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STORMWATER REPORT

For

Custom Woodwork Facility Expansion

55 Charlotte Furnace Road
W. Wareham, MA 02576

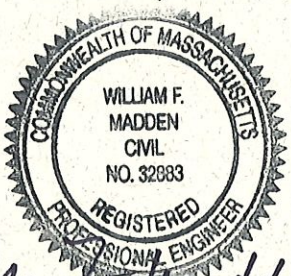
Prepared for

Master Millwork, Inc.

55 Charlotte Furnace Road
W. Wareham, MA 02576

Prepared by

G.A.F. Engineering, Inc.
266 Main Street
Wareham, MA 02571



July 8, 2020

G.A.F. Job No.: 18-9179

Table of Contents

DRAINAGE NARRATIVE

General Description

Master Millwork, Inc. established their current facility at 55 Charlotte Furnace Road in 2017. At that time the property was undeveloped woodlands. This initial development consisted of the construction of a 100'x 200' commercial building including offices, manufacturing, storage, and distribution. The facility was laid out in anticipation of the need for a future building for additional manufacturing to keep up with an increasing demand for their products. The building, access drive, and parking areas were situated on the north side of the property and proximate to Charlotte Furnace Road in order to leave space available along the rear of the property for future building expansion.

The proposed expansion of the facility consists of a 140'x 310' building located along the eastern portion of the lot. The two buildings will be connected at the east side of the existing building. Site access, parking, and circulation will be expanded as necessary for the operation of the new building.

This project is considered new construction under the Massachusetts Stormwater Handbook. The stormwater management system has been designed to collect, treat, store, and infiltrate the runoff in accordance with the applicable standards. Where necessary, existing drainage system components have been replaced with new "best management practices" to ensure compliance with the regulations and provide protection for adjacent properties.

Existing Conditions

The high point of the property is located along Charlotte Furnace Road. The topography slopes to the east toward a solar facility on the adjacent lot and to the south which is occupied by electric transmission lines. This establishes the need for two separate design points for comparison of pre-development and post-development peak flow rates and total storm volumes.

The portion of the property which contributes runoff toward the solar farm is modeled as sub-catchment 1S. This area is just over an acre in size and consists entirely of woods which were not altered a during the initial property development.

The portion of the property which drains toward the south property line, the electric transmission easement, is comprised of two separate areas. Sub-catchment 2S is the area downstream of the existing stormwater collection system. This area is approximately 1.2 acres consisting of mostly woods and the grassed area below the rain garden spillway.

Sub-catchment 3S is the developed portion of the property which directs runoff to a rain garden located along the south side of the gravel area south of the building. This rain garden has been modeled as a detention facility based on the as-constructed survey data. The engineered soil and surface contours were input to determine the amount of available storage. An exfiltration rate of 8.27 inches per hour was input based on the Rawls rate for the existing soils. The stone spillway conveys

overflows to a swale which directs the runoff toward the southeastern corner of the property.

The discharge flow from the raingarden, Pond 1P, and the flow from sub-catchment 2S, are combined using Link 1L to determine the total peak flow rate and volume presently directed to the easement.

Soils on the property as mapped by the USDA Natural Resources Conservation Service are classified as Carver loamy coarse sand (259B), 3-8 percent slopes, with a Hydrologic Soil Group rating A. These soils were confirmed by test pits which were excavated in the areas of proposed stormwater BMPs.

The rainfall volumes used in the program were taken from the information available online using NOAA Atlas 14, Volume 10, Version 3.

Proposed Conditions

The existing southerly raingarden and associated inlet and outlet swales are being filled as part of the expansion project. The gravel parking area will be paved over when the new pavement areas are installed. New stormwater management systems are proposed to compensate for the loss of the present system and to mitigate for the increases in peak rates and volumes associated with the new building and increase in pavement.

Sub-catchment 1S is the portion of the facility which contributes surface runoff to the proposed infiltration basin, Pond 1P. This is an approximately one acre watershed which includes the access road and parking area along the south and east sides of the proposed new building, as well as the basin itself.

The proposed new building will have a peaked roof along the centerline. Runoff from the back half of the roof will fall onto a crushed stone trench which is 5' wide and 3' deep for the full length of the building. Runoff from the front half of the roof will be collected with a scupper/gutter system and piped under the building slab to the infiltration basin. The back half of the roof is input as sub-catchment 2S, with discharge to the crushed stone trench, Pond 2P. Once the trench reaches full capacity runoff will enter the infiltration basin, Pond 1P. The front half of the roof that is directly piped into the basin is input as sub-catchment 7S.

Sub-catchments 3S and 4S are the areas along the back edge of the limit of work which are relatively narrow strips of land adjacent to the easterly and southerly property lines. These are the areas used for comparison with pre-development sub-catchments 1S and 1L, respectively.

Sub-catchment 5S consists of the front half roof runoff from the existing building and the majority of the new paved surfaces. This runoff is collected in several catch basins and discharged to a conveyance and infiltration system consisting of two leaching pits and a 24" perforated pipe surrounded by washed crushed stone. The leaching pits serve the purpose of connection manholes and provide additional storage and infiltration. Leaching pit #2 has an outlet pipe set above the perforated pipe so that it will function as an overflow manhole to facilitate the storage and infiltration of the system prior to entering the surface basin. The calculations indicate that there will be

slightly more than one foot of freeboard within the basin, Pond 1P, during the 100 year storm.

There will be a depressed truck dock area at the southwest corner of the proposed building. Due to the small size of the area and low elevation a separate drainage system is proposed to be installed. A standard deep sump catch basin will receive the surface runoff which will then be discharged to an oil/water separator. The combination of the two treatment units will provide the necessary pretreatment prior to conveyance to leaching galleys which are sized to store and infiltrate all storm events up to and including the 100 year storm.

The summary table which follows lists the comparison of peak flow rates and volumes resulting from the construction of the stormwater management system.

In our opinion the successful development of this project in compliance with the design will not result in any adverse impacts to the environment or adjacent properties with respect to stormwater runoff, and provides compliance with the Massachusetts Stormwater Handbook.

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Drainage Summary

Table 1 – Pre-Development vs. Post-Development to East (1S/3S)

Storm Event	Pre		Post		Pre vs. Post changes	
	Peak Discharge (cfs)	Volume (ac-ft.)	Peak Discharge (cfs)	Volume (ac-ft.)	Peak Discharge (cfs)	Volume (ac-ft.)
2 yr	0	0	0	0	0	0
10 yr	0	0	0	.002	0	.002
25 yr	.01	.006	.02	.005	.01	-.001
100 yr	.06	.027	.07	.013	.01	-.014

Table 2 – Pre-Development vs. Post-Development to Easement (1L/4S)

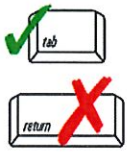
Storm Event	Pre		Post		Pre vs. Post changes	
	Peak Discharge (cfs)	Volume (ac-ft.)	Peak Discharge (cfs)	Volume (ac-ft.)	Peak Discharge (cfs)	Volume (ac-ft.)
2 yr	0	0	0	0	0	0
10 yr	0	.001	0	.001	0	0
25 yr	1.13	.040	.01	.004	-1.12	-.036
100 yr	3.73	.140	.05	.009	-3.68	-.131

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.

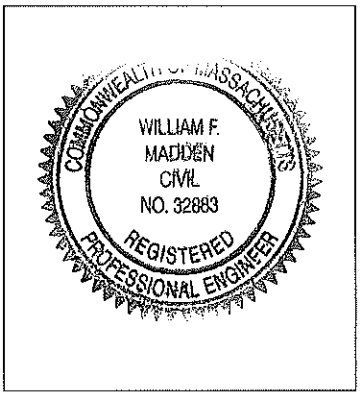
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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



William F Madden 7/7/20
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.

COMPLIANCE WITH THE STORMWATER MANAGEMENT STANDARDS

The Stormwater Management Standards

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

    - *This project does not include any drainage outfalls. The infiltration basin has been sized to store and infiltrate all storm events up to and including the 100 year storm. An emergency spillway has been specified and at least one foot of freeboard is provided to the basin berm.*

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

    - *The drainage calculations confirm that the proposed project matches or reduces the rate of runoff for all design storms.*

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

    - *Recharge is enhanced with the collection and infiltration of the runoff in the crushed stone trenches and infiltration basin. Volume calculations are included in the report and confirm that this standard is met.*

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 determined in accordance with the Massachusetts Stormwater Handbook; and

c. Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.

- *This project includes deep sump catch basins, proprietary treatment structures, and an oil/grit chamber in order to provide the required 44% pretreatment prior to infiltration. Subsequent treatment within the infiltration systems results in greater than 80% annual TSS removal.*

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

   - *This project is not considered a land use with higher potential pollutant loads.*

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

   - *This project is not located within a Zone II of a public water supply.*

7. A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural best management practice

requirements of Standards 4, 5, and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.

- *This project is considered new development. Full compliance with the standards is provided by the stormwater management system design.*

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.

    - *Construction period erosion and sedimentation control measures are included on the design plans and in this report.*

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

    - *A long-term operation and maintenance plan has been listed on the design plans and is included in this report.*

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

    - *An illicit discharge compliance statement is included in the drainage report.*

Date: 07/07/20

To whom it may concern:

I hereby certify that no illicit discharge connections to the drainage system are proposed at 55 Charlotte Furnace Road in West Wareham, MA nor will any be permitted in the future.

Chanan Masse

Owner – Master Millwork, Inc.

Long Term Operation and Maintenance Plan

Responsible Party: Master Millwork, Inc.
55 Charlotte Furnace Road
West Wareham, MA 02576

The property owner is responsible for the inspection, operation and maintenance of the Stormwater Management System. The director of the facility will be provided with copies of the approved site design and as-built plans to make them aware of the locations of system components. A copy of this Operation and Maintenance (O & M) Plan should also be provided.

System Description: The drainage system consists of a number of Best Management Practices, BMPs, which collect, treat, and infiltrate stormwater runoff from all storm events up to and including the 100 year storm event. Roof drainage from the front of the existing building is piped to a leaching pit on the south side of the property. There are two deep sump catch basins, one in the new parking lot and one along the new access drive, which are piped to a proprietary treatment device which then discharges to an infiltration trench. The infiltration trench contains a 24" perforated pipe and two leaching pits. The downstream leaching pit serves as a control point with an 18" outlet pipe set as an overflow to an infiltration basin. The infiltration basin is equipped with crushed stone trenches and an overflow spillway. Runoff from the roof of the new building spills onto a 5' wide crushed stone trench. Overflow from the trench is directed to the infiltration basin.

Parking Lot Sweeping: Parking lot sweeping is an effective non-structural source control that will remove sediment from paved surfaces. Parking lot sweeping should be done with a high efficiency vacuum sweeper or regenerative air sweeper. Parking lot sweeping should be done twice per year. Once removed from paved surfaces, the sweepings must be handled and disposed of properly in one of the ways approved by MassDEP. (See Policy #BAW-18-001: Reuse and Disposal of Street Sweepings)

Deep Sump Catch Basins: Deep sump catch basins are underground retention systems designed to remove trash, debris, and coarse sediment from stormwater runoff and serve as temporary spill containment devices for floatables such as oils and grease. Inspect catch basins monthly and clean out at least two times per year at the end of the foliage and snow removal seasons. Sediment must also be removed whenever the depth of the deposits is greater than or equal to one-half the distance from the bottom of the structure to the outlet invert. Sediment shall be removed through the use of a vacuum truck. Sediment must be handled and disposed of properly in one of the ways approved by MassDEP. Refer to their policy on the management of catch basin cleanings. If there is evidence that they have been contaminated by a spill or other means, the cleanings must be evaluated in accordance with the MassDEP hazardous waste regulations, 310 CMR 30.00 and handled as hazardous waste.

Oil/Grit Separators: Oil/Grit separators are underground storage tanks with three chambers designed to remove heavy particulates, floating debris, and hydrocarbons from stormwater. Inspect oil/grit separators monthly and clean them out at least twice per year. Polluted water from an oil/grit separator should be disposed of in accordance with all applicable local, state, & federal laws and regulations.

Proprietary Catch Basins and Manholes: Proprietary drainage structures are underground retention systems designed to remove trash, debris, and coarse sediment from stormwater runoff and serve as temporary spill containment devices for floatables such as oils and grease. Inspect the units monthly, clean at least two times a year at the end of the foliage and snow removal seasons. Sediments must also be removed when sediment has reached the depth recommended for cleanout by the manufacturer's specifications. Sediment must be handled and disposed of in the same manner as listed above for deep sump catch basins.

Nyloplast Drain Manholes: Nyloplast drain manholes shall be inspected monthly, and shall be cleaned at least four times per year and at the end of the foliage and snow removal seasons. All debris, sediment, and hydrocarbons should be handled properly and disposed of in accordance with all local, state, and federal guidelines and regulations. If there is evidence that they have been contaminated for any reason the cleanings must be evaluated in accordance with the MassDEP hazardous waste regulations, 310 CMR 30.00 and handled as hazardous waste.

Infiltration Basins: The basin should be inspected monthly for bare spots and re-seeded if necessary. Any debris, trash, or sediment should be removed. Mowing of the basin will be infrequent, once or twice a year, primarily to prevent the growth of undesirable weeds, trees, and shrubs. Check the emergency outlet spillway for erosion and reset the stone and concrete curb if necessary. Remove any sediment which has entered the basin. Dispose of any sediment in accordance with local, state, and federal guidelines and regulations.

Leaching Pits and Galleys: Leaching pits and galleys shall be inspected after every major storm event for the first few months after installation to ensure proper stabilization and function. Thereafter inspection shall occur annually. Water depth in the pits and galleys should be observed after major storms to determine proper function. Exfiltration rates are determined by the drop in water level over the time it takes for the unit to empty. A comparison of exfiltration rate measurements taken over a period of years can provide helpful information in the event that clogging problems occur.

Public Safety Features: The raingarden and basin are no more than two feet deep with 3:1 side slopes. The emergency outlet control structure includes a pedestrian safe grate.

Operation and Maintenance Budget: The estimated annual cost for inspection, mowing, and sediment removal associated with the maintenance of the Stormwater Management System is $2,500.

Reference: For full details on drainage system Construction, Operation and Maintenance refer to the current edition of the Massachusetts Stormwater Handbook.

Construction Period Pollution Prevention and

Erosion & Sedimentation Control Plan

Narrative: This project consists of construction of a 43,400± square foot custom woodworking building with associated access drive, parking lots, loading docks, drainage systems, and utilities.

Responsible Parties: The site contractor and the owner.

Construction Period Operation / Maintenance Plan:

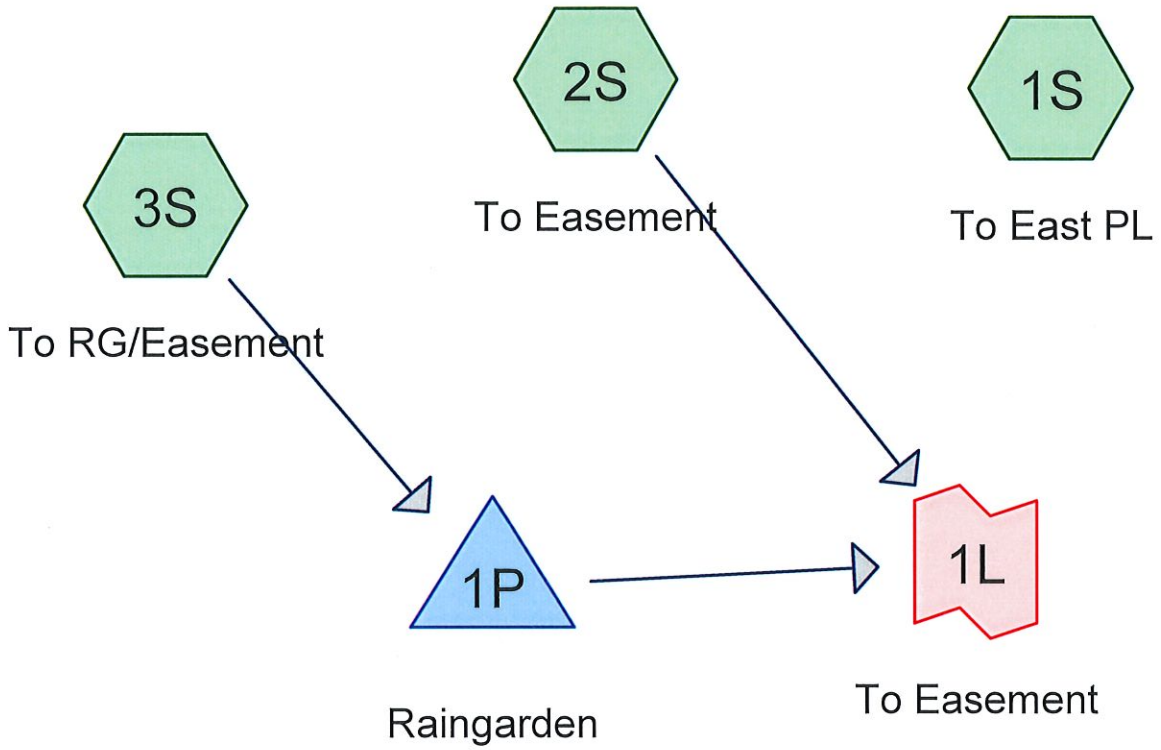
- Provide sufficient refuse containers and empty as needed.
- Inspect erosion controls daily. Repair or replace as needed.
- Police the area for safety hazards and trash on a daily basis.
- Store materials away from drainage and resource areas.
- Provide or receive only the materials which can be installed promptly.
- Inspect vehicles for leaks and repair or replace when necessary.
- Provide dust control with watering.
- Maintain truck runoff pads.
- Provide a contact person for complaints and to receive notification of problems.
- Direct dewatering to adequately sized containment areas.

Construction Sequence:

- Install erosion controls per the plans.
- Install silt sacks in existing catch basins.
- Clear the land, remove stumps, and rough grade.
- Install the building foundation.
- Install drainage structures and utilities.
- Install base course of pavement.
- Install top course pavement.
- Install landscaping. Loam & seed disturbed areas.
- Install permanent pavement markings.
- Remove erosion controls.

Maintenance Schedule:

- Erosion controls are to be inspected daily and repaired or replaced as needed.
- Trash is to be picked up daily.
- Water shall be used for dust control as needed.
- Silt sacks shall be emptied or replaced when full.
- Vehicles shall be inspected daily for any leaks and repaired or replaced as needed.



Subcat Reach Pond Link

Routing Diagram for 9342 Pre
Prepared by G.A.F. Engineering, Inc., Printed 7/2/2020

Project Notes

Rainfall events imported from "9342 Post.hcp"

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.668	39	>75% Grass cover, Good, HSG A (2S, 3S)
0.017	98	Basin Bottom (3S)
0.041	98	Concrete Pads (3S)
0.560	96	Gravel surface, HSG A (3S)
0.230	98	Roof (3S)
2.174	30	Woods, Good, HSG A (1S, 2S)
3.690	**47**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
3.402	HSG A	1S, 2S, 3S
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.288	Other	3S
3.690		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.668	0.000	0.000	0.000	0.000	0.668	>75% Grass cover, Good	2S, 3S
0.000	0.000	0.000	0.000	0.017	0.017	Basin Bottom	3S
0.000	0.000	0.000	0.000	0.041	0.041	Concrete Pads	3S
0.560	0.000	0.000	0.000	0.000	0.560	Gravel surface	3S
0.000	0.000	0.000	0.000	0.230	0.230	Roof	3S
2.174	0.000	0.000	0.000	0.000	2.174	Woods, Good	1S, 2S
3.402	**0.000**	**0.000**	**0.000**	**0.288**	**3.690**	**TOTAL AREA**	

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: To East PL Runoff Area=44,010 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=200' Tc=10.6 min CN=30 Runoff=0.00 cfs 0.000 af

Subcatchment 2S: To Easement Runoff Area=53,100 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=305' Slope=0.0240 '/' Tc=12.8 min CN=30 Runoff=0.00 cfs 0.000 af

Subcatchment 3S: To RG/Easement Runoff Area=63,630 sf 19.72% Impervious Runoff Depth=1.08"
Flow Length=336' Tc=5.4 min CN=72 Runoff=1.77 cfs 0.131 af

Pond 1P: Raingarden Peak Elev=72.20' Storage=1,450 cf Inflow=1.77 cfs 0.131 af
Discarded=0.50 cfs 0.131 af Primary=0.00 cfs 0.000 af Outflow=0.50 cfs 0.131 af

Link 1L: To Easement Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Total Runoff Area = 3.690 ac Runoff Volume = 0.131 af Average Runoff Depth = 0.43"
92.19% Pervious = 3.402 ac 7.81% Impervious = 0.288 ac

Summary for Subcatchment 1S: To East PL

[45] Hint: Runoff=Zero

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

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Year Storm Rainfall=3.43"

Area (sf)	CN	Description
44,010	30	Woods, Good, HSG A
44,010		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.9	50	0.0320	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.43"
0.7	150	0.0510	3.64		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
10.6	200	Total			

Summary for Subcatchment 2S: To Easement

[45] Hint: Runoff=Zero

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

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Year Storm Rainfall=3.43"

Area (sf)	CN	Description
2,400	39	>75% Grass cover, Good, HSG A
50,700	30	Woods, Good, HSG A
53,100	30	Weighted Average
53,100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.1	50	0.0240	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.43"
1.7	255	0.0240	2.49		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
12.8	305	Total			

Summary for Subcatchment 3S: To RG/Easement

Runoff = 1.77 cfs @ 12.09 hrs, Volume= 0.131 af, Depth= 1.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Year Storm Rainfall=3.43"

	Area (sf)	CN	Description
*	10,000	98	Roof
*	1,800	98	Concrete Pads
*	750	98	Basin Bottom
	24,390	96	Gravel surface, HSG A
	26,690	39	>75% Grass cover, Good, HSG A
	63,630	72	Weighted Average
	51,080		80.28% Pervious Area
	12,550		19.72% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.2	50	0.0980	0.20		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.43"
0.6	86	0.0270	2.46		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.6	200		5.67		**Lake or Reservoir, Raingarden** Mean Depth= 1.00'
5.4	336	Total			

Summary for Pond 1P: Raingarden

Inflow Area = 1.461 ac, 19.72% Impervious, Inflow Depth = 1.08" for 2 Year Storm event
Inflow = 1.77 cfs @ 12.09 hrs, Volume= 0.131 af
Outflow = 0.50 cfs @ 12.49 hrs, Volume= 0.131 af, Atten= 72%, Lag= 24.2 min
Discarded = 0.50 cfs @ 12.49 hrs, Volume= 0.131 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 72.20' @ 12.49 hrs Surf.Area= 2,610 sf Storage= 1,450 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 38.2 min (901.8 - 863.6)

Volume	Invert	Avail.Storage	Storage Description
#1	69.00'	1,029 cf	**5.00'W x 210.00'L x 2.80'H Engineered Soil** 2,940 cf Overall x 35.0% Voids
#2	71.80'	8,240 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
		9,269 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
71.80	750	0	0
72.00	980	173	173
73.00	3,950	2,465	2,638
74.00	7,254	5,602	8,240

Device	Routing	Invert	Outlet Devices
#1	Discarded	69.00'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	73.00'	**8.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.50 cfs @ 12.49 hrs HW=72.20' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.50 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=69.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Link 1L: To Easement

Inflow Area = 2.680 ac, 10.75% Impervious, Inflow Depth = 0.00" for 2 Year Storm event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: To East PL Runoff Area=44,010 sf 0.00% Impervious Runoff Depth=0.01"
Flow Length=200' Tc=10.6 min CN=30 Runoff=0.00 cfs 0.000 af

Subcatchment 2S: To Easement Runoff Area=53,100 sf 0.00% Impervious Runoff Depth=0.01"
Flow Length=305' Slope=0.0240 '/' Tc=12.8 min CN=30 Runoff=0.00 cfs 0.001 af

Subcatchment 3S: To RG/Easement Runoff Area=63,630 sf 19.72% Impervious Runoff Depth=2.23"
Flow Length=336' Tc=5.4 min CN=72 Runoff=3.86 cfs 0.271 af

Pond 1P: Raingarden Peak Elev=72.96' Storage=3,526 cf Inflow=3.86 cfs 0.271 af
Discarded=0.94 cfs 0.271 af Primary=0.00 cfs 0.000 af Outflow=0.94 cfs 0.271 af

Link 1L: To Easement Inflow=0.00 cfs 0.001 af
Primary=0.00 cfs 0.001 af

Total Runoff Area = 3.690 ac Runoff Volume = 0.272 af Average Runoff Depth = 0.89"
92.19% Pervious = 3.402 ac 7.81% Impervious = 0.288 ac

Summary for Subcatchment 1S: To East PL

Runoff = 0.00 cfs @ 23.71 hrs, Volume= 0.000 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 Year Storm Rainfall=5.04"

Area (sf)	CN	Description
44,010	30	Woods, Good, HSG A
44,010		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.9	50	0.0320	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.43"
0.7	150	0.0510	3.64		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
10.6	200	Total			

Summary for Subcatchment 2S: To Easement

Runoff = 0.00 cfs @ 23.71 hrs, Volume= 0.001 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 Year Storm Rainfall=5.04"

Area (sf)	CN	Description
2,400	39	>75% Grass cover, Good, HSG A
50,700	30	Woods, Good, HSG A
53,100	30	Weighted Average
53,100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.1	50	0.0240	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.43"
1.7	255	0.0240	2.49		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
12.8	305	Total			

Summary for Subcatchment 3S: To RG/Easement

Runoff = 3.86 cfs @ 12.08 hrs, Volume= 0.271 af, Depth= 2.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 Year Storm Rainfall=5.04"

	Area (sf)	CN	Description
*	10,000	98	Roof
*	1,800	98	Concrete Pads
*	750	98	Basin Bottom
	24,390	96	Gravel surface, HSG A
	26,690	39	>75% Grass cover, Good, HSG A
	63,630	72	Weighted Average
	51,080		80.28% Pervious Area
	12,550		19.72% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.2	50	0.0980	0.20		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.43"
0.6	86	0.0270	2.46		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.6	200		5.67		**Lake or Reservoir, Raingarden** Mean Depth= 1.00'
5.4	336	Total			

Summary for Pond 1P: Raingarden

Inflow Area = 1.461 ac, 19.72% Impervious, Inflow Depth = 2.23" for 10 Year Storm event
Inflow = 3.86 cfs @ 12.08 hrs, Volume= 0.271 af
Outflow = 0.94 cfs @ 12.50 hrs, Volume= 0.271 af, Atten= 76%, Lag= 24.9 min
Discarded = 0.94 cfs @ 12.50 hrs, Volume= 0.271 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 72.96' @ 12.50 hrs Surf.Area= 4,893 sf Storage= 3,526 cf

Plug-Flow detention time= 46.0 min calculated for 0.271 af (100% of inflow)
Center-of-Mass det. time= 46.0 min (887.6 - 841.6)

Volume	Invert	Avail.Storage	Storage Description
#1	69.00'	1,029 cf	**5.00'W x 210.00'L x 2.80'H Engineered Soil**
			2,940 cf Overall x 35.0% Voids
#2	71.80'	8,240 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
		9,269 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
71.80	750	0	0
72.00	980	173	173
73.00	3,950	2,465	2,638
74.00	7,254	5,602	8,240

Device	Routing	Invert	Outlet Devices
#1	Discarded	69.00'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	73.00'	**8.0' long x 5.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50
			Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.94 cfs @ 12.50 hrs HW=72.96' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.94 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=69.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Link 1L: To Easement

Inflow Area = 2.680 ac, 10.75% Impervious, Inflow Depth = 0.00" for 10 Year Storm event
Inflow = 0.00 cfs @ 23.71 hrs, Volume= 0.001 af
Primary = 0.00 cfs @ 23.71 hrs, Volume= 0.001 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: To East PL Runoff Area=44,010 sf 0.00% Impervious Runoff Depth=0.08"
Flow Length=200' Tc=10.6 min CN=30 Runoff=0.01 cfs 0.006 af

Subcatchment 2S: To Easement Runoff Area=53,100 sf 0.00% Impervious Runoff Depth=0.08"
Flow Length=305' Slope=0.0240 '/' Tc=12.8 min CN=30 Runoff=0.01 cfs 0.008 af

Subcatchment 3S: To RG/Easement Runoff Area=63,630 sf 19.72% Impervious Runoff Depth=3.03"
Flow Length=336' Tc=5.4 min CN=72 Runoff=5.29 cfs 0.368 af

Pond 1P: Raingarden Peak Elev=73.15' Storage=4,313 cf Inflow=5.29 cfs 0.368 af
Discarded=1.05 cfs 0.337 af Primary=1.13 cfs 0.032 af Outflow=2.19 cfs 0.368 af

Link 1L: To Easement Inflow=1.13 cfs 0.040 af
Primary=1.13 cfs 0.040 af

Total Runoff Area = 3.690 ac Runoff Volume = 0.383 af Average Runoff Depth = 1.24"
92.19% Pervious = 3.402 ac 7.81% Impervious = 0.288 ac

Summary for Subcatchment 1S: To East PL

Runoff = 0.01 cfs @ 15.51 hrs, Volume= 0.006 af, Depth= 0.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 Year Storm Rainfall=6.04"

Area (sf)	CN	Description
44,010	30	Woods, Good, HSG A
44,010		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.9	50	0.0320	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.43"
0.7	150	0.0510	3.64		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
10.6	200	Total			

Summary for Subcatchment 2S: To Easement

Runoff = 0.01 cfs @ 15.57 hrs, Volume= 0.008 af, Depth= 0.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 Year Storm Rainfall=6.04"

Area (sf)	CN	Description
2,400	39	>75% Grass cover, Good, HSG A
50,700	30	Woods, Good, HSG A
53,100	30	Weighted Average
53,100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.1	50	0.0240	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.43"
1.7	255	0.0240	2.49		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
12.8	305	Total			

Summary for Subcatchment 3S: To RG/Easement

Runoff = 5.29 cfs @ 12.08 hrs, Volume= 0.368 af, Depth= 3.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 Year Storm Rainfall=6.04"

	Area (sf)	CN	Description
*	10,000	98	Roof
*	1,800	98	Concrete Pads
*	750	98	Basin Bottom
	24,390	96	Gravel surface, HSG A
	26,690	39	>75% Grass cover, Good, HSG A
	63,630	72	Weighted Average
	51,080		80.28% Pervious Area
	12,550		19.72% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.2	50	0.0980	0.20		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.43"
0.6	86	0.0270	2.46		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.6	200		5.67		**Lake or Reservoir, Raingarden** Mean Depth= 1.00'
5.4	336	Total			

Summary for Pond 1P: Raingarden

Inflow Area = 1.461 ac, 19.72% Impervious, Inflow Depth = 3.03" for 25 Year Storm event
Inflow = 5.29 cfs @ 12.08 hrs, Volume= 0.368 af
Outflow = 2.19 cfs @ 12.31 hrs, Volume= 0.368 af, Atten= 59%, Lag= 14.0 min
Discarded = 1.05 cfs @ 12.31 hrs, Volume= 0.337 af
Primary = 1.13 cfs @ 12.31 hrs, Volume= 0.032 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 73.15' @ 12.31 hrs Surf.Area= 5,508 sf Storage= 4,313 cf

Plug-Flow detention time= 44.2 min calculated for 0.368 af (100% of inflow)
Center-of-Mass det. time= 44.2 min (876.9 - 832.7)

Volume	Invert	Avail.Storage	Storage Description
#1	69.00'	1,029 cf	**5.00'W x 210.00'L x 2.80'H Engineered Soil** 2,940 cf Overall x 35.0% Voids
#2	71.80'	8,240 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
		9,269 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
71.80	750	0	0
72.00	980	173	173
73.00	3,950	2,465	2,638
74.00	7,254	5,602	8,240

Device	Routing	Invert	Outlet Devices
#1	Discarded	69.00'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	73.00'	**8.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=1.05 cfs @ 12.31 hrs HW=73.15' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 1.05 cfs)

Primary OutFlow Max=1.13 cfs @ 12.31 hrs HW=73.15' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 1.13 cfs @ 0.92 fps)

Summary for Link 1L: To Easement

Inflow Area = 2.680 ac, 10.75% Impervious, Inflow Depth = 0.18" for 25 Year Storm event
Inflow = 1.13 cfs @ 12.31 hrs, Volume= 0.040 af
Primary = 1.13 cfs @ 12.31 hrs, Volume= 0.040 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: To East PL Runoff Area=44,010 sf 0.00% Impervious Runoff Depth=0.32"
Flow Length=200' Tc=10.6 min CN=30 Runoff=0.06 cfs 0.027 af

Subcatchment 2S: To Easement Runoff Area=53,100 sf 0.00% Impervious Runoff Depth=0.32"
Flow Length=305' Slope=0.0240 '/' Tc=12.8 min CN=30 Runoff=0.07 cfs 0.033 af

Subcatchment 3S: To RG/Easement Runoff Area=63,630 sf 19.72% Impervious Runoff Depth=4.33"
Flow Length=336' Tc=5.4 min CN=72 Runoff=7.58 cfs 0.527 af

Pond 1P: Raingarden Peak Elev=73.33' Storage=5,154 cf Inflow=7.58 cfs 0.527 af
Discarded=1.17 cfs 0.420 af Primary=3.73 cfs 0.107 af Outflow=4.90 cfs 0.527 af

Link 1L: To Easement Inflow=3.73 cfs 0.140 af
Primary=3.73 cfs 0.140 af

Total Runoff Area = 3.690 ac Runoff Volume = 0.587 af Average Runoff Depth = 1.91"
92.19% Pervious = 3.402 ac 7.81% Impervious = 0.288 ac

Summary for Subcatchment 1S: To East PL

Runoff = 0.06 cfs @ 12.53 hrs, Volume= 0.027 af, Depth= 0.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Year Storm Rainfall=7.58"

Area (sf)	CN	Description
44,010	30	Woods, Good, HSG A
44,010		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.9	50	0.0320	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.43"
0.7	150	0.0510	3.64		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
10.6	200	Total			

Summary for Subcatchment 2S: To Easement

Runoff = 0.07 cfs @ 12.56 hrs, Volume= 0.033 af, Depth= 0.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Year Storm Rainfall=7.58"

Area (sf)	CN	Description
2,400	39	>75% Grass cover, Good, HSG A
50,700	30	Woods, Good, HSG A
53,100	30	Weighted Average
53,100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.1	50	0.0240	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.43"
1.7	255	0.0240	2.49		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
12.8	305	Total			

Summary for Subcatchment 3S: To RG/Easement

Runoff = 7.58 cfs @ 12.08 hrs, Volume= 0.527 af, Depth= 4.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Year Storm Rainfall=7.58"

	Area (sf)	CN	Description
*	10,000	98	Roof
*	1,800	98	Concrete Pads
*	750	98	Basin Bottom
	24,390	96	Gravel surface, HSG A
	26,690	39	>75% Grass cover, Good, HSG A
	63,630	72	Weighted Average
	51,080		80.28% Pervious Area
	12,550		19.72% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.2	50	0.0980	0.20		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.43"
0.6	86	0.0270	2.46		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.6	200		5.67		**Lake or Reservoir, Raingarden** Mean Depth= 1.00'
5.4	336	Total			

Summary for Pond 1P: Raingarden

Inflow Area = 1.461 ac, 19.72% Impervious, Inflow Depth = 4.33" for 100 Year Storm event
Inflow = 7.58 cfs @ 12.08 hrs, Volume= 0.527 af
Outflow = 4.90 cfs @ 12.17 hrs, Volume= 0.527 af, Atten= 35%, Lag= 5.4 min
Discarded = 1.17 cfs @ 12.17 hrs, Volume= 0.420 af
Primary = 3.73 cfs @ 12.17 hrs, Volume= 0.107 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 73.33' @ 12.17 hrs Surf.Area= 6,093 sf Storage= 5,154 cf

Plug-Flow detention time= 40.7 min calculated for 0.527 af (100% of inflow)
Center-of-Mass det. time= 40.7 min (863.1 - 822.4)

Volume	Invert	Avail.Storage	Storage Description
#1	69.00'	1,029 cf	**5.00'W x 210.00'L x 2.80'H Engineered Soil** 2,940 cf Overall x 35.0% Voids
#2	71.80'	8,240 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
		9,269 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
71.80	750	0	0
72.00	980	173	173
73.00	3,950	2,465	2,638
74.00	7,254	5,602	8,240

Device	Routing	Invert	Outlet Devices
#1	Discarded	69.00'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	73.00'	**8.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

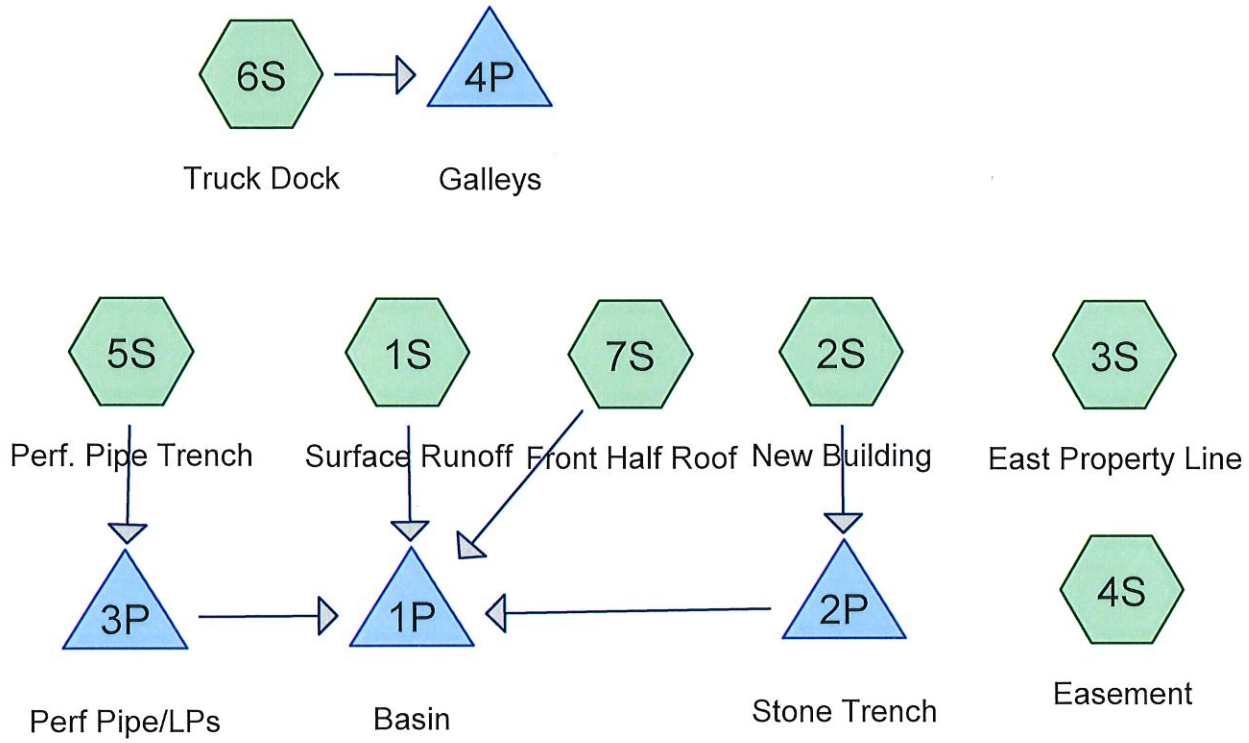
Discarded OutFlow Max=1.17 cfs @ 12.17 hrs HW=73.33' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 1.17 cfs)

Primary OutFlow Max=3.72 cfs @ 12.17 hrs HW=73.33' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 3.72 cfs @ 1.41 fps)

Summary for Link 1L: To Easement

Inflow Area = 2.680 ac, 10.75% Impervious, Inflow Depth = 0.63" for 100 Year Storm event
Inflow = 3.73 cfs @ 12.17 hrs, Volume= 0.140 af
Primary = 3.73 cfs @ 12.17 hrs, Volume= 0.140 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs



Subcat Reach Pond Link

Routing Diagram for 9342 Post ALT 2
Prepared by G.A.F. Engineering, Inc., Printed 7/2/2020

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.330	39	>75% Grass cover, Good, HSG A (1S, 3S, 4S, 5S)
0.170	98	Basin Bottom (1S)
0.035	98	Building Facade at Dock (6S)
0.096	96	Gravel surface, HSG A (1S)
1.270	98	Pavement (1S, 5S, 6S)
0.728	98	Roof (5S, 7S)
0.498	98	Roofs, HSG A (2S)
0.120	30	Woods, Good, HSG A (3S, 4S)
4.246	**78**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
2.044	HSG A	1S, 2S, 3S, 4S, 5S
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
2.202	Other	1S, 5S, 6S, 7S
4.246		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
1.330	0.000	0.000	0.000	0.000	1.330	>75% Grass cover, Good	1S, 3S, 4S, 5S
0.000	0.000	0.000	0.000	0.170	0.170	Basin Bottom	1S
0.000	0.000	0.000	0.000	0.035	0.035	Building Facade at Dock	6S
0.096	0.000	0.000	0.000	0.000	0.096	Gravel surface	1S
0.000	0.000	0.000	0.000	1.270	1.270	Pavement	1S, 5S, 6S
0.000	0.000	0.000	0.000	0.728	0.728	Roof	5S, 7S
0.498	0.000	0.000	0.000	0.000	0.498	Roofs	2S
0.120	0.000	0.000	0.000	0.000	0.120	Woods, Good	3S, 4S
2.044	**0.000**	**0.000**	**0.000**	**2.202**	**4.246**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	3P	72.00	71.80	10.0	0.0200	0.012	18.0	0.0	0.0

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 1S: Surface Runoff Runoff Area=41,050 sf 41.05% Impervious Runoff Depth=0.91"
Flow Length=230' Tc=15.7 min CN=69 Runoff=0.67 cfs 0.072 af

Subcatchment 2S: New Building Runoff Area=21,700 sf 100.00% Impervious Runoff Depth=3.20"
Tc=6.0 min CN=98 Runoff=1.66 cfs 0.133 af

Subcatchment 3S: East Property Line Runoff Area=9,300 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=200' Tc=8.2 min CN=36 Runoff=0.00 cfs 0.000 af

Subcatchment 4S: Easement Runoff Area=6,200 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=200' Tc=16.6 min CN=36 Runoff=0.00 cfs 0.000 af

Subcatchment 5S: Perf. Pipe Trench Runoff Area=81,220 sf 65.97% Impervious Runoff Depth=1.44"
Tc=6.0 min CN=78 Runoff=3.11 cfs 0.224 af

Subcatchment 6S: Truck Dock Runoff Area=3,800 sf 100.00% Impervious Runoff Depth=3.20"
Tc=6.0 min CN=98 Runoff=0.29 cfs 0.023 af

Subcatchment 7S: Front Half Roof Runoff Area=21,700 sf 100.00% Impervious Runoff Depth=3.20"
Tc=6.0 min CN=98 Runoff=1.66 cfs 0.133 af

Pond 1P: Basin Peak Elev=71.53' Storage=684 cf Inflow=2.02 cfs 0.206 af
Outflow=1.51 cfs 0.206 af

Pond 2P: Stone Trench Peak Elev=74.29' Storage=1,112 cf Inflow=1.66 cfs 0.133 af
Discarded=0.51 cfs 0.133 af Primary=0.00 cfs 0.000 af Outflow=0.51 cfs 0.133 af

Pond 3P: Perf Pipe/LPs Peak Elev=72.14' Storage=2,710 cf Inflow=3.11 cfs 0.224 af
Discarded=0.69 cfs 0.223 af Primary=0.11 cfs 0.002 af Outflow=0.80 cfs 0.224 af

Pond 4P: Galleys Peak Elev=68.39' Storage=198 cf Inflow=0.29 cfs 0.023 af
Outflow=0.08 cfs 0.023 af

Total Runoff Area = 4.246 ac Runoff Volume = 0.585 af Average Runoff Depth = 1.65"
36.41% Pervious = 1.546 ac 63.59% Impervious = 2.700 ac

Summary for Subcatchment 1S: Surface Runoff

Runoff = 0.67 cfs @ 12.24 hrs, Volume= 0.072 af, Depth= 0.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Year Storm Rainfall=3.43"

	Area (sf)	CN	Description
*	9,450	98	Pavement
*	7,400	98	Basin Bottom
	4,200	96	Gravel surface, HSG A
	20,000	39	>75% Grass cover, Good, HSG A
	41,050	69	Weighted Average
	24,200		58.95% Pervious Area
	16,850		41.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.6	50	0.0120	0.06		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.43"
1.1	180	0.0270	2.65		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
15.7	230	Total			

Summary for Subcatchment 2S: New Building

Runoff = 1.66 cfs @ 12.08 hrs, Volume= 0.133 af, Depth= 3.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Year Storm Rainfall=3.43"

Area (sf)	CN	Description
21,700	98	Roofs, HSG A
21,700		100.00% Impervious Area

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

Summary for Subcatchment 3S: East Property Line

[45] Hint: Runoff=Zero

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

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Year Storm Rainfall=3.43"

Area (sf)	CN	Description
6,440	39	>75% Grass cover, Good, HSG A
2,860	30	Woods, Good, HSG A
9,300	36	Weighted Average
9,300		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	50	0.0660	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.43"
0.8	150	0.0340	2.97		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
8.2	200	Total			

Summary for Subcatchment 4S: Easement

[45] Hint: Runoff=Zero

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

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Year Storm Rainfall=3.43"

Area (sf)	CN	Description
3,850	39	>75% Grass cover, Good, HSG A
2,350	30	Woods, Good, HSG A
6,200	36	Weighted Average
6,200		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.7	50	0.0100	0.05		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.43"
0.9	150	0.0300	2.79		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
16.6	200	Total			

Summary for Subcatchment 5S: Perf. Pipe Trench

Runoff = 3.11 cfs @ 12.09 hrs, Volume= 0.224 af, Depth= 1.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Year Storm Rainfall=3.43"

	Area (sf)	CN	Description
*	43,580	98	Pavement
*	10,000	98	Roof
	27,640	39	>75% Grass cover, Good, HSG A
	81,220	78	Weighted Average
	27,640		34.03% Pervious Area
	53,580		65.97% Impervious Area

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

Summary for Subcatchment 6S: Truck Dock

Runoff = 0.29 cfs @ 12.08 hrs, Volume= 0.023 af, Depth= 3.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Year Storm Rainfall=3.43"

	Area (sf)	CN	Description
*	2,280	98	Pavement
*	1,520	98	Building Facade at Dock
	3,800	98	Weighted Average
	3,800		100.00% Impervious Area

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

Summary for Subcatchment 7S: Front Half Roof

Runoff = 1.66 cfs @ 12.08 hrs, Volume= 0.133 af, Depth= 3.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Year Storm Rainfall=3.43"

	Area (sf)	CN	Description
*	21,700	98	Roof
	21,700		100.00% Impervious Area

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

Summary for Pond 1P: Basin

Inflow Area = 3.803 ac, 68.71% Impervious, Inflow Depth = 0.65" for 2 Year Storm event
Inflow = 2.02 cfs @ 12.10 hrs, Volume= 0.206 af
Outflow = 1.51 cfs @ 12.22 hrs, Volume= 0.206 af, Atten= 25%, Lag= 7.4 min
Discarded = 1.51 cfs @ 12.22 hrs, Volume= 0.206 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 71.53' @ 12.22 hrs Surf.Area= 7,869 sf Storage= 684 cf

Plug-Flow detention time= 28.6 min calculated for 0.206 af (100% of inflow)
Center-of-Mass det. time= 28.6 min (828.1 - 799.5)

Volume	Invert	Avail.Storage	Storage Description
#1	68.50'	480 cf	**2.00'W x 200.00'L x 3.00'H Prismatoid** 1,200 cf Overall x 40.0% Voids
#2	71.50'	26,004 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
		26,484 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
71.50	7,400	0	0
72.00	8,660	4,015	4,015
73.00	10,221	9,441	13,456
74.00	14,875	12,548	26,004

Device	Routing	Invert	Outlet Devices
#1	Discarded	68.50'	**8.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=1.51 cfs @ 12.22 hrs HW=71.53' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 1.51 cfs)

Summary for Pond 2P: Stone Trench

Inflow Area = 0.498 ac,100.00% Impervious, Inflow Depth = 3.20" for 2 Year Storm event
Inflow = 1.66 cfs @ 12.08 hrs, Volume= 0.133 af
Outflow = 0.51 cfs @ 12.39 hrs, Volume= 0.133 af, Atten= 69%, Lag= 18.2 min
Discarded = 0.51 cfs @ 12.39 hrs, Volume= 0.133 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 74.29' @ 12.39 hrs Surf.Area= 1,550 sf Storage= 1,112 cf

Plug-Flow detention time= 12.2 min calculated for 0.133 af (100% of inflow)
Center-of-Mass det. time= 12.2 min (767.1 - 755.0)

Volume	Invert	Avail.Storage	Storage Description
#1	72.50'	1,860 cf	**5.00'W x 310.00'L x 3.00'H Prismatoid** 4,650 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	72.50'	**8.270 in/hr Exfiltration over Wetted area**
#2	Primary	75.30'	**310.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.51 cfs @ 12.39 hrs HW=74.29' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.51 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=72.50' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 3P: Perf Pipe/LPs

Inflow Area = 1.865 ac, 65.97% Impervious, Inflow Depth = 1.44" for 2 Year Storm event
Inflow = 3.11 cfs @ 12.09 hrs, Volume= 0.224 af
Outflow = 0.80 cfs @ 12.50 hrs, Volume= 0.224 af, Atten= 74%, Lag= 24.7 min
Discarded = 0.69 cfs @ 12.50 hrs, Volume= 0.223 af
Primary = 0.11 cfs @ 12.50 hrs, Volume= 0.002 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 72.14' @ 12.50 hrs Surf.Area= 1,687 sf Storage= 2,710 cf

Plug-Flow detention time= 34.0 min calculated for 0.224 af (100% of inflow)
Center-of-Mass det. time= 33.9 min (879.4 - 845.4)

Volume	Invert	Avail.Storage	Storage Description
#1	69.00'	2,740 cf	**6.00'W x 255.00'L x 5.00'H Excavation/Crushed Stone** 7,650 cf Overall - 801 cf Embedded = 6,849 cf x 40.0% Voids
#2	70.50'	801 cf	**24.0" Round Pipe Storage** Inside #1 L= 255.0'
#3	68.00'	336 cf	**10.00'D x 7.50'H Excavation/Crushed Stone** x 2 1,178 cf Overall - 339 cf Embedded = 839 cf x 40.0% Voids
#4	69.00'	339 cf	**6.00'D x 6.00'H Leaching Pit** x 2 Inside #3
		4,215 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	68.00'	**8.270 in/hr Exfiltration over Wetted area**
#2	Primary	72.00'	**18.0" Round Culvert** L= 10.0' Ke= 0.500 Inlet / Outlet Invert= 72.00' / 71.80' S= 0.0200 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf

Discarded OutFlow Max=0.69 cfs @ 12.50 hrs HW=72.14' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.69 cfs)

Primary OutFlow Max=0.10 cfs @ 12.50 hrs HW=72.14' (Free Discharge)
↑—**2=Culvert** (Inlet Controls 0.10 cfs @ 1.27 fps)

Summary for Pond 4P: Galleys

Inflow Area = 0.087 ac,100.00% Impervious, Inflow Depth = 3.20" for 2 Year Storm event
Inflow = 0.29 cfs @ 12.08 hrs, Volume= 0.023 af
Outflow = 0.08 cfs @ 12.42 hrs, Volume= 0.023 af, Atten= 72%, Lag= 20.4 min
Discarded = 0.08 cfs @ 12.42 hrs, Volume= 0.023 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 68.39' @ 12.42 hrs Surf.Area= 320 sf Storage= 198 cf

Plug-Flow detention time= 13.1 min calculated for 0.023 af (100% of inflow)
Center-of-Mass det. time= 13.1 min (768.1 - 755.0)

Volume	Invert	Avail.Storage	Storage Description
#1	67.00'	516 cf	**16.00'W x 20.00'L x 5.50'H Excavation/Crushed Stone** 1,760 cf Overall - 471 cf Embedded = 1,289 cf x 40.0% Voids
#2	68.00'	355 cf	**Concrete Galley 4x4x4** x 8 Inside #1 Inside= 42.0"W x 43.0"H => 12.67 sf x 3.50'L = 44.3 cf Outside= 52.8"W x 48.0"H => 14.72 sf x 4.00'L = 58.9 cf 8 Chambers in 2 Rows
		870 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	67.00'	**8.270 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.08 cfs @ 12.42 hrs HW=68.39' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.08 cfs)

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 1S: Surface Runoff Runoff Area=41,050 sf 41.05% Impervious Runoff Depth=1.99"
Flow Length=230' Tc=15.7 min CN=69 Runoff=1.59 cfs 0.156 af

Subcatchment 2S: New Building Runoff Area=21,700 sf 100.00% Impervious Runoff Depth=4.80"
Tc=6.0 min CN=98 Runoff=2.46 cfs 0.199 af

Subcatchment 3S: East Property Line Runoff Area=9,300 sf 0.00% Impervious Runoff Depth=0.11"
Flow Length=200' Tc=8.2 min CN=36 Runoff=0.00 cfs 0.002 af

Subcatchment 4S: Easement Runoff Area=6,200 sf 0.00% Impervious Runoff Depth=0.11"
Flow Length=200' Tc=16.6 min CN=36 Runoff=0.00 cfs 0.001 af

Subcatchment 5S: Perf. Pipe Trench Runoff Area=81,220 sf 65.97% Impervious Runoff Depth=2.75"
Tc=6.0 min CN=78 Runoff=6.01 cfs 0.427 af

Subcatchment 6S: Truck Dock Runoff Area=3,800 sf 100.00% Impervious Runoff Depth=4.80"
Tc=6.0 min CN=98 Runoff=0.43 cfs 0.035 af

Subcatchment 7S: Front Half Roof Runoff Area=21,700 sf 100.00% Impervious Runoff Depth=4.80"
Tc=6.0 min CN=98 Runoff=2.46 cfs 0.199 af

Pond 1P: Basin Peak Elev=72.16' Storage=5,929 cf Inflow=7.26 cfs 0.455 af
Outflow=1.78 cfs 0.455 af

Pond 2P: Stone Trench Peak Elev=75.31' Storage=1,740 cf Inflow=2.46 cfs 0.199 af
Discarded=0.64 cfs 0.194 af Primary=0.65 cfs 0.005 af Outflow=1.28 cfs 0.199 af

Pond 3P: Perf Pipe/LPs Peak Elev=73.05' Storage=3,414 cf Inflow=6.01 cfs 0.427 af
Discarded=0.79 cfs 0.332 af Primary=4.00 cfs 0.094 af Outflow=4.79 cfs 0.427 af

Pond 4P: Galleys Peak Elev=69.33' Storage=368 cf Inflow=0.43 cfs 0.035 af
Outflow=0.09 cfs 0.035 af

Total Runoff Area = 4.246 ac Runoff Volume = 1.020 af Average Runoff Depth = 2.88"
36.41% Pervious = 1.546 ac 63.59% Impervious = 2.700 ac

Summary for Subcatchment 1S: Surface Runoff

Runoff = 1.59 cfs @ 12.23 hrs, Volume= 0.156 af, Depth= 1.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 Year Storm Rainfall=5.04"

	Area (sf)	CN	Description
*	9,450	98	Pavement
*	7,400	98	Basin Bottom
	4,200	96	Gravel surface, HSG A
	20,000	39	>75% Grass cover, Good, HSG A
	41,050	69	Weighted Average
	24,200		58.95% Pervious Area
	16,850		41.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.6	50	0.0120	0.06		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.43"
1.1	180	0.0270	2.65		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
15.7	230	Total			

Summary for Subcatchment 2S: New Building

Runoff = 2.46 cfs @ 12.08 hrs, Volume= 0.199 af, Depth= 4.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 Year Storm Rainfall=5.04"

Area (sf)	CN	Description
21,700	98	Roofs, HSG A
21,700		100.00% Impervious Area

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

Summary for Subcatchment 3S: East Property Line

Runoff = 0.00 cfs @ 14.84 hrs, Volume= 0.002 af, Depth= 0.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 Year Storm Rainfall=5.04"

Area (sf)	CN	Description
6,440	39	>75% Grass cover, Good, HSG A
2,860	30	Woods, Good, HSG A
9,300	36	Weighted Average
9,300		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	50	0.0660	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.43"
0.8	150	0.0340	2.97		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
8.2	200	Total			

Summary for Subcatchment 4S: Easement

Runoff = 0.00 cfs @ 14.96 hrs, Volume= 0.001 af, Depth= 0.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 Year Storm Rainfall=5.04"

Area (sf)	CN	Description
3,850	39	>75% Grass cover, Good, HSG A
2,350	30	Woods, Good, HSG A
6,200	36	Weighted Average
6,200		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.7	50	0.0100	0.05		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.43"
0.9	150	0.0300	2.79		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
16.6	200	Total			

Summary for Subcatchment 5S: Perf. Pipe Trench

Runoff = 6.01 cfs @ 12.09 hrs, Volume= 0.427 af, Depth= 2.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 Year Storm Rainfall=5.04"

	Area (sf)	CN	Description
*	43,580	98	Pavement
*	10,000	98	Roof
	27,640	39	>75% Grass cover, Good, HSG A
	81,220	78	Weighted Average
	27,640		34.03% Pervious Area
	53,580		65.97% Impervious Area

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

Summary for Subcatchment 6S: Truck Dock

Runoff = 0.43 cfs @ 12.08 hrs, Volume= 0.035 af, Depth= 4.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 Year Storm Rainfall=5.04"

	Area (sf)	CN	Description
*	2,280	98	Pavement
*	1,520	98	Building Facade at Dock
	3,800	98	Weighted Average
	3,800		100.00% Impervious Area

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

Summary for Subcatchment 7S: Front Half Roof

Runoff = 2.46 cfs @ 12.08 hrs, Volume= 0.199 af, Depth= 4.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 Year Storm Rainfall=5.04"

	Area (sf)	CN	Description
*	21,700	98	Roof
	21,700		100.00% Impervious Area

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

Summary for Pond 1P: Basin

[79] Warning: Submerged Pond 3P Primary device # 2 INLET by 0.16'

Inflow Area = 3.803 ac, 68.71% Impervious, Inflow Depth = 1.44" for 10 Year Storm event
Inflow = 7.26 cfs @ 12.14 hrs, Volume= 0.455 af
Outflow = 1.78 cfs @ 12.57 hrs, Volume= 0.455 af, Atten= 75%, Lag= 25.6 min
Discarded = 1.78 cfs @ 12.57 hrs, Volume= 0.455 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 72.16' @ 12.57 hrs Surf.Area= 9,315 sf Storage= 5,929 cf

Plug-Flow detention time= 37.0 min calculated for 0.455 af (100% of inflow)
Center-of-Mass det. time= 37.7 min (821.5 - 783.8)

Volume	Invert	Avail.Storage	Storage Description
#1	68.50'	480 cf	**2.00'W x 200.00'L x 3.00'H Prismatoid**
			1,200 cf Overall x 40.0% Voids
#2	71.50'	26,004 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
		26,484 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
71.50	7,400	0	0
72.00	8,660	4,015	4,015
73.00	10,221	9,441	13,456
74.00	14,875	12,548	26,004

Device	Routing	Invert	Outlet Devices
#1	Discarded	68.50'	**8.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=1.78 cfs @ 12.57 hrs HW=72.16' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 1.78 cfs)

Summary for Pond 2P: Stone Trench

Inflow Area = 0.498 ac,100.00% Impervious, Inflow Depth = 4.80" for 10 Year Storm event
Inflow = 2.46 cfs @ 12.08 hrs, Volume= 0.199 af
Outflow = 1.28 cfs @ 12.22 hrs, Volume= 0.199 af, Atten= 48%, Lag= 8.5 min
Discarded = 0.64 cfs @ 12.22 hrs, Volume= 0.194 af
Primary = 0.65 cfs @ 12.22 hrs, Volume= 0.005 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 75.31' @ 12.22 hrs Surf.Area= 1,550 sf Storage= 1,740 cf

Plug-Flow detention time= 16.9 min calculated for 0.199 af (100% of inflow)
Center-of-Mass det. time= 16.4 min (764.3 - 747.9)

Volume	Invert	Avail.Storage	Storage Description
#1	72.50'	1,860 cf	**5.00'W x 310.00'L x 3.00'H Prismatoid** 4,650 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	72.50'	**8.270 in/hr Exfiltration over Wetted area**
#2	Primary	75.30'	**310.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.64 cfs @ 12.22 hrs HW=75.31' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.64 cfs)

Primary OutFlow Max=0.31 cfs @ 12.22 hrs HW=75.31' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 0.31 cfs @ 0.18 fps)

Summary for Pond 3P: Perf Pipe/LPs

Inflow Area = 1.865 ac, 65.97% Impervious, Inflow Depth = 2.75" for 10 Year Storm event
Inflow = 6.01 cfs @ 12.09 hrs, Volume= 0.427 af
Outflow = 4.79 cfs @ 12.15 hrs, Volume= 0.427 af, Atten= 20%, Lag= 3.7 min
Discarded = 0.79 cfs @ 12.15 hrs, Volume= 0.332 af
Primary = 4.00 cfs @ 12.15 hrs, Volume= 0.094 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 73.05' @ 12.15 hrs Surf.Area= 1,687 sf Storage= 3,414 cf

Plug-Flow detention time= 28.5 min calculated for 0.427 af (100% of inflow)
Center-of-Mass det. time= 28.5 min (855.3 - 826.8)

Volume	Invert	Avail.Storage	Storage Description
#1	69.00'	2,740 cf	**6.00'W x 255.00'L x 5.00'H Excavation/Crushed Stone** 7,650 cf Overall - 801 cf Embedded = 6,849 cf x 40.0% Voids
#2	70.50'	801 cf	**24.0" Round Pipe Storage** Inside #1 L= 255.0'
#3	68.00'	336 cf	**10.00'D x 7.50'H Excavation/Crushed Stone** x 2 1,178 cf Overall - 339 cf Embedded = 839 cf x 40.0% Voids
#4	69.00'	339 cf	**6.00'D x 6.00'H Leaching Pit** x 2 Inside #3
		4,215 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	68.00'	**8.270 in/hr Exfiltration over Wetted area**
#2	Primary	72.00'	**18.0" Round Culvert** L= 10.0' Ke= 0.500 Inlet / Outlet Invert= 72.00' / 71.80' S= 0.0200 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf

Discarded OutFlow Max=0.79 cfs @ 12.15 hrs HW=73.05' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.79 cfs)

Primary OutFlow Max=4.00 cfs @ 12.15 hrs HW=73.05' (Free Discharge)
↑—**2=Culvert** (Barrel Controls 4.00 cfs @ 4.25 fps)

Summary for Pond 4P: Galleys

Inflow Area = 0.087 ac,100.00% Impervious, Inflow Depth = 4.80" for 10 Year Storm event
Inflow = 0.43 cfs @ 12.08 hrs, Volume= 0.035 af
Outflow = 0.09 cfs @ 12.49 hrs, Volume= 0.035 af, Atten= 78%, Lag= 24.3 min
Discarded = 0.09 cfs @ 12.49 hrs, Volume= 0.035 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 69.33' @ 12.49 hrs Surf.Area= 320 sf Storage= 368 cf

Plug-Flow detention time= 23.0 min calculated for 0.035 af (100% of inflow)
Center-of-Mass det. time= 23.0 min (770.9 - 747.9)

Volume	Invert	Avail.Storage	Storage Description
#1	67.00'	516 cf	**16.00'W x 20.00'L x 5.50'H Excavation/Crushed Stone** 1,760 cf Overall - 471 cf Embedded = 1,289 cf x 40.0% Voids
#2	68.00'	355 cf	**Concrete Galley 4x4x4** x 8 Inside #1 Inside= 42.0"W x 43.0"H => 12.67 sf x 3.50'L = 44.3 cf Outside= 52.8"W x 48.0"H => 14.72 sf x 4.00'L = 58.9 cf 8 Chambers in 2 Rows
		870 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	67.00'	**8.270 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.09 cfs @ 12.49 hrs HW=69.33' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.09 cfs)

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 1S: Surface Runoff Runoff Area=41,050 sf 41.05% Impervious Runoff Depth=2.74"
Flow Length=230' Tc=15.7 min CN=69 Runoff=2.23 cfs 0.215 af

Subcatchment 2S: New Building Runoff Area=21,700 sf 100.00% Impervious Runoff Depth=5.80"
Tc=6.0 min CN=98 Runoff=2.95 cfs 0.241 af

Subcatchment 3S: East Property Line Runoff Area=9,300 sf 0.00% Impervious Runoff Depth=0.30"
Flow Length=200' Tc=8.2 min CN=36 Runoff=0.02 cfs 0.005 af

Subcatchment 4S: Easement Runoff Area=6,200 sf 0.00% Impervious Runoff Depth=0.30"
Flow Length=200' Tc=16.6 min CN=36 Runoff=0.01 cfs 0.004 af

Subcatchment 5S: Perf. Pipe Trench Runoff Area=81,220 sf 65.97% Impervious Runoff Depth=3.61"
Tc=6.0 min CN=78 Runoff=7.89 cfs 0.562 af

Subcatchment 6S: Truck Dock Runoff Area=3,800 sf 100.00% Impervious Runoff Depth=5.80"
Tc=6.0 min CN=98 Runoff=0.52 cfs 0.042 af

Subcatchment 7S: Front Half Roof Runoff Area=21,700 sf 100.00% Impervious Runoff Depth=5.80"
Tc=6.0 min CN=98 Runoff=2.95 cfs 0.241 af

Pond 1P: Basin Peak Elev=72.68' Storage=10,760 cf Inflow=12.70 cfs 0.643 af
Outflow=1.94 cfs 0.643 af

Pond 2P: Stone Trench Peak Elev=75.32' Storage=1,748 cf Inflow=2.95 cfs 0.241 af
Discarded=0.64 cfs 0.220 af Primary=1.92 cfs 0.021 af Outflow=2.55 cfs 0.241 af

Pond 3P: Perf Pipe/LPs Peak Elev=73.45' Storage=3,694 cf Inflow=7.89 cfs 0.562 af
Discarded=0.83 cfs 0.396 af Primary=6.46 cfs 0.166 af Outflow=7.29 cfs 0.562 af

Pond 4P: Galleys Peak Elev=69.94' Storage=478 cf Inflow=0.52 cfs 0.042 af
Outflow=0.10 cfs 0.042 af

Total Runoff Area = 4.246 ac Runoff Volume = 1.310 af Average Runoff Depth = 3.70"
36.41% Pervious = 1.546 ac 63.59% Impervious = 2.700 ac

Summary for Subcatchment 1S: Surface Runoff

Runoff = 2.23 cfs @ 12.22 hrs, Volume= 0.215 af, Depth= 2.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 Year Storm Rainfall=6.04"

	Area (sf)	CN	Description
*	9,450	98	Pavement
*	7,400	98	Basin Bottom
	4,200	96	Gravel surface, HSG A
	20,000	39	>75% Grass cover, Good, HSG A
	41,050	69	Weighted Average
	24,200		58.95% Pervious Area
	16,850		41.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.6	50	0.0120	0.06		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.43"
1.1	180	0.0270	2.65		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
15.7	230	Total			

Summary for Subcatchment 2S: New Building

Runoff = 2.95 cfs @ 12.08 hrs, Volume= 0.241 af, Depth= 5.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 Year Storm Rainfall=6.04"

Area (sf)	CN	Description
21,700	98	Roofs, HSG A
21,700		100.00% Impervious Area

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

Summary for Subcatchment 3S: East Property Line

Runoff = 0.02 cfs @ 12.46 hrs, Volume= 0.005 af, Depth= 0.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 Year Storm Rainfall=6.04"

Area (sf)	CN	Description
6,440	39	>75% Grass cover, Good, HSG A
2,860	30	Woods, Good, HSG A
9,300	36	Weighted Average
9,300		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	50	0.0660	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.43"
0.8	150	0.0340	2.97		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
8.2	200	Total			

Summary for Subcatchment 4S: Easement

Runoff = 0.01 cfs @ 12.59 hrs, Volume= 0.004 af, Depth= 0.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 Year Storm Rainfall=6.04"

Area (sf)	CN	Description
3,850	39	>75% Grass cover, Good, HSG A
2,350	30	Woods, Good, HSG A
6,200	36	Weighted Average
6,200		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.7	50	0.0100	0.05		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.43"
0.9	150	0.0300	2.79		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
16.6	200	Total			

Summary for Subcatchment 5S: Perf. Pipe Trench

Runoff = 7.89 cfs @ 12.09 hrs, Volume= 0.562 af, Depth= 3.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 Year Storm Rainfall=6.04"

	Area (sf)	CN	Description
*	43,580	98	Pavement
*	10,000	98	Roof
	27,640	39	>75% Grass cover, Good, HSG A
	81,220	78	Weighted Average
	27,640		34.03% Pervious Area
	53,580		65.97% Impervious Area

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

Summary for Subcatchment 6S: Truck Dock

Runoff = 0.52 cfs @ 12.08 hrs, Volume= 0.042 af, Depth= 5.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 Year Storm Rainfall=6.04"

	Area (sf)	CN	Description
*	2,280	98	Pavement
*	1,520	98	Building Facade at Dock
	3,800	98	Weighted Average
	3,800		100.00% Impervious Area

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

Summary for Subcatchment 7S: Front Half Roof

Runoff = 2.95 cfs @ 12.08 hrs, Volume= 0.241 af, Depth= 5.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 Year Storm Rainfall=6.04"

	Area (sf)	CN	Description
*	21,700	98	Roof
	21,700		100.00% Impervious Area

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

Summary for Pond 1P: Basin

[81] Warning: Exceeded Pond 3P by 0.41' @ 12.89 hrs

Inflow Area = 3.803 ac, 68.71% Impervious, Inflow Depth = 2.03" for 25 Year Storm event
Inflow = 12.70 cfs @ 12.13 hrs, Volume= 0.643 af
Outflow = 1.94 cfs @ 12.62 hrs, Volume= 0.643 af, Atten= 85%, Lag= 29.8 min
Discarded = 1.94 cfs @ 12.62 hrs, Volume= 0.643 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 72.68' @ 12.62 hrs Surf.Area= 10,124 sf Storage= 10,760 cf

Plug-Flow detention time= 52.2 min calculated for 0.643 af (100% of inflow)
Center-of-Mass det. time= 52.0 min (829.6 - 777.6)

Volume	Invert	Avail.Storage	Storage Description
#1	68.50'	480 cf	**2.00'W x 200.00'L x 3.00'H Prismatoid** 1,200 cf Overall x 40.0% Voids
#2	71.50'	26,004 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
		26,484 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
71.50	7,400	0	0
72.00	8,660	4,015	4,015
73.00	10,221	9,441	13,456
74.00	14,875	12,548	26,004

Device	Routing	Invert	Outlet Devices
#1	Discarded	68.50'	**8.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=1.94 cfs @ 12.62 hrs HW=72.68' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 1.94 cfs)

Summary for Pond 2P: Stone Trench

Inflow Area = 0.498 ac,100.00% Impervious, Inflow Depth = 5.80" for 25 Year Storm event
Inflow = 2.95 cfs @ 12.08 hrs, Volume= 0.241 af
Outflow = 2.55 cfs @ 12.13 hrs, Volume= 0.241 af, Atten= 13%, Lag= 2.8 min
Discarded = 0.64 cfs @ 12.13 hrs, Volume= 0.220 af
Primary = 1.92 cfs @ 12.13 hrs, Volume= 0.021 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 75.32' @ 12.13 hrs Surf.Area= 1,550 sf Storage= 1,748 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 15.2 min (760.3 - 745.0)

Volume	Invert	Avail.Storage	Storage Description
#1	72.50'	1,860 cf	**5.00'W x 310.00'L x 3.00'H Prismatoid** 4,650 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	72.50'	**8.270 in/hr Exfiltration over Wetted area**
#2	Primary	75.30'	**310.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.64 cfs @ 12.13 hrs HW=75.32' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.64 cfs)

Primary OutFlow Max=1.85 cfs @ 12.13 hrs HW=75.32' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 1.85 cfs @ 0.32 fps)

Summary for Pond 3P: Perf Pipe/LPs

Inflow Area = 1.865 ac, 65.97% Impervious, Inflow Depth = 3.61" for 25 Year Storm event
Inflow = 7.89 cfs @ 12.09 hrs, Volume= 0.562 af
Outflow = 7.29 cfs @ 12.12 hrs, Volume= 0.562 af, Atten= 8%, Lag= 2.0 min
Discarded = 0.83 cfs @ 12.12 hrs, Volume= 0.396 af
Primary = 6.46 cfs @ 12.12 hrs, Volume= 0.166 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 73.45' @ 12.12 hrs Surf.Area= 1,687 sf Storage= 3,694 cf

Plug-Flow detention time= 26.7 min calculated for 0.561 af (100% of inflow)
Center-of-Mass det. time= 26.8 min (845.6 - 818.9)

Volume	Invert	Avail.Storage	Storage Description
#1	69.00'	2,740 cf	**6.00'W x 255.00'L x 5.00'H Excavation/Crushed Stone** 7,650 cf Overall - 801 cf Embedded = 6,849 cf x 40.0% Voids
#2	70.50'	801 cf	**24.0" Round Pipe Storage** Inside #1 L= 255.0'
#3	68.00'	336 cf	**10.00'D x 7.50'H Excavation/Crushed Stone** x 2 1,178 cf Overall - 339 cf Embedded = 839 cf x 40.0% Voids
#4	69.00'	339 cf	**6.00'D x 6.00'H Leaching Pit** x 2 Inside #3
		4,215 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	68.00'	**8.270 in/hr Exfiltration over Wetted area**
#2	Primary	72.00'	**18.0" Round Culvert** L= 10.0' Ke= 0.500 Inlet / Outlet Invert= 72.00' / 71.80' S= 0.0200 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf

Discarded OutFlow Max=0.83 cfs @ 12.12 hrs HW=73.44' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.83 cfs)

Primary OutFlow Max=6.45 cfs @ 12.12 hrs HW=73.44' (Free Discharge)
↑**2=Culvert** (Barrel Controls 6.45 cfs @ 4.72 fps)

Summary for Pond 4P: Galleys

Inflow Area = 0.087 ac,100.00% Impervious, Inflow Depth = 5.80" for 25 Year Storm event
Inflow = 0.52 cfs @ 12.08 hrs, Volume= 0.042 af
Outflow = 0.10 cfs @ 12.51 hrs, Volume= 0.042 af, Atten= 80%, Lag= 25.6 min
Discarded = 0.10 cfs @ 12.51 hrs, Volume= 0.042 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 69.94' @ 12.51 hrs Surf.Area= 320 sf Storage= 478 cf

Plug-Flow detention time= 28.9 min calculated for 0.042 af (100% of inflow)
Center-of-Mass det. time= 28.9 min (774.0 - 745.0)

Volume	Invert	Avail.Storage	Storage Description
#1	67.00'	516 cf	**16.00'W x 20.00'L x 5.50'H Excavation/Crushed Stone** 1,760 cf Overall - 471 cf Embedded = 1,289 cf x 40.0% Voids
#2	68.00'	355 cf	**Concrete Galley 4x4x4** x 8 Inside #1 Inside= 42.0"W x 43.0"H => 12.67 sf x 3.50'L = 44.3 cf Outside= 52.8"W x 48.0"H => 14.72 sf x 4.00'L = 58.9 cf 8 Chambers in 2 Rows
		870 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	67.00'	**8.270 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.10 cfs @ 12.51 hrs HW=69.94' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.10 cfs)

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 1S: Surface Runoff Runoff Area=41,050 sf 41.05% Impervious Runoff Depth=4.00"
Flow Length=230' Tc=15.7 min CN=69 Runoff=3.27 cfs 0.314 af

Subcatchment 2S: New Building Runoff Area=21,700 sf 100.00% Impervious Runoff Depth=7.34"
Tc=6.0 min CN=98 Runoff=3.71 cfs 0.305 af

Subcatchment 3S: East Property Line Runoff Area=9,300 sf 0.00% Impervious Runoff Depth=0.74"
Flow Length=200' Tc=8.2 min CN=36 Runoff=0.07 cfs 0.013 af

Subcatchment 4S: Easement Runoff Area=6,200 sf 0.00% Impervious Runoff Depth=0.74"
Flow Length=200' Tc=16.6 min CN=36 Runoff=0.05 cfs 0.009 af

Subcatchment 5S: Perf. Pipe Trench Runoff Area=81,220 sf 65.97% Impervious Runoff Depth=5.00"
Tc=6.0 min CN=78 Runoff=10.85 cfs 0.778 af

Subcatchment 6S: Truck Dock Runoff Area=3,800 sf 100.00% Impervious Runoff Depth=7.34"
Tc=6.0 min CN=98 Runoff=0.65 cfs 0.053 af

Subcatchment 7S: Front Half Roof Runoff Area=21,700 sf 100.00% Impervious Runoff Depth=7.34"
Tc=6.0 min CN=98 Runoff=3.71 cfs 0.305 af

Pond 1P: Basin Peak Elev=73.43' Storage=18,748 cf Inflow=17.94 cfs 0.957 af
Outflow=2.42 cfs 0.957 af

Pond 2P: Stone Trench Peak Elev=75.32' Storage=1,751 cf Inflow=3.71 cfs 0.305 af
Discarded=0.64 cfs 0.259 af Primary=3.04 cfs 0.045 af Outflow=3.68 cfs 0.304 af

Pond 3P: Perf Pipe/LPs Peak Elev=73.96' Storage=4,057 cf Inflow=10.85 cfs 0.778 af
Discarded=0.89 cfs 0.484 af Primary=9.12 cfs 0.294 af Outflow=10.01 cfs 0.778 af

Pond 4P: Galleys Peak Elev=70.92' Storage=654 cf Inflow=0.65 cfs 0.053 af
Outflow=0.12 cfs 0.053 af

Total Runoff Area = 4.246 ac Runoff Volume = 1.776 af Average Runoff Depth = 5.02"
36.41% Pervious = 1.546 ac 63.59% Impervious = 2.700 ac

Summary for Subcatchment 1S: Surface Runoff

Runoff = 3.27 cfs @ 12.22 hrs, Volume= 0.314 af, Depth= 4.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Year Storm Rainfall=7.58"

	Area (sf)	CN	Description
*	9,450	98	Pavement
*	7,400	98	Basin Bottom
	4,200	96	Gravel surface, HSG A
	20,000	39	>75% Grass cover, Good, HSG A
	41,050	69	Weighted Average
	24,200		58.95% Pervious Area
	16,850		41.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.6	50	0.0120	0.06		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.43"
1.1	180	0.0270	2.65		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
15.7	230	Total			

Summary for Subcatchment 2S: New Building

Runoff = 3.71 cfs @ 12.08 hrs, Volume= 0.305 af, Depth= 7.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Year Storm Rainfall=7.58"

Area (sf)	CN	Description
21,700	98	Roofs, HSG A
21,700		100.00% Impervious Area

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

Summary for Subcatchment 3S: East Property Line

Runoff = 0.07 cfs @ 12.31 hrs, Volume= 0.013 af, Depth= 0.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Year Storm Rainfall=7.58"

Area (sf)	CN	Description
6,440	39	>75% Grass cover, Good, HSG A
2,860	30	Woods, Good, HSG A
9,300	36	Weighted Average
9,300		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	50	0.0660	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.43"
0.8	150	0.0340	2.97		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
8.2	200	Total			

Summary for Subcatchment 4S: Easement

Runoff = 0.05 cfs @ 12.45 hrs, Volume= 0.009 af, Depth= 0.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Year Storm Rainfall=7.58"

Area (sf)	CN	Description
3,850	39	>75% Grass cover, Good, HSG A
2,350	30	Woods, Good, HSG A
6,200	36	Weighted Average
6,200		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.7	50	0.0100	0.05		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.43"
0.9	150	0.0300	2.79		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
16.6	200	Total			

Summary for Subcatchment 5S: Perf. Pipe Trench

Runoff = 10.85 cfs @ 12.09 hrs, Volume= 0.778 af, Depth= 5.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Year Storm Rainfall=7.58"

	Area (sf)	CN	Description
*	43,580	98	Pavement
*	10,000	98	Roof
	27,640	39	>75% Grass cover, Good, HSG A
	81,220	78	Weighted Average
	27,640		34.03% Pervious Area
	53,580		65.97% Impervious Area

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

Summary for Subcatchment 6S: Truck Dock

Runoff = 0.65 cfs @ 12.08 hrs, Volume= 0.053 af, Depth= 7.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Year Storm Rainfall=7.58"

	Area (sf)	CN	Description
*	2,280	98	Pavement
*	1,520	98	Building Facade at Dock
	3,800	98	Weighted Average
	3,800		100.00% Impervious Area

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

Summary for Subcatchment 7S: Front Half Roof

Runoff = 3.71 cfs @ 12.08 hrs, Volume= 0.305 af, Depth= 7.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Year Storm Rainfall=7.58"

	Area (sf)	CN	Description
*	21,700	98	Roof
	21,700		100.00% Impervious Area

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

Summary for Pond 1P: Basin

[81] Warning: Exceeded Pond 3P by 1.08' @ 13.06 hrs

Inflow Area = 3.803 ac, 68.71% Impervious, Inflow Depth = 3.02" for 100 Year Storm event
Inflow = 17.94 cfs @ 12.11 hrs, Volume= 0.957 af
Outflow = 2.42 cfs @ 12.66 hrs, Volume= 0.957 af, Atten= 87%, Lag= 33.3 min
Discarded = 2.42 cfs @ 12.66 hrs, Volume= 0.957 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 73.43' @ 12.66 hrs Surf.Area= 12,618 sf Storage= 18,748 cf

Plug-Flow detention time= 75.1 min calculated for 0.957 af (100% of inflow)
Center-of-Mass det. time= 75.1 min (846.8 - 771.7)

Volume	Invert	Avail.Storage	Storage Description
#1	68.50'	480 cf	**2.00'W x 200.00'L x 3.00'H Prismatoid** 1,200 cf Overall x 40.0% Voids
#2	71.50'	26,004 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
		26,484 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
71.50	7,400	0	0
72.00	8,660	4,015	4,015
73.00	10,221	9,441	13,456
74.00	14,875	12,548	26,004

Device	Routing	Invert	Outlet Devices
#1	Discarded	68.50'	**8.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=2.42 cfs @ 12.66 hrs HW=73.43' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 2.42 cfs)

Summary for Pond 2P: Stone Trench

Inflow Area = 0.498 ac,100.00% Impervious, Inflow Depth = 7.34" for 100 Year Storm event
Inflow = 3.71 cfs @ 12.08 hrs, Volume= 0.305 af
Outflow = 3.68 cfs @ 12.09 hrs, Volume= 0.304 af, Atten= 1%, Lag= 0.4 min
Discarded = 0.64 cfs @ 12.09 hrs, Volume= 0.259 af
Primary = 3.04 cfs @ 12.09 hrs, Volume= 0.045 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 75.32' @ 12.09 hrs Surf.Area= 1,550 sf Storage= 1,751 cf

Plug-Flow detention time= 15.0 min calculated for 0.304 af (100% of inflow)
Center-of-Mass det. time= 14.3 min (756.2 - 741.9)

Volume	Invert	Avail.Storage	Storage Description
#1	72.50'	1,860 cf	**5.00'W x 310.00'L x 3.00'H Prismatoid** 4,650 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	72.50'	**8.270 in/hr Exfiltration over Wetted area**
#2	Primary	75.30'	**310.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.64 cfs @ 12.09 hrs HW=75.32' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.64 cfs)

Primary OutFlow Max=2.85 cfs @ 12.09 hrs HW=75.32' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 2.85 cfs @ 0.37 fps)

Summary for Pond 3P: Perf Pipe/LPs

Inflow Area = 1.865 ac, 65.97% Impervious, Inflow Depth = 5.00" for 100 Year Storm event
Inflow = 10.85 cfs @ 12.09 hrs, Volume= 0.778 af
Outflow = 10.01 cfs @ 12.12 hrs, Volume= 0.778 af, Atten= 8%, Lag= 2.0 min
Discarded = 0.89 cfs @ 12.12 hrs, Volume= 0.484 af
Primary = 9.12 cfs @ 12.12 hrs, Volume= 0.294 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 73.96' @ 12.12 hrs Surf.Area= 1,687 sf Storage= 4,057 cf

Plug-Flow detention time= 25.0 min calculated for 0.777 af (100% of inflow)
Center-of-Mass det. time= 25.0 min (834.6 - 809.6)

Volume	Invert	Avail.Storage	Storage Description
#1	69.00'	2,740 cf	**6.00'W x 255.00'L x 5.00'H Excavation/Crushed Stone** 7,650 cf Overall - 801 cf Embedded = 6,849 cf x 40.0% Voids
#2	70.50'	801 cf	**24.0" Round Pipe Storage** Inside #1 L= 255.0'
#3	68.00'	336 cf	**10.00'D x 7.50'H Excavation/Crushed Stone** x 2 1,178 cf Overall - 339 cf Embedded = 839 cf x 40.0% Voids
#4	69.00'	339 cf	**6.00'D x 6.00'H Leaching Pit** x 2 Inside #3
		4,215 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	68.00'	**8.270 in/hr Exfiltration over Wetted area**
#2	Primary	72.00'	**18.0" Round Culvert** L= 10.0' Ke= 0.500 Inlet / Outlet Invert= 72.00' / 71.80' S= 0.0200 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf

Discarded OutFlow Max=0.89 cfs @ 12.12 hrs HW=73.96' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.89 cfs)

Primary OutFlow Max=9.15 cfs @ 12.12 hrs HW=73.96' (Free Discharge)
↑**2=Culvert** (Barrel Controls 9.15 cfs @ 5.21 fps)

Summary for Pond 4P: Galleys

Inflow Area = 0.087 ac,100.00% Impervious, Inflow Depth = 7.34" for 100 Year Storm event
Inflow = 0.65 cfs @ 12.08 hrs, Volume= 0.053 af
Outflow = 0.12 cfs @ 12.53 hrs, Volume= 0.053 af, Atten= 82%, Lag= 26.9 min
Discarded = 0.12 cfs @ 12.53 hrs, Volume= 0.053 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 70.92' @ 12.53 hrs Surf.Area= 320 sf Storage= 654 cf

Plug-Flow detention time= 37.7 min calculated for 0.053 af (100% of inflow)
Center-of-Mass det. time= 37.7 min (779.5 - 741.9)

Volume	Invert	Avail.Storage	Storage Description
#1	67.00'	516 cf	**16.00'W x 20.00'L x 5.50'H Excavation/Crushed Stone** 1,760 cf Overall - 471 cf Embedded = 1,289 cf x 40.0% Voids
#2	68.00'	355 cf	**Concrete Galley 4x4x4** x 8 Inside #1 Inside= 42.0"W x 43.0"H => 12.67 sf x 3.50'L = 44.3 cf Outside= 52.8"W x 48.0"H => 14.72 sf x 4.00'L = 58.9 cf 8 Chambers in 2 Rows
		870 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	67.00'	**8.270 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.12 cfs @ 12.53 hrs HW=70.92' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.12 cfs)

INSTRUCTIONS:

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

Version 1, Automated: Mar. 4, 2008

Location: 55 Charlotte Furnace Road, Wareham, MA

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	0.25	1.00	0.25	0.75
Oil Grit Separator	0.25	0.75	0.19	0.56
Infiltration Trench	0.80	0.56	0.45	0.11
	0.00	0.11	0.00	0.11
	0.00	0.11	0.00	0.11

Total TSS Removal = 89%

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

Project: Master Millwork

Prepared By: GAF Engineering, Inc.

Date: 8-Jul-20

*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: 55 Charlotte Furnace Road, Wareham

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 & Hooded Catch Basin	0.25	1.00	0.25	0.75
WQS #1 CDS 2015-4	0.88	0.75	0.66	0.09
Infiltration Trench	0.80	0.09	0.07	0.02

Total TSS Removal = 98 %

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

Project: Master Millwork
Prepared By: GAF Engineering
Date: 10-Jun-20

*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: 55 Charlotte Furnace Road, Wareham

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)
WQS #2 CDS 1515-3	0.92	1.00	0.92	0.08
Infiltration Basin	0.80	0.08	0.06	0.02

Total TSS Removal = 98 %

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

Project: Master Millwork

Prepared By: GAT Engineering

Date: 10-JUN-20

*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

Recharge Volume Calculation

Required Recharge Depth = 0.60 inch volume from impervious surfaces (HSG A Soil)

The 1.00 inch water quality volume calculations confirm that the capacity of the infiltration basin and leaching galley system exceed that required volume therefore they also exceed the 0.60 inch required recharge volume. The system drawdown calculations are as follows. The storage volume input is based on the 100 year volume listed in the HydroCAD calculations for each system.

Recharge System Drawdown time (72 hrs. max.)

$$\text{Time} = \frac{\text{Storage Volume}}{(\text{Rawls Rate})\ (\text{Bottom Area})}$$

Infiltration Basin - Pond 1P:

$$\text{Time} = \frac{18{,}748 \text{ cf}}{(8.27 \text{ inches/hour})(1 \text{ ft}/12 \text{ inches})(7{,}400 \text{ sf})}$$

3.7 hours ≤ 72 hours – OK

Crushed Stone Trench – Pond 2P:

$$\text{Time} = \frac{1{,}751 \text{ cf}}{(8.27 \text{ inches/hour})(1 \text{ ft}/12 \text{ inches})(1550 \text{ sf})}$$

1.6 hours ≤ 72 hours - OK

Perf Pipe/Leaching Pits – Pond 3P:

$$\text{Time} = \frac{4{,}057 \text{ cf}}{(8.27 \text{ inches/hour})(1 \text{ ft}/12\text{inches})(1{,}530 \text{ sf})}$$

3.8 hours ≤ 72 hours – OK

Galley Chambers:

$$\text{Time} = \frac{654 \text{ cf}}{(8.27 \text{ inches/hour})(1 \text{ ft}/12 \text{ inches})(320 \text{ sf})}$$

3.0 hours ≤ 72 hours - OK

Water Quality Volume Calculation

Required Water Quality Depth = 1.00 inch volume from impervious surfaces.

Contech WQS #1 and WQS #2 provide pretreatment of the 1" WQV. See flow rate sheets.

Impervious Pavement to Infiltration Basin 1P = 9,450 sf

Impervious Roof to Crushed Stone Trench 2P = 43,400 sf

Impervious Pavement and Roof to Leaching Pits and Pipe 3P = 43,580 sf

Since Pond 2P and 3P overflows are directed to Pond 1P the volumes may be combined.

Total Impervious Area = 9,450 sf + 43,400 sf + 43,580 sf = 96,430 sf

Water Quality Volume = 96,430 sf x 1.00"/12 = 8,036 cf

Total Storage: Infiltration Basin Pond 1P = 19,686 cf
Crushed Stone Trench Pond 2P = 1,763 cf
Perforated Pipe/Leaching Pits Pond 3P = 4,057 cf

Total Storage = 25,506 cf

25,506 cf > 8,036 cf OK

Impervious Pavement to CB #4 (Loading Dock) = 2,280 sf

2,280 sf x 1.00"/12 = 190 cf

Storage in First Chamber of Oil/Grit Separator = 6'-4" x 5'-6" x 6'-0" = 208.9 cf

Total Storage in Galley Chamber System = 654 cf

654 cf > 190 cf OK

Project:	Master Millwork
Location:	Wareham, MA
Prepared For:	GAF Engineering

CONTECH ENGINEERED SOLUTIONS

Purpose: To calculate the water quality flow rate (WQF) over a given site area. In this situation the WQF is derived from the first 1" of runoff from the contributing impervious surface.

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

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

Compute Q Rate using the following equation:

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

where:

Q = flow rate associated with first 1" of runoff
qu = the unit peak discharge, in csm/in.
A = impervious surface drainage area (in square miles)
WQV = water quality volume in watershed inches (1" in this case)

Structure Name	Impv. (acres)	A (miles^2)	t_c (min)	t_c (hr)	WQV (in)	qu (csm/in.)	Q (cfs)
WQS #1	1.00	0.0015625	6.0	0.100	1.00	774.00	1.21
WQS #2	0.22	0.0003438	6.0	0.100	1.00	774.00	0.27

CONTECH® ENGINEERED SOLUTIONS

CDS TECHNOLOGIES

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION BASED ON THE RATIONAL RAINFALL METHOD

MASTER MILLWORK
WAREHAM, MA

Area	1.00 ac	Unit Site Designation	WQS #1
Weighted C	0.9	Rainfall Station #	68
t_c	6 min		
CDS Model	2015-4	CDS Treatment Capacity	1.4 cfs

Rainfall Intensity[1] (in/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (cfs)	Treated Flowrate (cfs)	Incremental Removal (%)
0.02	9.3%	9.3%	0.02	0.02	9.3
0.04	9.5%	18.8%	0.04	0.04	9.5
0.06	8.7%	27.5%	0.05	0.05	8.7
0.08	10.1%	37.6%	0.07	0.07	10.0
0.10	7.2%	44.8%	0.09	0.09	7.0
0.12	6.0%	50.8%	0.11	0.11	5.9
0.14	6.3%	57.1%	0.13	0.13	6.1
0.16	5.6%	62.7%	0.14	0.14	5.4
0.18	4.7%	67.4%	0.16	0.16	4.5
0.20	3.6%	71.0%	0.18	0.18	3.4
0.25	8.2%	79.1%	0.23	0.23	7.6
0.50	14.9%	94.0%	0.45	0.45	12.8
0.75	3.2%	97.3%	0.68	0.68	2.5
1.00	1.2%	98.5%	0.90	0.90	0.9
1.50	0.7%	99.2%	1.35	1.35	0.4
2.00	0.8%	100.0%	1.80	1.40	0.3
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
					94.4
				Removal Efficiency Adjustment[2] =	6.5%
				Predicted % Annual Rainfall Treated =	93.4%
				Predicted Net Annual Load Removal Efficiency =	**88.0%**

1 - Based on 10 years of rainfall data from NCDC station 736, Blue Hill, Norfolk County, MA
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

CONTECH® ENGINEERED SOLUTIONS

CDS TECHNOLOGIES

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION BASED ON THE RATIONAL RAINFALL METHOD

MASTER MILLWORK
WAREHAM, MA

Area	0.22 ac	Unit Site Designation	WQS #2
Weighted C	0.9	Rainfall Station #	68
t_c	6 min		
CDS Model	1515-3	CDS Treatment Capacity	1.0 cfs

Rainfall Intensity[1] (in/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (cfs)	Treated Flowrate (cfs)	Incremental Removal (%)
0.02	9.3%	9.3%	0.00	0.00	9.3
0.04	9.5%	18.8%	0.01	0.01	9.5
0.06	8.7%	27.5%	0.01	0.01	8.7
0.08	10.1%	37.6%	0.02	0.02	10.1
0.10	7.2%	44.8%	0.02	0.02	7.2
0.12	6.0%	50.8%	0.02	0.02	6.0
0.14	6.3%	57.1%	0.03	0.03	6.3
0.16	5.6%	62.7%	0.03	0.03	5.6
0.18	4.7%	67.4%	0.04	0.04	4.7
0.20	3.6%	71.0%	0.04	0.04	3.6
0.25	8.2%	79.1%	0.05	0.05	8.1
0.50	14.9%	94.0%	0.10	0.10	14.4
0.75	3.2%	97.3%	0.15	0.15	3.0
1.00	1.2%	98.5%	0.20	0.20	1.1
1.50	0.7%	99.2%	0.30	0.30	0.6
2.00	0.8%	100.0%	0.40	0.40	0.6
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
					98.9
				Removal Efficiency Adjustment[2] =	6.5%
				Predicted % Annual Rainfall Treated =	93.5%
				Predicted Net Annual Load Removal Efficiency =	**92.4%**

1 - Based on 10 years of rainfall data from NCDC station 736, Blue Hill, Norfolk County, MA
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

Hydrologic Soil Group—Plymouth County, Massachusetts
(55 Charlotte Furnace Road)

Map Scale: 1:7,650 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 100 200 400 600

Feet: 0 350 700 1400 2100

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

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

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

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: Plymouth County, Massachusetts
Survey Area Data: Version 11, Sep 7, 2018

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

Date(s) aerial images were photographed: Dec 31, 2009—Jul 3, 2017

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
1	Water		7.3	2.8%
7A	Rainberry coarse sand, 0 to 3 percent slopes, sanded surface	A/D	5.6	2.1%
52A	Freetown muck, 0 to 1 percent slopes	B/D	1.4	0.5%
53A	Freetown muck, ponded, 0 to 1 percent slopes	B/D	6.9	2.6%
55A	Freetown coarse sand, 0 to 3 percent slopes, sanded surface	B/D	2.0	0.8%
60A	Swansea coarse sand, 0 to 2 percent slopes	B/D	12.8	4.8%
69A	Mattapoisett loamy sand, 0 to 3 percent slopes, extremely stony	D	1.7	0.6%
252A	Carver coarse sand, 0 to 3 percent slopes	A	87.9	33.2%
252B	Carver coarse sand, 3 to 8 percent slopes	A	5.3	2.0%
259A	Carver loamy coarse sand, 0 to 3 percent slopes	A	10.2	3.8%
259B	Carver loamy coarse sand, 3 to 8 percent slopes	A	37.6	14.2%
259C	Carver loamy coarse sand, 8 to 15 percent slopes	A	4.0	1.5%
435B	Plymouth loamy coarse sand, 3 to 8 percent slopes	A	0.4	0.2%
438B	Plymouth loamy coarse sand, 3 to 8 percent slopes, extremely bouldery	A	6.1	2.3%
637B	Carver - Urban land complex, 0 to 8 percent slopes	A	39.9	15.0%
656B	Udorthents - Urban land complex, 0 to 8 percent slopes	B	0.8	0.3%
657A	Aquepts, 0 to 3 percent slopes	D	5.7	2.2%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
665B	Udipsamments, 0 to 8 percent slopes	A	8.4	3.2%
700A	Udipsamments, wet substratum, 0 to 3 percent slopes	A/D	13.9	5.2%
702C	Udipsamments, 8 to 15 percent slopes	A	7.2	2.7%
Totals for Area of Interest			**265.2**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

NOAA Atlas 14, Volume 10, Version 3
Location name: West Wareham, Massachusetts, USA*
Latitude: 41.7986°, Longitude: -70.7467°
Elevation: 78.71 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

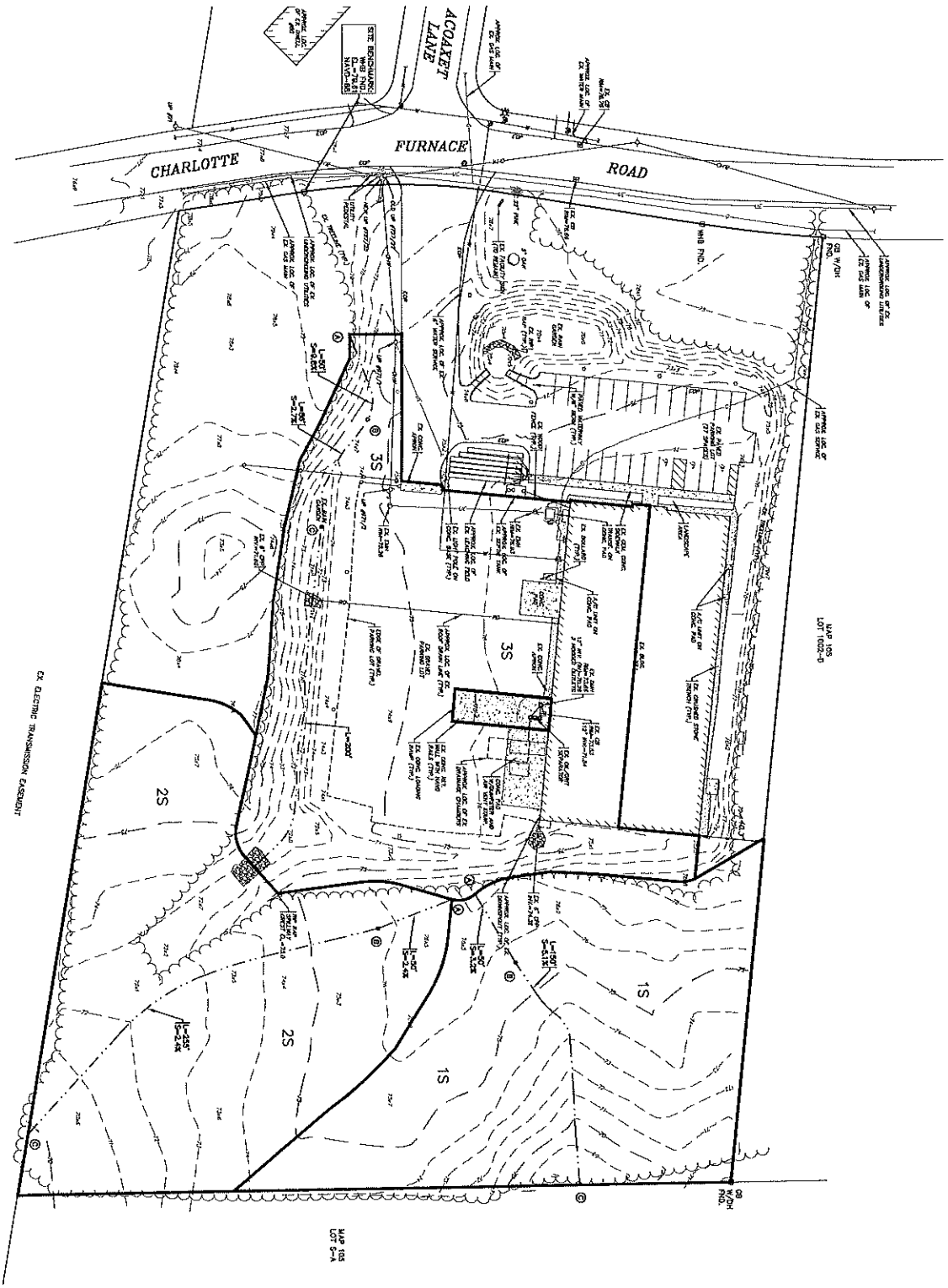
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.295 (0.238-0.361)	0.366 (0.294-0.448)	0.482 (0.386-0.591)	0.578 (0.461-0.712)	0.710 (0.550-0.908)	0.808 (0.615-1.05)	0.914 (0.678-1.23)	1.04 (0.725-1.40)	1.23 (0.823-1.70)	1.38 (0.908-1.95)
10-min	0.418 (0.337-0.511)	0.518 (0.417-0.634)	0.682 (0.547-0.837)	0.819 (0.653-1.01)	1.01 (0.779-1.29)	1.15 (0.870-1.49)	1.29 (0.960-1.74)	1.47 (1.03-1.99)	1.74 (1.17-2.41)	1.96 (1.29-2.76)
15-min	0.492 (0.396-0.601)	0.610 (0.491-0.746)	0.803 (0.644-0.985)	0.963 (0.768-1.19)	1.18 (0.916-1.51)	1.35 (1.02-1.75)	1.52 (1.13-2.05)	1.73 (1.21-2.34)	2.04 (1.37-2.83)	2.30 (1.51-3.24)
30-min	0.704 (0.567-0.861)	0.872 (0.702-1.07)	1.15 (0.921-1.41)	1.38 (1.10-1.70)	1.69 (1.31-2.16)	1.93 (1.46-2.51)	2.18 (1.61-2.93)	2.47 (1.73-3.34)	2.92 (1.96-4.04)	3.29 (2.16-4.63)
60-min	0.916 (0.738-1.12)	1.14 (0.913-1.39)	1.49 (1.20-1.83)	1.79 (1.43-2.21)	2.20 (1.70-2.81)	2.50 (1.90-3.26)	2.83 (2.10-3.80)	3.22 (2.24-4.35)	3.79 (2.55-5.26)	4.28 (2.81-6.02)
2-hr	1.22 (0.992-1.49)	1.53 (1.24-1.85)	2.02 (1.63-2.46)	2.43 (1.95-2.97)	2.99 (2.34-3.81)	3.41 (2.62-4.41)	3.86 (2.90-5.17)	4.41 (3.10-5.91)	5.24 (3.55-7.21)	5.96 (3.95-8.30)
3-hr	1.44 (1.17-1.74)	1.79 (1.46-2.17)	2.36 (1.92-2.87)	2.84 (2.29-3.46)	3.49 (2.74-4.42)	3.98 (3.06-5.13)	4.50 (3.39-6.00)	5.14 (3.63-6.85)	6.11 (4.16-8.35)	6.95 (4.63-9.63)
6-hr	1.88 (1.54-2.26)	2.30 (1.88-2.77)	2.99 (2.44-3.60)	3.56 (2.89-4.31)	4.34 (3.43-5.45)	4.93 (3.82-6.29)	5.55 (4.21-7.31)	6.30 (4.49-8.32)	7.43 (5.11-10.1)	8.39 (5.65-11.5)
12-hr	2.40 (1.98-2.87)	2.87 (2.37-3.43)	3.64 (2.99-4.36)	4.28 (3.50-5.14)	5.16 (4.09-6.40)	5.81 (4.53-7.33)	6.51 (4.94-8.43)	7.30 (5.26-9.55)	8.46 (5.87-11.3)	9.41 (6.39-12.8)
24-hr	2.90 (2.41-3.43)	3.43 (2.85-4.07)	4.31 (3.57-5.12)	5.04 (4.15-6.01)	6.04 (4.82-7.42)	6.79 (5.32-8.47)	7.58 (5.78-9.69)	8.45 (6.14-10.9)	9.69 (6.79-12.8)	10.7 (7.32-14.4)
2-day	3.33 (2.78-3.91)	3.96 (3.31-4.66)	5.00 (4.16-5.90)	5.86 (4.85-6.94)	7.04 (5.67-8.59)	7.93 (6.27-9.81)	8.87 (6.82-11.2)	9.90 (7.25-12.7)	11.4 (8.04-14.9)	12.6 (8.68-16.7)
3-day	3.64 (3.06-4.27)	4.32 (3.62-5.06)	5.41 (4.53-6.36)	6.32 (5.27-7.46)	7.58 (6.13-9.19)	8.53 (6.76-10.5)	9.51 (7.34-12.0)	10.6 (7.80-13.5)	12.1 (8.62-15.8)	13.3 (9.28-17.7)
4-day	3.93 (3.31-4.59)	4.62 (3.89-5.40)	5.74 (4.82-6.73)	6.68 (5.58-7.85)	7.96 (6.46-9.62)	8.94 (7.11-10.9)	9.95 (7.69-12.5)	11.0 (8.16-14.0)	12.6 (8.97-16.3)	13.8 (9.63-18.2)
7-day	4.68 (3.97-5.44)	5.40 (4.57-6.28)	6.58 (5.55-7.66)	7.55 (6.34-8.83)	8.89 (7.25-10.6)	9.92 (7.92-12.0)	11.0 (8.50-13.6)	12.0 (8.98-15.2)	13.5 (9.73-17.4)	14.7 (10.3-19.2)
10-day	5.39 (4.58-6.24)	6.13 (5.21-7.10)	7.34 (6.22-8.52)	8.35 (7.04-9.73)	9.74 (7.96-11.6)	10.8 (8.66-13.0)	11.9 (9.23-14.6)	13.0 (9.71-16.3)	14.4 (10.4-18.5)	15.5 (11.0-20.1)
20-day	7.48 (6.41-8.60)	8.30 (7.11-9.55)	9.65 (8.23-11.1)	10.8 (9.14-12.4)	12.3 (10.1-14.5)	13.5 (10.9-16.1)	14.7 (11.5-17.8)	15.8 (11.9-19.6)	17.2 (12.6-21.8)	18.2 (13.0-23.4)
30-day	9.23 (7.94-10.6)	10.1 (8.70-11.6)	11.6 (9.93-13.3)	12.8 (10.9-14.7)	14.5 (12.0-16.9)	15.8 (12.8-18.7)	17.0 (13.3-20.5)	18.2 (13.8-22.4)	19.6 (14.4-24.7)	20.5 (14.8-26.2)
45-day	11.4 (9.87-13.0)	12.4 (10.7-14.2)	14.0 (12.1-16.0)	15.4 (13.2-17.6)	17.2 (14.3-20.0)	18.7 (15.2-21.9)	20.0 (15.7-23.9)	21.2 (16.2-26.0)	22.6 (16.8-28.4)	23.5 (17.0-29.9)
60-day	13.3 (11.5-15.1)	14.3 (12.4-16.3)	16.1 (13.9-18.3)	17.5 (15.0-20.0)	19.5 (16.2-22.6)	21.1 (17.2-24.7)	22.6 (17.8-26.7)	23.8 (18.3-29.1)	25.2 (18.7-31.5)	26.1 (18.9-33.0)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Back to Top



PERMIT SET
(NOT FOR CONSTRUCTION)

JOB NO.: 19-9342
DWG. 1 OF 2

PRE-DEVELOPMENT WATERSHED PLAN

55 CHARLOTTE FURNACE ROAD WAREHAM, MA

PREPARED FOR:

MASTER MILLWORK, INC.

41 MEETING HOUSE LANE, SUITE 11 SAGAMORE BEACH, MA

G.A.F. ENGINEERING, INC.
PROFESSIONAL ENGINEERS & LAND SURVEYORS
266 MAIN STREET - WAREHAM, MA 02571
TEL: (508) 295-6600 FAX: (508) 295-6634
E-MAIL: gaf@gaf-eng.com

APPROVED BY:

APPROVED BY:

DATE: JULY 8, 2020
DRAWN BY: AJP
CHECKED BY: MTM
JOB NO.: 19-9342
SCALE: 1" = 30'

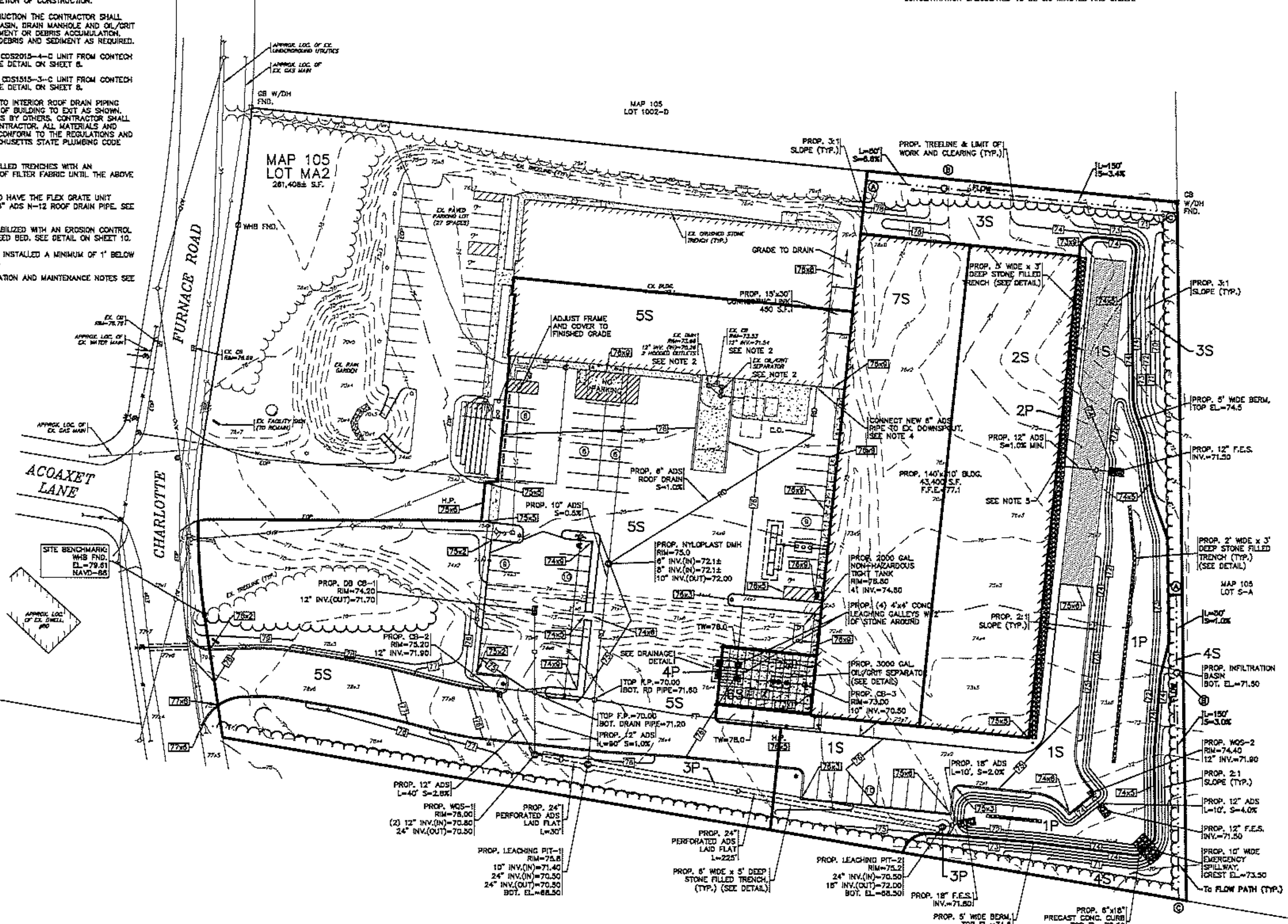
REV.	DATE	BY	APP'D	DESCRIPTION

NOTES:

1. ALL EXISTING CATCH BASINS, PROPOSED CATCH BASINS AND WATER QUALITY CATCH BASINS SHALL HAVE A TEMPORARY SILT SACK OR AN APPROVED EQUAL INSTALLED IN THEM AS SOON AS THE STRUCTURE IS SET. CONTRACTOR SHALL REMOVE AND DISPOSE OF THE SILT SACKS AT THE COMPLETION OF CONSTRUCTION.
2. AT THE COMPLETION OF CONSTRUCTION THE CONTRACTOR SHALL INSPECT THE EXISTING CATCH BASIN, DRAIN MANHOLE AND OIL/GRIT SEPARATOR FOR EVIDENCE SEDIMENT OR DEBRIS ACCUMULATION. REMOVE AND DISPOSE OF ANY DEBRIS AND SEDIMENT AS REQUIRED.
3. PROPOSED WQS-1 SHALL BE A CDS2015-4-C UNIT FROM CONTECH ENGINEERED SOLUTIONS LLC. SEE DETAIL ON SHEET 8.
4. PROPOSED WQS-2 SHALL BE A CDS1515-3-C UNIT FROM CONTECH ENGINEERED SOLUTIONS LLC. SEE DETAIL ON SHEET 8.
5. INSTALL FRONT ROOF GUTTERS TO INTERIOR ROOF DRAIN PIPING AND INSTALL UNDER THE SLAB OF BUILDING TO EXIT AS SHOWN. REFER TO ARCHITECTURAL PLANS BY OTHERS. CONTRACTOR SHALL COORDINATE WITH PLUMBING CONTRACTOR. ALL MATERIALS AND INSTALLATION METHODS SHALL CONFORM TO THE REGULATIONS AND SPECIFICATIONS OF THE MASSACHUSETTS STATE PLUMBING CODE (248 CMR 10.00).
6. COVER ALL PROPOSED STONE FILLED TRENCHES WITH AN ADDITIONAL TEMPORARY LAYER OF FILTER FABRIC UNTIL THE ABOVE GRADIENT SLOPE IS STABILIZED.
7. MODIFY EXISTING DOWNSPOUT TO HAVE THE FLEX GRATE UNIT INSTALLED AND CONNECT NEW 8" ADS N-12 ROOF DRAIN PIPE. SEE DOWNSPOUT DETAIL.
8. 2:1 SIDE SLOPES SHALL BE STABILIZED WITH AN EROSION CONTROL BLANKET OVER THE PLANTED SEED BED. SEE DETAIL ON SHEET 10.
9. WATER MAIN/SERVICE SHALL BE INSTALLED A MINIMUM OF 1' BELOW ALL PROPOSED DRAINAGE LINES.
10. FOR COMPLETE DRAINAGE OPERATION AND MAINTENANCE NOTES SEE SHEET 2.

FLOW PATH NOTE:

1. FLOW PATHS NOT SHOWN FOR WATERSHEDS WITH TIMES OF CONCENTRATION CALCULATED TO BE 6.0 MINUTES AND UNDER.



POST-DEVELOPMENT

SCALE: 1"=30'

0 30 60 120

PERMIT SET
(NOT FOR CONSTRUCTION)

REV.	DATE	BY	APP'D	DESCRIPTION

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DRAWN BY: JJP
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POST-DEVELOPMENT WATERSHED PLAN
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PREPARED FOR:
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41 MEETING HOUSE LANE, SUITE 11 SAGAMORE BEACH, MA

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DWG. 2 OF 2