Stormwater Report

For

294 Main Street
Acton, MA

December 20, 2010

Applicant: 294 Main Street LLC
P.O. Box 2350
Acton, MA 01720

Stamski And McNary, Inc.
Engineering - Planning – Surveying
1000 Main Street; Acton, MA 01720 (978) 263-8585

SM-4703 File: 4703 supplement.doc

Table of Contents

Project Narrative

Standard 1: No Untreated Discharges

No untreated discharges are proposed. A rain garden, infiltration trenches, and a drip edge will treat runoff.

Standard 2: Peak Rate Attenuation

The post-development peak discharge rates must not be increased from pre-development rates for the 2-year and 10-year storm events. Also, offsite flood impact from the 100-year storm must not be increased. With a combination of infiltration and detention, the peak runoff rate has been decreased as summarized in the following table.

Discharge Summary Table

2-year Storm		10-year Storm		100-year Storm	
Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)
0.36	0.26	1.14	1.04	2.48	1.98

Standard 3: Stormwater Recharge

A prescribed amount of water must be infiltrated to recharge groundwater due to the development. As the project will increase impervious area over NRCS Hydrologic Soil Type B, 0.35 inches of runoff over said area must be infiltrated. This recharge will occur in the Rain Garden. The "Simply Dynamic" method was used with a Rawls Rate of 2.41 in/hr in sizing the required storage volume to infiltrate the recharging runoff. Calculations were performed to insure drawdown within 72 hours to provide storage for the next storm event. For the infiltration trench, which has less than a 4' offset to groundwater water table, mounding analysis was performed which shows groundwater mounding will not break out of the surface or flood the infiltration basin. Detailed calculations showing compliance with Standard 3 have been attached to this report.

Standard 4: Water Quality

With onsite infiltration less than 2.4 in/hr, 1/2 inch of water over the impervious area must be treated for water quality prior to discharge offsite. Water is considered adequately treated with 80% TSS removal. The combination a Rain Garden and an Infiltration Trench will provide greater than 80% TSS removal. Calculations showing treatment levels are attached.

Standard 5: Land Uses with Higher Potential Pollutant Loads

The site is will not contain "land uses with higher potential pollutant loads."

Standard 6: Critical Areas

The site does not discharge runoff to critical areas.

Standard 7: Redevelopment

While the proposed project is a mix of new development and redevelopment, stormwater management will meet the applicable requirements for new development which are more stringent than those required for redevelopment.

Standard 8: Construction Period Controls

Erosion controls will include haybale siltation barriers along the limit of work, a stabilized construction entrance, erosion controls mats, and slope stabilization. All disturbed areas will be loamed and seeded.

Standard 9: Operation and Maintenance Plan

An Operation and Maintenance Plan has been attached to this report.

Standard 10: Illicit Discharges to Drainage System

An Illicit Discharges Compliance Statement will be submitted after the issuances of the Order of Conditions. The Statement verifies that no illicit discharges will occur on the site.

Stormwater Management

The site is located at 294 Main Street in Acton Massachusetts and is approximately 0.74 acres. The site currently consists of a single family dwelling. The project proposes to remove an existing structure and construct 3 two family buildings for a total of 6 units in its place. Low Impact Development (LID) techniques have been utilized to minimize impacts by drainage structures and to control and treat stormwater runoff associated with the proposed project.

According to the Natural Resources Conservation Service (N.R.C.S.) soil survey indicated the presences of Charlton-Hollis-Rock Outcrop. The soil group rates as Hydrologic Group B.

Pre-Development

The site currently has a single family residential dwelling with associated yard and appurtenances. The site is a mix of impervious surfaces, such as roof and pavement, lawn, and woods. The site has a running gentle slope from west to east and the entire site is contained is Subcatchment 1. The eastern property line was selected as the analyst point for both pre and post development.

Post-Development

The project proposes three-two family residential structures with a shared driveway. Runoff from Unit 6 and a portion of the driveway (Subcatchment 3) will be captured and infiltrated by a drip edge and infiltration trench, respectively. Runoff from Unit 5 and the majority of the driveway (Subcatchment 2a) will be collected and infiltrated in a Rain Garden. Overflow will be directed to a subsurface infiltration trench. The runoff from Units 1, 2, 3, and 4 (Subcatchment 2b) will be directed to the subsurface infiltration trench along with the overflow from the Rain Garden. Subcatchment 1 will continue to be uncontrolled overland flow in a similar fashion to pre-development conditions. The Rain Garden and Subsurface Infiltration Trench will provide treatment and peak attenuation prior to discharge. Runoff from all subcatchments leaves the site through the eastern property line.

Compliance with MA DEP Stormwater Management Standards

As the project is a small residential project with 5-9 units in a multi-family development provided there is no discharge that may affect a critical area the project is subject to the Stormwater Management Standards to the maximum extend practicable. The proposed project complies with the Stormwater Management Standards as follows:

Design Basis

1. The rational method (Q=CIA) was used as a basis for sizing pipes. Runoff Coefficients: C=0.15 for woods, 0.20 for grass/landscaped areas, 0.76 for gravel, and 0.9 for impervious surfaces.
2. The 100-year storm was used for sizing pipes. Rainfall intensity values were taken from the U.S. Weather Bureau Technical Paper 40.
3. The United States Department of Agriculture Natural Resource Conservation Service (N.R.C.S.) TR55 methodology was used to determine offsite rates of runoff.
4. The twenty-four hour rainfall, taken from N.R.C.S. publications, is 6.4 inches for the 100-year storm, 4.5 inches for the 10-year storm, and 3.1 inches for the 2-year storm event.
5. The hydrologic calculations were performed using the computer program: "Hydraflow Hydrographs 2007" by Intelisolve.
6. The soil types of the site were taken from the N.R.C.S. Soil Survey Map from nesoil.com.
7. Soil conditions and estimated seasonal high groundwater table were based on on-site soil evaluations.
8. The Hantoush Method was used for Mouning analysis.

TABLE 2-1 HYDROLOGIC SOIL PROPERTIES CLASSIFIED BY SOIL TEXTURE*

Texture Class	Effective Water Capacity (C_w)	Minimum Infiltration Rate (f)	Hydrologic Soil Grouping
Sand	0.35	8.27	A
Loamy Sand	0.31	2.41	A
Sandy Loam	0.25	1.02	B
Loam	0.19	.52	B
Silt Loam	0.17	.27	C
Sandy Clay Loam	0.14	.17	C
Clay Loam	0.14	.09	D
Silty Clay Loam	0.11	.06	D
Sandy Clay	0.09	.05	D
Silty Clay	0.09	.04	D
Clay	0.08	.02	D

* Source: Rawls, Brakensiek and Saxton, 1982

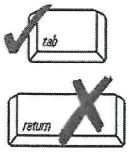
Checklist for Stormwater Report

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

Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

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

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

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

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

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

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

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

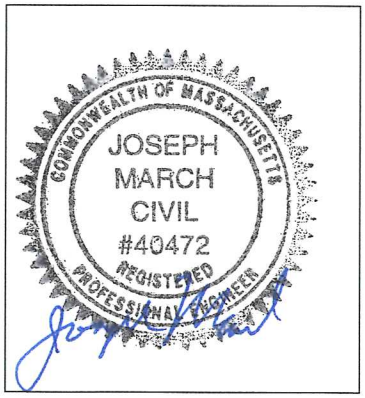
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature



Joseph March 12/23/10

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): Drip Edge and Infiltration Trench

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.

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.

Pre-Development Hydrology

Hydrograph Return Period Recap

Hydraflow Hydrographs by Intelisolve v9.2

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	-------	-------	0.362	-------	-------	1.142	-------	-------	2.484	Subcatchment A - Pre

Worksheet 2: Runoff curve number and runoff **SM-4703**

Project: 294 Main Street By BRE Date 12/15/2010

Location: Acton MA Checked _____ Date _____

Circle one: [Present] Developed Subcatchment A

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
CHARLTON HOLLIS ROCK B	Impervious	98			0.12	11.76
CHARLTON HOLLIS ROCK B	Open Spaces, good condition	61			0.43	26.23
CHARLTON HOLLIS ROCK B	Woods, good condition	55			0.33	18.15
CHARLTON HOLLIS ROCK B	Woods/grass combo	58			0.06	3.48
	Gravel	90			0.01	0.90
Totals =					0.95	60.52

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{60.52}{0.95} = 63.71$; Use CN = 63.7

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	10	100
Rainfall, P (24-hour).....	in	3.1	4.5	6.4
Runoff, Q..... (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)	in	0.50	1.25	2.53
Runoff, Q.....	cf	1731	4300	8709

(210-VI-TR-55, Second Ed., June 1986)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) **SM-4703**

Project: 294 Main Street By BRE Date 12/15/2010

Location: Acton, MA Checked _____ Date _____

Circle one: Present Developed Subcatchment A

through subarea _____

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			WOODS			
2. Mannings roughness coeff., n (table 3-1)			0.4			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.07			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.13			0.13
Shallow concentrated Flow		Segment ID	B-C	C-D	D-E	
7. Surface Description (paved or unpaved)			Unpaved	Paved	Unpaved	
8. Flow Length, L		ft	26	18	68	
9. Watercourse slope, s		ft/ft	0.09	0.03	0.10	
10. Average Velocity, V (figure 3-1)		ft/s	4.73	3.52	5.10	
11. Tt = L / 3600V	Compute Tt	hr	0.00	0.00	0.00	0.01
Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0.00

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19)	hr	0.13
	min	8.0

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Monday, Dec 20, 2010

Hyd. No. 1

Subcatchment A - Pre

Hydrograph type	= SCS Runoff	Peak discharge	= 0.362 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.13 hrs
Time interval	= 2 min	Hyd. volume	= 1,730 cuft
Drainage area	= 0.950 ac	Curve number	= 63.7
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 8.0 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Discharge Table

(Printed values >= 98.00% of Qp.)

Time (hrs)	Outflow (cfs)	
12.13	0.362	<<
12.17	0.357	

...End

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Monday, Dec 20, 2010

Hyd. No. 1

Subcatchment A - Pre

Hydrograph type	= SCS Runoff	Peak discharge	= 1.142 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.13 hrs
Time interval	= 2 min	Hyd. volume	= 1,730 cuft
Drainage area	= 0.950 ac	Curve number	= 63.7
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 8.0 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Discharge Table

(Printed values >= 98.00% of Qp.)

Time (hrs)	Outflow (cfs)
12.10	1.133
12.13	1.142 <<

...End

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Monday, Dec 20, 2010

Hyd. No. 1

Subcatchment A - Pre

Hydrograph type	= SCS Runoff	Peak discharge	= 2.484 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.10 hrs
Time interval	= 2 min	Hyd. volume	= 1,730 cuft
Drainage area	= 0.950 ac	Curve number	= 63.7
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 8.0 min
Total precip.	= 6.40 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Discharge Table

(Printed values >= 98.00% of Qp.)

Time (hrs)	Outflow (cfs)	
12.10	2.484	<<
12.13	2.448	

...End

Post-Development Hydrology

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.2

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	0.160	2	730	853	----	------	------	Subcatchment 1 - Uncontrolled
2	SCS Runoff	0.271	2	726	972	----	------	------	Subcatchment 2a - Controlled
3	Diversion1	0.030	2	712	623	2	------	------	Area Above Trench-No infil
4	Diversion2	0.241	2	726	349	2	------	------	Rain Garden Infiltration Area
5	SCS Runoff	0.348	2	724	1,171	----	------	------	Subc 2b - Roof Runoff to Trench
6	SCS Runoff	0.116	2	724	390	----	------	------	Subcatchment 3 - Infiltration
8	Reservoir	0.000	2	728	0	4	212.77	270	Rain Garden
9	Combine	0.378	2	724	1,794	3, 5, 8	------	------	Outlet of Rain Garden
11	Reservoir	0.125	2	736	253	9	209.17	403	Infiltration Trench
13	Combine	0.262	2	734	1,107	1, 11,	------	------	Total leaving site

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.2

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	0.576	2	728	2,223	----	------	------	Subcatchment 1 - Uncontrolled
2	SCS Runoff	0.558	2	726	1,918	----	------	------	Subcatchment 2a - Controlled
3	Diversion1	0.030	2	700	947	2	------	------	Area Above Trench-No infil
4	Diversion2	0.528	2	726	972	2	------	------	Rain Garden Infiltration Area
5	SCS Runoff	0.509	2	724	1,741	----	------	------	Subc 2b - Roof Runoff to Trench
6	SCS Runoff	0.170	2	724	580	----	------	------	Subcatchment 3 - Infiltration
8	Reservoir	0.000	2	746	0	4	213.12	661	Rain Garden
9	Combine	0.539	2	724	2,688	3, 5, 8	------	------	Outlet of Rain Garden
11	Reservoir	0.474	2	724	751	9	209.35	434	Infiltration Trench
13	Combine	1.039	2	726	2,974	1, 11,	------	------	Total leaving site

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.2

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	1.305	2	726	4,625	----	------	------	Subcatchment 1 - Uncontrolled
2	SCS Runoff	0.985	2	726	3,364	----	------	------	Subcatchment 2a - Controlled
3	Diversion1	0.030	2	678	1,284	2	------	------	Area Above Trench-No infil
4	Diversion2	0.955	2	726	2,081	2	------	------	Rain Garden Infiltration Area
5	SCS Runoff	0.726	2	724	2,516	----	------	------	Subc 2b - Roof Runoff to Trench
6	SCS Runoff	0.242	2	724	839	----	------	------	Subcatchment 3 - Infiltration
8	Reservoir	0.212	2	748	237	4	213.54	1,222	Rain Garden
9	Combine	0.756	2	724	4,036	3, 5, 8	------	------	Outlet of Rain Garden
11	Reservoir	0.699	2	724	1,704	9	209.43	449	Infiltration Trench
13	Combine	1.982	2	726	6,329	1, 11,	------	------	Total leaving site

Worksheet 2: Runoff curve number and runoff **SM-4703**

Project: 294 Main Street By BRE Date 12/15/2010

Location: Acton MA Checked _____ Date _____

Circle one: Present [Developed] Subcatchment 1

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
CHARLTON HOLLIS ROCK B	Impervious	98			0.05	4.90
CHARLTON HOLLIS ROCK B	Open Spaces, good condition	61			0.24	14.64
CHARLTON HOLLIS ROCK B	Woods, good condition	55			0.21	11.55
CHARLTON HOLLIS ROCK B	Woods/grass combo	58			0.04	2.32
	Gravel	90			0.00	
Totals =					0.54	33.41

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{33.41}{0.54} = 61.87$; Use CN = [61.9]

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	10	100
Rainfall, P (24-hour).....	in	3.1	4.5	6.4
Runoff, Q..... (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)	in	0.43	1.13	2.36
Runoff, Q.....	cf	851	2219	4620

(210-VI-TR-55, Second Ed., June 1986)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) **SM-4703**

Project: 294 Main Street By BRE Date 12/15/2010

Location: Acton, MA Checked _____ Date _____

Circle one: Present [Developed] Subcatchment 1 through subarea _____

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			WOODS			
2. Mannings roughness coeff., n (table 3-1)			0.4			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.07			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.13			0.13
Shallow concentrated Flow		Segment ID	B-C	C-D	D-E	
7. Surface Description (paved or unpaved)			Unpaved	Paved	Unpaved	
8. Flow Length, L		ft	29	24	65	
9. Watercourse slope, s		ft/ft	0.05	0.06	0.11	
10. Average Velocity, V (figure 3-1)		ft/s	3.61	4.98	5.35	
11. Tt = L / 3600V	Compute Tt	hr	0.00	0.00	0.00	0.01
Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0.00

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19)	hr	0.13
	min	8.0

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Monday, Dec 20, 2010

Hyd. No. 1

Subcatchment 1 - Uncontrolled

Hydrograph type	= SCS Runoff	Peak discharge	= 0.160 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.17 hrs
Time interval	= 2 min	Hyd. volume	= 4,625 cuft
Drainage area	= 0.540 ac	Curve number	= 61.9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 8.0 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Discharge Table

(Printed values >= 98.00% of Qp.)

Time (hrs)	Outflow (cfs)
12.13	0.158
12.17	0.160 <<

...End

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Monday, Dec 20, 2010

Hyd. No. 1

Subcatchment 1 - Uncontrolled

Hydrograph type	= SCS Runoff	Peak discharge	= 0.576 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.13 hrs
Time interval	= 2 min	Hyd. volume	= 4,625 cuft
Drainage area	= 0.540 ac	Curve number	= 61.9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 8.0 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Discharge Table

(Printed values >= 98.00% of Qp.)

Time (hrs)	Outflow (cfs)
12.10	0.567
12.13	0.576 <<

...End

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Monday, Dec 20, 2010

Hyd. No. 1

Subcatchment 1 - Uncontrolled

Hydrograph type	= SCS Runoff	Peak discharge	= 1.305 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.10 hrs
Time interval	= 2 min	Hyd. volume	= 4,625 cuft
Drainage area	= 0.540 ac	Curve number	= 61.9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 8.0 min
Total precip.	= 6.40 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Discharge Table

(Printed values >= 98.00% of Qp.)

Time (hrs)	Outflow (cfs)
12.10	1.305 <<
12.13	1.291

...End

Worksheet 2: Runoff curve number and runoff **SM-4703**

Project: 294 Main Street By BRE Date 12/15/2010

Location: Acton MA Checked _____ Date _____

Circle one: Present [Developed] Subcatchment 2a

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
CHARLTON HOLLIS ROCK B	Impervious	98			0.10	9.80
CHARLTON HOLLIS ROCK B	Open Spaces, good condition	61			0.15	9.15
CHARLTON HOLLIS ROCK B	Woods, good condition	55			0.00	
CHARLTON HOLLIS ROCK B	Woods/grass combo	58			0.00	
	Gravel	90			0.00	
Totals =					0.25	18.95

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{18.95}{0.25} = 75.80$; Use CN = [75.8]

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	10	100
Rainfall, P (24-hour).....	in	3.1	4.5	6.4
Runoff, Q..... (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)	in	1.07	2.11	3.71
Runoff, Q.....	cf	972	1918	3364

(210-VI-TR-55, Second Ed., June 1986)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) **SM-4703**

Project: 294 Main Street By BRE Date 12/17/2010

Location: Acton, MA Checked _____ Date _____

Circle one: Present Developed Subcatchment 2a

Circle one: Tc Tt through subarea _____

Sheet flow (Applicable to Tc only)		Segment ID	A-B	B-C	C-D	
1. Surface Description (table 3-1)			Grass	Woods	Grass	
2. Mannings roughness coeff., n (table 3-1)			0.24	0.4	0.24	
3. Flow length, L (total L <= 300 ft)		ft	14	13	23	
4. Two-yr 24-hr rainfall, P2		in	3.1	3.1	3.1	
5. Land Slope, s		ft/ft	0.07	0.08	0.06	
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.03	0.04	0.05	0.12
Shallow concentrated Flow		Segment ID	D-E	E-F		
7. Surface Description (paved or unpaved)			Unpaved	Paved		
8. Flow Length, L		ft	40	18		
9. Watercourse slope, s		ft/ft	0.03	0.03		
10. Average Velocity, V (figure 3-1)		ft/s	2.79	3.52		
11. Tt = L / 3600V	Compute Tt	hr	0.00	0.00		0.01
Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0.00

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19)	hr	0.12
	min	7.5

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Monday, Dec 20, 2010

Hyd. No. 2

Subcatchment 2a - Controlled

Hydrograph type	= SCS Runoff	Peak discharge	= 0.271 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.10 hrs
Time interval	= 2 min	Hyd. volume	= 3,364 cuft
Drainage area	= 0.250 ac	Curve number	= 75.8
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 7.5 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Discharge Table

(Printed values >= 98.00% of Qp.)

Time (hrs)	Outflow (cfs)
12.10	0.271 <<
12.13	0.269

...End

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Monday, Dec 20, 2010

Hyd. No. 2

Subcatchment 2a - Controlled

Hydrograph type	= SCS Runoff	Peak discharge	= 0.558 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.10 hrs
Time interval	= 2 min	Hyd. volume	= 3,364 cuft
Drainage area	= 0.250 ac	Curve number	= 75.8
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 7.5 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Discharge Table

(Printed values >= 98.00% of Qp.)

Time (hrs)	Outflow (cfs)	
12.10	0.558	<<

...End

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Monday, Dec 20, 2010

Hyd. No. 2

Subcatchment 2a - Controlled

Hydrograph type	= SCS Runoff	Peak discharge	= 0.985 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.10 hrs
Time interval	= 2 min	Hyd. volume	= 3,364 cuft
Drainage area	= 0.250 ac	Curve number	= 75.8
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 7.5 min
Total precip.	= 6.40 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Discharge Table

(Printed values >= 98.00% of Qp.)

Time (hrs)	Outflow (cfs)	
12.10	0.985	<<

...End

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Monday, Dec 20, 2010

Hyd. No. 3

Area Above Trench-No infil

Hydrograph type	= Diversion1	Peak discharge	= 0.030 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.87 hrs
Time interval	= 2 min	Hyd. volume	= 1,284 cuft
Inflow hydrograph	= 2 - Subcatchment 2a - Controlled	2nd diverted hyd.	= 4
Diversion method	= Constant Q	Constant Q	= 0.03 cfs

Hydrograph Discharge Table

(Printed values >= 98.00% of Qp.)

Time (hrs)	Inflow cfs	2nd Diverted cfs	Outflow cfs
11.73	0.035	0.005	0.030
11.77	0.042	0.012	0.030
11.80	0.050	0.020	0.030
11.83	0.058	0.028	0.030
11.87	0.067	0.037	0.030 <<
11.90	0.077	0.047	0.030 <<
11.93	0.091	0.061	0.030 <<
11.97	0.113	0.083	0.030 <<
12.00	0.150	0.120	0.030 <<
12.03	0.199	0.169	0.030 <<
12.07	0.246	0.216	0.030 <<
12.10	0.271 <<	0.241 <<	0.030 <<
12.13	0.269	0.239	0.030 <<
12.17	0.248	0.218	0.030 <<
12.20	0.218	0.188	0.030 <<
12.23	0.189	0.159	0.030 <<
12.27	0.166	0.136	0.030 <<
12.30	0.151	0.121	0.030 <<
12.33	0.140	0.110	0.030 <<
12.37	0.131	0.101	0.030 <<
12.40	0.121	0.091	0.030 <<
12.43	0.110	0.080	0.030 <<
12.47	0.099	0.069	0.030 <<
12.50	0.088	0.058	0.030 <<
12.53	0.077	0.047	0.030 <<
12.57	0.067	0.037	0.030 <<
12.60	0.059	0.029	0.030
12.63	0.054	0.024	0.030
12.67	0.050	0.020	0.030
12.70	0.048	0.018	0.030
12.73	0.046	0.016	0.030
12.77	0.045	0.015	0.030
12.80	0.044	0.014	0.030
12.83	0.043	0.013	0.030
12.87	0.042	0.012	0.030
12.90	0.040	0.010	0.030
12.93	0.039	0.009	0.030
12.97	0.038	0.008	0.030
13.00	0.037	0.007	0.030
13.03	0.035	0.005	0.030

Continues on next page...

Hydrograph Report

Hyd. No. 3

Area Above Trench-No infil

Hydrograph type	= Diversion1	Peak discharge	= 0.030 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.67 hrs
Time interval	= 2 min	Hyd. volume	= 1,284 cuft
Inflow hydrograph	= 2 - Subcatchment 2a - Controlled	2nd diverted hyd.	= 4
Diversion method	= Constant Q	Constant Q	= 0.03 cfs

Hydrograph Discharge Table

(Printed values >= 98.00% of Qp.)

Time (hrs)	Inflow cfs	2nd Diverted cfs	Outflow cfs
11.33	0.030	0.000	0.030
11.37	0.032	0.002	0.030
11.40	0.033	0.003	0.030
11.43	0.035	0.005	0.030
11.47	0.037	0.007	0.030
11.50	0.038	0.008	0.030
11.53	0.041	0.011	0.030
11.57	0.044	0.014	0.030
11.60	0.050	0.020	0.030
11.63	0.058	0.028	0.030
11.67	0.069	0.039	0.030 <<
11.70	0.082	0.052	0.030 <<
11.73	0.096	0.066	0.030 <<
11.77	0.112	0.082	0.030 <<
11.80	0.129	0.099	0.030 <<
11.83	0.146	0.116	0.030 <<
11.87	0.165	0.135	0.030 <<
11.90	0.186	0.156	0.030 <<
11.93	0.212	0.182	0.030 <<
11.97	0.256	0.226	0.030 <<
12.00	0.331	0.301	0.030 <<
12.03	0.427	0.397	0.030 <<
12.07	0.515	0.485	0.030 <<
12.10	0.558 <<	0.528 <<	0.030
12.13	0.545	0.515	0.030
12.17	0.494	0.464	0.030 <<
12.20	0.428	0.398	0.030 <<
12.23	0.367	0.337	0.030 <<
12.27	0.319	0.289	0.030 <<
12.30	0.287	0.257	0.030 <<
12.33	0.265	0.235	0.030 <<
12.37	0.245	0.215	0.030 <<
12.40	0.226	0.196	0.030 <<
12.43	0.205	0.175	0.030 <<
12.47	0.184	0.154	0.030 <<
12.50	0.163	0.133	0.030 <<
12.53	0.142	0.112	0.030 <<
12.57	0.123	0.093	0.030 <<
12.60	0.108	0.078	0.030 <<
12.63	0.098	0.068	0.030 <<

Continues on next page...

Hydrograph Report

Hyd. No. 3

Area Above Trench-No infil

Hydrograph type	= Diversion1	Peak discharge	= 0.030 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.30 hrs
Time interval	= 2 min	Hyd. volume	= 1,284 cuft
Inflow hydrograph	= 2 - Subcatchment 2a - Controlled	2nd diverted hyd.	= 4
Diversion method	= Constant Q	Constant Q	= 0.03 cfs

Hydrograph Discharge Table

(Printed values >= 98.00% of Qp.)

Time (hrs)	Inflow cfs	2nd Diverted cfs	Outflow cfs
10.43	0.029	0.000	0.029
10.47	0.030	0.000	0.030
10.50	0.031	0.001	0.030
10.53	0.032	0.002	0.030
10.57	0.033	0.003	0.030
10.60	0.034	0.004	0.030
10.63	0.035	0.005	0.030
10.67	0.035	0.005	0.030
10.70	0.036	0.006	0.030
10.73	0.037	0.007	0.030
10.77	0.038	0.008	0.030
10.80	0.039	0.009	0.030
10.83	0.040	0.010	0.030
10.87	0.041	0.011	0.030
10.90	0.042	0.012	0.030
10.93	0.043	0.013	0.030
10.97	0.044	0.014	0.030
11.00	0.045	0.015	0.030
11.03	0.046	0.016	0.030
11.07	0.047	0.017	0.030
11.10	0.049	0.019	0.030
11.13	0.051	0.021	0.030
11.17	0.053	0.023	0.030
11.20	0.056	0.026	0.030
11.23	0.059	0.029	0.030
11.27	0.061	0.031	0.030
11.30	0.064	0.034	0.030 <<
11.33	0.067	0.037	0.030 <<
11.37	0.070	0.040	0.030 <<
11.40	0.073	0.043	0.030 <<
11.43	0.076	0.046	0.030 <<
11.47	0.080	0.050	0.030 <<
11.50	0.083	0.053	0.030 <<
11.53	0.087	0.057	0.030 <<
11.57	0.094	0.064	0.030 <<
11.60	0.106	0.076	0.030 <<
11.63	0.122	0.092	0.030 <<
11.67	0.144	0.114	0.030 <<
11.70	0.168	0.138	0.030 <<
11.73	0.196	0.166	0.030 <<

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Area Above Trench-No infil

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	2nd Diverted cfs	Outflow cfs
11.77	0.225	0.195	0.030 <<
11.80	0.255	0.225	0.030 <<
11.83	0.288	0.258	0.030 <<
11.87	0.321	0.291	0.030 <<
11.90	0.356	0.326	0.030 <<
11.93	0.402	0.372	0.030 <<
11.97	0.479	0.449	0.030 <<
12.00	0.608	0.578	0.030
12.03	0.773	0.743	0.030
12.07	0.920	0.890	0.030
12.10	0.985 <<	0.955 <<	0.030
12.13	0.953	0.923	0.030
12.17	0.856	0.826	0.030
12.20	0.736	0.706	0.030
12.23	0.625	0.595	0.030
12.27	0.539	0.509	0.030
12.30	0.482	0.452	0.030 <<
12.33	0.443	0.413	0.030 <<
12.37	0.410	0.380	0.030 <<
12.40	0.375	0.345	0.030 <<
12.43	0.340	0.310	0.030 <<
12.47	0.305	0.275	0.030 <<
12.50	0.269	0.239	0.030 <<
12.53	0.234	0.204	0.030 <<
12.57	0.203	0.173	0.030 <<
12.60	0.178	0.148	0.030 <<
12.63	0.161	0.131	0.030 <<
12.67	0.150	0.120	0.030 <<
12.70	0.143	0.113	0.030 <<
12.73	0.138	0.108	0.030 <<
12.77	0.135	0.105	0.030 <<
12.80	0.131	0.101	0.030 <<
12.83	0.127	0.097	0.030 <<
12.87	0.123	0.093	0.030 <<
12.90	0.119	0.089	0.030 <<
12.93	0.116	0.086	0.030 <<
12.97	0.112	0.082	0.030 <<
13.00	0.108	0.078	0.030 <<
13.03	0.104	0.074	0.030 <<
13.07	0.101	0.071	0.030 <<
13.10	0.098	0.068	0.030 <<
13.13	0.096	0.066	0.030 <<
13.17	0.094	0.064	0.030 <<
13.20	0.093	0.063	0.030 <<
13.23	0.092	0.062	0.030 <<
13.27	0.091	0.061	0.030 <<
13.30	0.090	0.060	0.030 <<
13.33	0.089	0.059	0.030 <<
13.37	0.088	0.058	0.030 <<
13.40	0.087	0.057	0.030 <<
13.43	0.086	0.056	0.030 <<
13.47	0.085	0.055	0.030 <<
13.50	0.084	0.054	0.030 <<

Continues on next page...

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Monday, Dec 20, 2010

Hyd. No. 4

Rain Garden Infiltration Area

Hydrograph type	= Diversion2	Peak discharge	= 0.241 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.10 hrs
Time interval	= 2 min	Hyd. volume	= 2,081 cuft
Inflow hydrograph	= 2 - Subcatchment 2a - Controlled	2nd diverted hyd.	= 3
Diversion method	= Constant Q	Constant Q	= 0.03 cfs

Hydrograph Discharge Table

(Printed values >= 98.00% of Qp.)

Time (hrs)	Inflow cfs	2nd Diverted cfs	Outflow cfs
12.10	0.271 <<	0.030 <<	0.241 <<
12.13	0.269	0.030 <<	0.239

...End

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Monday, Dec 20, 2010

Hyd. No. 4

Rain Garden Infiltration Area

Hydrograph type	= Diversion2	Peak discharge	= 0.528 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.10 hrs
Time interval	= 2 min	Hyd. volume	= 2,081 cuft
Inflow hydrograph	= 2 - Subcatchment 2a - Controlled	2nd diverted hyd.	= 3
Diversion method	= Constant Q	Constant Q	= 0.03 cfs

Hydrograph Discharge Table

(Printed values >= 98.00% of Qp.)

Time (hrs)	Inflow cfs	2nd Diverted cfs	Outflow cfs
12.10	0.558 <<	0.030	0.528 <<

...End

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Monday, Dec 20, 2010

Hyd. No. 4

Rain Garden Infiltration Area

Hydrograph type	= Diversion2	Peak discharge	= 0.955 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.10 hrs
Time interval	= 2 min	Hyd. volume	= 2,081 cuft
Inflow hydrograph	= 2 - Subcatchment 2a - Controlled	2nd diverted hyd.	= 3
Diversion method	= Constant Q	Constant Q	= 0.03 cfs

Hydrograph Discharge Table

(Printed values >= 98.00% of Qp.)

Time (hrs)	Inflow cfs	2nd Diverted cfs	Outflow cfs
12.10	0.985 <<	0.030	0.955 <<

...End

Pond Report

Hydraflow Hydrographs by Intelisolve v9.2 — Tuesday, Dec 21, 2010

Pond No. 1 - Rain Garden

Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 212.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	212.50	881	0	0
0.50	213.00	1,105	495	495
1.50	214.00	1,588	1,339	1,834

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	0.00	0.00	0.00
Span (in)	= 12.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 212.50	0.00	0.00	0.00
Length (ft)	= 49.00	0.00	0.00	0.00
Slope (%)	= 0.50	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)	= 4.71 ★	Inactive	Inactive	Inactive
Crest El. (ft)	= 213.50	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Riser	---	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 2.410 (by Contour)

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).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	212.50	0.00	---	---	---	0.00	---	---	---	0.000	---	0.000
0.50	495	213.00	0.00	---	---	---	0.00	---	---	---	0.062	---	0.062
1.50	1,834	214.00	2.98 oc	---	---	---	2.98 s	---	---	---	0.089	---	3.071

★ ACTUAL WEIR RISER 24" AREA = 3.1 S.F.
24" GRATE OPENING AREA = 2.0 S.F.
ASSUMED 18" RISER FOR CALCULATION
AREA = 1.8 S.F.

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Tuesday, Dec 21, 2010

Hyd. No. 8

Rain Garden

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= 728 min
Time interval	= 2 min	Hyd. volume	= 237 cuft
Inflow hyd. No.	= 4 - Rain Garden Infiltration Area	Reservoir name	= Rain Garden
Max. Elevation	= 212.77 ft	Max. Storage	= 270 cuft

Storage Indication method used. Exfiltration extracted from Outflow.

Hydrograph Discharge Table

(Printed values >= 99.00% of Qp.)

Time (min)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
728	0.239	212.65 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.018	0.000 <<
730	0.218	212.65 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.018	0.000 <<
828	0.000	212.65 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.018	0.000 <<
834	0.000	212.65 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.018	0.000 <<
838	0.000	212.65 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.018	0.000 <<
840	0.000	212.65 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.018	0.000 <<
846	0.000	212.65 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.018	0.000 <<
848	0.000	212.65 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.018	0.000 <<
852	0.000	212.65 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.018	0.000 <<
854	0.000	212.65 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.018	0.000 <<
856	0.000	212.65 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.018	0.000 <<
858	0.000	212.65 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.018	0.000 <<

...End

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Tuesday, Dec 21, 2010

Hyd. No. 8

Rain Garden

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 10 yrs	Time to peak	= 746 min
Time interval	= 2 min	Hyd. volume	= 237 cuft
Inflow hyd. No.	= 4 - Rain Garden Infiltration Area	Reservoir name	= Rain Garden
Max. Elevation	= 213.12 ft	Max. Storage	= 661 cuft

Storage Indication method used. Exfiltration extracted from Outflow.

Hydrograph Discharge Table

(Printed values >= 99.00% of Qp.)

Time (min)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
746	0.175	212.89 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.049	0.000 <<
748	0.154	212.89 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.049	0.000 <<
750	0.133	212.89 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.049	0.000 <<
752	0.112	212.89 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.049	0.000 <<
754	0.093	212.89 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.049	0.000 <<
756	0.078	212.89 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.049	0.000 <<
758	0.068	212.89 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.049	0.000 <<
760	0.061	212.89 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.049	0.000 <<
762	0.057	212.89 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.049	0.000 <<
764	0.054	212.89 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.049	0.000 <<
766	0.052	212.89 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.049	0.000 <<
768	0.050	212.89 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.049	0.000 <<
770	0.048	212.89 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.049	0.000 <<
772	0.046	212.89 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.049	0.000 <<
774	0.043	212.89 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.049	0.000 <<
776	0.041	212.89 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.049	0.000 <<
778	0.039	212.89 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.049	0.000 <<
780	0.036	212.89 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.049	0.000 <<
782	0.034	212.89 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.049	0.000 <<
784	0.032	212.89 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.049	0.000 <<
786	0.030	212.89 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.049	0.000 <<
788	0.029	212.89 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.049	0.000 <<
790	0.028	212.89 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.049	0.000 <<
874	0.007	212.89 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.049	0.000 <<
876	0.007	212.89 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.049	0.000 <<
878	0.006	212.89 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.049	0.000 <<

...End

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Tuesday, Dec 21, 2010

Hyd. No. 8

Rain Garden

Hydrograph type	= Reservoir	Peak discharge	= 0.212 cfs
Storm frequency	= 100 yrs	Time to peak	= 748 min
Time interval	= 2 min	Hyd. volume	= 237 cuft
Inflow hyd. No.	= 4 - Rain Garden Infiltration Area	Reservoir name	= Rain Garden
Max. Elevation	= 213.54 ft	Max. Storage	= 1,222 cuft

Storage Indication method used. Exfiltration extracted from Outflow.

Hydrograph Discharge Table

(Printed values >= 99.00% of Qp.)

Time (min)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
748	0.275	213.54 <<	0.212	-----	-----	-----	0.212	-----	-----	-----	0.076	0.212 <<

...End

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Monday, Dec 20, 2010

Hyd. No. 9

Outlet of Rain Garden

Hydrograph type	= Combine	Peak discharge	= 0.378 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 4,037 cuft
Inflow hyds.	= 3, 5, 8	Contrib. drain. area	= 0.120 ac

Hydrograph Discharge Table

(Printed values >= 98.00% of Qp.)

Time (hrs)	Hyd. 3 + (cfs)	Hyd. 5 + (cfs)	Hyd. 8 = (cfs)	Outflow (cfs)
12.07	0.030 <<	0.348 <<	0.000	0.378 <<

...End

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Monday, Dec 20, 2010

Hyd. No. 9

Outlet of Rain Garden

Hydrograph type	= Combine	Peak discharge	= 0.539 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 4,037 cuft
Inflow hyds.	= 3, 5, 8	Contrib. drain. area	= 0.120 ac

Hydrograph Discharge Table

(Printed values >= 98.00% of Qp.)

Time (hrs)	Hyd. 3 + (cfs)	Hyd. 5 + (cfs)	Hyd. 8 = (cfs)	Outflow (cfs)
12.07	0.030 <<	0.509 <<	0.000	0.539 <<

...End

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Monday, Dec 20, 2010

Hyd. No. 9

Outlet of Rain Garden

Hydrograph type	= Combine	Peak discharge	= 0.756 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 4,037 cuft
Inflow hyds.	= 3, 5, 8	Contrib. drain. area	= 0.120 ac

Hydrograph Discharge Table

(Printed values >= 98.00% of Qp.)

Time (hrs)	Hyd. 3 + (cfs)	Hyd. 5 + (cfs)	Hyd. 8 = (cfs)	Outflow (cfs)
12.07	0.030	0.726 <<	0.000	0.756 <<

...End

Worksheet 2: Runoff curve number and runoff **SM-4703**

Project: 294 Main Street By BRE Date 12/15/2010

Location: Acton MA Checked _____ Date _____

Circle one: Present [Developed] Subcatchment 2b

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
CHARLTON OLLIS ROCK B	Impervious	98			0.12	11.76
CHARLTON OLLIS ROCK B	Open Spaces, good condition	61			0.00	
CHARLTON OLLIS ROCK B	Woods, good condition	55			0.00	
CHARLTON OLLIS ROCK B	Woods/grass combo	58			0.00	
	Gravel	90			0.00	
Totals =					0.12	11.76

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{11.76}{0.12} = 98.00$; Use CN = [98.0]

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	10	100
Rainfall, P (24-hour).....	in	3.1	4.5	6.4
Runoff, Q..... (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)	in	2.87	4.26	6.16
Runoff, Q.....	cf	1249	1857	2684

(210-VI-TR-55, Second Ed., June 1986)

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Monday, Dec 20, 2010

Hyd. No. 5

Subc 2b - Roof Runoff to Trench

Hydrograph type	= SCS Runoff	Peak discharge	= 0.348 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 2,516 cuft
Drainage area	= 0.120 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.0 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Discharge Table

(Printed values >= 98.00% of Qp.)

Time (hrs)	Outflow (cfs)
12.07	0.348 <<

...End

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Monday, Dec 20, 2010

Hyd. No. 5

Subc 2b - Roof Runoff to Trench

Hydrograph type	= SCS Runoff	Peak discharge	= 0.509 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 2,516 cuft
Drainage area	= 0.120 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.0 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Discharge Table

(Printed values >= 98.00% of Qp.)

Time (hrs)	Outflow (cfs)	
12.07	0.509	<<

...End

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Monday, Dec 20, 2010

Hyd. No. 5

Subc 2b - Roof Runoff to Trench

Hydrograph type	= SCS Runoff	Peak discharge	= 0.726 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 2,516 cuft
Drainage area	= 0.120 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.0 min
Total precip.	= 6.40 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Discharge Table

(Printed values >= 98.00% of Qp.)

Time (hrs)	Outflow (cfs)	
12.07	0.726	<<

...End

Pond Report

Hydraflow Hydrographs by Intelisolve v9.2 — Monday, Dec 20, 2010

Pond No. 3 - Infiltration Trench

Pond Data

UG Chambers - Invert elev. = 208.00 ft, Rise x Span = 1.00 x 1.00 ft, Barrel Len = 46.00 ft, No. Barrels = 1, Slope = 0.00%, Headers = No
Encasement - Invert elev. = 207.10 ft, Width = 10.00 ft, Height = 3.00 ft, Voids = 40.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	207.10	n/a	0	0
0.30	207.40	n/a	55	55
0.60	207.70	n/a	55	110
0.90	208.00	n/a	55	166
1.20	208.30	n/a	61	226
1.50	208.60	n/a	63	290
1.80	208.90	n/a	62	352
2.10	209.20	n/a	56	408
2.40	209.50	n/a	55	463
2.70	209.80	n/a	55	519
3.00	210.10	n/a	55	574

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	0.00	0.00	0.00
Span (in)	= 12.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 209.00	0.00	0.00	0.00
Length (ft)	= 73.00	0.00	0.00	0.00
Slope (%)	= 1.60	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)	Inactive	Inactive	Inactive	Inactive
Crest El. (ft)	= 209.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Riser	---	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 2.410 (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).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	207.10	0.00	---	---	---	0.00	---	---	---	0.000	---	0.000
0.30	55	207.40	0.00	---	---	---	0.00	---	---	---	0.027	---	0.027
0.60	110	207.70	0.00	---	---	---	0.00	---	---	---	0.029	---	0.029
0.90	166	208.00	0.00	---	---	---	0.00	---	---	---	0.030	---	0.030
1.20	226	208.30	0.00	---	---	---	0.00	---	---	---	0.032	---	0.032
1.50	290	208.60	0.00	---	---	---	0.00	---	---	---	0.033	---	0.033
1.80	352	208.90	0.00	---	---	---	0.00	---	---	---	0.035	---	0.035
2.10	408	209.20	0.17 ic	---	---	---	0.00	---	---	---	0.036	---	0.207
2.40	463	209.50	0.95 ic	---	---	---	0.00	---	---	---	0.038	---	0.985
2.70	519	209.80	2.05 ic	---	---	---	0.00	---	---	---	0.040	---	2.091
3.00	574	210.10	2.93 ic	---	---	---	0.00	---	---	---	0.041	---	2.970

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Monday, Dec 20, 2010

Hyd. No. 11

Infiltration Trench

Hydrograph type	= Reservoir	Peak discharge	= 0.125 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 1,704 cuft
Inflow hyd. No.	= 9 - Outlet of Rain Garden	Reservoir name	= Infiltration Tren
Max. Elevation	= 209.17 ft	Max. Storage	= 403 cuft

Storage Indication method used. Exfiltration extracted from Outflow.

Hydrograph Discharge Table

(Printed values >= 98.00% of Qp.)

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
12.27	0.162	209.17 <<	0.125	-----	-----	-----	-----	-----	-----	-----	0.036	0.125 <<

...End

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Monday, Dec 20, 2010

Hyd. No. 11

Infiltration Trench

Hydrograph type	= Reservoir	Peak discharge	= 0.474 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 1,704 cuft
Inflow hyd. No.	= 9 - Outlet of Rain Garden	Reservoir name	= Infiltration Tren
Max. Elevation	= 209.35 ft	Max. Storage	= 434 cuft

Storage Indication method used. Exfiltration extracted from Outflow.

Hydrograph Discharge Table

(Printed values >= 98.00% of Qp.)

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
12.07	0.539 <<	209.34 <<	0.474	-----	-----	-----	-----	-----	-----	-----	0.037	0.474 <<
12.10	0.481	209.34	0.473	-----	-----	-----	-----	-----	-----	-----	0.037	0.473

...End

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Monday, Dec 20, 2010

Hyd. No. 11

Infiltration Trench

Hydrograph type	= Reservoir	Peak discharge	= 0.699 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 1,704 cuft
Inflow hyd. No.	= 9 - Outlet of Rain Garden	Reservoir name	= Infiltration Tren
Max. Elevation	= 209.43 ft	Max. Storage	= 449 cuft

Storage Indication method used. Exfiltration extracted from Outflow.

Hydrograph Discharge Table

(Printed values >= 98.00% of Qp.)

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
12.07	0.756 <<	209.42 <<	0.699	-----	-----	-----	-----	-----	-----	-----	0.038	0.699 <<

...End

Worksheet 2: Runoff curve number and runoff **SM-4703**

Project: 294 Main Street By BRE Date 12/15/2010

Location: Acton MA Checked _____ Date _____

Circle one: Present [Developed] Subcatchment 3

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
CHARLTON OLLIS ROCK B	Impervious	98			0.04	3.92
CHARLTON OLLIS ROCK B	Open Spaces, good condition	61			0.00	
CHARLTON OLLIS ROCK B	Woods, good condition	55			0.00	
CHARLTON OLLIS ROCK B	Woods/grass combo	58			0.00	
	Gravel	90			0.00	
Totals =					0.04	3.92

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{3.92}{0.04} = 98.00$; Use CN = [98.0]

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	10	100
Rainfall, P (24-hour).....	in	3.1	4.5	6.4
Runoff, Q..... (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)	in	2.87	4.26	6.16
Runoff, Q.....	cf	416	619	895

(210-VI-TR-55, Second Ed., June 1986)

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

Monday, Dec 20, 2010

Hyd. No. 6

Subcatchment 3 - Infiltration

Hydrograph type	= SCS Runoff	Peak discharge	= 0.116 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 839 cuft
Drainage area	= 0.040 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.0 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Discharge Table

(Printed values >= 98.00% of Qp.)

Time -- (hrs)	Outflow cfs)
12.07	0.116 <<

...End

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

Monday, Dec 20, 2010

Hyd. No. 6

Subcatchment 3 - Infiltration

Hydrograph type	= SCS Runoff	Peak discharge	= 0.170 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 839 cuft
Drainage area	= 0.040 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.0 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Discharge Table

(Printed values >= 98.00% of Qp.)

Time (hrs)	Outflow (cfs)
12.07	0.170 <<

...End

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

Monday, Dec 20, 2010

Hyd. No. 6

Subcatchment 3 - Infiltration

Hydrograph type	= SCS Runoff	Peak discharge	= 0.242 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 839 cuft
Drainage area	= 0.040 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.0 min
Total precip.	= 6.40 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Discharge Table

(Printed values >= 98.00% of Qp.)

Time -- Outflow (hrs cfs)	
12.07	0.242 <<

...End

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

Monday, Dec 20, 2010

Hyd. No. 13

Total leaving site

Hydrograph type	= Combine	Peak discharge	= 0.262 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.23 hrs
Time interval	= 2 min	Hyd. volume	= 6,329 cuft
Inflow hyds.	= 1, 11	Contrib. drain. area	= 0.540 ac

Hydrograph Discharge Table

(Printed values >= 98.00% of Qp.)

Time (hrs)	Hyd. 1 + (cfs)	Hyd. 11 + (cfs)	Outflow (cfs)
12.23	0.144	0.117	0.262 <<
12.27	0.134	0.125 <<	0.260

...End

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Monday, Dec 20, 2010

Hyd. No. 13

Total leaving site

Hydrograph type	= Combine	Peak discharge	= 1.039 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.10 hrs
Time interval	= 2 min	Hyd. volume	= 6,329 cuft
Inflow hyds.	= 1, 11	Contrib. drain. area	= 0.540 ac

Hydrograph Discharge Table

(Printed values >= 98.00% of Qp.)

Time (hrs)	Hyd. 1 + (cfs)	Hyd. 11 + (cfs)	Outflow (cfs)
12.10	0.567	0.473	1.039 <<

...End

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

Monday, Dec 20, 2010

Hyd. No. 13

Total leaving site

Hydrograph type	= Combine	Peak discharge	= 1.982 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.10 hrs
Time interval	= 2 min	Hyd. volume	= 6,329 cuft
Inflow hyds.	= 1, 11	Contrib. drain. area	= 0.540 ac

Hydrograph Discharge Table

(Printed values >= 98.00% of Qp.)

Time (hrs)	Hyd. 1 + (cfs)	Hyd. 11 + (cfs)	Outflow (cfs)
12.10	1.305 <<	0.677	1.982 <<

...End

Storm Sewer Design

DESIGN STORM: 100 YEAR
DATE: 12/20/10
DONE BY: BRE
FILE: 4703 RATIONAL METHOD.wb3

STORM SEWER DESIGN

(ADS N-12)"n"= 0.010 4"-10"
(ADS N-12)"n"= 0.012 12"-36"
(ADS N-12)"n"= 0.013 42"-60"
(Cast Iron)"n"= 0.011

PROJECT: SM-4703
LOCATION: Acton, MA

FROM	TO	LENGTH (FT)	TRIBUTARY AREA		TIME OF FLOW		RUNOFF COEFF. "C"	RAINFALL INTENSITY (IN/HR)	"Q" TOTAL RUNOFF (CFS)	SLOPE of PIPE (FT/FT)	DIAM (IN)	MANN. "n"	CAPACITY FULL (CFS)	VELOCITY FULL (FPS)	DESIGN FLOW				MANHOLE INVERT DROP (FT)	FALL IN PIPE (FT)	DRAIN INV. ELEVATION		GROUND SURFACE	
			INCR. (ACRES)	TOTAL (ACRES)	TO UPPER END (MIN)	TIME IN SECTION (MIN)									VELOCITY (FPS)	VELOCITY HEAD (FT)	DEPTH OF FLOW (FT)	TOTAL ENERGY HEAD (FT)			UPPER END	LOWER END	UPPER END	LOWER END
Roofs	Inf Trench	50		0.12	10	0.21	0.90	7.6	0.82	0.010	8	0.012	1.30	3.74	3.95	0.24	0.38	0.63		0.50	208.60	208.10	217.00	213.00
															0.00	0.00	0.00	0.00		0.10	208.00	207.90	213.00	213.00
End Trench	Cleanout	45		0.37	10	0.19	0.62	7.6	1.73	0.006	12	0.012	2.93	3.73	3.89	0.23	0.55	0.79		0.26	209.00	208.74	213.00	213.00
Cleanout	Outlet	28		0.37	10	0.13	0.62	7.6	1.73	0.005	12	0.012	2.72	3.47	3.68	0.21	0.58	0.79		0.14	208.64	208.50	213.00	209.00

Rain Garden Rain Garden BMP
Roofs Runoff from Roofs
Inf Trench INFILRATION TRENCH

Closed Drainage System

Project: 294 Main Street By BRE Date 12/20/10

Location: Acton, MA Checked _____ Date _____

Rational Method

Q = peak flow rate, (cfs) i = rainfall intensity inches/hour

C = runoff coefficient, A = area (ac)
C = 0.90 impervious
C = 0.20 landscaped / grass
C = 0.15 woods

Rain Garden

Surface Cover	A (ac)	C	Product A x C
impervious	0.10	0.90	0.090
lands/grass	0.15	0.20	0.030
woods	0.00	0.15	0.000
sum =	0.25	sum =	0.120

C = **0.48** = total product / total area

Roofs

Surface Cover	A (ac)	C	Product A x C
impervious	0.12	0.90	0.108
lands/grass	0.00	0.20	0.000
woods	0.00	0.15	0.000
sum =	0.12	sum =	0.108

C = **0.90** = total product / total area

Cleanout

Surface Cover	A (ac)	C	Product A x C
Rain Garden	0.25	0.48	0.120
Roofs	0.12	0.90	0.108
		Rain	
sum =	0.37	sum =	0.228

C = **0.62** = total product / total area

Infiltration Trench Sizing

STAMSKI AND McNARY, INC.
1000 Main Street
ACTON, MASSACHUSETTS 01720
TEL (978) 263-8585
FAX (978) 263-9883

JOB SM-4703
SHEET NO. _____ OF _____
CALCULATED BY BLE DATE 12/20/10
CHECKED BY _____ DATE _____
SCALE _____

INFILTRATION TRENCH SIZING

SIZE OF TRENCH : 2' W x 2' D x 61' L

TRENCH VOLUME : (2' x 2' x 61') 40% VOID FOR GRAVEL

TRENCH VOLUME : 98 FT^3

IMPERVIOUS AREA : 730 S.F.

100YR STORM EVENT : 6.4 IN

100YR STORM VOLUME : $730\ S.F. \times \frac{6.4\ IN}{12\ IN}(1\ FT) = 390\ FT^3$

TRENCH INFILTRATION AREA

BOTTOM AREA + SIDEWALL
$(61 \times 2) + [2(2 \times 2) + 2(2 \times 61)] = 374$ S.F.

INFILTRATION AREA REQUIRED
INFILTRATION RATE (SEE TABLE 2-1)
LOAMY SAND $2.41\ \frac{IN}{HR}\left(\frac{24\ HR}{1\ DAY}\right)\left(\frac{1\ FT}{12\ IN}\right) = 4.82\ FT/DAY$

$390\ FT^3 \times \frac{DAY}{4.82\ FT} = 81$ S.F.

∴ 374 SF > 81 S.F. O.K.
PROVIDED REQUIRED

STAMSKI AND McNARY, INC.
1000 Main Street
ACTON, MASSACHUSETTS 01720
TEL (978) 263-8585
FAX (978) 263-9883

JOB SM-4703
SHEET NO. _____ OF _____
CALCULATED BY BRE DATE 12/20/10
CHECKED BY _____ DATE _____
SCALE _____

DRIP EDGE SIZING

SIZE OF DRIP EDGE: 2'W x 6"D x 109'L

DRIP EDGE VOLUME: (2'x0.5'x109') 40% VOID FOR GRAVEL

DRIP EDGE VOLUME: 44 FT^3

UNIT 6 ROOF AREA: 952 FT^2

100 YR STORM EVENT: 6.4 IN/DAY

100 YR STORM VOLUME: $952\ FT^2 \times 6.4\ \frac{IN}{DAY}\left(\frac{1\ FT}{12\ IN}\right) = 508\ FT^3/DAY$

DRIP EDGE INFILTRATION AREA

BOTTOM AREA + SIDEWALL AREA
(109 x 2) + (109 x .5)
218 S.F. + 54 S.F. = 272 S.F.

INFILTRATION AREA REQUIRED

INFILTRATION RATE (SEE TABLE 2-1)
LOAMY SAND $2.41\ \frac{IN}{HR}\left(\frac{24\ HR}{DAY}\right)\left(\frac{FT}{12\ IN}\right) = 4.82\ FT/DAY$

$508\ FT^3/DAY \times \frac{DAY}{4.82\ FT} = 105\ S.F.$

∴ 272 S.F. PROVIDED > 105 S.F. REQUIRED

Water Quality Volume Calculations

STAMSKI AND McNARY, INC.
1000 Main Street
ACTON, MASSACHUSETTS 01720
TEL (978) 263-8585
FAX (978) 263-9883

JOB SM 4703
SHEET NO. _____ OF _____
CALCULATED BY BAE DATE 12/20/10
CHECKED BY _____ DATE _____
SCALE _____

WATER QUALITY TREATMENT VOLUMES:

$$V_{WQ} = \frac{D_{WQ}}{12} \times A_{IMP}$$

RAIN GARDEN

$D_{WQ} = 1/2"$

$A_{IMP} = 0.31$ AC FOR SITE

$0.31\ AC \left(\frac{43560\ S.F.}{AC} \right) = 13,504\ S.F.$

$$V_{WQ} = \frac{1/2}{12} \times 13504$$

$V_{WQ} = 563$ C.F.

RAIN GARDEN VOLUME = 1,347 C.F.

1,347 C.F. > 563 C.F. O.K.

Groundwater Recharge Calculations

STAMSKI AND McNARY, INC.
1000 Main Street
ACTON, MASSACHUSETTS 01720
TEL (978) 263-8585
FAX (978) 263-9883

JOB SM-4703
SHEET NO. _____ OF _____
CALCULATED BY BAE DATE 12/20/10
CHECKED BY _____ DATE _____
SCALE _____

REQUIRED RECHARGE VOLUME

$R_V = F(\text{TARGET DEPTH}) \times \text{IMPERVIOUS AREA}$

$F = 0.35$ IN FOR HYDROLOGIC GROUP B

$A_{IMP} = 0.31$ AC FOR SITE

$$R_V = 0.35\ \text{IN}\left(\frac{\text{FT}}{12\ \text{IN}}\right) \times 0.31\ \text{AC}$$

$R_V = 0.009$ ACRE-FT

$$R_V = 0.009\ \text{AC-FT} \times \left(\frac{43560\ \text{FT}^2}{1\ \text{AC}}\right)$$

$R_V = 394$ C.F.

RAIN GARDEN VOLUME = 1,347 C.F.

1,347 C.F. > 394 C.F. O.K.

DRAWDOWN

$$\text{TIME}_{\text{DRAWDOWN}} = \frac{R_V}{(K)(\text{RAINGARDEN BOTTOM AREA})}$$

$T = 394\ \text{C.F.} / (2.41\ \text{IN/HR})(1/12)(1105\ \text{S.F.})$
$T = 1.8$ HOURS

1.8 HOURS < 72 HOURS O.K.

TSS Removal Calculations

INSTRUCTIONS:

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Non-automated: Mar. 4, 2008

Location:

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
RAIN GARDEN W/ PRETREATMENT	90%	1.00	0.90	0.10
INFILTRATION TRENCH	80%	0.10	0.08	0.02

Total TSS Removal = 98%

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

Project: 294 MAIN ST.
Prepared By: BRE
Date: 12/20/10

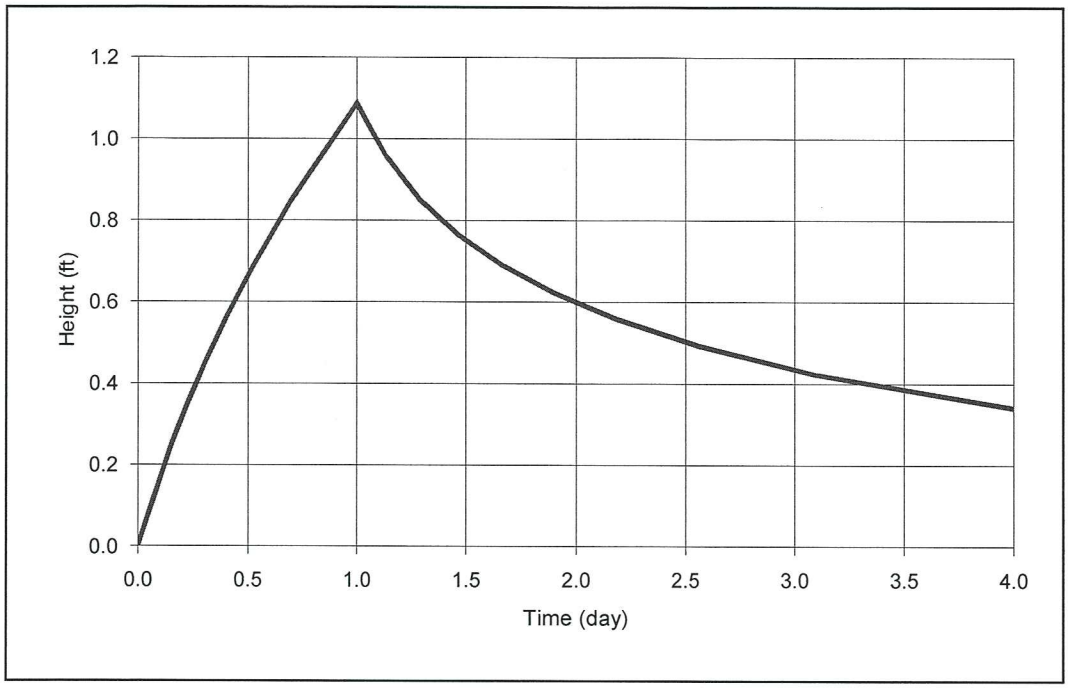
*Equals remaining load from previous BMP (E) which enters the BMP

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

1. *From MassDEP Stormwater Handbook Vol. 1*

Mounding Analysis

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Stamski and McNary

PROJECT: 294 Main Street Acton

ANALYST: BRE

DATE: 12/20/2010 TIME: 9:20:46 AM

INPUT PARAMETERS

Application rate: 0.61 c.ft/day/sq. ft
Duration of application: 1 day
Total simulation time: 4 day
Fillable porosity: 0.35
Hydraulic conductivity: 28 ft/day
Initial saturated thickness: 0.5 ft
Length of application area: 46 ft
Width of application area: 10 ft
Constant head boundary used at: 500 ft
Groundwater mounding @
X coordinate: 0 ft
Y coordinate: 0 ft
Total volume applied: 280.6 cft

MODEL RESULTS

Time (day)	Mound Height (ft)
0	0
0	0.02
0	0.08
0.1	0.16
0.2	0.26
0.2	0.35
0.3	0.45
0.4	0.56
0.5	0.69
0.7	0.85
1	1.09
1	1.05
1.1	0.96
1.3	0.85
1.5	0.76
1.7	0.69
1.9	0.62
2.2	0.56
2.6	0.49
3.1	0.42
4	0.34

STAMSKI AND McNARY, INC.
1000 Main Street
ACTON, MASSACHUSETTS 01720
TEL (978) 263-8585
FAX (978) 263-9883

JOB 4703
SHEET NO. _____ OF _____
CALCULATED BY BRE DATE 12/20/10
CHECKED BY _____ DATE _____
SCALE _____

GROUNDWATER MOUNDING CALCULATIONS

APPLICATION RATE BASED ON RECHARGE VOLUME

RECHARGE VOLUME FOR INFILTRATION TRENCH

$$R_V = F(\text{TARGET DEPTH}) \times \text{IMPERVIOUS AREA}$$

$$R_V = 0.35\ \text{IN}\left(\frac{1\ \text{FT}}{12\ \text{IN}}\right) \times 0.22\ \text{ACRES}$$

$$R_V = 0.006\ \text{ACRE-FT/DAY}$$

RATE OF APPLICATION

$$\text{RATE} = \text{RECHARGE VOLUME} / \text{AREA OF TRENCH}$$

$$\text{AREA} = 10' \times 46' = 460\ \text{S.F.}$$

$$\text{RATE} = 0.006\ \text{AC-FT}\left(43560\ \frac{\text{S.F.}}{\text{AC}}\right) / 460\ \text{S.F.}$$

$$\text{RATE} = 0.61\ \frac{\text{CF/DAY}}{\text{S.F.}}$$

Soil Testing

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wastewater Permitting Program
Site Address or Map/Lot Number

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed disposal area)*

Deep Observation Hole A: 10/28/10 (Date) 9:15 (Time) SUNNY (Weather)

1. Deep Observation Hole Logs

Deep Hole Number TP-1 Ground Elevation at Surface of Hole _____

Location (Identify on Plan) SEE SKETCH

2. Land Use: EDGE OF YARD (e.g. woodland, agricultural field, vacant lot, etc.) — (Surface Stones) — (Slope (%))

GRASS (Vegetation) — (Landform) — SHOULDER (Position on landscape (attach sheet))

3. Distances from: Open Water Body — feet Drainage Way — feet Possible Wet Area 740' feet

Property Line 235 feet Drinking Water Well — feet Other _____

4. Parent Material: GLACIAL TILL Unsuitable Materials Present: Yes ☐ No ☒

If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

Estimated Depth to High Groundwater: 9'6" inches — elevation

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wastewater Permitting Program
294 MAIN ST.
Site Address or Map/Lot Number
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Deep Observation Hole A: Deep Hole Number: TP-1

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-60"	FILL										
60"-68"	A	10YR 4/3	—	—	—	SANDY LOAM	—	—	MASSIVE	FRIABLE	
68"-74"	B	10YR 5/4	—	—	—	SANDY LOAM	—	—	MASSIVE	FRIABLE	
74"-10'	C	2.5Y 4/4	9'6"	7.5YR 4/2	2%	LOAMY SAND	2%	10%	MASSIVE	FRIABLE	

Additional Notes LARGE BOULDER @ 10'
C LAYER DID NOT FORM EASY

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wastewater Permitting Program
Site Address or Map/Lot Number

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review

(minimum of two holes required at every proposed disposal area)

Deep Observation Hole A: 10/28/10 (Date) 9:45 (Time) SUNNY (Weather)

1. Deep Observation Hole Logs

Deep Hole Number TP-2 Ground Elevation at Surface of Hole _____

Location (Identify on Plan) SEE ATTACHED SKETCH

2. Land Use: YARD (e.g. woodland, agricultural field, vacant lot, etc.) — (Surface Stones) 5-10% (Slope %)

GRASS (Vegetation) _____ (Landform) ON SLOPE (Position on landscape (attach sheet))

3. Distances from: Open Water Body — feet Drainage Way _____ feet Possible Wet Area 2100' feet

Property Line 20' feet Drinking Water Well — feet Other _____

4. Parent Material: GLACIAL TILL Unsuitable Materials Present: Yes ☒ No ☐

If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☒

5. Groundwater Observed: Yes ☐ No ☒

If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

Estimated Depth to High Groundwater: 42" Inches _____ elevation

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wastewater Permitting Program
294 MAIN ST
Site Address or Map/Lot Number
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Deep Observation Hole A: Deep Hole Number: TP-2

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-12"	A	10YR3/3	—	—	—	SANDY LOAM	—	—	MASSIVE	FRIABLE	
12"-16"	B	10YR5/4	—	—	—	SANDY LOAM	—	—	MASSIVE	FRIABLE	
16"-C'	C	10YR6/3	42"	7.5YR5/6	5%	LOAMY SAND	2%	20%	MASSIVE	FRIABLE	

Additional Notes REFUSAL @ 6'

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wastewater Permitting Program
Site Address or Map/Lot Number
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed disposal area)*

Deep Observation Hole A: 10/28/10 (Date) 10:30 (Time) SUNNY (Weather)

1. Deep Observation Hole Logs

Deep Hole Number _____ Ground Elevation at Surface of Hole _____

Location (Identify on Plan) _____

2. Land Use: VACANT (e.g. woodland, agricultural field, vacant lot, etc.) — (Surface Stones) 2-10% (Slope (%))

GRASS (Vegetation) _____ (Landform) ON SLOPE (Position on landscape (attach sheet))

3. Distances from: Open Water Body — feet Drainage Way _____ feet Possible Wet Area 100+/- feet

Property Line 710 feet Drinking Water Well — feet Other _____

4. Parent Material: GLACIAL TILL Unsuitable Materials Present: Yes ☒ No ☐

If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☒

5. Groundwater Observed: Yes ☐ No ☒

If Yes: Depth Weeping from Pit _____ Depth Standing Water in Hole —

Estimated Depth to High Groundwater: 42" (Inches) _____ (elevation)

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wastewater Permitting Program
294 MAIN ST.
Site Address or Map/Lot Number
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Deep Observation Hole A: Deep Hole Number: TP-3

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-10"	A	10YR 3/2	—	—	—	SANDY LOAM	—	—	MASSIVE	FRIABLE	
10-24"	B	10YR 5/4	—	—	—	SANDY LOAM	—	—	MASSIVE	FRIABLE	
24"-6'	C	2.5Y 6/4	42"	Distinct 7.5YR 5/8	>5%	LOAMY SAND	2%	10%	MASSIVE	FRIABLE	

Additional Notes REFUSAL @ 6'

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wastewater Permitting Program
Site Address or Map/Lot Number

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed disposal area)*

Deep Observation Hole A: 10/28/10 (Date) 10:45 (Time) SUNNY (Weather)

1. Deep Observation Hole Logs

Deep Hole Number TP-4 Ground Elevation at Surface of Hole _____

Location (Identify on Plan) SEE ATTACHED SKETCH

2. Land Use: YARD (e.g. woodland, agricultural field, vacant lot, etc.) — (Surface Stones) 2-10% (Slope (%))

GRASS (Vegetation) _____ (Landform) ON SLOPE (Position on landscape (attach sheet))

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area 200 feet

Property Line 210 feet Drinking Water Well — feet Other _____

4. Parent Material: GLACIAL TILL Unsuitable Materials Present: Yes ☒ No ☐

If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☒

5. Groundwater Observed: Yes ☐ No ☐

If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

Estimated Depth to High Groundwater: 44" (Inches) _____ (elevation)

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wastewater Permitting Program
294 MAIN ST
Site Address or Map/Lot Number
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Deep Observation Hole A: Deep Hole Number: TP-4

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-16"	A	10YR 3/2	—	—	—	SANDY LOAM	—	—	MASSIVE	FRIABLE	
16"-30"	B	10YR 5/4	—	—	—	SANDY LOAM	—	—	MASSIVE	FRIABLE	
30"-54"	C	2.5Y 6/4	44"	7.5YR 5/6 7.5YR 4/6	5%	LOAMY SAND	5%	5%	MASSIVE	FRIABLE	

Additional Notes REFUSAL @ 4'6"

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wastewater Permitting Program
Site Address or Map/Lot Number

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed disposal area)*

Deep Observation Hole A: 10/28/10 (Date) 11:00 (Time) SUNNY (Weather)

1. Deep Observation Hole Logs
   Deep Hole Number TP-5 Ground Elevation at Surface of Hole ____
   Location (Identify on Plan) ____
2. Land Use: YARD (e.g. woodland, agricultural field, vacant lot, etc.) — (Surface Stones) 5-10% (Slope (%))
   GRASS (Vegetation) ____ (Landform) ON SLOPE (Position on landscape (attach sheet))
3. Distances from: Open Water Body — feet Drainage Way ____ feet Possible Wet Area 7100' feet
   Property Line 20' feet Drinking Water Well — feet Other ____
4. Parent Material: GLACIAL TILL Unsuitable Materials Present: Yes ☒ No ☐
   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☒
5. Groundwater Observed: Yes ☐ No ☒
   If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —
   Estimated Depth to High Groundwater: 48" (Inches) ____ (elevation)

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wastewater Permitting Program
294 MAIN ST.
Site Address or Map/Lot Number
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Deep Observation Hole A: Deep Hole Number: TP-5

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-14"	A	10YR 3/2	—	—	—	SANDY LOAM	—	—	MASSIVE	FRIABLE	
14"-26"	B	10YR 5/4	—	—	—	SANDY LOAM	—	—	MASSIVE	FRIABLE	
26"-74"	C	2.5Y 6/4	48"	7.5YR 5/6	2%	LOAMY SAND	2%	15%	MASSIVE	FRIABLE	

Additional Notes REFUSAL @ 74"

Drainage Maps

SUBCATCHMENT	AREA
1 TO PROPERTY LINE	0.95± AC

SOIL TYPE KEY

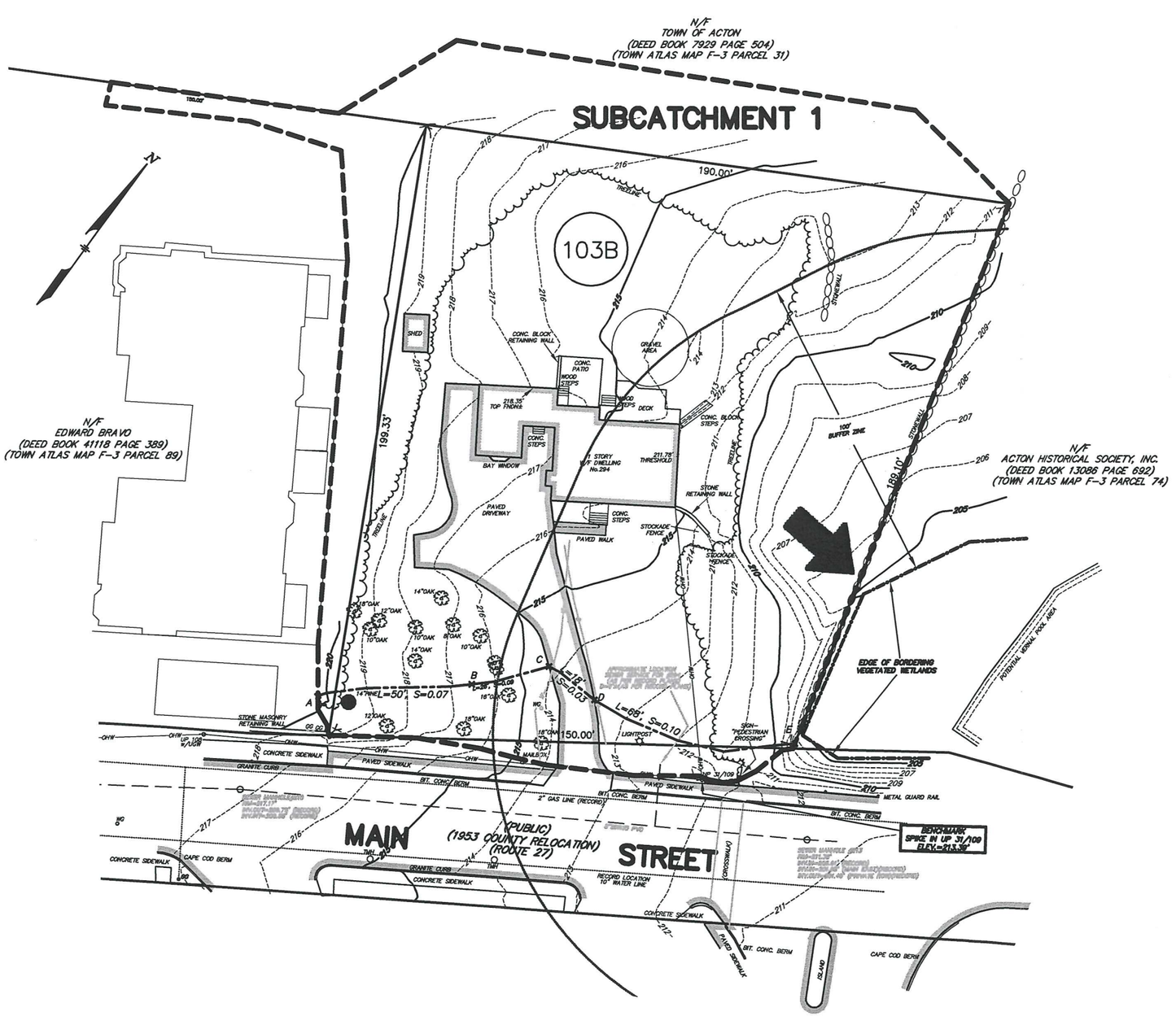
MAP SYMBOL	SOIL NAME	HYDROLOGIC SOIL GROUP
103B	CHARLTON–HOLLIS–ROCK OUTCROP COMPLEX	B

LEGEND

- PROPOSED SUBCATCHMENT
- SUBCATCHMENT NUMBER
- A ● B TRAVEL PATH THROUGH SUBCATCHMENT (TC)
- HYDRAULIC SOIL BOUNDARIES (FROM SCS MAP)
- TREELINE
- STONEWALL
- EXISTING CONTOUR
- EXISTING CONTOUR
- EDGE OF BORDERING VEGETATED WETLANDS
- WF 1 WET FLAG
- FENCE
- TREE

UTILITY NOTE:

ALL UNDERGROUND UTILITIES SHOWN HERE WERE COMPILED ACCORDING TO AVAILABLE RECORD PLANS FROM VARIOUS UTILITY COMPANIES AND PUBLIC AGENCIES AND ARE APPROXIMATE ONLY. ACTUAL LOCATIONS MUST BE DETERMINED IN THE FIELD BEFORE DESIGNING, EXCAVATING, BLASTING, INSTALLING, BACKFILLING, GRADING, PAVEMENT RESTORATION OR REPAIRING. ALL UTILITY COMPANIES, PUBLIC AND PRIVATE, MUST BE CONTACTED INCLUDING THOSE IN CONTROL OF UTILITIES NOT SHOWN ON THIS PLAN. SEE CHAPTER 370., ACTS OF 1963 MASS. WE ASSUME NO RESPONSIBILITY FOR DAMAGES INCURRED AS A RESULT OF UTILITIES OMITTED OR INACCURATELY SHOWN. BEFORE PLANNING FUTURE CONNECTIONS, THE APPROPRIATE PUBLIC UTILITY ENGINEERING DEPARTMENT MUST BE CONSULTED. DIG SAFE TELE. NO. 1–888–344–7233.



PRE–DEVELOPMENT DRAINAGE MAP IN ACTON, MASSACHUSETTS

(MIDDLESEX COUNTY)

FOR: ACTON MANAGEMENT, INC.

SCALE: 1"=40' DECEMBER 20, 2010

STAMSKI AND MCNARY, INC.
1000 MAIN STREET ACTON, MASSACHUSETTS
ENGINEERING – PLANNING – SURVEYING

0 20 40 80 120 160 FT

SM–4703 4703 PRE.dwg

SUBCATCHMENT	AREA
1 TO PROPERTY LINE	0.54± AC
2a TO PROPERTY LINE	0.25± AC
2b TO PROPERTY LINE	0.12± AC
3 TO PROPERTY LINE	0.04± AC
TOTAL	0.95± AC

SOIL TYPE KEY

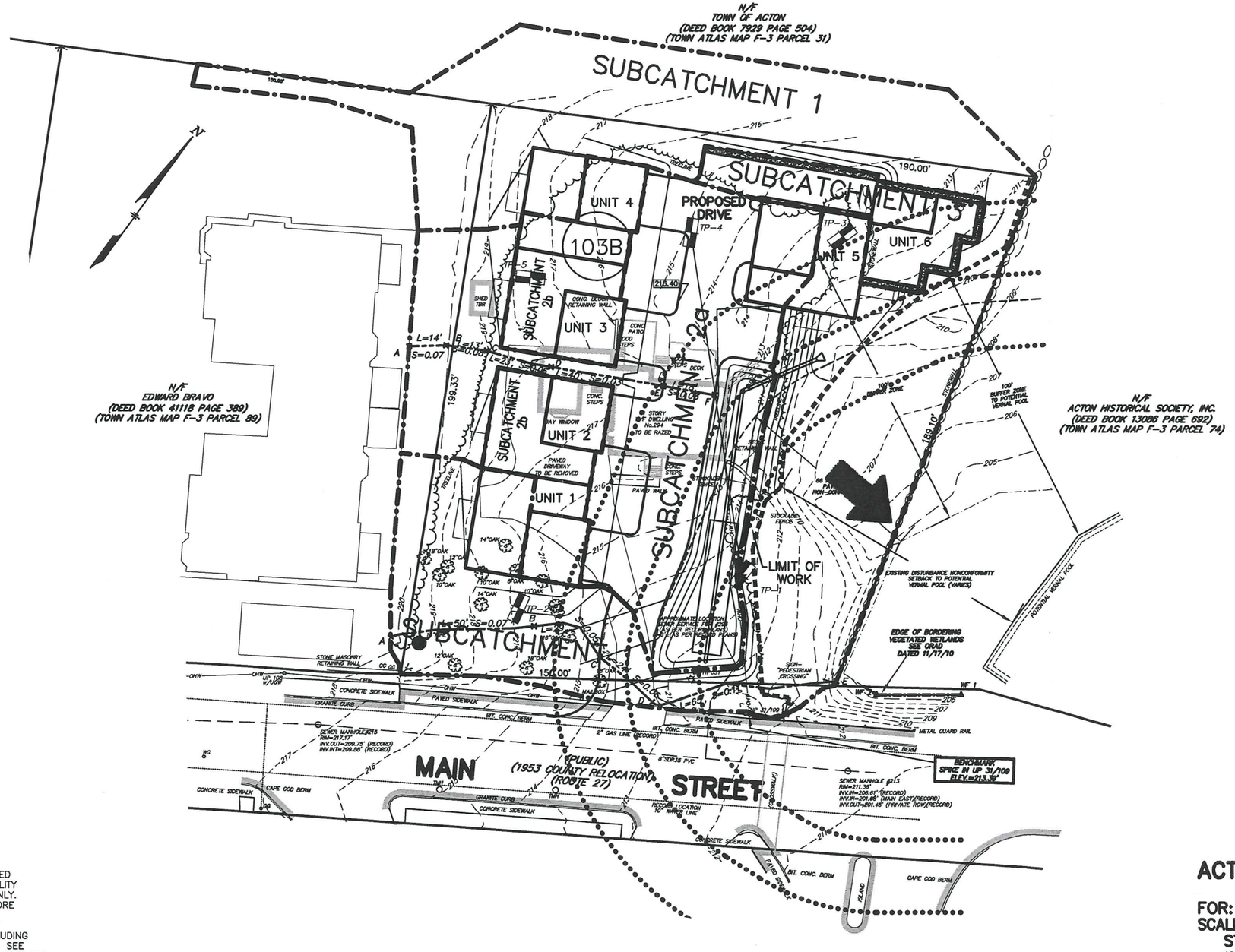
MAP SYMBOL	SOIL NAME	HYDROLOGIC SOIL GROUP
103B	CHARLTON–HOLLIS–ROCK OUTCROP COMPLEX	B

LEGEND

- PROPOSED SUBCATCHMENT
- ① SUBCATCHMENT NUMBER
- A ×——× B TRAVEL PATH THROUGH SUBCATCHMENT (TC)
- HYDRAULIC SOIL BOUNDARIES (FROM SCS MAP)
- TREELINE
- STONEWALL
- 220 EXISTING CONTOUR
- 224 EXISTING CONTOUR
- EDGE OF BORDERING VEGETATED WETLANDS
- ▲WF 1 WET FLAG
- FENCE
- TREE

UTILITY NOTE:

ALL UNDERGROUND UTILITIES SHOWN HERE WERE COMPILED ACCORDING TO AVAILABLE RECORD PLANS FROM VARIOUS UTILITY COMPANIES AND PUBLIC AGENCIES AND ARE APPROXIMATE ONLY. ACTUAL LOCATIONS MUST BE DETERMINED IN THE FIELD BEFORE DESIGNING, EXCAVATING, BLASTING, INSTALLING, BACKFILLING, GRADING, PAVEMENT RESTORATION OR REPAIRING. ALL UTILITY COMPANIES, PUBLIC AND PRIVATE, MUST BE CONTACTED INCLUDING THOSE IN CONTROL OF UTILITIES NOT SHOWN ON THIS PLAN. SEE CHAPTER 370., ACTS OF 1963 MASS. WE ASSUME NO RESPONSIBILITY FOR DAMAGES INCURRED AS A RESULT OF UTILITIES OMITTED OR INACCURATELY SHOWN. BEFORE PLANNING FUTURE CONNECTIONS, THE APPROPRIATE PUBLIC UTILITY ENGINEERING DEPARTMENT MUST BE CONSULTED. DIG SAFE TELE. NO. 1–888–344–7233.



POST–DEVELOPMENT
DRAINAGE MAP
IN

ACTON, MASSACHUSETTS

(MIDDLESEX COUNTY)

FOR: ACTON MANAGEMENT, INC.
SCALE: 1"=40' DECEMBER 20, 2010
STAMSKI AND MCNARY, INC.
1000 MAIN STREET ACTON, MASSACHUSETTS
ENGINEERING – PLANNING – SURVEYING

0 20 40 80 120 160 FT

SM–4703 4703 POST DEV PRELIM.dwg