Stormwater Report

for

Medway Mill Parking Expansion

163-165 Main Street
Medway, MA

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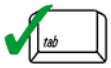
Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

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

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

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

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

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

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

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature

Dale MacKinnon 9/21/2021
Signature and Date

Checklist

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

☐ New development

☐ Redevelopment

☒ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

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

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

Standard 1: No New Untreated Discharges

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

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

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

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

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

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

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

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

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

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.

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SITE LOCATION & DESCRIPTION

This report was prepared on behalf of the applicant NRG Concepts, Inc. The project development area is 317,260+- sf. (7.28+/-Ac.) owned by the applicant. The property is mixed commercial with office space and consists of multiple structures constructed on the foundation of the original Stone Mill from the 1800's. The property is bordered by residential and commercial uses, woods, and wetlands, with Chicken Brook flowing beneath the Stone Mill Building. The site is located within the ARII zoning district and the Adaptive Use Overlay/Mill Conversion Subdistrict and has primary frontage along Main Street with a rear entrance off Lincoln Street. The site lies within the jurisdictional buffers of Chicken Brook and its associated wetlands, including riverfront and flood hazard zones. The site does not lie within a mapped water resource district.

PROJECT DESCRIPTION

The Applicant is proposing to construct a new 42 space overflow parking facility to service the existing mill building uses. The applicant also proposes to widen the existing bridge over Chicken Brook and pave approximately 4,400 sf of existing gravel parking area. In addition, the applicant proposes to restore approximately 10,370 sf of existing gravel parking lot to a natural condition. The remediation areas are located within the riverfront/wetland buffers and are identified on sheet 9 of the accompanying site plan. Drainage infrastructure and pedestrian walkways associated with the overflow parking facility will also be constructed. The property is bisected by Chicken Brook, with both sides of the property draining principally to the brook and its associated wetlands. The topography consists of slopes ranging from 0% to 33% grade. The portion of upland east of Chicken Brook is fully developed, consisting of the existing mill buildings and both paved and gravel parking facilities. The Western portion of the site includes a portion of the existing mill building, a 22 space parking area, a driveway out to Lincoln Street, and undeveloped woodland.

DESCRIPTION OF EXISTING DRAINAGE

The Pre-Developed site drains principally to the northeast with approximately 119,136 square feet of residential properties, woodland, gravel, and a parking area draining to Chicken Brook and its associated wetlands both overland and through an existing catch basin in the parking area. The pre-development drainage area is modeled as a single hydrologic area. This hydrologic area is shown on the Pre-Development Watershed Plan attached to this report and is denoted as EX-1.

DESCRIPTION OF PROPOSED DRAINAGE FACILITIES

The proposed drainage system to manage stormwater from the proposed parking lot expansion consists of Deep Sump Hooded Catch Basins, a Sediment Forebay, and an Infiltration Basin. Stormwater from lawns, driveways, and the parking lot are collected and conveyed by a conventional catch basin and drain manhole system to the sediment forebay/infiltration basin for treatment, detention, and infiltration. The eastern side of Chicken Brook has only minor redevelopment work proposed, and was not included in this analysis as the paving of a 4,400sf section of existing hard packed gravel parking lot is offset by the restoration of approximately 8,400sf of gravel parking area

to a natural condition. A swale has been proposed to the south of the existing parking area to increase water quality of runoff discharged to the wetlands and chicken brook.

In the Post-Development condition, two hydrologic areas were considered. These watershed areas consider the driveways, lawns, parking lot, sidewalks, and drainage facilities proposed to be constructed. These hydrologic areas are shown on the Post-Development Watershed Plan attached to this report and are denoted as PR-1 and PR-2.

PR-1 contains approximately 41,698 square feet of contributing area and includes the land which drains to the proposed Catch Basins 1 and 2. Runoff is captured by the catch basins and is conveyed to the northeast and then discharged to the sediment forebay and infiltration basin for treatment, detention, and infiltration.

PR-2 contains approximately 77,443 square feet of contributing area and includes all land not captured by the proposed drainage improvements which drains northeasterly to Chicken Brook.

This report documents design compliance with the applicable sections of the Massachusetts Stormwater Management Standards 1-10.

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Stormwater Design Parameter:

The stormwater management system was designed to control the post-development rate of peak rainfall runoff from the site by keeping it below the post-development peak rate of rainfall runoff as stated as the objective in the Massachusetts Stormwater Handbook. The calculations were performed using the HydroCAD hydraulic program, developed by applied Microcomputer System. The HydroCAD software is based upon the Soil Conservation Service, "Technical Release 55 – Urban Hydrology for Small Watersheds" and is generally accepted industry methodology.

The analysis was performed for the 2-year, 10-year, 25-year, and 100-year 24-hour storm events.

The following data was required for input:

- Watershed Area: Areas of each watershed were calculated and expressed in square feet for these calculations.
- SCS Curve Number (Cn): Based on the cover type and hydrologic soil group, a weighted curve number (CN) was determined for each of the existing watersheds utilizing Table 2-2a- *Runoff Curve Numbers For Urban Areas* and *Worksheet 2, Runoff Curve Number and Runoff* from the Soil Conservation Service Technical Release 55 – Urban Hydrology for Small Watersheds.
- Time of Concentration, Tc (Minutes): The time of concentration for each watershed was determined by finding the time necessary for runoff to travel from the hydraulically most distant point in the watershed to the point of analysis. This was calculated by using a minimum time of 6 minutes for runoff to reach the most distant catch basin.
- SCS 24-Hour Storm Type: For the greater New England region, a Type III storm rainfall distribution is recommended for drainage calculations and was used for this project.
- Rainfall Precipitation: Rainfall precipitations used the Atlas-14 Rainfall Estimates for Norfolk County for the 2, 10, 25, and 100 year storm events and are as follows:

2-year storm event:	3.22 inches
10-year storm event:	4.86 inches
25-year storm event:	6.15 inches
100-year storm event:	8.80 inches

An on-site conventional storm drainage collection system is designed based on the "Rational Method" using Manning's equation to carry a minimum 25-year storm event and underground culverts to carry a minimum 50-year storm event through the site (See Pipe Sizing Attachments). The proposed drainage pipes will be Class III reinforced concrete pipe (RCP) and where cover is less than 3.5 ft Class V RCP will be used, unless otherwise noted on the plans.

Standard 1: No new stormwater conveyances (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.

All Paved area runoff from the proposed parking area will sheet flow across the pavement areas, accumulate into hooded catch basins, connect with drain pipe to a sediment forebay, which discharge to the infiltration basin. No new untreated stormwater discharges are proposed.

Standard 2: Stormwater management systems shall be designed so that the post-development peak discharge rates do not exceed pre-development peak discharge rates.

To meet Standard 2, the post-development peak discharge rate must be equal to or less than pre-development rates to prevent storm damage and downstream and offsite flooding from the 2-year and the 10-year 24-hour storm events.

Peak discharge rates were calculated and evaluated at the western edge of Chicken Brook, AP-1. The point of evaluation is shown on the accompanying watershed plans.

In summary of the attached drainage analysis (HydroCAD), the peak discharge rates at the point of evaluation in cubic feet per second (cfs) are as follows;

		Run off		
	Storm Events	Pre (cfs)	Post (cfs)	Change (cfs)
Analysis Point 1 (AP-1)	2-year	1.67	1.53	-0.14
	10-year	4.68	4.46	-0.22
	25-year	7.44	6.72	-0.72
	100-year	13.67	13.61	-0.06

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

Soil Evaluation

Soil evaluation is broken down into two stages. Stage 1 identifies the underlying soils just beneath the surface that contribute to how much runoff is generated as stormwater falls and moves across the surface. Stage 2 evaluates the soils in direct contact with the proposed infiltration BMPs. The attachments section includes the NRCS Soil Survey used for Stage 1 while Sheet 4 of the site plan set includes the on-site soil textural analysis in the specific locations that infiltration is proposed. The information from the NRCS Soil Survey is included on the Pre and Post Development Drainage Plans.

Recharge Volume

The required recharge volume is determined by calculating the impervious area proposed over the corresponding soil identified in the NRCS Soil Survey. Soils underlying the site are defined as map units 420B Canton fine sandy loam, 3-8% slopes, and 51 Swansea muck, 0-1% slopes. We have estimated the soil as hydrologic group “B” for the site based on the Web Soil Survey USDA/NRCS Soil Map. Swansea muck is a dual hydrologic soil group, B/D, and B was used for the upland portion of the site being developed.

Table 2: Required Recharge Volume Calculation

	Recharge	Impervious	Volume
Hydrologic Group	(in/sqft)	(sqft)	(cf)
A - *sand*	0.60	None	0
B - *loam*	0.35	42,645	1,244 cf
C - *silty loam*	0.25	None	0
D - *clay*	0.10	None	0
Required Recharge Volume Total			**1,244 cf**

Stormwater Basin Sizing

There are three ways of determining the recharge volume provided by a storm water basin (Static, Simple Dynamic and Dynamic Field). The Static Method, used here, includes the volume of water that can be stored beneath the lowest outlet of the basin. This, the most conservative method of determining the recharge volume, doesn't account for any infiltration that takes place while the basin is filling with water and is less dependent on maintenance of the basin since the only way for the water below the lowest invert can leave the basin is though infiltration. The following table summarizes the recharge volume provided by the infiltration basin. Detailed volume calculations for the basin are included in the attachments.

Table 3: Basin Recharge Volumes

	Recharge Volume
Basin 1 @ 184.75	1,332 cf
Total	1,332 cf

72-hour Drawdown

When using the conservative Static Method to determine infiltration volume provided, the Rawls Rate is used to represent the infiltration rate in place of a hydraulic conductivity rate. The specific rate chosen is based on the textural analysis of the in-site soil performed by a competent soil professional.

A Massachusetts Certified Soil Evaluator performed an evaluation of the soil at the proposed infiltration BMP. The soil textural analysis for the infiltration BMP is listed below with the associated Rawls Rate used in the HydroCAD calculations. Where textural analysis varied within any single BMP, the most restrictive textural evaluation and Rawls Rate were used. Soil logs of the in situ soil evaluation are included on Sheet 4 of the Site Plan set.

Table 4: Rawls Rate

	Most Restrictive Soil Texture	Rawls Rate (in/hour)
Basin 1	Loamy Sand	2.41 in/hr

Drawdown time for the infiltration basin is modeled by HydroCAD and included in the attachments. The following table summarizes the drawdown time for the basin to show it will drawdown within the 72-hour maximum.

Table 5: Basin Drawdown

	Time for Drawdown
Basin 1	37 hours

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

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

The Water Quality Volume requiring 80% TSS removal, is calculated as follows:

The required water quality volume is based on 1.0" as the soil recharge rate is 2.41 in/hr, meeting the threshold rate of 2.4 in/hr or greater. Because the site is a redevelopment project, the water quality volume equals 1.0 inches of runoff times the increased impervious area of the post-development site.

Existing Site Impervious Area = 27,673 sf
Proposed Site Impervious Area = 42,645 sf
Total Site Impervious Area Increase = 14,972 sf
Impervious area to be treated = **14,972 sf**

Total volume to be treated:
1.0" x 1'/12" x 14,972 sf = 1,248 **cf Water Quality Volume Required**

Provided Water Quality Volume:

Treatment volume (infiltration basin) = 1,332 cf @ el. 184.75

See TSS Removal Calculations in Attachment Section.

Standard 4: requires the development and implementation of suitable practices for source control and pollution prevention. These measures must be identified in a long-term pollution prevention plan.

The long-term pollution prevention plan is incorporated into the Operation and Maintenance Plan required by Standard 9.

Standard 5: For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable.

The proposed project is not a use with higher potential pollutant loads.

Standard 6: Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply and stormwater discharges near or to any other critical area require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas, as provided in the Massachusetts Stormwater Handbook.

The subject property does not discharge stormwater within the Zone II of a public water supply, IWPA, or any other critical area as defined by the Massachusetts Stormwater Handbook.

Standard 7: A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable:

This project is a mix of new development and redevelopment. The portion of the project that is considered new development is fully meeting all applicable stormwater standards. The redevelopment portion of the project is meeting standards to the maximum extent practical, including the restoration of existing developed areas within the riverfront to a natural condition.

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

During land disturbance and construction activities, project proponents must implement controls that prevent erosion, control sediment movement, and stabilize exposed soils to prevent pollutants from moving offsite or entering wetlands or waters. Land disturbance activities include demolition, construction, clearing, excavation, grading, filling, and reconstruction.

Construction Period Pollution Prevention Plan and Erosion and Sedimentation Control.
EPA NPDES – Storm Water Pollution Prevention Plan (SWPPP)

A. Names of Persons or Entities Responsible for Plan Compliance

John Greene
NRG Concepts, Inc.
165 Main Street
Suite 307
Medway, MA 02053
Tel: 508-367-8745

B. Construction Period Pollution Prevention Measures
1. Inventory materials to be present on site during construction.
2. Train employees and subcontractors in prevention and clean up procedures.

3. All materials stored on site will be stored in their appropriate containers and if possible under a roof or covered.
4. Follow manufacturer's recommendation for disposal of used containers.
5. Store only enough products on site to do the job.
6. On site equipment, fueling and maintenance measures:
    a. Inspect on-site vehicles and equipment daily for leaks.
    b. Conduct all vehicle and equipment maintenance and refueling in front of building, away from storm drains.
    c. Perform major repairs and maintenance off site.
    d. Use drip pans, drip cloths or absorbent pads when replacing spent fuels.
    e. Collect spent fuels and remove from site, per Local and State regulations.
    f. Maintain a clean construction entrance; install a crushed stone apron where truck traffic is frequent to reduce soil compaction constant sweeping is required and limit tracking of sediment into streets, sweeping street when silt is observed on street.
7. A temporary concrete washout station and equipment wash station shall be located on the site. Areas shall be surrounded with a silt fence and or Filter Mitt to contain materials and provide ease of cleanup.
8. Stock pile materials, and maintain Erosion Control around the materials where it can easily be accessed. Maintain easy access to clean up materials to include brooms, mops, rags gloves, goggles, sand, sawdust, plastic and metal trash containers.
9. Clean up spills.
    a. Never hose down "dirty" pavement or impermeable surfaces where fluids have spilled. Use dry cleanup methods (sawdust, cat litter and/or rags and absorbent pads).
    b. Sweep up dry materials immediately. Never wash them away or bury them.
    c. Clean up spills on dirt areas by digging up and properly disposing of contaminated soil in a certified container and notify a certified hauler for removal.
    d. Report significant spills to the Fire Department.

10. It is the responsibility of the site superintendent or employees designated by the Applicant to inspect erosion control and repair as needed, also to inspect all on site vehicles for leaks and check all containers on site that may contain hazardous materials daily.

C. <u>Site Development Plans</u>
    1. See Site Plan set "Site Plan Medway Mill 163-165 Main Street Medway Massachusetts" dated February 14, 2020 and revised through December 22, 2020, prepared by Guerriere & Halnon, Inc.

D. <u>Construction Erosion and Sedimentation Control Plan;</u>
    1. See Site Plan set "Site Plan Medway Mill 163-165 Main Street Medway Massachusetts" dated February 14, 2020 and revised through December 22, 2020, prepared by Guerriere & Halnon, Inc.

E. <u>Plans</u>
    1. <u>Construction Sequencing Plan</u>
        a. A NPDES NOI shall be filed with the EPA.
        b. Record Order of Conditions - The site superintendent shall be aware of all the Conditions contained within the Order including inspection schedules.

c. Install DEP File # Sign.
d. Prior to any work on the site including tree/brush clearing, the approved limit of clearing as well as the location of the proposed erosion control devices (such as silt fence/straw bales, etc.) must be staked on the ground under the direction of a Massachusetts registered Professional Land Surveyor.
e. Install erosion control barrier at locations depicted on the plans.
f. Erosion control to be inspected by either the design engineer (or agent) or an erosion control monitor appointed by the Town of Medway.
g. Extra erosion control devices shall be stored on the site to be used in case of an emergency (large storm).
h. Perform tree/brush removal.
i. Strip off top and subsoil. Stockpile material to be reused away from any drainage inlet or protected wetland areas, remove excess material from the site. Install and maintain erosion control barrier around stockpile.
j. Rough grade site, maintaining temporary low areas/sediment traps for sediment accumulation and away from the wetlands and prevent sedimentation from migrating from the site.
k. Construct forebay/basin, water quality swale, and outlets/outfalls. Install pipes, manholes and catch basins. Stabilize side slopes with loam, seed and mulch.
l. Install underground utilities; protect all open drainage structures with erosion/siltation control devices, and rope off any areas susceptible to heavy vehicle damage.
m. Prepare compacted pavement base.
n. Loam and seed (mulch as required) disturbed areas of site other than immediately adjacent to work area.
o. Upon all catchment structures and mitigation features becoming operational, install pavement up to binder finish grade. Straw bales backed by crushed stone to be provided on down gradient side of catch basins to direct water to temporary basin.
p. Install curbing and catch basin curb inlets.
q. Install final pavement wearing course.
r. Construct pervious sidewalk.
s. Finish grade - loam and seed (mulch as required adjacent to parking lot.
t. Maintain all erosion control devices until site is stabilized and final inspections are performed.

The Contractor shall be responsible to schedule any required inspections of his/her work.

2. Construction Waste Management Plan
   a. Dumpster for trash and bulk waste collection shall be provided separately for construction.
   b. Recycle materials whenever possible (paper, plaster cardboard, metal cans). Separate containers for material are recommended.
   c. Segregate and provide containers for disposal options for waste.
   d. Do not bury waste and debris on site.
   e. Certified haulers will be hired to remove the dumpster container waste as needed. Recycling products will also be removed off site weekly.
   f. The sewer system is only for disposal of human waste, and substances permitted for disposal by the Charles River Pollution Control District (CRPCD).

F. Operation and Maintenance of Erosion and Sedimentation Controls

The operation and maintenance of sedimentation control shall be the responsibility of the contractor. The inspection and maintenance of the storm water component shall be performed as noted below. The contractor shall, at all times have erosion control in place. The contractor, based on future weather reports shall prepare and inspect all erosion control devices; cleaning, repairing and upgrading is a priority so that the devices perform as per design. Inspect the site during rain events. **Don't stay away from the site.** At a minimum, there should be inspection to assure the devices are not clogged or plugged, or that devices have not been destroyed or damaged during the rain event. After a storm event inspection is required to clean and repair any damage components. Immediate repair is required.

G. Inspection and Maintenance Schedules

1. Inspection must be conducted at least once every 7 days and within 24 hours prior to and after the end of a storm event 0.5 inches or greater.
2. Inspection frequency can be reduced to once a month if:
   a. The site is temporarily stabilized.
   b. Runoff is unlikely due to winter conditions, when site is covered with snow or ice.
3. Inspections must be conducted by qualified personnel, "qualified personnel" means a person knowledgeable in the principles and practice of erosion and sediment controls and who possess the skills to assess the conditions and take measures to maintain and ensure proper operation, also to conclude if the erosion control methods selected are effective.
4. For each inspection, the inspection report must include:
   a. The inspection date.
   b. Names, titles of personnel making the inspection.
   c. Weather information for the period since the last inspection.
   d. Weather information at the time of the inspection.
   e. Locations of discharges of sediment from the site, if any.
   f. Locations of BMP's that need to be maintained.
   g. Locations where additional BMP's may be required.
   h. Corrective action required or any changes to the SWPPP that may be necessary.
5. Qualified personnel shall inspect the following in-place work;

Inspection Schedule:

Erosion Control	Weekly
Catch Basins	Weekly
Temporary Sedimentation Traps/Basins	Weekly
Pavement Sweeping	Weekly

Please Note: Special inspections shall also be made after a significant rainfall event.

Maintenance Schedule

Erosion Control Devices Failure	Immediately
Temporary Sedimentation Traps/Basins	As needed
Pavement Sweeping	14 days minimum and prior to any significant rain event.

Please Note: Special maintenance shall also be made after a significant rainfall event.

H. Inspection and Maintenance Log Form.
   1. See Construction Phase Inspection and Maintenance Form attached

Standard 9: A Long –Term Operation and Maintenance (O&M) Plan shall be developed and implemented to ensure that storm water management systems function as designed.

The following shall serve as the (O&M) Plan required by Standard 9, as well as the Long-Term Pollution Prevention Plan required by Standard 4.

A. Names of Persons or Entities Responsible for Plan Compliance;

John Greene
NRG Concepts, Inc.
165 Main Street
Suite 307
Medway, MA 02053
Tel: 508-367-8745

It is the intent of the Applicant to have the site completed and released by the various town Departments and Boards.

B. Good housekeeping practices
   1. Maintain site, landscaping and vegetation.
   2. Sweep and pick up litter on pavements and grounds.
   3. Deliveries shall be monitored by owners or representative to ensure that if any spillage occurs, it shall be contained and cleaned up immediately.
   4. Maintain pavement and curbing in good repair.

C. Requirements for routine inspections and maintenance of stormwater BMPs
   1. Plans: The storm water Operation and Maintenance Plan shall consist of all Plans, documents and all local state and federal approvals as required for the subject property.
   2. Record Keeping:
      a. Maintain a log of all operation and maintenance activities for at least three years following construction, including inspections, repairs, replacement and disposal (for disposal, the log shall indicate the type of material and the disposal location);

   3. Descriptions and Designs: The Best Management Practices (BMP) incorporated into the design include the following;
      a. Pavement Sweeping – Stipulated within the Construction Period Pollution Prevention Plan, the Long Term Pollution Prevention Plan, and the Operation and Maintenance Plan. As the amount of TSS removal is discretionary, no credit was taken within the calculations for this BMP.
      b. Deep sump catch basins with hoods installed to promote TSS Removal of solids and control floatable pollutants. This BMP has a design rate of 25% TSS Removal.
      c. Sediment Forebay - installed to promote TSS Removal of solids. This BMP has a design rate of 25% TSS Removal.

d. Infiltration Basin – infiltration BMP provides the required groundwater recharge and has a design rate of 80% TSS Removal. Refer to TSS Removal Worksheet included in the Attachments.
e. Spill Containment Kit to contain and clean-up spills that could occur on site.

4. BMP Maintenance: After construction it is the responsibility of the owner to perform maintenance. The cleaning of the components of the stormwater management system shall generally be as follows:
   a. Pavement: The owner shall keep the pavement swept with a mechanical sweeper or hand swept semi-annually at a minimum.
   b. Catch Basins: Shall be cleaned by excavating, pumping or vacuuming. The sediment shall be disposed of off-site by the Owner. Inspect quarterly, remove silt when ¼ full.
   c. Sediment Forebay: Inspect monthly. Clean forebay 4 times per year.
   d. Infiltration Basin: Inspect for proper function after every major storm event during the first 3 months of operation, inspect/remove debris twice per year afterward. Mow basin at least twice per year, remove clippings.

5. Access Provisions: All of the components of the storm water system will be accessible by the Owner

D. Spill prevention and response plans
1. Train employees and subcontractors in prevention and clean up procedures.
2. All materials stored on site will be stored in their appropriate containers under a roof or in the approved underground storage tanks.
3. Follow manufacturer's recommendation for disposal of used containers.
4. On site equipment, fueling and maintenance measures:
   a. Inspect on-site vehicles and equipment daily for leaks.
   b. Conduct all vehicle and equipment maintenance off Site and refueling in one location, away from storm drains and wetlands.
5. Clean up spills.
   a. Never hose down "dirty" pavement or impermeable surfaces where fluids have spilled. Use dry clean-up methods (sawdust, cat litter and/or rags and absorbent pads).
   b. Sweep up dry materials immediately. Never wash them away or bury them.
   c. Clean up spills on dirt areas by digging up and properly disposing of contaminated soil.
   d. Report significant spills to the Fire Department, Conservation Commission and Board of Health.

E. Provisions for maintenance of lawns, gardens, and other landscaped areas
Dispose of clippings away from storm drainage.

F. Requirements for storage and use of herbicides, and pesticides
The application of herbicides or pesticides will be done by professional certified contractor.

G. Provisions for solid waste management
1. Waste Management Plan

a. Recycle materials whenever possible (paper, plaster cardboard, metal cans). Separate containers for material is recommended.
b. Do not bury waste and debris on site.
c. Certified haulers will be hired to remove the dumpster container waste as needed. Recycling products will also be removed off site weekly.

H. Snow disposal and plowing plans
Snow storage is adequate around the site for large storm events, see site plan

I. Winter Road Salt and/or Sand Use and Storage restrictions
No sand, salt, or chemicals for de-icing will be stored outside.

J. Pavement sweeping schedules
Sweeping, the act of cleaning pavement can be done by mechanical sweepers, vacuum sweeper or hand sweeper. The quantity of sand is a direct correlation with the treatment of ice and snow and the types of chemicals and spreaders that are being used on site to manage snow. If a liquid de-icer such as calcium chloride is used as a pretreatment to new events the amount of sand is minimized. Sweeping for this site should be done semi-annually at a minimum. Collecting the particulate before it enters the catch basins is cheaper and more environmentally friendly than in a catch basin mixing with oils and greases in the surface water runoff in catch basins.

K. Provisions for prevention of illicit discharges to the stormwater management system
The discharge into the stormwater system is not being violated, see attachment for illicit discharges compliance.

L. Training the staff or personnel involved with implementing Long-Term Pollution Prevention Plan
The owner shall develop policies and procedures for containing the illicit spilling of oils, soda, beer, paper and litter. These wastes provide a degrading of the water quality. The placement of signs and trash barrels with lids around the site would contribute to a clean water quality site conditions.

M. List of Emergency contacts for implementing Long-Term Pollution Prevention Plan:

John Greene
NRG Concepts, Inc.
165 Main Street
Suite 307
Medway, MA 02053
Tel: 508-367-8745

BMP	Estimated Maintenance Cost
Pavement sweeping	$ 400 per year
Catch basin cleaning	$ 200 per catch basin per cleaning
Sediment Forebay	$ 400 per year
Infiltration Basin	$ 500 per cleaning
Spill Containment Kit	$ 750 purchase price

Stormwater Report
Medway Mill Parking Expansion
Franklin, MA

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

Standard 10 prohibits illicit discharges to stormwater management systems. The stormwater management system is the system for conveying, treating, and infiltrating stormwater on site, including stormwater best management practices and any pipes intended to transport stormwater to the ground water, a surface water, or municipal separate storm sewer system. Illicit discharges to the stormwater management system are discharges that are not entirely comprised of stormwater. Notwithstanding the foregoing, an illicit discharge does not include discharges from the following activities or facilities: firefighting, water line flushing, landscape irrigation, uncontaminated ground water, potable water sources, foundation drains, air conditioning condensation, footing drains, individual resident car washing, flows from riparian habitats and wetlands, dechlorinated water from swimming pools, water used for street washing and water used to clean residential buildings without detergents.

Illicit Discharge Compliance Statement

It is the intent of the Applicant, NRG Concepts, Inc, 165 Main Street, Suite 307, Medway, MA to prevent illicit discharges to the stormwater management system, including wastewater discharges and discharges of stormwater contaminated by contact with process wastes, raw materials, toxic pollutants, hazardous substances, oil, or grease. There will be no connection to the storm water system to inadvertently direct other types of liquids, chemicals or solids into the storm drainage system. The Owner will also promote a clean Green Environment by mitigating spills onto pavements; oils, soda, chemicals, pet waste, debris and litter.

Respectfully Acknowledged,

PRE- AND POST-DEVELOPMENT WATERSHED PLANS

F3519

APPROVED DATE:

MEDWAY PLANNING BOARD

BEING A MAJORITY

UTILITIES ARE PLOTTED AS A COMPILATION OF RECORD DOCUMENTS, MARKINGS AND OTHER OBSERVED EVIDENCE TO DEVELOP A VIEW OF THE UNDERGROUND UTILITIES AND SHOULD BE CONSIDERED APPROXIMATE. LACKING EXCAVATION, THE EXACT LOCATION OF UNDERGROUND FEATURES CANNOT BE ACCURATELY, COMPLETELY AND RELIABLY DEPICTED. ADDITIONAL UTILITIES, NOT EVIDENCED BY RECORD DOCUMENTS OR OBSERVED PHYSICAL EVIDENCE, MAY EXIST. CONTRACTORS (IN ACCORDANCE WITH MASS.G.L. CHAPTER 82 SECTION 40 AS AMENDED) MUST CONTACT ALL UTILITY COMPANIES BEFORE EXCAVATING AND DRILLING AND CALL DIGSAFE AT 1(888)DIG-SAFE(7233).

CONSTRUCTION ON THIS LAND IS SUBJECT TO ANY EASEMENTS, RIGHTS-OF-WAY, RESTRICTIONS, RESERVATIONS, OR OTHER LIMITATIONS WHICH MAY BE REVEALED BY AN EXAMINATION OF THE TITLE.

OWNER

165 MAIN STREET REALTY TRUST
JOHN J. GREENE TRUSTEE
165 MAIN STREET
SUITE 307
MEDWAY, MA

DEED BOOK 24499 PAGE 10
A.M. 48 LOT 092

APPLICANT

NRG CONCEPTS, INC.
165 MAIN STREET
SUITE 307
MEDWAY, MA

SITE PLAN
MEDWAY MILL
163-165 MAIN STREET
MEDWAY
MASSACHUSETTS

PRE-DEVELOPMENT WATERSHED PLAN

FEBRUARY 14, 2020

DATE	REVISION DESCRIPTION

0 15 30 FEET 60 90
0 2.5 5 10 METERS 20

Guerriere & Halnon, Inc.
ENGINEERING & LAND SURVEYING
55 WEST CENTRAL ST. PH. (508) 528-3221
FRANKLIN, MA 02038 FX. (508) 528-7921
www.gandhengineering.com

SHEET 1 OF 2

JOB NO. F3519

F3519

APPROVED DATE:

MEDWAY PLANNING BOARD

BEING A MAJORITY

UTILITIES ARE PLOTTED AS A COMPILATION OF RECORD DOCUMENTS, MARKINGS AND OTHER OBSERVED EVIDENCE TO DEVELOP A VIEW OF THE UNDERGROUND UTILITIES AND SHOULD BE CONSIDERED APPROXIMATE. LACKING EXCAVATION, THE EXACT LOCATION OF UNDERGROUND FEATURES CANNOT BE ACCURATELY, COMPLETELY AND RELIABLY DEPICTED. ADDITIONAL UTILITIES, NOT EVIDENCED BY RECORD DOCUMENTS OR OBSERVED PHYSICAL EVIDENCE, MAY EXIST. CONTRACTORS (IN ACCORDANCE WITH MASS.G.L. CHAPTER 82 SECTION 40 AS AMENDED) MUST CONTACT ALL UTILITY COMPANIES BEFORE EXCAVATING AND DRILLING AND CALL DIGSAFE AT 1(888)DIG-SAFE(7233).

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165 MAIN STREET
SUITE 307
MEDWAY, MA

SITE PLAN
MEDWAY MILL
161-165 MAIN STREET
MEDWAY
MASSACHUSETTS

POST-DEVELOPMENT WATERSHED PLAN

FEBRUARY 14, 2020

DATE	REVISION DESCRIPTION
12/22/2020	REVISED PER TOWN COMMENTS
4/21/2021	REVISED PER TOWN COMMENTS

0 15 30 FEET 60 90
0 2.5 5 10 METERS 20

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SHEET 2 OF 2

JOB NO. F3519

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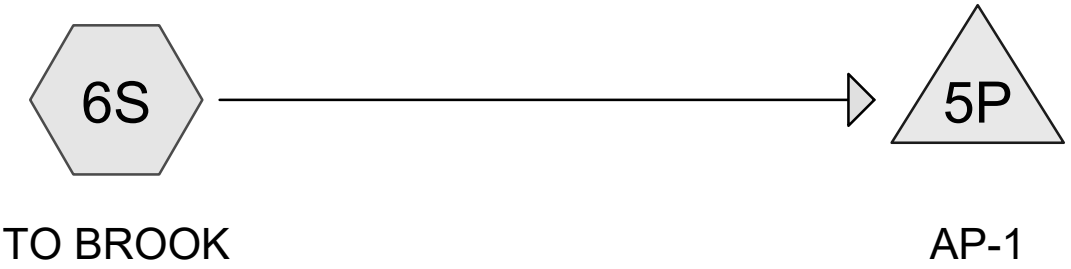
DRAINAGE ANALYSIS

HydroCAD Calculations – Pre-Post Development Conditions 2, 10, 25, 100-Year Storm Events



Subcat Reach Pond Link

Routing Diagram for F-3519 ex-development rev2
Prepared by Guerriere & Halnon, Inc., Printed 4/27/2021
HydroCAD® 10.00-21 s/n 01433 © 2018 HydroCAD Software Solutions LLC

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.679	72	1/3 acre lots, 30% imp, HSG B (6S)
0.093	96	Gravel surface, HSG B (6S)
0.432	98	Paved parking, HSG B (6S)
1.531	55	Woods, Good, HSG B (6S)
2.735	**67**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
2.735	HSG B	6S
0.000	HSG C	
0.000	HSG D	
0.000	Other	
2.735		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.679	0.000	0.000	0.000	0.679	1/3 acre lots, 30% imp	6S
0.000	0.093	0.000	0.000	0.000	0.093	Gravel surface	6S
0.000	0.432	0.000	0.000	0.000	0.432	Paved parking	6S
0.000	1.531	0.000	0.000	0.000	1.531	Woods, Good	6S
0.000	**2.735**	**0.000**	**0.000**	**0.000**	**2.735**	**TOTAL AREA**	

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment6S: TO BROOK Runoff Area=119,142 sf 23.23% Impervious Runoff Depth=0.70"
Flow Length=207' Tc=8.8 min CN=67 Runoff=1.67 cfs 0.159 af

Pond 5P: AP-1 Inflow=1.67 cfs 0.159 af
Primary=1.67 cfs 0.159 af

Total Runoff Area = 2.735 ac Runoff Volume = 0.159 af Average Runoff Depth = 0.70"
76.77% Pervious = 2.100 ac 23.23% Impervious = 0.635 ac

Summary for Subcatchment 6S: TO BROOK

Runoff = 1.67 cfs @ 12.15 hrs, Volume= 0.159 af, Depth= 0.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.22"

Area (sf)	CN	Description
4,071	96	Gravel surface, HSG B
66,693	55	Woods, Good, HSG B
18,800	98	Paved parking, HSG B
29,578	72	1/3 acre lots, 30% imp, HSG B
119,142	67	Weighted Average
91,469		76.77% Pervious Area
27,673		23.23% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.5	50	0.0700	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
1.0	80	0.0700	1.32		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.3	65	0.0800	4.24		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.0	12	0.5000	10.61		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
8.8	207	Total			

Summary for Pond 5P: AP-1

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.735 ac, 23.23% Impervious, Inflow Depth = 0.70" for 2-Year event
Inflow = 1.67 cfs @ 12.15 hrs, Volume= 0.159 af
Primary = 1.67 cfs @ 12.15 hrs, Volume= 0.159 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment6S: TO BROOK Runoff Area=119,142 sf 23.23% Impervious Runoff Depth=1.71"
Flow Length=207' Tc=8.8 min CN=67 Runoff=4.68 cfs 0.389 af

Pond 5P: AP-1 Inflow=4.68 cfs 0.389 af
Primary=4.68 cfs 0.389 af

Total Runoff Area = 2.735 ac Runoff Volume = 0.389 af Average Runoff Depth = 1.71"
76.77% Pervious = 2.100 ac 23.23% Impervious = 0.635 ac

Summary for Subcatchment 6S: TO BROOK

Runoff = 4.68 cfs @ 12.14 hrs, Volume= 0.389 af, Depth= 1.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.86"

Area (sf)	CN	Description
4,071	96	Gravel surface, HSG B
66,693	55	Woods, Good, HSG B
18,800	98	Paved parking, HSG B
29,578	72	1/3 acre lots, 30% imp, HSG B
119,142	67	Weighted Average
91,469		76.77% Pervious Area
27,673		23.23% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.5	50	0.0700	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
1.0	80	0.0700	1.32		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.3	65	0.0800	4.24		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.0	12	0.5000	10.61		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
8.8	207	Total			

Summary for Pond 5P: AP-1

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.735 ac, 23.23% Impervious, Inflow Depth = 1.71" for 10-Year event
Inflow = 4.68 cfs @ 12.14 hrs, Volume= 0.389 af
Primary = 4.68 cfs @ 12.14 hrs, Volume= 0.389 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment6S: TO BROOK Runoff Area=119,142 sf 23.23% Impervious Runoff Depth=2.64"
Flow Length=207' Tc=8.8 min CN=67 Runoff=7.44 cfs 0.603 af

Pond 5P: AP-1 Inflow=7.44 cfs 0.603 af
Primary=7.44 cfs 0.603 af

Total Runoff Area = 2.735 ac Runoff Volume = 0.603 af Average Runoff Depth = 2.64"
76.77% Pervious = 2.100 ac 23.23% Impervious = 0.635 ac

Summary for Subcatchment 6S: TO BROOK

Runoff = 7.44 cfs @ 12.13 hrs, Volume= 0.603 af, Depth= 2.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.15"

Area (sf)	CN	Description
4,071	96	Gravel surface, HSG B
66,693	55	Woods, Good, HSG B
18,800	98	Paved parking, HSG B
29,578	72	1/3 acre lots, 30% imp, HSG B
119,142	67	Weighted Average
91,469		76.77% Pervious Area
27,673		23.23% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.5	50	0.0700	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
1.0	80	0.0700	1.32		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.3	65	0.0800	4.24		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.0	12	0.5000	10.61		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
8.8	207	Total			

Summary for Pond 5P: AP-1

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.735 ac, 23.23% Impervious, Inflow Depth = 2.64" for 25-Year event
Inflow = 7.44 cfs @ 12.13 hrs, Volume= 0.603 af
Primary = 7.44 cfs @ 12.13 hrs, Volume= 0.603 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment6S: TO BROOK Runoff Area=119,142 sf 23.23% Impervious Runoff Depth=4.79"
Flow Length=207' Tc=8.8 min CN=67 Runoff=13.67 cfs 1.093 af

Pond 5P: AP-1 Inflow=13.67 cfs 1.093 af
Primary=13.67 cfs 1.093 af

Total Runoff Area = 2.735 ac Runoff Volume = 1.093 af Average Runoff Depth = 4.79"
76.77% Pervious = 2.100 ac 23.23% Impervious = 0.635 ac

Summary for Subcatchment 6S: TO BROOK

Runoff = 13.67 cfs @ 12.13 hrs, Volume= 1.093 af, Depth= 4.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.80"

Area (sf)	CN	Description
4,071	96	Gravel surface, HSG B
66,693	55	Woods, Good, HSG B
18,800	98	Paved parking, HSG B
29,578	72	1/3 acre lots, 30% imp, HSG B
119,142	67	Weighted Average
91,469		76.77% Pervious Area
27,673		23.23% Impervious Area

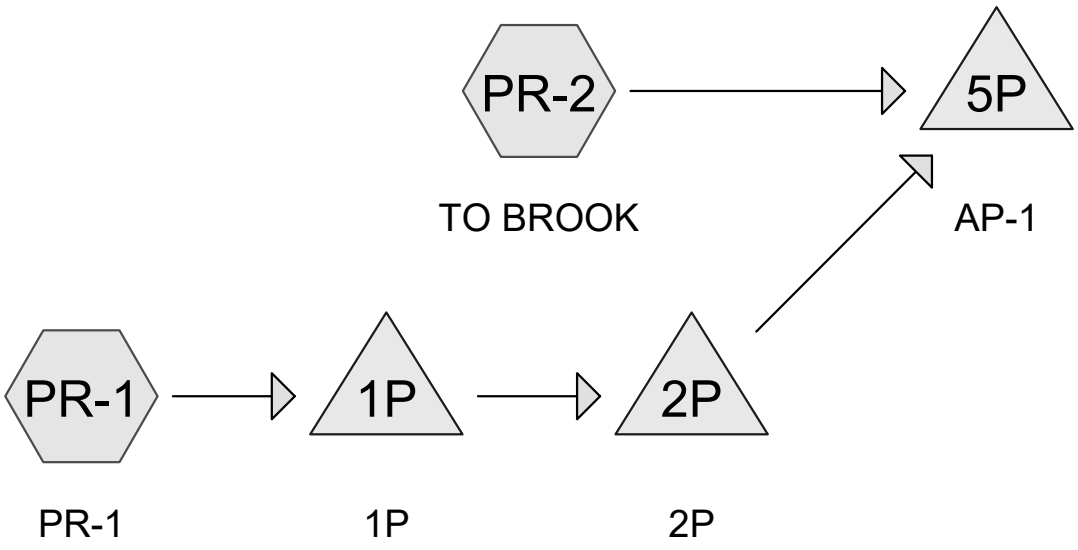
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.5	50	0.0700	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
1.0	80	0.0700	1.32		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.3	65	0.0800	4.24		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.0	12	0.5000	10.61		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
8.8	207	Total			

Summary for Pond 5P: AP-1

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.735 ac, 23.23% Impervious, Inflow Depth = 4.79" for 100-Year event
Inflow = 13.67 cfs @ 12.13 hrs, Volume= 1.093 af
Primary = 13.67 cfs @ 12.13 hrs, Volume= 1.093 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs



Subcat Reach Pond Link

Routing Diagram for F-3519 post-development rev3
Prepared by Guerriere & Halnon, Inc., Printed 4/27/2021
HydroCAD® 10.00-21 s/n 01433 © 2018 HydroCAD Software Solutions LLC

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.679	72	1/3 acre lots, 30% imp, HSG B (PR-1, PR-2)
0.729	61	>75% Grass cover, Good, HSG B (PR-1, PR-2)
0.775	98	Paved parking, HSG B (PR-1, PR-2)
0.552	55	Woods, Good, HSG B (PR-2)
2.735	**73**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
2.735	HSG B	PR-1, PR-2
0.000	HSG C	
0.000	HSG D	
0.000	Other	
2.735		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.679	0.000	0.000	0.000	0.679	1/3 acre lots, 30% imp	PR-1, PR-2
0.000	0.729	0.000	0.000	0.000	0.729	>75% Grass cover, Good	PR-1, PR-2
0.000	0.775	0.000	0.000	0.000	0.775	Paved parking	PR-1, PR-2
0.000	0.552	0.000	0.000	0.000	0.552	Woods, Good	PR-2
0.000	**2.735**	**0.000**	**0.000**	**0.000**	**2.735**	**TOTAL AREA**	

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment PR-1: PR-1 Runoff Area=41,698 sf 44.04% Impervious Runoff Depth=1.23"
Tc=6.0 min CN=77 Runoff=1.34 cfs 0.098 af

Subcatchment PR-2: TO BROOK Runoff Area=77,443 sf 31.35% Impervious Runoff Depth=0.89"
Flow Length=207' Tc=8.8 min CN=71 Runoff=1.53 cfs 0.132 af

Pond 1P: 1P Peak Elev=185.14' Storage=684 cf Inflow=1.34 cfs 0.098 af
Outflow=1.30 cfs 0.098 af

Pond 2P: 2P Peak Elev=185.06' Storage=1,058 cf Inflow=1.30 cfs 0.098 af
Discarded=0.06 cfs 0.075 af Primary=0.25 cfs 0.023 af Outflow=0.31 cfs 0.098 af

Pond 5P: AP-1 Inflow=1.53 cfs 0.154 af
Primary=1.53 cfs 0.154 af

Total Runoff Area = 2.735 ac Runoff Volume = 0.230 af Average Runoff Depth = 1.01"
64.21% Pervious = 1.756 ac 35.79% Impervious = 0.979 ac

Summary for Subcatchment PR-1: PR-1

Runoff = 1.34 cfs @ 12.09 hrs, Volume= 0.098 af, Depth= 1.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.22"

Area (sf)	CN	Description
12,667	98	Paved parking, HSG B
18,991	72	1/3 acre lots, 30% imp, HSG B
10,040	61	>75% Grass cover, Good, HSG B
41,698	77	Weighted Average
23,334		55.96% Pervious Area
18,364		44.04% Impervious Area

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

Summary for Subcatchment PR-2: TO BROOK

Runoff = 1.53 cfs @ 12.14 hrs, Volume= 0.132 af, Depth= 0.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.22"

Area (sf)	CN	Description
24,040	55	Woods, Good, HSG B
21,101	98	Paved parking, HSG B
10,595	72	1/3 acre lots, 30% imp, HSG B
21,707	61	>75% Grass cover, Good, HSG B
77,443	71	Weighted Average
53,164		68.65% Pervious Area
24,280		31.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.5	50	0.0700	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
1.0	80	0.0700	1.32		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.3	65	0.0800	4.24		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.0	12	0.5000	10.61		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
8.8	207	Total			

Summary for Pond 1P: 1P

Inflow Area = 0.957 ac, 44.04% Impervious, Inflow Depth = 1.23" for 2-Year event
Inflow = 1.34 cfs @ 12.09 hrs, Volume= 0.098 af
Outflow = 1.30 cfs @ 12.11 hrs, Volume= 0.098 af, Atten= 3%, Lag= 1.2 min
Primary = 1.30 cfs @ 12.11 hrs, Volume= 0.098 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 185.14' @ 12.11 hrs Surf.Area= 521 sf Storage= 684 cf

Plug-Flow detention time= 121.5 min calculated for 0.098 af (100% of inflow)
Center-of-Mass det. time= 121.5 min (973.5 - 852.0)

Volume	Invert	Avail.Storage	Storage Description
#1	183.00'	3,688 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
183.00	153	0	0
184.00	297	225	225
185.00	482	390	615
186.00	764	623	1,238
188.00	1,341	2,105	3,343
188.25	1,422	345	3,688

Device	Routing	Invert	Outlet Devices
#1	Primary	183.00'	**1.5" Vert. Orifice/Grate** C= 0.600
#2	Primary	185.00'	**10.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=1.29 cfs @ 12.11 hrs HW=185.14' TW=183.71' (Dynamic Tailwater)
1=Orifice/Grate (Orifice Controls 0.07 cfs @ 5.75 fps)
2=Broad-Crested Rectangular Weir (Weir Controls 1.22 cfs @ 0.88 fps)

Summary for Pond 2P: 2P

Inflow Area = 0.957 ac, 44.04% Impervious, Inflow Depth = 1.23" for 2-Year event
Inflow = 1.30 cfs @ 12.11 hrs, Volume= 0.098 af
Outflow = 0.31 cfs @ 12.54 hrs, Volume= 0.098 af, Atten= 76%, Lag= 25.3 min
Discarded = 0.06 cfs @ 12.54 hrs, Volume= 0.075 af
Primary = 0.25 cfs @ 12.54 hrs, Volume= 0.023 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 185.06' @ 12.54 hrs Surf.Area= 802 sf Storage= 1,058 cf

Plug-Flow detention time= 159.6 min calculated for 0.098 af (100% of inflow)
Center-of-Mass det. time= 159.6 min (1,133.1 - 973.5)

Volume	Invert	Avail.Storage	Storage Description
#1	183.00'	5,279 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
183.00	268	0	0
184.00	482	375	375
186.00	1,083	1,565	1,940
188.00	1,795	2,878	4,818
188.25	1,892	461	5,279

Device	Routing	Invert	Outlet Devices
#1	Primary	176.00'	**10.0" Round Culvert** L= 160.1' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 176.00' / 174.88' S= 0.0070 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.55 sf
#2	Device 1	186.90'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	184.75'	**6.0" Vert. Orifice/Grate** C= 0.600
#4	Primary	187.25'	**10.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#5	Discarded	183.00'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 180.35' Phase-In= 0.01'

Discarded OutFlow Max=0.06 cfs @ 12.54 hrs HW=185.06' (Free Discharge)
└**5=Exfiltration** (Controls 0.06 cfs)

Primary OutFlow Max=0.25 cfs @ 12.54 hrs HW=185.06' TW=0.00' (Dynamic Tailwater)
├**1=Culvert** (Passes 0.25 cfs of 5.61 cfs potential flow)
│ ├**2=Orifice/Grate** (Controls 0.00 cfs)
│ └**3=Orifice/Grate** (Orifice Controls 0.25 cfs @ 1.91 fps)
└**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 5P: AP-1

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.735 ac, 35.79% Impervious, Inflow Depth = 0.68" for 2-Year event
Inflow = 1.53 cfs @ 12.14 hrs, Volume= 0.154 af
Primary = 1.53 cfs @ 12.14 hrs, Volume= 0.154 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment PR-1: PR-1 Runoff Area=41,698 sf 44.04% Impervious Runoff Depth=2.51"
Tc=6.0 min CN=77 Runoff=2.81 cfs 0.200 af

Subcatchment PR-2: TO BROOK Runoff Area=77,443 sf 31.35% Impervious Runoff Depth=2.01"
Flow Length=207' Tc=8.8 min CN=71 Runoff=3.74 cfs 0.298 af

Pond 1P: 1P Peak Elev=185.87' Storage=1,142 cf Inflow=2.81 cfs 0.200 af
Outflow=2.31 cfs 0.200 af

Pond 2P: 2P Peak Elev=185.87' Storage=1,804 cf Inflow=2.31 cfs 0.200 af
Discarded=0.09 cfs 0.093 af Primary=0.88 cfs 0.107 af Outflow=0.97 cfs 0.200 af

Pond 5P: AP-1 Inflow=4.46 cfs 0.405 af
Primary=4.46 cfs 0.405 af

Total Runoff Area = 2.735 ac Runoff Volume = 0.498 af Average Runoff Depth = 2.18"
64.21% Pervious = 1.756 ac 35.79% Impervious = 0.979 ac

Summary for Subcatchment PR-1: PR-1

Runoff = 2.81 cfs @ 12.09 hrs, Volume= 0.200 af, Depth= 2.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.86"

Area (sf)	CN	Description
12,667	98	Paved parking, HSG B
18,991	72	1/3 acre lots, 30% imp, HSG B
10,040	61	>75% Grass cover, Good, HSG B
41,698	77	Weighted Average
23,334		55.96% Pervious Area
18,364		44.04% Impervious Area

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

Summary for Subcatchment PR-2: TO BROOK

Runoff = 3.74 cfs @ 12.13 hrs, Volume= 0.298 af, Depth= 2.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.86"

Area (sf)	CN	Description
24,040	55	Woods, Good, HSG B
21,101	98	Paved parking, HSG B
10,595	72	1/3 acre lots, 30% imp, HSG B
21,707	61	>75% Grass cover, Good, HSG B
77,443	71	Weighted Average
53,164		68.65% Pervious Area
24,280		31.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.5	50	0.0700	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
1.0	80	0.0700	1.32		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.3	65	0.0800	4.24		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.0	12	0.5000	10.61		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
8.8	207	Total			

Summary for Pond 1P: 1P

Inflow Area = 0.957 ac, 44.04% Impervious, Inflow Depth = 2.51" for 10-Year event
Inflow = 2.81 cfs @ 12.09 hrs, Volume= 0.200 af
Outflow = 2.31 cfs @ 12.05 hrs, Volume= 0.200 af, Atten= 18%, Lag= 0.0 min
Primary = 2.31 cfs @ 12.05 hrs, Volume= 0.200 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 185.87' @ 12.40 hrs Surf.Area= 728 sf Storage= 1,142 cf

Plug-Flow detention time= 75.1 min calculated for 0.200 af (100% of inflow)
Center-of-Mass det. time= 75.0 min (906.0 - 831.0)

Volume	Invert	Avail.Storage	Storage Description
#1	183.00'	3,688 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
183.00	153	0	0
184.00	297	225	225
185.00	482	390	615
186.00	764	623	1,238
188.00	1,341	2,105	3,343
188.25	1,422	345	3,688

Device	Routing	Invert	Outlet Devices
#1	Primary	183.00'	**1.5" Vert. Orifice/Grate** C= 0.600
#2	Primary	185.00'	**10.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=1.86 cfs @ 12.05 hrs HW=185.22' TW=185.14' (Dynamic Tailwater)
└─**1=Orifice/Grate** (Orifice Controls 0.02 cfs @ 1.36 fps)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 1.84 cfs @ 0.85 fps)

Summary for Pond 2P: 2P

[80] Warning: Exceeded Pond 1P by 0.04' @ 12.11 hrs (3.90 cfs 0.099 af)

Inflow Area = 0.957 ac, 44.04% Impervious, Inflow Depth = 2.51" for 10-Year event
Inflow = 2.31 cfs @ 12.05 hrs, Volume= 0.200 af
Outflow = 0.97 cfs @ 12.39 hrs, Volume= 0.200 af, Atten= 58%, Lag= 20.4 min
Discarded = 0.09 cfs @ 12.39 hrs, Volume= 0.093 af
Primary = 0.88 cfs @ 12.39 hrs, Volume= 0.107 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 185.87' @ 12.39 hrs Surf.Area= 1,045 sf Storage= 1,804 cf

Plug-Flow detention time= 102.8 min calculated for 0.200 af (100% of inflow)
Center-of-Mass det. time= 102.8 min (1,008.8 - 906.0)

Volume	Invert	Avail.Storage	Storage Description
#1	183.00'	5,279 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
183.00	268	0	0
184.00	482	375	375
186.00	1,083	1,565	1,940
188.00	1,795	2,878	4,818
188.25	1,892	461	5,279

Device	Routing	Invert	Outlet Devices
#1	Primary	176.00'	**10.0" Round Culvert** L= 160.1' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 176.00' / 174.88' S= 0.0070 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.55 sf
#2	Device 1	186.90'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	184.75'	**6.0" Vert. Orifice/Grate** C= 0.600
#4	Primary	187.25'	**10.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#5	Discarded	183.00'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 180.35' Phase-In= 0.01'

Discarded OutFlow Max=0.09 cfs @ 12.39 hrs HW=185.87' (Free Discharge)
└**5=Exfiltration** (Controls 0.09 cfs)

Primary OutFlow Max=0.88 cfs @ 12.39 hrs HW=185.87' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 0.88 cfs of 5.85 cfs potential flow)
  └**2=Orifice/Grate** (Controls 0.00 cfs)
  └**3=Orifice/Grate** (Orifice Controls 0.88 cfs @ 4.50 fps)
└**4=Broad-Crested Rectangular Weir**(Controls 0.00 cfs)

Summary for Pond 5P: AP-1

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.735 ac, 35.79% Impervious, Inflow Depth = 1.78" for 10-Year event
Inflow = 4.46 cfs @ 12.13 hrs, Volume= 0.405 af
Primary = 4.46 cfs @ 12.13 hrs, Volume= 0.405 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment PR-1: PR-1 Runoff Area=41,698 sf 44.04% Impervious Runoff Depth=3.61"
Tc=6.0 min CN=77 Runoff=4.05 cfs 0.288 af

Subcatchment PR-2: TO BROOK Runoff Area=77,443 sf 31.35% Impervious Runoff Depth=3.02"
Flow Length=207' Tc=8.8 min CN=71 Runoff=5.70 cfs 0.447 af

Pond 1P: 1P Peak Elev=186.55' Storage=1,699 cf Inflow=4.05 cfs 0.288 af
Outflow=2.80 cfs 0.288 af

Pond 2P: 2P Peak Elev=186.55' Storage=2,586 cf Inflow=2.80 cfs 0.288 af
Discarded=0.11 cfs 0.103 af Primary=1.18 cfs 0.185 af Outflow=1.29 cfs 0.288 af

Pond 5P: AP-1 Inflow=6.72 cfs 0.632 af
Primary=6.72 cfs 0.632 af

Total Runoff Area = 2.735 ac Runoff Volume = 0.735 af Average Runoff Depth = 3.23"
64.21% Pervious = 1.756 ac 35.79% Impervious = 0.979 ac

Summary for Subcatchment PR-1: PR-1

Runoff = 4.05 cfs @ 12.09 hrs, Volume= 0.288 af, Depth= 3.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.15"

Area (sf)	CN	Description
12,667	98	Paved parking, HSG B
18,991	72	1/3 acre lots, 30% imp, HSG B
10,040	61	>75% Grass cover, Good, HSG B
41,698	77	Weighted Average
23,334		55.96% Pervious Area
18,364		44.04% Impervious Area

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

Summary for Subcatchment PR-2: TO BROOK

Runoff = 5.70 cfs @ 12.13 hrs, Volume= 0.447 af, Depth= 3.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.15"

Area (sf)	CN	Description
24,040	55	Woods, Good, HSG B
21,101	98	Paved parking, HSG B
10,595	72	1/3 acre lots, 30% imp, HSG B
21,707	61	>75% Grass cover, Good, HSG B
77,443	71	Weighted Average
53,164		68.65% Pervious Area
24,280		31.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.5	50	0.0700	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
1.0	80	0.0700	1.32		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.3	65	0.0800	4.24		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.0	12	0.5000	10.61		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
8.8	207	Total			

Summary for Pond 1P: 1P

Inflow Area = 0.957 ac, 44.04% Impervious, Inflow Depth = 3.61" for 25-Year event
Inflow = 4.05 cfs @ 12.09 hrs, Volume= 0.288 af
Outflow = 2.80 cfs @ 12.09 hrs, Volume= 0.288 af, Atten= 31%, Lag= 0.0 min
Primary = 2.80 cfs @ 12.09 hrs, Volume= 0.288 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 186.55' @ 12.42 hrs Surf.Area= 922 sf Storage= 1,699 cf

Plug-Flow detention time= 59.0 min calculated for 0.288 af (100% of inflow)
Center-of-Mass det. time= 59.1 min (879.6 - 820.5)

Volume	Invert	Avail.Storage	Storage Description
#1	183.00'	3,688 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
183.00	153	0	0
184.00	297	225	225
185.00	482	390	615
186.00	764	623	1,238
188.00	1,341	2,105	3,343
188.25	1,422	345	3,688

Device	Routing	Invert	Outlet Devices
#1	Primary	183.00'	**1.5" Vert. Orifice/Grate** C= 0.600
#2	Primary	185.00'	**10.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=0.00 cfs @ 12.09 hrs HW=185.88' TW=185.94' (Dynamic Tailwater)
1=Orifice/Grate (Controls 0.00 cfs)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond 2P: 2P

[80] Warning: Exceeded Pond 1P by 0.06' @ 12.08 hrs (9.33 cfs 0.284 af)

Inflow Area = 0.957 ac, 44.04% Impervious, Inflow Depth = 3.61" for 25-Year event
Inflow = 2.80 cfs @ 12.09 hrs, Volume= 0.288 af
Outflow = 1.29 cfs @ 12.41 hrs, Volume= 0.288 af, Atten= 54%, Lag= 19.4 min
Discarded = 0.11 cfs @ 12.41 hrs, Volume= 0.103 af
Primary = 1.18 cfs @ 12.41 hrs, Volume= 0.185 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 186.55' @ 12.41 hrs Surf.Area= 1,278 sf Storage= 2,586 cf

Plug-Flow detention time= 83.3 min calculated for 0.288 af (100% of inflow)
Center-of-Mass det. time= 83.3 min (962.9 - 879.6)

Volume	Invert	Avail.Storage	Storage Description
#1	183.00'	5,279 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
183.00	268	0	0
184.00	482	375	375
186.00	1,083	1,565	1,940
188.00	1,795	2,878	4,818
188.25	1,892	461	5,279

Device	Routing	Invert	Outlet Devices
#1	Primary	176.00'	**10.0" Round Culvert** L= 160.1' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 176.00' / 174.88' S= 0.0070 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.55 sf
#2	Device 1	186.90'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	184.75'	**6.0" Vert. Orifice/Grate** C= 0.600
#4	Primary	187.25'	**10.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#5	Discarded	183.00'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 180.35' Phase-In= 0.01'

Discarded OutFlow Max=0.11 cfs @ 12.41 hrs HW=186.55' (Free Discharge)
└**5=Exfiltration** (Controls 0.11 cfs)

Primary OutFlow Max=1.18 cfs @ 12.41 hrs HW=186.55' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 1.18 cfs of 6.04 cfs potential flow)
  └**2=Orifice/Grate** (Controls 0.00 cfs)
  └**3=Orifice/Grate** (Orifice Controls 1.18 cfs @ 5.99 fps)
└**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 5P: AP-1

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.735 ac, 35.79% Impervious, Inflow Depth = 2.77" for 25-Year event
Inflow = 6.72 cfs @ 12.13 hrs, Volume= 0.632 af
Primary = 6.72 cfs @ 12.13 hrs, Volume= 0.632 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment PR-1: PR-1 Runoff Area=41,698 sf 44.04% Impervious Runoff Depth=6.01"
Tc=6.0 min CN=77 Runoff=6.67 cfs 0.480 af

Subcatchment PR-2: TO BROOK Runoff Area=77,443 sf 31.35% Impervious Runoff Depth=5.28"
Flow Length=207' Tc=8.8 min CN=71 Runoff=9.99 cfs 0.782 af

Pond 1P: 1P Peak Elev=187.13' Storage=2,282 cf Inflow=6.67 cfs 0.480 af
Outflow=4.64 cfs 0.480 af

Pond 2P: 2P Peak Elev=187.13' Storage=3,386 cf Inflow=4.64 cfs 0.480 af
Discarded=0.14 cfs 0.117 af Primary=4.20 cfs 0.363 af Outflow=4.34 cfs 0.480 af

Pond 5P: AP-1 Inflow=13.61 cfs 1.145 af
Primary=13.61 cfs 1.145 af

Total Runoff Area = 2.735 ac Runoff Volume = 1.262 af Average Runoff Depth = 5.54"
64.21% Pervious = 1.756 ac 35.79% Impervious = 0.979 ac

Summary for Subcatchment PR-1: PR-1

Runoff = 6.67 cfs @ 12.09 hrs, Volume= 0.480 af, Depth= 6.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.80"

Area (sf)	CN	Description
12,667	98	Paved parking, HSG B
18,991	72	1/3 acre lots, 30% imp, HSG B
10,040	61	>75% Grass cover, Good, HSG B
41,698	77	Weighted Average
23,334		55.96% Pervious Area
18,364		44.04% Impervious Area

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

Summary for Subcatchment PR-2: TO BROOK

Runoff = 9.99 cfs @ 12.12 hrs, Volume= 0.782 af, Depth= 5.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.80"

Area (sf)	CN	Description
24,040	55	Woods, Good, HSG B
21,101	98	Paved parking, HSG B
10,595	72	1/3 acre lots, 30% imp, HSG B
21,707	61	>75% Grass cover, Good, HSG B
77,443	71	Weighted Average
53,164		68.65% Pervious Area
24,280		31.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.5	50	0.0700	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
1.0	80	0.0700	1.32		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.3	65	0.0800	4.24		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.0	12	0.5000	10.61		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
8.8	207	Total			

Summary for Pond 1P: 1P

Inflow Area = 0.957 ac, 44.04% Impervious, Inflow Depth = 6.01" for 100-Year event
Inflow = 6.67 cfs @ 12.09 hrs, Volume= 0.480 af
Outflow = 4.64 cfs @ 12.14 hrs, Volume= 0.480 af, Atten= 30%, Lag= 3.2 min
Primary = 4.64 cfs @ 12.14 hrs, Volume= 0.480 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 187.13' @ 12.18 hrs Surf.Area= 1,089 sf Storage= 2,282 cf

Plug-Flow detention time= 41.5 min calculated for 0.480 af (100% of inflow)
Center-of-Mass det. time= 41.6 min (847.6 - 806.0)

Volume	Invert	Avail.Storage	Storage Description
#1	183.00'	3,688 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
183.00	153	0	0
184.00	297	225	225
185.00	482	390	615
186.00	764	623	1,238
188.00	1,341	2,105	3,343
188.25	1,422	345	3,688

Device	Routing	Invert	Outlet Devices
#1	Primary	183.00'	**1.5" Vert. Orifice/Grate** C= 0.600
#2	Primary	185.00'	**10.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=0.00 cfs @ 12.14 hrs HW=187.07' TW=187.10' (Dynamic Tailwater)
1=Orifice/Grate (Controls 0.00 cfs)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond 2P: 2P

[80] Warning: Exceeded Pond 1P by 0.08' @ 12.07 hrs (21.06 cfs 0.389 af)

Inflow Area = 0.957 ac, 44.04% Impervious, Inflow Depth = 6.01" for 100-Year event
Inflow = 4.64 cfs @ 12.14 hrs, Volume= 0.480 af
Outflow = 4.34 cfs @ 12.17 hrs, Volume= 0.480 af, Atten= 6%, Lag= 2.0 min
Discarded = 0.14 cfs @ 12.17 hrs, Volume= 0.117 af
Primary = 4.20 cfs @ 12.17 hrs, Volume= 0.363 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 187.13' @ 12.17 hrs Surf.Area= 1,484 sf Storage= 3,386 cf

Plug-Flow detention time= 59.8 min calculated for 0.480 af (100% of inflow)
Center-of-Mass det. time= 59.8 min (907.4 - 847.6)

Volume	Invert	Avail.Storage	Storage Description
#1	183.00'	5,279 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
183.00	268	0	0
184.00	482	375	375
186.00	1,083	1,565	1,940
188.00	1,795	2,878	4,818
188.25	1,892	461	5,279

Device	Routing	Invert	Outlet Devices
#1	Primary	176.00'	**10.0" Round Culvert** L= 160.1' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 176.00' / 174.88' S= 0.0070 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.55 sf
#2	Device 1	186.90'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	184.75'	**6.0" Vert. Orifice/Grate** C= 0.600
#4	Primary	187.25'	**10.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#5	Discarded	183.00'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 180.35' Phase-In= 0.01'

Discarded OutFlow Max=0.14 cfs @ 12.17 hrs HW=187.13' (Free Discharge)
└**5=Exfiltration** (Controls 0.14 cfs)

Primary OutFlow Max=4.19 cfs @ 12.17 hrs HW=187.13' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 4.19 cfs of 6.20 cfs potential flow)
  └**2=Orifice/Grate** (Weir Controls 2.81 cfs @ 1.56 fps)
  └**3=Orifice/Grate** (Orifice Controls 1.38 cfs @ 7.02 fps)
└**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 5P: AP-1

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.735 ac, 35.79% Impervious, Inflow Depth = 5.02" for 100-Year event
Inflow = 13.61 cfs @ 12.15 hrs, Volume= 1.145 af
Primary = 13.61 cfs @ 12.15 hrs, Volume= 1.145 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

DRAINAGE ANALYSIS

Storm Drain Calculations – Rational Method and Catchment Area Calculation

Land Use Coefficients "C"

Pave	0.90
Gravel	0.80
Wetland	0.72
Grass	0.30
Woods	0.25
Roof	0.90

Drainage Area	Land Use Area Impervious (acres)	Gravel (acres)	Wetland (acres)	Pervious (acres)	Woods (acres)	Roof (acres)	Total (acres)	Weighted #DIV/0!
CB-1	0.064			9.936	0.000	0.000	10.000	0.30
CB-2	0.360			0.292	0.000	0.000	0.652	0.63
CB-4	0.335			0.315	0.129	0.000	0.779	0.55
SUBTOTAL	0.758			10.543		0.000	11.431	
OVERALL TOTALS	0.758			10.543		0.000	11.431	

Guerriere & Halnon, Inc.
55 West Central Steet
Franklin, MA 01757-0235

Project: Medway Mills Parking Expansion
Job No.: F-3519

DESIGN COMPUTATIONS FOR STORM DRAINS

Prepared By: MAH Date: 12/22/2020 Revised: 4/21/21
Checked By: Date: Revised:

Drainage Area	Upper Structure	Lower Structure	Sum of CA's (sf)	Time of Concentration (Tc) (min)	Rainfall Intensity (I) (in/hr)	Actual Peak Flow Rate (Q) (cfs)	Pipe Diameter (in)	Slope (ft/ft)	Roughness Coefficient (n)	Design Flow Full (Q) (cfs)	Velocity Flow Full (V) (fps)	Actual Velocity (V) (fps)	Length of Pipe (L)* (ft)	Time in pipe (min)	Total Fall (ft)	Invert Elevation Elev. Upper End	Invert Elevation Elev. Lower End	Rim Elev Elev. Upper End	Rim Elev Elev. Lower End	Destination
CB-1	CB-1	DMH-1	3.04	6.00	5.80	17.61	12	0.005	0.013	2.53	3.22	22.42	27.8	0.14	0.14	184.80	184.66	187.80	189.20	
CB-2	CB-2	DMH-1	0.41	6.00	5.80	2.38	12	0.005	0.013	2.52	3.21	3.04	12.0	0.06	0.06	184.72	184.66	188.90	189.20	
	DMH-1	DMH-2	3.45	6.14	5.80	20.00	12	0.005	0.013	2.52	3.20	25.46	40.1	0.21	0.20	184.56	184.36	189.20	188.80	Infiltration Basin
	DMH-2	H.W.#1	3.45	6.35	5.80	20.00	12	0.025	0.013	5.63	7.17	25.46	30.4	0.07	0.76	184.26	183.50	188.80	186.00	
CB-4	CB-4	DMH-3	0.43	6.00	5.80	2.48	10	0.027	0.010	4.69	8.60	4.55	7.0	0.01	0.19	172.97	172.78	176.70	176.68	
TO HW2	DMH-3	H.W.#2	0.43	6.01	5.80	2.48	12	0.014	0.013	4.15	5.28	3.16	72.4	0.23	0.98	174.68	173.70	176.70	176.68	

USDA WEB SOIL SURVEY

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Norfolk and Suffolk Counties, Massachusetts

February 12, 2020

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map (Medway Mill Parking Expansion)

MAP LEGEND

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

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

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

Soil Survey Area: Norfolk and Suffolk Counties, Massachusetts
Survey Area Data: Version 15, Sep 12, 2019

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

Date(s) aerial images were photographed: Jul 28, 2019—Aug 15, 2019

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

Map Unit Legend (Medway Mill Parking Expansion)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
51	Swansea muck, 0 to 1 percent slopes	4.1	48.5%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	0.1	1.6%
420B	Canton fine sandy loam, 3 to 8 percent slopes	1.7	20.1%
653	Udorthents, sandy	2.5	29.8%
Totals for Area of Interest		**8.5**	**100.0%**

Map Unit Descriptions (Medway Mill Parking Expansion)

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it

was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Norfolk and Suffolk Counties, Massachusetts

51—Swansea muck, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2trl2
Elevation: 0 to 1,140 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Swansea and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Swansea

Setting

Landform: Bogs, swamps
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Highly decomposed organic material over loose sandy and gravelly glaciofluvial deposits

Typical profile

Oa1 - 0 to 24 inches: muck
Oa2 - 24 to 34 inches: muck
Cg - 34 to 79 inches: coarse sand

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: Rare
Frequency of ponding: Frequent
Available water storage in profile: Very high (about 16.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8w
Hydrologic Soil Group: B/D
Hydric soil rating: Yes

Minor Components

Freetown

Percent of map unit: 10 percent
Landform: Bogs, swamps
Landform position (three-dimensional): Dip

Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Whitman

Percent of map unit: 5 percent
Landform: Depressions, drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Scarboro

Percent of map unit: 5 percent
Landform: Depressions, drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

254B—Merrimac fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2tyqs
Elevation: 0 to 1,290 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Merrimac and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Merrimac

Setting

Landform: Kames, eskers, outwash terraces, moraines, outwash plains
Landform position (two-dimensional): Backslope, footslope, shoulder, summit
Landform position (three-dimensional): Side slope, crest, riser, tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy glaciofluvial deposits derived from granite, schist, and gneiss over sandy and gravelly glaciofluvial deposits derived from granite, schist, and gneiss

Typical profile

Ap - 0 to 10 inches: fine sandy loam

Bw1 - 10 to 22 inches: fine sandy loam
Bw2 - 22 to 26 inches: stratified gravel to gravelly loamy sand
2C - 26 to 65 inches: stratified gravel to very gravelly sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 2 percent
Salinity, maximum in profile: Nonsaline (0.0 to 1.4 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 1.0
Available water storage in profile: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Hinckley

Percent of map unit: 5 percent
Landform: Eskers, deltas, outwash plains, kames
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest, head slope, rise
Down-slope shape: Convex
Across-slope shape: Convex, linear
Hydric soil rating: No

Sudbury

Percent of map unit: 5 percent
Landform: Terraces, deltas, outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Windsor

Percent of map unit: 3 percent
Landform: Dunes, deltas, outwash terraces, outwash plains
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Tread, riser
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Hydric soil rating: No

Agawam

Percent of map unit: 2 percent

Landform: Moraines, outwash plains, kames, stream terraces, eskers, outwash terraces
Landform position (three-dimensional): Rise
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

420B—Canton fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2w81b
Elevation: 0 to 1,180 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Canton and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Canton

Setting

Landform: Hills, moraines, ridges
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Side slope, crest, nose slope
Down-slope shape: Linear, convex
Across-slope shape: Convex
Parent material: Coarse-loamy over sandy melt-out till derived from gneiss, granite, and/or schist

Typical profile

Ap - 0 to 7 inches: fine sandy loam
Bw1 - 7 to 15 inches: fine sandy loam
Bw2 - 15 to 26 inches: gravelly fine sandy loam
2C - 26 to 65 inches: gravelly loamy sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 19 to 39 inches to strongly contrasting textural stratification
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Available water storage in profile: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Scituate

Percent of map unit: 10 percent
Landform: Hills, ground moraines, drumlins
Landform position (two-dimensional): Backslope, footslope, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Montauk

Percent of map unit: 5 percent
Landform: Hills, drumlins, ground moraines, moraines
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear, convex
Across-slope shape: Convex
Hydric soil rating: No

Charlton

Percent of map unit: 4 percent
Landform: Ridges, ground moraines, hills
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear, convex
Across-slope shape: Convex
Hydric soil rating: No

Swansea

Percent of map unit: 1 percent
Landform: Swamps, kettles, bogs, depressions, marshes
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

653—Udorthents, sandy

Map Unit Setting

National map unit symbol: vky8
Elevation: 0 to 3,000 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F

Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Udorthents and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents

Setting

Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Tread, riser
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Parent material: Excavated and filled sandy glaciofluvial deposits

Typical profile

H1 - 0 to 6 inches: variable
H2 - 6 to 60 inches: variable

Properties and qualities

Slope: 0 to 25 percent
Depth to restrictive feature: More than 80 inches
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to very high (0.06 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Hydric soil rating: Unranked

Minor Components

Udorthents

Percent of map unit: 8 percent
Hydric soil rating: Unranked

Urban land

Percent of map unit: 5 percent
Hydric soil rating: Unranked

Swansea

Percent of map unit: 2 percent
Landform: Bogs
Hydric soil rating: Yes

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TSS REMOVAL CALCULATIONS

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

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

Location: Medway Mill Parking Expansion, Medway, MA

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)
Deep Sump and Hooded Catch Basin	0.25	1.00	0.25	0.75
Infiltration Basin	0.80	0.75	0.60	0.15

Total TSS Removal = 85%

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

Project: F-3519

Prepared By: Michael Hassett

Date: 14-Feb-2020

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

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

1. From MassDEP Stormwater Handbook Vol. 1

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

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

Location: Medway Mill Parking Expansion, Medway, MA

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)
Deep Sump and Hooded Catch Basin	0.25	1.00	0.25	0.75
Sediment Forebay	0.25	0.75	0.19	0.56

Infiltration Basin Pretreatment

Total TSS Removal = 44%

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

Project: F-3519

Prepared By: Michael Hassett

Date: 14-Feb-2020

*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

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.
Cells highlighted in yellow are values that can be changed by the user. Cells highlighted in red are output values based on user-specified inputs. The user MUST click the blue "Re-Calculate Now" button each time ANY of the user-specified inputs are changed otherwise necessary iterations to converge on the correct solution will not be done and values shown will be incorrect. Use consistent units for all input values (for example, feet and days)

use consistent units (e.g. feet & days **or** inches & hours)

Input Values		
4.8200	*R*	**Recharge (infiltration) rate (feet/day)**
0.260	Sy	**Specific yield, Sy (dimensionless, between 0 and 1)**
48.20	K	**Horizontal hydraulic conductivity, Kh (feet/day)***
6.000	x	**1/2 length of basin (x direction, in feet)**
17.500	y	**1/2 width of basin (y direction, in feet)**
1.323	t	**duration of infiltration period (days)**
10.000	hi(0)	**initial thickness of saturated zone (feet)**

Conversion Table

inch/hour	feet/day
0.67	1.33
2.00	4.00

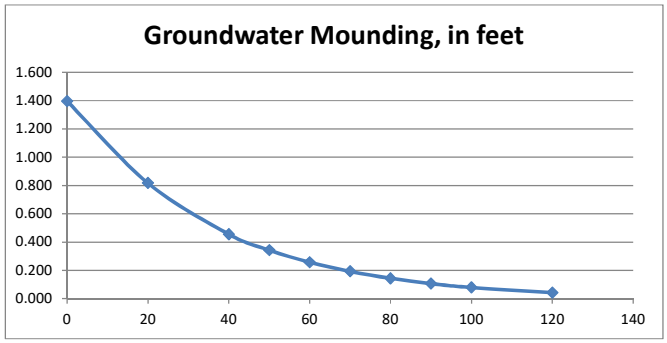
hours	days
36	1.50

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

11.396	h(max)	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
1.396	Δh(max)	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
1.396	0
0.817	20
0.455	40
0.342	50
0.257	60
0.192	70
0.143	80
0.106	90
0.079	100
0.043	120

Re-Calculate Now



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

DRAWDOWN CALCULATIONS (100-YR)

Hydrograph for Pond 2P: 2P

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)
0.00	0.00	0	183.00	0.00	0.00	0.00
1.00	0.00	0	183.00	0.00	0.00	0.00
2.00	0.00	0	183.00	0.00	0.00	0.00
3.00	0.00	0	183.00	0.00	0.00	0.00
4.00	0.00	0	183.00	0.00	0.00	0.00
5.00	0.00	0	183.00	0.00	0.00	0.00
6.00	0.00	0	183.00	0.00	0.00	0.00
7.00	0.00	0	183.00	0.00	0.00	0.00
8.00	0.00	0	183.00	0.00	0.00	0.00
9.00	0.02	7	183.03	0.02	0.02	0.00
10.00	0.04	59	183.20	0.02	0.02	0.00
11.00	0.06	157	183.49	0.02	0.02	0.00
12.00	**1.76**	**1,401**	**185.46**	**0.72**	**0.08**	**0.64**
13.00	**0.65**	**1,897**	**185.96**	**1.02**	**0.09**	**0.93**
14.00	0.30	1,094	185.11	0.37	0.07	0.31
15.00	0.19	992	184.98	0.21	0.06	0.14
16.00	0.14	952	184.93	0.15	0.06	0.09
17.00	0.11	923	184.89	0.12	0.06	0.06
18.00	0.09	898	184.86	0.09	0.06	0.03
19.00	0.08	881	184.83	0.08	0.06	0.02
20.00	0.07	870	184.82	0.07	0.06	0.01
21.00	0.06	859	184.80	0.07	0.06	0.01
22.00	0.06	847	184.79	0.06	0.06	0.00
23.00	0.05	831	184.76	0.06	0.06	0.00
24.00	0.05	805	184.73	0.05	0.05	0.00
25.00	0.03	723	184.61	0.05	0.05	0.00
26.00	0.02	632	184.47	0.05	0.05	0.00
27.00	0.02	543	184.32	0.04	0.04	0.00
28.00	0.02	459	184.17	0.04	0.04	0.00
29.00	0.01	382	184.01	0.03	0.03	0.00
30.00	0.01	311	183.86	0.03	0.03	0.00
31.00	0.01	246	183.71	0.03	0.03	0.00
32.00	0.01	187	183.57	0.03	0.03	0.00
33.00	0.01	134	183.43	0.02	0.02	0.00
34.00	0.01	86	183.29	0.02	0.02	0.00
35.00	0.01	44	183.16	0.02	0.02	0.00
36.00	0.00	5	183.02	0.02	0.02	0.00
37.00	0.00	0	183.00	0.00	0.00	0.00
38.00	0.00	0	183.00	0.00	0.00	0.00
39.00	0.00	0	183.00	0.00	0.00	0.00
40.00	0.00	0	183.00	0.00	0.00	0.00
41.00	0.00	0	183.00	0.00	0.00	0.00
42.00	0.00	0	183.00	0.00	0.00	0.00
43.00	0.00	0	183.00	0.00	0.00	0.00
44.00	0.00	0	183.00	0.00	0.00	0.00
45.00	0.00	0	183.00	0.00	0.00	0.00
46.00	0.00	0	183.00	0.00	0.00	0.00
47.00	0.00	0	183.00	0.00	0.00	0.00
48.00	0.00	0	183.00	0.00	0.00	0.00
49.00	0.00	0	183.00	0.00	0.00	0.00
50.00	0.00	0	183.00	0.00	0.00	0.00
51.00	0.00	0	183.00	0.00	0.00	0.00

Hydrograph for Pond 2P: 2P (continued)

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)
52.00	0.00	0	183.00	0.00	0.00	0.00
53.00	0.00	0	183.00	0.00	0.00	0.00
54.00	0.00	0	183.00	0.00	0.00	0.00
55.00	0.00	0	183.00	0.00	0.00	0.00
56.00	0.00	0	183.00	0.00	0.00	0.00
57.00	0.00	0	183.00	0.00	0.00	0.00
58.00	0.00	0	183.00	0.00	0.00	0.00
59.00	0.00	0	183.00	0.00	0.00	0.00
60.00	0.00	0	183.00	0.00	0.00	0.00
61.00	0.00	0	183.00	0.00	0.00	0.00
62.00	0.00	0	183.00	0.00	0.00	0.00
63.00	0.00	0	183.00	0.00	0.00	0.00
64.00	0.00	0	183.00	0.00	0.00	0.00
65.00	0.00	0	183.00	0.00	0.00	0.00
66.00	0.00	0	183.00	0.00	0.00	0.00
67.00	0.00	0	183.00	0.00	0.00	0.00
68.00	0.00	0	183.00	0.00	0.00	0.00
69.00	0.00	0	183.00	0.00	0.00	0.00
70.00	0.00	0	183.00	0.00	0.00	0.00
71.00	0.00	0	183.00	0.00	0.00	0.00
72.00	0.00	0	183.00	0.00	0.00	0.00

SUPPLEMENT ATTACHMENTS

Post Construction Inspection Report
Medway Mill Parking Expansion
Medway, Massachusetts

INSPECTION DATE:						
Person Inspecting		Weather				Other Personnel Present
		Clear				
Item	**N/A***	**sat.****	**NMR*****	**CAM****	**MCA***	**Comments:**
Pavement Swept						
Catch Basins						
CB #1						
CB #2						
CB #4						
Infiltration Basin						
Sediment Forebay						
Infiltration Basin						
Water Quality Swale						
NMR* normal maintenance requested						
N/A* not applicable at the time of inspection						
CAM* corrective action - minor						
SAT* satisfactory conditions as compliant						
MCA* Major corrective action						

NOTES:

1. SNOW STORAGE IS NOT PERMITTED WITHIN WETLAND RESOURCE AREAS OR WITHIN THE LIMITS OF THE INFILTRATION BASIN OR FOREBAY.
2. THIS PLAN IS INTENDED TO ACCOMPANY THE STORMWATER REPORT / OPERATION & MAINTENANCE PLAN DATED FEBRUARY 14, 2020 AND REVISED THROUGH APRIL 21, 2021

The following shall serve as the (O&M) Plan required by Standard 9, as well as the Long-Term Pollution Prevention Plan required by Standard 4.

A. Names of Persons or Entities Responsible for Plan Compliance:

John Greene
NRG Concepts, Inc.
165 Main Street
Suite 307
Medway, MA 02053
Tel: 508-367-8745

It is the intent of the Applicant to have the site completed and released by the various town Departments and Boards.

B. Good housekeeping practices
1. Maintain site, landscaping and vegetation.
2. Sweep and pick up litter on pavements and grounds.
3. Deliveries shall be monitored by owners or representative to ensure that if any spillage occurs, it shall be contained and cleaned up immediately.
4. Maintain pavement and curbing in good repair.
5. Spill Containment Kit to contain and clean-up spills that could occur on site.

C. Requirements for routine inspections and maintenance of stormwater BMPs and Mitigation Areas:
1. Plans: The storm water Operation and Maintenance Plan shall consist of all Plans, documents and all local state and federal approvals as required for the subject property.
2. Record Keeping:
   a. Maintain a log of all operation and maintenance activities for at least three years following construction, including inspections, repairs, replacement and disposal (for disposal, the log shall indicate the type of material and the disposal location);
3. Inspection Requirements:
   a. All stormwater BMPs and Mitigation Areas are to be inspected biannually for evidence of soil erosion, the presence of invasive species, trash, and dead vegetation, and for proper functioning of the BMP.
   b. Inspections shall be logged on the provided inspections forms, or if another form or document is used, it shall contain the same information as the included forms.
   c. Photos of the BMPs and mitigation areas shall be included with the inspection report submitted to the town after each inspection.
4. BMP Maintenance: After construction it is the responsibility of the owner to perform maintenance. The cleaning of the components of the stormwater management system shall generally be as follows:
   a. Pavement: The owner shall keep the pavement swept with a mechanical sweeper or hand swept semi-annually at a minimum.
   b. Catch Basins: Shall be cleaned by excavating, pumping or vacuuming. The sediment shall be disposed of off-site by the Owner. Inspect quarterly, remove silt when ½ full.
   c. Sediment Forebay: Inspect monthly. Clean forebay 4 times per year.
   d. Infiltration Basin: Inspect for proper function after every major storm event during the first 3 months of operation, inspect/remove debris twice per year afterward. Mow basin at least twice per year, remove clippings.
5. Mitigation Areas to be inspected;
   a. Remediation Area A is located on the east side of the brook, south of the parking lot, and is bordered on the north by a boulder barrier.
   b. Remediation Area B is located on the east side of the brook, along the eastern edge of the parking lot, and is bordered on the west by a boulder barrier.
   c. Remediation Area C is located on the west side of the brook, directly west of the bridge, on either side of the paved fire access lane.
6. Access Provisions: The mitigation areas and all components of the stormwater system will be accessible by the Owner.

D. Spill prevention and response plans
1. Train employees and subcontractors in prevention and clean up procedures.
2. All materials stored on site will be stored in their appropriate containers under a roof or in the approved underground storage tanks.
3. Follow manufacturer's recommendation for disposal of used containers.
4. On site equipment, fueling and maintenance measures:
   a. Inspect on-site vehicles and equipment daily for leaks.
   b. Conduct all vehicle and equipment maintenance off Site and refueling in one location, away from storm drains and wetlands.
5. Clean up spills.
   a. Never hose down "dirty" pavement or impermeable surfaces where fluids have spilled. Use dry clean-up methods (sawdust, cat litter and/or rags and absorbent pads).
   b. Sweep up dry materials immediately. Never wash them away or bury them.
   c. Clean up spills on dirt areas by digging up and properly disposing of contaminated soil.
   d. Report significant spills to the Fire Department, Conservation Commission and Board of Health.

E. Provisions for maintenance of lawns, gardens, and other landscaped areas
Dispose of clippings away from storm drainage.

F. Requirements for storage and use of herbicides, and pesticides
The application of herbicides or pesticides requires the approval of the Medway Conservation Commission and must be done by a professional certified contractor.

G. Provisions for solid waste management
1. Waste Management Plan
   a. Recycle materials whenever possible (paper, plaster cardboard, metal cans). Separate containers for material is recommended.
   b. Do not burry waste and debris on site.
   c. Certified haulers will be hired to remove the dumpster container waste as needed. Recycling products will also be removed off site weekly.

H. Snow disposal and plowing plans
Snow storage is adequate around the site for large storm events, see site plan. If additional snow storage is required during significant storm events, the swale adjacent to Remediation Area A may be utilized. No snow storage may encroach into the remediation areas.

I. Winter Road Salt and/or Sand Use and Storage restrictions
No sand, salt, or chemicals for de-icing will be stored outside.

J. Pavement sweeping schedules
Sweeping, the act of cleaning pavement can be done by mechanical sweepers, vacuum sweeper or hand sweeper. The quantity of sand is a direct correlation with the treatment of ice and snow and the types of chemicals and spreaders that are being used on site to manage snow. If a liquid de-icer such as calcium chloride is used as a pretreatment to new events the amount of sand is minimized. Sweeping for this site should be done semi-annually at a minimum. Collecting the particulate before it enters the catch basins is cheaper and more environmentally friendly than in a catch basin mixing with oils and greases in the surface water runoff in catch basins.

K. Provisions for prevention of illicit discharges to the stormwater management system
No illicit discharges to the stormwater management system are proposed, and an illicit discharge compliance statement has been provided within the stormwater report in accordance with the requirements of Standard 10.

L. Training the staff or personnel involved with implementing Long-Term Pollution Prevention Plan
The owner shall develop policies and procedures for containing the illicit spilling of oils, soda, beer, paper and litter. These wastes provide a degrading of the water quality. The placement of signs and trash barrels with lids around the site would contribute to a clean water quality site conditions.

M. List of Emergency contacts for implementing Long-Term Pollution Prevention Plan:

John Greene
NRG Concepts, Inc.
165 Main Street
Suite 307
Medway, MA 02053
Tel: 508-367-8745

BMP	Estimated Maintenance Cost
Pavement sweeping	$ 400 per year
Catch basin cleaning	$ 200 per catch basin per cleaning
Sediment Forebay	$ 400 per year
Infiltration Basin	$ 500 per cleaning
Spill Containment Kit	$ 750 purchase price

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APPROVED DATE:

MEDWAY PLANNING BOARD

BEING A MAJORITY

ENDORSEMENT DATE

UTILITIES ARE PLOTTED AS A COMPILATION OF RECORD DOCUMENTS. MARKINGS AND OTHER OBSERVED EVIDENCE TO DEVELOP A VIEW OF THE UNDERGROUND UTILITIES AND SHOULD BE CONSIDERED APPROXIMATE. LOOKING EXCAVATION, THE EXACT LOCATION OF UNDERGROUND FEATURES CANNOT BE ACCURATELY, COMPLETELY AND RELIABLY DEPICTED. ADDITIONAL UTILITIES, NOT EVIDENCED BY RECORD DOCUMENTS OR OBSERVED PHYSICAL EVIDENCE, MAY EXIST. CONTRACTORS (IN ACCORDANCE WITH MASS.G.L. CHAPTER 82 SECTION 40 AS AMENDED) MUST CONTACT ALL UTILITY COMPANIES BEFORE EXCAVATING AND DRILLING AND CALL DIGSAFE AT 1(888)DIG-SAFE(72233).

CONSTRUCTION ON THIS LAND IS SUBJECT TO ANY EASEMENTS, RIGHTS-OF-WAY, RESTRICTIONS, RESERVATIONS, OR OTHER LIMITATIONS WHICH MAY BE REVEALED BY AN EXAMINATION OF THE TITLE.

OWNER

165 MAIN STREET REALTY TRUST
JOHN J. GREENE TRUSTEE
165 MAIN STREET
SUITE 307
MEDWAY, MA

DEED BOOK 24499 PAGE 10
A.M. 48 LOT 092

APPLICANT

NRG CONCEPTS, INC.
165 MAIN STREET
SUITE 307
MEDWAY, MA. 02053

SITE PLAN
MEDWAY MILL
163-165 MAIN STREET
MEDWAY
MASSACHUSETTS

OPERATIONS & MAINTENANCE PLAN

FEBRUARY 14, 2020

DATE	REVISION DESCRIPTION
10/13/2020	REVISED PARKING CONFIGURATION
12/23/2020	PER TOWN COMMENTS
04/20/2021	PER TOWN COMMENTS

Guerriere & Halnon, Inc.
ENGINEERING & LAND SURVEYING
55 WEST CENTRAL ST. PH. (508) 528-3221
FRANKLIN, MA 02038 FX. (508) 528-7921
www.gandhengineering.com

SHEET 1 OF 1

JOB NO. F3519

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