3.83	3.01	**Pipe Channel, pipe flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
0.2	40	0.0050	3.79	2.98	**Pipe Channel, pipe flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
7.4	556	Total			

Summary for Subcatchment PR-22: Overland (Offsite)

Runoff = 1.41 cfs @ 12.27 hrs, Volume= 0.150 af, Depth= 3.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Adj	Description
1,040	98		Unconnected roofs, HSG D
331	98		Unconnected pavement, HSG D
12,989	80		>75% Grass cover, Good, HSG D
11,172	77		Woods, Good, HSG D
25,532	80	79	Weighted Average, UI Adjusted
24,161			94.63% Pervious Area
1,371			5.37% Impervious Area
1,371			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.5	50	0.0400	0.05		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.2	19	0.1000	1.58		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.6	135	0.0430	1.45		**Shallow Concentrated Flow, Woods** Short Grass Pasture Kv= 7.0 fps
0.4	59	0.1520	2.73		**Shallow Concentrated Flow, Woods** Short Grass Pasture Kv= 7.0 fps
1.4	85	0.0410	1.01		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
20.1	348	Total			

Summary for Subcatchment PR-23: Overland (Offsite)

Runoff = 1.80 cfs @ 12.11 hrs, Volume= 0.136 af, Depth= 3.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.30"

	Area (sf)	CN	Description
*	198	98	roof
*	21,719	80	grass
*	582	77	woods
	22,499	80	Weighted Average
	22,301		99.12% Pervious Area
	198		0.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	50	0.0600	0.23		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
4.0	405	0.0580	1.69		**Shallow Concentrated Flow, Woods** Short Grass Pasture Kv= 7.0 fps
7.7	455	Total			

Summary for Subcatchment PR-24: Overland

Runoff = 6.35 cfs @ 12.45 hrs, Volume= 0.822 af, Depth= 2.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.30"

	Area (sf)	CN	Description
*	34,871	80	grass
*	82,856	77	woods
*	27,039	77	wetland - woods
	144,766	78	Weighted Average
	144,766		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	11	0.3330	0.33		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
13.8	39	0.0385	0.05		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
1.0	60	0.0417	1.02		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.1	87	0.0747	1.37		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
2.7	255	0.0500	1.57		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
12.9	547	0.0200	0.71		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
32.1	999	Total			

Summary for Subcatchment PR-31: Overland

Runoff = 10.40 cfs @ 12.45 hrs, Volume= 1.361 af, Depth= 3.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.30"

	Area (sf)	CN	Description
	1,180	98	Unconnected roofs, HSG D
*	7,956	80	Wetland (Grass, HSG D)
	190,213	80	>75% Grass cover, Good, HSG D
	24,006	77	Woods, Good, HSG D
	2,002	73	Brush, Good, HSG D
	225,357	80	Weighted Average
	224,177		99.48% Pervious Area
	1,180		0.52% Impervious Area
	1,180		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	20	0.0500	0.18		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
14.0	30	0.0220	0.04		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
1.4	62	0.0220	0.74		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.3	24	0.0910	1.51		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.8	100	0.1000	2.21		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
0.5	47	0.0420	1.43		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
1.3	83	0.0240	1.08		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
8.4	224	0.0040	0.44		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
1.5	65	0.0100	0.70		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
2.5	105	0.0100	0.70		**Shallow Concentrated Flow, Wetland** Short Grass Pasture Kv= 7.0 fps
32.6	760	Total			

Summary for Subcatchment PR-32: Overland (Offsite)

Runoff = 0.19 cfs @ 12.15 hrs, Volume= 0.016 af, Depth= 3.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
1,717	80	>75% Grass cover, Good, HSG D
1,021	77	Woods, Good, HSG D
2,738	79	Weighted Average
2,738		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	48	0.1300	0.08		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.2	2	0.1300	0.16		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
0.3	35	0.1050	2.27		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
10.5	85	Total			

Summary for Subcatchment PR-41: Overland

Runoff = 2.63 cfs @ 12.12 hrs, Volume= 0.203 af, Depth= 3.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.30"

	Area (sf)	CN	Description
*	1,149	96	gravel drive
*	1,331	98	pavement
*	14,404	80	grass
*	16,357	77	woods
	398	73	Brush, Good, HSG D
	33,639	80	Weighted Average
	32,308		96.04% Pervious Area
	1,331		3.96% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	10	0.0100	0.08		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
0.9	20	0.3300	0.37		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
0.8	9	0.0770	0.18		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
3.8	11	0.0770	0.05		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.8	55	0.0500	1.12		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
8.4	105	Total			

Summary for Subcatchment PR-51: Overland

Runoff = 2.52 cfs @ 12.22 hrs, Volume= 0.243 af, Depth= 2.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.30"

	Area (sf)	CN	Description
*	136	98	roof
*	1,200	89	dirt drive
*	4,534	80	grass
*	36,872	77	woods
	42,742	78	Weighted Average
	42,606		99.68% Pervious Area
	136		0.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	10	0.0350	0.13		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
8.9	40	0.1200	0.07		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.6	66	0.1200	1.73		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
4.7	180	0.0160	0.63		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.6	39	0.0460	1.07		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
16.1	335	Total			

Summary for Subcatchment PR-61: Overland

Runoff = 2.95 cfs @ 12.37 hrs, Volume= 0.348 af, Depth= 2.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.30"

	Area (sf)	CN	Description
*	24,517	80	grass
*	36,854	77	woods
	61,371	78	Weighted Average
	61,371		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.5	50	0.0400	0.05		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
9.7	462	0.0250	0.79		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
26.2	512	Total			

Summary for Subcatchment PR-62: Housing

Runoff = 3.44 cfs @ 12.16 hrs, Volume= 0.310 af, Depth= 4.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
21,132	98	Unconnected roofs, HSG D
17,766	80	>75% Grass cover, Good, HSG D
38,898	90	Weighted Average
17,766		45.67% Pervious Area
21,132		54.33% Impervious Area
21,132		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	50	0.0500	0.21		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
0.2	15	0.0500	1.57		**Shallow Concentrated Flow, grass** Short Grass Pasture Kv= 7.0 fps
0.1	18	0.3333	4.04		**Shallow Concentrated Flow, grass** Short Grass Pasture Kv= 7.0 fps
3.6	185	0.0150	0.86		**Shallow Concentrated Flow, grass** Short Grass Pasture Kv= 7.0 fps
4.3	400	0.0050	1.54	0.13	**Pipe Channel, pipe flow** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.013 Corrugated PE, smooth interior
12.2	668	Total			

Summary for Subcatchment PR-71: Overland

Runoff = 5.09 cfs @ 12.28 hrs, Volume= 0.545 af, Depth= 3.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.30"

	Area (sf)	CN	Description
*	52,577	77	woods
	35,443	80	>75% Grass cover, Good, HSG D
	4,953	98	Paved parking, HSG D
	92,973	79	Weighted Average
	88,020		94.67% Pervious Area
	4,953		5.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.2	50	0.0700	0.06		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.1	5	0.0700	1.32		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.3	24	0.0400	1.40		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
1.3	84	0.0240	1.08		**Shallow Concentrated Flow, Sheet Flow** Short Grass Pasture Kv= 7.0 fps
0.6	52	0.0380	1.36		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
3.0	115	0.0086	0.65		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
0.4	31	0.0320	1.25		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
0.3	45	0.1110	2.33		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
0.2	21	0.1190	1.72		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.3	76	0.0390	0.99		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
20.7	503	Total			

Summary for Subcatchment PR-72: Overland (Offsite)

Runoff = 0.81 cfs @ 12.27 hrs, Volume= 0.085 af, Depth= 3.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.30"

	Area (sf)	CN	Description
*	606	98	pavement
*	3,197	80	grass
*	10,761	77	woods
	14,564	79	Weighted Average
	13,958		95.84% Pervious Area
	606		4.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.1	50	0.0600	0.06		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.7	55	0.0700	1.32		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.6	71	0.0700	1.85		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
1.6	125	0.0640	1.26		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.5	23	0.0100	0.70		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
0.3	40	0.0150	2.49		**Shallow Concentrated Flow, Pavement** Paved Kv= 20.3 fps
0.3	23	0.0330	1.27		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
1.7	102	0.0400	1.00		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
19.8	489	Total			

Summary for Subcatchment PR-73: Overland (Offsite)

Runoff = 0.09 cfs @ 12.21 hrs, Volume= 0.009 af, Depth= 2.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.30"

	Area (sf)	CN	Description
*	1,620	77	woods
	1,620		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.4	25	0.0120	0.03		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"

Summary for Pond P11: Gravel Wetland #3

Inflow Area = 10.976 ac, 45.02% Impervious, Inflow Depth = 3.95" for 25-Year event
Inflow = 48.17 cfs @ 12.09 hrs, Volume= 3.612 af
Outflow = 4.22 cfs @ 13.06 hrs, Volume= 3.406 af, Atten= 91%, Lag= 57.7 min
Primary = 4.22 cfs @ 13.06 hrs, Volume= 3.406 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 314.74' @ 13.06 hrs Surf.Area= 33,360 sf Storage= 82,672 cf

Plug-Flow detention time= 253.3 min calculated for 3.405 af (94% of inflow)
Center-of-Mass det. time= 222.2 min (1,018.8 - 796.6)

Volume	Invert	Avail.Storage	Storage Description
#1	309.00'	126,295 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
309.00	1,785	0	0
310.00	2,773	2,279	2,279
311.00	3,931	3,352	5,631
312.00	5,345	4,638	10,269
313.00	29,625	17,485	27,754
314.00	31,741	30,683	58,437
315.00	33,915	32,828	91,265
316.00	36,144	35,030	126,295

Device	Routing	Invert	Outlet Devices
#1	Primary	309.00'	**12.0" Round Culvert** L= 56.6' RCP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 309.00' / 308.40' S= 0.0106 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Device 1	309.00'	**8.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	311.75'	**10.0" Vert. Orifice/Grate** C= 0.600
#4	Device 2	313.00'	**12.0" Round Culvert X 0.00** L= 20.0' RCP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 313.00' / 312.80' S= 0.0100 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#5	Primary	315.50'	**4.0' long x 8.0' 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) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Primary OutFlow Max=4.22 cfs @ 13.06 hrs HW=314.74' (Free Discharge)
└─**1=Culvert** (Passes 4.22 cfs of 7.64 cfs potential flow)
  ├─**2=Orifice/Grate** (Passes 0.00 cfs of 3.91 cfs potential flow)
  │ └─**4=Culvert** (Controls 0.00 cfs)
  └─**3=Orifice/Grate** (Orifice Controls 4.22 cfs @ 7.73 fps)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P13: Gravel Wetland #1

Inflow Area = 3.545 ac, 44.45% Impervious, Inflow Depth = 3.95" for 25-Year event
Inflow = 12.23 cfs @ 12.19 hrs, Volume= 1.168 af
Outflow = 5.70 cfs @ 12.50 hrs, Volume= 1.103 af, Atten= 53%, Lag= 18.5 min
Primary = 5.70 cfs @ 12.50 hrs, Volume= 1.103 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 319.30' @ 12.50 hrs Surf.Area= 8,975 sf Storage= 18,803 cf

Plug-Flow detention time= 112.1 min calculated for 1.102 af (94% of inflow)
Center-of-Mass det. time= 81.4 min (885.4 - 804.0)

Volume	Invert	Avail.Storage	Storage Description
#1	315.00'	25,384 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
315.00	732	0	0
316.00	1,538	1,135	1,135
317.00	2,713	2,126	3,261
318.00	7,244	4,979	8,239
319.00	8,596	7,920	16,159
320.00	9,854	9,225	25,384

Device	Routing	Invert	Outlet Devices
#1	Primary	315.00'	**12.0" Round Culvert** L= 20.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 315.00' / 314.80' S= 0.0100 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Device 1	316.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	316.85'	**8.0" Vert. Orifice/Grate** C= 0.600
#4	Device 2	318.00'	**12.0" Round Culvert X 0.00** L= 10.0' RCP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 318.00' / 317.90' S= 0.0100 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#5	Primary	319.00'	**8.0' long x 4.0' 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) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=5.69 cfs @ 12.50 hrs HW=319.30' (Free Discharge)
└─**1=Culvert** (Passes 2.45 cfs of 9.18 cfs potential flow)
  ├─**2=Orifice/Grate** (Passes 0.00 cfs of 1.65 cfs potential flow)
  │ └─**4=Culvert** (Controls 0.00 cfs)
  └─**3=Orifice/Grate** (Orifice Controls 2.45 cfs @ 7.01 fps)
└─**5=Broad-Crested Rectangular Weir** (Weir Controls 3.25 cfs @ 1.35 fps)

Summary for Pond P21: Gravel Wetland #2

Inflow Area = 3.645 ac, 57.34% Impervious, Inflow Depth = 4.17" for 25-Year event
Inflow = 16.31 cfs @ 12.10 hrs, Volume= 1.265 af
Outflow = 1.54 cfs @ 13.00 hrs, Volume= 1.072 af, Atten= 91%, Lag= 53.8 min
Primary = 1.54 cfs @ 13.00 hrs, Volume= 1.072 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 305.15' @ 13.00 hrs Surf.Area= 10,938 sf Storage= 32,105 cf

Plug-Flow detention time= 312.0 min calculated for 1.072 af (85% of inflow)
Center-of-Mass det. time= 247.5 min (1,037.5 - 790.1)

Volume	Invert	Avail.Storage	Storage Description
#1	299.00'	41,844 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
299.00	714	0	0
300.00	1,434	1,074	1,074
301.00	2,271	1,853	2,927
302.00	3,362	2,817	5,743
303.00	8,208	5,785	11,528
304.00	9,442	8,825	20,353
305.00	10,731	10,087	30,440
306.00	12,077	11,404	41,844

Device	Routing	Invert	Outlet Devices
#1	Primary	299.00'	**12.0" Round Culvert** L= 28.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 299.00' / 298.70' S= 0.0107 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Device 1	299.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	302.55'	**6.0" Vert. Orifice/Grate** C= 0.600
#4	Device 2	305.00'	**12.0" Round Culvert** L= 6.0' RCP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 305.00' / 304.90' S= 0.0167 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#5	Primary	306.00'	**4.0' long x 8.0' 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) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Primary OutFlow Max=1.54 cfs @ 13.00 hrs HW=305.15' (Free Discharge)
1=Culvert (Passes 1.54 cfs of 10.88 cfs potential flow)
2=Orifice/Grate (Passes 0.09 cfs of 2.30 cfs potential flow)
4=Culvert (Inlet Controls 0.09 cfs @ 1.18 fps)
3=Orifice/Grate (Orifice Controls 1.45 cfs @ 7.39 fps)
5=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond P62: Detention Basin #1

Inflow Area = 0.893 ac, 54.33% Impervious, Inflow Depth = 4.17" for 25-Year event
Inflow = 3.44 cfs @ 12.16 hrs, Volume= 0.310 af
Outflow = 2.54 cfs @ 12.28 hrs, Volume= 0.310 af, Atten= 26%, Lag= 7.1 min
Primary = 2.54 cfs @ 12.28 hrs, Volume= 0.310 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 332.93' @ 12.28 hrs Surf.Area= 2,509 sf Storage= 2,025 cf

Plug-Flow detention time= 30.2 min calculated for 0.310 af (100% of inflow)
Center-of-Mass det. time= 30.4 min (824.9 - 794.5)

Volume	Invert	Avail.Storage	Storage Description
#1	332.00'	8,890 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
332.00	1,844	0	0
333.00	2,559	2,202	2,202
334.00	3,330	2,945	5,146
335.00	4,158	3,744	8,890

Device	Routing	Invert	Outlet Devices
#1	Primary	332.00'	**12.0" Round Culvert** L= 25.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 332.00' / 331.75' S= 0.0100 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Primary	334.50'	**4.0' long x 8.0' 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) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Primary OutFlow Max=2.54 cfs @ 12.28 hrs HW=332.93' (Free Discharge)
—**1=Culvert** (Barrel Controls 2.54 cfs @ 4.34 fps)
—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Link DP-1: Wetland #1

Inflow Area = 20.667 ac, 31.80% Impervious, Inflow Depth = 3.53" for 25-Year event
Inflow = 22.18 cfs @ 12.43 hrs, Volume= 6.076 af
Primary = 22.18 cfs @ 12.43 hrs, Volume= 6.076 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link DP-2: Wetland #2

Inflow Area = 8.071 ac, 26.34% Impervious, Inflow Depth > 3.24" for 25-Year event
Inflow = 9.51 cfs @ 12.39 hrs, Volume= 2.179 af
Primary = 9.51 cfs @ 12.39 hrs, Volume= 2.179 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link DP-3: Wetland #3

Inflow Area = 5.236 ac, 0.52% Impervious, Inflow Depth = 3.16" for 25-Year event
Inflow = 10.49 cfs @ 12.43 hrs, Volume= 1.377 af
Primary = 10.49 cfs @ 12.43 hrs, Volume= 1.377 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link DP-4: Eliot Street

Inflow Area = 0.772 ac, 3.96% Impervious, Inflow Depth = 3.16" for 25-Year event
Inflow = 2.63 cfs @ 12.12 hrs, Volume= 0.203 af
Primary = 2.63 cfs @ 12.12 hrs, Volume= 0.203 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link DP-5: (Offsite Southeast)

Inflow Area = 0.981 ac, 0.32% Impervious, Inflow Depth = 2.97" for 25-Year event
Inflow = 2.52 cfs @ 12.22 hrs, Volume= 0.243 af
Primary = 2.52 cfs @ 12.22 hrs, Volume= 0.243 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link DP-6: Prospect Heights

Inflow Area = 2.302 ac, 21.08% Impervious, Inflow Depth = 3.43" for 25-Year event
Inflow = 5.40 cfs @ 12.32 hrs, Volume= 0.658 af
Primary = 5.40 cfs @ 12.32 hrs, Volume= 0.658 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link DP-7: Chestnut Street

Inflow Area = 2.506 ac, 5.09% Impervious, Inflow Depth = 3.06" for 25-Year event
Inflow = 5.99 cfs @ 12.28 hrs, Volume= 0.639 af
Primary = 5.99 cfs @ 12.28 hrs, Volume= 0.639 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentPR-11: Housing Runoff Area=475,007 sf 45.31% Impervious Runoff Depth=5.11"
Flow Length=1,594' Tc=6.7 min CN=88 Runoff=61.26 cfs 4.642 af

SubcatchmentPR-12: Overland Runoff Area=267,695 sf 0.89% Impervious Runoff Depth=4.13"
Flow Length=701' Tc=26.3 min CN=79 Runoff=17.84 cfs 2.115 af

SubcatchmentPR-13: Housing Runoff Area=154,430 sf 44.45% Impervious Runoff Depth=5.11"
Flow Length=678' Tc=14.8 min CN=88 Runoff=15.62 cfs 1.509 af

SubcatchmentPR-14: Overland (Offsite) Runoff Area=3,104 sf 0.00% Impervious Runoff Depth=4.24"
Flow Length=87' Slope=0.0520 '/' Tc=15.4 min CN=80 Runoff=0.26 cfs 0.025 af

SubcatchmentPR-21: Housing Runoff Area=158,766 sf 57.34% Impervious Runoff Depth=5.33"
Flow Length=556' Tc=7.4 min CN=90 Runoff=20.60 cfs 1.620 af

SubcatchmentPR-22: Overland (Offsite) Runoff Area=25,532 sf 5.37% Impervious Runoff Depth=4.13"
Flow Length=348' Tc=20.1 min UI Adjusted CN=79 Runoff=1.90 cfs 0.202 af

SubcatchmentPR-23: Overland (Offsite) Runoff Area=22,499 sf 0.88% Impervious Runoff Depth=4.24"
Flow Length=455' Tc=7.7 min CN=80 Runoff=2.40 cfs 0.182 af

SubcatchmentPR-24: Overland Runoff Area=144,766 sf 0.00% Impervious Runoff Depth=4.02"
Flow Length=999' Tc=32.1 min CN=78 Runoff=8.60 cfs 1.114 af

SubcatchmentPR-31: Overland Runoff Area=225,357 sf 0.52% Impervious Runoff Depth=4.24"
Flow Length=760' Tc=32.6 min CN=80 Runoff=13.92 cfs 1.826 af

SubcatchmentPR-32: Overland (Offsite) Runoff Area=2,738 sf 0.00% Impervious Runoff Depth=4.13"
Flow Length=85' Tc=10.5 min CN=79 Runoff=0.26 cfs 0.022 af

SubcatchmentPR-41: Overland Runoff Area=33,639 sf 3.96% Impervious Runoff Depth=4.24"
Flow Length=105' Tc=8.4 min CN=80 Runoff=3.51 cfs 0.273 af

SubcatchmentPR-51: Overland Runoff Area=42,742 sf 0.32% Impervious Runoff Depth=4.02"
Flow Length=335' Tc=16.1 min CN=78 Runoff=3.41 cfs 0.329 af

SubcatchmentPR-61: Overland Runoff Area=61,371 sf 0.00% Impervious Runoff Depth=4.02"
Flow Length=512' Tc=26.2 min CN=78 Runoff=3.99 cfs 0.472 af

SubcatchmentPR-62: Housing Runoff Area=38,898 sf 54.33% Impervious Runoff Depth=5.33"
Flow Length=668' Tc=12.2 min CN=90 Runoff=4.35 cfs 0.397 af

SubcatchmentPR-71: Overland Runoff Area=92,973 sf 5.33% Impervious Runoff Depth=4.13"
Flow Length=503' Tc=20.7 min CN=79 Runoff=6.85 cfs 0.734 af

SubcatchmentPR-72: Overland (Offsite) Runoff Area=14,564 sf 4.16% Impervious Runoff Depth=4.13"
Flow Length=489' Tc=19.8 min CN=79 Runoff=1.09 cfs 0.115 af

Subcatchment PR-73: Overland (Offsite) Runoff Area=1,620 sf 0.00% Impervious Runoff Depth=3.92"
Flow Length=25' Slope=0.0120 '/' Tc=15.4 min CN=77 Runoff=0.13 cfs 0.012 af

Pond P11: Gravel Wetland #3 Peak Elev=315.50' Storage=108,495 cf Inflow=61.45 cfs 4.667 af
Outflow=4.79 cfs 4.461 af

Pond P13: Gravel Wetland #1 Peak Elev=319.50' Storage=20,603 cf Inflow=15.62 cfs 1.509 af
Outflow=9.93 cfs 1.443 af

Pond P21: Gravel Wetland #2 Peak Elev=305.76' Storage=38,965 cf Inflow=20.60 cfs 1.620 af
Outflow=3.10 cfs 1.426 af

Pond P62: Detention Basin #1 Peak Elev=333.11' Storage=2,475 cf Inflow=4.35 cfs 0.397 af
Outflow=3.17 cfs 0.397 af

Link DP-1: Wetland #1 Inflow=32.21 cfs 8.019 af
Primary=32.21 cfs 8.019 af

Link DP-2: Wetland #2 Inflow=13.69 cfs 2.925 af
Primary=13.69 cfs 2.925 af

Link DP-3: Wetland #3 Inflow=14.03 cfs 1.848 af
Primary=14.03 cfs 1.848 af

Link DP-4: Eliot Street Inflow=3.51 cfs 0.273 af
Primary=3.51 cfs 0.273 af

Link DP-5: (Offsite Southeast) Inflow=3.41 cfs 0.329 af
Primary=3.41 cfs 0.329 af

Link DP-6: Prospect Heights Inflow=7.08 cfs 0.869 af
Primary=7.08 cfs 0.869 af

Link DP-7: Chestnut Street Inflow=8.06 cfs 0.862 af
Primary=8.06 cfs 0.862 af

Total Runoff Area = 40.535 ac Runoff Volume = 15.590 af Average Runoff Depth = 4.62"
76.88% Pervious = 31.164 ac 23.12% Impervious = 9.371 ac

Summary for Subcatchment PR-11: Housing

Runoff = 61.26 cfs @ 12.09 hrs, Volume= 4.642 af, Depth= 5.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
105,642	98	Paved parking, HSG D
109,581	98	Unconnected roofs, HSG D
250,927	80	>75% Grass cover, Good, HSG D
8,857	77	Woods, Good, HSG D
475,007	88	Weighted Average
259,784		54.69% Pervious Area
215,223		45.31% Impervious Area
109,581		50.92% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	50	0.0170	1.10		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 3.10"
1.1	150	0.0133	2.34		**Shallow Concentrated Flow, pavement** Paved Kv= 20.3 fps
0.4	62	0.0161	2.58		**Shallow Concentrated Flow, pavement** Paved Kv= 20.3 fps
0.0	12	0.0085	4.94	3.88	**Pipe Channel, pipe flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011 Concrete pipe, straight & clean
0.3	60	0.0050	3.79	2.98	**Pipe Channel, pipe flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
0.5	114	0.0053	3.90	3.07	**Pipe Channel, Pipe Flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
0.5	120	0.0050	3.79	2.98	**Pipe Channel, Pipe Flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
1.0	228	0.0050	3.79	2.98	**Pipe Channel, ipe flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
0.4	201	0.0266	8.74	6.87	**Pipe Channel, pipe flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
0.4	234	0.0322	9.62	7.56	**Pipe Channel, pipe flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
0.7	166	0.0051	3.83	3.01	**Pipe Channel, pipe flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
0.4	87	0.0057	4.05	3.18	**Pipe Channel, pipe flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25'

					n= 0.011
0.2	110	0.0090	8.07	25.36	**Pipe Channel, pipe flow** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.011
6.7	1,594	Total			

Summary for Subcatchment PR-12: Overland

Runoff = 17.84 cfs @ 12.36 hrs, Volume= 2.115 af, Depth= 4.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

	Area (sf)	CN	Description
*	564	98	roof
*	1,821	98	pavement
*	119,319	80	grass
*	68,895	77	woods
*	77,096	77	wetland - woods
	267,695	79	Weighted Average
	265,310		99.11% Pervious Area
	2,385		0.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	6	0.3300	0.29		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
0.9	7	0.0450	0.14		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
12.4	37	0.0450	0.05		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
12.7	651	0.0290	0.85		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
26.3	701	Total			

Summary for Subcatchment PR-13: Housing

Runoff = 15.62 cfs @ 12.19 hrs, Volume= 1.509 af, Depth= 5.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
27,749	98	Paved parking, HSG D
40,892	98	Unconnected roofs, HSG D
85,789	80	>75% Grass cover, Good, HSG D
154,430	88	Weighted Average
85,789		55.55% Pervious Area
68,641		44.45% Impervious Area
40,892		59.57% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	50	0.0466	0.20		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
0.2	16	0.0625	1.75		**Shallow Concentrated Flow, grass** Short Grass Pasture Kv= 7.0 fps
0.0	6	0.3300	4.02		**Shallow Concentrated Flow, grass** Short Grass Pasture Kv= 7.0 fps
2.3	123	0.0160	0.89		**Shallow Concentrated Flow, grass** Short Grass Pasture Kv= 7.0 fps
0.6	52	0.0400	1.40		**Shallow Concentrated Flow, grass** Short Grass Pasture Kv= 7.0 fps
0.1	8	0.1250	2.47		**Shallow Concentrated Flow, grass** Short Grass Pasture Kv= 7.0 fps
6.5	192	0.0050	0.49		**Shallow Concentrated Flow, grass** Short Grass Pasture Kv= 7.0 fps
0.6	54	0.0050	1.54	0.13	**Pipe Channel, pipe flow** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.013 Corrugated PE, smooth interior
0.2	105	0.0138	7.31	8.97	**Pipe Channel, pipe flow** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.011
0.2	72	0.0152	7.67	9.41	**Pipe Channel, pipe flow** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.011
14.8	678	Total			

Summary for Subcatchment PR-14: Overland (Offsite)

Runoff = 0.26 cfs @ 12.20 hrs, Volume= 0.025 af, Depth= 4.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

	Area (sf)	CN	Description
*	3,104	80	woods
	3,104		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	50	0.0520	0.06		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.5	37	0.0520	1.14		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
15.4	87	Total			

Summary for Subcatchment PR-21: Housing

Runoff = 20.60 cfs @ 12.10 hrs, Volume= 1.620 af, Depth= 5.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
51,916	98	Unconnected roofs, HSG D
39,125	98	Paved parking, HSG D
67,725	80	>75% Grass cover, Good, HSG D
158,766	90	Weighted Average
67,725		42.66% Pervious Area
91,041		57.34% Impervious Area
51,916		57.02% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	50	0.0500	0.21		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
0.4	46	0.0650	1.78		**Shallow Concentrated Flow, grass** Short Grass Pasture Kv= 7.0 fps
0.1	16	0.3333	4.04		**Shallow Concentrated Flow, grass** Short Grass Pasture Kv= 7.0 fps
1.3	75	0.0200	0.99		**Shallow Concentrated Flow, grass** Short Grass Pasture Kv= 7.0 fps
0.1	25	0.0200	2.87		**Shallow Concentrated Flow, pavement** Paved Kv= 20.3 fps
0.1	12	0.0050	3.79	2.98	**Pipe Channel, pipe flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
0.1	33	0.0050	3.79	2.98	**Pipe Channel, pipe flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
0.7	168	0.0050	3.79	2.98	**Pipe Channel, pipe flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
0.4	91	0.0051	3.83	3.01	**Pipe Channel, pipe flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
0.2	40	0.0050	3.79	2.98	**Pipe Channel, pipe flow** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
7.4	556	Total			

Summary for Subcatchment PR-22: Overland (Offsite)

Runoff = 1.90 cfs @ 12.27 hrs, Volume= 0.202 af, Depth= 4.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Adj	Description
1,040	98		Unconnected roofs, HSG D
331	98		Unconnected pavement, HSG D
12,989	80		>75% Grass cover, Good, HSG D
11,172	77		Woods, Good, HSG D
25,532	80	79	Weighted Average, UI Adjusted
24,161			94.63% Pervious Area
1,371			5.37% Impervious Area
1,371			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.5	50	0.0400	0.05		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.2	19	0.1000	1.58		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.6	135	0.0430	1.45		**Shallow Concentrated Flow, Woods** Short Grass Pasture Kv= 7.0 fps
0.4	59	0.1520	2.73		**Shallow Concentrated Flow, Woods** Short Grass Pasture Kv= 7.0 fps
1.4	85	0.0410	1.01		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
20.1	348	Total			

Summary for Subcatchment PR-23: Overland (Offsite)

Runoff = 2.40 cfs @ 12.11 hrs, Volume= 0.182 af, Depth= 4.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

	Area (sf)	CN	Description
*	198	98	roof
*	21,719	80	grass
*	582	77	woods
	22,499	80	Weighted Average
	22,301		99.12% Pervious Area
	198		0.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	50	0.0600	0.23		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
4.0	405	0.0580	1.69		**Shallow Concentrated Flow, Woods** Short Grass Pasture Kv= 7.0 fps
7.7	455	Total			

Summary for Subcatchment PR-24: Overland

Runoff = 8.60 cfs @ 12.45 hrs, Volume= 1.114 af, Depth= 4.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

	Area (sf)	CN	Description
*	34,871	80	grass
*	82,856	77	woods
*	27,039	77	wetland - woods
	144,766	78	Weighted Average
	144,766		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	11	0.3330	0.33		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
13.8	39	0.0385	0.05		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
1.0	60	0.0417	1.02		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.1	87	0.0747	1.37		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
2.7	255	0.0500	1.57		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
12.9	547	0.0200	0.71		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
32.1	999	Total			

Summary for Subcatchment PR-31: Overland

Runoff = 13.92 cfs @ 12.43 hrs, Volume= 1.826 af, Depth= 4.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

	Area (sf)	CN	Description
	1,180	98	Unconnected roofs, HSG D
*	7,956	80	Wetland (Grass, HSG D)
	190,213	80	>75% Grass cover, Good, HSG D
	24,006	77	Woods, Good, HSG D
	2,002	73	Brush, Good, HSG D
	225,357	80	Weighted Average
	224,177		99.48% Pervious Area
	1,180		0.52% Impervious Area
	1,180		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	20	0.0500	0.18		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
14.0	30	0.0220	0.04		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
1.4	62	0.0220	0.74		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.3	24	0.0910	1.51		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.8	100	0.1000	2.21		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
0.5	47	0.0420	1.43		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
1.3	83	0.0240	1.08		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
8.4	224	0.0040	0.44		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
1.5	65	0.0100	0.70		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
2.5	105	0.0100	0.70		**Shallow Concentrated Flow, Wetland** Short Grass Pasture Kv= 7.0 fps
32.6	760	Total			

Summary for Subcatchment PR-32: Overland (Offsite)

Runoff = 0.26 cfs @ 12.14 hrs, Volume= 0.022 af, Depth= 4.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
1,717	80	>75% Grass cover, Good, HSG D
1,021	77	Woods, Good, HSG D
2,738	79	Weighted Average
2,738		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	48	0.1300	0.08		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.2	2	0.1300	0.16		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
0.3	35	0.1050	2.27		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
10.5	85	Total			

Summary for Subcatchment PR-41: Overland

Runoff = 3.51 cfs @ 12.12 hrs, Volume= 0.273 af, Depth= 4.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

	Area (sf)	CN	Description
*	1,149	96	gravel drive
*	1,331	98	pavement
*	14,404	80	grass
*	16,357	77	woods
	398	73	Brush, Good, HSG D
	33,639	80	Weighted Average
	32,308		96.04% Pervious Area
	1,331		3.96% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	10	0.0100	0.08		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
0.9	20	0.3300	0.37		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
0.8	9	0.0770	0.18		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
3.8	11	0.0770	0.05		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.8	55	0.0500	1.12		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
8.4	105	Total			

Summary for Subcatchment PR-51: Overland

Runoff = 3.41 cfs @ 12.22 hrs, Volume= 0.329 af, Depth= 4.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

	Area (sf)	CN	Description
*	136	98	roof
*	1,200	89	dirt drive
*	4,534	80	grass
*	36,872	77	woods
	42,742	78	Weighted Average
	42,606		99.68% Pervious Area
	136		0.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	10	0.0350	0.13		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
8.9	40	0.1200	0.07		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.6	66	0.1200	1.73		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
4.7	180	0.0160	0.63		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.6	39	0.0460	1.07		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
16.1	335	Total			

Summary for Subcatchment PR-61: Overland

Runoff = 3.99 cfs @ 12.37 hrs, Volume= 0.472 af, Depth= 4.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

	Area (sf)	CN	Description
*	24,517	80	grass
*	36,854	77	woods
	61,371	78	Weighted Average
	61,371		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.5	50	0.0400	0.05		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
9.7	462	0.0250	0.79		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
26.2	512	Total			

Summary for Subcatchment PR-62: Housing

Runoff = 4.35 cfs @ 12.16 hrs, Volume= 0.397 af, Depth= 5.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
21,132	98	Unconnected roofs, HSG D
17,766	80	>75% Grass cover, Good, HSG D
38,898	90	Weighted Average
17,766		45.67% Pervious Area
21,132		54.33% Impervious Area
21,132		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	50	0.0500	0.21		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
0.2	15	0.0500	1.57		**Shallow Concentrated Flow, grass** Short Grass Pasture Kv= 7.0 fps
0.1	18	0.3333	4.04		**Shallow Concentrated Flow, grass** Short Grass Pasture Kv= 7.0 fps
3.6	185	0.0150	0.86		**Shallow Concentrated Flow, grass** Short Grass Pasture Kv= 7.0 fps
4.3	400	0.0050	1.54	0.13	**Pipe Channel, pipe flow** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.013 Corrugated PE, smooth interior
12.2	668	Total			

Summary for Subcatchment PR-71: Overland

Runoff = 6.85 cfs @ 12.28 hrs, Volume= 0.734 af, Depth= 4.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

	Area (sf)	CN	Description
*	52,577	77	woods
	35,443	80	>75% Grass cover, Good, HSG D
	4,953	98	Paved parking, HSG D
	92,973	79	Weighted Average
	88,020		94.67% Pervious Area
	4,953		5.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.2	50	0.0700	0.06		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.1	5	0.0700	1.32		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.3	24	0.0400	1.40		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
1.3	84	0.0240	1.08		**Shallow Concentrated Flow, Sheet Flow** Short Grass Pasture Kv= 7.0 fps
0.6	52	0.0380	1.36		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
3.0	115	0.0086	0.65		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
0.4	31	0.0320	1.25		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
0.3	45	0.1110	2.33		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
0.2	21	0.1190	1.72		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.3	76	0.0390	0.99		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
20.7	503	Total			

Summary for Subcatchment PR-72: Overland (Offsite)

Runoff = 1.09 cfs @ 12.26 hrs, Volume= 0.115 af, Depth= 4.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

	Area (sf)	CN	Description
*	606	98	pavement
*	3,197	80	grass
*	10,761	77	woods
	14,564	79	Weighted Average
	13,958		95.84% Pervious Area
	606		4.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.1	50	0.0600	0.06		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.7	55	0.0700	1.32		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.6	71	0.0700	1.85		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
1.6	125	0.0640	1.26		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.5	23	0.0100	0.70		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
0.3	40	0.0150	2.49		**Shallow Concentrated Flow, Pavement** Paved Kv= 20.3 fps
0.3	23	0.0330	1.27		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
1.7	102	0.0400	1.00		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
19.8	489	Total			

Summary for Subcatchment PR-73: Overland (Offsite)

Runoff = 0.13 cfs @ 12.21 hrs, Volume= 0.012 af, Depth= 3.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

	Area (sf)	CN	Description
*	1,620	77	woods
	1,620		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.4	25	0.0120	0.03		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"

Summary for Pond P11: Gravel Wetland #3

Inflow Area = 10.976 ac, 45.02% Impervious, Inflow Depth = 5.10" for 100-Year event
Inflow = 61.45 cfs @ 12.09 hrs, Volume= 4.667 af
Outflow = 4.79 cfs @ 13.22 hrs, Volume= 4.461 af, Atten= 92%, Lag= 67.6 min
Primary = 4.79 cfs @ 13.22 hrs, Volume= 4.461 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 315.50' @ 13.22 hrs Surf.Area= 35,029 sf Storage= 108,495 cf

Plug-Flow detention time= 283.6 min calculated for 4.460 af (96% of inflow)
Center-of-Mass det. time= 258.6 min (1,048.2 - 789.6)

Volume	Invert	Avail.Storage	Storage Description
#1	309.00'	126,295 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
309.00	1,785	0	0
310.00	2,773	2,279	2,279
311.00	3,931	3,352	5,631
312.00	5,345	4,638	10,269
313.00	29,625	17,485	27,754
314.00	31,741	30,683	58,437
315.00	33,915	32,828	91,265
316.00	36,144	35,030	126,295

Device	Routing	Invert	Outlet Devices
#1	Primary	309.00'	**12.0" Round Culvert** L= 56.6' RCP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 309.00' / 308.40' S= 0.0106 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Device 1	309.00'	**8.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	311.75'	**10.0" Vert. Orifice/Grate** C= 0.600
#4	Device 2	313.00'	**12.0" Round Culvert X 0.00** L= 20.0' RCP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 313.00' / 312.80' S= 0.0100 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#5	Primary	315.50'	**4.0' long x 8.0' 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) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Primary OutFlow Max=4.79 cfs @ 13.22 hrs HW=315.50' (Free Discharge)
1=Culvert (Passes 4.79 cfs of 8.17 cfs potential flow)
2=Orifice/Grate (Passes 0.00 cfs of 4.17 cfs potential flow)
4=Culvert (Controls 0.00 cfs)
3=Orifice/Grate (Orifice Controls 4.79 cfs @ 8.79 fps)
5=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond P13: Gravel Wetland #1

Inflow Area = 3.545 ac, 44.45% Impervious, Inflow Depth = 5.11" for 100-Year event
Inflow = 15.62 cfs @ 12.19 hrs, Volume= 1.509 af
Outflow = 9.93 cfs @ 12.39 hrs, Volume= 1.443 af, Atten= 36%, Lag= 11.7 min
Primary = 9.93 cfs @ 12.39 hrs, Volume= 1.443 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 319.50' @ 12.39 hrs Surf.Area= 9,224 sf Storage= 20,603 cf

Plug-Flow detention time= 98.4 min calculated for 1.443 af (96% of inflow)
Center-of-Mass det. time= 73.4 min (870.3 - 796.9)

Volume	Invert	Avail.Storage	Storage Description
#1	315.00'	25,384 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
315.00	732	0	0
316.00	1,538	1,135	1,135
317.00	2,713	2,126	3,261
318.00	7,244	4,979	8,239
319.00	8,596	7,920	16,159
320.00	9,854	9,225	25,384

Device	Routing	Invert	Outlet Devices
#1	Primary	315.00'	**12.0" Round Culvert** L= 20.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 315.00' / 314.80' S= 0.0100 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Device 1	316.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	316.85'	**8.0" Vert. Orifice/Grate** C= 0.600
#4	Device 2	318.00'	**12.0" Round Culvert X 0.00** L= 10.0' RCP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 318.00' / 317.90' S= 0.0100 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#5	Primary	319.00'	**8.0' long x 4.0' 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) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=9.92 cfs @ 12.39 hrs HW=319.50' (Free Discharge)
—**1=Culvert** (Passes 2.56 cfs of 9.44 cfs potential flow)
  —**2=Orifice/Grate** (Passes 0.00 cfs of 1.70 cfs potential flow)
    —**4=Culvert** (Controls 0.00 cfs)
  —**3=Orifice/Grate** (Orifice Controls 2.56 cfs @ 7.33 fps)
—**5=Broad-Crested Rectangular Weir** (Weir Controls 7.37 cfs @ 1.85 fps)

Summary for Pond P21: Gravel Wetland #2

Inflow Area = 3.645 ac, 57.34% Impervious, Inflow Depth = 5.33" for 100-Year event
Inflow = 20.60 cfs @ 12.10 hrs, Volume= 1.620 af
Outflow = 3.10 cfs @ 12.61 hrs, Volume= 1.426 af, Atten= 85%, Lag= 30.7 min
Primary = 3.10 cfs @ 12.61 hrs, Volume= 1.426 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 305.76' @ 12.61 hrs Surf.Area= 11,752 sf Storage= 38,965 cf

Plug-Flow detention time= 288.0 min calculated for 1.426 af (88% of inflow)
Center-of-Mass det. time= 233.2 min (1,016.7 - 783.5)

Volume	Invert	Avail.Storage	Storage Description
#1	299.00'	41,844 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
299.00	714	0	0
300.00	1,434	1,074	1,074
301.00	2,271	1,853	2,927
302.00	3,362	2,817	5,743
303.00	8,208	5,785	11,528
304.00	9,442	8,825	20,353
305.00	10,731	10,087	30,440
306.00	12,077	11,404	41,844

Device	Routing	Invert	Outlet Devices
#1	Primary	299.00'	**12.0" Round Culvert** L= 28.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 299.00' / 298.70' S= 0.0107 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Device 1	299.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	302.55'	**6.0" Vert. Orifice/Grate** C= 0.600
#4	Device 2	305.00'	**12.0" Round Culvert** L= 6.0' RCP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 305.00' / 304.90' S= 0.0167 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#5	Primary	306.00'	**4.0' long x 8.0' 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) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Primary OutFlow Max=3.10 cfs @ 12.61 hrs HW=305.76' (Free Discharge)
- **1=Culvert** (Passes 3.10 cfs of 11.47 cfs potential flow)
  - **2=Orifice/Grate** (Passes 1.48 cfs of 2.41 cfs potential flow)
    - **4=Culvert** (Barrel Controls 1.48 cfs @ 3.20 fps)
  - **3=Orifice/Grate** (Orifice Controls 1.63 cfs @ 8.28 fps)
- **5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P62: Detention Basin #1

Inflow Area = 0.893 ac, 54.33% Impervious, Inflow Depth = 5.33" for 100-Year event
Inflow = 4.35 cfs @ 12.16 hrs, Volume= 0.397 af
Outflow = 3.17 cfs @ 12.28 hrs, Volume= 0.397 af, Atten= 27%, Lag= 7.2 min
Primary = 3.17 cfs @ 12.28 hrs, Volume= 0.397 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 333.11' @ 12.28 hrs Surf.Area= 2,640 sf Storage= 2,475 cf

Plug-Flow detention time= 27.8 min calculated for 0.397 af (100% of inflow)
Center-of-Mass det. time= 27.7 min (815.7 - 787.9)

Volume	Invert	Avail.Storage	Storage Description
#1	332.00'	8,890 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
332.00	1,844	0	0
333.00	2,559	2,202	2,202
334.00	3,330	2,945	5,146
335.00	4,158	3,744	8,890

Device	Routing	Invert	Outlet Devices
#1	Primary	332.00'	**12.0" Round Culvert** L= 25.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 332.00' / 331.75' S= 0.0100 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Primary	334.50'	**4.0' long x 8.0' 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) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Primary OutFlow Max=3.17 cfs @ 12.28 hrs HW=333.11' (Free Discharge)
1=Culvert (Barrel Controls 3.17 cfs @ 4.56 fps)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Link DP-1: Wetland #1

Inflow Area = 20.667 ac, 31.80% Impervious, Inflow Depth = 4.66" for 100-Year event
Inflow = 32.21 cfs @ 12.37 hrs, Volume= 8.019 af
Primary = 32.21 cfs @ 12.37 hrs, Volume= 8.019 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link DP-2: Wetland #2

Inflow Area = 8.071 ac, 26.34% Impervious, Inflow Depth = 4.35" for 100-Year event
Inflow = 13.69 cfs @ 12.42 hrs, Volume= 2.925 af
Primary = 13.69 cfs @ 12.42 hrs, Volume= 2.925 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link DP-3: Wetland #3

Inflow Area = 5.236 ac, 0.52% Impervious, Inflow Depth = 4.23" for 100-Year event
Inflow = 14.03 cfs @ 12.43 hrs, Volume= 1.848 af
Primary = 14.03 cfs @ 12.43 hrs, Volume= 1.848 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link DP-4: Eliot Street

Inflow Area =	0.772 ac,	3.96% Impervious,	Inflow Depth = 4.24"	for 100-Year event	
Inflow =	3.51 cfs @	12.12 hrs,	Volume=	0.273 af	
Primary =	3.51 cfs @	12.12 hrs,	Volume=	0.273 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link DP-5: (Offsite Southeast)

Inflow Area =	0.981 ac,	0.32% Impervious,	Inflow Depth = 4.02"	for 100-Year event	
Inflow =	3.41 cfs @	12.22 hrs,	Volume=	0.329 af	
Primary =	3.41 cfs @	12.22 hrs,	Volume=	0.329 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link DP-6: Prospect Heights

Inflow Area =	2.302 ac,	21.08% Impervious,	Inflow Depth = 4.53"	for 100-Year event	
Inflow =	7.08 cfs @	12.33 hrs,	Volume=	0.869 af	
Primary =	7.08 cfs @	12.33 hrs,	Volume=	0.869 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link DP-7: Chestnut Street

Inflow Area =	2.506 ac,	5.09% Impervious,	Inflow Depth = 4.13"	for 100-Year event	
Inflow =	8.06 cfs @	12.28 hrs,	Volume=	0.862 af	
Primary =	8.06 cfs @	12.28 hrs,	Volume=	0.862 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs