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STORMWATER REPORT

For

"3127 Cranberry Highway Site Development"

3127 Cranberry Highway
Wareham, MA

Prepared for

Peter Koulouras
P.O. Box 961
N. Falmouth, MA 02556

Prepared by

G.A.F. Engineering, Inc.
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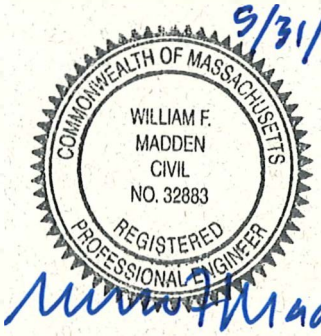
5/31/23



May 25, 2023
G.A.F. Job No.: 22-9890

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DRAINAGE NARRATIVE

General Description

This project consists of the redevelopment of a 15,881 square foot lot which is vacant and covered with impervious pavement and concrete pads. A 35'x 40' commercial building will be constructed with associated utilities, landscaping, and stormwater management system. Development of the project will result in a 33% reduction in impervious surfaces. All of the site runoff from the pavement and building roof will be collected and treated prior to infiltration. There are no new drainage outfalls associated with the project.

Existing Conditions

The lot is entirely surfaced with pavement or concrete. The drainage system consists of a single catch basin at a low point in the center of the lot on the south side approximately 40 feet from the property line with the railroad. The catch basin discharges to an underground storage and infiltration system of undetermined capacity and performance. For the purpose of this analysis it is assumed that there is no offsite discharge from this system or property.

Soils as mapped by the USDA Natural Resources Conservation Service consist of Carver – Urban land complex (637B), 0 to 8 percent slopes. These soils have a Hydrologic soil group (HSG) rating "A".

A design point was established at the existing catch basin for comparison of the existing rate and volume of runoff which is partially treated and infiltrated to the reduced volume resulting from the proposed project and the establishment of landscaped buffers.

The volumes input for each storm event are as listed in the Point Precipitation Frequency Estimates published by NOAA Atlas 14, Volume 10, Version 3.

Proposed Conditions

The stormwater management system consists of a proprietary catch basin with discharge to an underground storage and infiltration system consisting of four rows of nine concrete galleys, and a long narrow depression in the landscape area along the south property line which receives runoff solely from landscaped areas and will function similar to an infiltration basin.

All of the impervious surfaces are routed to the proprietary catch basin in order to provide total suspended solids removal in excess of the required 44% prior to infiltration in HSG "A" soils. The unit will also provide retention of coarse sediment, floatables, and oil/petroleum. Inspection and maintenance requirements for this system are included on the plans and in this report. The watershed for the area which drains to the catch basin

has been input as sub-catchment 1S in the calculations with the concrete galleys input as pond 1P.

Four inch high steel landscape edging will be installed along the side and rear property lines to contain the mulch and vegetation and prevent the transmission of runoff into and out of the landscaping. A portion of the landscaping along the south property line adjacent to the railroad has been specified with a bottom area one foot wide and one foot deep to contain and infiltrate runoff from the landscape areas which are lower than the adjacent pavement. An infiltration rate of 2.41 inches per hour has been utilized in the calculations, which is the Rawls Rate for loamy sand. The landscape area is modeled as watershed 2S and the low point pond 2P in the calculations.

Both the concrete galley system and landscaped depression store and infiltrate all calculated storm events including the 100 year event. The summary table that follows provides a comparison of existing and proposed flow rates and volumes to the existing and proposed single catch basins, which are located in close proximity on the lot. This provides documentation of the benefit resulting from the reduction in impervious surface as a 100% redevelopment project. No waivers from full compliance are being requested.

In summary, the development of the project in accordance with the design will provide the required stormwater runoff mitigation as well as protection to downgradient properties in compliance with the Massachusetts Stormwater Handbook and the applicable Town of Wareham rules and regulations.

Drainage Summary

Table 1 – Pre-Development vs. Post-Development to Catch Basin (1S/2S)

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	1.22	0.097	0.75	0.054	-0.47	-0.043
10 yr	1.79	0.146	1.23	0.090	-0.56	-0.056
25 yr	2.15	0.176	1.53	0.113	-0.62	-0.063
100 yr	2.70	0.222	1.99	0.149	-0.71	-0.073

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.

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[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.

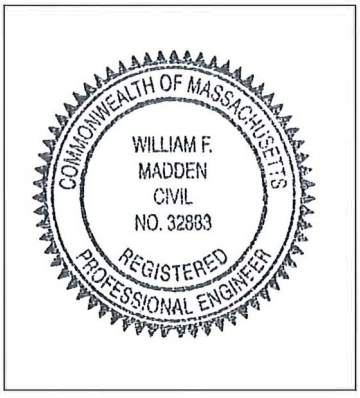
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the 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 5/3/23
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 new stormwater conveyances or outfalls.*

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 this standard has been met.*

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 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 has specified a proprietary catch basin unit which exceeds the required TSS removal rate for pretreatment based on the DEP Standard*

Method to Convert Required Water Quality Volume to a Discharge Rate for Sizing Flow. The combination of proprietary structures and infiltration chambers provides 96% 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 load.*

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 and there are no critical areas downstream from the property.*

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 100% redevelopment. Impervious surfaces are being reduced by approximately 33%. Full compliance is provided for all of the Stormwater Management Standards.*

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 post-construction operation and maintenance plan shall be developed and implemented to ensure that stormwater management systems function as designed.

    - *The post-construction operation and maintenance plan has been listed on the design plans and in this report.*

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

    - *An illicit discharge statement is included in this report.*

Date: 5/30/2023

To whom it may concern:

I hereby certify that no illicit discharge connections presently exist nor will any be permitted in the future for the property and future commercial development located at 3127 Cranberry Highway, Map 8 Parcel B which is a portion of Map 8 Lot 1022A.

Peter Koulouras, by Attorney

Peter Koulouras

Existing Conditions

Subcat Reach Pond Link

Routing Diagram for 9890PRE
Prepared by GAF Engineering, Inc, Printed 5/31/2023
HydroCAD® 10.20-3c s/n 02319 © 2023 HydroCAD Software Solutions LLC

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2 Year Storm	Type III 24-hr		Default	24.00	1	3.44	2
2	10 Year Storm	Type III 24-hr		Default	24.00	1	5.03	2
3	25 Year Storm	Type III 24-hr		Default	24.00	1	6.02	2
4	100 Year Storm	Type III 24-hr		Default	24.00	1	7.55	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.365	98	Paved parking, HSG A (1S)
0.365	**98**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.365	HSG A	1S
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.000	Other	
0.365		**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
0.365	0.000	0.000	0.000	0.000	0.365	Paved parking	1S
0.365	**0.000**	**0.000**	**0.000**	**0.000**	**0.365**	**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: Existing Conditions Runoff Area=15,881 sf 100.00% Impervious Runoff Depth=3.21"
Tc=6.0 min CN=98 Runoff=1.22 cfs 0.097 af

Total Runoff Area = 0.365 ac Runoff Volume = 0.097 af Average Runoff Depth = 3.21"
0.00% Pervious = 0.000 ac 100.00% Impervious = 0.365 ac

Summary for Subcatchment 1S: Existing Conditions

Runoff = 1.22 cfs @ 12.08 hrs, Volume= 0.097 af, Depth= 3.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Year Storm Rainfall=3.44"

Area (sf)	CN	Description
15,881	98	Paved parking, HSG A
15,881		100.00% Impervious Area

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

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: Existing Conditions Runoff Area=15,881 sf 100.00% Impervious Runoff Depth=4.79"
Tc=6.0 min CN=98 Runoff=1.79 cfs 0.146 af

Total Runoff Area = 0.365 ac Runoff Volume = 0.146 af Average Runoff Depth = 4.79"
0.00% Pervious = 0.000 ac 100.00% Impervious = 0.365 ac

Summary for Subcatchment 1S: Existing Conditions

Runoff = 1.79 cfs @ 12.08 hrs, Volume= 0.146 af, Depth= 4.79"

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=5.03"

Area (sf)	CN	Description
15,881	98	Paved parking, HSG A
15,881		100.00% Impervious Area

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

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: Existing Conditions Runoff Area=15,881 sf 100.00% Impervious Runoff Depth=5.78"
Tc=6.0 min CN=98 Runoff=2.15 cfs 0.176 af

Total Runoff Area = 0.365 ac Runoff Volume = 0.176 af Average Runoff Depth = 5.78"
0.00% Pervious = 0.000 ac 100.00% Impervious = 0.365 ac

Summary for Subcatchment 1S: Existing Conditions

Runoff = 2.15 cfs @ 12.08 hrs, Volume= 0.176 af, Depth= 5.78"

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=6.02"

Area (sf)	CN	Description
15,881	98	Paved parking, HSG A
15,881		100.00% Impervious Area

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

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: Existing Conditions Runoff Area=15,881 sf 100.00% Impervious Runoff Depth=7.31"
Tc=6.0 min CN=98 Runoff=2.70 cfs 0.222 af

Total Runoff Area = 0.365 ac Runoff Volume = 0.222 af Average Runoff Depth = 7.31"
0.00% Pervious = 0.000 ac 100.00% Impervious = 0.365 ac

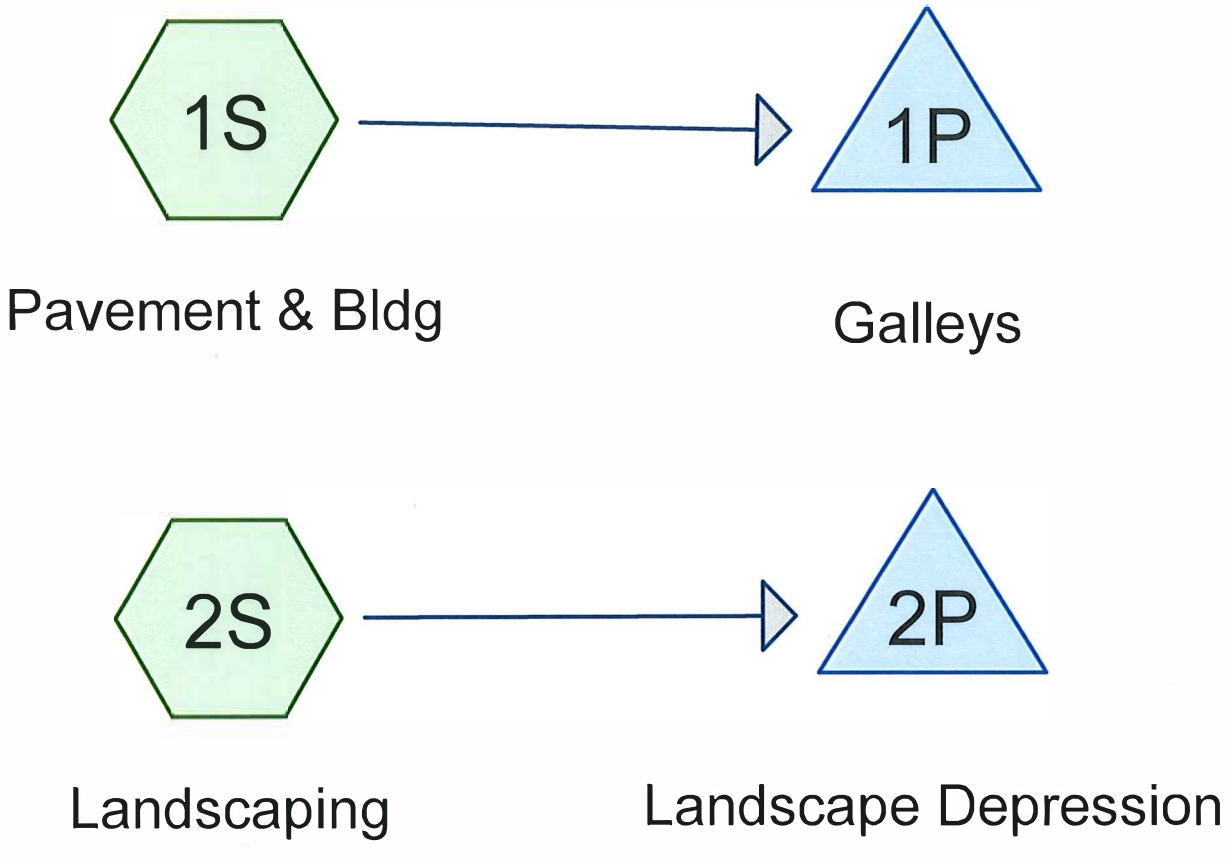
Summary for Subcatchment 1S: Existing Conditions

Runoff = 2.70 cfs @ 12.08 hrs, Volume= 0.222 af, Depth= 7.31"

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=7.55"

Area (sf)	CN	Description
15,881	98	Paved parking, HSG A
15,881		100.00% Impervious Area

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



Subcat Reach Pond Link

Routing Diagram for 9890POST
Prepared by GAF Engineering, Inc, Printed 5/31/2023
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Project Notes

Rainfall events imported from "9890PRE.hcp"

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2 Year Storm	Type III 24-hr		Default	24.00	1	3.44	2
2	10 Year Storm	Type III 24-hr		Default	24.00	1	5.03	2
3	25 Year Storm	Type III 24-hr		Default	24.00	1	6.02	2
4	100 Year Storm	Type III 24-hr		Default	24.00	1	7.55	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.121	39	>75% Grass cover, Good, HSG A (1S, 2S)
0.002	98	Basin bottom (2S)
0.241	98	Paved parking, HSG A (1S)
0.365	**78**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.363	HSG A	1S, 2S
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.002	Other	2S
0.365		**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
0.121	0.000	0.000	0.000	0.000	0.121	>75% Grass cover, Good	1S, 2S
0.000	0.000	0.000	0.000	0.002	0.002	Basin bottom	2S
0.241	0.000	0.000	0.000	0.000	0.241	Paved parking	1S
0.363	**0.000**	**0.000**	**0.000**	**0.002**	**0.365**	**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: Pavement & Bldg Runoff Area=12,690 sf 82.74% Impervious Runoff Depth=2.21"
Tc=6.0 min CN=88 Runoff=0.75 cfs 0.054 af

Subcatchment 2S: Landscaping Runoff Area=3,191 sf 2.82% Impervious Runoff Depth=0.02"
Tc=6.0 min CN=41 Runoff=0.00 cfs 0.000 af

Pond 1P: Galleys Peak Elev=35.40' Storage=540 cf Inflow=0.75 cfs 0.054 af
Outflow=0.19 cfs 0.054 af

Pond 2P: Landscape Depression Peak Elev=40.50' Storage=0 cf Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Total Runoff Area = 0.365 ac Runoff Volume = 0.054 af Average Runoff Depth = 1.77"
33.32% Pervious = 0.121 ac 66.68% Impervious = 0.243 ac

Summary for Subcatchment 1S: Pavement & Bldg

Runoff = 0.75 cfs @ 12.09 hrs, Volume= 0.054 af, Depth= 2.21"
Routed to Pond 1P : Galleys

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=3.44"

Area (sf)	CN	Description
10,500	98	Paved parking, HSG A
2,190	39	>75% Grass cover, Good, HSG A
12,690	88	Weighted Average
2,190		17.26% Pervious Area
10,500		82.74% Impervious Area

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

Summary for Subcatchment 2S: Landscaping

Runoff = 0.00 cfs @ 20.74 hrs, Volume= 0.000 af, Depth= 0.02"
Routed to Pond 2P : Landscape Depression

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=3.44"

	Area (sf)	CN	Description
*	90	98	Basin bottom
	3,101	39	>75% Grass cover, Good, HSG A
	3,191	41	Weighted Average
	3,101		97.18% Pervious Area
	90		2.82% Impervious Area

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

Summary for Pond 1P: Galleys

Inflow Area = 0.291 ac, 82.74% Impervious, Inflow Depth = 2.21" for 2 Year Storm event
Inflow = 0.75 cfs @ 12.09 hrs, Volume= 0.054 af
Outflow = 0.19 cfs @ 12.48 hrs, Volume= 0.054 af, Atten= 75%, Lag= 23.6 min
Discarded = 0.19 cfs @ 12.48 hrs, Volume= 0.054 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 35.40' @ 12.48 hrs Surf.Area= 800 sf Storage= 540 cf

Plug-Flow detention time= 17.2 min calculated for 0.054 af (100% of inflow)
Center-of-Mass det. time= 17.2 min (829.3 - 812.1)

Volume	Invert	Avail.Storage	Storage Description
#1	34.00'	912 cf	**20.00'W x 40.00'L x 5.50'H Prismatoid** 4,400 cf Overall - 2,120 cf Embedded = 2,280 cf x 40.0% Voids
#2	35.00'	1,596 cf	**Concrete Galley 4x4x4** x 36 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 36 Chambers in 4 Rows
		2,509 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	34.00'	**8.270 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.19 cfs @ 12.48 hrs HW=35.40' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.19 cfs)

Summary for Pond 2P: Landscape Depression

Inflow Area = 0.073 ac, 2.82% Impervious, Inflow Depth = 0.02" for 2 Year Storm event
Inflow = 0.00 cfs @ 20.74 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 20.79 hrs, Volume= 0.000 af, Atten= 0%, Lag= 2.9 min
Discarded = 0.00 cfs @ 20.79 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 40.50' @ 20.79 hrs Surf.Area= 90 sf Storage= 0 cf

Plug-Flow detention time= 2.9 min calculated for 0.000 af (100% of inflow)
Center-of-Mass det. time= 2.9 min (1,182.1 - 1,179.2)

Volume	Invert	Avail.Storage	Storage Description
#1	40.50'	375 cf	**1.00'W x 90.00'L x 1.00'H Prismatoid Z=3.0**

Device	Routing	Invert	Outlet Devices
#1	Discarded	40.50'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.01 cfs @ 20.79 hrs HW=40.50' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.01 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+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Pavement & Bldg Runoff Area=12,690 sf 82.74% Impervious Runoff Depth=3.70"
Tc=6.0 min CN=88 Runoff=1.23 cfs 0.090 af

Subcatchment 2S: Landscaping Runoff Area=3,191 sf 2.82% Impervious Runoff Depth=0.28"
Tc=6.0 min CN=41 Runoff=0.01 cfs 0.002 af

Pond 1P: Galleys Peak Elev=36.52' Storage=1,166 cf Inflow=1.23 cfs 0.090 af
Outflow=0.21 cfs 0.090 af

Pond 2P: Landscape Depression Peak Elev=40.51' Storage=1 cf Inflow=0.01 cfs 0.002 af
Outflow=0.01 cfs 0.002 af

Total Runoff Area = 0.365 ac Runoff Volume = 0.091 af Average Runoff Depth = 3.01"
33.32% Pervious = 0.121 ac 66.68% Impervious = 0.243 ac

Summary for Subcatchment 1S: Pavement & Bldg

Runoff = 1.23 cfs @ 12.09 hrs, Volume= 0.090 af, Depth= 3.70"
Routed to Pond 1P : Galleys

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=5.03"

Area (sf)	CN	Description
10,500	98	Paved parking, HSG A
2,190	39	>75% Grass cover, Good, HSG A
12,690	88	Weighted Average
2,190		17.26% Pervious Area
10,500		82.74% Impervious Area

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

Summary for Subcatchment 2S: Landscaping

Runoff = 0.01 cfs @ 12.40 hrs, Volume= 0.002 af, Depth= 0.28"
Routed to Pond 2P : Landscape Depression

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=5.03"

	Area (sf)	CN	Description
*	90	98	Basin bottom
	3,101	39	>75% Grass cover, Good, HSG A
	3,191	41	Weighted Average
	3,101		97.18% Pervious Area
	90		2.82% Impervious Area

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

Summary for Pond 1P: Galleys

Inflow Area = 0.291 ac, 82.74% Impervious, Inflow Depth = 3.70" for 10 Year Storm event
Inflow = 1.23 cfs @ 12.09 hrs, Volume= 0.090 af
Outflow = 0.21 cfs @ 12.55 hrs, Volume= 0.090 af, Atten= 83%, Lag= 28.0 min
Discarded = 0.21 cfs @ 12.55 hrs, Volume= 0.090 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 36.52' @ 12.55 hrs Surf.Area= 800 sf Storage= 1,166 cf

Plug-Flow detention time= 37.6 min calculated for 0.090 af (100% of inflow)
Center-of-Mass det. time= 37.6 min (835.3 - 797.7)

Volume	Invert	Avail.Storage	Storage Description
#1	34.00'	912 cf	**20.00'W x 40.00'L x 5.50'H Prismatoid** 4,400 cf Overall - 2,120 cf Embedded = 2,280 cf x 40.0% Voids
#2	35.00'	1,596 cf	**Concrete Galley 4x4x4** x 36 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 36 Chambers in 4 Rows
		2,509 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	34.00'	**8.270 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.21 cfs @ 12.55 hrs HW=36.52' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.21 cfs)

Summary for Pond 2P: Landscape Depression

Inflow Area = 0.073 ac, 2.82% Impervious, Inflow Depth = 0.28" for 10 Year Storm event
Inflow = 0.01 cfs @ 12.40 hrs, Volume= 0.002 af
Outflow = 0.01 cfs @ 12.51 hrs, Volume= 0.002 af, Atten= 14%, Lag= 6.1 min
Discarded = 0.01 cfs @ 12.51 hrs, Volume= 0.002 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 40.51' @ 12.51 hrs Surf.Area= 97 sf Storage= 1 cf

Plug-Flow detention time= 3.0 min calculated for 0.002 af (100% of inflow)
Center-of-Mass det. time= 2.9 min (985.4 - 982.5)

Volume	Invert	Avail.Storage	Storage Description
#1	40.50'	375 cf	**1.00'W x 90.00'L x 1.00'H Prismatoid Z=3.0**

Device	Routing	Invert	Outlet Devices
#1	Discarded	40.50'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.01 cfs @ 12.51 hrs HW=40.51' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.01 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+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Pavement & Bldg Runoff Area=12,690 sf 82.74% Impervious Runoff Depth=4.65"
Tc=6.0 min CN=88 Runoff=1.53 cfs 0.113 af

Subcatchment 2S: Landscaping Runoff Area=3,191 sf 2.82% Impervious Runoff Depth=0.56"
Tc=6.0 min CN=41 Runoff=0.02 cfs 0.003 af

Pond 1P: Galleys Peak Elev=37.26' Storage=1,576 cf Inflow=1.53 cfs 0.113 af
Outflow=0.23 cfs 0.113 af

Pond 2P: Landscape Depression Peak Elev=40.63' Storage=16 cf Inflow=0.02 cfs 0.003 af
Outflow=0.01 cfs 0.003 af

Total Runoff Area = 0.365 ac Runoff Volume = 0.116 af Average Runoff Depth = 3.82"
33.32% Pervious = 0.121 ac 66.68% Impervious = 0.243 ac

Summary for Subcatchment 1S: Pavement & Bldg

Runoff = 1.53 cfs @ 12.09 hrs, Volume= 0.113 af, Depth= 4.65"
Routed to Pond 1P : Galleys

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=6.02"

Area (sf)	CN	Description
10,500	98	Paved parking, HSG A
2,190	39	>75% Grass cover, Good, HSG A
12,690	88	Weighted Average
2,190		17.26% Pervious Area
10,500		82.74% Impervious Area

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

Summary for Subcatchment 2S: Landscaping

Runoff = 0.02 cfs @ 12.29 hrs, Volume= 0.003 af, Depth= 0.56"
Routed to Pond 2P : Landscape Depression

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=6.02"

	Area (sf)	CN	Description
*	90	98	Basin bottom
	3,101	39	>75% Grass cover, Good, HSG A
	3,191	41	Weighted Average
	3,101		97.18% Pervious Area
	90		2.82% Impervious Area

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

Summary for Pond 1P: Galleys

Inflow Area = 0.291 ac, 82.74% Impervious, Inflow Depth = 4.65" for 25 Year Storm event
Inflow = 1.53 cfs @ 12.09 hrs, Volume= 0.113 af
Outflow = 0.23 cfs @ 12.58 hrs, Volume= 0.113 af, Atten= 85%, Lag= 29.7 min
Discarded = 0.23 cfs @ 12.58 hrs, Volume= 0.113 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 37.26' @ 12.58 hrs Surf.Area= 800 sf Storage= 1,576 cf

Plug-Flow detention time= 50.2 min calculated for 0.113 af (100% of inflow)
Center-of-Mass det. time= 50.2 min (841.6 - 791.4)

Volume	Invert	Avail.Storage	Storage Description
#1	34.00'	912 cf	**20.00'W x 40.00'L x 5.50'H Prismatoid** 4,400 cf Overall - 2,120 cf Embedded = 2,280 cf x 40.0% Voids
#2	35.00'	1,596 cf	**Concrete Galley 4x4x4** x 36 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 36 Chambers in 4 Rows
		2,509 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	34.00'	**8.270 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.23 cfs @ 12.58 hrs HW=37.26' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.23 cfs)

Summary for Pond 2P: Landscape Depression

Inflow Area = 0.073 ac, 2.82% Impervious, Inflow Depth = 0.56" for 25 Year Storm event
Inflow = 0.02 cfs @ 12.29 hrs, Volume= 0.003 af
Outflow = 0.01 cfs @ 12.62 hrs, Volume= 0.003 af, Atten= 53%, Lag= 19.8 min
Discarded = 0.01 cfs @ 12.62 hrs, Volume= 0.003 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 40.63' @ 12.62 hrs Surf.Area= 162 sf Storage= 16 cf

Plug-Flow detention time= 12.3 min calculated for 0.003 af (100% of inflow)
Center-of-Mass det. time= 12.3 min (954.5 - 942.2)

Volume	Invert	Avail.Storage	Storage Description
#1	40.50'	375 cf	**1.00'W x 90.00'L x 1.00'H Prismatoid Z=3.0**

Device	Routing	Invert	Outlet Devices
#1	Discarded	40.50'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.01 cfs @ 12.62 hrs HW=40.63' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.01 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+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Pavement & Bldg Runoff Area=12,690 sf 82.74% Impervious Runoff Depth=6.13"
Tc=6.0 min CN=88 Runoff=1.99 cfs 0.149 af

Subcatchment 2S: Landscaping Runoff Area=3,191 sf 2.82% Impervious Runoff Depth=1.15"
Tc=6.0 min CN=41 Runoff=0.07 cfs 0.007 af

Pond 1P: Galleys Peak Elev=38.47' Storage=2,242 cf Inflow=1.99 cfs 0.149 af
Outflow=0.26 cfs 0.149 af

Pond 2P: Landscape Depression Peak Elev=40.85' Storage=66 cf Inflow=0.07 cfs 0.007 af
Outflow=0.02 cfs 0.007 af

Total Runoff Area = 0.365 ac Runoff Volume = 0.156 af Average Runoff Depth = 5.13"
33.32% Pervious = 0.121 ac 66.68% Impervious = 0.243 ac

Summary for Subcatchment 1S: Pavement & Bldg

Runoff = 1.99 cfs @ 12.08 hrs, Volume= 0.149 af, Depth= 6.13"
Routed to Pond 1P : Galleys

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=7.55"

Area (sf)	CN	Description
10,500	98	Paved parking, HSG A
2,190	39	>75% Grass cover, Good, HSG A
12,690	88	Weighted Average
2,190		17.26% Pervious Area
10,500		82.74% Impervious Area

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

Summary for Subcatchment 2S: Landscaping

Runoff = 0.07 cfs @ 12.12 hrs, Volume= 0.007 af, Depth= 1.15"
Routed to Pond 2P : Landscape Depression

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=7.55"

	Area (sf)	CN	Description
*	90	98	Basin bottom
	3,101	39	>75% Grass cover, Good, HSG A
	3,191	41	Weighted Average
	3,101		97.18% Pervious Area
	90		2.82% Impervious Area

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

Summary for Pond 1P: Galleys

Inflow Area = 0.291 ac, 82.74% Impervious, Inflow Depth = 6.13" for 100 Year Storm event
Inflow = 1.99 cfs @ 12.08 hrs, Volume= 0.149 af
Outflow = 0.26 cfs @ 12.63 hrs, Volume= 0.149 af, Atten= 87%, Lag= 32.7 min
Discarded = 0.26 cfs @ 12.63 hrs, Volume= 0.149 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 38.47' @ 12.63 hrs Surf.Area= 800 sf Storage= 2,242 cf

Plug-Flow detention time= 68.9 min calculated for 0.149 af (100% of inflow)
Center-of-Mass det. time= 68.9 min (852.8 - 783.9)

Volume	Invert	Avail.Storage	Storage Description
#1	34.00'	912 cf	**20.00'W x 40.00'L x 5.50'H Prismatoid** 4,400 cf Overall - 2,120 cf Embedded = 2,280 cf x 40.0% Voids
#2	35.00'	1,596 cf	**Concrete Galley 4x4x4** x 36 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 36 Chambers in 4 Rows
		2,509 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	34.00'	**8.270 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.26 cfs @ 12.63 hrs HW=38.47' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.26 cfs)

Summary for Pond 2P: Landscape Depression

Inflow Area = 0.073 ac, 2.82% Impervious, Inflow Depth = 1.15" for 100 Year Storm event
Inflow = 0.07 cfs @ 12.12 hrs, Volume= 0.007 af
Outflow = 0.02 cfs @ 12.78 hrs, Volume= 0.007 af, Atten= 76%, Lag= 39.6 min
Discarded = 0.02 cfs @ 12.78 hrs, Volume= 0.007 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 40.85' @ 12.78 hrs Surf.Area= 286 sf Storage= 66 cf

Plug-Flow detention time= 38.9 min calculated for 0.007 af (100% of inflow)
Center-of-Mass det. time= 38.9 min (947.8 - 908.9)

Volume	Invert	Avail.Storage	Storage Description
#1	40.50'	375 cf	**1.00'W x 90.00'L x 1.00'H Prismatoid Z=3.0**

Device	Routing	Invert	Outlet Devices
#1	Discarded	40.50'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.02 cfs @ 12.78 hrs HW=40.85' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.02 cfs)

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: 3127 Cranberry Highway, 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)
Proprietary CB	**0.80**	**1.00**	**0.80**	**0.20**
Infiltration Chambers	**0.80**	**0.20**	**0.16**	**0.04**

Total TSS Removal = **96%**

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

Project: Commercial Building

Prepared By: G.A.F. Engineering, Inc.

Date: 25-May-23

*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 Mass DEP Stormwater Handbook Vol. 1

Mass. Dept. of Environmental Protections

Water Quality Volume Calculation

Required Water Quality Depth = 1.0 inch volume from paved surfaces.

Pavement Area to Galley System Pond 1P = 10,500 sf

WQV = 10,500 sf x 1.0 in x 1 ft/12 in = 875 cf

Volume Available in System = 2,509 cf (HydroCAD)

2,509 cf > 875 cf OK

Water Quality Volume to Discharge Rate Calculation

This project specifies a proprietary drainage structure in order to achieve greater than 44% TSS removal prior to discharge to the infiltration BMPs. A flow rate is required to be calculated based on the required water quality volume and total amount of impervious surface directed to the proprietary structure. The calculations are based on the standardized method developed by DEP effective October 15, 2013.

Equation: $Q = (qu)(A)(WQV)$

Where: Q = peak flow rate associated with first 1.00 inches 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 (1.00 inches in this case)

The determination of qu is based on the time of concentration and Figure 4 Table in the DEP guidance document. The area draining to the proprietary structure has a time of concentration of 6 minutes.

Water Quality Catch Basin 1:

$Q = (774)(0.000377)(1.00) = 0.29$ cfs

First Defense® - High Capacity

particle sizes range of 50 µm to 150 µm (D_{50}=108µm). A comparison of the two gradations is shown in Figure 3, which shows the test sand gradation to be slightly finer than OK110 between 50µm and 100µm. For example, the test sand had 15% finer than 75 microns compared to the OK110 PSD that had only 3% less than 75 microns. Given finer particles are more difficult to settle, performance results based on the "OK110" particle size band of the test sand is considered conservative.

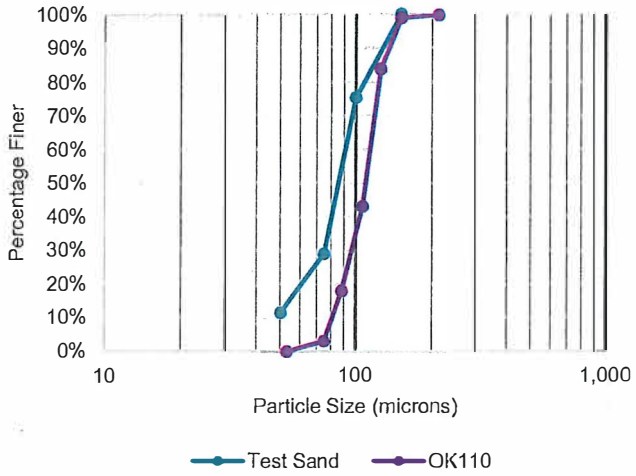


Figure 3 - Particle Size Distribution Comparison

Removal Efficiency Testing

Removal efficiency testing with the feed sediment was conducted in accordance with Section 5 of the NJDEP Laboratory Protocol for Manufactured Treatment Devices. Five flow rates ranging from 25% to 125% of the design treatment flow rate were evaluated.

The test sediment was fed into the flow stream at a rate that was equivalent to 200 mg/L. The average influent TSS concentration was calculated using the total sediment mass and volume of water added during dosing. The influent concentration for each particle size band was calculated using the percentage of particles in each particle size band and known average inlet concentration. Three time-spaced effluent grab samples were composited and analyzed using laser diffraction (ISO 13320) to evaluate the effluent particle sizes.

Table 1 – OK110 Particle Size Range Test Results

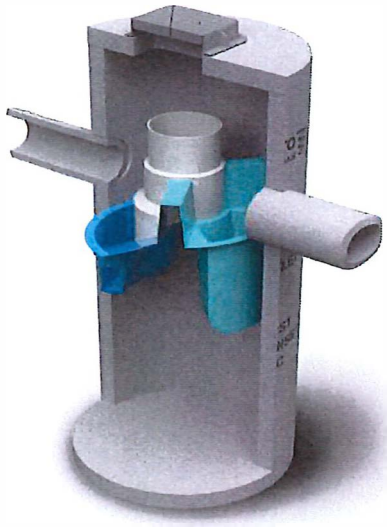
Flow	Inlet Conc.	Outlet Conc.	Removal
cfs (L/s)	mg/L	mg/L	%
0.38 (10.8)	84	4.44	95
0.75 (21.2)	83	5.50	93
1.13 (32.0)	78	4.00	95
1.5 (42.5)	83	6.57	92
1.88 (53.2)	79	8.81	89

The average effluent sediment concentration of the three composited samples was also measured for each flow rate in accordance with ASTM D3977-97. The effluent concentration for each particle size band was then calculated using the average effluent composite concentration and percentage of particles in each particle size band.

Percent removed at each of the five tested flow rates is shown in Table 1. Inlet concentrations of the OK110 particle size range varied from 79-84 mg/L compared to 4-8.5 mg/L at the outlet. As expected, the highest concentration measured at the outlet was at the highest tested flow rate of 1.88 cfs (53.2 L/s). In general, the 4-ft FDHC removed greater than 80% of the OK110 particle size range for all tested flow rates. Table 2 provides "Treatment Flow Rates" for the available models.

Table 2 – FDHC Treatment Flow Rate for > 80% TSS

Model:	FD-3HC	FD-4HC	FD-5HC	FD-6HC	FD-8HC
Size:	3 ft (900 mm)	4 ft (1.2 m)	5 ft (1.5 m)	6 ft (1.8 m)	8 ft (2.4m)
cfs:	1.06	1.88	2.94	4.23	7.52
L/s:	29.9	53.2	83.2	119.8	212.9



For design purposes the selected model's Treatment Flow Rate must be equal or greater to the site's required Water Quality Flow Rate. The peak flow rate and maximum pipe size must be considered to determine whether an online or offline configuration is appropriate. Full removal curves are available on request.

Refer First Defense product information brochure or visit www.hydro-int.com/us for more information

Hydro International. 94 Hutchins Drive. Portland. ME 04102
Tel: 207.756.6200 Fax: 207.756.6212
Email: stormwaterinquiry@hydro-int.com Web: www.hydro-int.com

Required Recharge Volume Calculation

Galley System

Total Impervious Area to Chamber System Pond 1 = 10,500 sf

Required Recharge Depth = 0.6 inches (HSG A Soil)

Required Recharge Volume = 10,500 sf x 0.6"/12 = 525 cf

Available Storage = 2,509 cf (HydroCAD)

2,509 cf > 525 cf - OK

Recharge System Drawdown time (72 hours maximum for 100 year storm volume)

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

$$\text{Time} = \frac{2{,}242\ \text{cf}}{(8.27\ \text{inches/hour})\ (1\text{ft}/12\text{inches})\ (800\ \text{sf})}$$

= 4.1 hours < 72 hours – OK

Recharge System Drawdown time for Landscape Depression

$$\text{Time} = \frac{66\ \text{cf}}{(2.41\ \text{inches/hour})\ (1\text{ft}/12\text{inches})\ (90\ \text{sf})}$$

= 3.7 hours < 72 hours – OK

Construction Period Pollution Prevention and

Erosion & Sedimentation Control Plan

Narrative: This project consists of the construction of a 35'x 40' commercial building on a lot that is entirely paved. A minimum 10' wide perimeter landscaped buffer will be established by removing the existing pavement, excavating unsuitable soils, and

Responsible Parties: The site contractor and 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.
- Maintain an inspection log to document problem areas and corrective actions.
- Provide temporary stabilization of disturbed areas and soil stockpiles which will remain in place for more than 30 days. (erosion control fabric, mulch, hydroseed, etc.)
- Provide a contact person for complaints and notification of problems.

Construction Sequence:

- Install erosion controls per the plans.
- Install silt sacks and outlet hoods in existing catch basins.
- Remove existing pavement, concrete slabs, and other unwanted materials.
- Excavate for building foundations.
- Install foundations and backfill.
- Install underground utilities.
- Construct the building.
- Install sanitary sewer.
- Fill and grade the site around buildings.
- Install galley infiltration system, catch basin, and roof drain piping.
- Grade the landscape depression.
- Remove construction entrance.
- Loam and seed the site. Install landscaping.
- Install gravel base material for parking lot and site access drives.
- Install binder course and cape cod berm.

- Install top course of pavement.
- Remove erosion controls once site is stabilized.

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.

Long Term Operation and Maintenance Plan

Responsible Party: Peter Koulouras
P.O. Box 961
N. Falmouth, MA 02556

The property owner is responsible for the inspection, operation and maintenance of the Stormwater Management System. The manager 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 two primary components, Best Management Practices (BMPs), which collect, treat, and infiltrate stormwater runoff from all storm events up to and including the 100 year storm event. Paved areas are graded to a proprietary catch basin located at the low point on the south side of the proposed building. This unit provides the necessary pretreatment prior to discharge to the storage and infiltration system. The infiltration system consists of four rows of nine 4'x 4' concrete galleys surrounded by crushed stone. The roof runoff from the building piped directly into the proprietary catch 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)

Proprietary Catch Basins: Proprietary catch basins are underground drainage structures designed to remove a greater percentage of total suspended solids when compared to traditional deep sump catch basins. They also remove trash, debris, and coarse sediment from stormwater and provide temporary spill containment for floatables such as oil and grease. Inspect the unit monthly, and clean at least two times per 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 per the manufacturer's specifications. 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.

Leaching Trenches and Chambers: Leaching trenches and chambers 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 chambers should be observed in the inspection ports 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 drainage system frames, grates, and covers have all been specified for H20 loading. Catch basin grates are bicycle and pedestrian safe.

Operation and Maintenance Budget: The estimated annual cost for inspection 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.

OPERATION AND MAINTENANCE LOG

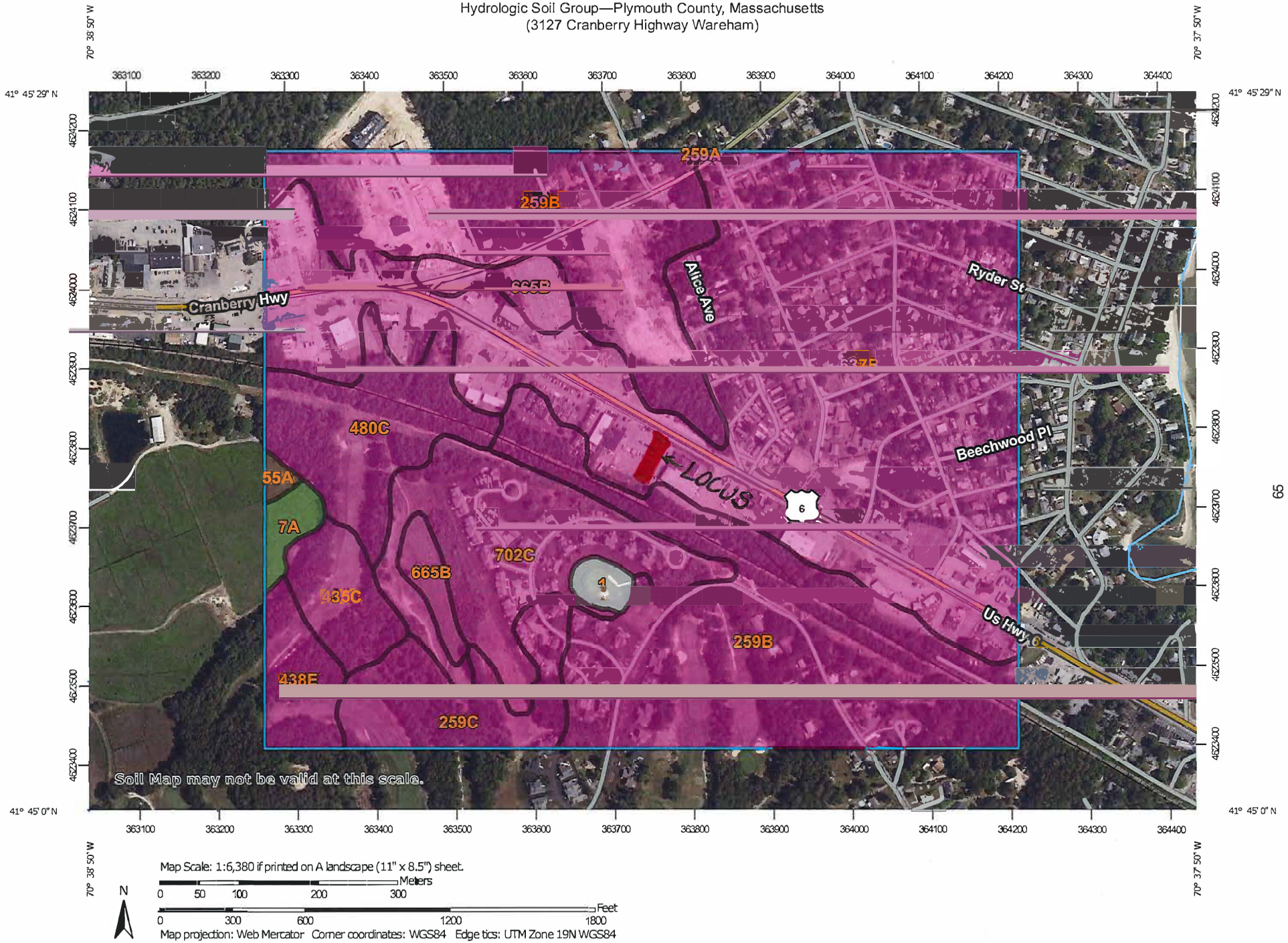
This template is intended to comply with the operation and maintenance log requirements of the 2008 DEP Stormwater Management Handbook. Copies of this log should be made for all inspections and kept on file for three years from the inspection date.

Name/Company of Inspector:
Date/Time of Inspection:
Weather Conditions: (Note current weather and any recent precipitation events)

Stormwater BMP	Inspection Observations	Actions Required

G.A.F. Engineering
266 Main Street,
Wareham, MA, 02571
508-295-6600

Hydrologic Soil Group—Plymouth County, Massachusetts
(3127 Cranberry Highway Wareham)



Map Scale: 1:6,380 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 300 600 1200 1800

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.

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

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

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

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

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

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

Soil Survey Area: Plymouth County, Massachusetts
Survey Area Data: Version 15, Sep 9, 2022

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

Date(s) aerial images were photographed: Jun 10, 2022—Jun 30, 2022

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.

99

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
1	Water		1.1	0.6%
7A	Rainberry coarse sand, 0 to 3 percent slopes, sanded surface	A/D	1.4	0.8%
55A	Freetown coarse sand, 0 to 3 percent slopes, sanded surface	B/D	0.4	0.2%
259A	Carver loamy coarse sand, 0 to 3 percent slopes	A	0.0	0.0%
259B	Carver loamy coarse sand, 3 to 8 percent slopes	A	54.7	30.7%
259C	Carver loamy coarse sand, 8 to 15 percent slopes	A	8.1	4.6%
435C	Plymouth loamy coarse sand, 8 to 15 percent slopes	A	4.4	2.5%
438E	Plymouth loamy coarse sand, 15 to 35 percent slopes, extremely bouldery	A	4.0	2.2%
480C	Plymouth - Carver complex, 8 to 15 percent slopes	A	10.5	5.9%
637B	Carver - Urban land complex, 0 to 8 percent slopes	A	73.3	41.3%
665B	Udipsamments, 0 to 8 percent slopes	A	4.3	2.4%
702C	Udipsamments, 8 to 15 percent slopes	A	15.5	8.7%
Totals for Area of Interest			**177.7**	**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.

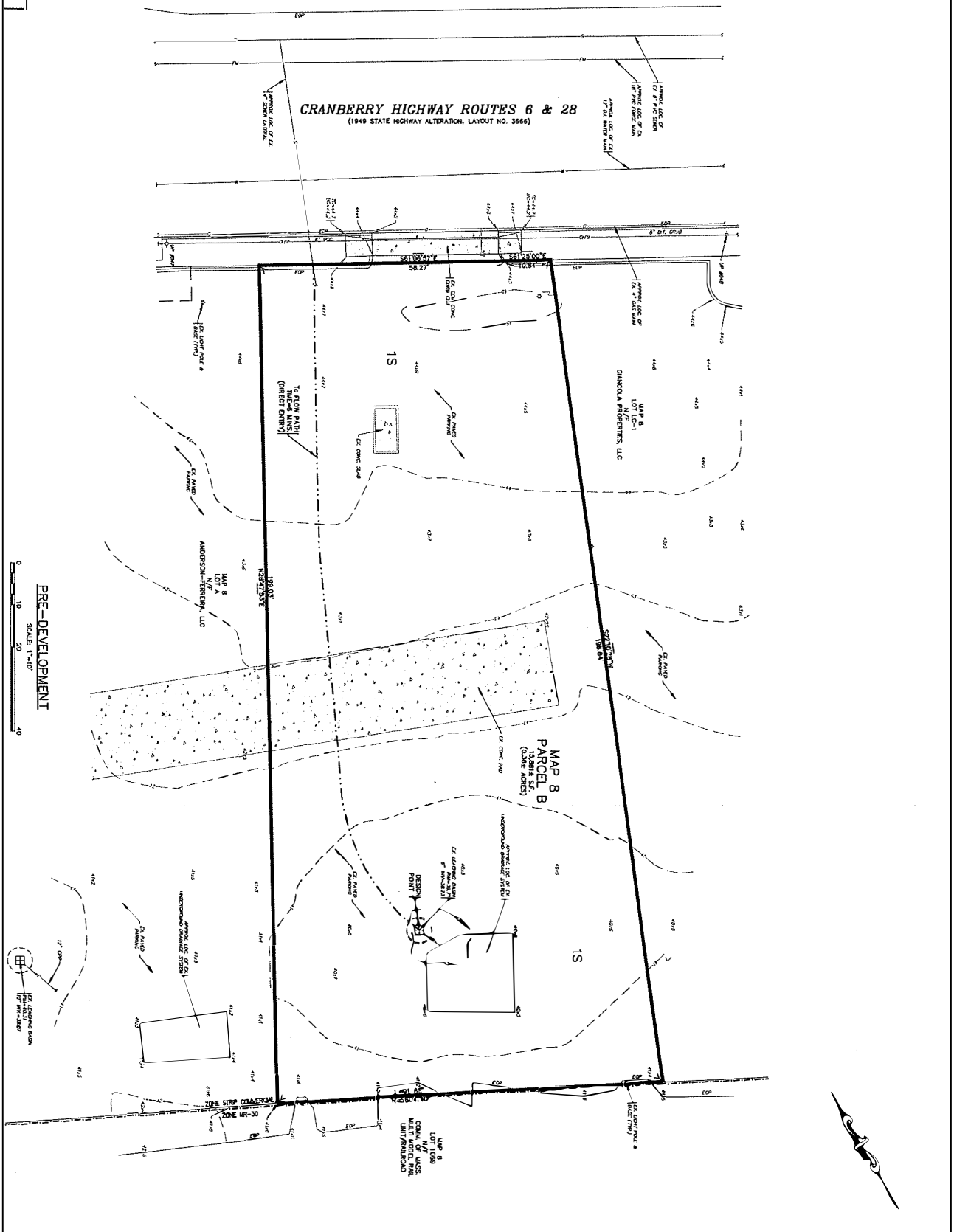
Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

PERMIT SET
(NOT FOR CONSTRUCTION)

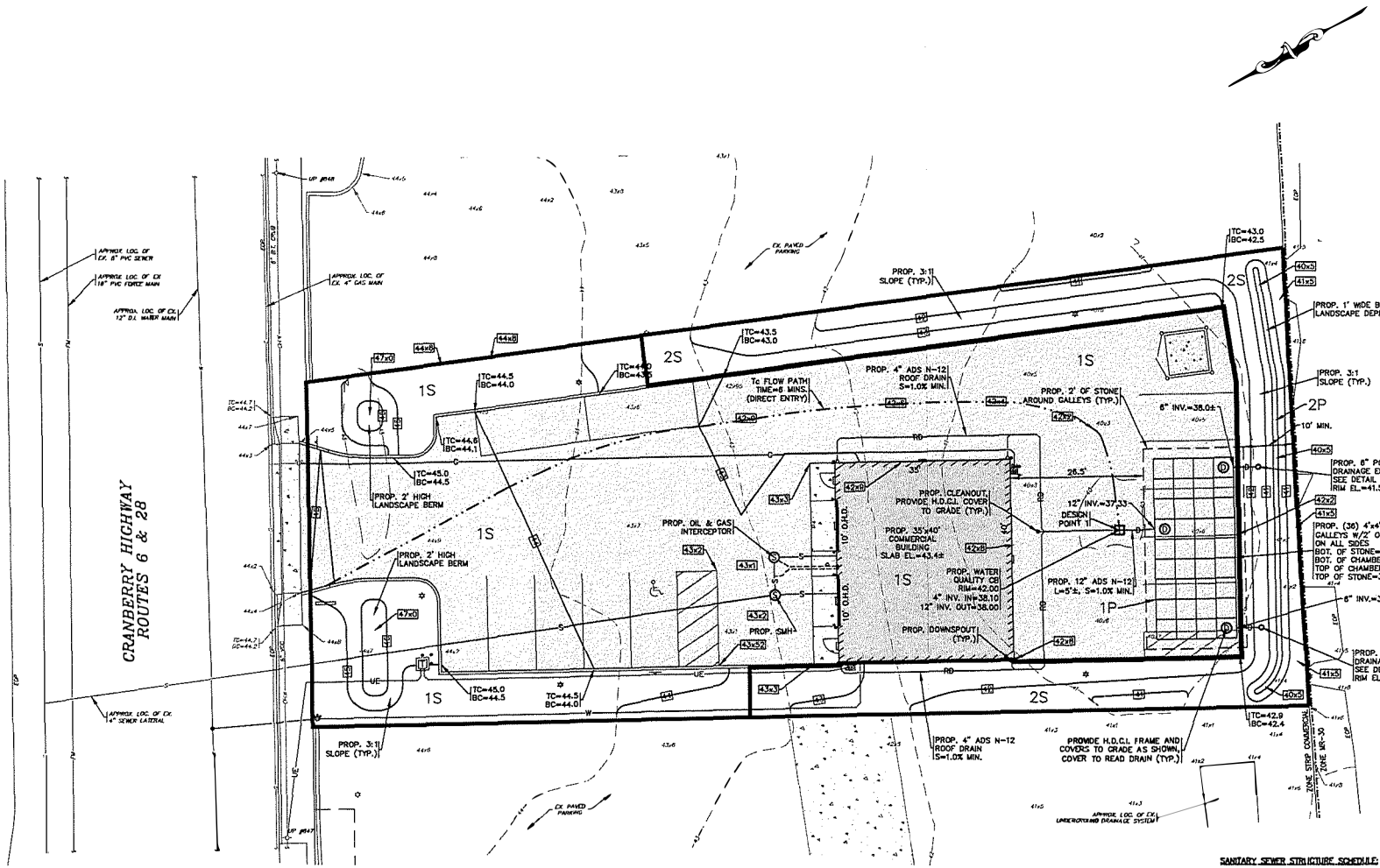


JOB NO.: 22-9890	PRE-DEVELOPMENT WATERSHED PLAN 3127 CRANBERRY HIGHWAY WAREHAM, MA PREPARED FOR: PETER KOULOURAS P.O. BOX 951 N. FALMOUTH, MA	G.A.F. ENGINEERING, INC. PROFESSIONAL ENGINEERS & LAND SURVEYORS 266 MAIN STREET – WAREHAM, MA 02571 TEL: (508) 295-6600 FAX: (508) 295-6634 E-MAIL: info@gafenginc.com 	APPROVED BY:	APPROVED BY:	DATE: MAY 25, 2023 DRAWN BY: MP CHECKED BY: WFM JOB NO.: 22-9890 SCALE: 1" = 10'	REV. DATE BY APP'D

DWG. 1 OF 2

NOTES:

1. REFER TO ARCHITECTURAL PLANS PREPARED BY OTHERS FOR ALL PROPOSED COMMERCIAL BUILDING DIMENSIONS, CONSTRUCTION NOTES AND DETAILS. CONTRACTOR SHALL CONFIRM SLAB ELEVATION WITH OWNER PRIOR TO CONSTRUCTION.
2. ALL PROPOSED WATER QUALITY CATCH BASINS SHALL HAVE A TEMPORARY SILT SACK INSTALLED IN THEM AS SOON AS THE STRUCTURE IS SET. CONTRACTOR SHALL EMPTY WHEN NEEDED AND REMOVE & DISPOSE OF THE SILT SACKS AT THE COMPLETION OF CONSTRUCTION.
3. PROPOSED WATER QUALITY CATCH BASIN SHALL BE A FIRST DEFENSE FDHC-3 UNIT FROM HYDRO INTERNATIONAL OR AN APPROVED EQUAL.
4. REFER TO ARCHITECTURAL PLANS BY OTHERS FOR FINAL LOCATIONS, SIZES AND COMPLETE CONSTRUCTION DETAILS ON THE PROPOSED DOWNSPOUTS.
5. WATER MAIN/SERVICES SHALL BE INSTALLED A MINIMUM OF 1' BELOW ALL PROPOSED DRAINAGE AND ROOF DRAINAGE PIPES AND 5' MINIMUM BELOW GRADE.
6. PROVIDE CLEAN OUTS WITH H.D.C.I. FRAME AND COVER TO GRADE, COVER TO READ 'DRAIN'.



POST-DEVELOPMENT
SCALE: 1"=10'
0 10 20 40

SANITARY SEWER STRUCTURE SCHEDULE:

STRUCTURE	RIM EL.	INV. (IN)	INV. (OUT)
OIL&GAS INTERCEPTOR	43.1±	40.20	39.87
SEWER MANHOLE	43.2±	(2) 39.80	39.70

PERMIT SET
(NOT FOR CONSTRUCTION)

REV.	DATE	BY	APP'D	DESCRIPTION

DATE: MAY 25, 2021
DRAWN BY: AAP
CHECKED BY: WFM
JOB NO.: 22-9890
SCALE: 1" = 10'

APPROVED BY:

APPROVED BY:

G.A.F. ENGINEERING, INC.
PROFESSIONAL ENGINEERS & LAND SURVEYORS
286 MAIN STREET - WAREHAM, MA 02571
TEL: (508) 295-6600 FAX: (508) 295-6634

POST-DEVELOPMENT
WATERSHED PLAN
3127 CRANBERRY HIGHWAY WAREHAM, MA

PREPARED FOR:
PETER KOULOURAS
P.O. BOX 981 N. FALMOUTH, MA

JOB NO.: 22-9890
DWG. 2 OF 2