STORMWATER MANAGEMENT REPORT

01/09/2015

COMMONWEALTH OF MASSACHUSETTS
DAVID NOEL KELLY
CIVIL
NO. 37942
REGISTERED PROFESSIONAL ENGINEER

David Noel Kelly
2015.01.12 11:29:56 -05'00'

NEWTON NEXUS
131, 141-143, 151-153, 165, 173, & 181 NEEDHAM STREET
NEWTON, MA

PREPARED FOR:

WELLFORD ASSOCIATES
C/O CROSSPOINT ASSOCIATES, INC.
300 THIRD AVENUE, SUITE 2
WALTHAM, MA 02451

PREPARED BY:

KELLY ENGINEERING GROUP, INC.
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INTRODUCTION

The purpose of this report is to analyze the pre-development and post-development drainage conditions for the proposed project and to demonstrate that the project will have no negative impacts on the surrounding properties and resource areas. The design incorporates best management practices recommended by the Massachusetts Stormwater Management Handbook.

EXISTING SITE

The site is located at 131, 141-143, 151-153, 165, 173, & 181 Needham Street in Newton, MA. The existing site contains approximately 11 acres of office buildings, parking areas, woodlands, landscaped areas, an abandoned railroad, and South Meadow Brook traverses the site. Bordering Land Subject to Flooding is also located within the site.

Currently all runoff from the site discharges to South Meadow Brook. The developed portion of the site is captured by catch basins and drainage structures through a network of drainage lines before discharging into South Meadow Brook. Portions of the undeveloped area of the site south of the former railway drain directly into the brook. See Existing Drainage Exhibit in **Attachment A**.

PROPOSED SITE

The proposed project involves the renovation of #141 – 143 Needham Street and 165 Needham Street that will be used for retail and restaurant uses. #151 – 153 Needham Street office building on the site will remain. Various utilities and site development features will be relocated or replaced. The project will maintain the existing stormwater management system with significant upgrades to accommodate the new buildings and the

16,175 ± s.f. increase of impervious area as outlined in this report.

A stormwater management system has been designed to comply with Massachusetts Department of Environmental Protection Standards for stormwater management.

The stormwater management system will incorporate many Best Management Practices (BMP's), which will include Contech proprietary water quality devices, Cultec 330XLHD subsurface recharge chambers, and an operations and maintenance program designed to treat, recharge, and reduce peak runoff from the runoff generated from the expansion of the development.

The project involves fill in the flood plain and compensatory storage has been provided in the Compensatory Storage Areas shown in the BMP Location Map in **Attachment D**. These systems are not related to DEP standards for stormwater and are not included in any calculations for this report.

See Proposed Conditions Drainage Exhibit in **Attachment B**.

STORMWATER MANAGEMENT STANDARDS

The following is a discussion of the Massachusetts Stormwater Management Standards

STANDARD 1: NO NEW UNTREATED DISCHARGES

The proposed project has been designed for no new untreated discharges from the site. The proposed pavement areas will be treated by proprietary water quality devices or biofilter swales.

STANDARD 2: PEAK RATE ATTENUATION

Existing and developed sites were modeled using Hydraflow Hydrographs 10 computer program by AutoCAD Civil 3D 2013. This computer software uses the TR55/TR20 tabular method of computing peak flows, hydrograph addition, and pond routing. The runoff curve numbers for the existing and propose conditions analysis were assumed to be hydrologic group B. soils. Research from NRCS soils survey maps shows the site as Urban Land with no hydrologic group. See soil survey map in **Attachment E**. The time of concentration for the existing and proposed conditions analysis was conservatively assumed to be 6 minutes.

As can be seen from the summary chart below, the peak flows from the design storm on the site will be reduced as a result of this project. Peak flow mitigation will be provided within the Cultec subsurface chambers.

The entire TR55 analysis is included in **Attachment A** (Existing Conditions) and **Attachment B** (Proposed Conditions) of this report.

Peak Runoff Chart – Total Site Runoff

Storm (yr, inches)	**Existing** (cfs)	**Proposed** (cfs)	**Difference** (cfs)
2, 3.1	28.14	26.88	-1.26
10, 4.5	43.54	42.12	-1.42
25, 5.3	52.27	51.13	-1.14
50, 5.9	58.78	58.10	-0.68
100, 6.5	65.26	65.12	-0.14

STANDARD 3: RECHARGE

The hydrologic group of the soils was assumed to be Group B. Based on DEP guidelines for recharge, the required recharge volume for hydrologic group B soils is 0.35". The total increase of impervious area on the proposed site is approximately 16,175 s.f. Since a portion of the impervious area on the site does not reach the subsurface recharge system, the required recharge is increased by a factor of the total impervious area on the site divided by the impervious area that reaches the system.

Required = 16,175 s.f. * (395,647 s.f. / 260,076 s.f.) * 0.35" * 1'/ 12" = 718 cubic feet

The dedicated recharge volume has been provided in the subsurface system below the weir at elevation of 101.3 in the outlet control structure. The provided recharge volumes for the infiltration basins were calculated using Hydraflow Hydrographs Extension for AutoCAD Civil 3D 2013 Version 10. The recharge chambers have been designed to hold approximately 736 cu.ft. See **Attachment C** for pond volume and recharge calculations.

The volume in the subsurface chambers above the recharge volume at elevation 101.3 were used to attenuate peak flows. No infiltration rates were applied to the subsurface system, but an infiltration rate of 1.02 in/hr was assumed to calculate drain down time in **Attachment C**. See Infiltration Rates in **Attachment E**.

STANDARD 4: STORMWATER QUALITY

Stormwater runoff from the site will be enhanced by means of a number of Best Management Practices (BMP's), which have been designed to comply with the DEP Stormwater Management Guidelines. In order to achieve a Total Suspended Solids (TSS) removal rate of 80%, the following BMP's will be incorporated:

- Pavement sweeping and maintenance program
- Contech proprietary water quality devices
- Deep sump catch basins

The total TSS removal is expected to be greater than 80%. See TSS Removal in **Attachment D**.

STANDARD 5: Land Uses with Higher Potential Pollutant Loads (LUHPPL's)

The proposed project is considered to be a LUHPPL because it has the potential to generate greater than 1,000 vehicle trips per day. 1" of water quality flow rate for the increase of impervious area has been provided in the Contech proprietary water quality devices as seen in **Attachment C**. The proposed use is not an industrial use and is not subject to a NPDES Multi-Sector General Permit.

STANDARD 6: CRITICAL AREAS

The site is not in an active public water supply, surface water protection area, nor groundwater protection area, and is not in an area of critical environmental concern.

STANDARD 7: REDEVELOPMENT

The proposed project constitutes both redevelopment and new development and therefore is subject to the Stormwater Management Standards to the maximum extent practicable.

STANDARD 8: CONSTRUCTION PERIOD POLLUTION PREVENTION AND EROSION CONTROL

A construction phasing plan will be established when a site contractor is consulted. At that time a construction phasing plan and the associated Stormwater Pollution

Prevention Plan will be prepared and submitted to the City of Newton and the EPA.

STANDARD 9: OPERATIONS AND MAINTENANCE PLAN

The Stormwater Management System Operation and Maintenance Plan and Long Term Pollution Prevention Plan, Operations and Maintenance Log, and BMP Location Map are provided in **Attachment D.**

STANDARD 10: ILLICIT DISCHARGES

An Illicit Discharge Statement is attached and can be found it the Table of Contents. The Long Term Pollution Prevention Plan can be found in **Attachment D.**

CONCLUSION

An extensive stormwater management system has been designed for the project. The stormwater management system has been designed to comply with current (DEP) standards and will incorporate a number of Best Management Practices ("BMP's") that will ensure that the runoff will be treated prior to leaving the site.

The construction of the stormwater management system will ensure that stormwater runoff from this site will be of high quality and that there will be no adverse impacts on surrounding properties or resource areas.

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

Checklist for Stormwater Report

A. Introduction

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

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

The Stormwater Report must include:

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

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

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

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

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

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

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

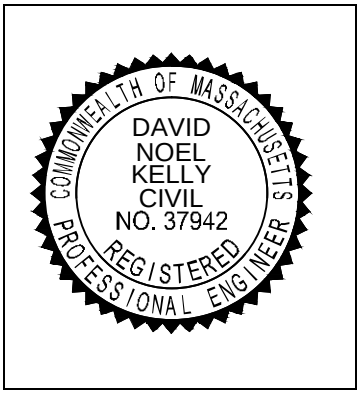
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature



David Noel Kelly
2015.01.12 11:30:24
-05'00'

Signature and Date

Checklist

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

☐ New development

☐ Redevelopment

☒ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

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

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

Standard 1: No New Untreated Discharges

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

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

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

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

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

Standard 3: Recharge

☐ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

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

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

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

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

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

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

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

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.

*Treatment train includes proprietary water quality devices.

Standard 6: Critical Areas

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

- ☒ Name of the stormwater management system owners;
- ☒ 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.

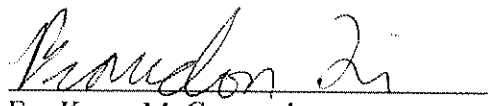
ILLICIT DISCHARGE STATEMENT

This statement has been prepared to comply with Stormwater Management Standard #10 as referenced in the Massachusetts Stormwater Handbook, Volume One, Chapter One, Page 25. This handbook has been issued by the Massachusetts Department of Environmental Protection for compliance with revised Regulations for Wetlands 310 CMR 10.00.

As detailed in the Site Development Plans accompanying this application this project will not involve any illicit discharge to the stormwater management system. Furthermore, to the best of my knowledge there are no illicit discharges to the stormwater management system of the existing site.

Owner and Responsible Party for Operating and Managing the site:

Wellford Associates
c/o Crosspoint Associates, Inc.
300 Third Avenue, Suite 2
Waltham, MA 02451
508-655-0505



For Kerry McCormack,
Crosspoint Associates, Inc.

01/09/15
Date

RUNOFF SUMMARY

Peak Runoff Chart

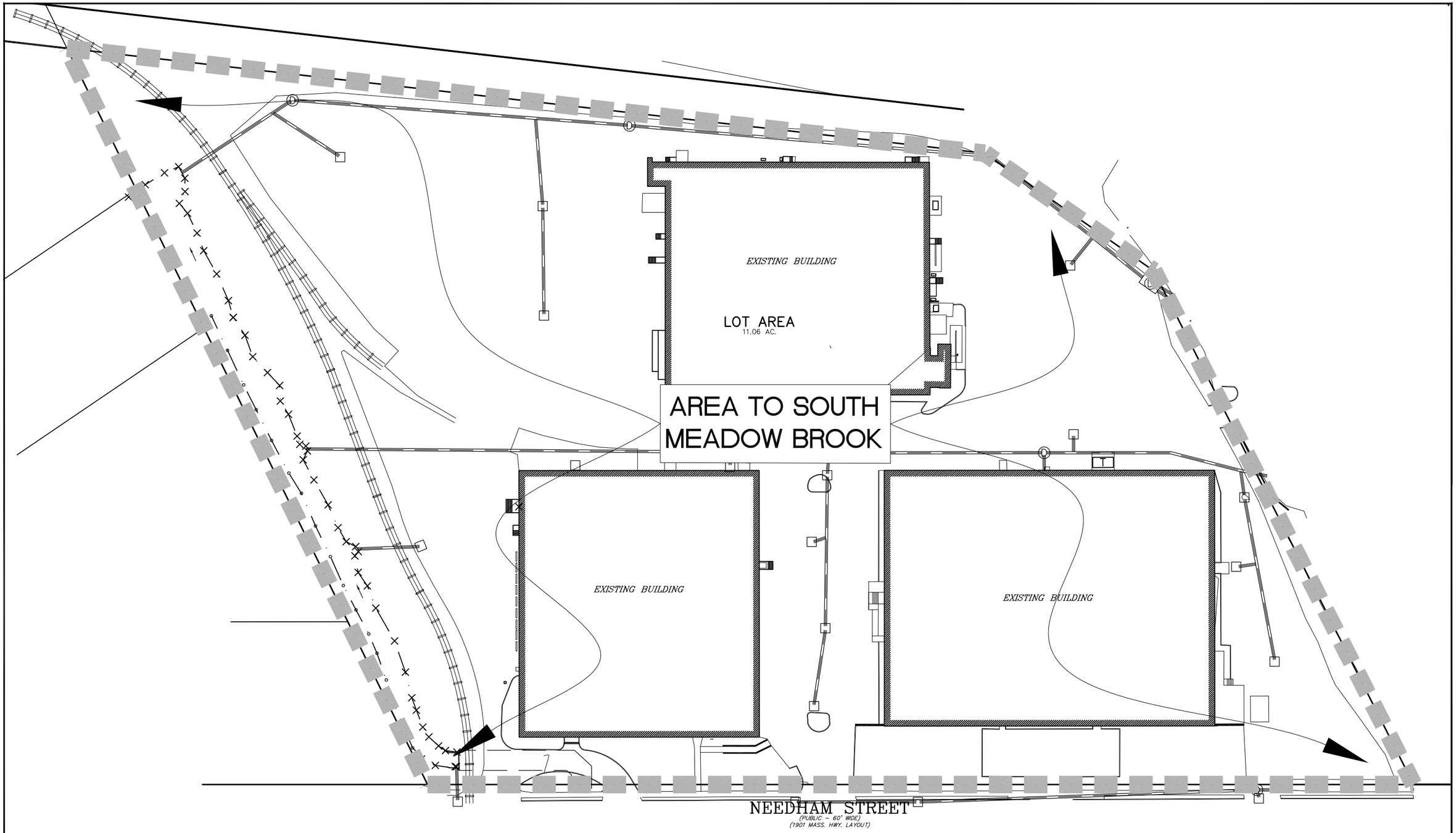
Storm	Existing	Proposed	Difference
(yr, inches)	(cfs)	(cfs)	(cfs)
2,3.1	28.14	26.88	-1.26
10,4.5	43.54	42.12	-1.42
25,5.3	52.27	51.13	-1.14
50,5.9	58.78	58.10	-0.68
100,6.5	65.26	65.12	-0.14

Runoff Volume Chart

Storm	Existing	Proposed	Difference
(yr, inches)	(cu.ft)	(cu.ft)	(cu.ft)
2,3.1	86,659	90,090	3,431
10,4.5	137,558	141,148	3,590
25,5.3	167,023	170,660	3,637
50,5.9	189,225	192,888	3,663
100,6.5	211,491	215,174	3,683

KELLY ENGINEERING GROUP, INC.
Zero Campanelli Drive-Braintree-MA 02184 Phone 781 843 4333

Attachment A
Existing Conditions



131,141-143,151-153,165,173,&181
NEEDHAM STREET
NEWTON, MA

SCALE: 1"= 80'

DATE: 01/09/15

2013-075-EXDR00

EXISTING DRAINAGE EXHIBIT

KELLY ENGINEERING GROUP, INC.
CIVIL ENGINEERING CONSULTANTS
0 CAMPANELLI DRIVE · BRAINTREE MA · 02184
PHONE: 781 843 4333 FAX: 781 843 0028

Runoff Curve Number and Runoff

Name: Crosspoint Associates, Inc. **By:** hk **Date:** 01/09/15
Location : 131, 141-143, 151-153, 165, 173, 181 Needham St., Newton, MA
Description: **Existing Conditions - Site to South Meadow Brook**

Circle One: **Pre** or Post

Runoff Curve Number (CN):

Surface Description	Soil Name; hydrologic group; hydrologic condition	**CN**	s.f.	Product of CN x Area
Green Area	Fair Condition; Hydrologic Group B	69	90642	6254298
Roof Area		98	154768	1.5E+07
Wetlands		98	11869	1163162
Paved/Concrete		98	224704	2.2E+07
		Totals =	481983.00	4.5E+07
		Acres =	11.0648072	

CN or C (weighted) = total product/total area = **92.5**

Reference: *Urban Hydrology for Small Watersheds*
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Watershed Model Schematic

Legend

Hyd.	Origin	Description
1	SCS Runoff	Total Site Runoff

Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	------	-------	28.14	-------	-------	43.54	52.27	58.78	65.26	Total Site Runoff

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	28.14	2	724	86,659	------	------	------	Total Site Runoff

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	43.54	2	724	137,558	------	------	------	Total Site Runoff

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	52.27	2	724	167,023	------	------	------	Total Site Runoff

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	58.78	2	724	189,225	------	------	------	Total Site Runoff

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	65.26	2	724	211,491	------	------	------	Total Site Runoff

Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	0.0000	0.0000	0.0000	--------
2	17.4950	4.2000	0.6438	--------
3	0.0000	0.0000	0.0000	--------
5	40.8144	10.8000	0.7755	--------
10	45.6810	10.9000	0.7723	--------
25	106.0698	18.5000	0.9101	--------
50	44.6078	10.9000	0.6858	--------
100	47.7883	11.3000	0.6734	--------

File name: Boston IDF.IDF

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	4.19	3.17	2.61	2.25	1.99	1.80	1.65	1.53	1.42	1.34	1.26	1.20
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	4.80	3.88	3.28	2.86	2.55	2.30	2.10	1.94	1.80	1.69	1.59	1.50
10	5.39	4.37	3.70	3.23	2.88	2.60	2.38	2.20	2.04	1.91	1.80	1.70
25	5.99	5.03	4.34	3.82	3.42	3.10	2.84	2.61	2.43	2.26	2.12	2.00
50	6.69	5.55	4.79	4.24	3.83	3.50	3.23	3.01	2.82	2.66	2.52	2.40
100	7.29	6.09	5.29	4.70	4.25	3.90	3.61	3.37	3.17	2.99	2.84	2.70

Tc = time in minutes. Values may exceed 60.

Precip. file name: Sample.pcp

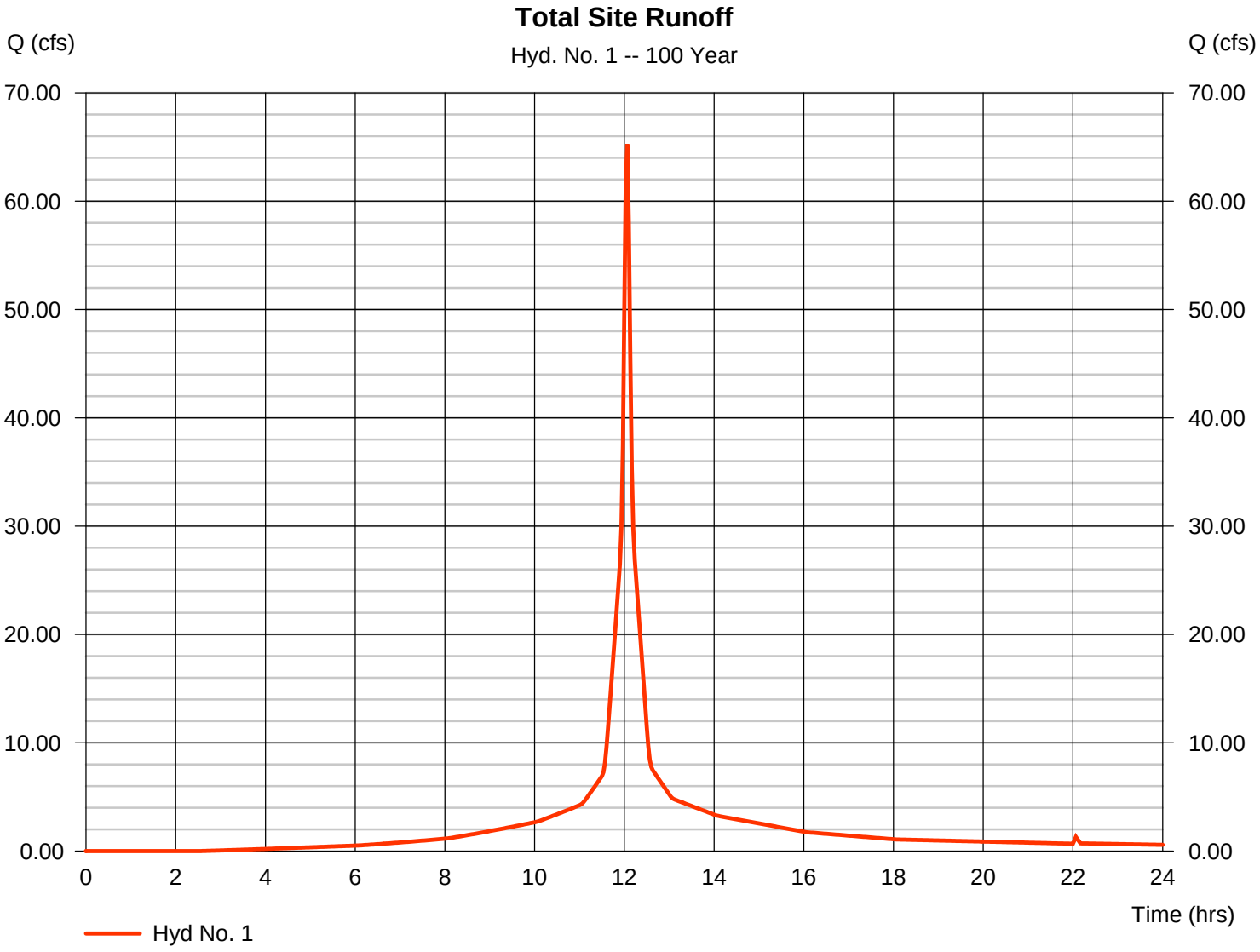
Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	0.00	3.10	0.00	3.30	4.50	5.30	5.90	6.50
SCS 6-Hr	0.00	1.80	0.00	0.00	2.60	0.00	0.00	4.00
Huff-1st	0.00	1.55	0.00	2.75	4.00	5.38	6.50	8.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	0.00	1.75	0.00	2.80	3.90	5.25	6.00	7.10

Hydrograph Report

Hyd. No. 1

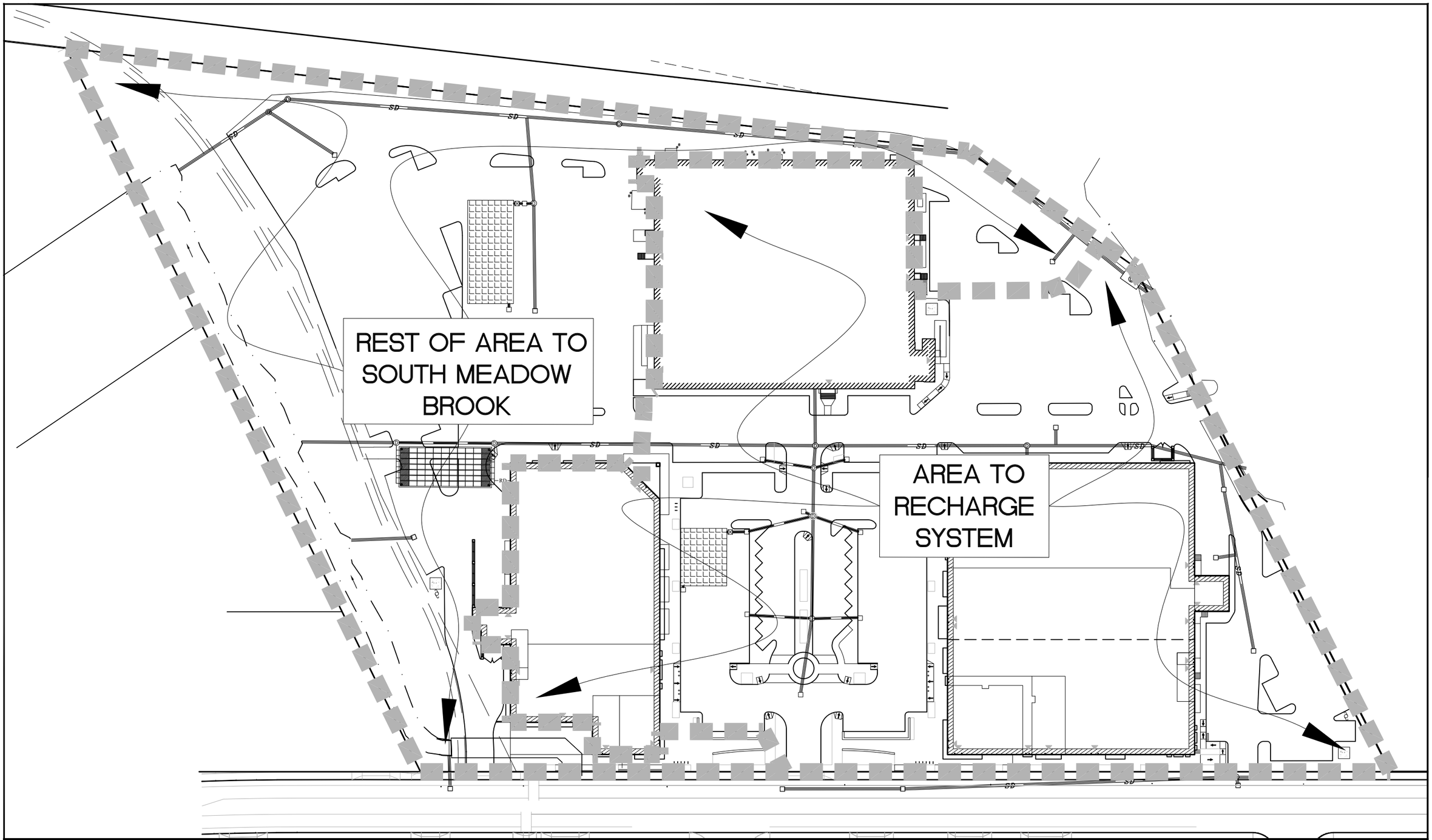
Total Site Runoff

Hydrograph type	=	SCS Runoff	Peak discharge	=	65.26 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	211,491 cuft
Drainage area	=	11.060 ac	Curve number	=	92.5
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	6.00 min
Total precip.	=	6.50 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



KELLY ENGINEERING GROUP, INC.
Zero Campanelli Drive-Braintree-MA 02184 Phone 781 843 4333

Attachment B
Proposed Conditions



141-143, 151-153, 165, 173, & 181
NEEDHAM STREET
NEWTON, MA

SCALE: 1"= 80'

DATE: 01/09/15

2013-075-PRDR00

PROPOSED DRAINAGE EXHIBIT

KELLY ENGINEERING GROUP, INC.
CIVIL ENGINEERING CONSULTANTS
0 CAMPANELLI DRIVE · BRAINTREE MA · 02184
PHONE: 781 843 4333 FAX: 781 843 0028

Runoff Curve Number and Runoff

Name: Crosspoint Associates, Inc. **By:** hk **Date:** 01/09/15
Location : 131, 141-143, 151-153, 165, 173, 181 Needham St., Newton, MA
Description: **Proposed Conditions - Area to Subsurface Recharge**

Circle One: **Pre** or Post

Runoff Curve Number (CN):

Surface Description	Soil Name; hydrologic group; hydrologic condition	**CN**	s.f.	Product of CN x Area
Green Area	Fair Condition; Hydrologic Group B	69	15758	1087302
Roof Area		98	132960	1.3E+07
Wetlands		98	0	0
Paved/Concrete		98	127116	1.2E+07
		Totals =	275834.00	2.7E+07
		Acres =	6.33227732	

CN or C (weighted) = total product/total area = **96.3**

Reference: *Urban Hydrology for Small Watersheds*
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Number and Runoff

Name: Crosspoint Associates, Inc. **By:** hk **Date:** 01/09/15
Location : 131, 141-143, 151-153, 165, 173, 181 Needham St., Newton, MA
Description: **Proposed Conditions - Remainder of Site to South Meadow Brook**

Circle One: **Pre** or Post

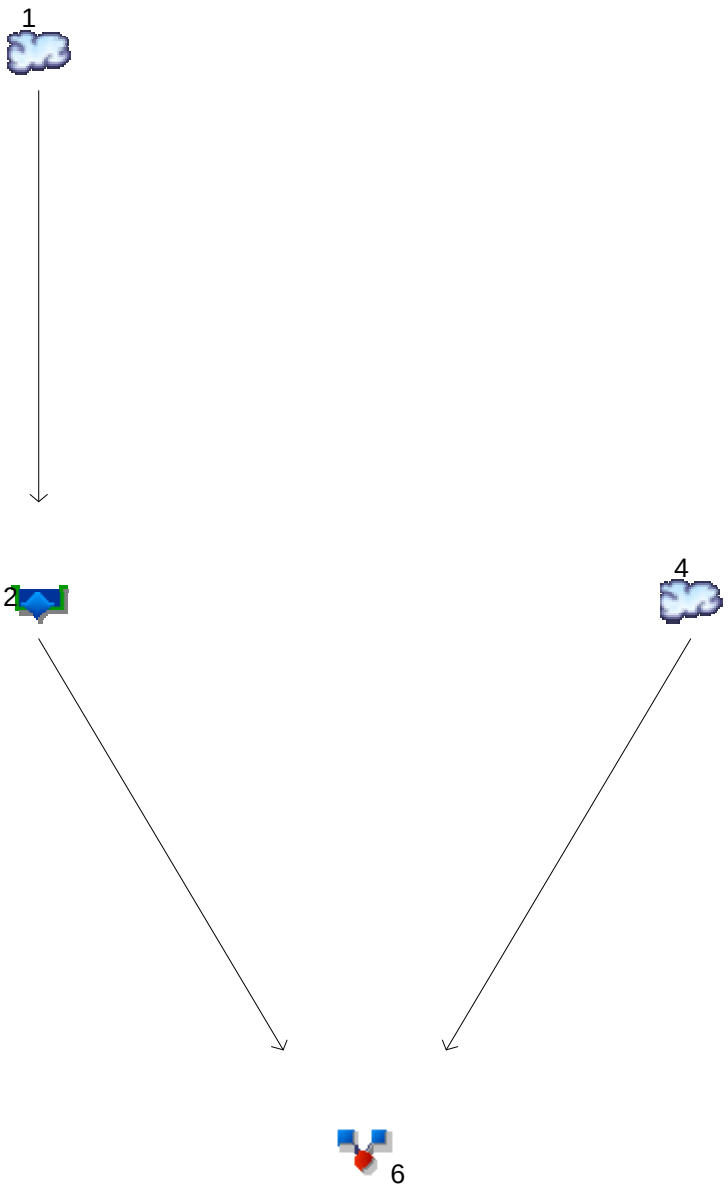
Runoff Curve Number (CN):

Surface Description	Soil Name; hydrologic group; hydrologic condition	**CN**	s.f.	Product of CN x Area
Green Area	Fair Condition; Hydrologic Group B	69	58709	4050921
Roof Area		98	0	0
Wetlands		98	11869	1163162
Paved/Concrete		98	135571	1.3E+07
		Totals =	206149.00	1.9E+07
		Acres =	4.73252984	

CN or C (weighted) = total product/total area = **89.7**

Reference: *Urban Hydrology for Small Watersheds*
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Watershed Model Schematic



Legend

Hyd.	Origin	Description
1	SCS Runoff	Area to Recharge System
2	Reservoir	To Recharge System
4	SCS Runoff	Rest of Site to Brook
6	Combine	Total Site Runoff

Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)							Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	------	-------	17.82	-------	-------	26.41	31.29	34.93	38.57	Area to Recharge System
2	Reservoir	1	-------	16.55	-------	-------	24.86	29.80	33.95	38.15	To Recharge System
4	SCS Runoff	------	-------	10.92	-------	-------	17.56	21.34	24.16	26.97	Rest of Site to Brook
6	Combine	2, 4,	-------	26.88	-------	-------	42.12	51.13	58.10	65.12	Total Site Runoff

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	17.82	2	724	57,781	------	------	------	Area to Recharge System
2	Reservoir	16.55	2	726	57,089	1	102.72	3,928	To Recharge System
4	SCS Runoff	10.92	2	724	33,001	------	------	------	Rest of Site to Brook
6	Combine	26.88	2	724	90,090	2, 4,	------	------	Total Site Runoff

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	26.41	2	724	87,667	------	------	------	Area to Recharge System
2	Reservoir	24.86	2	726	86,975	1	103.19	4,779	To Recharge System
4	SCS Runoff	17.56	2	724	54,172	------	------	------	Rest of Site to Brook
6	Combine	42.12	2	724	141,148	2, 4,	------	------	Total Site Runoff

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	31.29	2	724	104,807	------	------	------	Area to Recharge System
2	Reservoir	29.80	2	724	104,114	1	103.43	5,165	To Recharge System
4	SCS Runoff	21.34	2	724	66,546	------	------	------	Rest of Site to Brook
6	Combine	51.13	2	724	170,660	2, 4,	------	------	Total Site Runoff

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	34.93	2	724	117,677	------	------	------	Area to Recharge System
2	Reservoir	33.95	2	724	116,985	1	103.61	5,408	To Recharge System
4	SCS Runoff	24.16	2	724	75,903	------	------	------	Rest of Site to Brook
6	Combine	58.10	2	724	192,888	2, 4,	------	------	Total Site Runoff

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	38.57	2	724	130,557	------	------	------	Area to Recharge System
2	Reservoir	38.15	2	724	129,865	1	103.77	5,614	To Recharge System
4	SCS Runoff	26.97	2	724	85,310	------	------	------	Rest of Site to Brook
6	Combine	65.12	2	724	215,174	2, 4,	------	------	Total Site Runoff

Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	0.0000	0.0000	0.0000	--------
2	17.4950	4.2000	0.6438	--------
3	0.0000	0.0000	0.0000	--------
5	40.8144	10.8000	0.7755	--------
10	45.6810	10.9000	0.7723	--------
25	106.0698	18.5000	0.9101	--------
50	44.6078	10.9000	0.6858	--------
100	47.7883	11.3000	0.6734	--------

File name: Boston IDF.IDF

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	4.19	3.17	2.61	2.25	1.99	1.80	1.65	1.53	1.42	1.34	1.26	1.20
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	4.80	3.88	3.28	2.86	2.55	2.30	2.10	1.94	1.80	1.69	1.59	1.50
10	5.39	4.37	3.70	3.23	2.88	2.60	2.38	2.20	2.04	1.91	1.80	1.70
25	5.99	5.03	4.34	3.82	3.42	3.10	2.84	2.61	2.43	2.26	2.12	2.00
50	6.69	5.55	4.79	4.24	3.83	3.50	3.23	3.01	2.82	2.66	2.52	2.40
100	7.29	6.09	5.29	4.70	4.25	3.90	3.61	3.37	3.17	2.99	2.84	2.70

Tc = time in minutes. Values may exceed 60.

Precip. file name: Sample.pcp

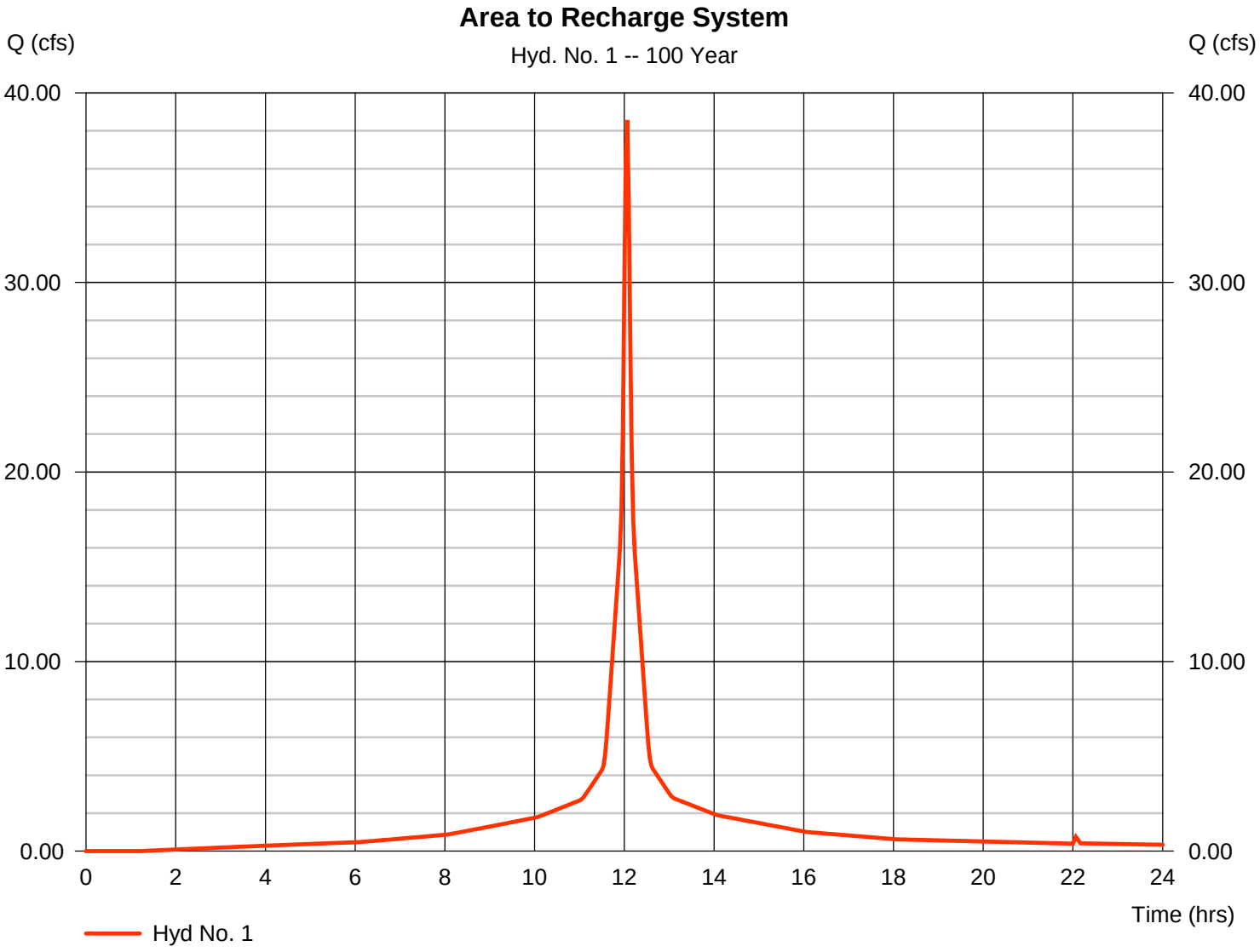
Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	0.00	3.10	0.00	3.30	4.50	5.30	5.90	6.50
SCS 6-Hr	0.00	1.80	0.00	0.00	2.60	0.00	0.00	4.00
Huff-1st	0.00	1.55	0.00	2.75	4.00	5.38	6.50	8.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	0.00	1.75	0.00	2.80	3.90	5.25	6.00	7.10

Hydrograph Report

Hyd. No. 1

Area to Recharge System

Hydrograph type	=	SCS Runoff	Peak discharge	=	38.57 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	130,557 cuft
Drainage area	=	6.330 ac	Curve number	=	96.3
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	6.00 min
Total precip.	=	6.50 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



Hydrograph Report

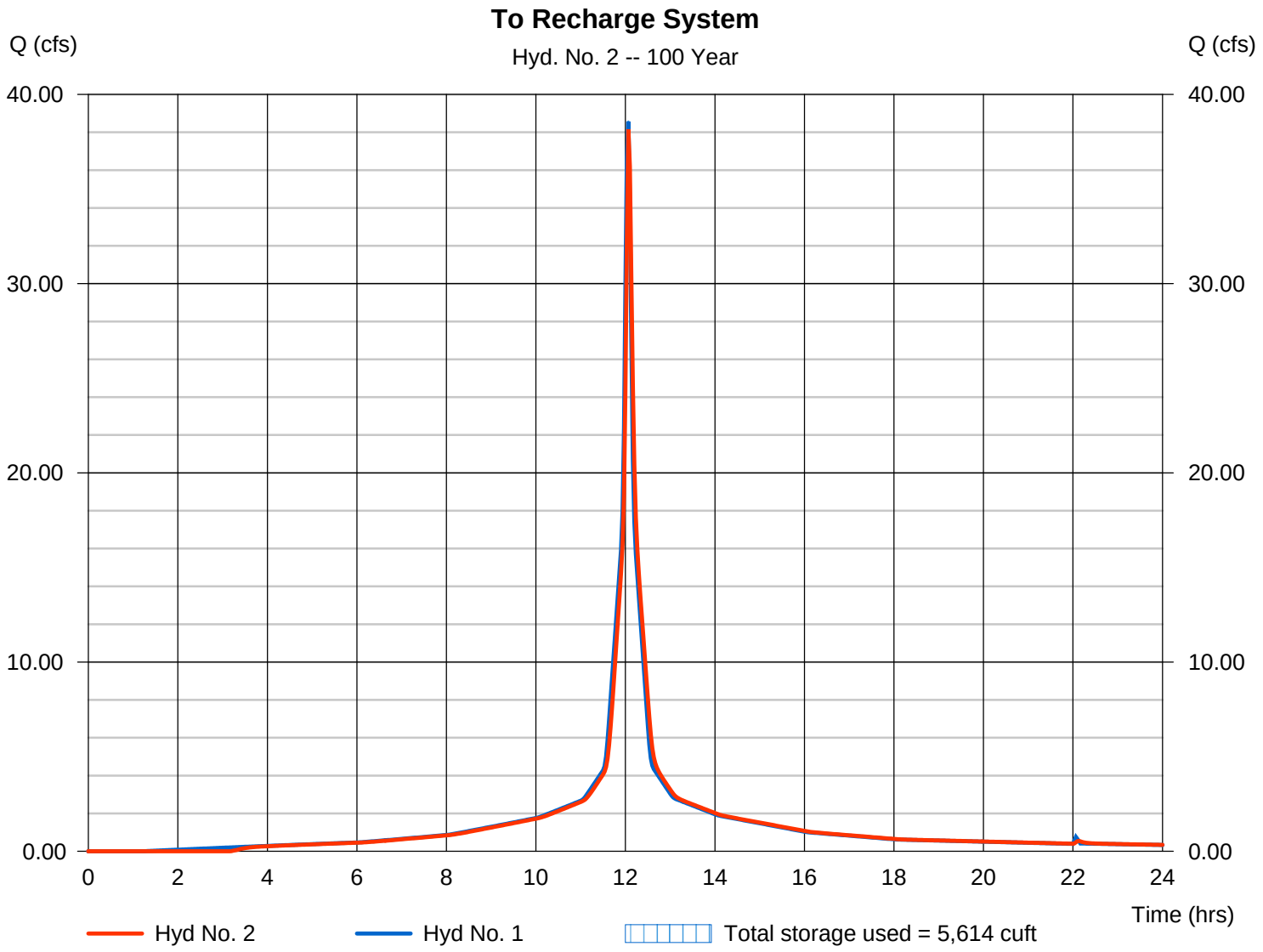
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 01 / 9 / 2015

Hyd. No. 2

To Recharge System

Hydrograph type	=	Reservoir	Peak discharge	=	38.15 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	129,865 cuft
Inflow hyd. No.	=	1 - Area to Recharge System	Max. Elevation	=	103.77 ft
Reservoir name	=	Subsurface Recharge	Max. Storage	=	5,614 cuft

Storage Indication method used.



Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 — Friday, 01 / 9 / 2015

Pond No. 1 - Subsurface Recharge

Pond Data

UG Chambers -Invert elev. = 101.00 ft, Rise x Span = 2.54 x 4.30 ft, Barrel Len = 7.00 ft, No. Barrels = 77, Slope = 0.00%, Headers = No
Encasement -Invert elev. = 101.00 ft, Width = 4.80 ft, Height = 3.04 ft, Voids = 40.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	101.00	n/a	0	0
0.30	101.30	n/a	736	736
0.61	101.61	n/a	730	1,467
0.91	101.91	n/a	718	2,185
1.22	102.22	n/a	698	2,883
1.52	102.52	n/a	671	3,553
1.82	102.82	n/a	632	4,186
2.13	103.13	n/a	579	4,765
2.43	103.43	n/a	498	5,263
2.74	103.74	n/a	344	5,607
3.04	104.04	n/a	315	5,921

Culvert / Orifice Structures

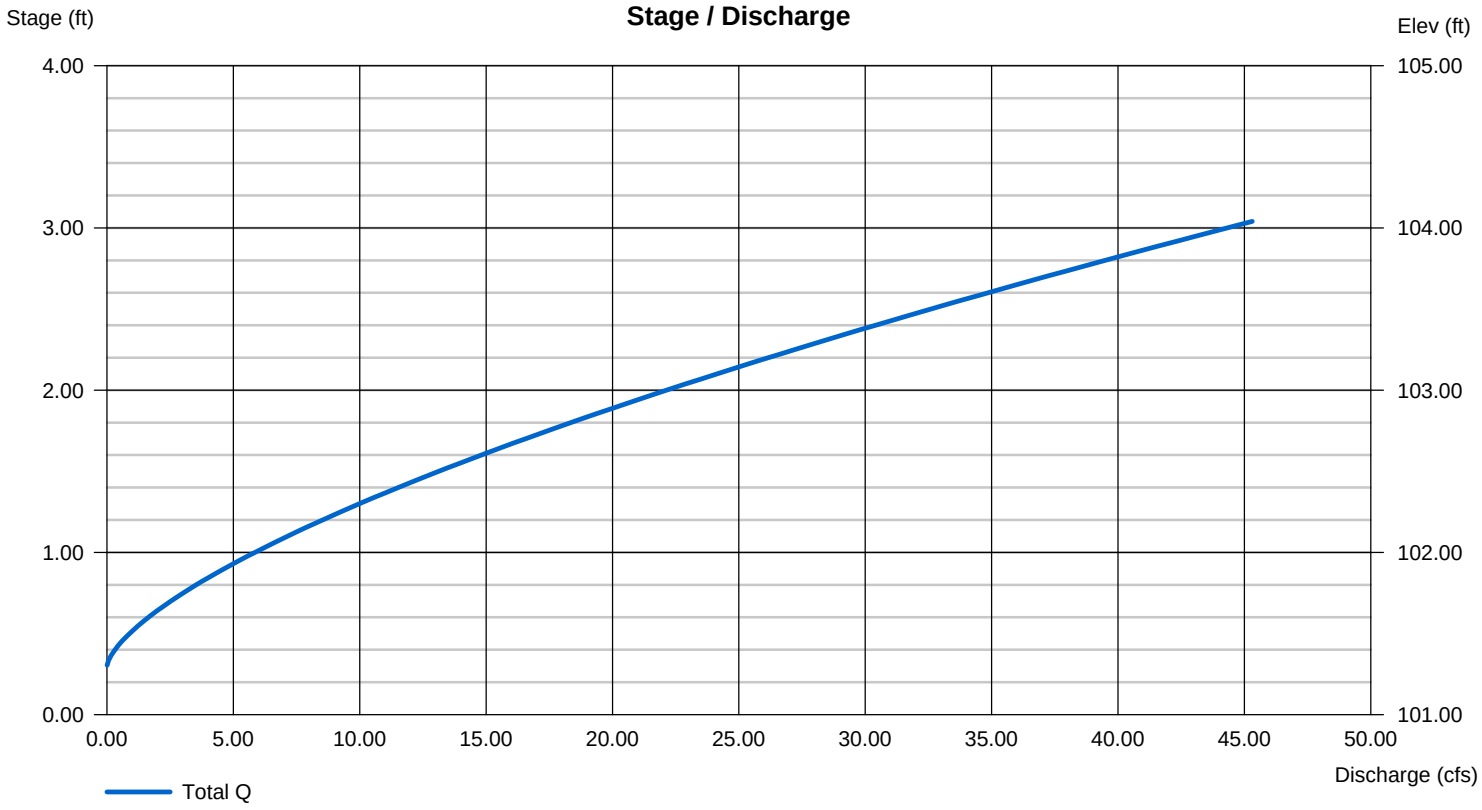
	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 3.00	0.00	0.00	0.00
Crest El. (ft)	= 101.30	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)
TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

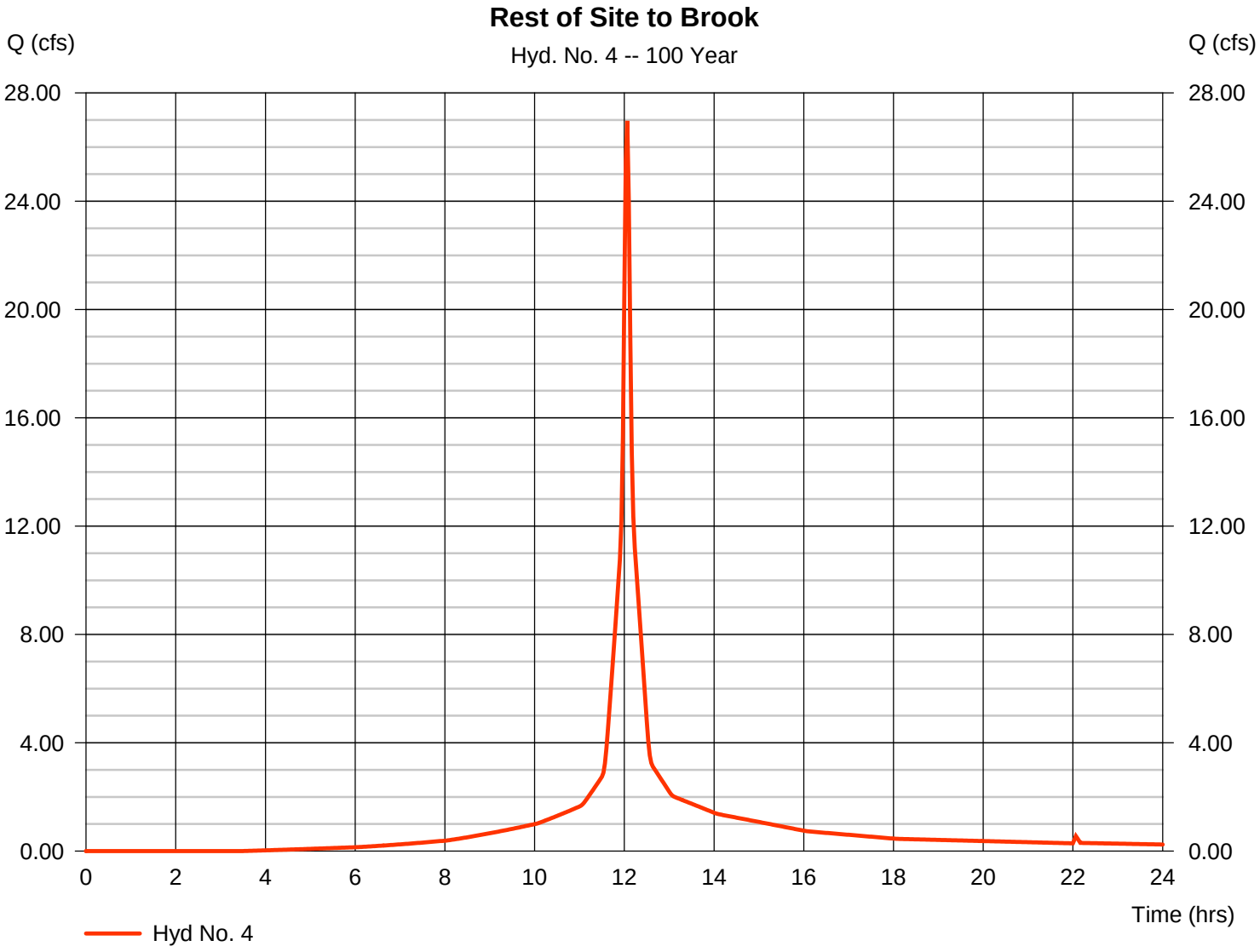


Hydrograph Report

Hyd. No. 4

Rest of Site to Brook

Hydrograph type	= SCS Runoff	Peak discharge	= 26.97 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 85,310 cuft
Drainage area	= 4.730 ac	Curve number	= 89.7
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 6.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



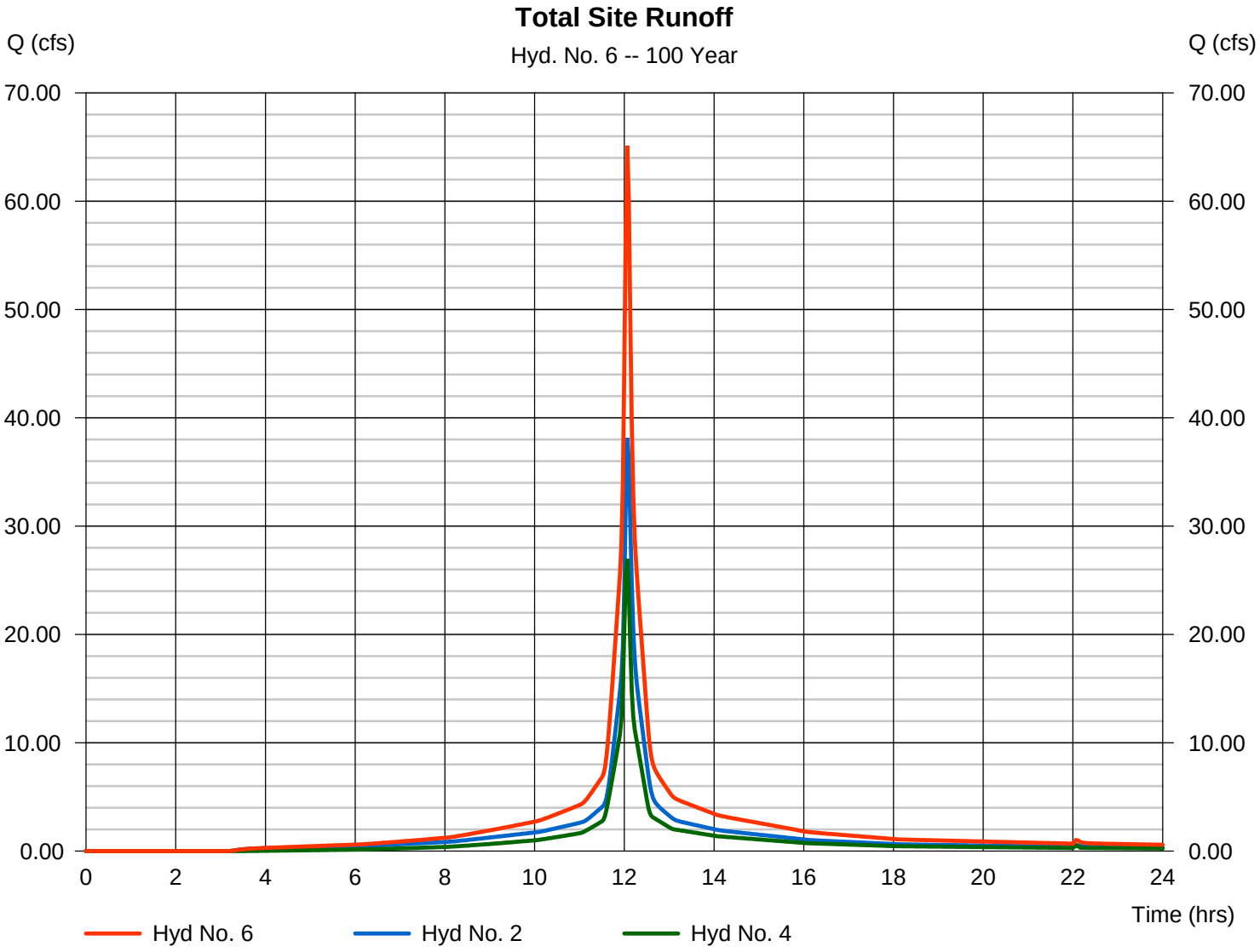
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 01 / 9 / 2015

Hyd. No. 6

Total Site Runoff

Hydrograph type	= Combine	Peak discharge	= 65.12 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 215,174 cuft
Inflow hyds.	= 2, 4	Contrib. drain. area	= 4.730 ac



KELLY ENGINEERING GROUP, INC.
Zero Campanelli Drive-Braintree-MA 02184 Phone 781 843 4333

Attachment C
Recharge & Water Quality Calculations

Recharge System Calculations

Required Recharge for Hydrologic Group B Soils = 0.35”

Impervious Area to Recharge System = 260,076 ± s.f.
Total Impervious Area on Site = 395,647 ± s.f.

Required Dedicated Recharge Volume = 16,175 s.f *(395,647 s.f. / 260,076 s.f.)*0.35”*(1’/12”)
= **718 cu.ft**

Provided Recharge Volume at Weir (el=101.3) = **736 cu.ft**. (see Pond Report in Attachment B)

Drain Down Time

Draw down analysis is based on soil texture from NRCS soil survey.
The soils are assumed to be Sandy Loams (1.02 in/hr).

Subsurface Recharge Chambers
Bottom Contact Area = 2,844 s.f.
Recharge Rate = 2,844 s.f. * 1.02 in/hr *1’/12” = 242 cu.ft/ hr
Drain Time for recharge volume = 736 cu.ft / 242 cu.ft/hr = 3**.0 hours**

Water Quality Volume

Required Water Quality Volume = 1.0” over the increase of impervious area for redevelopment

Required Water Quality Volume = 16,175 s.f * 1.0” * 1’/12” = **1,348 cu.ft**

See Contech Water Quality Calculations in Attachment C for provided volume.

CULTEC

Stormwater and Septic Solutions
Since 1986

1-800-4-CULTEC
Manufactured at ISO 9001:2000 certified facilities

Prepared For:	Project Information:	Engineer:	Calculations Performed By:
Crosspoint Associates, Inc.	131, 141-143, 151-153, 165, 173, 181	Brandon Li	
300 Third Avenue	Needham Street	Kelly Engineering Group, Inc.	
Suite 2	Newton	0 Campanelli Drive	
Waltham	MA 02461	Braintree	
MA 02451	Date: January 09, 2015	MA 02184	
508-655-0505		781-843-4333	
781-890-6600		781-843-0028	
kmccormack@crosspointassociates.com		bli@kellyengineeringgroup.com	

Input Given Parameters

Unit of Measure	**English**	
Select Model	**Recharger 330XLHD**	
Stone Porosity	**40.0%**	
Number of Header Systems	**1 Header**	
Stone Depth **Above** Chamber	**6**	inches
Stone Depth **Below** Chamber	**6**	inches
Workable Bed Depth	**10.00**	feet
Max. Bed Width	**40.00**	feet
Storage Volume Required	**6000.00**	cu. feet

Image for visual reference only.May not reflect selected model.

Chamber Specifications

Height	**30.5**	inches
Width	**52.00**	inches
Length	**8.50**	feet
Installed Length	**7.00**	feet
Bare Chamber Volume	**52.21**	cu. feet
Installed Chamber Volume	**79.26**	cu. feet
Bed Depth	**4.63**	feet
Bed Width	**35.33**	feet
Storage Volume Provided	**6490.34**	cu. feet

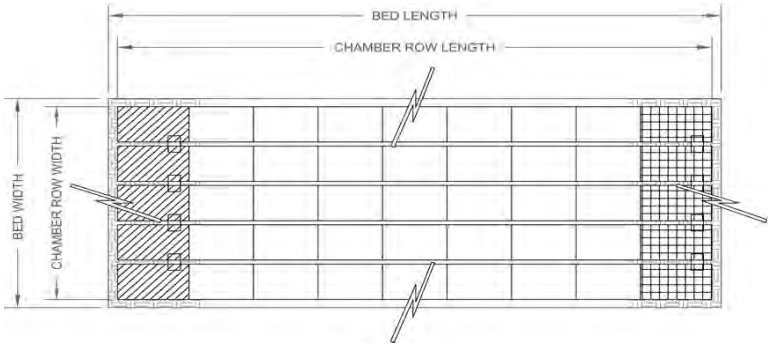
Materials List

Recharger 330XLHD Stormwater System by CULTEC, Inc.

Approx. Unit Count - not for construction	75	pieces
Actual Number of Chambers Required	**77**	pieces
Starter Chambers	**7**	pieces
Intermediate Chambers	**63**	pieces
End Chambers	**7**	pieces

HVLV FC-24	**6**	pieces
CULTEC No. 410™ Filter Fabric	**795.56**	sq. yards
CULTEC No. 20L Polyethylene Liner	**35.33**	feet
Stone	**221.19**	cu. yards
Volume of Excavation	**487.22**	cu. yards

Bed Detail



Number of Rows Wide	**7**	pieces
Number of Chambers Long	**11**	pieces
Chamber Row Width	**33.33**	feet
Chamber Row Length	**78.50**	feet
Bed Width	**35.33**	feet
Bed Length	**80.50**	feet
Bed Area Required	**2844.33**	sq. feet

Bed detail for reference only. Not project specific. Not to scale. Use CULTEC StormGenie to output project specific detail.

CULTEC, Inc.
P.O. Box 280, Brookfield, CT 06804 USA
Phone: 203-775-4416 - Fax: 203-775-1462 - **www.cultec.com**

CULTEC

Stormwater and Septic Solutions
Since 1986

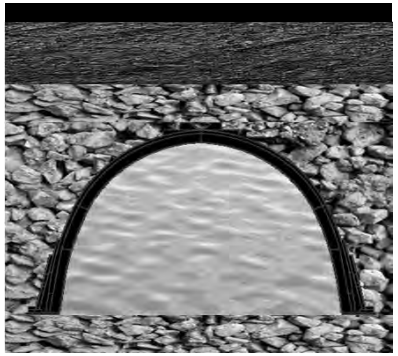
1-800-4-CULTEC
Manufactured at ISO 9001:2000 certified facilities

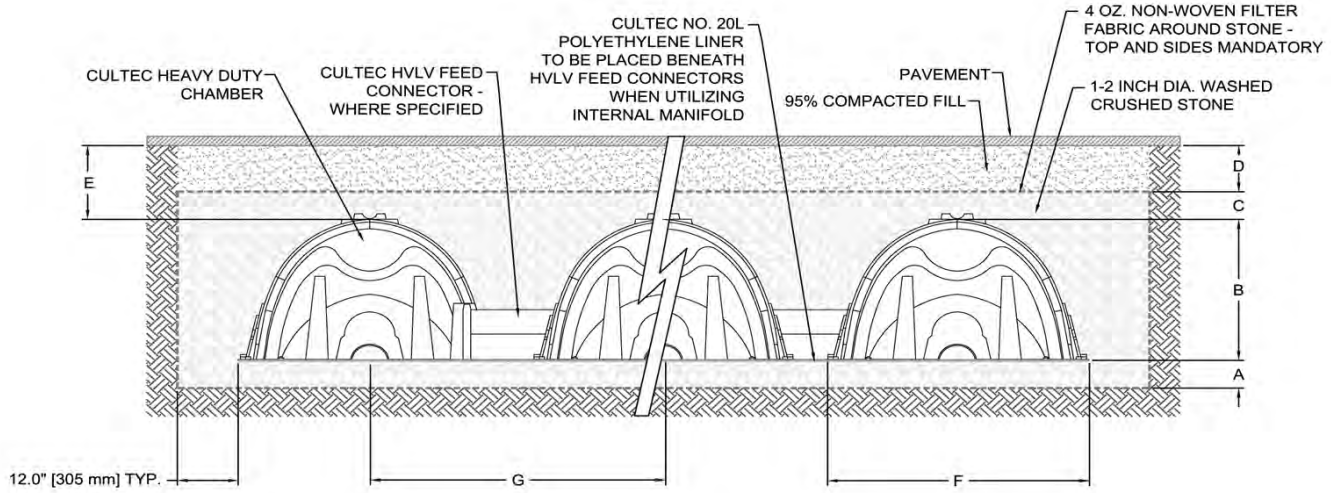
Project Name: 131, 141-143, 151-153, 165, 173, 181 **Date:** January 09, 2015

Cross Section Detail

Conceptual graphic only. Not job specific.

Recharger 330XLHD		
Pavement	**3**	inches
95% Compacted Fill	**10**	inches
Stone Above	**6**	inches
Chamber Height	**30.5**	inches
Stone Below	**6**	inches
Effective Depth	**42.5**	inches
Bed Depth	**55.5**	inches





A	Depth of Stone Base	**6.0**	inches
B	Chamber Height	**30.5**	inches
C	Depth of Stone Above Units	**6.0**	inches
D	Depth of 95% Compacted Fill	**10.0**	inches
E	Max. Depth of Cover Allowed Above Crown of Chamber	**12.0**	feet
F	Chamber Width	**52.0**	inches
G	Center to Center Spacing	**4.83**	feet

Breakdown of Storage Provided by Recharger 330XLHD	Stormwater System	
Chambers	**4098.72**	cu. feet
Feed Connectors	**2.73**	cu. feet
Stone	**2388.89**	cu. feet
Total Storage Provided	**6490.34**	cu. feet

CULTEC, Inc.
P.O. Box 280, Brookfield, CT 06804 USA
Phone: 203-775-4416 - Fax: 203-775-1462 - **www.cultec.com**

Project: Crosspoint Associates - Needham St
Location: Newton, MA
Prepared For: Brandon Li - Kelly Engineering Group, Inc.

Purpose: To calculate the water quality flow rate (WQF) over a given site area. In this situation the WQF is derived from the first 1.0" of runoff.

Reference: Massachusetts Dept. of Environmental Protection Wetlands Program / United States Department of Agriculture Natural Resources Conservation Service TR-55 Manual

Given:

Structure Name	Impv. (acres)	A (miles^2)	t_c (min)	t_c (hr)	WQV (in)
WQD #1	2.47	0.0038596	10.0	0.167	1.00
WQD #2	5.25	0.0082000	15.0	0.250	1.00
WQD #3	0.42	0.0006556	6.0	0.100	1.00

Procedure:

Determine unit peak discharge using Figure 1 or 2. Figure 2 is in tabular form so is preferred. Using the tc, read the unit peak discharge (qu) from Figure 1 or Table in Figure 2. qu is expressed in the following units: cfs/mi^2/watershed inches (csm/in).

Structure Name	qu (csm/in.)
WQD #1	700.00
WQD #2	628.00
WQD #3	774.00

1. Compute Q Rate using the following equation:

$$Q_1 = (qu)\ (A)\ (WQV)$$

where:

Q_1 = flow fate associated with first 1.0" of runoff
qu = the unit peak discharge, in csm/in.
A = impervious surface drainage area (in square miles)
WQV = water quality volume in watershed inches (1.0" in this case)

Structure Name	Q_1 (cfs)
WQD #1	2.70
WQD #2	5.15
WQD #3	0.51

KELLY ENGINEERING GROUP, INC.
Zero Campanelli Drive-Braintree-MA 02184 Phone 781 843 4333

Attachment D
TSS Removal

INSTRUCTIONS:

Version 1, Automated: Mar. 4, 2008

1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Location: WQD #1 - Contech CDS 2020-5

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Street Sweeping - 5%	**0.05**	**1.00**	**0.05**	**0.95**
PROPRIETARY DEVICE: CONTECH CDS 2020-5	0.848	**0.95**	0.81	0.14

Total TSS Removal = 86%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project:	2013-075, 141 Needham St
Prepared By:	Kelly Engineering Group,Inc.
Date:	1/9/2015

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed

1. From MassDEP Stormwater Handbook Vol. 1

INSTRUCTIONS:

Version 1, Automated: Mar. 4, 2008

1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Location: WQD #2 - Contech CDS 3030-6

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Street Sweeping - 5%	**0.05**	**1.00**	**0.05**	**0.95**
PROPRIETARY DEVICE: CONTECH CDS 3030-6	0.836	**0.95**	0.79	0.16

Total TSS Removal = 84%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: 2013-075, 141 Needham St

Prepared By: Kelly Engineering Group,Inc.

Date: 1/9/2015

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed

1. From MassDEP Stormwater Handbook Vol. 1

INSTRUCTIONS:

Version 1, Automated: Mar. 4, 2008

1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Location: WQD #3 - Contech VSHS36

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Street Sweeping - 5%	**0.05**	**1.00**	**0.05**	**0.95**
PROPRIETARY DEVICE: CONTECH VSHS36	0.908	**0.95**	0.86	0.09

Total TSS Removal = 91%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: 2013-075, 141 Needham St

Prepared By: Kelly Engineering Group,Inc.

Date: 1/9/2015

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed

1. From MassDEP Stormwater Handbook Vol. 1

CDS ESTIMATED NET ANNUAL TSS REDUCTION BASED ON THE RATIONAL RAINFALL METHOD

CROSSPOINT ASSOCIATES - NEEDHAM ST.
NEWTON UPPER FALLS, MA
for SYSTEM: WQD #1

Area	2.47	acres	CDS Model	
Weighted C	0.90		2020-5	
Tc	10	minutes	CDS Treatment Capacity	
			3.2	cfs

Rainfall Intensity[1] (in/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (cfs)	Treated Flowrate (cfs)	Removal Efficiency (%)	Incremental Removal (%)
0.02	10.2%	10.2%	0.04	0.04	99.7	10.1
0.04	9.6%	19.8%	0.09	0.09	98.7	9.5
0.06	9.4%	29.3%	0.13	0.13	97.8	9.2
0.08	7.7%	37.0%	0.18	0.18	96.9	7.5
0.10	8.6%	45.6%	0.22	0.22	95.9	8.2
0.12	6.3%	51.9%	0.27	0.27	95.0	6.0
0.14	4.7%	56.5%	0.31	0.31	94.1	4.4
0.16	4.6%	61.2%	0.36	0.36	93.1	4.3
0.18	3.5%	64.7%	0.40	0.40	92.2	3.3
0.20	4.3%	69.1%	0.44	0.44	91.3	4.0
0.25	8.0%	77.1%	0.56	0.56	88.9	7.1
0.30	5.6%	82.7%	0.67	0.67	86.6	4.8
0.35	4.4%	87.0%	0.78	0.78	84.2	3.7
0.40	2.5%	89.5%	0.89	0.89	81.9	2.1
0.45	2.5%	92.1%	1.00	1.00	79.6	2.0
0.50	1.4%	93.5%	1.11	1.11	77.2	1.1
0.75	5.0%	98.5%	1.67	1.67	65.5	3.3
1.00	1.0%	99.5%	2.22	2.22	53.8	0.5
1.50	0.0%	99.5%	3.33	3.20	31.9	0.0
2.00	0.0%	99.5%	4.45	3.20	23.9	0.0
3.00	0.5%	100.0%	6.67	3.20	16.0	0.1
						91.2
					Removal Efficiency Adjustment[2] =	6.5%
					Predicted % Annual Rainfall Treated =	93.3%
					Predicted Net Annual Load Removal Efficiency =	**84.8%**

1 - Based on 10 years of hourly precipitation data from NCDC Station 770, Boston WSFO AP, Suffolk County, MA
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

CDS ESTIMATED NET ANNUAL TSS REDUCTION BASED ON THE RATIONAL RAINFALL METHOD

CROSSPOINT ASSOCIATES - NEEDHAM ST.
NEWTON UPPER FALLS, MA
for SYSTEM: WQD #2

Area	5.25	acres	CDS Model	
Weighted C	0.90		3030-6	
Tc	15	minutes	CDS Treatment Capacity	
			6.1	cfs

Rainfall Intensity[1] (in/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (cfs)	Treated Flowrate (cfs)	Removal Efficiency (%)	Incremental Removal (%)
0.02	10.2%	10.2%	0.09	0.09	99.5	10.1
0.04	9.6%	19.8%	0.19	0.19	98.5	9.5
0.06	9.4%	29.3%	0.28	0.28	97.4	9.2
0.08	7.7%	37.0%	0.38	0.38	96.4	7.5
0.10	8.6%	45.6%	0.47	0.47	95.3	8.2
0.12	6.3%	51.9%	0.57	0.57	94.2	5.9
0.14	4.7%	56.5%	0.66	0.66	93.2	4.3
0.16	4.6%	61.2%	0.76	0.76	92.1	4.3
0.18	3.5%	64.7%	0.85	0.85	91.1	3.2
0.20	4.3%	69.1%	0.95	0.95	90.0	3.9
0.25	8.0%	77.1%	1.18	1.18	87.3	7.0
0.30	5.6%	82.7%	1.42	1.42	84.7	4.7
0.35	4.4%	87.0%	1.65	1.65	82.0	3.6
0.40	2.5%	89.5%	1.89	1.89	79.4	2.0
0.45	2.5%	92.1%	2.13	2.13	76.7	1.9
0.50	1.4%	93.5%	2.36	2.36	74.1	1.0
0.75	5.0%	98.5%	3.54	3.54	60.8	3.1
1.00	1.0%	99.5%	4.73	4.73	47.6	0.5
1.50	0.0%	99.5%	7.09	6.10	27.6	0.0
2.00	0.0%	99.5%	9.45	6.10	20.7	0.0
3.00	0.5%	100.0%	14.18	6.10	13.8	0.1
						90.0
					Removal Efficiency Adjustment[2] =	6.5%
					Predicted % Annual Rainfall Treated =	93.3%
					Predicted Net Annual Load Removal Efficiency =	**83.6%**

1 - Based on 10 years of hourly precipitation data from NCDC Station 770, Boston WSFO AP, Suffolk County, MA
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

VortSentry® HS Estimated Net Annual TSS Reduction

CROSSPOINT ASSOCIATES - NEEDHAM ST.
NEWTON UPPER FALLS, MA
Model VSHS36
System WQD #3

Design Ratio[1] = $\frac{\text{0.42 acres x 0.9}}{\text{27 ft3}}$ **= 0.014**

Rainfall Intensity "/hr	Flow Rate cfs	Operating Rate[2] cfs/ft^3	% Total Rainfall Depth[3]	Rmvl. Effcy[4] (%)	Rel. Effcy (%)
0.02	0.01	0.00029	10.2%	98.0%	10.0%
0.04	0.02	0.00057	9.6%	98.0%	9.5%
0.06	0.02	0.00086	9.4%	98.0%	9.3%
0.08	0.03	0.00114	7.7%	98.0%	7.6%
0.10	0.04	0.00143	8.6%	98.0%	8.4%
0.12	0.05	0.00171	6.3%	98.0%	6.2%
0.14	0.05	0.00200	4.7%	98.0%	4.6%
0.16	0.06	0.00228	4.6%	98.0%	4.5%
0.18	0.07	0.00257	3.5%	98.0%	3.5%
0.20	0.08	0.00285	4.3%	98.0%	4.3%
0.25	0.09	0.00357	8.0%	98.0%	7.8%
0.30	0.11	0.00428	5.6%	98.0%	5.5%
0.35	0.13	0.00499	4.4%	98.0%	4.3%
0.40	0.15	0.00570	2.5%	98.0%	2.5%
0.45	0.17	0.00642	2.5%	98.0%	2.5%
0.50	0.19	0.00713	1.4%	98.0%	1.4%
0.75	0.28	0.01070	5.0%	94.4%	4.8%
1.00	0.38	0.01426	1.0%	89.3%	0.9%
1.50	0.57	0.02139	0.0%	77.1%	0.0%
2.00	0.76	0.02852	0.0%	61.7%	0.0%
3.00	1.13	0.04278	0.5%	13.3%	0.1%
					97.3%
				% rain falling at >0"/hr =	0.0%
				Removal Efficiency Adjustment[4] =	6.5%
				Predicted Net Annual Load Removal Efficiency =	**90.8%**

1 - Design Ratio = (Total Drainage Area x Runoff Coefficient) / VortSentry HS Treatment Volume
= The Total Drainage Area and Runoff Coefficient are specified by the site engineer.

2 - Operating Rate (cfs/ft^3) = Rainfall Intensity ("/hr) x Design Ratio

3 - Based on 10 years of hourly precipitation data from NCDC Station 770, Boston WSFO AP, Suffolk County, MA

4 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

Calculated by: CJA	Date: 01/08/15	Checked by:	Date:

CROSSPOINT ASSOCIATES, INC.
NEWTON NEXUS
NEEDHAM STREET, NEWTON, MA
STORMWATER MANAGEMENT SYSTEM
OPERATION AND MAINTENANCE PLAN
&
LONG-TERM POLLUTION PREVENTION PLAN

1/9/15

Prepared by:

KELLY ENGINEERING GROUP, INC.
Zero Campanelli Drive
Braintree, Massachusetts 02184

OWNER AND RESPONSIBLE PARTY:
Wellford Associates
c/o Crosspoint Associates, Inc.
300 Third Avenue, Suite 2
Waltham, MA 02451

Note: If ownership of this property changes then the new owner becomes the responsible party. The Owner may assign responsibility to a tenant on the property.

Introduction

Considerable time, effort and cost has been spent in the design and construction of the stormwater management system for this development. The stormwater management system consists of a number of Best Management Practices (BMP's). These BMP's combine to ensure that storm runoff from the site will not damage the sensitive environmental resources surrounding the site. In order to ensure that these BMP's operate as designed it is very important that the procedures in this operation and maintenance plan be followed. Most of these operation procedures require observation and measurement; however, at certain times more extensive maintenance measures may be needed. The following is an itemization of each of these BMP's and their maintenance needs.

The party responsible for maintenance should contract with a maintenance organization capable of performing the more extensive measures such as pumping of catch basin sumps, etc.

BMP No. 1 – Paved Road Surface/Parking Lot Area:

- Regularly pick up and remove litter from the parking lot area, landscaped islands and perimeter landscaped areas and water quality areas.

- The paved area is to be swept a minimum of two times per year, at least once during April and again during September with a high efficiency vacuum sweeper or a regenerative air sweeper. If a mechanical sweeper is used, the paved area is to be swept a minimum of once a month.

BMP No. 2 - Deep Sump Catch Basins:

- Basins are to be inspected twice a year.

    1. Verify that tees are secure and free-flowing.
    2. Measure depth of sediment below water line.

- Basins are to be cleaned whenever sediment and hydrocarbons are observed. Basins are to be cleaned a minimum of twice per year. One of these cleanings shall occur before April 15th of each year and one shall occur before September 15th of each year. Basins may be cleaned either using a clamshell or a vacuum pump.

- All liquid shall be pumped from the sump of each basin at least once per year.

- All sediments and hydrocarbons should be properly handled and disposed of, in accordance with local, state and federal guidelines and regulations.

Note: See catch basin detail for explanation of terms.

BMP No. 3 –Contech Water Quality Units:

- Twice a year inspect the Units to ensure that it is operating correctly and to measure the sediment depth.

- When the sediment depth is within 6" of the dry weather water surface elevation, the Unit should be cleaned. This determination can be made by taking 2 measurements with a stadia rod or similar measuring device; one measurement from the manhole opening to the top of the sediment pile and the other from the manhole opening to the water surface. The Unit should be cleaned out if the difference between the two measurements is six inches or less.

- Cleanout of the Units shall occur during dry weather, with a vacuum truck or a "clamshell" grab. Sediment is evacuated through the manhole over the grit chamber. See VortSentry Manual for required servicing and maintenance.

–CDS:

- Twice a year inspect the Units to ensure that it is operating correctly and to measure the sediment depth using a "dip stick". The floatables should be removed and the sump cleaned when the sump is above 85% full. At least once a year, the unit should be pumped down and the screen carefully inspected for damage and to ensure that it is properly fastened. Ideally, the screen should be power washed for the inspection.

If any problems are encountered with the Contech Units, contact the manufacturer.

BMP No. 4 - Subsurface Recharge System:

- The inlet pipe and observation basin shall be inspected twice a year. Any accumulated debris shall be removed.

- Inspect recharge facilities following a rainfall event greater than 2.5 inches in a 24 hour period.

- If standing water is observed for more than 48 hours following a storm event, immediately retain a qualified professional to assess whether infiltration function has been lost and develop recommended corrective actions.

Snow Removal:

- There shall be no plowing or stock piling of snow within all resource areas and any area subject to the jurisdiction of local and state regulations without the prior written permission from state or local approving authority.
- Road salts and de-icing materials shall be stored on impervious pads and covered to protect from wind and precipitation.
- No de-icing materials shall be stored nor used within all resource areas and any area subject to the jurisdiction of local and state regulations without the prior written permission from state or local approving authority.
- No de-icing materials shall be stored within Zone I, Zone II, Zone A, and 200 feet from a river or estuary.

Storage and Use of Chemicals:

- No pesticides, herbicides, nor insecticides shall be stored nor used within all resource areas and any area subject to the jurisdiction of local and state regulations without the prior written permission from state or local approving authority.
- Chemical storage on site shall be limited. Any chemicals that must be stored shall be stored in a secure area in accordance with Local and State regulations.

Hazardous Waste:

- Containment – In the event of a discharge or spill of oil or another hazardous material, outlets to stormwater management ponds shall be plugged so that hazardous material do not enter resource areas.

- Reporting - In the event of a discharge or spill of oil or another hazardous material, responsible facility personnel, oil spill and/or hazardous material removal organizations, federal, state, and local regulatory agencies, the City of Newton Department of Public Works, and the EPA National Response Center 1-800-424-8802 shall be rapidly notified.
- Hazardous Waste – All hazardous waste materials will be disposed of in the manner specified by local, state and/or federal regulations and by the manufacturer of such products.
- There shall be no illicit discharges to the stormwater management system.

Material and Waste Storage, Handling and Management:

- All waste materials will be collected and stored in a securely lidded metal dumpster from a solid waste management company licensed to do business by the state and the town. The dumpster will comply with all local and state solid waste management regulations.

Training for Long Term Pollution Prevention Plan:

- All staff or personnel involved and responsible for implementing the Stormwater Management System Operations and Maintenance Plan and the Long-Term Pollution Prevention Plan shall be properly trained as required under the DEP Stormwater Management Regulations. Training shall be documented with records kept with other stormwater maintenance records.

Vehicle Washing:

- There shall be no vehicle washing on the site.

Lawn and Garden activities:

- There shall be no exterior storage of fertilizers, pesticides, herbicides, or insecticides. No pesticides, herbicides, nor insecticides shall be stored nor used within any resource areas its buffers, and any area subject to the jurisdiction of local and state regulations without the prior written permission from state or local approving authority.
- Fertilizers and pesticides shall be applied properly, sparingly, and outside any resource areas and its buffers.

To reduce the impact of fertilizers, consider the following tips;

- Don't fertilize before a rain storm.
- Consider using organic fertilizers. They release nutrients more slowly.
- Test soils before applying fertilizers. Some soils may not need fertilizers. A standard soil test costs $9.00. (Call the UMass Extension Soil Testing Lab at 413-545-2311 or download a soil test order form at http://www.umass.edu/plsoils/soiltest/.)

Newton Nexus

PROJECT LOCATION: 131, 141-143, 151-153, 165, 173, & 181 Needham Street, Newton, MA

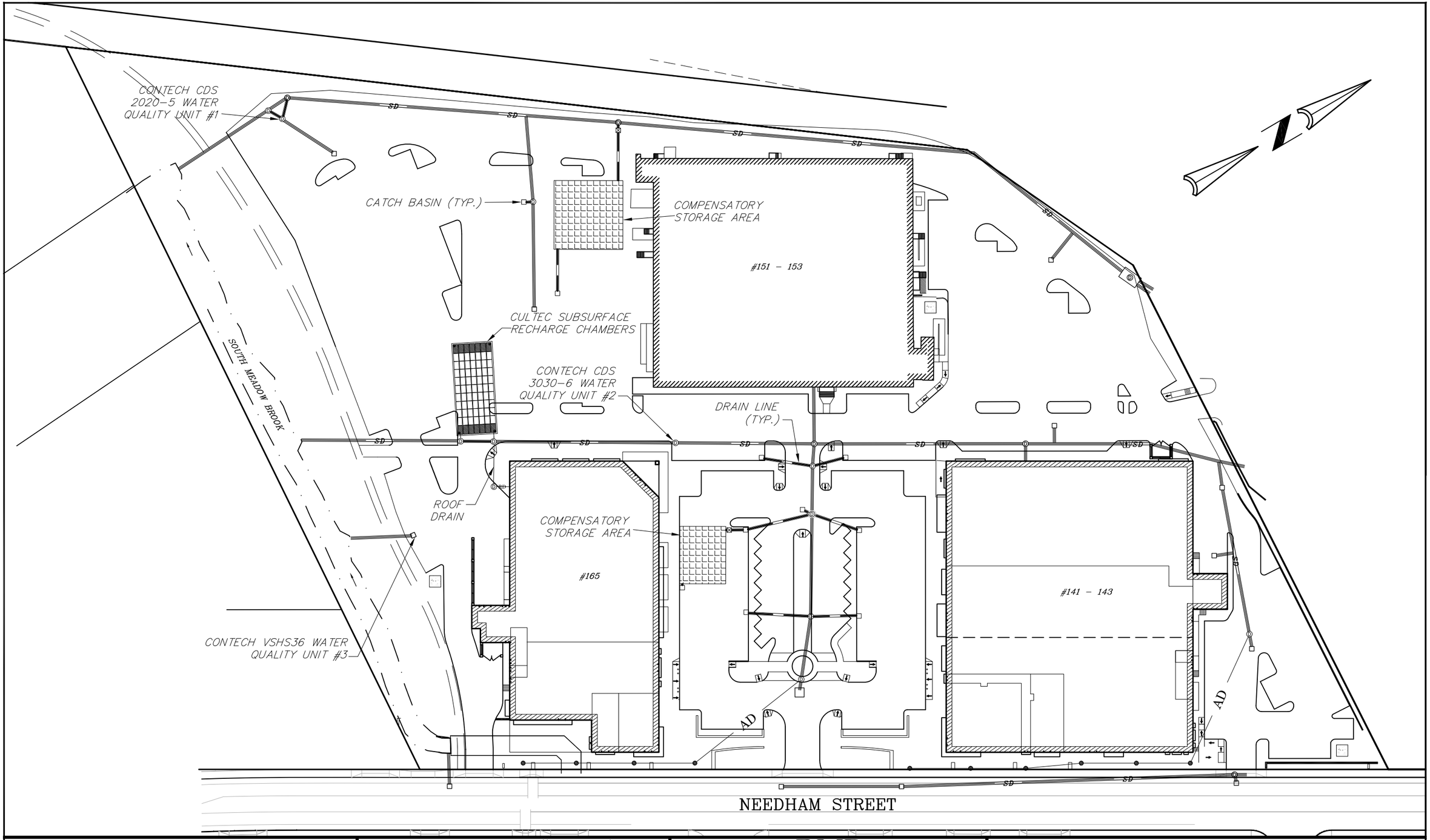
STORMWATER ANAGEMENT BEST MANAGEMENT PRACTICES - INSPECTION SCHEDULE AND EVALUATION CHECKLIST

Best Management Practice	Inspection Frequency (1)	Date I	Inspector	Minimum Maintenance and Key Items to Check (1)	Cleaning/Repair Needed yes__ no__ (list items)	Date of Cleaning /Repair	Performed By
Street Sweeping	2x per year			Vacuum sweeper			
Deep Sump and Hooded Catch Basins	2x per year			Remove sediment 1x per year or if >6”			
Cultech subsurface recharge	2x per year			Inspect inlets, remove debris, drain time less than 4 days			
CDS water Quality device	2x per year			Per manufacturer Requirements			

(1) Refer to the Operation and Maintenance Plan for recommendations regarding frequency of inspections and maintenance of specific BMP's.

recommendations regarding frequency for inspection and maintenance of specific BMPs.

Stormwater Control Manager/Environmental Monitor: **Stamp/Signature**



141-143, 151-153, 165, 173, & 181 NEEDHAM STREET NEWTON, MA	SCALE: 1"= 80' DATE: 01/09/15 2013-075-BMP00	BMP LOCATION MAP	KELLY ENGINEERING GROUP, INC. CIVIL ENGINEERING CONSULTANTS 0 CAMPANELLI DRIVE · BRAINTREE MA · 02184 PHONE: 781 843 4333 FAX: 781 843 0028

KELLY ENGINEERING GROUP, INC.
Zero Campanelli Drive-Braintree-MA 02184 Phone 781 843 4333

Attachment E
Miscellaneous

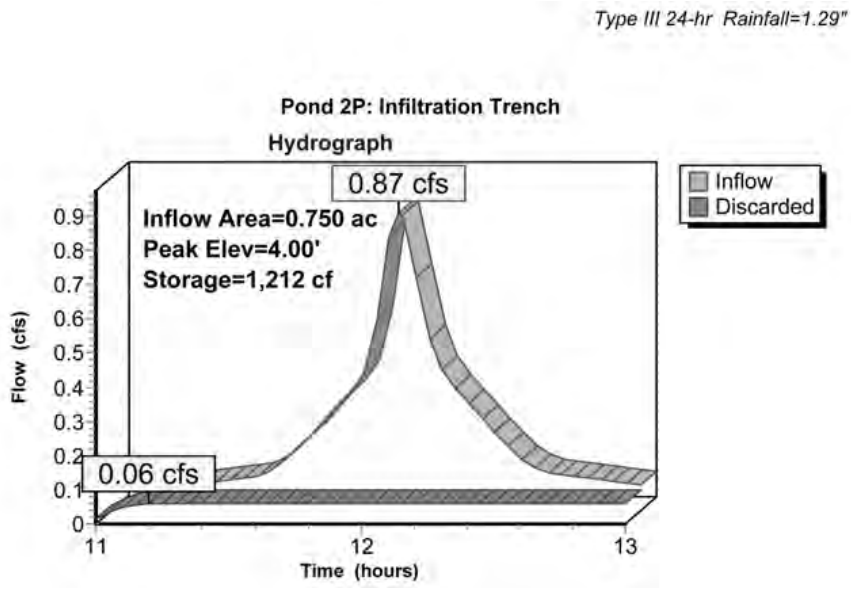


Table 2.3.3. 1982 Rawls Rates[18]

Texture Class	NRCS Hydrologic Soil Group (HSG)	Infiltration Rate Inches/Hour
Sand	A	8.27
Loamy Sand	A	2.41
Sandy Loam	B	1.02
Loam	B	0.52
Silt Loam	C	0.27
Sandy Clay Loam	C	0.17
Clay Loam	D	0.09
Silty Clay Loam	D	0.06
Sandy Clay	D	0.05
Silty Clay	D	0.04
Clay	D	0.02

[18] Rawls, Brakensiek and Saxton, 1982

Attention must be given to ensure consistency in units. In particular, the Target Depth Factors must be converted to feet.

NRCS HYDROLOGIC SOIL TYPE	APPROX. SOIL TEXTURE	TARGET DEPTH FACTOR (F)
A	sand	**0.6-inch**
B	loam	**0.35-inch**
C	silty loam	**0.25-inch**
D	clay	**0.1-inch**

Table 2.3.2: Recharge Target Depth by Hydrologic Soil Group

When a site contains multiple Hydrologic Soil Groups, determine the *Required Recharge Volume* for each impervious area by Hydrologic Soil Group and then add the volumes together.

Example: Assume a ten (10) acre site. 5.0 acres are proposed to be developed for a retail use. A section of the entrance roadway is to be bridged over a stream that is classified as land under water. As such, the bridging is subject to the Wetlands Protection Act Regulations, and the Stormwater Management Standards apply to stormwater runoff from all proposed roads, parking areas, and rooftops. Of the 5.0 acres proposed to be developed, 2 acres of impervious surfaces are proposed atop Hydrologic Soil Group (HSG) "A" soils, 1 acre of impervious surfaces atop HSG "B" soil, 1.5 acres of impervious surfaces atop HSG "C" soil, and 0.5 acres are proposed to be landscaped area. The remaining 5.0 acres, located on HSG "A" soil, are proposed to remain forested. Determine the *Required Recharge Volume*.

Solution: The *Required Recharge Volume* is determined only for the impervious surfaces. The 5.0-acre forested area and the 0.5-acre landscaped area are not impervious areas. Although converted from forest, landscaped area is pervious area for purposes of Standard 3. Use *Equation (1)* to determine the *Required Recharge Volume* for each Hydrologic Soil Group covered by impervious area. Add together the *Required Recharge Volumes* determined for each HSG.

Rv = F x impervious area

$Rv = [(F_{HSG\ "A"})\ (Area_1)] + [(F_{HSG\ "B"})\ (Area_2)] + [(F_{HSG\ "C"})(Area_3)] + [(F_{HSG\ "D"})(Area_4)]$ ***Equation (2)***

Rv = [(0.6-in/12)(2 acres)] + [(0.35-in/12)(1 acre)] + [(0.25-in/12)(1.5 acres)] + [(0.1-in/12)(0 acres)]

Rv = 0.1605 acre-feet

Rv = 0.1605 acre-feet x 43560 square feet/acre-feet = 6,991 cubic feet or *258.9 cubic yards*

Soil Map—Middlesex County, Massachusetts
(151-153, 165, & 173 Needham St. Newton, MA)

MAP LEGEND

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

Soils
- Soil Map Units

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

Special Line Features
- Gully
- Short Steep Slope
- Other

Political Features
- Cities

Water Features
- Oceans
- Streams and Canals

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

MAP INFORMATION

Map Scale: 1:2,100 if printed on A size (8.5" × 11") sheet.

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

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

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

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

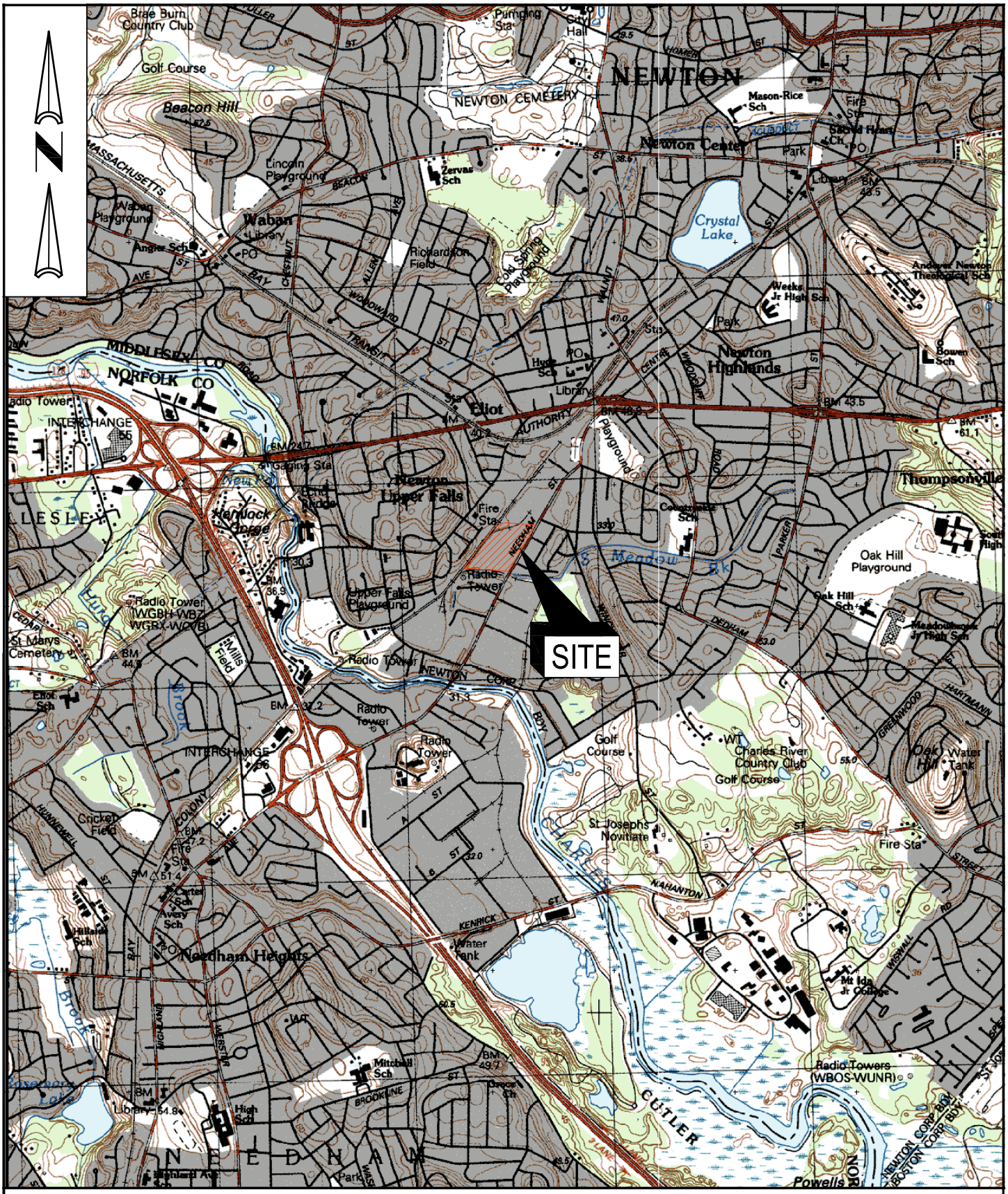
Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 10, Feb 5, 2010

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

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

Map Unit Legend

Middlesex County, Massachusetts (MA017)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
602	Urban land	13.7	100.0%
Totals for Area of Interest		**13.7**	**100.0%**



SCALE; 1"= 2083'±

DATE: 01/09/15

151-153, 165, & 173
NEEDHAM STREET
NEWTON, MA

LOCATION PLAN

SOURCE: USGS

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