ENGINEERING, INC.
ENGINEERS
SURVEYORS

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STORMWATER REPORT

For

"Village Townhouses"

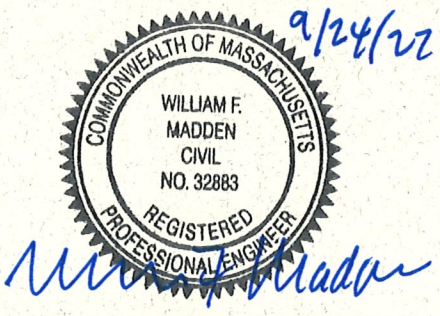
434 Main Street
Wareham, MA

Prepared for

Nazih B. Elkallassi
20 Tower Terrace
Wareham, MA 02571

Prepared by

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



9/24/22

September 8, 2022
G.A.F. Job No.: 21-9751

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DRAINAGE NARRATIVE

General Description

This project consists of the construction of a multi-family residential building containing nine units with attached garages, access drives, utilities, and stormwater management system.

The drainage system consists of several catch basins, drain manholes, and leaching galleys which store and infiltrate all of the runoff from the building and pavement. Development of the project results in a decrease in runoff to Main Street.

Existing Conditions

The project site is a 31,754 square foot rectangular shaped lot located at 434 Main Street. The lot is developed with a single family dwelling, paved driveway, and concrete walks. The topography of the lot directs all of the surface runoff toward Main Street.

Soils on the property as mapped by the USDA Natural Resources Conservation Service consist of Canton-Urban land complex (628B), 0 to 8 percent slopes. This soil has a Hydrologic soil group (HSG) rating "A". Three test pits were excavated and logged by G.A.F. Engineering, Inc. on August 19, 2022. The locations and soil logs are shown on the site plans. The soils were confirmed to consist primarily of fine-medium sand. No mottles were observed. Groundwater was not encountered in any of the test pits.

The design point for comparison of pre-development and post-development runoff rates and volumes is Main Street. Sub-catchment 1S in the pre-development analysis is the area of the lot and up-gradient contributory areas totaling 44,000 square feet.

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 designed for the project utilizes precast concrete galleys to store and infiltrate all of the runoff from the required storm events. Runoff from the paved surfaces in front of the building is first collected in deep sump catch basins located at each of the two access drives. The catch basins discharge to drain manholes which also have four foot sumps and outlet hoods to provide additional total suspended solids (TSS) removal prior to discharge to the leaching galleys. Roof runoff from the front of the building will be piped directly into the galleys.

Due to the width of the proposed building and existing topography, it is necessary to create a low point in the back yard or west side of the building. Two galleys surrounded by crushed stone will be installed at the low point behind each of the nine units. These

galleys will each have a frame and grate to collect surface water from the yard area. The roof runoff from the rear of the building will be piped directly into the galleys.

An exfiltration rate of 8.27 inches per hour was input in the HydroCAD program which is the Rawls rate for HSG "A" soils comprised of fine-medium sand as confirmed by the test pits.

Post-development drainage analysis is comprised of four watersheds. Three of the areas are drained by their respective galley systems. The fourth is the small remaining portion of the site which flows overland to Main Street.

Sub-catchment 1S is the portion of the building and access drive on the north side of the lot adjacent to Main Street. There are two proposed catch basins and one drain manhole which convey the runoff to nineteen leaching galleys. The galley system is designated as Pond 1P in the calculations.

Sub-catchment 2S is the portion of the building and access drive on the south side of the lot adjacent to Main Street. There are two proposed catch basins and one drain manhole which convey the runoff to twenty leaching galleys. The galley system is designated as Pond 2P in the calculations.

Sub-catchment 3S is the back of the building and yard area up to the crest of the lot. The galleys are specified with frames and grates to collect surface water. The rear portion of the building roofs is piped into the galleys. The galley system is designated as Pond 3P in the calculations.

Sub-catchment 4S is the land adjacent to Main Street which is not collected in the catch basins and contributes runoff to Main Street. This small unmitigated area is compared to pre-development area 1S for determination of compliance with the required reduction in peak storm flow rates and volumes. The summary table provided in this report indicates the calculated reduction for each storm event.

In summary, the development of the project in accordance with the design will provide the required water quality 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 Main Street (1S/4S)

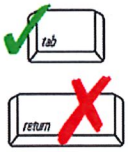
Storm Event	Pre		Post		Pre vs. Post changes	
	Peak Discharge (cfs)	Volume (ac-ft.)	Peak Discharge (cfs)	Volume (ac-ft.)	Peak Discharge (cfs)	Volume (ac-ft.)
2 yr	0.11	0.022	0.02	0.002	-0.09	-0.020
10 yr	0.70	0.074	0.05	0.004	-0.65	-0.070
25 yr	1.27	0.117	0.08	0.006	-1.19	-0.111
100 yr	2.28	0.194	0.13	0.010	-2.15	-0.184

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.

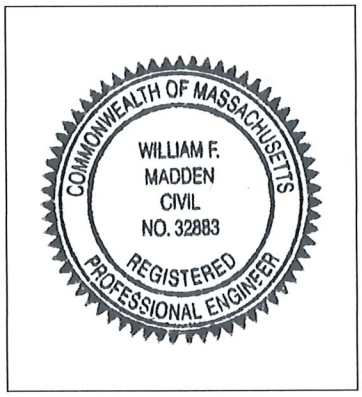
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the 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 9/24/22
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 deep sump hooded catch basins and drain manholes for collection of runoff from paved surfaces prior to discharge*

to leaching galleys. A TSS Calculation Sheet is included in the report to document compliance.

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 considered new development.*

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: 9/6/2022

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 located at 434 Main Street, Wareham, Mass., shown as Lot 1057 on Assessors Map 61.

Nazih Elkallassi - Owner

To Main Street

Subcat Reach Pond Link

Routing Diagram for 9751PRE
Prepared by GAF Engineering, Inc, Printed 9/6/2022
HydroCAD® 10.20-2f s/n 02319 © 2022 HydroCAD Software Solutions LLC

Project Notes

Rainfall events imported from "9460POST.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	5.05	2
3	25 Year Storm	Type III 24-hr		Default	24.00	1	6.05	2
4	100 Year Storm	Type III 24-hr		Default	24.00	1	7.59	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.764	39	>75% Grass cover, Good, HSG A (1S)
0.246	98	Roofs, pavement, concrete (1S)
1.010	**53**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.764	HSG A	1S
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.246	Other	1S
1.010		**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
0.764	0.000	0.000	0.000	0.000	0.764	>75% Grass cover, Good	1S
0.000	0.000	0.000	0.000	0.246	0.246	Roofs, pavement, concrete	1S
0.764	**0.000**	**0.000**	**0.000**	**0.246**	**1.010**	**TOTAL AREA**	

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 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 Main Street Runoff Area=44,000 sf 24.37% Impervious Runoff Depth=0.26"
Flow Length=160' Tc=8.6 min CN=53 Runoff=0.11 cfs 0.022 af

Total Runoff Area = 1.010 ac Runoff Volume = 0.022 af Average Runoff Depth = 0.26"
75.62% Pervious = 0.764 ac 24.37% Impervious = 0.246 ac

Summary for Subcatchment 1S: To Main Street

Runoff = 0.11 cfs @ 12.38 hrs, Volume= 0.022 af, Depth= 0.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.44"

	Area (sf)	CN	Description
*	10,725	98	Roofs, pavement, concrete
	33,275	39	>75% Grass cover, Good, HSG A
	44,000	53	Weighted Average
	33,275		75.62% Pervious Area
	10,725		24.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.8	50	0.0080	0.11		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.44"
0.8	110	0.0190	2.22		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
8.6	160	Total			

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 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 Main Street Runoff Area=44,000 sf 24.37% Impervious Runoff Depth=0.88"
Flow Length=160' Tc=8.6 min CN=53 Runoff=0.70 cfs 0.074 af

Total Runoff Area = 1.010 ac Runoff Volume = 0.074 af Average Runoff Depth = 0.88"
75.62% Pervious = 0.764 ac 24.37% Impervious = 0.246 ac

Summary for Subcatchment 1S: To Main Street

Runoff = 0.70 cfs @ 12.16 hrs, Volume= 0.074 af, Depth= 0.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=5.05"

	Area (sf)	CN	Description
*	10,725	98	Roofs, pavement, concrete
	33,275	39	>75% Grass cover, Good, HSG A
	44,000	53	Weighted Average
	33,275		75.62% Pervious Area
	10,725		24.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.8	50	0.0080	0.11		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.44"
0.8	110	0.0190	2.22		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
8.6	160	Total			

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 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 Main Street Runoff Area=44,000 sf 24.37% Impervious Runoff Depth=1.39"
Flow Length=160' Tc=8.6 min CN=53 Runoff=1.27 cfs 0.117 af

Total Runoff Area = 1.010 ac Runoff Volume = 0.117 af Average Runoff Depth = 1.39"
75.62% Pervious = 0.764 ac 24.37% Impervious = 0.246 ac

Summary for Subcatchment 1S: To Main Street

Runoff = 1.27 cfs @ 12.15 hrs, Volume= 0.117 af, Depth= 1.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Storm Rainfall=6.05"

	Area (sf)	CN	Description
*	10,725	98	Roofs, pavement, concrete
	33,275	39	>75% Grass cover, Good, HSG A
	44,000	53	Weighted Average
	33,275		75.62% Pervious Area
	10,725		24.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.8	50	0.0080	0.11		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.44"
0.8	110	0.0190	2.22		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
8.6	160	Total			

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 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 Main Street Runoff Area=44,000 sf 24.37% Impervious Runoff Depth=2.30"
Flow Length=160' Tc=8.6 min CN=53 Runoff=2.28 cfs 0.194 af

Total Runoff Area = 1.010 ac Runoff Volume = 0.194 af Average Runoff Depth = 2.30"
75.62% Pervious = 0.764 ac 24.37% Impervious = 0.246 ac

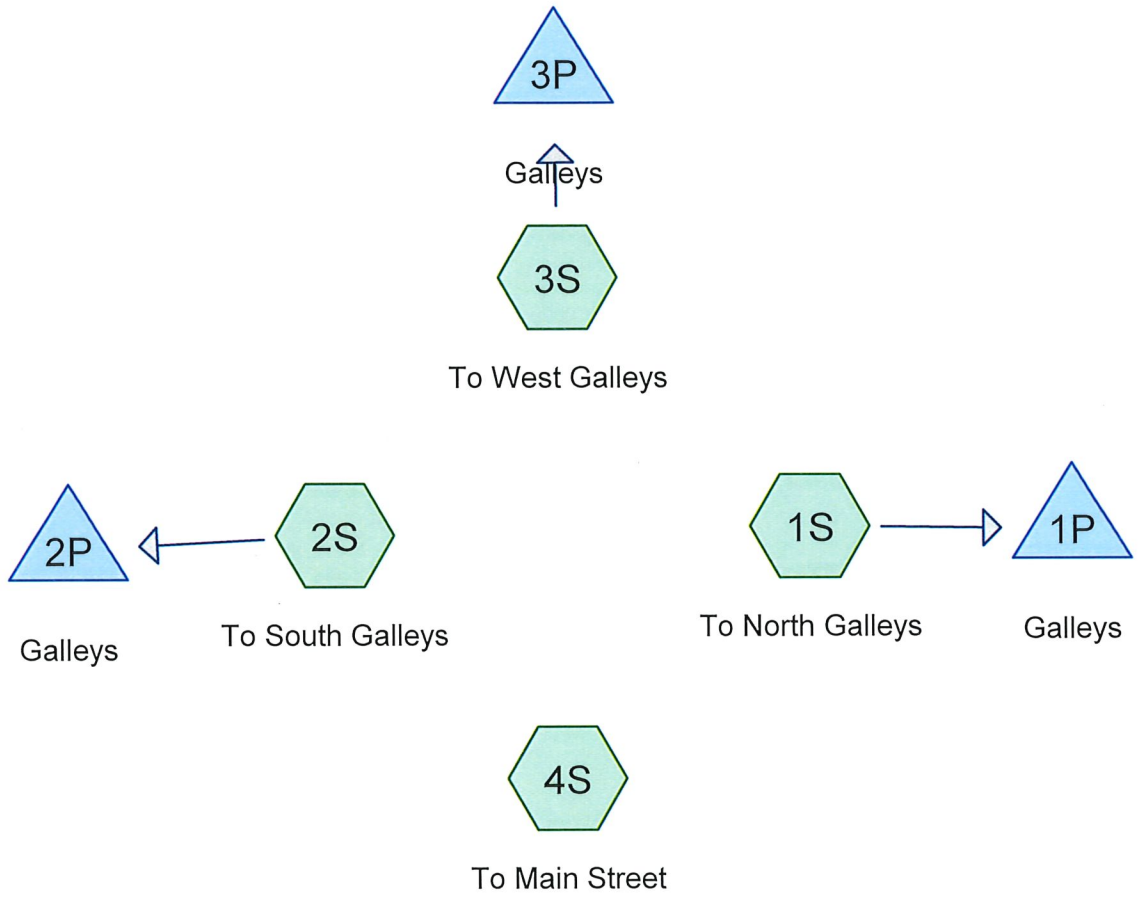
Summary for Subcatchment 1S: To Main Street

Runoff = 2.28 cfs @ 12.14 hrs, Volume= 0.194 af, Depth= 2.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=7.59"

	Area (sf)	CN	Description
*	10,725	98	Roofs, pavement, concrete
	33,275	39	>75% Grass cover, Good, HSG A
	44,000	53	Weighted Average
	33,275		75.62% Pervious Area
	10,725		24.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.8	50	0.0080	0.11		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.44"
0.8	110	0.0190	2.22		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
8.6	160	Total			



Subcat Reach Pond Link

Routing Diagram for 9751POST
Prepared by GAF Engineering, Inc, Printed 9/6/2022
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Project Notes

Rainfall events imported from "9751PRE.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	5.05	2
3	25 Year Storm	Type III 24-hr		Default	24.00	1	6.05	2
4	100 Year Storm	Type III 24-hr		Default	24.00	1	7.59	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.589	39	>75% Grass cover, Good, HSG A (1S, 2S, 3S, 4S)
0.209	98	Pavement (1S, 2S, 4S)
0.153	98	Roofs, porches, decks (2S, 3S)
0.058	98	Roofs, porches, steps (1S)
1.010	**64**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.589	HSG A	1S, 2S, 3S, 4S
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.421	Other	1S, 2S, 3S, 4S
1.010		**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
0.589	0.000	0.000	0.000	0.000	0.589	>75% Grass cover, Good	1S, 2S, 3S, 4S
0.000	0.000	0.000	0.000	0.209	0.209	Pavement	1S, 2S, 4S
0.000	0.000	0.000	0.000	0.153	0.153	Roofs, porches, decks	2S, 3S
0.000	0.000	0.000	0.000	0.058	0.058	Roofs, porches, steps	1S
0.589	**0.000**	**0.000**	**0.000**	**0.421**	**1.010**	**TOTAL AREA**	

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 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 North Galleys Runoff Area=9,140 sf 74.22% Impervious Runoff Depth=1.81"
Tc=6.0 min CN=83 Runoff=0.44 cfs 0.032 af

Subcatchment 2S: To South Galleys Runoff Area=10,460 sf 68.36% Impervious Runoff Depth=1.52"
Tc=6.0 min CN=79 Runoff=0.42 cfs 0.030 af

Subcatchment 3S: To West Galleys Runoff Area=22,800 sf 16.67% Impervious Runoff Depth=0.16"
Tc=6.0 min CN=49 Runoff=0.02 cfs 0.007 af

Subcatchment 4S: To Main Street Runoff Area=1,600 sf 37.50% Impervious Runoff Depth=0.55"
Tc=6.0 min CN=61 Runoff=0.02 cfs 0.002 af

Pond 1P: Galleys Peak Elev=23.41' Storage=232 cf Inflow=0.44 cfs 0.032 af
Outflow=0.15 cfs 0.032 af

Pond 2P: Galleys Peak Elev=23.26' Storage=204 cf Inflow=0.42 cfs 0.030 af
Outflow=0.16 cfs 0.030 af

Pond 3P: Galleys Peak Elev=22.81' Storage=2 cf Inflow=0.02 cfs 0.007 af
Outflow=0.02 cfs 0.007 af

Total Runoff Area = 1.010 ac Runoff Volume = 0.071 af Average Runoff Depth = 0.84"
58.33% Pervious = 0.589 ac 41.67% Impervious = 0.421 ac

Summary for Subcatchment 1S: To North Galleys

Runoff = 0.44 cfs @ 12.09 hrs, Volume= 0.032 af, Depth= 1.81"
Routed to Pond 1P : Galleys

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.44"

	Area (sf)	CN	Description
*	2,544	98	Roofs, porches, steps
*	4,240	98	Pavement
	2,356	39	>75% Grass cover, Good, HSG A
	9,140	83	Weighted Average
	2,356		25.78% Pervious Area
	6,784		74.22% Impervious Area

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

Summary for Subcatchment 2S: To South Galleys

Runoff = 0.42 cfs @ 12.10 hrs, Volume= 0.030 af, Depth= 1.52"
Routed to Pond 2P : Galleys

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.44"

	Area (sf)	CN	Description
*	2,880	98	Roofs, porches, decks
*	4,270	98	Pavement
	3,310	39	>75% Grass cover, Good, HSG A
	10,460	79	Weighted Average
	3,310		31.64% Pervious Area
	7,150		68.36% Impervious Area

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

Summary for Subcatchment 3S: To West Galleys

Runoff = 0.02 cfs @ 12.45 hrs, Volume= 0.007 af, Depth= 0.16"
Routed to Pond 3P : Galleys

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.44"

	Area (sf)	CN	Description
*	3,800	98	Roofs, porches, decks
	19,000	39	>75% Grass cover, Good, HSG A
	22,800	49	Weighted Average
	19,000		83.33% Pervious Area
	3,800		16.67% Impervious Area

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

Summary for Subcatchment 4S: To Main Street

Runoff = 0.02 cfs @ 12.12 hrs, Volume= 0.002 af, Depth= 0.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.44"

	Area (sf)	CN	Description
*	600	98	Pavement
	1,000	39	>75% Grass cover, Good, HSG A
	1,600	61	Weighted Average
	1,000		62.50% Pervious Area
	600		37.50% 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 = 0.210 ac, 74.22% Impervious, Inflow Depth = 1.81" for 2 Year Storm event
Inflow = 0.44 cfs @ 12.09 hrs, Volume= 0.032 af
Outflow = 0.15 cfs @ 12.40 hrs, Volume= 0.032 af, Atten= 65%, Lag= 18.3 min
Discarded = 0.15 cfs @ 12.40 hrs, Volume= 0.032 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 23.41' @ 12.40 hrs Surf.Area= 640 sf Storage= 232 cf

Plug-Flow detention time= 8.7 min calculated for 0.032 af (100% of inflow)
Center-of-Mass det. time= 8.7 min (838.2 - 829.6)

Volume	Invert	Avail.Storage	Storage Description
#1	22.50'	823 cf	**8.00'W x 80.00'L x 4.50'H Crushed Stone** 2,880 cf Overall - 821 cf Embedded = 2,059 cf x 40.0% Voids
#2	23.50'	593 cf	**Concrete Galley 4x4x3** x 19 Inside #1 Inside= 42.0"W x 30.0"H => 8.91 sf x 3.50'L = 31.2 cf Outside= 48.0"W x 36.0"H => 10.81 sf x 4.00'L = 43.2 cf
		1,416 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	22.50'	**8.270 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.15 cfs @ 12.40 hrs HW=23.41' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.15 cfs)

Summary for Pond 2P: Galleys

Inflow Area = 0.240 ac, 68.36% Impervious, Inflow Depth = 1.52" for 2 Year Storm event
Inflow = 0.42 cfs @ 12.10 hrs, Volume= 0.030 af
Outflow = 0.16 cfs @ 12.39 hrs, Volume= 0.030 af, Atten= 63%, Lag= 17.9 min
Discarded = 0.16 cfs @ 12.39 hrs, Volume= 0.030 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 23.26' @ 12.39 hrs Surf.Area= 672 sf Storage= 204 cf

Plug-Flow detention time= 7.5 min calculated for 0.030 af (100% of inflow)
Center-of-Mass det. time= 7.5 min (849.7 - 842.2)

Volume	Invert	Avail.Storage	Storage Description
#1	22.50'	864 cf	**8.00'W x 84.00'L x 4.50'H Crushed Stone** 3,024 cf Overall - 865 cf Embedded = 2,159 cf x 40.0% Voids
#2	23.50'	624 cf	**Concrete Galley 4x4x3** x 20 Inside #1 Inside= 42.0"W x 30.0"H => 8.91 sf x 3.50'L = 31.2 cf Outside= 48.0"W x 36.0"H => 10.81 sf x 4.00'L = 43.2 cf
		1,488 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	22.50'	**8.270 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.16 cfs @ 12.39 hrs HW=23.26' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.16 cfs)

Summary for Pond 3P: Galleys

Inflow Area = 0.523 ac, 16.67% Impervious, Inflow Depth = 0.16" for 2 Year Storm event
Inflow = 0.02 cfs @ 12.45 hrs, Volume= 0.007 af
Outflow = 0.02 cfs @ 12.47 hrs, Volume= 0.007 af, Atten= 1%, Lag= 1.5 min
Discarded = 0.02 cfs @ 12.47 hrs, Volume= 0.007 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 22.81' @ 12.47 hrs Surf.Area= 864 sf Storage= 2 cf

Plug-Flow detention time= 1.5 min calculated for 0.007 af (100% of inflow)
Center-of-Mass det. time= 1.5 min (1,000.7 - 999.1)

Volume	Invert	Avail.Storage	Storage Description
#1	22.80'	1,521 cf	**8.00'W x 12.00'L x 4.50'H Crushed Stone** x 9 3,888 cf Overall - 86 cf Embedded = 3,802 cf x 40.0% Voids
#2	23.80'	62 cf	**Concrete Galley 4x4x3** x 2 Inside #1 Inside= 42.0"W x 30.0"H => 8.91 sf x 3.50'L = 31.2 cf Outside= 48.0"W x 36.0"H => 10.81 sf x 4.00'L = 43.2 cf 2 Chambers in 9 Rows
		1,583 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	22.80'	**8.270 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.17 cfs @ 12.47 hrs HW=22.81' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.17 cfs)

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 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 North Galleys Runoff Area=9,140 sf 74.22% Impervious Runoff Depth=3.22"
Tc=6.0 min CN=83 Runoff=0.77 cfs 0.056 af

Subcatchment 2S: To South Galleys Runoff Area=10,460 sf 68.36% Impervious Runoff Depth=2.84"
Tc=6.0 min CN=79 Runoff=0.79 cfs 0.057 af

Subcatchment 3S: To West Galleys Runoff Area=22,800 sf 16.67% Impervious Runoff Depth=0.66"
Tc=6.0 min CN=49 Runoff=0.23 cfs 0.029 af

Subcatchment 4S: To Main Street Runoff Area=1,600 sf 37.50% Impervious Runoff Depth=1.40"
Tc=6.0 min CN=61 Runoff=0.05 cfs 0.004 af

Pond 1P: Galleys Peak Elev=24.43' Storage=616 cf Inflow=0.77 cfs 0.056 af
Outflow=0.19 cfs 0.056 af

Pond 2P: Galleys Peak Elev=24.35' Storage=615 cf Inflow=0.79 cfs 0.057 af
Outflow=0.19 cfs 0.057 af

Pond 3P: Galleys Peak Elev=22.92' Storage=41 cf Inflow=0.23 cfs 0.029 af
Outflow=0.17 cfs 0.029 af

Total Runoff Area = 1.010 ac Runoff Volume = 0.146 af Average Runoff Depth = 1.74"
58.33% Pervious = 0.589 ac 41.67% Impervious = 0.421 ac

Summary for Subcatchment 1S: To North Galleys

Runoff = 0.77 cfs @ 12.09 hrs, Volume= 0.056 af, Depth= 3.22"
Routed to Pond 1P : Galleys

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=5.05"

	Area (sf)	CN	Description
*	2,544	98	Roofs, porches, steps
*	4,240	98	Pavement
	2,356	39	>75% Grass cover, Good, HSG A
	9,140	83	Weighted Average
	2,356		25.78% Pervious Area
	6,784		74.22% Impervious Area

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

Summary for Subcatchment 2S: To South Galleys

Runoff = 0.79 cfs @ 12.09 hrs, Volume= 0.057 af, Depth= 2.84"
Routed to Pond 2P : Galleys

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=5.05"

	Area (sf)	CN	Description
*	2,880	98	Roofs, porches, decks
*	4,270	98	Pavement
	3,310	39	>75% Grass cover, Good, HSG A
	10,460	79	Weighted Average
	3,310		31.64% Pervious Area
	7,150		68.36% Impervious Area

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

Summary for Subcatchment 3S: To West Galleys

Runoff = 0.23 cfs @ 12.14 hrs, Volume= 0.029 af, Depth= 0.66"
Routed to Pond 3P : Galleys

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=5.05"

	Area (sf)	CN	Description
*	3,800	98	Roofs, porches, decks
	19,000	39	>75% Grass cover, Good, HSG A
	22,800	49	Weighted Average
	19,000		83.33% Pervious Area
	3,800		16.67% Impervious Area

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

Summary for Subcatchment 4S: To Main Street

Runoff = 0.05 cfs @ 12.10 hrs, Volume= 0.004 af, Depth= 1.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=5.05"

	Area (sf)	CN	Description
*	600	98	Pavement
	1,000	39	>75% Grass cover, Good, HSG A
	1,600	61	Weighted Average
	1,000		62.50% Pervious Area
	600		37.50% 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 = 0.210 ac, 74.22% Impervious, Inflow Depth = 3.22" for 10 Year Storm event
Inflow = 0.77 cfs @ 12.09 hrs, Volume= 0.056 af
Outflow = 0.19 cfs @ 12.49 hrs, Volume= 0.056 af, Atten= 76%, Lag= 23.9 min
Discarded = 0.19 cfs @ 12.49 hrs, Volume= 0.056 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 24.43' @ 12.49 hrs Surf.Area= 640 sf Storage= 616 cf

Plug-Flow detention time= 21.2 min calculated for 0.056 af (100% of inflow)
Center-of-Mass det. time= 21.2 min (834.2 - 813.0)

Volume	Invert	Avail.Storage	Storage Description
#1	22.50'	823 cf	**8.00'W x 80.00'L x 4.50'H Crushed Stone** 2,880 cf Overall - 821 cf Embedded = 2,059 cf x 40.0% Voids
#2	23.50'	593 cf	**Concrete Galley 4x4x3** x 19 Inside #1 Inside= 42.0"W x 30.0"H => 8.91 sf x 3.50'L = 31.2 cf Outside= 48.0"W x 36.0"H => 10.81 sf x 4.00'L = 43.2 cf
		1,416 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	22.50'	**8.270 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.19 cfs @ 12.49 hrs HW=24.43' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.19 cfs)

Summary for Pond 2P: Galleys

Inflow Area = 0.240 ac, 68.36% Impervious, Inflow Depth = 2.84" for 10 Year Storm event
Inflow = 0.79 cfs @ 12.09 hrs, Volume= 0.057 af
Outflow = 0.19 cfs @ 12.50 hrs, Volume= 0.057 af, Atten= 75%, Lag= 24.2 min
Discarded = 0.19 cfs @ 12.50 hrs, Volume= 0.057 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 24.35' @ 12.50 hrs Surf.Area= 672 sf Storage= 615 cf

Plug-Flow detention time= 20.6 min calculated for 0.057 af (100% of inflow)
Center-of-Mass det. time= 20.6 min (844.6 - 824.0)

Volume	Invert	Avail.Storage	Storage Description
#1	22.50'	864 cf	**8.00'W x 84.00'L x 4.50'H Crushed Stone** 3,024 cf Overall - 865 cf Embedded = 2,159 cf x 40.0% Voids
#2	23.50'	624 cf	**Concrete Galley 4x4x3** x 20 Inside #1 Inside= 42.0"W x 30.0"H => 8.91 sf x 3.50'L = 31.2 cf Outside= 48.0"W x 36.0"H => 10.81 sf x 4.00'L = 43.2 cf
		1,488 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	22.50'	**8.270 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.19 cfs @ 12.50 hrs HW=24.35' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.19 cfs)

Summary for Pond 3P: Galleys

Inflow Area = 0.523 ac, 16.67% Impervious, Inflow Depth = 0.66" for 10 Year Storm event
Inflow = 0.23 cfs @ 12.14 hrs, Volume= 0.029 af
Outflow = 0.17 cfs @ 12.34 hrs, Volume= 0.029 af, Atten= 24%, Lag= 11.9 min
Discarded = 0.17 cfs @ 12.34 hrs, Volume= 0.029 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 22.92' @ 12.34 hrs Surf.Area= 864 sf Storage= 41 cf

Plug-Flow detention time= 1.9 min calculated for 0.029 af (100% of inflow)
Center-of-Mass det. time= 1.9 min (920.8 - 918.9)

Volume	Invert	Avail.Storage	Storage Description
#1	22.80'	1,521 cf	**8.00'W x 12.00'L x 4.50'H Crushed Stone** x 9 3,888 cf Overall - 86 cf Embedded = 3,802 cf x 40.0% Voids
#2	23.80'	62 cf	**Concrete Galley 4x4x3** x 2 Inside #1 Inside= 42.0"W x 30.0"H => 8.91 sf x 3.50'L = 31.2 cf Outside= 48.0"W x 36.0"H => 10.81 sf x 4.00'L = 43.2 cf 2 Chambers in 9 Rows
		1,583 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	22.80'	**8.270 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.17 cfs @ 12.34 hrs HW=22.92' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.17 cfs)

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 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 North Galleys Runoff Area=9,140 sf 74.22% Impervious Runoff Depth=4.14"
Tc=6.0 min CN=83 Runoff=0.98 cfs 0.072 af

Subcatchment 2S: To South Galleys Runoff Area=10,460 sf 68.36% Impervious Runoff Depth=3.72"
Tc=6.0 min CN=79 Runoff=1.02 cfs 0.075 af

Subcatchment 3S: To West Galleys Runoff Area=22,800 sf 16.67% Impervious Runoff Depth=1.10"
Tc=6.0 min CN=49 Runoff=0.51 cfs 0.048 af

Subcatchment 4S: To Main Street Runoff Area=1,600 sf 37.50% Impervious Runoff Depth=2.04"
Tc=6.0 min CN=61 Runoff=0.08 cfs 0.006 af

Pond 1P: Galleys Peak Elev=25.12' Storage=880 cf Inflow=0.98 cfs 0.072 af
Outflow=0.21 cfs 0.072 af

Pond 2P: Galleys Peak Elev=25.09' Storage=910 cf Inflow=1.02 cfs 0.075 af
Outflow=0.22 cfs 0.075 af

Pond 3P: Galleys Peak Elev=23.56' Storage=261 cf Inflow=0.51 cfs 0.048 af
Outflow=0.22 cfs 0.048 af

Total Runoff Area = 1.010 ac Runoff Volume = 0.201 af Average Runoff Depth = 2.39"
58.33% Pervious = 0.589 ac 41.67% Impervious = 0.421 ac

Summary for Subcatchment 1S: To North Galleys

Runoff = 0.98 cfs @ 12.09 hrs, Volume= 0.072 af, Depth= 4.14"
Routed to Pond 1P : Galleys

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Storm Rainfall=6.05"

	Area (sf)	CN	Description
*	2,544	98	Roofs, porches, steps
*	4,240	98	Pavement
	2,356	39	>75% Grass cover, Good, HSG A
	9,140	83	Weighted Average
	2,356		25.78% Pervious Area
	6,784		74.22% Impervious Area

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

Summary for Subcatchment 2S: To South Galleys

Runoff = 1.02 cfs @ 12.09 hrs, Volume= 0.075 af, Depth= 3.72"
Routed to Pond 2P : Galleys

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Storm Rainfall=6.05"

	Area (sf)	CN	Description
*	2,880	98	Roofs, porches, decks
*	4,270	98	Pavement
	3,310	39	>75% Grass cover, Good, HSG A
	10,460	79	Weighted Average
	3,310		31.64% Pervious Area
	7,150		68.36% Impervious Area

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

Summary for Subcatchment 3S: To West Galleys

Runoff = 0.51 cfs @ 12.11 hrs, Volume= 0.048 af, Depth= 1.10"
Routed to Pond 3P : Galleys

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Storm Rainfall=6.05"

	Area (sf)	CN	Description
*	3,800	98	Roofs, porches, decks
	19,000	39	>75% Grass cover, Good, HSG A
	22,800	49	Weighted Average
	19,000		83.33% Pervious Area
	3,800		16.67% Impervious Area

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

Summary for Subcatchment 4S: To Main Street

Runoff = 0.08 cfs @ 12.10 hrs, Volume= 0.006 af, Depth= 2.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Storm Rainfall=6.05"

	Area (sf)	CN	Description
*	600	98	Pavement
	1,000	39	>75% Grass cover, Good, HSG A
	1,600	61	Weighted Average
	1,000		62.50% Pervious Area
	600		37.50% 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 = 0.210 ac, 74.22% Impervious, Inflow Depth = 4.14" for 25 Year Storm event
Inflow = 0.98 cfs @ 12.09 hrs, Volume= 0.072 af
Outflow = 0.21 cfs @ 12.51 hrs, Volume= 0.072 af, Atten= 79%, Lag= 25.5 min
Discarded = 0.21 cfs @ 12.51 hrs, Volume= 0.072 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 25.12' @ 12.51 hrs Surf.Area= 640 sf Storage= 880 cf

Plug-Flow detention time= 29.1 min calculated for 0.072 af (100% of inflow)
Center-of-Mass det. time= 29.0 min (834.9 - 805.9)

Volume	Invert	Avail.Storage	Storage Description
#1	22.50'	823 cf	**8.00'W x 80.00'L x 4.50'H Crushed Stone** 2,880 cf Overall - 821 cf Embedded = 2,059 cf x 40.0% Voids
#2	23.50'	593 cf	**Concrete Galley 4x4x3** x 19 Inside #1 Inside= 42.0"W x 30.0"H => 8.91 sf x 3.50'L = 31.2 cf Outside= 48.0"W x 36.0"H => 10.81 sf x 4.00'L = 43.2 cf
		1,416 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	22.50'	**8.270 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.21 cfs @ 12.51 hrs HW=25.12' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.21 cfs)

Summary for Pond 2P: Galleys

Inflow Area = 0.240 ac, 68.36% Impervious, Inflow Depth = 3.72" for 25 Year Storm event
Inflow = 1.02 cfs @ 12.09 hrs, Volume= 0.075 af
Outflow = 0.22 cfs @ 12.52 hrs, Volume= 0.075 af, Atten= 79%, Lag= 25.8 min
Discarded = 0.22 cfs @ 12.52 hrs, Volume= 0.075 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 25.09' @ 12.52 hrs Surf.Area= 672 sf Storage= 910 cf

Plug-Flow detention time= 29.4 min calculated for 0.074 af (100% of inflow)
Center-of-Mass det. time= 29.3 min (845.6 - 816.3)

Volume	Invert	Avail.Storage	Storage Description
#1	22.50'	864 cf	**8.00'W x 84.00'L x 4.50'H Crushed Stone** 3,024 cf Overall - 865 cf Embedded = 2,159 cf x 40.0% Voids
#2	23.50'	624 cf	**Concrete Galley 4x4x3** x 20 Inside #1 Inside= 42.0"W x 30.0"H => 8.91 sf x 3.50'L = 31.2 cf Outside= 48.0"W x 36.0"H => 10.81 sf x 4.00'L = 43.2 cf
		1,488 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	22.50'	**8.270 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.22 cfs @ 12.52 hrs HW=25.08' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.22 cfs)

Summary for Pond 3P: Galleys

Inflow Area = 0.523 ac, 16.67% Impervious, Inflow Depth = 1.10" for 25 Year Storm event
Inflow = 0.51 cfs @ 12.11 hrs, Volume= 0.048 af
Outflow = 0.22 cfs @ 12.47 hrs, Volume= 0.048 af, Atten= 57%, Lag= 21.2 min
Discarded = 0.22 cfs @ 12.47 hrs, Volume= 0.048 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 23.56' @ 12.47 hrs Surf.Area= 864 sf Storage= 261 cf

Plug-Flow detention time= 6.6 min calculated for 0.048 af (100% of inflow)
Center-of-Mass det. time= 6.6 min (904.2 - 897.6)

Volume	Invert	Avail.Storage	Storage Description
#1	22.80'	1,521 cf	**8.00'W x 12.00'L x 4.50'H Crushed Stone** x 9 3,888 cf Overall - 86 cf Embedded = 3,802 cf x 40.0% Voids
#2	23.80'	62 cf	**Concrete Galley 4x4x3** x 2 Inside #1 Inside= 42.0"W x 30.0"H => 8.91 sf x 3.50'L = 31.2 cf Outside= 48.0"W x 36.0"H => 10.81 sf x 4.00'L = 43.2 cf 2 Chambers in 9 Rows
		1,583 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	22.80'	**8.270 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.22 cfs @ 12.47 hrs HW=23.55' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.22 cfs)

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 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 North Galleys Runoff Area=9,140 sf 74.22% Impervious Runoff Depth=5.59"
Tc=6.0 min CN=83 Runoff=1.31 cfs 0.098 af

Subcatchment 2S: To South Galleys Runoff Area=10,460 sf 68.36% Impervious Runoff Depth=5.13"
Tc=6.0 min CN=79 Runoff=1.40 cfs 0.103 af

Subcatchment 3S: To West Galleys Runoff Area=22,800 sf 16.67% Impervious Runoff Depth=1.91"
Tc=6.0 min CN=49 Runoff=1.02 cfs 0.083 af

Subcatchment 4S: To Main Street Runoff Area=1,600 sf 37.50% Impervious Runoff Depth=3.14"
Tc=6.0 min CN=61 Runoff=0.13 cfs 0.010 af

Pond 1P: Galleys Peak Elev=26.53' Storage=1,297 cf Inflow=1.31 cfs 0.098 af
Outflow=0.26 cfs 0.098 af

Pond 2P: Galleys Peak Elev=26.60' Storage=1,380 cf Inflow=1.40 cfs 0.103 af
Outflow=0.27 cfs 0.103 af

Pond 3P: Galleys Peak Elev=24.91' Storage=743 cf Inflow=1.02 cfs 0.083 af
Outflow=0.31 cfs 0.083 af

Total Runoff Area = 1.010 ac Runoff Volume = 0.293 af Average Runoff Depth = 3.48"
58.33% Pervious = 0.589 ac 41.67% Impervious = 0.421 ac

Summary for Subcatchment 1S: To North Galleys

Runoff = 1.31 cfs @ 12.09 hrs, Volume= 0.098 af, Depth= 5.59"
Routed to Pond 1P : Galleys

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=7.59"

	Area (sf)	CN	Description
*	2,544	98	Roofs, porches, steps
*	4,240	98	Pavement
	2,356	39	>75% Grass cover, Good, HSG A
	9,140	83	Weighted Average
	2,356		25.78% Pervious Area
	6,784		74.22% Impervious Area

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

Summary for Subcatchment 2S: To South Galleys

Runoff = 1.40 cfs @ 12.09 hrs, Volume= 0.103 af, Depth= 5.13"
Routed to Pond 2P : Galleys

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=7.59"

	Area (sf)	CN	Description
*	2,880	98	Roofs, porches, decks
*	4,270	98	Pavement
	3,310	39	>75% Grass cover, Good, HSG A
	10,460	79	Weighted Average
	3,310		31.64% Pervious Area
	7,150		68.36% Impervious Area

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

Summary for Subcatchment 3S: To West Galleys

Runoff = 1.02 cfs @ 12.10 hrs, Volume= 0.083 af, Depth= 1.91"
Routed to Pond 3P : Galleys

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=7.59"

	Area (sf)	CN	Description
*	3,800	98	Roofs, porches, decks
	19,000	39	>75% Grass cover, Good, HSG A
	22,800	49	Weighted Average
	19,000		83.33% Pervious Area
	3,800		16.67% Impervious Area

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

Summary for Subcatchment 4S: To Main Street

Runoff = 0.13 cfs @ 12.10 hrs, Volume= 0.010 af, Depth= 3.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=7.59"

	Area (sf)	CN	Description
*	600	98	Pavement
	1,000	39	>75% Grass cover, Good, HSG A
	1,600	61	Weighted Average
	1,000		62.50% Pervious Area
	600		37.50% 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 = 0.210 ac, 74.22% Impervious, Inflow Depth = 5.59" for 100 Year Storm event
Inflow = 1.31 cfs @ 12.09 hrs, Volume= 0.098 af
Outflow = 0.26 cfs @ 12.53 hrs, Volume= 0.098 af, Atten= 80%, Lag= 26.4 min
Discarded = 0.26 cfs @ 12.53 hrs, Volume= 0.098 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 26.53' @ 12.53 hrs Surf.Area= 640 sf Storage= 1,297 cf

Plug-Flow detention time= 39.4 min calculated for 0.098 af (100% of inflow)
Center-of-Mass det. time= 39.4 min (836.9 - 797.5)

Volume	Invert	Avail.Storage	Storage Description
#1	22.50'	823 cf	**8.00'W x 80.00'L x 4.50'H Crushed Stone** 2,880 cf Overall - 821 cf Embedded = 2,059 cf x 40.0% Voids
#2	23.50'	593 cf	**Concrete Galley 4x4x3** x 19 Inside #1 Inside= 42.0"W x 30.0"H => 8.91 sf x 3.50'L = 31.2 cf Outside= 48.0"W x 36.0"H => 10.81 sf x 4.00'L = 43.2 cf
		1,416 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	22.50'	**8.270 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.26 cfs @ 12.53 hrs HW=26.53' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.26 cfs)

Summary for Pond 2P: Galleys

Inflow Area = 0.240 ac, 68.36% Impervious, Inflow Depth = 5.13" for 100 Year Storm event
Inflow = 1.40 cfs @ 12.09 hrs, Volume= 0.103 af
Outflow = 0.27 cfs @ 12.54 hrs, Volume= 0.103 af, Atten= 80%, Lag= 26.8 min
Discarded = 0.27 cfs @ 12.54 hrs, Volume= 0.103 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 26.60' @ 12.54 hrs Surf.Area= 672 sf Storage= 1,380 cf

Plug-Flow detention time= 40.8 min calculated for 0.103 af (100% of inflow)
Center-of-Mass det. time= 40.8 min (848.1 - 807.2)

Volume	Invert	Avail.Storage	Storage Description
#1	22.50'	864 cf	**8.00'W x 84.00'L x 4.50'H Crushed Stone** 3,024 cf Overall - 865 cf Embedded = 2,159 cf x 40.0% Voids
#2	23.50'	624 cf	**Concrete Galley 4x4x3** x 20 Inside #1 Inside= 42.0"W x 30.0"H => 8.91 sf x 3.50'L = 31.2 cf Outside= 48.0"W x 36.0"H => 10.81 sf x 4.00'L = 43.2 cf
		1,488 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	22.50'	**8.270 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.27 cfs @ 12.54 hrs HW=26.60' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.27 cfs)

Summary for Pond 3P: Galleys

Inflow Area = 0.523 ac, 16.67% Impervious, Inflow Depth = 1.91" for 100 Year Storm event
Inflow = 1.02 cfs @ 12.10 hrs, Volume= 0.083 af
Outflow = 0.31 cfs @ 12.51 hrs, Volume= 0.083 af, Atten= 70%, Lag= 24.5 min
Discarded = 0.31 cfs @ 12.51 hrs, Volume= 0.083 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 24.91' @ 12.51 hrs Surf.Area= 864 sf Storage= 743 cf

Plug-Flow detention time= 16.6 min calculated for 0.083 af (100% of inflow)
Center-of-Mass det. time= 16.6 min (894.1 - 877.5)

Volume	Invert	Avail.Storage	Storage Description
#1	22.80'	1,521 cf	**8.00'W x 12.00'L x 4.50'H Crushed Stone** x 9 3,888 cf Overall - 86 cf Embedded = 3,802 cf x 40.0% Voids
#2	23.80'	62 cf	**Concrete Galley 4x4x3** x 2 Inside #1 Inside= 42.0"W x 30.0"H => 8.91 sf x 3.50'L = 31.2 cf Outside= 48.0"W x 36.0"H => 10.81 sf x 4.00'L = 43.2 cf 2 Chambers in 9 Rows
		1,583 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	22.80'	**8.270 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.31 cfs @ 12.51 hrs HW=24.90' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.31 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: 434 Main Street, Wareham, Mass

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
Deep Sump and Hooded Catch Basin	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: Village Townhouses

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

Date: 8-Sept.-2022

*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

Water Quality Volume Calculation

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

Impervious Area to Galley System 1 = 6,784 sf

WQV = 6,784 sf x 1.0 in x 1 ft/12 in = 565.3 cf

Volume Available in System 1 = 1,416 cf (HydroCAD)

1,416 cf > 565.3 cf OK

Impervious Area to Galley System 2 = 7,150 sf

WQV = 7,150 sf x 1.0 in x 1 ft/12 in = 595.8 cf

Volume Available in System 2 = 1,488 cf (HydroCAD)

1,488 cf > 595.8 OK

Impervious Area to Galley System 3 = 3,800 sf

WQV = 3,800 sf x 1.0 in x 1 ft/12 in = 316.7 cf

Volume Available in System 3 = 1,583 cf (HydroCAD)

1,583 cf > 316.7 OK

Required Recharge Volume Calculation

Galley Systems

Total Impervious Area to Galley System 1 = 6,784 sf

Required Recharge Depth = 0.6 inches (HSG A Soil)

Required Recharge Volume = 6,784 sf x 0.6"/12 = 339.2 cf

Available Storage = 1,416 cf (HydroCAD)

1,416 cf > 339.2 cf - OK

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

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

$$\text{Time} = \frac{1{,}297 \text{ cf}}{(8.27 \text{ inches/hour})\ (1\text{ft}/12\text{inches})\ (640 \text{ sf})}$$

= 2.9 hours < 72 hours – OK

Total Impervious Area to Galley System 2 = 7,150 sf

Required Recharge Volume = 7,150 sf x 0.6"/12 = 357.5 cf

Available Storage = 1,488 cf

1,488 cf > 357.5 cf – OK

Recharge System Drawdown time

$$\text{Time} = \frac{1{,}380 \text{ cf}}{(8.27 \text{ inches/hour})\ (1\text{ft}/12\text{inches})\ (672 \text{ sf})}$$

= 3.0 hours < 72 hours - OK

G.A.F. Engineering, Inc.
September 8, 2022
G.A.F. Job No.: 21-9751

Total Impervious Area to Galley System 3 = 3,800 sf

Required Recharge Volume = 3,800 sf x 0.6"/12 = 190 cf

Available Storage = 1,583 cf

1,583 cf > 190 cf – OK

Recharge System Drawdown time

$$\text{Time} = \frac{743 \text{ cf}}{(8.27 \text{ inches/hour})\ (1\text{ft}/12\text{inches})\ (864 \text{ sf})}$$

= 1.2 hours < 72 hours - OK

Construction Period Pollution Prevention and

Erosion & Sedimentation Control Plan

Narrative: This project consists of the construction of a building serving ten residential housing units with associated access drives, utilities, and stormwater management system.

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.
- 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.
- Clear trees, demolish and remove existing dwelling and driveway.
- Rough grade the site access drive, parking lot, building pad and rear yard.
- Install underground drainage chambers.
- Install underground utilities and building foundation.
- Install catch basins and drain manholes
- Install gravel base material.
- Install roof drain conveyance pipes.
- Install gravel base material and base course of pavement.
- Install top course of pavement.
- Install landscaping.
- Loam and seed disturbed areas.
- Maintain erosion controls until all areas are stabilized with vegetation.

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: Current and Future Owner
434 Main Street
Wareham, MA 02571

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 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. Paved areas are graded to deep sump catch basins located at the entrance drives. The catch basins discharge to drain manholes specified with deep sumps and outlet hoods. The drain manholes discharge to underground infiltration systems consisting of concrete leaching galleys surrounded by crushed stone. The rear yard area contains a low point which will be drained with a series of underground leaching galleys which have been specified with frames and grates to collect any surface water. The roof runoff from the building will be piped directly into each of the galley systems.

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 and Drain Manholes: Deep sump catch basins and drain manholes 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.

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 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, 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.

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

Hydrologic Soil Group—Plymouth County, Massachusetts
(434 Main Street Wareham)

Map Scale: 1:7,380 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 14, Sep 2, 2021

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

Date(s) aerial images were photographed: Sep 25, 2020—Oct 9, 2020

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
6A	Scarboro muck, coastal lowland, 0 to 3 percent slopes	A/D	0.0	0.0%
37A	Massasoit - Mashpee complex, 0 to 3 percent slopes	D	2.1	0.8%
48A	Brockton sandy loam, 0 to 3 percent slopes, extremely stony	C/D	6.8	2.7%
51A	Swansea muck, 0 to 1 percent slopes	B/D	1.4	0.6%
53A	Freetown muck, ponded, 0 to 1 percent slopes	B/D	1.1	0.4%
66A	Ipswich - Pawcatuck - Matunuck complex, 0 to 2 percent slopes, very frequently flooded	A/D	10.0	4.0%
69A	Mattapoisett loamy sand, 0 to 3 percent slopes, extremely stony	D	6.9	2.7%
255B	Windsor loamy sand, 3 to 8 percent slopes	A	8.8	3.5%
256A	Deerfield loamy fine sand, 0 to 3 percent slopes	A	3.5	1.4%
256B	Deerfield loamy fine sand, 3 to 8 percent slopes	A	2.0	0.8%
321B	Birchwood sand, 3 to 8 percent slopes, very stony	B/D	14.1	5.6%
323B	Poquonock sand, 3 to 8 percent slopes, very stony	A	2.9	1.1%
323C	Poquonock sand, 8 to 15 percent slopes, very stony	A	12.0	4.8%
437C	Plymouth loamy coarse sand, 8 to 15 percent slopes, bouldery	A	17.9	7.1%
481C	Plymouth - Carver complex, 8 to 15 percent slopes, bouldery	A	1.0	0.4%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
602B	Urban land, 0 to 8 percent slopes		3.8	1.5%
608	Water, ocean		30.7	12.2%
628B	Canton - Urban land complex, 0 to 8 percent slopes	A	60.0	23.8%
634B	Birchwood - Urban land complex, 0 to 8 percent slopes	B/D	7.0	2.8%
636B	Montauk-Urban land complex, 0 to 8 percent slopes	C	18.5	7.3%
656B	Udorthents - Urban land complex, 0 to 8 percent slopes	B	20.5	8.1%
665B	Udipsamments, 0 to 8 percent slopes	A	0.3	0.1%
700A	Udipsamments, wet substratum, 0 to 3 percent slopes	A/D	3.9	1.5%
701A	Rainberry coarse sand, 0 to 3 percent slope, sanded surface, inactive	A/D	8.1	3.2%
702C	Udipsamments, 8 to 15 percent slopes	A	4.7	1.9%
704A	Freetown and Swansea coarse sands, 0 to 3 percent slopes, sanded surface and inactive	B/D	4.5	1.8%
Totals for Area of Interest			**252.7**	**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.

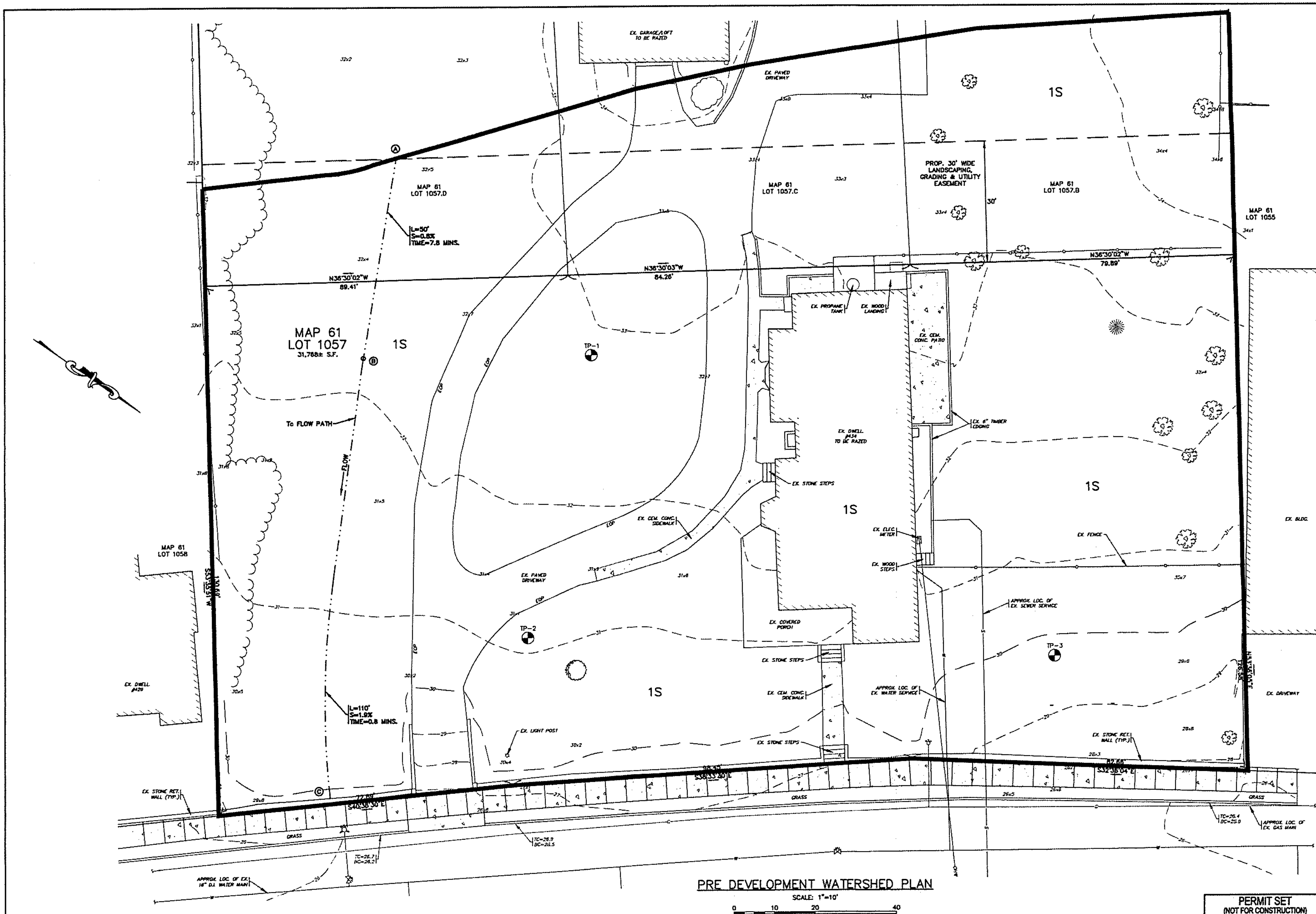
If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher



PERMIT SET
(NOT FOR CONSTRUCTION)

REV.	DATE	BY	APP'D	DESCRIPTION

APPROVED BY:

APPROVED BY:

DATE: SEPT. 8, 2022
DRAWN BY: JMP
CHECKED BY: WFM
JOB NO.: 21-9751
SCALE: 1" = 10'

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

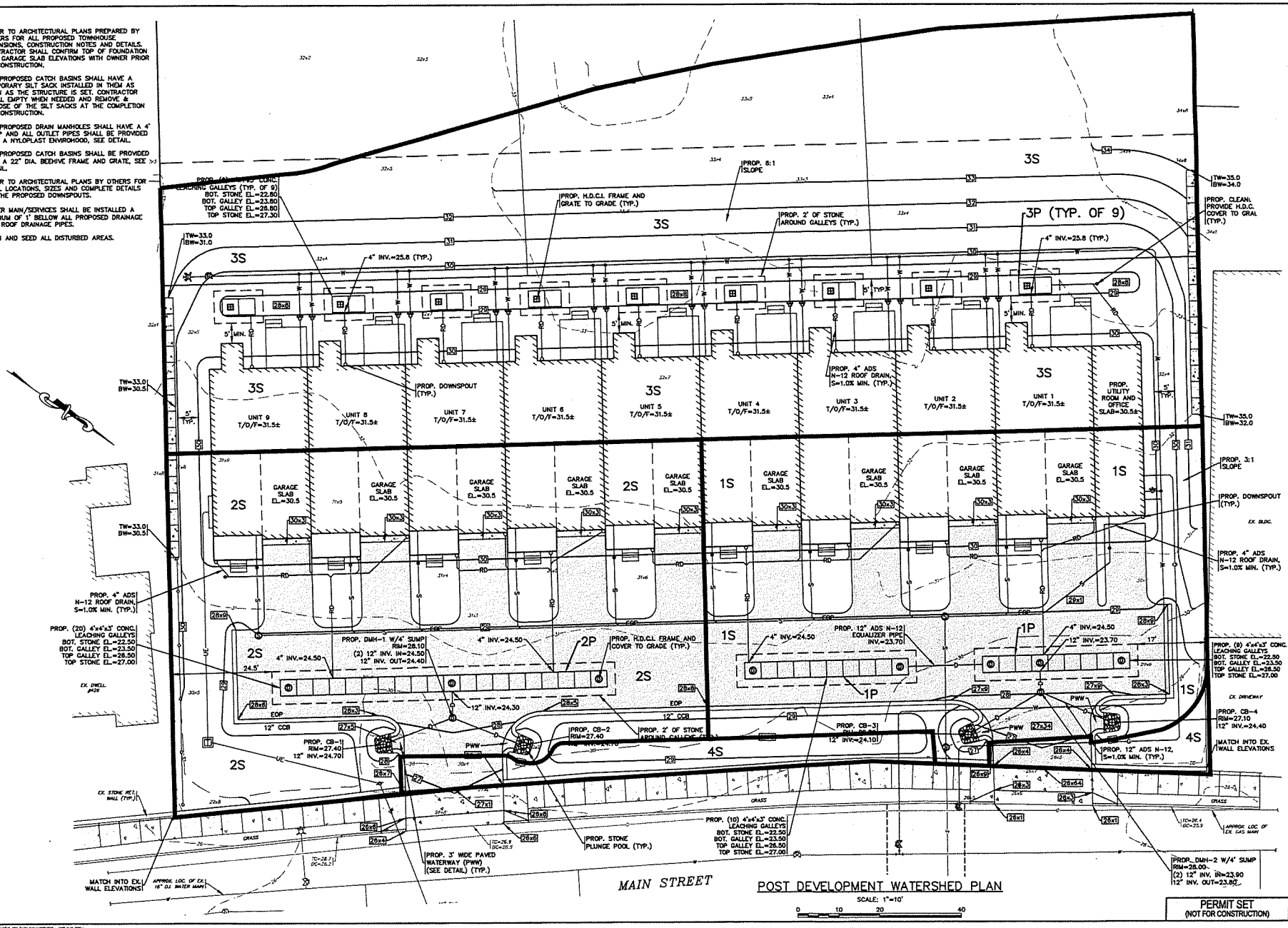
PRE DEVELOPMENT
WATERSHED PLAN
434 MAIN STREET WAREHAM, MA

PREPARED FOR:
NAZIH B. ELKALLASSI
20 TOWER TERRACE WAREHAM, MA

JOB NO.: 21-9751
DWG.
1 OF 2

NOTES:

1. REFER TO ARCHITECTURAL PLANS PREPARED BY OTHERS FOR ALL PROPOSED TOWNHOUSE DIMENSIONS, CONSTRUCTION NOTES AND DETAILS. CONTRACTOR SHALL CONFIRM TOP OF FOUNDATION AND GARAGE SLAB ELEVATIONS WITH OWNER PRIOR TO CONSTRUCTION.
2. ALL PROPOSED 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. ALL PROPOSED DRAIN MANHOLES SHALL HAVE A 4' SUMP AND ALL OUTLET PIPES SHALL BE PROVIDED WITH A NYLOPLAST ENVIROHOOD, SEE DETAIL.
4. ALL PROPOSED CATCH BASINS SHALL BE PROVIDED WITH A 22" DIA. BEEHIVE FRAME AND GRATE, SEE DETAIL.
5. REFER TO ARCHITECTURAL PLANS BY OTHERS FOR FINAL LOCATIONS, SIZES AND COMPLETE DETAILS ON THE PROPOSED DOWNSPOUTS.
6. WATER MAIN/SERVICES SHALL BE INSTALLED A MINIMUM OF 1' BELLOW ALL PROPOSED DRAINAGE AND ROOF DRAINAGE PIPES.
7. LOAM AND SEED ALL DISTURBED AREAS.



POST DEVELOPMENT WATERSHED PLAN

SCALE: 1"=10'

0 10 20 40

PERMIT SET
(NOT FOR CONSTRUCTION)

REV.	DATE	BY	APP'D	DESCRIPTION

DATE: SEPT. 6, 2022
DRAWN BY: AJP
CHECKED BY: WFM
JOB NO.: 21-9751
SCALE: 1" = 10'

APPROVED BY:

APPROVED BY:

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PRE DEVELOPMENT WATERSHED PLAN
434 MAIN STREET WAREHAM, MA

PREPARED FOR:
NAZIH B. ELKALLASSI
20 TOWER TERRACE WAREHAM, MA

JOB NO.: 21-9751

DWG. 2 OF 2