SUPPLEMENTAL STORMWATER MANAGEMENT REPORT

Project Address:	29 Winter Street Pembroke, MA 02359
Date Prepared: **Revised;**	January 19th 2023 March 20th, 2023
Project Number:	1622000082
Prepared for:	B&M 35 Hanover, LLC 29 Winter Street Pembroke MA 02359
Prepared by:	EBI Consulting 21 B Street Burlington MA 01803

EBI Consulting

SUPPLEMENTAL STORMWATER MANAGEMENT REPORT

29 WINTER STREET PEMBROKE MA

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NARRATIVE

A Stormwater Management Report was submitted to the Pembroke Planning Board for a Site Plan Approval Application on January 20th, 2023, for the Proposed Ancillary Building Addition Project. The Planning Board and the Peer Reviewer (Merrill Engineers and Land Surveyors) has reviewed the submitted application and issued a comment letter on March 6th, 2023 regarding the application.

This supplemental Stormwater Management Report includes the original report and the following revisions:

- Revised hydrologic calculations to account for the reduced infiltration rate of 1.02 in/hr
- Revised pipe sizing calculations (sized for the 100 year storm event)
- Revised recharge volume calculations
- Revised TSS calculations
- Scour protection calculations for the rip-rap areas.
- Revised short term O&M plan
- Revised long term O&M plan

METHODOLOGY

The hydrologic analysis models the pre- and post-development stormwater characteristics for the Project and compares changes in peak rate of runoff and water quality associated with the proposed development. Where increases to peak rate of runoff or reductions in water quality are identified, Stormwater Best Management Practices (BMPs) and Low Impact Development (LID) techniques are considered. The analysis shall demonstrate that post-development hydrologic conditions generally mimic pre-development hydrologic conditions; that any potential impacts to downstream properties, infrastructure, or environmentally sensitive areas are mitigated; and those local and state stormwater management standards are met to the extent practicable.

The pre-development hydrologic model establishes the limits of the study area and down-gradient Points of Analysis (POAs), which are dependent on topographic and environmental conditions. The model quantifies sub-watershed stormwater runoff characteristics related to topography, land use/cover types and soil conditions, computing peak runoff rates for specific design storm frequencies under pre-development conditions at the POAs.

The post-development hydrologic model analyzes the same study area, and accounts for changes in sub-watershed area topography and land use/cover types associated with the proposed development. The model computes the changes to the peak runoff rates at the same POAs, and BMPs are implemented to mitigate stormwater impacts due to development. In addition, BMPs are also implemented to improve

water quality and reduce Total Suspended Solid (TSS) pollutant concentrations to satisfy stormwater regulation requirements for the new construction.

For this analysis one (1) POAs have been established, including:

- POA 1: (Southerly Wetlands)

The hydrologic model, analysis, and proposed mitigation measures have been developed using the following resources:

- Hydrologic modeling techniques and methods established in NRCS - Technical Releases No. 20 and No. 55 (TR-20 and TR-55) using proprietary HydroCAD® stormwater modeling software.
- Massachusetts Department of Environmental Protection – Stormwater Handbook Volumes #1, #2, and #3 (as amended).

RAINFALL DATA

Table 1. – Summary of Rainfall Data

Rainfall Recurrence Interval	24 Hour Rainfall Depth
2-Year Storm	3.40 inches
10-Year Storm	4.70 inches
25-Year Storm	5.60 inches
100-Year Storm	7.00 inches

SOILS DATA

Based upon the USDA – NRCS Soil Conservation Service (SCS) Web Soil Survey for Plymouth, soils underlying the Project (excluding surface water bodies) are classified as follows:

Table 2. – Summary of USDA Soil Classification

Soil Classification	Hydrologic Soil Group (HSG)
Udorthents – Urban Land	HSG (B)
Aquepts	[HSG (D)

Subsurface investigations comprising of two (2) test pits were conducted at the footprint of the proposed infiltration/detention basin by EBI Consulting on December 20, 2022.

Even though the NRCS Web Soil Survey classifies most of the site as “B” soils, on site test pit data demonstrates that the parent material consists of sandy loam that is considered an “A” soil. The highest seasonal groundwater elevation was observed at elevation 91.3. For this analysis an infiltration rate of 2.41 in/hr was chosen.

PRE-DEVELOPMENT CONDITIONS

The portions of the Subject Property subject to this analysis is comprised of one (1) watershed areas as described below and analyzed at POA#1 described in the "Methodology" section in this report. Existing watershed areas include:

- PRE-1 64,531 ft^2 area comprising undeveloped land with mostly overgrown shrubs. Runoff from this watershed flows overland and discharges to POA#1 (wetlands)

Refer to the Pre-Dev Watershed Plan under Appendix A for information and limits of the existing watershed areas.

For the pre-development watershed analysis, Table 3 presents a summary of the watershed areas, the weighted TR-55 runoff curve numbers (CN – based on ground cover types), and Times of Concentration (T_c) for the existing Watershed Areas:

Table 3. – Pre-Development Watershed Areas and Runoff Curve Numbers

	PRE-1
Area	64,531 ft^2
CN	56
T_c	6.5 min

POST-DEVELOPMENT CONDITIONS

The project proposes to construct a 5,000 +/- SF ancillary storage building to assist the existing office building that is located on site

The portions of the Subject Property affected by the Project are divided into two (2) proposed watershed areas. The one (1) POA remain unchanged.

- POST-1 – A 24,995 ft^2 area comprising of proposed roof area, parking areas, drive isles and some landscaped areas. Runoff from the paved areas will flow overland to one of the catch basins and will be routed via the closed drainage system where it will be pre-treated before is routed towards the proposed infiltration/detention basin. Runoff from the roof will flow directly towards the proposed infiltration/detention basin. From the basin most of the runoff will be infiltrated and the portion of runoff that will be discharged by the basin will flow towards the wetlands POA#1
- POST-2 – A 39,536 ft^2 area comprising of existing and proposed landscaped areas. Most of the existing landscaped areas are overgrown shrubs. Runoff will flow overland towards the wetlands POA#1

Refer to the Post-Development Watershed Plan under Figures for information and limits of the proposed watershed areas.

Table 4 presents a comparison of watershed area, the weighted TR-55 runoff curve number (CN – based on ground cover types), and Time of Concentration (T_c) for the proposed watersheds:

Table 4. – Post-Development Watershed Areas and Runoff Curve Numbers

	Post1	Post2
Area	24,955 ft²	39,536 ft²
CN	84	57
T_c	6.0 min	6.0 min

STORMWATER MITIGATION

The stormwater management improvements are designed to meet the requirements of the Massachusetts Stormwater Handbook to provide the required water quality pretreatment of 1.0" of runoff for discharge to the existing wetland. The above ground infiltration/detention basin is designed to drain completely in less than 72 hours, is located outside lines of influence from building foundations, and is geometrically coordinated with other utility infrastructure.

The Project will result in a 24/995 ft^2 (0.57 acres) net increase in impervious site area. The stormwater management system and BMPs proposed for the Project are designed to mitigate water quantity and quality impacts prior to discharge to the wetlands on site. The Project results in net decreases in peak runoff rates generated by all storm events up to and including the 100-year storm. The proposed drainage collection system is designed to adequately collect and convey the 25 year storm event.

The increase in impervious area is mitigated via the implementation of the aboveground detention/infiltration system. Table 5 summarizes the pre- and post-development peak rates of runoff at the POA#1 for the Project after implementation of the selected stormwater BMPs for the all 4 rainfall events.

Table 5. – Summary of Pre- and Post-Development Peak Rates of Runoff

Design Storm	**POA 1: Southerly Wetlands**		
	Pre-Dev	**Post-Dev**	**Change**
2 Year	0.25 cfs	0.19 cfs	-0.06 cfs
10 Year	1.18 cfs	0.81 cfs	-0.37 cfs
25 Year	2.02 cfs	1.40 cfs	-0.62 cfs
100 Year	3.52 cfs	2.91 cfs	-0.61 cfs

Refer to Appendix C for TSS removal rates for each treatment train. The proposed TSS removal rates meet the Massachusetts Stormwater Policy Guidelines minimum removal rate of 80% prior to surface discharge.

Construction-Phase and Long-Term Stormwater Operation and Maintenance Plans (O&M Plans) have been included in Appendix D of this report and include information on the responsible party for the O&M plan implementation, a project overview, and the structural and non-structural BMPs to be utilized on site.

CONCLUSION

The Project will preserve the existing runoff patterns and off-site discharge locations of the Subject Property and will improve discharge conditions through implementation of stormwater infiltration/detention BMPs and reducing the volume of uncontrolled and untreated off-site runoff. The Project will also implement water quality treatment measures on-site. Potential stormwater impacts associated with the development will be mitigated as required by State and Municipal Regulations.

The Project will comply with Standards outlined in the Massachusetts Stormwater Management Handbook as follows:

STANDARD **1**	No New Untreated Discharges	Met, All existing discharge points are maintained. Mitigation is proposed to treat discharge impacts at existing points as feasible.
STANDARD **2**	Peak Rate Attenuation	Met, Calculations are provided showing post-development peak discharge rates do not exceed pre-development rates for the 2, 10, 25, and 100-year 24-hour storm events at the POAs.
STANDARD **3**	Recharge	Met, The required recharge volume for A soils is provided.
STANDARD **4**	Water Quality	Met, ADS Barracuda S4 has been sized to treat the full water quality and are designed to achieve a minimum 80% TSS removal rate prior to discharge.
STANDARD **5**	Land Uses with Higher Potential Pollutant Loads	N/A, The proposed project not a listed activity associated with a LUHPPL defined in the Handbook.
STANDARD **6**	Critical Areas	N/A, The Site does not to a Critical Area
STANDARD **7**	Redevelopments and Other Projects Subject to the Standards only to the Maximum Extent Practicable	Met, The proposed project is considered a new development. Stormwater management facilities and BMP designs are completed in accordance with DEP guidance.
STANDARD **8**	Construction Period Pollution Prevention and Erosion and Sedimentation Control	To be Met, The project is required to obtain an EPA - NPDES Construction General Permit prior to construction. A Stormwater Pollution Prevention Plan (SWPPP) will be prepared and filed with the EPA. Prior to the start of construction activities.
STANDARD **9**	Operation & Maintenance Plan	Met, Construction Phase and Long-Term Operation and Maintenance (O&M) Plans are included in Appendix D.
STANDARD **10**	Prohibition of Illicit Discharges	Met, A No Illicit Discharge Compliance Statement is included in Appendix A.

APPENDIX - A

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.

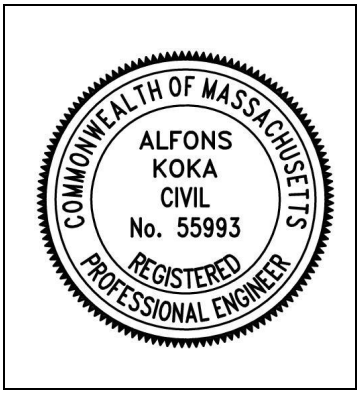
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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



01/19/2023

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.

ILLICIT DISCHARGE COMPLIANCE STATEMENT

By: B&M 35 Hanover, LLC (C/O Mike Murphy)
Project Site: 29 Winter Street Pembroke, MA 02359

Illicit discharges to the stormwater management system are discharges that do not entirely comprise stormwater. Notwithstanding the foregoing, an illicit discharge does not include discharges from the following activities or facilities: firefighting, water line flushing, landscape irrigation, uncontaminated groundwater, potable water sources, foundation drains, air conditioning condensation, footing drains, individual resident car washing, flows from riparian habitats and wetlands, dechlorinated water from swimming pools, water used for street washing, and water used to clean residential buildings without detergents.

The Project was designed to eliminate potential illicit discharges to the stormwater management system in accordance with Standard 10 of the Massachusetts Stormwater Handbook. In accordance with Standard 10, to the best of my knowledge, information, and belief the stormwater management system as designed does not receive, nor contribute, any illicit discharges to regulated environmental resource areas or the municipal stormwater collection system.

The Long-Term Stormwater Operation and Maintenance Plan outlines measures to prevent future illicit discharges.

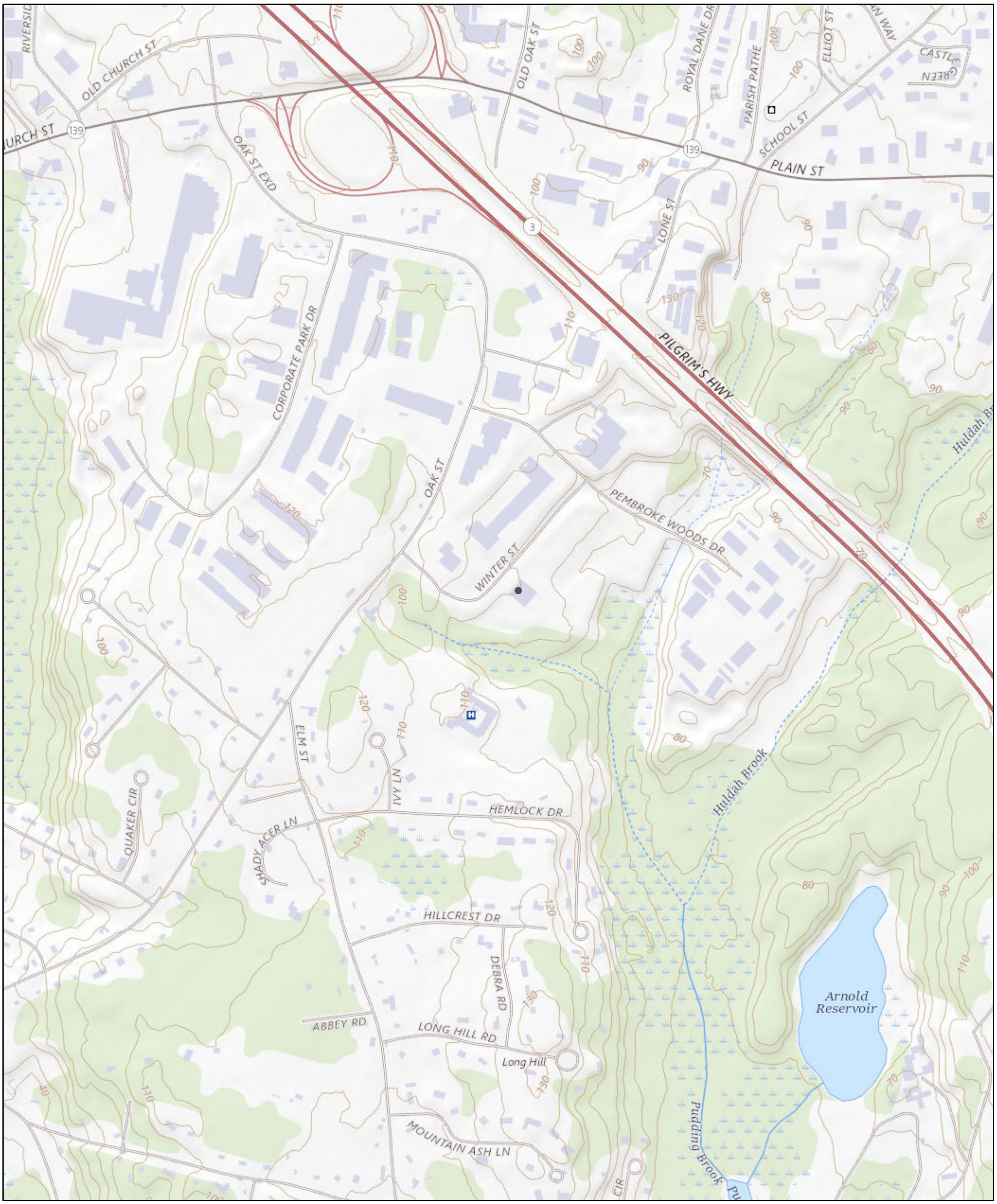
_____ 01/19/2023

(signature) (date)

B&M 35 Hanover, LLC
c/o Mike Murphy
29 Winter Street Pembroke, MA 02359
(781) 826-0222

APPENDIX - B

The National Map Advanced Viewer



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USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National

USGS
2021 USGS

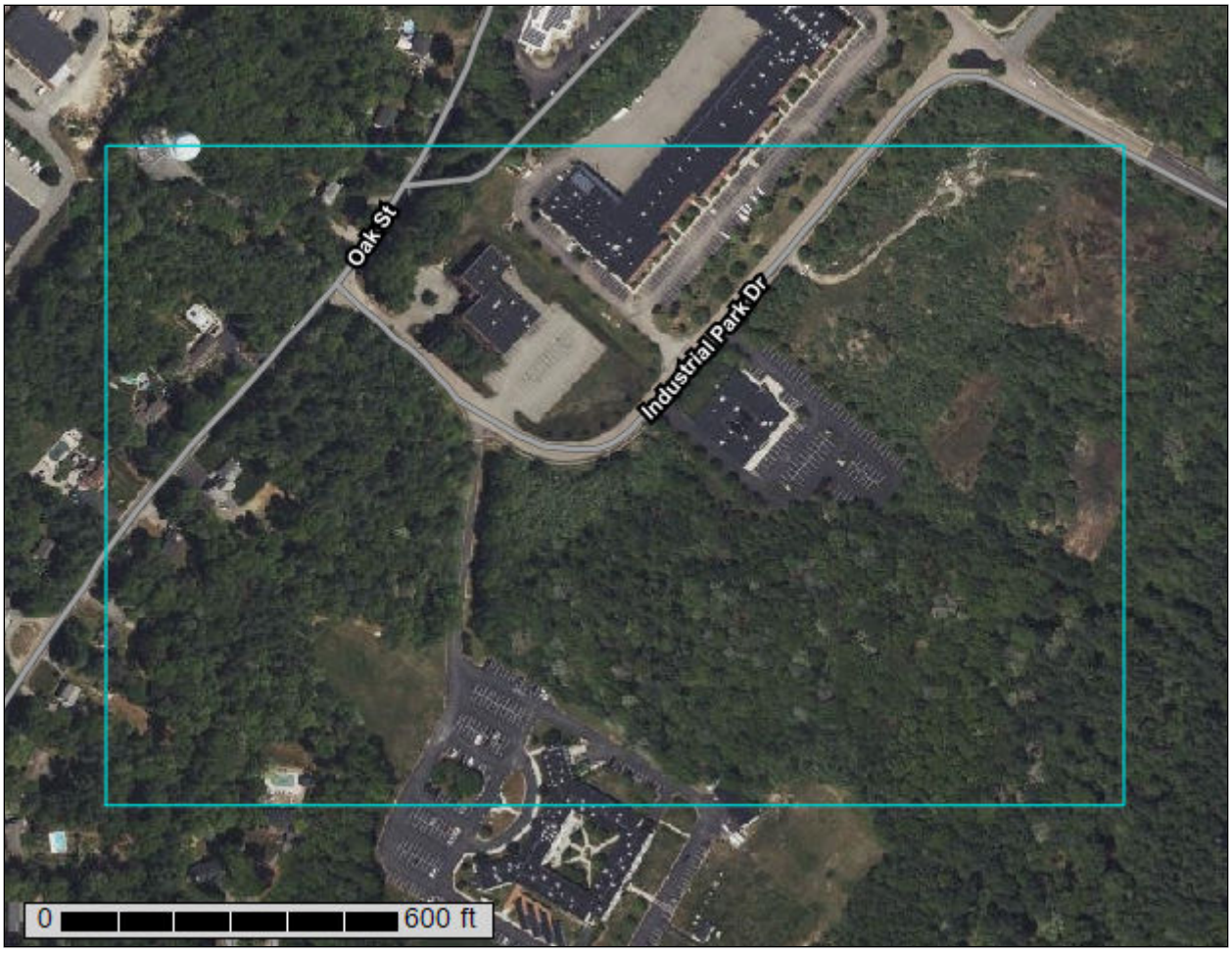
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

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

Custom Soil Resource Report for Plymouth County, Massachusetts



January 11, 2023

Preface

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

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

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

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

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

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

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

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Contents

Soil Map

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

Custom Soil Resource Report
Soil Map

Map Scale: 1:3,030 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 40 80 160 240

Feet: 0 100 200 400 600

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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: May 22, 2022—Jun 5, 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.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
6A	Scarboro muck, coastal lowland, 0 to 3 percent slopes	7.4	15.3%
427B	Newfields fine sandy loam, 3 to 8 percent slopes, extremely stony	1.9	4.0%
478B	Plymouth - Poquonock complex, 3 to 8 percent slopes, bouldery	14.3	29.4%
480C	Plymouth - Carver complex, 8 to 15 percent slopes	0.3	0.5%
636B	Montauk-Urban land complex, 0 to 8 percent slopes	0.0	0.0%
656B	Udorthents - Urban land complex, 0 to 8 percent slopes	22.0	45.3%
657A	Aquepts, 0 to 3 percent slopes	2.7	5.5%
Totals for Area of Interest		**48.7**	**100.0%**

Map Unit Descriptions

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

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

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a

given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

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

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

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

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

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

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

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

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

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

Plymouth County, Massachusetts

6A—Scarboro muck, coastal lowland, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2svkw
Elevation: 0 to 650 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Scarboro, Coastal Lowland

Setting

Landform: Depressions, outwash deltas, outwash terraces, drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread, dip
Down-slope shape: Concave
Across-slope shape: Concave, linear
Parent material: Sandy glaciofluvial deposits derived from schist and/or gneiss and/or granite

Typical profile

Oa - 0 to 8 inches: muck
A - 8 to 14 inches: mucky fine sandy loam
Cg1 - 14 to 22 inches: sand
Cg2 - 22 to 65 inches: gravelly sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (1.42 to 14.17 in/hr)
Depth to water table: About 0 to 2 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 6.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: A/D
Ecological site: F144AY031MA - Very Wet Outwash
Hydric soil rating: Yes

Minor Components

Swansea

Percent of map unit: 10 percent
Landform: Bogs, swamps
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Mashpee

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

427B—Newfields fine sandy loam, 3 to 8 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: bcxt
Elevation: 10 to 400 feet
Mean annual precipitation: 41 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Newfields, Extremely Stony

Setting

Landform: Moraines, till plains, hills
Landform position (two-dimensional): Shoulder, footslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Coarse-loamy eolian deposits over sandy and gravelly supraglacial meltout till

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 3 inches: fine sandy loam
Bs - 3 to 4 inches: fine sandy loam

Bw1 - 4 to 16 inches: fine sandy loam
Bw2 - 16 to 28 inches: gravelly fine sandy loam
2C - 28 to 63 inches: gravelly loamy coarse sand

Properties and qualities

Slope: 3 to 8 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 15 to 36 inches to strongly contrasting textural stratification
Drainage class: Moderately well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 5.95 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: B
Ecological site: F144AY008CT - Moist Till Uplands
Hydric soil rating: No

Minor Components

Barnstable, very stony

Percent of map unit: 8 percent
Landform: Moraines
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Norwell, extremely stony

Percent of map unit: 7 percent
Landform: Drainageways, depressions
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Scituate, very stony

Percent of map unit: 5 percent
Landform: Drumlins, ridges
Landform position (two-dimensional): Shoulder, footslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

478B—Plymouth - Poquonock complex, 3 to 8 percent slopes, bouldery

Map Unit Setting

National map unit symbol: n461
Elevation: 0 to 400 feet
Mean annual precipitation: 41 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Plymouth, bouldery, and similar soils: 60 percent
Poquonock, bouldery, and similar soils: 20 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Plymouth, Bouldery

Setting

Landform: Moraines, outwash plains
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve, tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Sandy and gravelly supraglacial meltout till over sandy and gravelly glaciofluvial deposits

Typical profile

Oi - 0 to 4 inches: slightly decomposed plant material
Oe - 4 to 6 inches: moderately decomposed plant material
A - 6 to 7 inches: loamy coarse sand
E - 7 to 11 inches: coarse sand
Bs - 11 to 15 inches: loamy coarse sand
Bw - 15 to 20 inches: coarse sand
BC - 20 to 29 inches: coarse sand
C - 29 to 64 inches: gravelly coarse sand

Properties and qualities

Slope: 3 to 8 percent
Surface area covered with cobbles, stones or boulders: 0.1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: A
Ecological site: F149BY005MA - Dry Outwash
Hydric soil rating: No

Description of Poquonock, Bouldery

Setting

Landform: Till plains, ground moraines, drumlins
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Sandy eolian deposits and/or glaciofluvial deposits over coarse-loamy lodgment till

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
Oe - 1 to 2 inches: moderately decomposed plant material
A - 2 to 4 inches: sand
E - 4 to 5 inches: sand
Bs - 5 to 7 inches: loamy sand
Bw - 7 to 26 inches: sand
BC - 26 to 35 inches: loamy sand
2Cd1 - 35 to 49 inches: gravelly sandy loam
2Cd2 - 49 to 71 inches: gravelly sandy loam

Properties and qualities

Slope: 3 to 8 percent
Surface area covered with cobbles, stones or boulders: 0.1 percent
Depth to restrictive feature: 20 to 39 inches to densic material
Drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 22 to 35 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 1.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: A
Ecological site: F144AY007CT - Well Drained Dense Till Uplands
Hydric soil rating: No

Minor Components

Barnstable, bouldery

Percent of map unit: 8 percent
Landform: Moraines
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve

Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Birchwood, very stony

Percent of map unit: 7 percent
Landform: Till plains, ground moraines, drumlins
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Carver, bouldery

Percent of map unit: 5 percent
Landform: Moraines, pitted outwash plains, outwash plains
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

480C—Plymouth - Carver complex, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: bcyy
Elevation: 0 to 400 feet
Mean annual precipitation: 41 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Plymouth and similar soils: 45 percent
Carver and similar soils: 40 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Plymouth

Setting

Landform: Moraines, outwash plains
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope, riser
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Sandy and gravelly supraglacial meltout till over sandy and gravelly glaciofluvial deposits

Typical profile

Oi - 0 to 4 inches: slightly decomposed plant material
Oe - 4 to 6 inches: moderately decomposed plant material
A - 6 to 7 inches: loamy coarse sand
E - 7 to 11 inches: coarse sand
Bs - 11 to 15 inches: loamy coarse sand
Bw - 15 to 20 inches: coarse sand
BC - 20 to 29 inches: coarse sand
C - 29 to 64 inches: gravelly coarse sand

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: A
Ecological site: F149BY005MA - Dry Outwash
Hydric soil rating: No

Description of Carver

Setting

Landform: Moraines, pitted outwash plains, outwash plains
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Sandy glaciofluvial deposits

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
Oe - 2 to 3 inches: moderately decomposed plant material
A - 3 to 7 inches: coarse sand
E - 7 to 10 inches: coarse sand
Bw1 - 10 to 15 inches: coarse sand
Bw2 - 15 to 28 inches: coarse sand
BC - 28 to 32 inches: coarse sand
C - 32 to 67 inches: coarse sand

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 14.17 in/hr)

Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Ecological site: F149BY005MA - Dry Outwash
Hydric soil rating: No

Minor Components

Barnstable

Percent of map unit: 10 percent
Landform: Moraines
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Hydric soil rating: No

Merrimac

Percent of map unit: 5 percent
Landform: Kames, terraces, outwash plains
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Convex
Hydric soil rating: No

636B—Montauk-Urban land complex, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2w7zx
Elevation: 0 to 230 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Montauk and similar soils: 50 percent
Urban land: 40 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Montauk

Setting

Landform: Recessionial moraines, ground moraines, hills, drumlins
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Coarse-loamy over sandy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Ap - 0 to 4 inches: fine sandy loam
Bw1 - 4 to 26 inches: fine sandy loam
Bw2 - 26 to 34 inches: sandy loam
2Cd - 34 to 72 inches: gravelly loamy sand

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 20 to 39 inches to densic material
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 1.42 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 5.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: F149BY009MA - Well Drained Dense Till Uplands
Hydric soil rating: No

Description of Urban Land

Typical profile

M - 0 to 10 inches: cemented material

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 0 inches to manufactured layer
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Available water supply, 0 to 60 inches: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: Unranked

Minor Components

Scituate

Percent of map unit: 5 percent
Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Udorthents, loamy

Percent of map unit: 5 percent
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

656B—Udorthents - Urban land complex, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: bd08
Elevation: 0 to 390 feet
Mean annual precipitation: 41 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Udorthents, loamy, and similar soils: 45 percent
Urban land: 40 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents, Loamy

Setting

Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Coarse-loamy human transported material

Typical profile

^A - 0 to 5 inches: loam
^C1 - 5 to 21 inches: gravelly loam
^C2 - 21 to 80 inches: gravelly sandy loam

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to very high (0.01 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: B
Ecological site: F149BY100NY - Urban Site Complex
Hydric soil rating: No

Minor Components

Udipsamments, wet substratum

Percent of map unit: 5 percent
Landform: Dikes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear, convex
Across-slope shape: Linear
Hydric soil rating: No

Udipsamments

Percent of map unit: 5 percent
Landform: Dikes
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread
Down-slope shape: Linear, convex
Across-slope shape: Linear
Hydric soil rating: No

Udorthents, wet substratum

Percent of map unit: 5 percent
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

657A—Aquepts, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: bd0z
Elevation: 0 to 390 feet
Mean annual precipitation: 41 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Aquepts

Setting

Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Coarse-loamy human transported material over sandy and gravelly glaciofluvial deposits

Typical profile

^A - 0 to 4 inches: very fine sandy loam
^BA - 4 to 17 inches: very fine sandy loam
^Cg - 17 to 42 inches: very fine sandy loam
2Oa - 42 to 47 inches: muck
3Cg - 47 to 65 inches: loamy sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.01 in/hr)
Depth to water table: About 0 to 4 inches
Frequency of flooding: None
Frequency of ponding: Occasional
Available water supply, 0 to 60 inches: Moderate (about 7.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: D
Hydric soil rating: Yes

Minor Components

Udorthents, wet substratum

Percent of map unit: 10 percent
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Udorthents, loamy

Percent of map unit: 10 percent
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

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National Flood Hazard Layer FIRMette

FEMA

70°46'6"W 42°6'12"N

70°45'29"W 42°5'45"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 1/12/2023 at 3:44 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

WINTER STREET

CB #3 INV. IN EL. = 97.36
CB #4 INV IN EL. = 96.24
DMH INV. IN EL. = 97.46
INV. OUT EL. = 91.48

CB #1 INV IN EL. = 101.87
CB #2 INV IN EL. = 101.88
DMH INV. IN EL. = 100.87
INV. OUT EL. = 100.34

GAS METER
WATER METER
GAS SERVICE

A
B
C

100' BUFFER
50' BUFFER
TC=6.4 MINS

PRE1

POA1
SOUTHERLY WETLANDS

UPLAND BWW

SUMMARY OF DRAINAGE CALCULATIONS

PRE-DEVELOPMENT AREA 1 (PRE-1)

TOTAL AREA: 64,531 SF
-WOODS(HSG B): 56,933 SF
- GRASS(HSG B): 7,598 SF

WEIGHTED CN: 56

TIME OF CONCENTRATION(TC): 6.5 MIN.

20 10 5 0 20
1"= 20'

PREPARED BY:
EBI Consulting
21 B Street | Burlington, MA 01803
Tel: 781.273.2500 | Fax: 781.273.3311
www.ebiconsulting.com

COMMONWEALTH OF MASSACHUSETTS
ALFONS KOKA
CIVIL
No. 55993
REGISTERED PROFESSIONAL ENGINEER

PRELIMINARY

REVISIONS

NO.	DESCRIPTION	DATE	INT.

Know what's below. Call before you dig.

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A. MURPHY INC.
ELECTRICAL DESIGN & CONTRACTING

DRAWING SCALES NOTED ARE FOR 24" x 36" SIZE PRINTED MEDIA ONLY. ALL OTHER PRINTED SIZES ARE DESIGNED NOT TO SCALE.

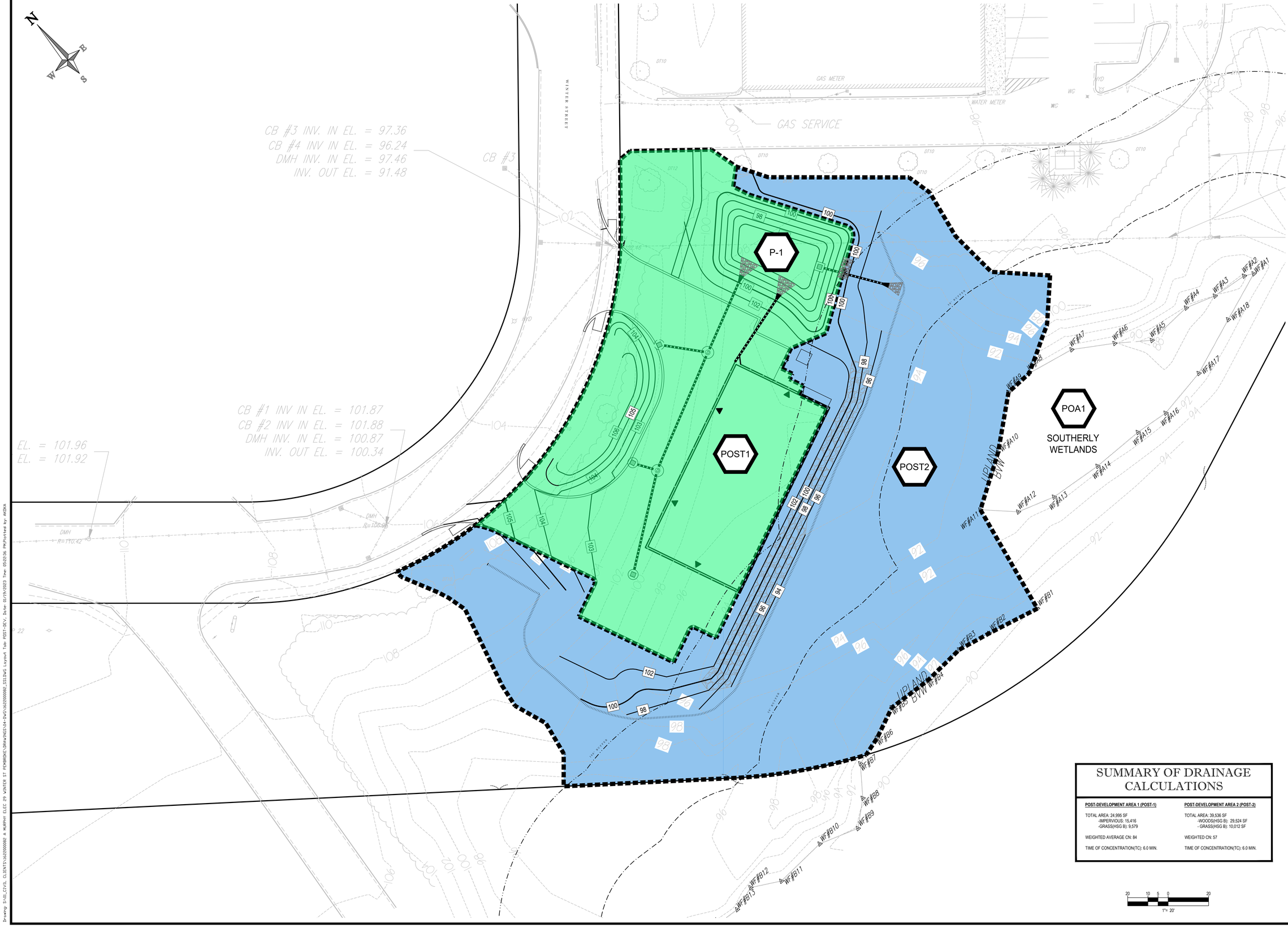
DRAWN BY: AK/PT
REVIEWED BY: KS
ISSUE DATE: 07/10/23
SCALE: AS SHOWN
PROJECT #: 1622000082

PROJECT TITLE:
SITE DEVELOPMENT PLANS

SHEET TITLE:
PRE-DEVELOPMENT WATERSHED PLAN

SITE ADDRESS:
29 WINTER STREET
PEMBROKE, MA

PRE
SHEET NO.



SUMMARY OF DRAINAGE CALCULATIONS

POST-DEVELOPMENT AREA 1 (POST-1)

TOTAL AREA: 24,995 SF
-IMPERVIOUS: 15,416
-GRASS(HSG B): 9,579

WEIGHTED AVERAGE CN: 84

TIME OF CONCENTRATION(TC): 6.0 MIN.

POST-DEVELOPMENT AREA 2 (POST-2)

TOTAL AREA: 39,536 SF
-WOODS(HSG B): 29,524 SF
- GRASS(HSG B): 10,012 SF

WEIGHTED CN: 57

TIME OF CONCENTRATION(TC): 6.0 MIN.

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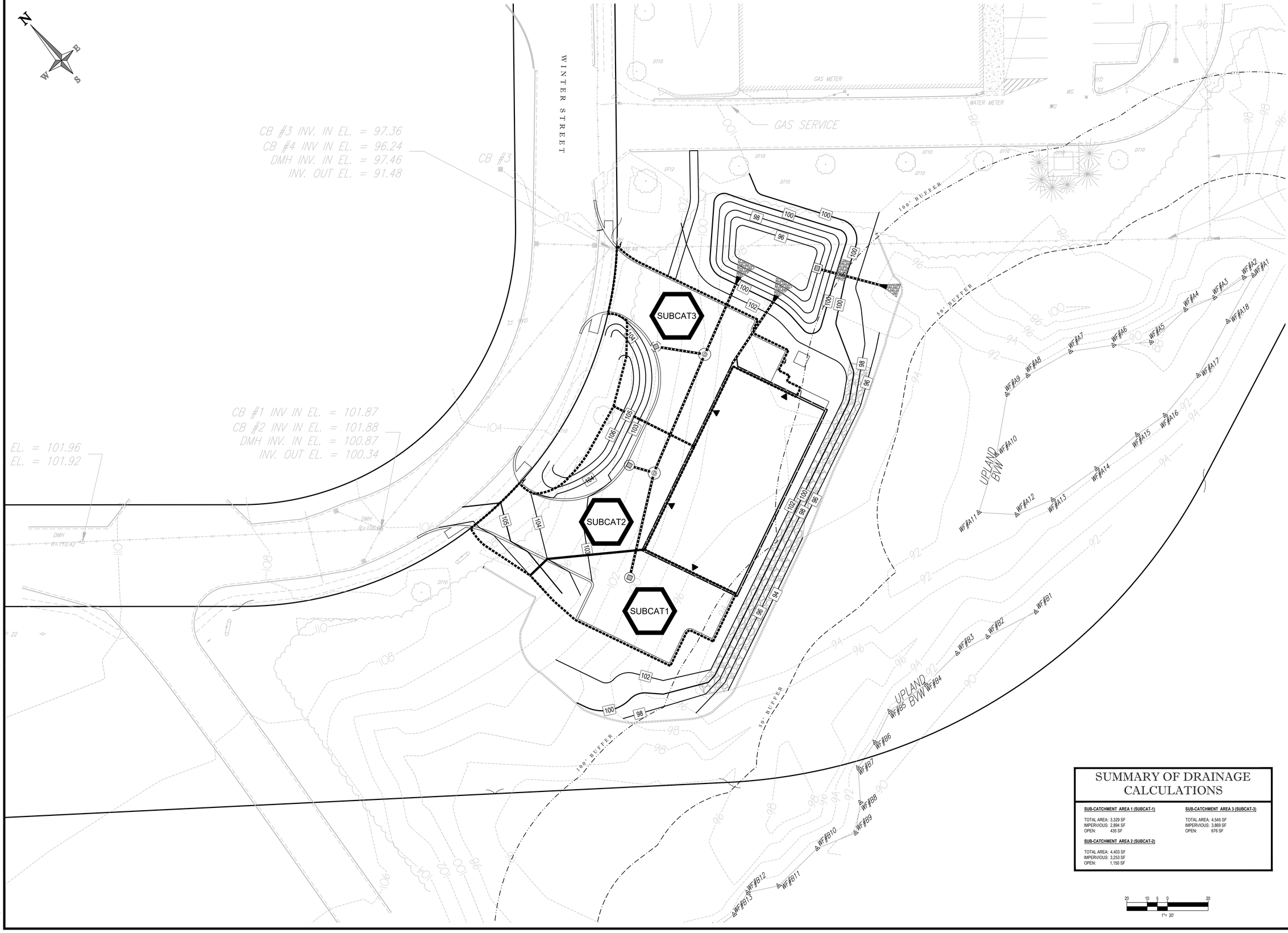
DRAWN BY:	REVIEWED BY:	ISSUE DATE	SCALE:	PROJECT #:
AK/PT	KS	01/19/23	AS SHOWN	1622200082

PROJECT TITLE:
SITE DEVELOPMENT PLANS

SHEET TITLE:
POST-DEVELOPMENT WATERSHED PLAN

SITE ADDRESS:
29 WINTER STREET
PEMBROKE, MA

SHEET NO.
POST



SUMMARY OF DRAINAGE CALCULATIONS

SUB-CATCHMENT AREA 1 (SUBCAT-1)

TOTAL AREA: 3,329 SF
IMPERVIOUS: 2,894 SF
OPEN: 435 SF

SUB-CATCHMENT AREA 2 (SUBCAT-2)

TOTAL AREA: 4,403 SF
IMPERVIOUS: 3,253 SF
OPEN: 1,150 SF

SUB-CATCHMENT AREA 3 (SUBCAT-3)

TOTAL AREA: 4,545 SF
IMPERVIOUS: 3,869 SF
OPEN: 676 SF

20 10 5 0 20
1"= 20'

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DRAWN BY:	REVIEWED BY:	ISSUE DATE	SCALE	PROJECT #
AK/PT	KS	01/19/23	AS SHOWN	1622000082

PROJECT TITLE:
SITE DEVELOPMENT PLANS

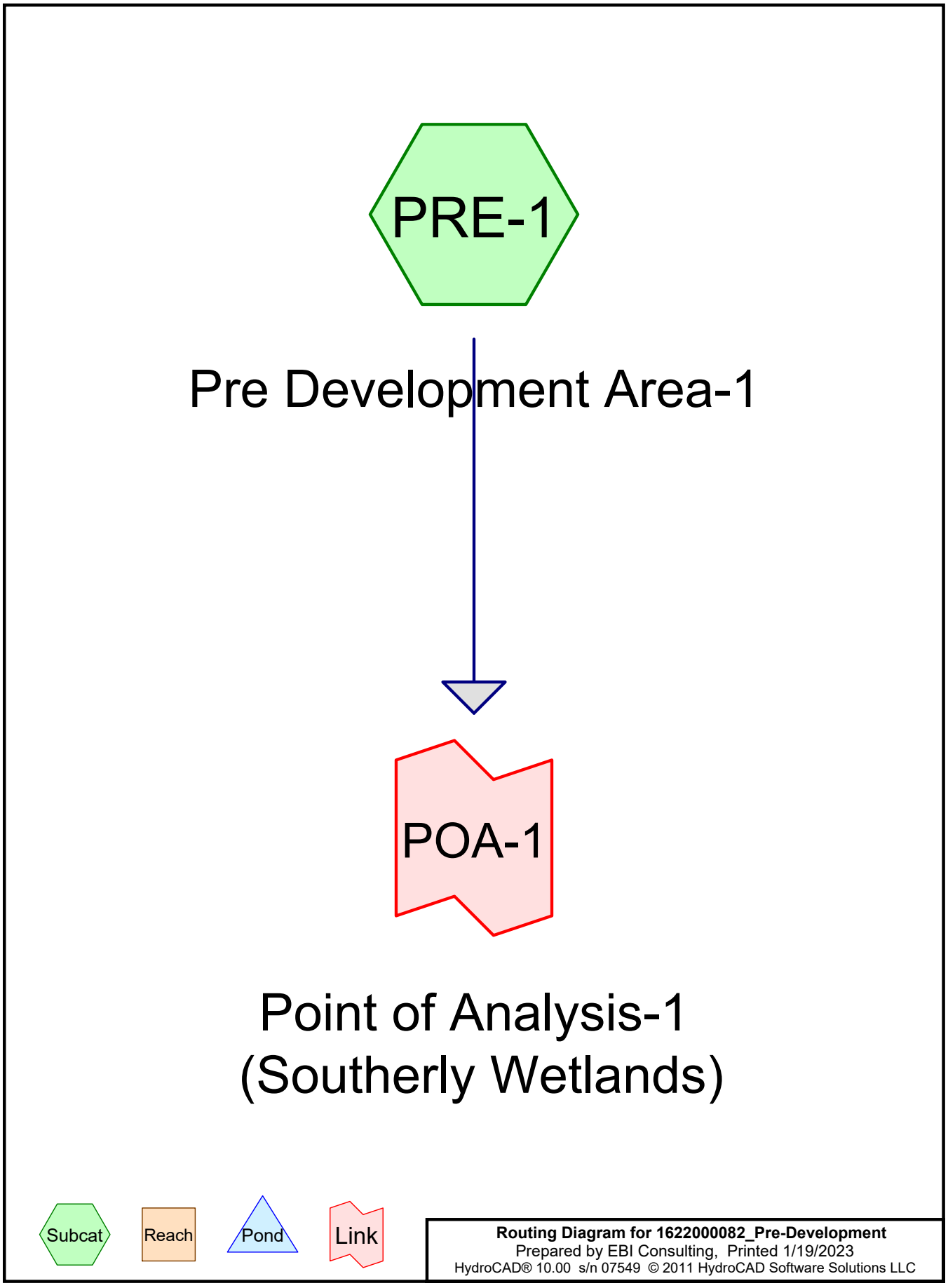
SHEET TITLE:
SUB-CATCHMENT PLAN

SITE ADDRESS:
29 WINTER STREET
PEMBROKE, MA

SUBCAT

SHEET NO.

APPENDIX - C



Routing Diagram for 1622000082_Pre-Development
Prepared by EBI Consulting, Printed 1/19/2023

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.307	55	Woods, Good, HSG B (PRE-1)
0.174	61	>75% Grass cover, Good, HSG B (PRE-1)
1.481	**56**	**TOTAL AREA**

Summary for Subcatchment PRE-1: Pre Development Area-1

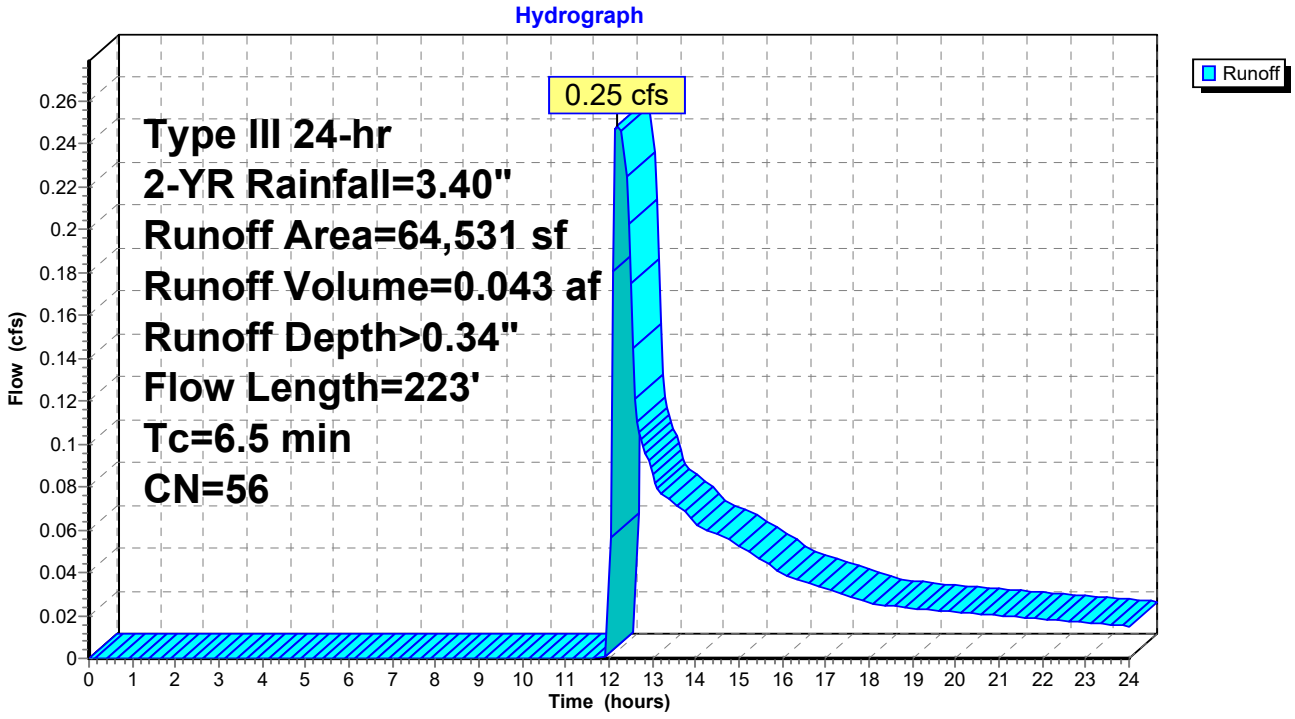
Runoff = 0.25 cfs @ 12.20 hrs, Volume= 0.043 af, Depth> 0.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.40"

Area (sf)	CN	Description
56,933	55	Woods, Good, HSG B
7,598	61	>75% Grass cover, Good, HSG B
64,531	56	Weighted Average
64,531		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.9	50	0.0460	0.21		**Sheet Flow, 1-2** Grass: Short n= 0.150 P2= 3.38"
2.6	173	0.0490	1.11		**Shallow Concentrated Flow, 2-3** Woodland Kv= 5.0 fps
6.5	223	Total			

Subcatchment PRE-1: Pre Development Area-1

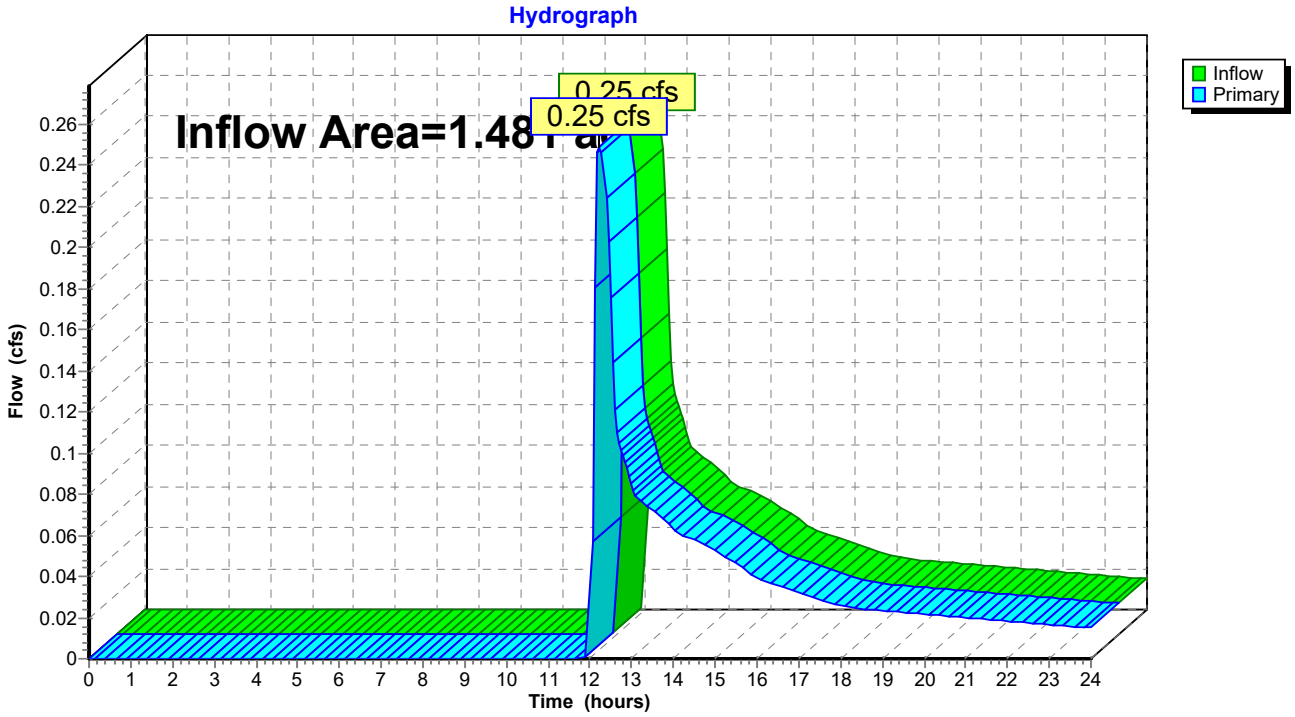


Summary for Link POA-1: Point of Analysis-1 (Southerly Wetlands)

Inflow Area = 1.481 ac, 0.00% Impervious, Inflow Depth > 0.34" for 2-YR event
Inflow = 0.25 cfs @ 12.20 hrs, Volume= 0.043 af
Primary = 0.25 cfs @ 12.20 hrs, Volume= 0.043 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link POA-1: Point of Analysis-1 (Southerly Wetlands)



Summary for Subcatchment PRE-1: Pre Development Area-1

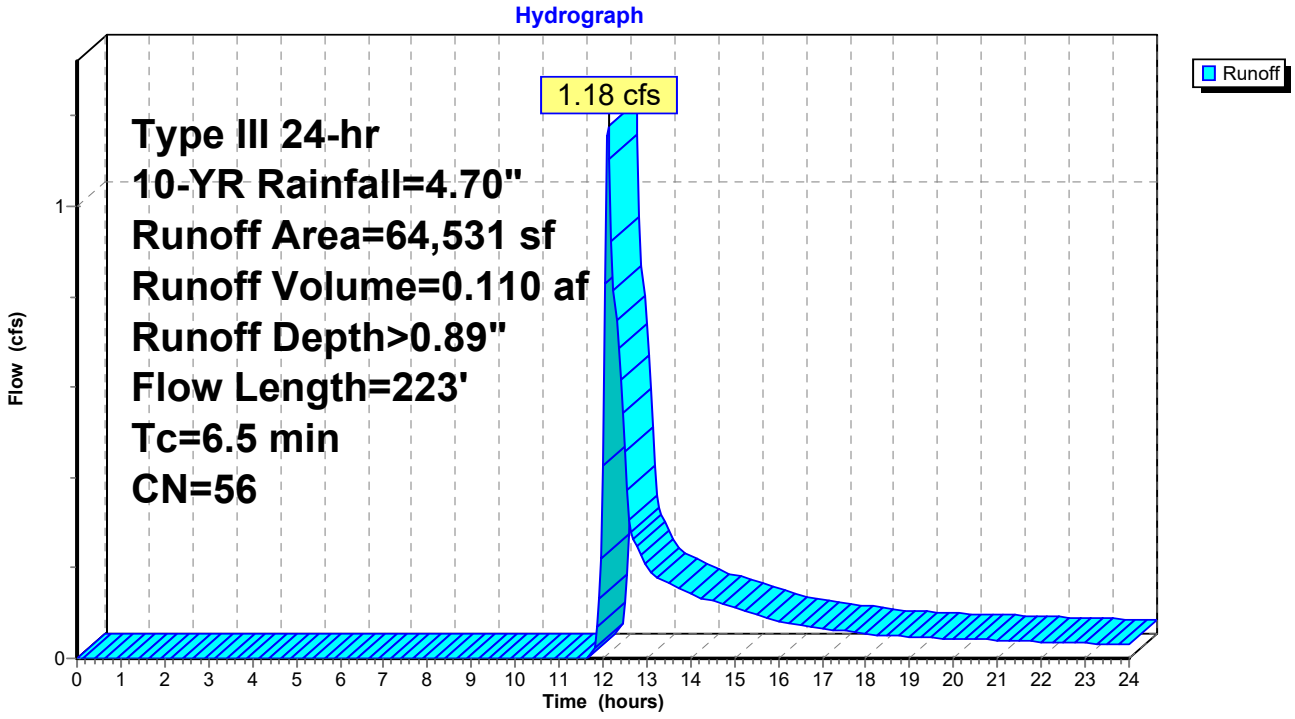
Runoff = 1.18 cfs @ 12.12 hrs, Volume= 0.110 af, Depth> 0.89"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
56,933	55	Woods, Good, HSG B
7,598	61	>75% Grass cover, Good, HSG B
64,531	56	Weighted Average
64,531		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.9	50	0.0460	0.21		**Sheet Flow, 1-2** Grass: Short n= 0.150 P2= 3.38"
2.6	173	0.0490	1.11		**Shallow Concentrated Flow, 2-3** Woodland Kv= 5.0 fps
6.5	223	Total			

Subcatchment PRE-1: Pre Development Area-1

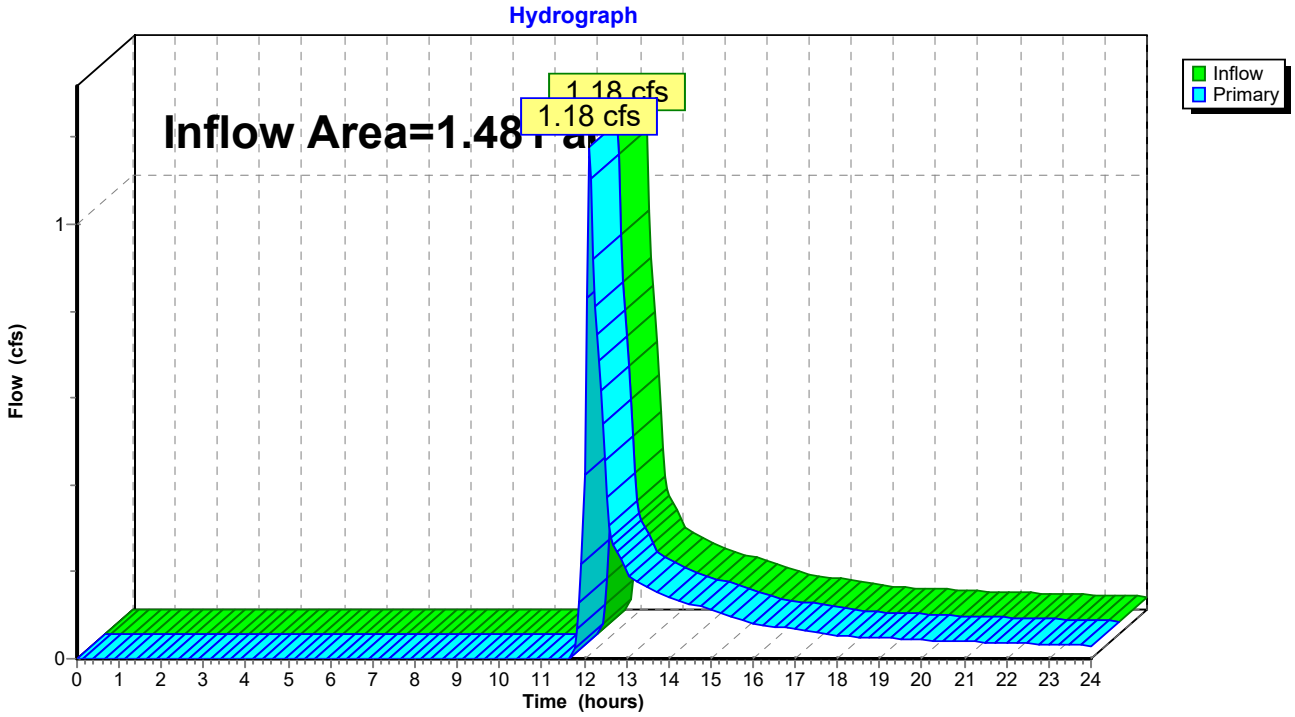


Summary for Link POA-1: Point of Analysis-1 (Southerly Wetlands)

Inflow Area = 1.481 ac, 0.00% Impervious, Inflow Depth > 0.89" for 10-YR event
Inflow = 1.18 cfs @ 12.12 hrs, Volume= 0.110 af
Primary = 1.18 cfs @ 12.12 hrs, Volume= 0.110 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link POA-1: Point of Analysis-1 (Southerly Wetlands)



Summary for Subcatchment PRE-1: Pre Development Area-1

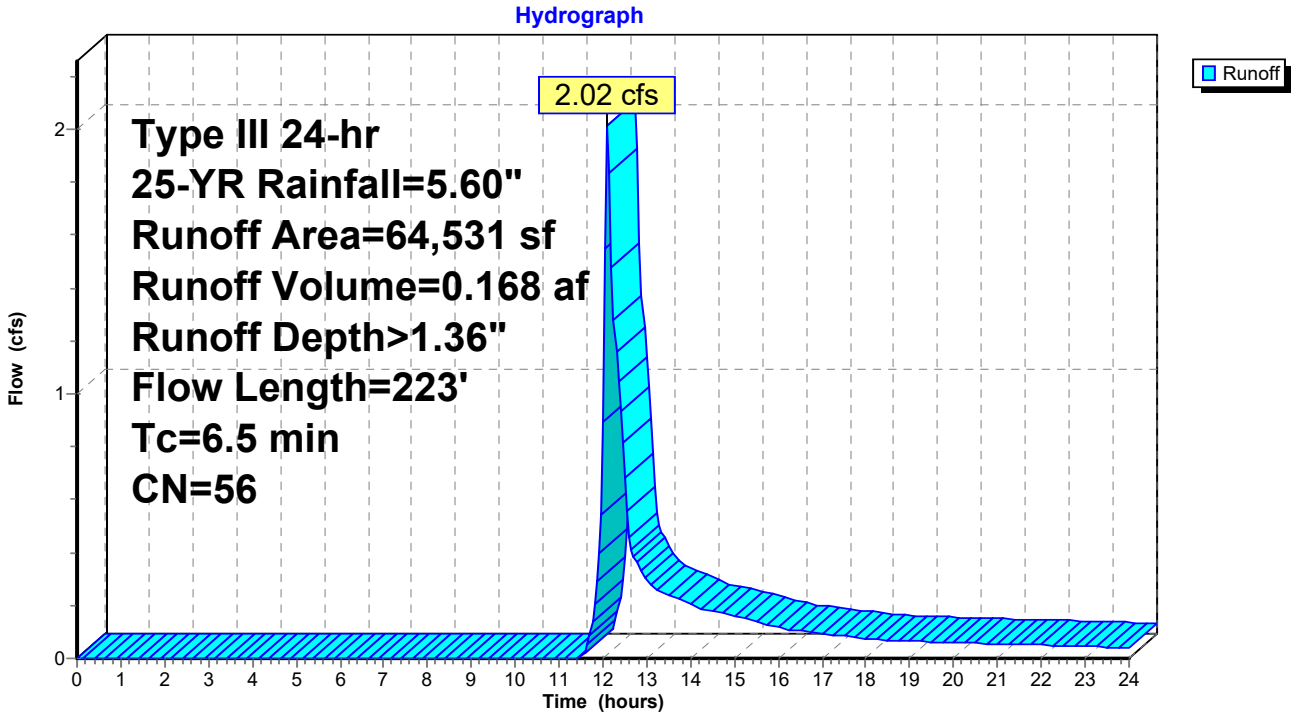
Runoff = 2.02 cfs @ 12.11 hrs, Volume= 0.168 af, Depth> 1.36"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=5.60"

Area (sf)	CN	Description
56,933	55	Woods, Good, HSG B
7,598	61	>75% Grass cover, Good, HSG B
64,531	56	Weighted Average
64,531		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.9	50	0.0460	0.21		**Sheet Flow, 1-2** Grass: Short n= 0.150 P2= 3.38"
2.6	173	0.0490	1.11		**Shallow Concentrated Flow, 2-3** Woodland Kv= 5.0 fps
6.5	223	Total			

Subcatchment PRE-1: Pre Development Area-1

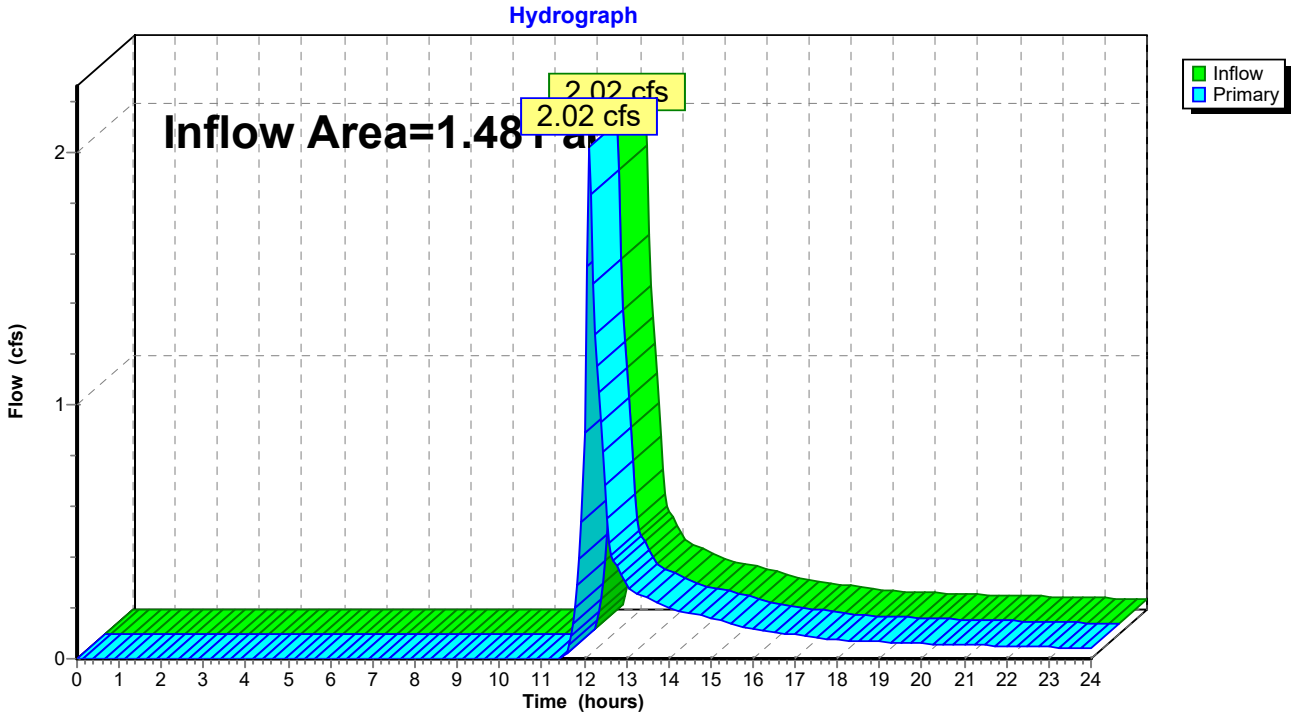


Summary for Link POA-1: Point of Analysis-1 (Southerly Wetlands)

Inflow Area = 1.481 ac, 0.00% Impervious, Inflow Depth > 1.36" for 25-YR event
Inflow = 2.02 cfs @ 12.11 hrs, Volume= 0.168 af
Primary = 2.02 cfs @ 12.11 hrs, Volume= 0.168 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link POA-1: Point of Analysis-1 (Southerly Wetlands)



Summary for Subcatchment PRE-1: Pre Development Area-1

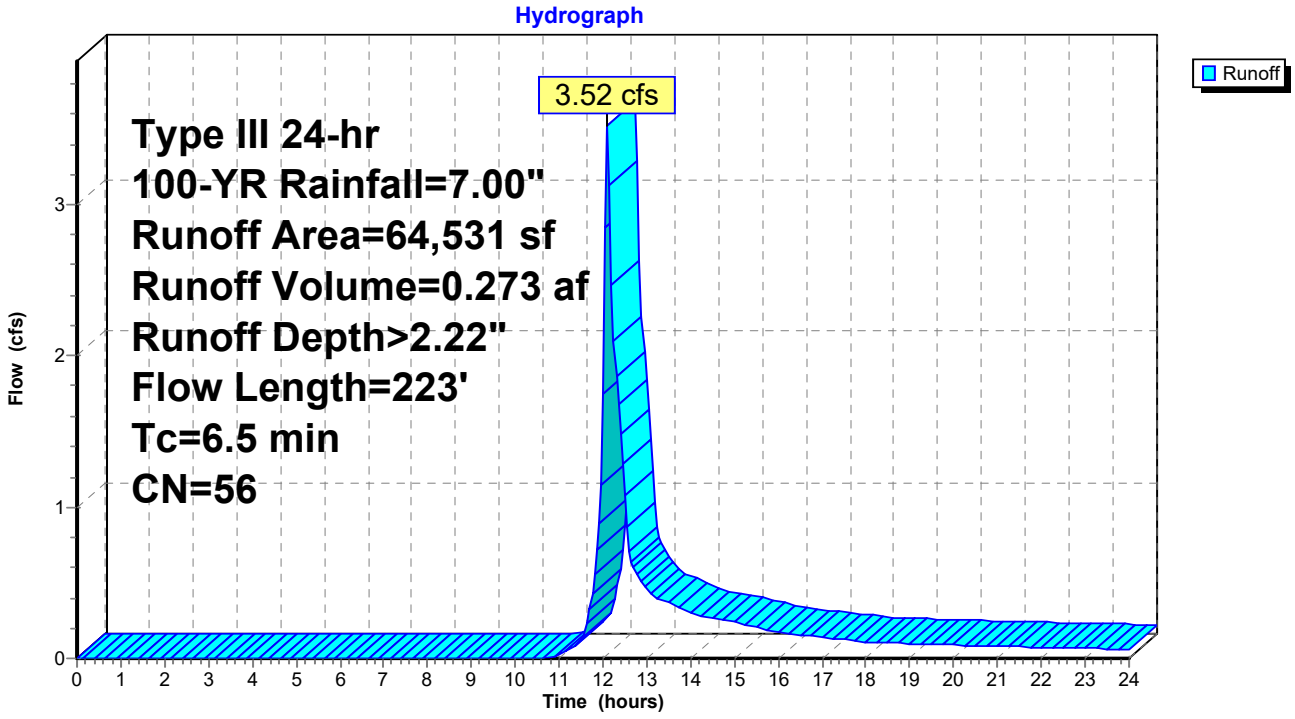
Runoff = 3.52 cfs @ 12.11 hrs, Volume= 0.273 af, Depth> 2.22"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR Rainfall=7.00"

Area (sf)	CN	Description
56,933	55	Woods, Good, HSG B
7,598	61	>75% Grass cover, Good, HSG B
64,531	56	Weighted Average
64,531		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.9	50	0.0460	0.21		**Sheet Flow, 1-2** Grass: Short n= 0.150 P2= 3.38"
2.6	173	0.0490	1.11		**Shallow Concentrated Flow, 2-3** Woodland Kv= 5.0 fps
6.5	223	Total			

Subcatchment PRE-1: Pre Development Area-1

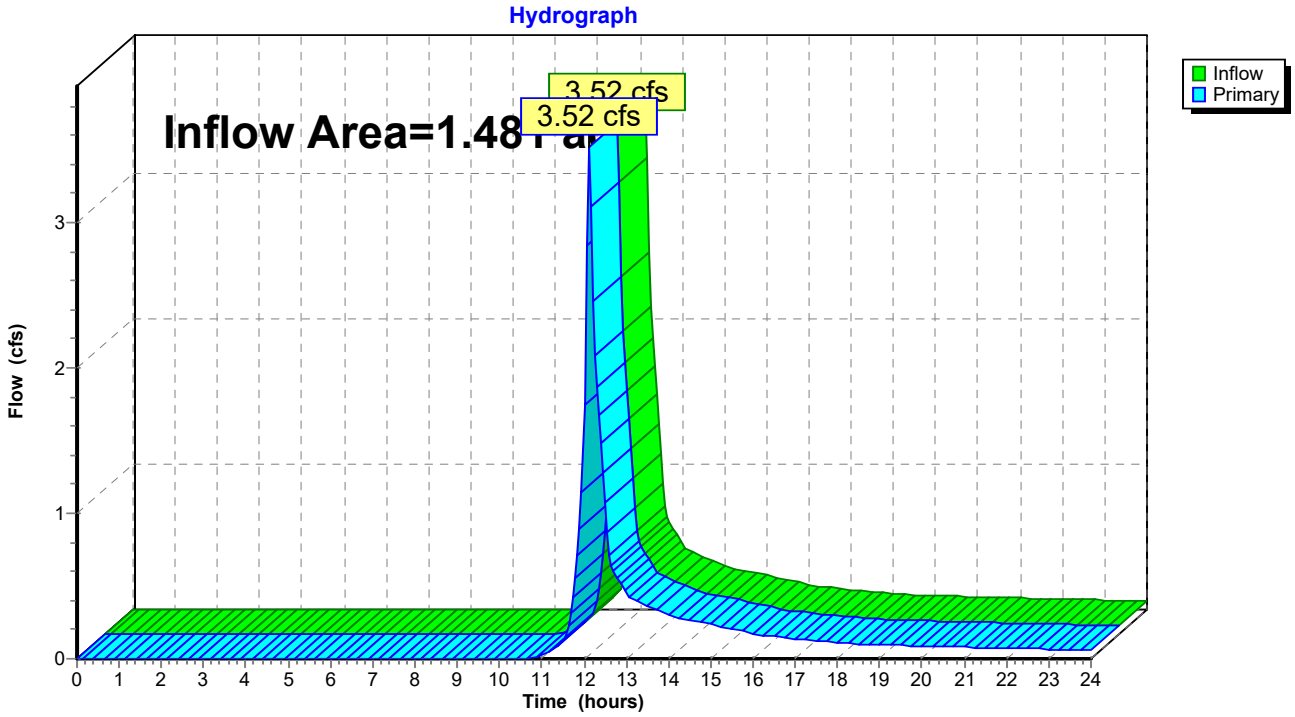


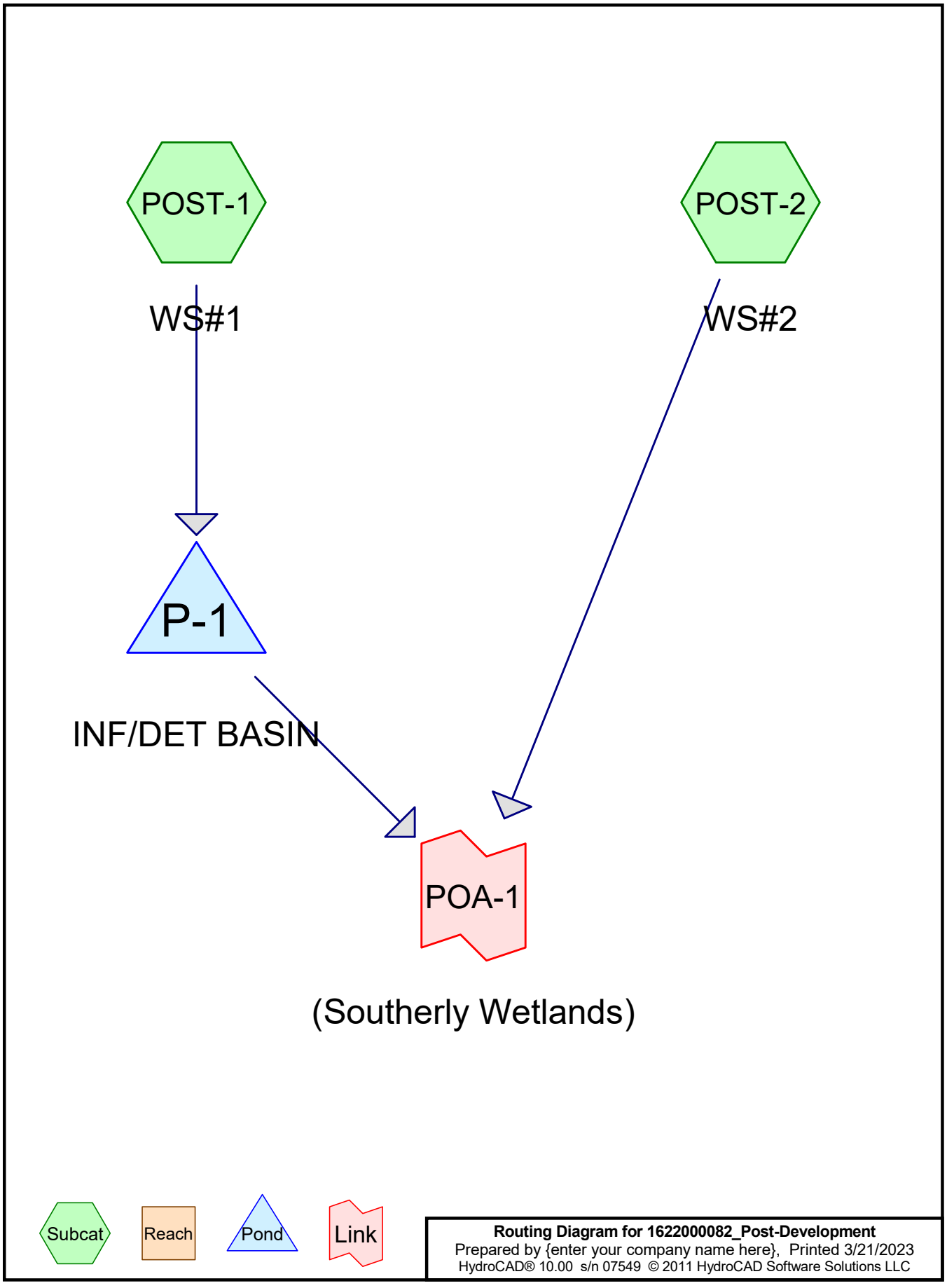
Summary for Link POA-1: Point of Analysis-1 (Southerly Wetlands)

Inflow Area = 1.481 ac, 0.00% Impervious, Inflow Depth > 2.22" for 100-YR event
Inflow = 3.52 cfs @ 12.11 hrs, Volume= 0.273 af
Primary = 3.52 cfs @ 12.11 hrs, Volume= 0.273 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link POA-1: Point of Analysis-1 (Southerly Wetlands)




POST-1
POST-2
WS#1
WS#2
P-1
INF/DET BASIN
POA-1
(Southerly Wetlands)
Subcat
Reach
Pond
Link
Routing Diagram for 1622000082_Post-Development
Prepared by {enter your company name here}, Printed 3/21/2023
HydroCAD® 10.00 s/n 07549 © 2011 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.678	55	Woods, Good, HSG B (POST-2)
0.450	61	>75% Grass cover, Good, HSG B (POST-1, POST-2)
0.354	98	Unconnected pavement, HSG B (POST-1)
1.481	**67**	**TOTAL AREA**

Summary for Subcatchment POST-1: WS#1

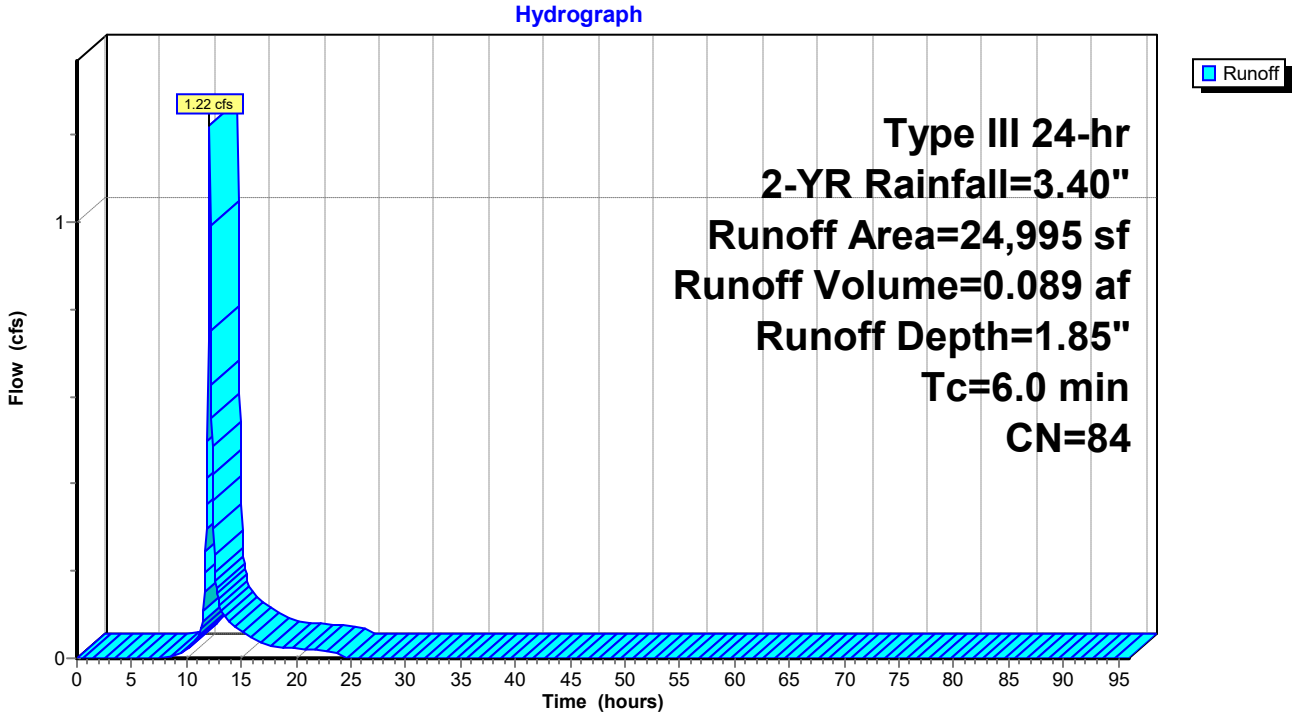
Runoff = 1.22 cfs @ 12.09 hrs, Volume= 0.089 af, Depth= 1.85"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.40"

Area (sf)	CN	Description
9,579	61	>75% Grass cover, Good, HSG B
15,416	98	Unconnected pavement, HSG B
24,995	84	Weighted Average
9,579		38.32% Pervious Area
15,416		61.68% Impervious Area
15,416		100.00% Unconnected

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

Subcatchment POST-1: WS#1



Summary for Subcatchment POST-2: WS#2

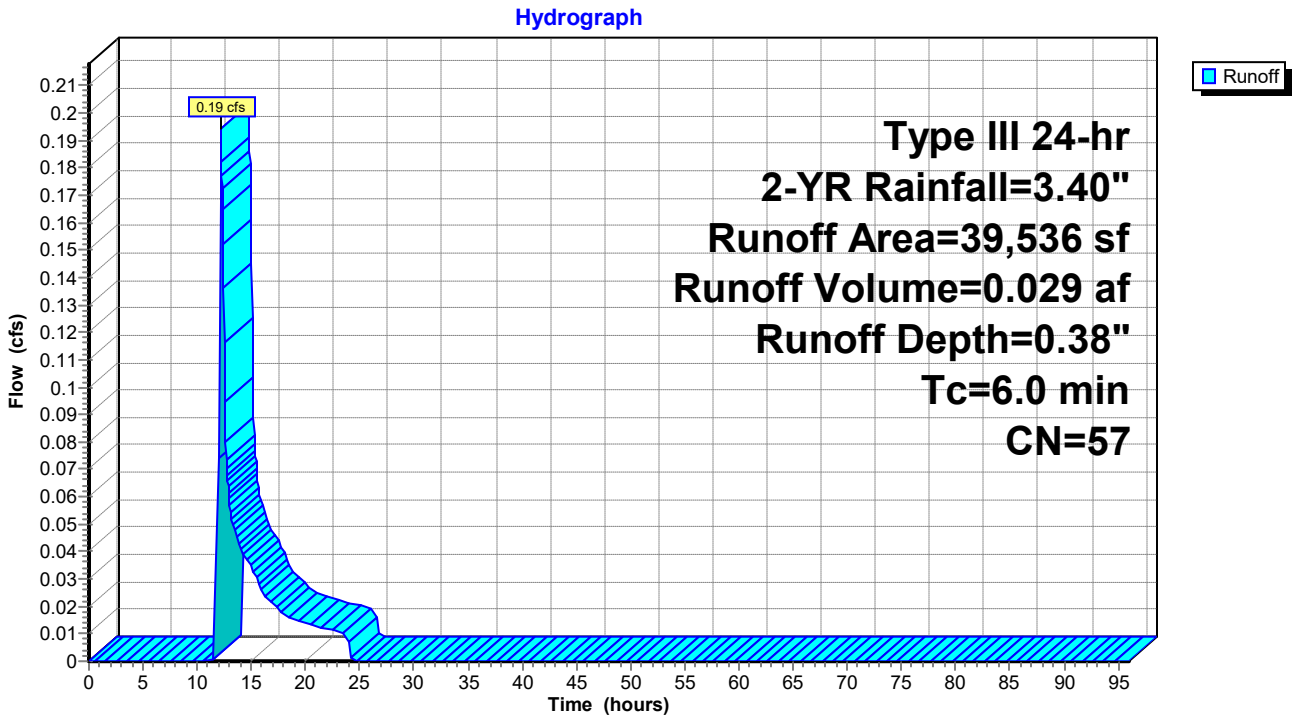
Runoff = 0.19 cfs @ 12.16 hrs, Volume= 0.029 af, Depth= 0.38"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.40"

Area (sf)	CN	Description
29,524	55	Woods, Good, HSG B
10,012	61	>75% Grass cover, Good, HSG B
39,536	57	Weighted Average
39,536		100.00% Pervious Area

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

Subcatchment POST-2: WS#2



Summary for Pond P-1: INF/DET BASIN

Inflow Area = 0.574 ac, 61.68% Impervious, Inflow Depth = 1.85" for 2-YR event
Inflow = 1.22 cfs @ 12.09 hrs, Volume= 0.089 af
Outflow = 0.04 cfs @ 16.06 hrs, Volume= 0.089 af, Atten= 96%, Lag= 238.0 min
Discarded = 0.04 cfs @ 16.06 hrs, Volume= 0.088 af
Primary = 0.00 cfs @ 16.06 hrs, Volume= 0.001 af

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 98.03' @ 16.06 hrs Surf.Area= 1,666 sf Storage= 2,446 cf

Plug-Flow detention time= 710.6 min calculated for 0.088 af (100% of inflow)
Center-of-Mass det. time= 710.9 min (1,537.7 - 826.8)

Volume	Invert	Avail.Storage	Storage Description
#1	96.00'	6,817 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

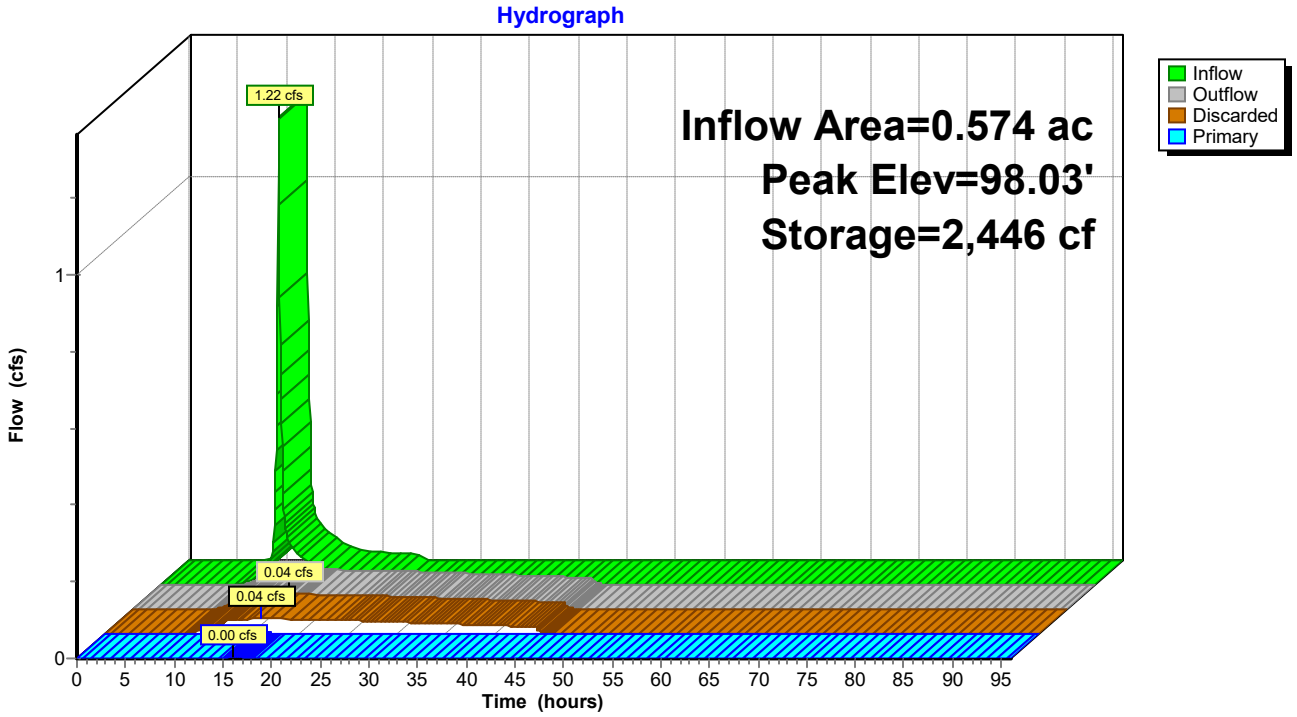
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
96.00	750	0	0
98.00	1,650	2,400	2,400
100.00	2,767	4,417	6,817

Device	Routing	Invert	Outlet Devices
#1	Discarded	96.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	96.00'	**12.0" Round Culvert** L= 30.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 96.00' / 94.00' S= 0.0667 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	99.00'	**4.0' long x 1.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s) 1.0' Crest Height
#4	Device 2	98.00'	**6.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.04 cfs @ 16.06 hrs HW=98.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.00 cfs @ 16.06 hrs HW=98.03' (Free Discharge)
└**2=Culvert** (Passes 0.00 cfs of 3.69 cfs potential flow)
  ├**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
  └**4=Orifice/Grate** (Orifice Controls 0.00 cfs @ 0.57 fps)

Pond P-1: INF/DET BASIN

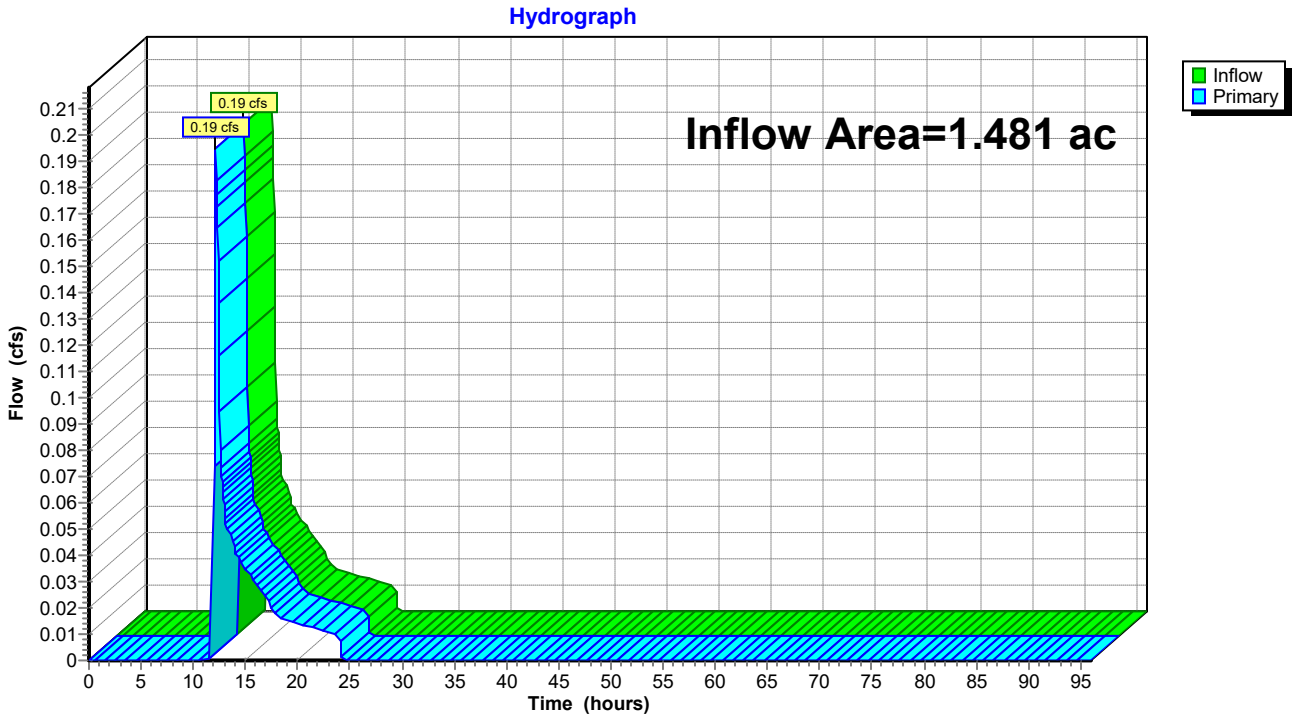


Summary for Link POA-1: (Southerly Wetlands)

Inflow Area = 1.481 ac, 23.89% Impervious, Inflow Depth = 0.24" for 2-YR event
Inflow = 0.19 cfs @ 12.16 hrs, Volume= 0.029 af
Primary = 0.19 cfs @ 12.16 hrs, Volume= 0.029 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Link POA-1: (Southerly Wetlands)



Summary for Subcatchment POST-1: WS#1

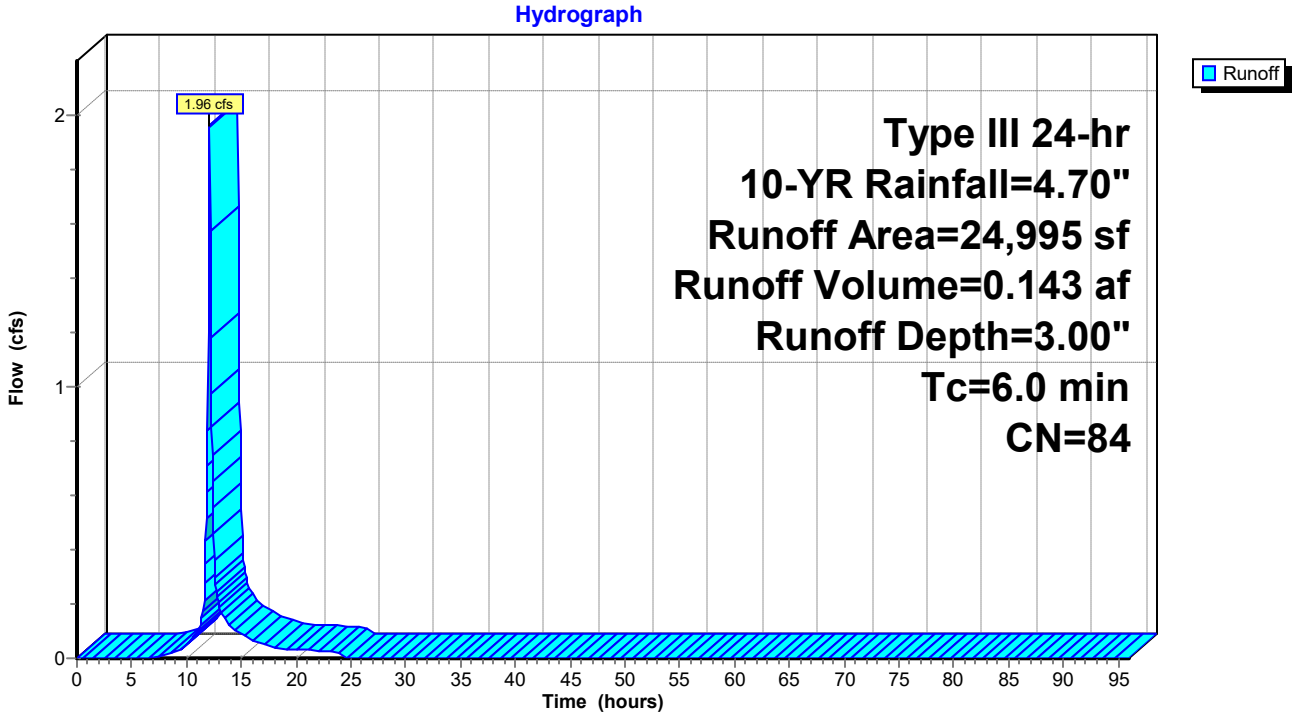
Runoff = 1.96 cfs @ 12.09 hrs, Volume= 0.143 af, Depth= 3.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
9,579	61	>75% Grass cover, Good, HSG B
15,416	98	Unconnected pavement, HSG B
24,995	84	Weighted Average
9,579		38.32% Pervious Area
15,416		61.68% Impervious Area
15,416		100.00% Unconnected

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

Subcatchment POST-1: WS#1



Summary for Subcatchment POST-2: WS#2

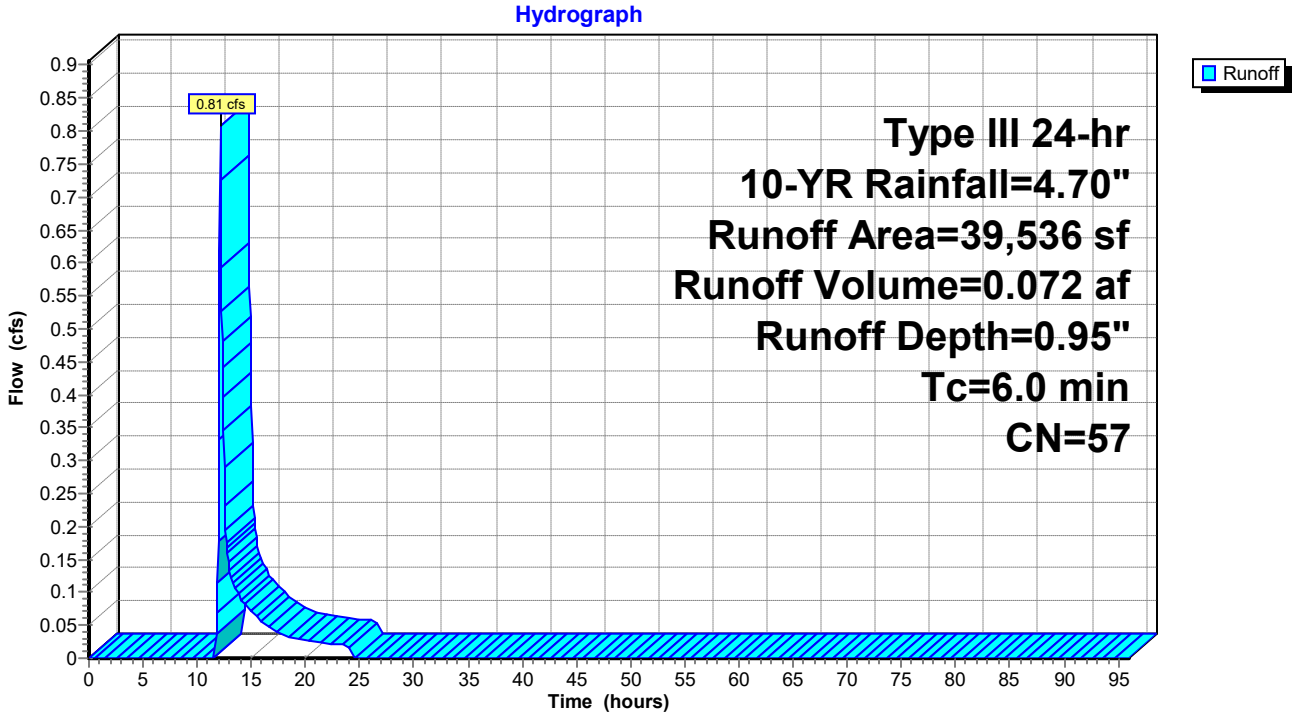
Runoff = 0.81 cfs @ 12.11 hrs, Volume= 0.072 af, Depth= 0.95"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
29,524	55	Woods, Good, HSG B
10,012	61	>75% Grass cover, Good, HSG B
39,536	57	Weighted Average
39,536		100.00% Pervious Area

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

Subcatchment POST-2: WS#2



Summary for Pond P-1: INF/DET BASIN

Inflow Area = 0.574 ac, 61.68% Impervious, Inflow Depth = 3.00" for 10-YR event
Inflow = 1.96 cfs @ 12.09 hrs, Volume= 0.143 af
Outflow = 0.35 cfs @ 12.56 hrs, Volume= 0.143 af, Atten= 82%, Lag= 28.3 min
Discarded = 0.04 cfs @ 12.56 hrs, Volume= 0.098 af
Primary = 0.31 cfs @ 12.56 hrs, Volume= 0.045 af

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 98.36' @ 12.56 hrs Surf.Area= 1,851 sf Storage= 3,031 cf

Plug-Flow detention time= 513.4 min calculated for 0.143 af (100% of inflow)
Center-of-Mass det. time= 513.9 min (1,326.9 - 813.0)

Volume	Invert	Avail.Storage	Storage Description
#1	96.00'	6,817 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

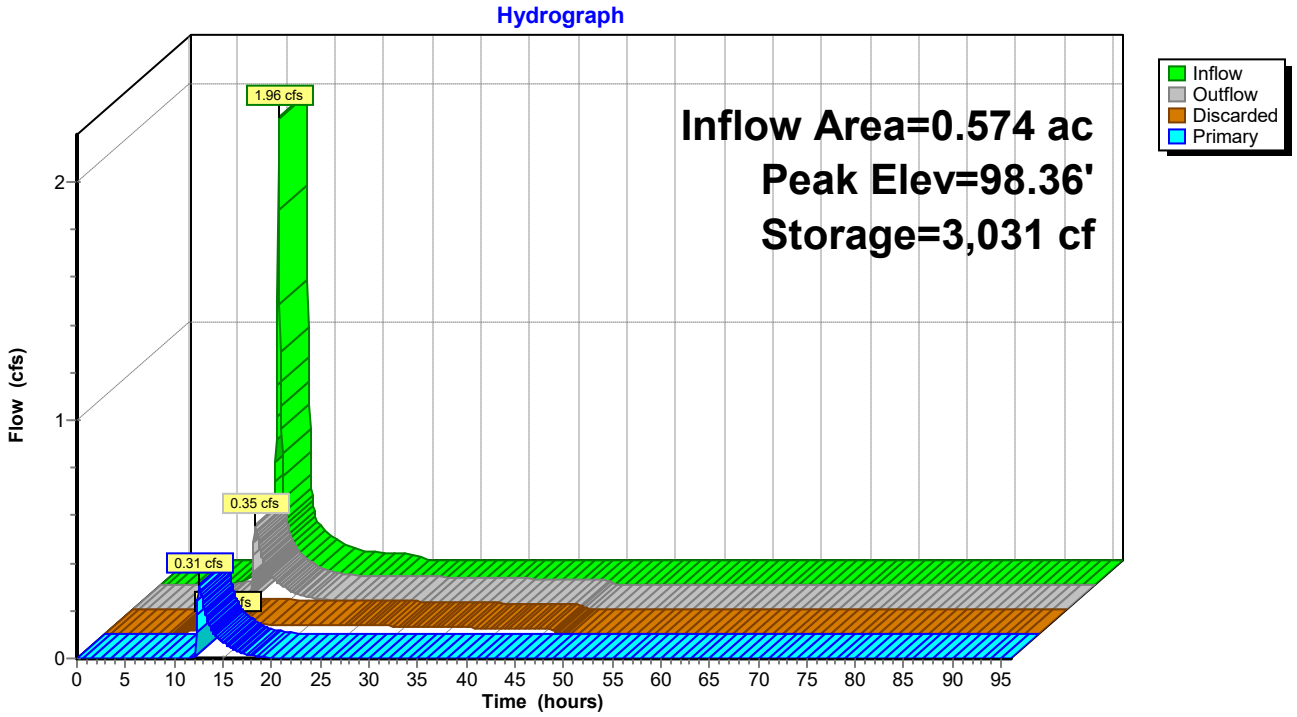
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
96.00	750	0	0
98.00	1,650	2,400	2,400
100.00	2,767	4,417	6,817

Device	Routing	Invert	Outlet Devices
#1	Discarded	96.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	96.00'	**12.0" Round Culvert** L= 30.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 96.00' / 94.00' S= 0.0667 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	99.00'	**4.0' long x 1.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s) 1.0' Crest Height
#4	Device 2	98.00'	**6.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.04 cfs @ 12.56 hrs HW=98.36' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.31 cfs @ 12.56 hrs HW=98.36' (Free Discharge)
└**2=Culvert** (Passes 0.31 cfs of 4.07 cfs potential flow)
  ├**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
  └**4=Orifice/Grate** (Orifice Controls 0.31 cfs @ 2.04 fps)

Pond P-1: INF/DET BASIN

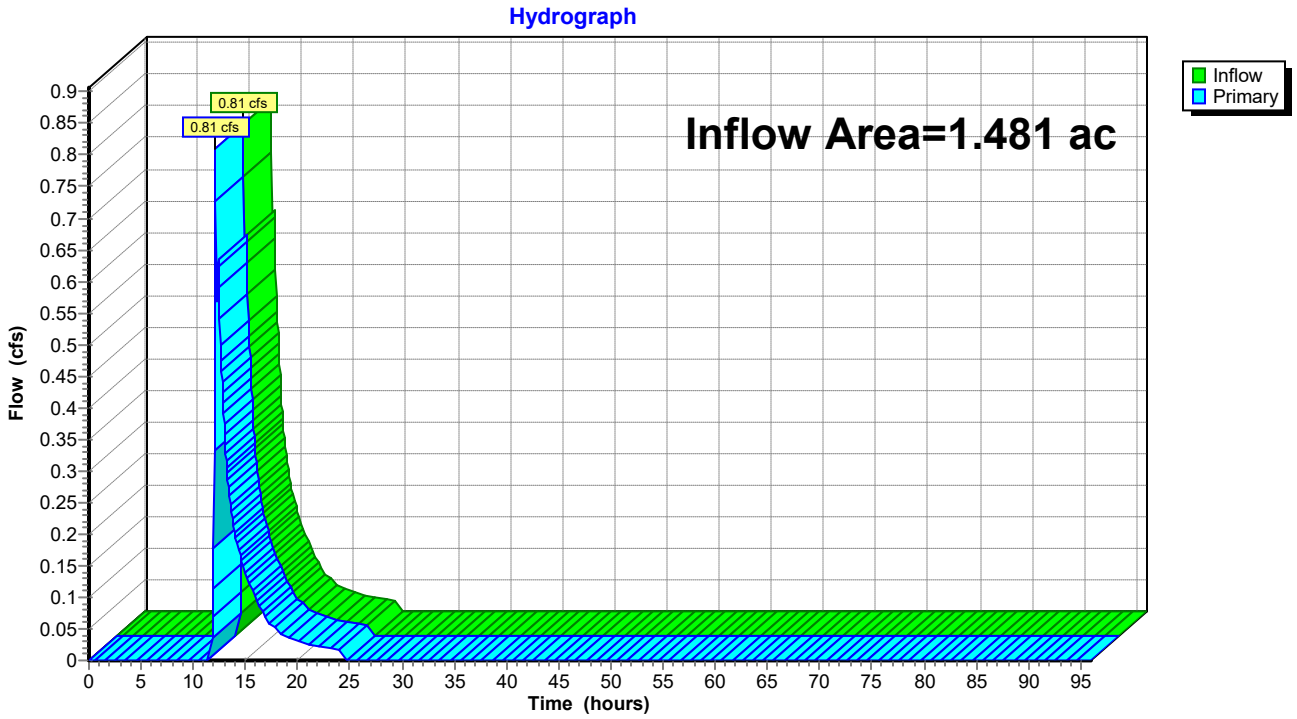


Summary for Link POA-1: (Southerly Wetlands)

Inflow Area = 1.481 ac, 23.89% Impervious, Inflow Depth = 0.95" for 10-YR event
Inflow = 0.81 cfs @ 12.11 hrs, Volume= 0.117 af
Primary = 0.81 cfs @ 12.11 hrs, Volume= 0.117 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Link POA-1: (Southerly Wetlands)



Summary for Subcatchment POST-1: WS#1

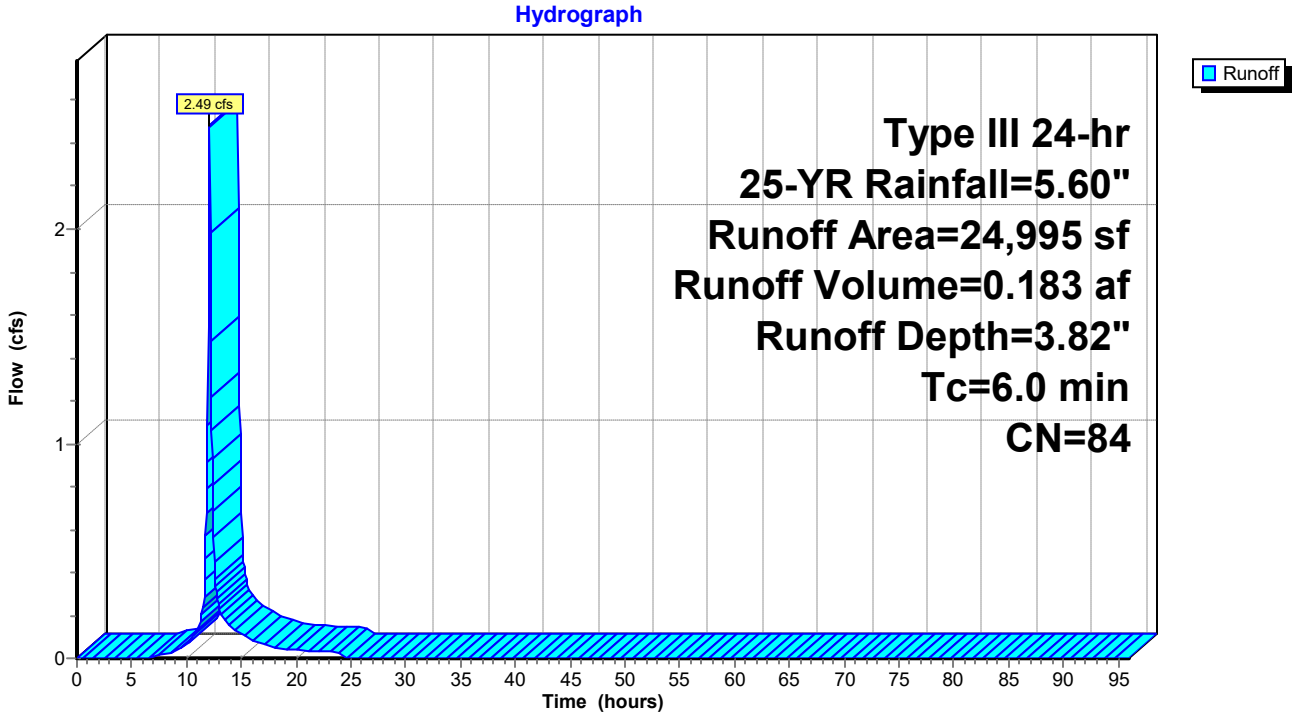
Runoff = 2.49 cfs @ 12.09 hrs, Volume= 0.183 af, Depth= 3.82"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=5.60"

Area (sf)	CN	Description
9,579	61	>75% Grass cover, Good, HSG B
15,416	98	Unconnected pavement, HSG B
24,995	84	Weighted Average
9,579		38.32% Pervious Area
15,416		61.68% Impervious Area
15,416		100.00% Unconnected

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

Subcatchment POST-1: WS#1



Summary for Subcatchment POST-2: WS#2

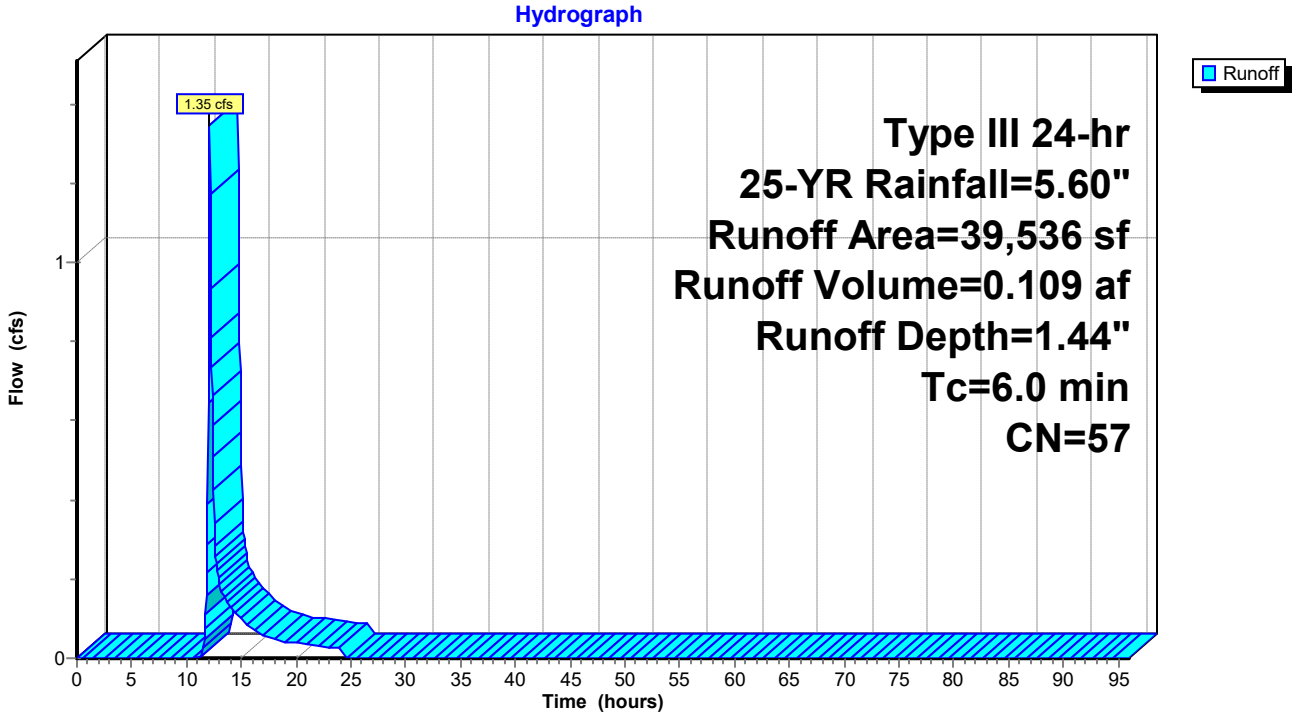
Runoff = 1.35 cfs @ 12.10 hrs, Volume= 0.109 af, Depth= 1.44"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=5.60"

Area (sf)	CN	Description
29,524	55	Woods, Good, HSG B
10,012	61	>75% Grass cover, Good, HSG B
39,536	57	Weighted Average
39,536		100.00% Pervious Area

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

Subcatchment POST-2: WS#2



Summary for Pond P-1: INF/DET BASIN

Inflow Area = 0.574 ac, 61.68% Impervious, Inflow Depth = 3.82" for 25-YR event
Inflow = 2.49 cfs @ 12.09 hrs, Volume= 0.183 af
Outflow = 0.64 cfs @ 12.47 hrs, Volume= 0.183 af, Atten= 74%, Lag= 22.9 min
Discarded = 0.05 cfs @ 12.47 hrs, Volume= 0.102 af
Primary = 0.59 cfs @ 12.47 hrs, Volume= 0.081 af

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 98.64' @ 12.47 hrs Surf.Area= 2,007 sf Storage= 3,568 cf

Plug-Flow detention time= 426.8 min calculated for 0.183 af (100% of inflow)
Center-of-Mass det. time= 427.4 min (1,233.5 - 806.1)

Volume	Invert	Avail.Storage	Storage Description
#1	96.00'	6,817 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

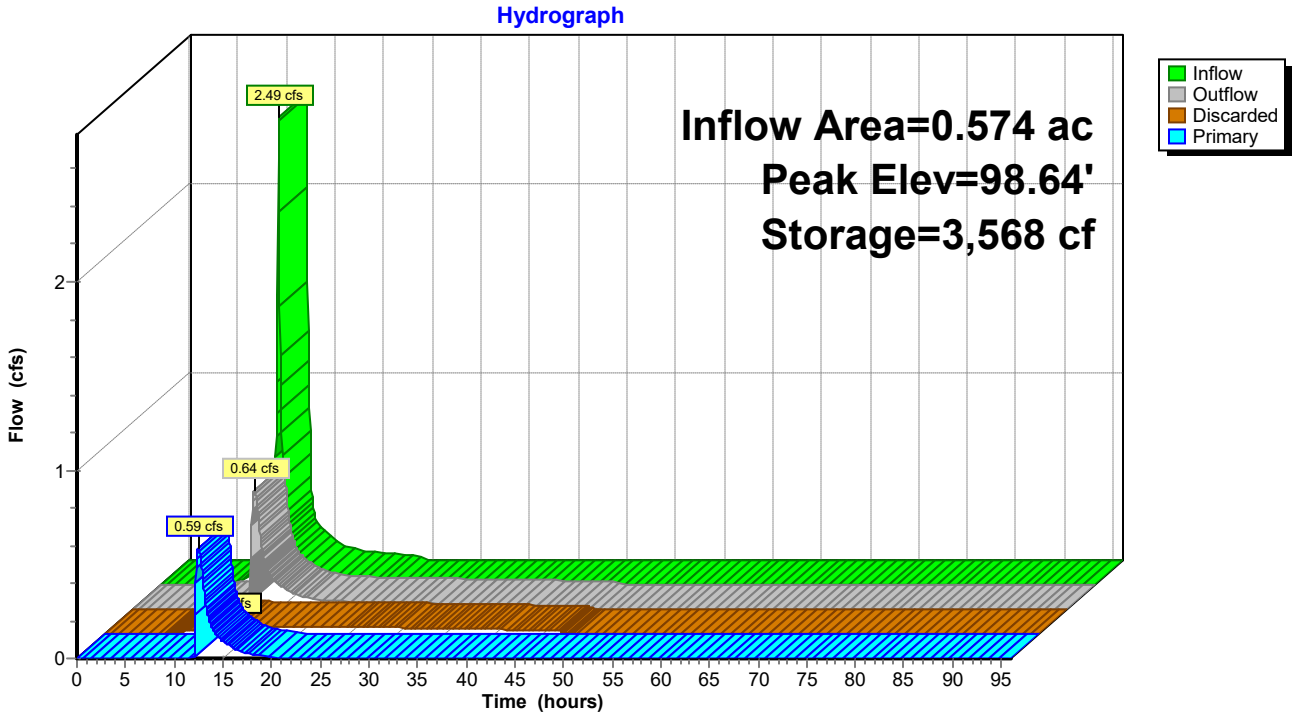
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
96.00	750	0	0
98.00	1,650	2,400	2,400
100.00	2,767	4,417	6,817

Device	Routing	Invert	Outlet Devices
#1	Discarded	96.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	96.00'	**12.0" Round Culvert** L= 30.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 96.00' / 94.00' S= 0.0667 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	99.00'	**4.0' long x 1.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s) 1.0' Crest Height
#4	Device 2	98.00'	**6.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.05 cfs @ 12.47 hrs HW=98.64' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.59 cfs @ 12.47 hrs HW=98.64' (Free Discharge)
└**2=Culvert** (Passes 0.59 cfs of 4.36 cfs potential flow)
  ├**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
  └**4=Orifice/Grate** (Orifice Controls 0.59 cfs @ 3.00 fps)

Pond P-1: INF/DET BASIN

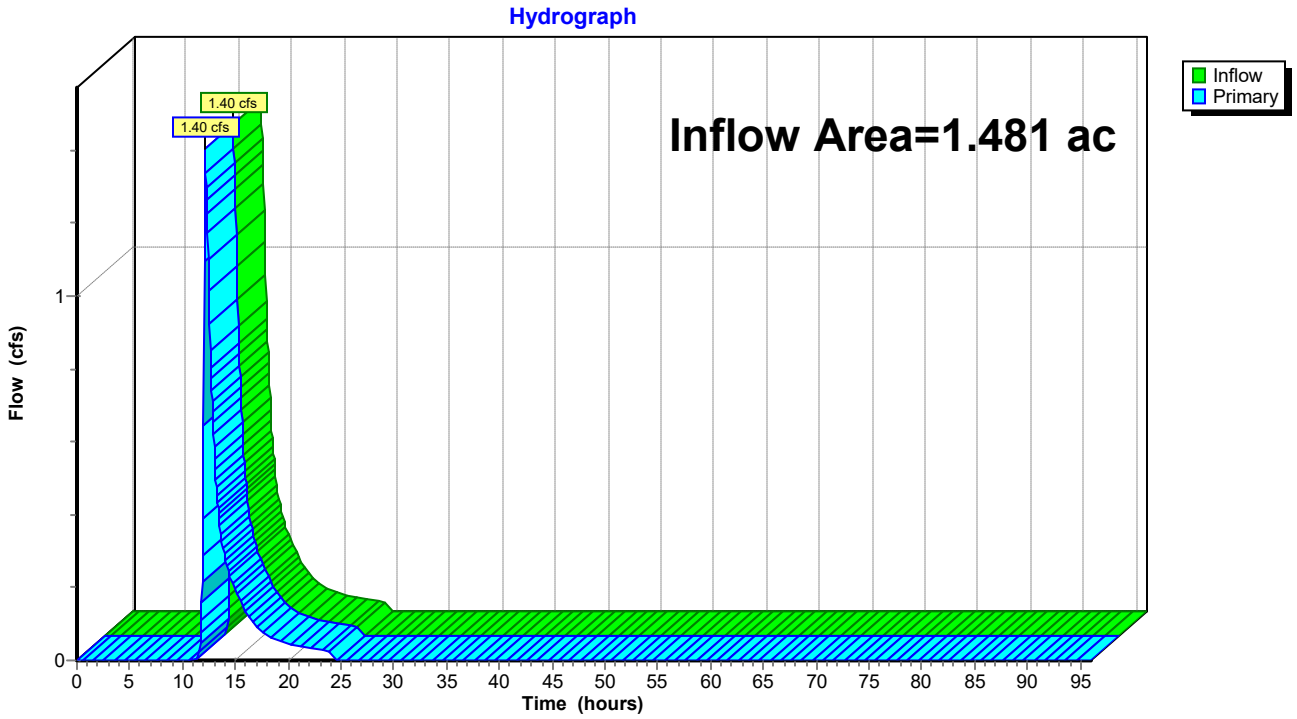


Summary for Link POA-1: (Southerly Wetlands)

Inflow Area = 1.481 ac, 23.89% Impervious, Inflow Depth = 1.53" for 25-YR event
Inflow = 1.40 cfs @ 12.14 hrs, Volume= 0.189 af
Primary = 1.40 cfs @ 12.14 hrs, Volume= 0.189 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Link POA-1: (Southerly Wetlands)



Summary for Subcatchment POST-1: WS#1

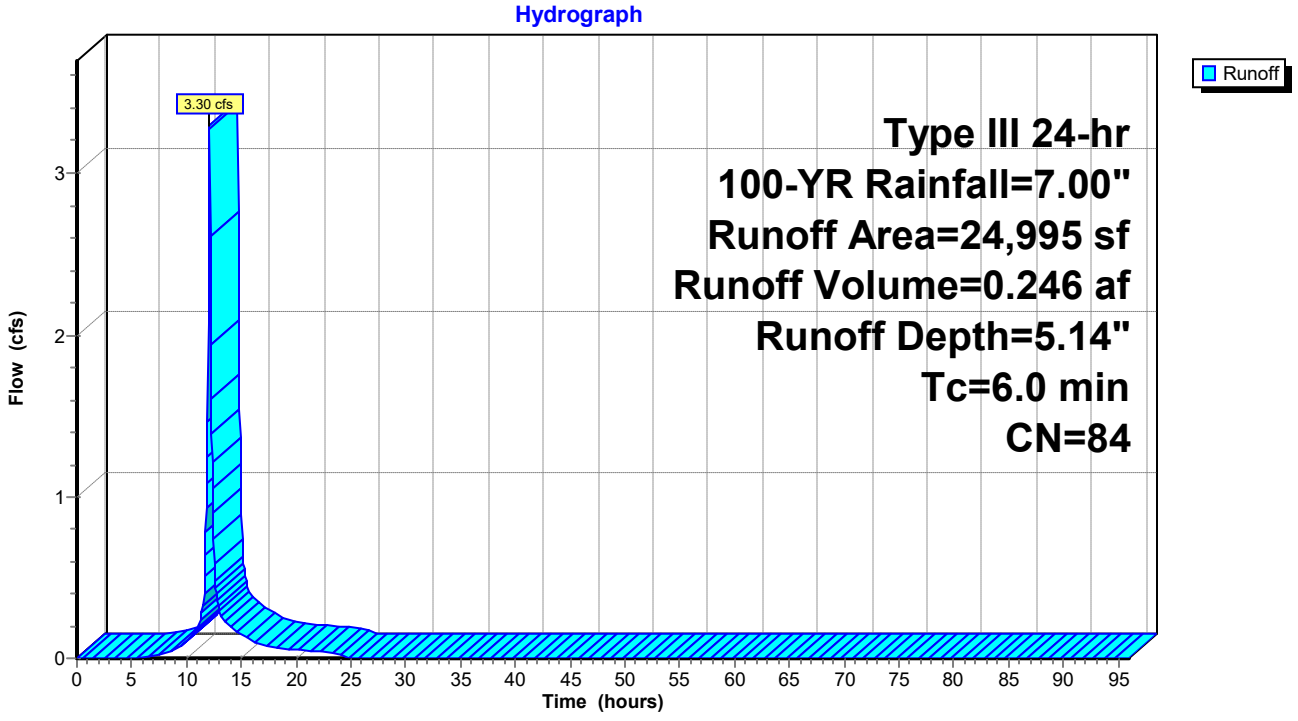
Runoff = 3.30 cfs @ 12.09 hrs, Volume= 0.246 af, Depth= 5.14"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR Rainfall=7.00"

Area (sf)	CN	Description
9,579	61	>75% Grass cover, Good, HSG B
15,416	98	Unconnected pavement, HSG B
24,995	84	Weighted Average
9,579		38.32% Pervious Area
15,416		61.68% Impervious Area
15,416		100.00% Unconnected

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

Subcatchment POST-1: WS#1



Summary for Subcatchment POST-2: WS#2

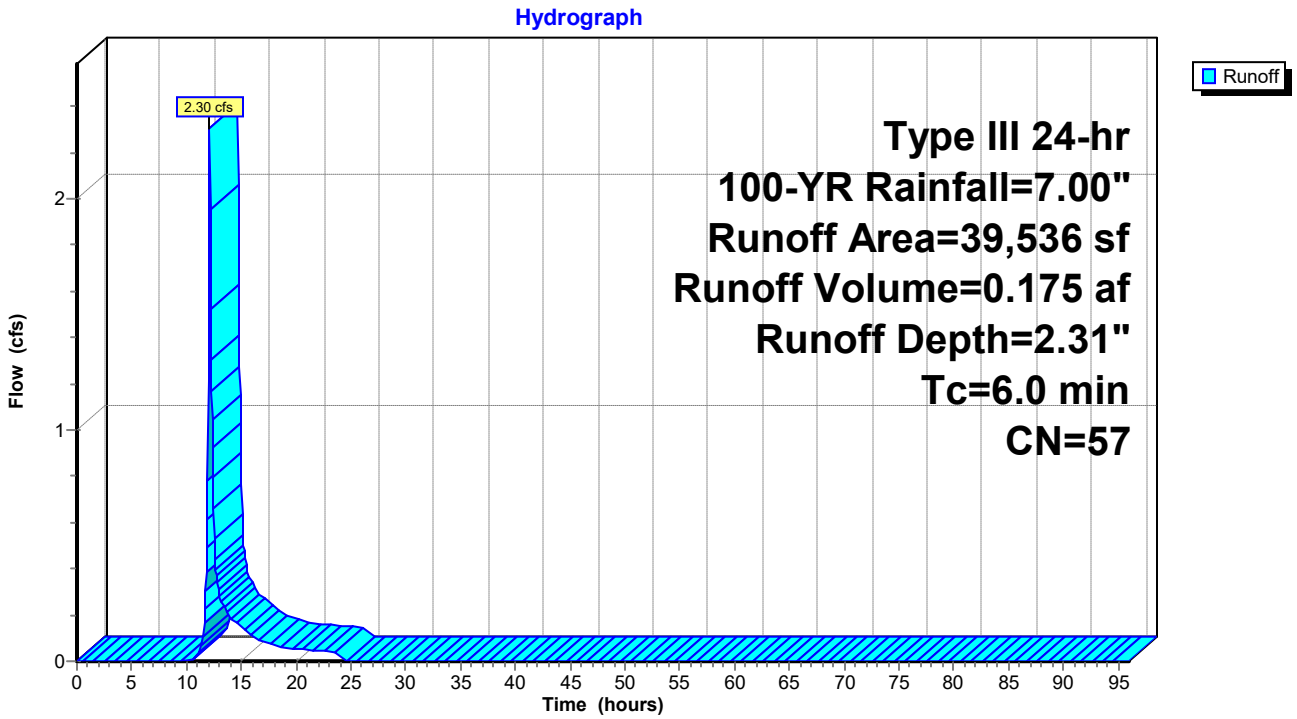
Runoff = 2.30 cfs @ 12.10 hrs, Volume= 0.175 af, Depth= 2.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR Rainfall=7.00"

Area (sf)	CN	Description
29,524	55	Woods, Good, HSG B
10,012	61	>75% Grass cover, Good, HSG B
39,536	57	Weighted Average
39,536		100.00% Pervious Area

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

Subcatchment POST-2: WS#2



Summary for Pond P-1: INF/DET BASIN

Inflow Area = 0.574 ac, 61.68% Impervious, Inflow Depth = 5.14" for 100-YR event
Inflow = 3.30 cfs @ 12.09 hrs, Volume= 0.246 af
Outflow = 1.19 cfs @ 12.36 hrs, Volume= 0.246 af, Atten= 64%, Lag= 16.5 min
Discarded = 0.05 cfs @ 12.36 hrs, Volume= 0.107 af
Primary = 1.14 cfs @ 12.36 hrs, Volume= 0.138 af

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 99.08' @ 12.36 hrs Surf.Area= 2,251 sf Storage= 4,498 cf

Plug-Flow detention time= 341.1 min calculated for 0.246 af (100% of inflow)
Center-of-Mass det. time= 340.9 min (1,138.8 - 797.8)

Volume	Invert	Avail.Storage	Storage Description
#1	96.00'	6,817 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

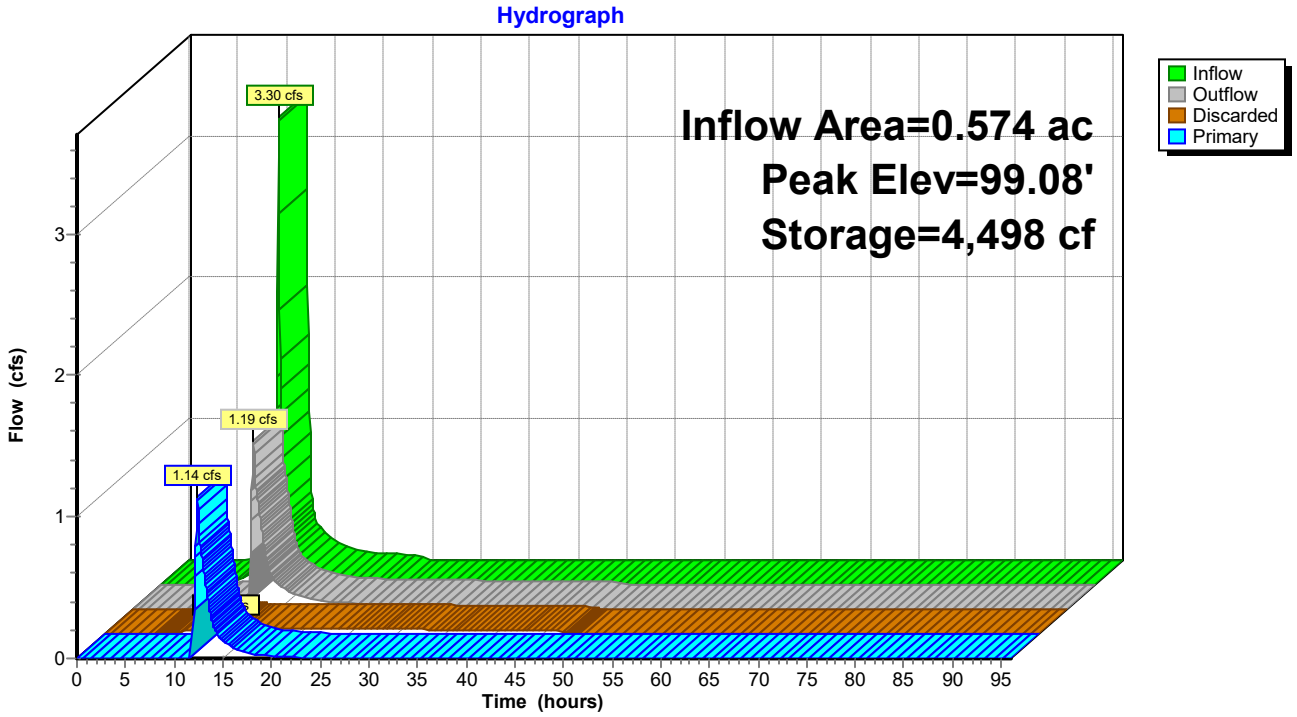
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
96.00	750	0	0
98.00	1,650	2,400	2,400
100.00	2,767	4,417	6,817

Device	Routing	Invert	Outlet Devices
#1	Discarded	96.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	96.00'	**12.0" Round Culvert** L= 30.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 96.00' / 94.00' S= 0.0667 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	99.00'	**4.0' long x 1.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s) 1.0' Crest Height
#4	Device 2	98.00'	**6.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.05 cfs @ 12.36 hrs HW=99.07' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=1.12 cfs @ 12.36 hrs HW=99.07' (Free Discharge)
└**2=Culvert** (Passes 1.12 cfs of 4.79 cfs potential flow)
  ├**3=Sharp-Crested Rectangular Weir** (Weir Controls 0.27 cfs @ 0.90 fps)
  └**4=Orifice/Grate** (Orifice Controls 0.86 cfs @ 4.37 fps)

Pond P-1: INF/DET BASIN

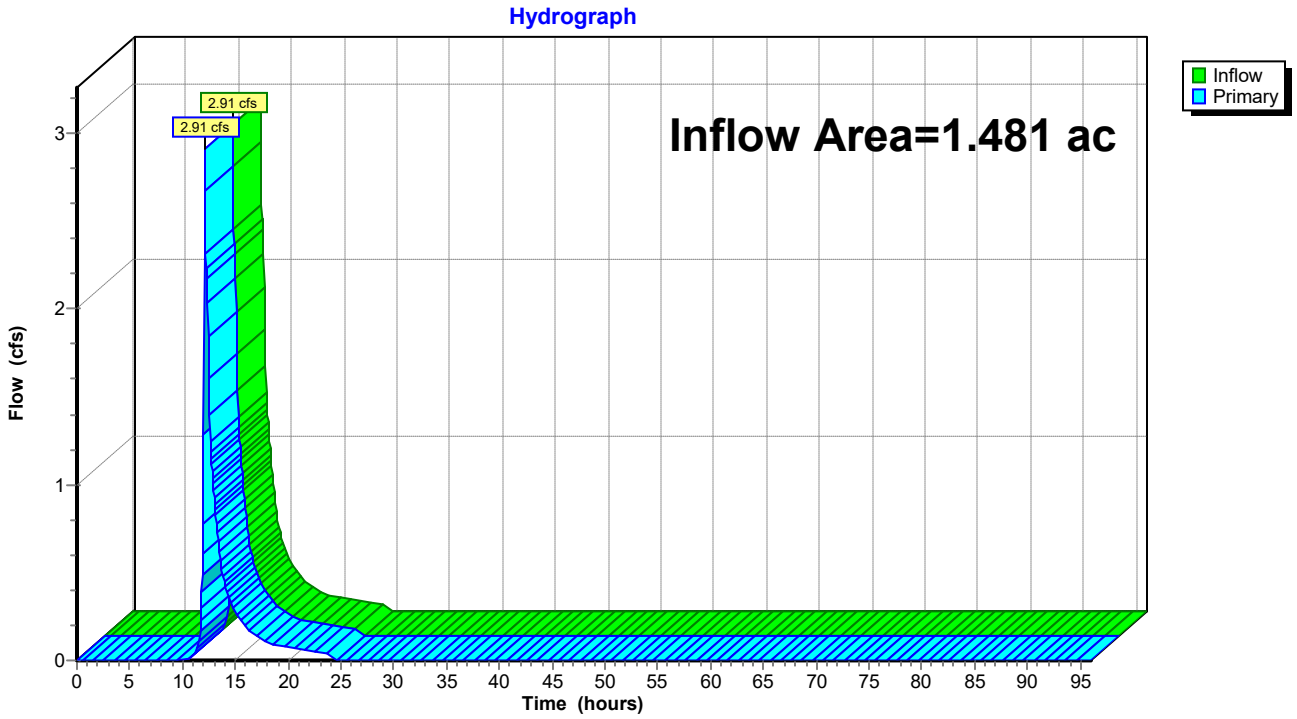


Summary for Link POA-1: (Southerly Wetlands)

Inflow Area = 1.481 ac, 23.89% Impervious, Inflow Depth = 2.54" for 100-YR event
Inflow = 2.91 cfs @ 12.11 hrs, Volume= 0.313 af
Primary = 2.91 cfs @ 12.11 hrs, Volume= 0.313 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Link POA-1: (Southerly Wetlands)



APPENDIX - D

EBI Consulting

Recharge Volume Calculation

29 Winter Street
Beverly, Massachusetts

Review of the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) for Essex County, Massachusetts indicates that the soils found on site consist of Udorthents Sandy Loam, Hydrologic Soil Group (HSG) "B" The future stormwater infiltration basin will be constructed norths west of the proposed building.

The Massachusetts Stormwater Handbook determines the required recharge volume using a calculation of 0.35 inches of runoff times the increased impervious cover of the site for a "B" soil. This infiltration basin will achieve the required recharge volume.

The total increased impervious cover of the proposed expansion is equal to 56,508 ft^2, therefore;

Mass DEP Requirement

Required Recharge Volume = 0.35 inches x Total Impervious Area for "B" soils
= 0.35 inches x 24,995 ft^2 x (1/12 in/ft) = 729 ft^3

Total Required Recharge Volume for Overall Project = 729 ft^3

Recharge to Groundwater Provided

The required recharge volume was achieved in the infiltration basin between elevations 96 and 98, below the low-level outlet.

Total Recharge Volume provided in basin = 2,400 ft^3 > 729 ft^3

Stage-Area-Storage for Pond P-1: INF/DET BASIN

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
96.00	750	0
96.05	772	38
96.10	795	77
96.15	818	118
96.20	840	159
96.25	863	202
96.30	885	245
96.35	907	290
96.40	930	336
96.45	953	383
96.50	975	431
96.55	997	481
96.60	1,020	531
96.65	1,043	583
96.70	1,065	635
96.75	1,088	689
96.80	1,110	744
96.85	1,132	800
96.90	1,155	857
96.95	1,178	916
97.00	1,200	975
97.05	1,222	1,036
97.10	1,245	1,097
97.15	1,268	1,160
97.20	1,290	1,224
97.25	1,313	1,289
97.30	1,335	1,355
97.35	1,357	1,423
97.40	1,380	1,491
97.45	1,403	1,561
97.50	1,425	1,631
97.55	1,447	1,703
97.60	1,470	1,776
97.65	1,493	1,850
97.70	1,515	1,925
97.75	1,538	2,002
97.80	1,560	2,079
97.85	1,582	2,158
97.90	1,605	2,237
97.95	1,628	2,318
98.00	1,650	2,400
98.05	1,678	2,483
98.10	1,706	2,568
98.15	1,734	2,654
98.20	1,762	2,741
98.25	1,790	2,830
98.30	1,818	2,920
98.35	1,845	3,012
98.40	1,873	3,105
98.45	1,901	3,199
98.50	1,929	3,295
98.55	1,957	3,392
98.60	1,985	3,491
98.65	2,013	3,590
98.70	2,041	3,692
98.75	2,069	3,795
98.80	2,097	3,899
98.85	2,125	4,004
98.90	2,153	4,111
98.95	2,181	4,220
99.00	2,209	4,329
99.05	2,236	4,440
99.10	2,264	4,553
99.15	2,292	4,667
99.20	2,320	4,782
99.25	2,348	4,899
99.30	2,376	5,017
99.35	2,404	5,136
99.40	2,432	5,257
99.45	2,460	5,380
99.50	2,488	5,503
99.55	2,516	5,628
99.60	2,544	5,755
99.65	2,572	5,883
99.70	2,599	6,012
99.75	2,627	6,143
99.80	2,655	6,275
99.85	2,683	6,408
99.90	2,711	6,543
99.95	2,739	6,679
100.00	**2,767**	**6,817**

EBI Consulting

TARGET WATER QUALITY FLOW RATE FOR PROPRIETARY WATER QUALITY UNIT

Water Quality Flow Rate: Q_1 = (qu)(A)(WQV)

[where Q_1 = water quality flow rate associated with first 1"]

qu = [774 csm/in (for first 1" runoff, T_c = 6 minutes)]

A = impervious surface drainage area in acres

WQV = 1.0 inch

Water quality unit "WQU #1": Model = ADS Barracuda S4

Treatment Capacity = 50% TSS Removal at 1.52 CFS

A = [19,955] sf

= [0.46] Ac

Q_1 = (774 csm/in)(0.46 ac)(0.0015625 sq mi/ac)(1.0")

= **[0.56] cfs** < 1.52 cfs

Reference:

"Standard Method to Convert Required Water Quality Volume of a Discharge Rate for Sizing Flow Based Manufactured Proprietary Stormwater Treatment Practices," Massachusetts Department of Environmental Protection Wetlands Program, September 10, 2013.

ADS® Barracuda™ Max

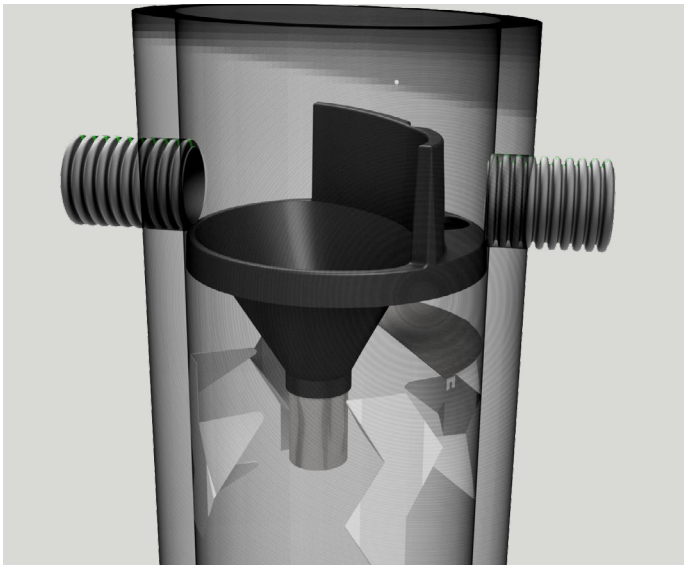
The Barracuda Max is market-changing stormwater quality technology. This high-performance vortex hydrodynamic separator is designed to remove total suspended solids in order to protect our precious receiving waters. The Barracuda Max is also an outstanding value that offers multiple pipe configurations, and quick installation. The “Max” version of the Barracuda is built on the base platform of the original ADS Barracuda with improved removal efficiencies and installation components.

Features

- Single manhole design
- No elevation loss between the inlet and outlet
- Variable inlet/outlet angle configurations (not just 180 degree orientation)
- Internal bypass for inline installation (where applicable)
- Revolutionary, patent-pending “teeth” mitigate turbulence in the sump area to prevent re-suspension of captured contaminants and an added deflector plate and bowl extension enhance the unit’s removal capabilities

Benefits

- Internal components are in stock for quick delivery
- The S3, S4, S6, and S8 can be installed in a standard 36” (900 mm), 48” (1200 m), 72” (1800 m), and 96” (2400 m) precast manhole, respectively
- The S3 & S4 can be provided factory installed within a 36” (900 mm) and 48” (1200 mm) ADS HP manhole and delivered to the jobsite
- The Barracuda Max “teeth” and deflector plate apparatus are fabricated and designed for quick and easy field assembly
- Designed for easy maintenance using a vacuum truck or similar equipment.
- Inspection and maintenance are performed from the surface with no confined space entry



ADS™

Barrucuda Specification

Materials and Design

- Concrete Structures: Designed for H-20 traffic loading and applicable soil loads or as otherwise determined by a Licensed Professional Engineer. The materials and structural design of the devices shall be per ASTM C857 and ASTM C858.
- 36” (900 mm) and 48” (1200 mm) HP Manhole Structures: Made from an impact modified copolymer polypropylene meeting the material requirements of ASTM F2764. The eccentric cone reducer shall be manufactured from polyethylene material meeting ASTM D3350 cell class 213320C. Gaskets shall be made of material meeting the requirements of ASTM F477.
- Separator internals shall be substantially constructed of stainless steel, polyethylene or other thermoplastic material approved by the manufacturer.

Performance

- The stormwater treatment unit shall be an inline unit capable of conveying 100% of the design peak flow. If peak flow rates exceed maximum hydraulic rate, the unit shall be installed offline.
- The Barracuda Max unit shall be designed to remove at least 80% of the suspended solids on an annual aggregate removal basis. Said removal shall be based on full-scale third party testing using OK-110 media gradation or equivalent and 300 mg/L influent concentration. Said full scale testing shall have included sediment capture based on actual total mass collected by the stormwater treatment unit.

  - OR -

  The Barracuda Max unit shall be designed to remove at least 50% of TSS using a media mix with d_{50}=75 micron and 200 mg/L influent concentration.

  - OR -

  The Barracuda Max unit shall be designed to remove at least 50% of TSS per current NJDEP/NJCAT HDS protocol.
- The stormwater treatment unit internals shall consist of (1) separator cone assembly, and (1) sump assembly, which includes the “teeth”.

Barracuda Max Model	Manhole Diameter	NJDEP (50% removal)	OK-110 (80% removal)
S3	36” (900 mm)	0.85 CFS (24.1 L/s)	0.86 CFS (24.1 L/s)
S4	48” (1200 mm)	1.52 CFS (43.0 L/s)	1.52 CFS (43.0 L/s)
S6	72” (1800 mm)	3.40 CFS (96.3 L/s)	3.42 CFS (96.8 L/s)
S8	96” (2400 mm)	6.08 CFS (172.2 L/s)	6.08 CFS (172.2 L/s)

* Peak bypass flows are dependent on final design

Installation

Installation of the stormwater treatment unit(s) shall be performed per manufacturer’s installation instructions. Such instructions can be obtained by calling Advanced Drainage Systems at 800-821-6710 or by logging on to www.adspipe.com.

adspipe.com
800-821-6710

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: 29 WINTER STREET PEMBROKE

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
DEEP SUMP CATCH BASIN	.25	**1.00**	.25	.75
BARRACUDA S4	.50	.75	.38	.37
INFILTRATION BASIN	.80	.37	.30	.07

Total TSS Removal = .93

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

Project: 29 WINTER ST

Prepared By: A. KOKA

Date: 03/20/2023

*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

EBI Consulting

Location: 29 Winter St, Pembroke MA
Development: B&M 35 Hanover, LLC
Storm Frequency: 100 Year Storm,

Date: 18-Jan-23
Revised: 3/20/2023
Calculated By: A. Koka

Project Number: 1622000082

From	To	Drainage Area (s.f.)	C	Total C x A (acres)	Tc (min)	I(100) (in/hr)	Q = (CIA) (cfs)	Flow from others (cfs)	Total Q (cfs)	Min. Slope (ft/ft)	Pipe Material	Manning's n	Dia (in)	Q (full) (cfs)	V (full) (fps)	Q/Q(full) < 1?	INV. IN (ft)	INV. OUT (ft)	Length (ft)	Pipe Rad. (ft)	Hydraulic Radius (ft)	Area (ft2)	Perimeter (ft)
Subcat #1	CB #1	0	0.20																				
		435	0.30																				
		2894	0.90																				
				0.06	5	7.00	0.44	0.00	0.44														
CB #1	DMH #1	0	0.20																				
		0	0.30																				
		0	0.90																				
				0.00	5	7.00	0.00	0.44	0.44	0.005	HDPE	0.011	12	3.05	3.88	0.14	99.25	99.5	48	0.5	0.25	0.785	3.142
Subcat #2	CB #2	0	0.20																				
		1150	0.30																				
		3253	0.90																				
				0.08	5	7.00	0.53	0.00	0.53														
CB #2	DMH #1	0	0.20																				
		0	0.30																				
		0	0.90																				
				0.00	5	7.00	0.00	0.53	0.53	0.006	HDPE	0.011	12	3.34	4.25	0.16	99.25	99.3	8	0.5	0.25	0.785	3.142
DMH#1	WQU#1	0	0.20																				
		0	0.30																				
		0	0.90																				
				0.00	5	7.00	0.00	0.97	0.97	0.006	HDPE	0.011	12	3.25	4.14	0.30	98.8	99.15	59	0.5	0.25	0.785	3.142
Subcat #3	CB#3	0	0.20																				
		676	0.30																				
		3869	0.90																				
				0.08	5	7.00	0.59	0.00	0.59														
CB#3	WQ#1	0	0.20																				
		0	0.30																				
		0	0.90																				
				0.00	5	7.00	0.00	0.59	0.59	0.005	HDPE	0.011	12	2.99	3.80	0.20	98.8	98.9	20	0.5	0.25	0.785	3.142
WQU#1	FES#1	0	0.20																				
		0	0.30																				
		0	0.90																				
				0.00	5	7.00	0.00	1.56	1.56	0.007	HDPE	0.011	12	3.49	4.44	0.45	98.5	98.8	44	0.5	0.25	0.785	3.142

Hydrograph for Pond P-1: INF/DET BASIN

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)
0.00	0.00	0	96.00	0.00	0.00	0.00
2.50	0.00	0	96.00	0.00	0.00	0.00
5.00	0.00	0	96.00	0.00	0.00	0.00
7.50	0.02	31	96.04	0.02	0.02	0.00
10.00	**0.11**	**375**	**96.44**	**0.02**	**0.02**	**0.00**
12.50	**0.74**	**4,419**	**99.04**	**1.00**	**0.05**	**0.95**
15.00	0.15	2,769	98.22	0.17	0.04	0.13
17.50	0.07	2,605	98.12	0.08	0.04	0.04
20.00	0.05	2,522	98.07	0.06	0.04	0.02
22.50	0.04	2,469	98.04	0.05	0.04	0.01
25.00	0.00	2,301	97.94	0.04	0.04	0.00
27.50	0.00	1,967	97.73	0.04	0.04	0.00
30.00	0.00	1,652	97.51	0.03	0.03	0.00
32.50	0.00	1,358	97.30	0.03	0.03	0.00
35.00	0.00	1,084	97.09	0.03	0.03	0.00
37.50	0.00	831	96.88	0.03	0.03	0.00
40.00	0.00	598	96.66	0.02	0.02	0.00
42.50	0.00	385	96.45	0.02	0.02	0.00
45.00	0.00	193	96.24	0.02	0.02	0.00
47.50	0.00	22	96.03	0.01	0.01	0.00
50.00	0.00	0	96.00	0.00	0.00	0.00
52.50	0.00	0	96.00	0.00	0.00	0.00
55.00	0.00	0	96.00	0.00	0.00	0.00
57.50	0.00	0	96.00	0.00	0.00	0.00
60.00	0.00	0	96.00	0.00	0.00	0.00
62.50	0.00	0	96.00	0.00	0.00	0.00
65.00	0.00	0	96.00	0.00	0.00	0.00
67.50	0.00	0	96.00	0.00	0.00	0.00
70.00	0.00	0	96.00	0.00	0.00	0.00
72.50	0.00	0	96.00	0.00	0.00	0.00
75.00	0.00	0	96.00	0.00	0.00	0.00
77.50	0.00	0	96.00	0.00	0.00	0.00
80.00	0.00	0	96.00	0.00	0.00	0.00
82.50	0.00	0	96.00	0.00	0.00	0.00
85.00	0.00	0	96.00	0.00	0.00	0.00
87.50	0.00	0	96.00	0.00	0.00	0.00
90.00	0.00	0	96.00	0.00	0.00	0.00
92.50	0.00	0	96.00	0.00	0.00	0.00
95.00	0.00	0	96.00	0.00	0.00	0.00

EBI Consulting

OUTLET PROTECTION DESIGN FOR SINGLE-PIPE DISCHARGE FROM WQU#1

The flared end sections (FES) #1 & #3 are designed with a 12-inch pipe discharging to the proposed Infiltration/Detention Basin at 2.30 cfs for the 100-Year Design Storm Event. The following method was used to determine the required length, width, and median stone size for the riprap lined apron at the end of the pipe.

Since the pipe does not discharge to a paved surface, a Minimum Tailwater Condition may be assumed.

Plate 3.18-3 was reviewed to determine an apron length (L_a) and a median stone size (d_{50}). Using the pipe diameter of 12" and a min discharge rate of approximately 3.5 cfs:

Minimum Apron Length (L_a)	**= 6.0 feet. (Provided 8 Feet)**
Median Stone Size (d_{50})	**= 3 inches**
Upstream apron width	**= 3 x Pipe Diameter (Provided 3 Feet)**
	= 3 x 1feet = 3 feet
Downstream apron width	**= Apron Length + Pipe Diameter**
	= 6 feet + 3 feet = 9 feet (Provided 10 Feet)

Refer to **Figure 1 – Plate 3.18-3 for Underground Detention System Discharge** for graphical determination of median stone size and apron length.

EBI Consulting

OUTLET PROTECTION DESIGN FOR SINGLE-PIPE DISCHARGE FROM WQU#1

The flared end section (FES) #2 is designed with a 12-inch pipe discharging to the existing wetlands at 1.14 cfs for the 100-Year Design Storm Event. The following method was used to determine the required length, width, and median stone size for the riprap lined apron at the end of the pipe.

Since the pipe does not discharge to a paved surface, a Minimum Tailwater Condition may be assumed.

Plate 3.18-3 was reviewed to determine an apron length (L_a) and a median stone size (d_{50}). Using the pipe diameter of 12" and a min discharge rate of approximately 3.5 cfs:

Minimum Apron Length (L_a) **= 6.0 feet. (Provided 8 Feet)**

Median Stone Size (d_{50}) **= 3 inches**

Upstream apron width **= 3 x Pipe Diameter (Provided 3 Feet)**

= 3 x 1feet = 3 feet

Downstream apron width **= Apron Length + Pipe Diameter**

= 6 feet + 3 feet = 9 feet (Provided 10 Feet)

Refer to **Figure 2– Plate 3.18-3 for Underground Detention System Discharge** for graphical determination of median stone size and apron length.

Figure 1- Plate 3.18-3 for FES#1 & FES#3 Discharge

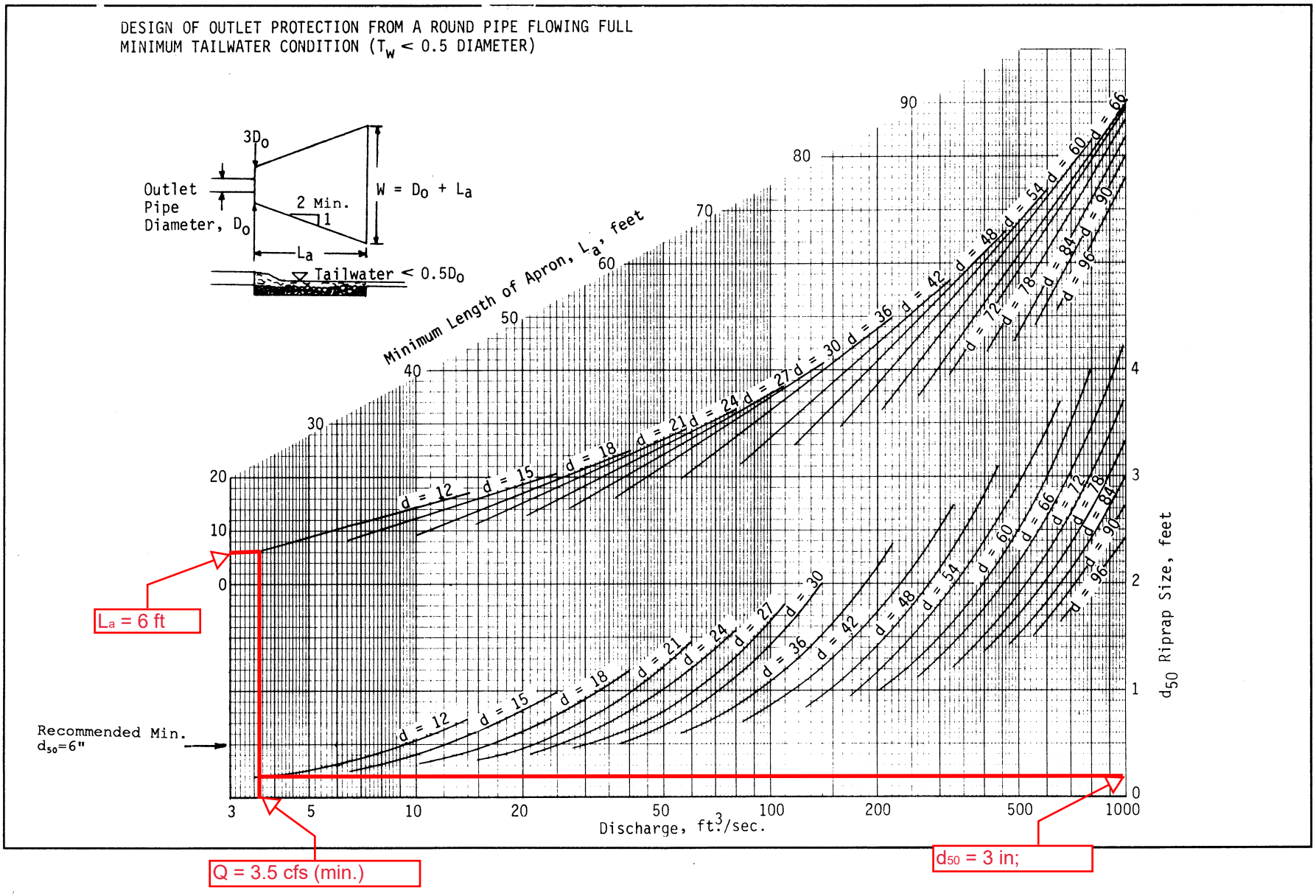
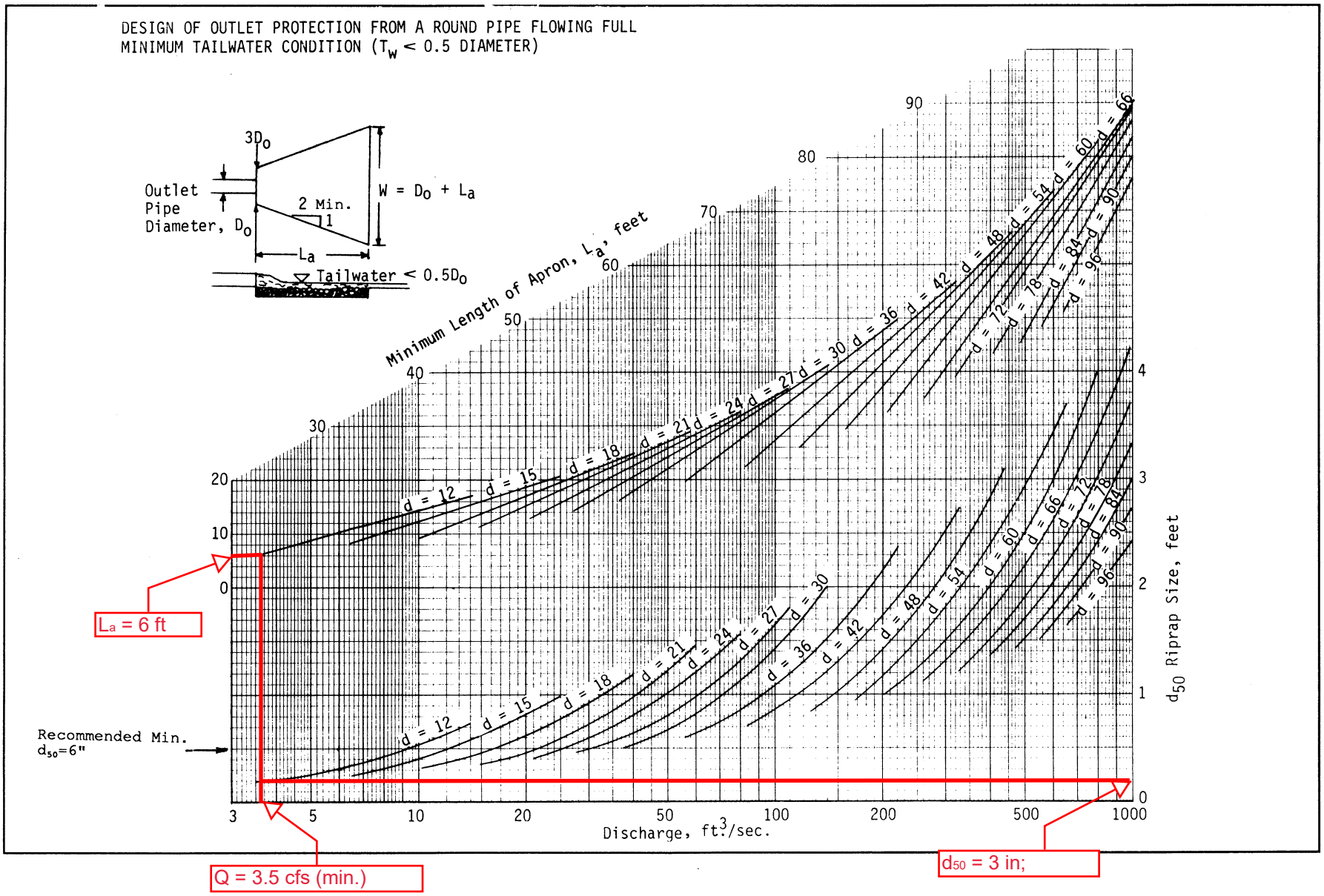


Figure 2- Plate 3.18-3 for FES#2 Discharge



Source: USDA-SCS

1992

III - 164

Plate 3.18-3

3.18

APPENDIX - E

EBI Consulting

CONSTRUCTION PHASE OPERATIONS AND MAINTENACE PLAN

DATE: January 19, 2023
Revised: March 20, 2023

PROJECT LOCATION:

Ancillary Storage Addition
29 Winter Street
Pembroke, MA 02359

OWNER:

B&M 35 Hanover, LLC c/o Mike Murphy
29 Winter Street
Pembroke, MA 02359
(781) 836-0222

RESPONSIBLE PARTY:

B&M 35 Hanover, LLC c/o Mike Murphy
29 Winter Street
Pembroke, MA 02359
(781) 836-0222

PROJECT OVERVIEW:

Prevention of offsite flooding and improvements to existing runoff, water quality, and groundwater recharge characteristics are the main priorities of the project with respect to the drainage design. The project will improve existing stormwater management within the property with respect to the current site condition, which includes no existing stormwater management facilities, by installing a new stormwater management system comprising various Best Management Practices (BMPs) to mitigate runoff and water quality impacts associated with the proposed site development. Water quality BMPs to mitigate the runoff generated by the site improvements during construction include straw wattle & siltation fence, drainage basin inlet inserts, construction entrance with anti-tracking pad, a temporary sediment basin, and periodic street sweeping along the site frontage.

It is the intent of the stormwater management design to achieve an 80% Total Suspended Solids (TSS) removal efficiency or 44% removal efficiency prior to discharge as outlined in the DEP Stormwater Management Standards.

The construction-phase BMPs used in this design were chosen for their effectiveness and ease of maintenance. Providing for maintenance requirements that are practical is essential to achieve the desired result of improved stormwater quality and peak attenuation. This plan will be provided to the property owner, property manager, and general contractor to educate them on the recommendations of this plan and the DEP Stormwater Management Guidelines.

CONSTRUCTION PERIOD – BEST MANAGEMENT PRACTICES:

a) MONITORING

During construction operations, the stormwater management system will be inspected at least once every seven (7) calendar days, or once every fourteen (14) calendar days and within twenty-four (24) hours after a storm event of one quarter inch (0.25") or greater. Sediment accumulation shall be removed once a depth of one-third the height of perimeter sedimentation control devices is achieved unless stated otherwise. Damaged or underperforming sedimentation controls shall be replaced, modified, or otherwise supplemented immediately.

b) WASTE AND RECYCLING DISPOSAL

Metal dumpster type waste and recycling disposal receptacles will be located on-site and kept covered when not in active use. The project site will be policed daily by a person appointed by the general contractor to be kept the project site free of construction debris.

c) DUST MONITORING PLAN

A dust monitoring plan will be established prior to the start of construction and kept on site at all times. This will reduce the particulate levels in the air and reduce impacts to surrounding areas. Recommended methods for controlling dust include:

- Provide vegetative cover to disturbed areas at the end of earth disturbing activities as soon as practical, but no longer than 14 days.
- Apply a mulch layer to disturbed areas at the end of earth disturbing activities as soon as practical, but no longer than 14 days.
- Cover stockpiles unused for a maximum of 7 days with poly sheeting or tarps.
- Water surface materials and soil stockpiles.
- Use covered trucks.
- Minimize spoils stockpiled on site.
- Monitor construction practices to minimize unnecessary disturbance/ transfer of soils.
- Conduct periodic street cleaning along the site frontage during excavation activities.
- Pave driveways and parking surfaces as early as possible (where applicable and feasible).
- Assign personnel to remove windblown debris daily.
- Limit the idling of engines or stopped vehicles (except asphalt and cement concrete mixing trucks and equipment) to five minutes.

d) SPILL PREVENTION, CONTAINMENT, AND CLEANUP

Construction activities for this project will necessitate the use of equipment fuels, engine fluids, paints, and adhesives on the construction site and must be considered in the spill prevention and response practices for the project.

The general contractor will ensure areas where potential pollutants can occur are well protected with erosion control barriers and clean up equipment to prevent discharge of wastewater, fuels, and oil from vehicles and any other toxic or hazardous spills from the project site.

Spill kits comprising equipment necessary to attend to spills or leaks shall be stored on site in equipment sheds or similar covered enclosures and shall consist of the following:

- Safety goggles.
- Chemically resistant gloves and overshoe boots.
- Water and chemical fire extinguishers.
- Shovels.
- Absorbent materials.
- Containers suitable for storage of site-specific materials.
- First aid kits.

Spills and leaks shall be treated according to the type, volume, and location of the released material. Generally, mitigation shall consist of the following:

- Prevention of additional material storage.
- Containment of spilled material.
- Safe, thorough, and environmentally sound removal of spilled material.
- Remediation of environmental damage.

In the event of a spill, all materials used for containment and cleanup shall be replaced in kind in the spill kits immediately. The following describes specific preventative methods to be employed for materials used on site.

Fuels, Antifreeze, and Coolant for Construction Equipment and Generators:

In the case of a fuel spill on a pervious surface, the spill shall be contained and treated with absorbent polymer material immediately and the affected soil shall be excavated and stored in an impervious, bermed area, and the Licensed Site Professional shall be contacted to coordinate next steps regarding soil management. In the case of a fuel spill on an impervious surface, the spill shall be contained to prevent runoff and treated with absorbent material.

Adhesives and Paints:

Adhesive and paint materials shall be transferred to the site on an as needed basis. Any containers to be stored on site shall be clearly labeled and stored in non-flammable lockers. Wash water from paints shall be containerized; washing of paints into storm drainage systems shall be prohibited. Water-based and latex paints shall either be recycled or dried up and thrown out with the regular household trash, and oil-based paints and thinners shall be removed from the site by a local professional hazardous material removal company.

Town of Pembroke Emergency Contacts are as Follows:

- Emergency Management: (888) 304-1133 (MassDEP 24-Hour Spill Reporting)
- Police Department: 911
- Fire Department: (781) 293-2300

For spills of less than five (5) gallons of material, mitigation shall consist of source control, containment, and clean-up with absorbent materials, unless an imminent hazard necessitates that a local professional hazardous material removal company become involved to mitigate the spill.

For spills greater than five (5) gallons of material, the incident shall be reported immediately to the MassDEP Hazardous Waste Incident Response Group at (617)-792-7653 and a professional emergency response contractor. Information that shall be provided to the said contractor is as follows:

- Type of material spilled.
- Quantity of material spilled.
- Location of the spill.
- Time of the spill.

The contractor shall then employ measures to prevent further spillage, contain and/or clean up the spill.

If a Reportable Quantity (RQ) of material is spilled during construction, the National Response Center (NRC) shall be notified immediately at (800) 424-8802. Reportable Quantities of hazardous material are available in 310 CMR 40: Massachusetts Contingency Plan Subpart P: Massachusetts Oil and Hazardous Material List. Within 14 days a report shall be submitted to the EPA New England Regional Office describing the following:

- Type of material released.
- Date and circumstances of the release.
- Measures taken to prevent future releases.

The report shall be submitted to the EPA New England Regional Office at the following address:

EPA New England, Region 1
1 Congress Street, Suite 1100
Boston, MA 02114-2023

Frequent inspections of areas where potential spill could occur is key to prevention. Inspection shall take place, at a minimum of once every calendar days, or once every 14 calendar days and within 24 hours of the occurrence of a storm event of 0.25 inches or greater or the occurrence of runoff from snowmelt sufficient to cause a discharge.

An inspection report shall be completed within 24 hours of completing any site inspection. Each inspection report must include, at minimum, the following:

- The inspection date and time.
- The weather and temperature.
- Names and titles of personnel making the inspection.
- A summary of inspection findings, covering at a minimum the observations made in accordance with Part 4.6 of the 2022 Construction General Permit, including any necessary maintenance or corrective actions.
- If inspecting because of rainfall measuring 0.25 inches or greater, include the applicable rain gauge or weather station readings that triggered the inspection.
- If determined that it is unsafe to inspect a portion of the site, describe the reason found to be unsafe and specify the locations to which the conditions apply.

e) STATE & LOCAL SANITARY LAWS

Portable sanitary units will be placed on-site during construction and will be serviced weekly.

V. CONSTRUCTION PERIOD - STRUCTURAL BEST MANAGEMENT PRACTICES

Structural BMPs are those physical facilities that are designed to manage both stormwater quantity and quality. Proper maintenance of the proposed structural BMPs will ensure design performance, promote longevity, and decrease operator maintenance costs. The structural BMPs selected for the proposed site development include straw wattle & siltation fence, temporary, drainage basin inlet inserts, construction entrance with anti-tracking pad, and a temporary sediment basin.

a) STRAW WATTLE & SILTATION FENCE

Compost filter sock sedimentation control barriers shall be installed as specified on the "Erosion Control Plan" (plan sheet C-8) prior to commencing construction activities. The straw wattles shall be inspected daily and maintained throughout construction. Accumulated sediment shall be removed before it has accumulated to one-third of the above ground height of the straw wattle. Any breach in the wattles shall be repaired within 24 hours or before next rainfall, whichever is sooner. Straw wattles shall remain in place for the duration of construction and may be supplemented and/or modified at any time. The general contractor shall maintain a stockpile of surplus straw wattle materials equivalent to 10 percent of the overall sedimentation control barrier length as depicted on plan sheet C-8.

b) **DRAINAGE INLET INSERTS FOR EXISTING AND PROPOSED CATCH BASINS**

Existing catch basins located in the public right of way adjacent to the construction entrance, as well as all new catch basins upon installation, shall be equipped with inlet inserts as shown on "Erosion Control Plan" (plan sheet C-8).

Inlet inserts shall be regular flow units installed below grate castings and be equipped with internal emergency bypass devices. Inlet inserts are to remain in place until the end of the construction and the site is stabilized. During construction, all catch basins and inlet inserts shall be inspected every fourteen (14) calendar days and after a storm of a quarter inch (0.25") or greater. Sediment accumulation shall be removed once sediment accumulates above the expansion restraint within the bag. Damaged inserts shall be replaced immediately. The contractor shall keep a minimum of two (2) extra inlet inserts on site in case damaged units need to be replaced. Disposal of accumulated sediment and trash is to be in accordance with applicable local, state, and federal guidelines and regulations. Upon completion of the work, contractor is responsible for inspection and cleaning of units to ensure delivery of clean units to owner prior to completion of project.

c) **CONSTRUCTION ENTRANCE ANTI-TRACKING PAD**

A construction entrance anti-tracking pad shall be installed at the existing driveway entrances as shown on the "Erosion Control Plan" (plan sheet C-8) to minimize the track-out of sediment onto the street and sidewalk surfaces from vehicles leaving the construction site. The sub-base for the pad will be compacted and covered with a filter cloth. Crushed stone ranging in aggregate size from 1.5 to 3 inches will be placed on top of the filter cloth at a minimum thickness of 6 inches. The anti-tracking pad will remain in place and maintained until parking and loading areas receive an asphalt binder course or concrete slab-on-grade, depending on location.

The anti-tracking pad shall be installed prior to material and heavy equipment hauling commences. Maintenance requirements include:

- Construction vehicles will be restricted to using only the designated entrance/exit armored with the tracking pad until the site has been stabilized with asphalt binder course. The removed stone and sediment from the pad will be hauled off site and disposed in accordance with all applicable local, state, and federal regulations.

- The exit will be maintained in a condition that will prevent tracking or flowing of sediment off-site. This could require additional crushed stone to be placed within the exit. Sediment shall be swept form the anti-tracking pads at least weekly, or more often if necessary. If excess sediment has clogged the pads, they shall be top dressed using new crushed stone and re-leveled. Replacement of the entire pad may be necessary if it becomes completely inundated with sediment. The pad will be reshaped as needed for drainage and runoff control depending on site conditions.

- Where sediment has been tracked into the public right of way from the construction site, the deposited sediment shall be removed by the end of the same workday. Sediment shall be removed by sweeping, shoveling, or vacuuming of these surfaces. Hosing or sweeping tracked-out sediment into a public or private stormwater system is prohibited.

- The exit will be inspected once every seven (7) calendar days and within 24 hours of storm events of 0.25 inches or greater, or the occurrence of runoff from snowmelt sufficient to cause a discharge.

END

EBI Consulting

LONG TERM OPERATIONS AND MAINTENACE PLAN

DATE: January 11, 2023
Revised: March 20, 2023

PROJECT LOCATION:

Ancillary Storage Addition
29 Winter Street
Pembroke, MA 02359

OWNER:

B&M 35 Hanover, LLC c/o Mike Murphy
29 Winter Street
Pembroke, MA 02359
(781) 836-0222

RESPONSIBLE PARTY:

B&M 35 Hanover, LLC c/o Mike Murphy
29 Winter Street
Pembroke, MA 02359
(781) 836-0222

PROJECT OVERVIEW:

Prevention of offsite flooding and implementation of stormwater runoff, water quality, and groundwater recharge improvements where none currently exist on-site are the main priorities of the project with respect to drainage design. The project will improve existing stormwater management within the property with respect to the existing site condition, which currently includes no such improvements, by installing a stormwater management system comprising various Best Management Practices (BMPs). Long-term water quality BMPs to mitigate the runoff generated by the site improvements include deep sump/hooded catch basin, a proprietary water quality unit, a detention/infiltration basin, and periodic mechanical sweeping to remove sand and sediment from paved surfaces.

It is the intent of the stormwater management design to achieve an 80% Total Suspended Solids (TSS) removal efficiency or 44% removal efficiency prior to discharge as outlined in the DEP Stormwater Management Standards.

The permanent BMPs used in this design were chosen for their effectiveness and ease of maintenance. Providing for maintenance requirements that are practical is essential to achieve the desired result of improved stormwater quality, and peak attenuation. This plan will be

provided to the property owner, property manager, and general contractor to educate them on the recommendations of this plan and the DEP Stormwater Management Guidelines.

POST-CONSTRUCTION BEST MANAGEMENT PRACTICES:

a) NON-STRUCTURAL BEST MANAGEMENT PRACTICES

Implementing source controls can aid in reducing the types and concentrations of contaminants in stormwater runoff. This principle for pollution prevention and non-structural controls, or BMPs, is to minimize the volume of runoff and to minimize contact of stormwater with potential pollutants. Measures such as street sweeping, managing snow removal, and educating the owner/operator of good maintenance practices are examples of non-structural BMPs.

i. PUBLIC AWARENESS

The proposed ancillary building will be utilized by the owner/applicant. Its anticipated use is for material storage to support the electrical contracting business. Even though the no hazardous waste is being proposed to be stored at the ancillary building no chemical bumping to the catch basins is allowed. The owner shall make aware whoever is working at the ancillary storage building that any chemical that might need disposing shall only be disposed as required by state and local requirements and shall not be dumped into the catch basins.

ii. STREET SWEEPING

Parking lot, driveway, and loading area sweeping is an integral part of the stormwater management plan as a fundamental component of source reduction efforts. Sweeping activities shall begin on or around April 1. However, sweeping may be done after winter thaw and the onset of early spring. It is critical to remove the accumulated sediment in the parking, loading, and driveway areas from the winter months as soon as possible before spring precipitation.

Sweeping activities should be performed a minimum of two times annually (April 1 and September 1).

iii. SNOW AND SNOWMELT MANAGEMENT

The removal contractor shall avoid stockpiling snow directly on top of catch basin grates and avoid stockpiled snow within the paved parking lot to allow normal vehicular maneuverability. During significant snow fall event, six (6) inches or greater, accumulated snow shall be stockpiled and/or removed from the site by a snow removal contractor. It is the responsibility of the owner to make sure the snow removal contractor utilizes previously approved areas. The owner shall remove sediment from snow storage areas every spring.

It is suggested that no de-icing compounds such as calcium chloride ($CaCl_2$), calcium magnesium acetate (CMA) or the like be used on the site. The snow removal contractor shall store all sand off-site. No quantities of sand compounds shall be stored on site.

iv. PUBLIC SAFETY FEATURES

The project has been designed with consideration for public safety and does not require any specific features as part of the stormwater management system.

b) STRUCTURAL BEST MANAGEMENT PRACTICES:

Structural BMPs are those physical facilities that are designed to manage both stormwater quantity and quality. Proper maintenance of the proposed structural BMPs will ensure design performance and promote longevity of the structure and may decrease operator maintenance costs.

i. DEEP-SUMP/HOODED CATCH BASINS

All proposed catch basins shall be a minimum of four feet in diameter and equipped with four-foot-deep sumps to trap sediments and any debris/trash. The pipe outlets shall be hooded to prevent floating debris and oils from entering the subsurface drainage conveyance system. The actual removal of sediments, trash, and associated pollutants only occurs when the deep sumps are cleaned out; therefore, frequent maintenance is required. The more frequent the cleaning, the less likely sediments will be re-suspended and subsequently discharged downstream. In addition, frequent cleaning also results in more volume available for future storms and enhances overall performance.

The recommended inspection frequency of the deep sumps is every three months, and cleaning two to three times per year, if necessary, post-construction. Disposal of accumulated sediment and trash is to be in accordance with all applicable local, state, and federal guidelines and regulations.

ii. ADS BARRACUDA® HYDRODYNAMIC SEPARATOR S4 WATER QUALITY UNIT

An ADS Barracuda© S4 water quality unit is proposed to prevent sediments and oils from entering the underground infiltration/detention basin. The actual removal of sediments, trash, and associated pollutants only occurs when the structures are cleaned out; therefore, frequent maintenance is required. The more frequent the cleaning, the less likely sediments will be re-suspended and subsequently discharged. In addition, frequent cleaning also results in more volume available for future storms and enhances overall performance. Structures are an approved means of BMP for storm water management. See the TSS Removal Calculation Worksheet included in the Appendix D for the specific TSS removals rate of the ADS Barracuda© S4.

Post-construction, the units shall be inspected every six months for the first year of operation to determine the oil and sediment accumulation rate. After the first year, inspections can be based on the first-year observations or local requirements. Cleaning, by full pump out, is recommended on an annual basis or when 15% of the units' storage capacity is filled with solids. Inspect the units immediately after an oil, fuel, or chemical spill. Maintenance shall be performed by conventional vacuum truck. Disposal of accumulated sediment, trash, and hydrocarbons shall be in accordance with all applicable local, state, and federal guidelines and regulations. Refer to product brochure in the Appendix for more information.

iii. DETENTION/INFILTRATION BASIN

The detention/infiltration basin shall be inspected twice a year at minimum and cleaned as needed. Check for erosion and cracking on side slopes. Check for undesirable vegetative growth (i.e., trees) and differential settlement on side slopes and basin floors. Confirm outlet control structure is clear of trash, sediment, debris, organics, or other obstructions. Clogged surfaces shall be broken up by way of deep tilling and re-vegetated immediately. Light machinery shall be used for all maintenance to avoid compaction of underlying soil. Mowing shall be performed in conjunction with overall site mowing schedule; clippings shall be removed from the basin.

Disposal of accumulated sediment and trash is to be in accordance with applicable local, state, and federal guidelines and regulations.

SITE FURNISHINGS BEST MANAGEMENT PRACTICES:

Site furnishings, as they pertain to this Operation and Maintenance Plan, comprise driveways and parking lots; walkways and hardscape areas; fences, walls, and guardrails; landscape areas; and solid waste management facilities.

i. DRIVEWAYS AND PARKING LOTS

All driveways, parking lots, loading areas, and emergency access ways shall be inspected twice annually (early Spring and Fall) to assess damage, cracking, differential settlement, and fading of pavement markings. Deteriorated asphalt and damaged curbs and signage shall be repaired as needed based on observation. Faded striping shall be re-painted in kind as needed.

Landscape vegetation around the perimeter and in the interior of the parking areas shall be inspected for overgrowth twice annually (early Spring and Summer) and pruned as needed based on inspection.

ii. WALKWAYS AND HARDSCAPE AREAS

All concrete walkways, landings, pads, and driveways shall be inspected annually for spalling, cracking, and heaving. Cracked or spalled concrete shall be patched and repaired with cement or grout as needed based on inspection. In the case of widespread structural damage to concrete surfaces, slabs shall be demolished and reconstructed in kind and sub-base shall be inspected for settlement or heaving and corrected and/or re-compacted as needed.

iii. FENCES, WALLS, AND GUARDRAILS

All chain link fences, retaining walls, guardrails, and galvanized steel pipe bollards shall be inspected annually.
Walls (including all retaining walls) shall be inspected for damage, subsidence, and settlement of adjacent surfaces. Any such observed defects shall be repaired immediately. The Responsible Party shall monitor repairs on a weekly basis once established to ensure integrity of corrective action and coordinate follow-up action immediately upon observation of resurgence of defects, if applicable.

The guardrail shall be inspected for rail and post damage and dislodgement, rust damage, and defacing. Any steel members observed to be structurally damaged or rusted out shall be replaced in kind immediately upon observation.

iv. LANDSCAPE AREAS

Spring clean-up shall be conducted twice annually in the months of March and April. Spring clean-up comprises removal of winter wraps from trees, lawn raking/ leaf blowing, weeding, and fertilization as needed. Landscape edges shall also be inspected and re-established as needed during Spring clean-up activities.

Mulch areas shall be inspected once annually during the month of April. New mulch shall be added to planting beds as needed and washed-out mulch shall be removed from adjacent areas. Subgrade in washout areas shall be checked for erosion and re-graded as needed prior to replacement of mulch. Pre-emergent weed control shall be applied to planting beds concurrently with inspection activities.

Shrub and tree planting fertilization activities shall be limited to twice annually between April 15 and October 15 as needed. Fertilizer use shall be minimized to the extent practicable and shall never be applied before a heavy rainfall event, on frozen ground, or within vegetated stormwater management BMPs. Insect and disease sprays shall be used as needed on shrub and tree plantings throughout the Summer and never during frozen ground conditions or before heavy rainfall events.

Mowing shall be conducted as necessary between the months of May and October. Excess lawn clippings shall be removed from mowed surfaces prior to next rainfall, and no excess lawn clippings are to be left within vegetated surface BMPs. Shrub and ornamental tree

pruning shall be conducted twice annually during the months of July and August. Structural tree pruning shall be conducted twice annually during the months of August and September.

Fall cleanup shall be conducted twice annually during the months of October and November. Fall cleanup activities comprise application of winter wraps to trees, raking/leaf blowing lawn areas, and weeding. Lawn fertilization, if conducted during fall cleanup, shall not occur after October 15. Lime application treatment for lawn areas shall be conducted once annually in the month of November.

SPILL PREVENTION, CONTAINMENT, AND COUNTERMEASURE PLAN:

Landscape maintenance and parking and loading operations which occur on site necessitate the use of various materials and must be considered in the spill prevention and response practices. The following is a summary of pollutants and the respective property use and maintenance activities generating each:

Pollutant-Generating Activity	**Pollutants or Pollutant Constituents** (that could be discharged if exposed to stormwater)	**Location on Site**
Landscaping Maintenance Operations	Gasoline (from lawnmowers), fertilizers	Lawn and landscape areas throughout site
Parking and Loading Operations	Hydraulic oil/fluid, Antifreeze, diesel/gasoline (all from automobiles)	Driveway, parking, and loading areas throughout site

The Owner/Responsible Party shall be responsible for coordinating necessary containment and cleanup efforts in the event of a spill at any location on site. Should a spill occur, equipment necessary to attend to spills or leaks shall be stored on site in a designated storage area within the building and shall consist, at minimum, of the following:

- Safety goggles.
- Chemically resistant gloves and overshoe boots.
- Water and chemical fire extinguishers.
- Shovels.
- Absorbent materials.
- Proprietary compact spill containment berms.
- Containers suitable for storage of site-specific materials.
- First aid kits.

Spills and leaks shall be treated according to the type, volume, and location of the released material. Generally, mitigation shall consist of the following:

- Prevention of additional material storage.
- Containment of spilled material.
- Safe, thorough, and environmentally sound removal of spilled material.
- Remediation of environmental damage.

The following describes specific preventative methods to be employed for materials to be used on site.

SPILLS FROM VEHICLES ACCESSING PARKING AND LOADING AREAS

Spills due to vehicular operations are not anticipated on pervious surfaces. In the case of a spill in the driveway, parking or loading areas, the spill shall be contained using spill berms and/or adhesive drain seals at all vulnerable catch basin inlets to prevent entering the subsurface drainage system, and the spill shall then be treated with absorbent material.

SPILLS FROM LANDSCAPE AND LAWN MAINTENANCE EQUIPMENT

In the case of a spill on a pervious surface, the spill shall be contained and treated with absorbent polymer material immediately and the affected soil, mulch, and/or planted vegetation shall be excavated and stored in a proprietary spill containment berm (by Ultratech or the like) for removal by a professional hazardous material removal company.

Town of Plainville Emergency Contacts are as follows:

- Emergency Management: (888) 304-1133 (MassDEP 24-Hour Spill Reporting)
- Police Department: 911
- Fire Department: (781) 293-2300

For spills of less than five (5) gallons of material, mitigation shall consist of source control, containment, and clean-up with absorbent materials, unless an imminent hazard necessitates that a local professional hazardous material removal company become involved to mitigate the spill.

For spills greater than five (5) gallons of material, the incident shall be reported immediately to the MassDEP Hazardous Waste Incident Response Group at (617) 792-7653 and a professional emergency response contractor (ERC). Information that shall be provided to the said ERC is as follows:

- Type of material spilled.
- Quantity of material spilled.
- Location of the spill.
- Time of the spill.

The Owner/Responsible Party shall then employ measures to prevent further spillage, contain and/or clean up the spill.

If a Reportable Quantity (RQ) of material is spilled during site maintenance and access activities, the National Response Center (NRC) shall be notified immediately at (800) 424-8802. Reportable Quantities of hazardous material are available in 310 CMR 40: Massachusetts Contingency Plan Subpart P: Massachusetts Oil and Hazardous Material List. Within 14 days a report shall be submitted to the EPA New England Regional Office describing the following:

- Type of material released.
- Date and circumstances of the release.
- Measures taken to prevent future releases.

This Spill Prevention Plan shall then be updated to document any such preventive measures implemented. The report shall then be submitted to the EPA New England Regional Office at the following address:

EPA New England, Region 1
1 Congress Street, Suite 1100
Boston, MA 02114-2023

Any inspection reports generated in accordance with a RQ spill shall be completed within 24 hours of completing any site inspection. A hard or electronic copy of the report must be retained on site for at least three (3) years from the date of reporting at the Responsible Party's office.

END.