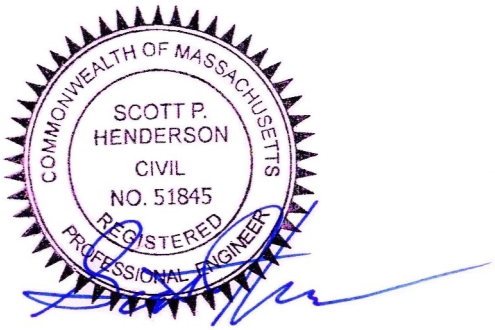
Stormwater Report & Drainage Calculations

MF Nursery Expansion
1049 West Street, Walpole, MA



March 5, 2024

Revised: April 16, 2024

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Appendices

Design Calculations & Standards

Pre- and Post-Development drainage calculations were prepared utilizing the U.S. Soil Conservation Service Technical Release 20 – Urban Hydrology for Small Watersheds, the U.S. Soil Conservation Service National Engineering Hydrology Handbook, Town of Walpole Drainage and Stormwater Management Standard rainfall data, and accepted engineering design practice. These standards were applied in the use of HydroCAD stormwater modeling software to generate a representative model of existing hydrology and proposed stormwater management features. Details of this model can be found in the appendices of this report.

Where applicable, MA Department of Environmental Protection (DEP) Stormwater Handbook performance standards, along with accepted engineering practices, are utilized in preparing a stormwater management system design. Furthermore, local regulations and performance standards are applied to the design, with the exception of any noted waiver requests.

Locus Analysis & Project Summary

The project proponent, Michael Freiberger, intends to expand the MF Nursery operation at 1049 West Street onto two adjacent parcels to the west of the main nursery site. This expansion is intended to be used to grow nursery stock, store stockpile materials (brush, soil, etc.) and support operation of the main nursery. No structures or utilities are intended in this location at the present time and the expansion will involve clearing woods and installation a gravel pad and grass meadow areas. Details are illustrated on the site plans included herewith.

Soil Conditions - The NRCS Soil Survey classifies the native soils on the property as *Scituate Fine Sandy Loam (315B), Canton Fine Sandy Loam (420B), Whitman Fine Sandy Loam (73A),* and *Hinckley Loamy Sand (245B)*. The hydrologic soil groups vary across these classifications from HSG D to HSG A. On 1/8/2021, limited on-site soil evaluation was conducted in upland areas outside of wetland buffer zones to determine suitability for a septic system that will be constructed on the site. Four test pits were excavated and revealed coarse sand and loamy sand parent soils consistent with a hydrologic soil classification of HSG B. Also, soil evaluation at the site of the proposed stormwater basin was completed on 4/2/24, which confirmed soil texture and groundwater conditions consistent with the hydrologic model included herewith.

As such, the included hydrology model assumes B-Soils across the entire site, with the exception of wetland areas. The hydraulic conductivity utilized in the design is 1.02 in/hr, which is consistent with HSG B sandy loam soils.

Wetland Resources – There are several bordering vegetated wetland resources located across the project locus. A Notice of Intent permitting work within these resources areas and their buffer zones will be submitted to the Walpole Conservation Commission and DEP for review.

Permits Required - The project will require the following permits prior to commencement of construction:

- Walpole Conservation Commission – Land Disturbance Permit & Notice of Intent

- National Pollutant Discharge Elimination System (NPDES) – Construction General Permit

Pre-Development Condition

The project locus is currently unimproved and consists entirely of wooded land that is both upland and wetland. In general, site topography slopes downhill from East to West toward the wetland area at the West side of the property. As such, one design point is included in the stormwater model that represents overland flow to the West edge of the property.

The main nursery site is located to the east of the proposed expansion area and the overflow from the infiltration basin located on that site discharges onto the expansion area property. This overflow does contribute to the overall flow rate and volume that discharges to this design point, however it is not modeled herewith. This surcharge will not flow into any of the proposed stormwater BMPs constructed for this project and, thus, will not impact their performance.

Drainage calculations for the pre-development condition indicate peak rates of runoff and volumes for the aforementioned design storms as follows:

Pre-Development Analysis Results								
	2-Year Storm (3.26")		10-Year Storm (4.94")		25-Year Storm (6.27")		100-Year Storm (9.02")	
Design Point	Peak Flow [CFS]	Volume [CuFT]	Peak Flow [CFS]	Volume [CuFT]	Peak Flow [CFS]	Volume [CuFT]	Peak Flow [CFS]	Volume [CuFT]
A	2.36	15,136	7.50	39,729	12.44	63,335	23.90	118,800

Post-Development Condition

The applicant proposes the construction of a stockpile area consisting of a gravel pad and grass for storing landscape material and nursery stock. In total, the project will include clearing approximately 3.58 acres of existing wooded area and the introduction of 39,623 square feet of gravel surface. All cleared areas that will not be paved will either be utilized for stormwater management or planted with meadow grasses that will not be maintained as manicured lawn.

At the downhill edge of the developed area, a stormwater infiltration basin will capture, treat and control runoff from the project site. Details of this basin are included on the site plans.

Drainage calculations for the post-development condition indicate peak rates of runoff and volumes for the aforementioned design storms as follows:

Post-Development Analysis Results								
	2-Year Storm (3.26")		10-Year Storm (4.94")		25-Year Storm (6.27")		100-Year Storm (9.02")	
Design Point	Peak Flow [CFS]	Volume [CuFT]	Peak Flow [CFS]	Volume [CuFT]	Peak Flow [CFS]	Volume [CuFT]	Peak Flow [CFS]	Volume [CuFT]
A	2.04	12,829	6.36	36,938	11.14	61,403	21.63	118,240

As indicated by the table above, the post-development condition for the analyzed design storms matches or reduces peak runoff rates and volumes from the project site as a whole.

DEP Stormwater Management Standards

As the project is subject to the MA Wetlands Protection Act, the proposed stormwater management system must comply with the Department of Environmental Protection Stormwater Management Regulations (SMR). The proposed site redevelopment is designed to comply with these standards in their entirety:

Standard 1 - No New Untreated Discharges

There are no new untreated stormwater discharges proposed as part of the site redevelopment. The proposed stormwater discharges are of runoff that has passed through an adequate treatment train. Discharge points are stabilized with proper erosion controls.

Standard 2 - Peak Rate Attenuation

The hydrologic model provided with this report illustrates that peak rates of runoff are reduced in the post development condition due to the proposed infiltration systems and stormwater BMPs. Details can be found in the tables above and in the hydrologic models provided in the appendices of this report.

Standard 3 - Groundwater Recharge

The target depth factor defined in SMR for Hydrologic Soil Group B soils is 0.35 inches. Calculations indicating that this target depth is properly infiltrated are included in this report. Furthermore, a post-development stormwater model is included in the appendix that illustrates no overflow the from proposed treatment and infiltration BMPs during a 2-inch rainfall event, thus greatly exceeding the groundwater recharge requirements.

Standard 4 - Water Quality Control

The project requires a Water Quality Treatment Volume of 0.5-inch and pretreatment of 44% of Total Suspended Solids (TSS) in runoff prior to discharge into a subsurface infiltration system. The proposed treatment train for all infiltration BMPs includes the adequate pretreatment and the infiltration BMPs are sized to handle 2 inches of runoff without overflow.

Standard 5 - Land Uses with Higher Potential Pollutant Loads (LUHPPL)

This project is not classified as a LUHPPL per applicable DEP regulations and the SMR.

Standard 6 - Discharge to Critical Areas

The project site does not discharge runoff to a critical area as defined by MA DEP.

Standard 7 - Redevelopment Projects

The project is not considered a redevelopment project.

Standard 8 - Construction Period Pollution Prevention

A construction period pollution prevention plan is included in the appendices to this report.

Standard 9 - Long Term Operation & Maintenance Plan

A long-term operation and maintenance plan is included in the appendices to this report. Furthermore, the project will disturb more than one (1) acre of land area and is subject to the National Pollutant Discharge Elimination System (NPDES), requiring a Construction General Permit (CGP). Prior to the start of construction, a full Stormwater Pollution Prevention Plan (SWPPP) and valid NPDES permit will be completed.

Standard 10 - Illicit Discharge Prohibition

An illicit discharge compliance statement will be submitted prior to activation of any proposed stormwater management BMP.

Town of Walpole Drainage & Stormwater Performance Standards

Infiltration Capacity Greater than 1-Inch Rainfall Over Impervious Catchment Area

The hydrologic model included in the appendices of this report includes a model of a rainfall event with a depth of two (2) inches. The performance of all proposed infiltration systems indicates that, during this rainfall event, no overflow will occur and 100 percent of the rainfall entering each system is captured and infiltrated into the groundwater table below.

60% Phosphorus TMDL

Calculations are included in the appendices of this report that indicate a reduction in total phosphorus load of greater than 60% on average across yearly rainfall events.

Stormwater Best Management Practices

Infiltration Systems

Details of the proposed infiltration systems are included on the proposed site plans. All system components are designed in compliance with Stormwater Management Handbook guidance and typical design practice.

Erosion Control

A detailed Construction Period Operation and Maintenance plan, along with the Stormwater Pollution Prevention Plan (SWPPP) required for the National Pollutant Discharge Elimination System (NPDES) Construction General Permit, will provide details regarding erosion control methods to be utilized during construction. The Construction Period Operation and Maintenance Plan is included in the appendices of this report. The SWPPP will be produced prior to construction and submitted to the Conservation Commission for review. Prior to any site disturbance, erosion controls shall be installed and inspected by the Walpole Stormwater Officer and the valid NPDES permit and SWPPP shall be reviewed and approved by the same.

Appendix A

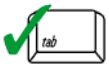
MA DEP Stormwater Checklist

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

Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

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

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

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

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

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

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

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature

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;

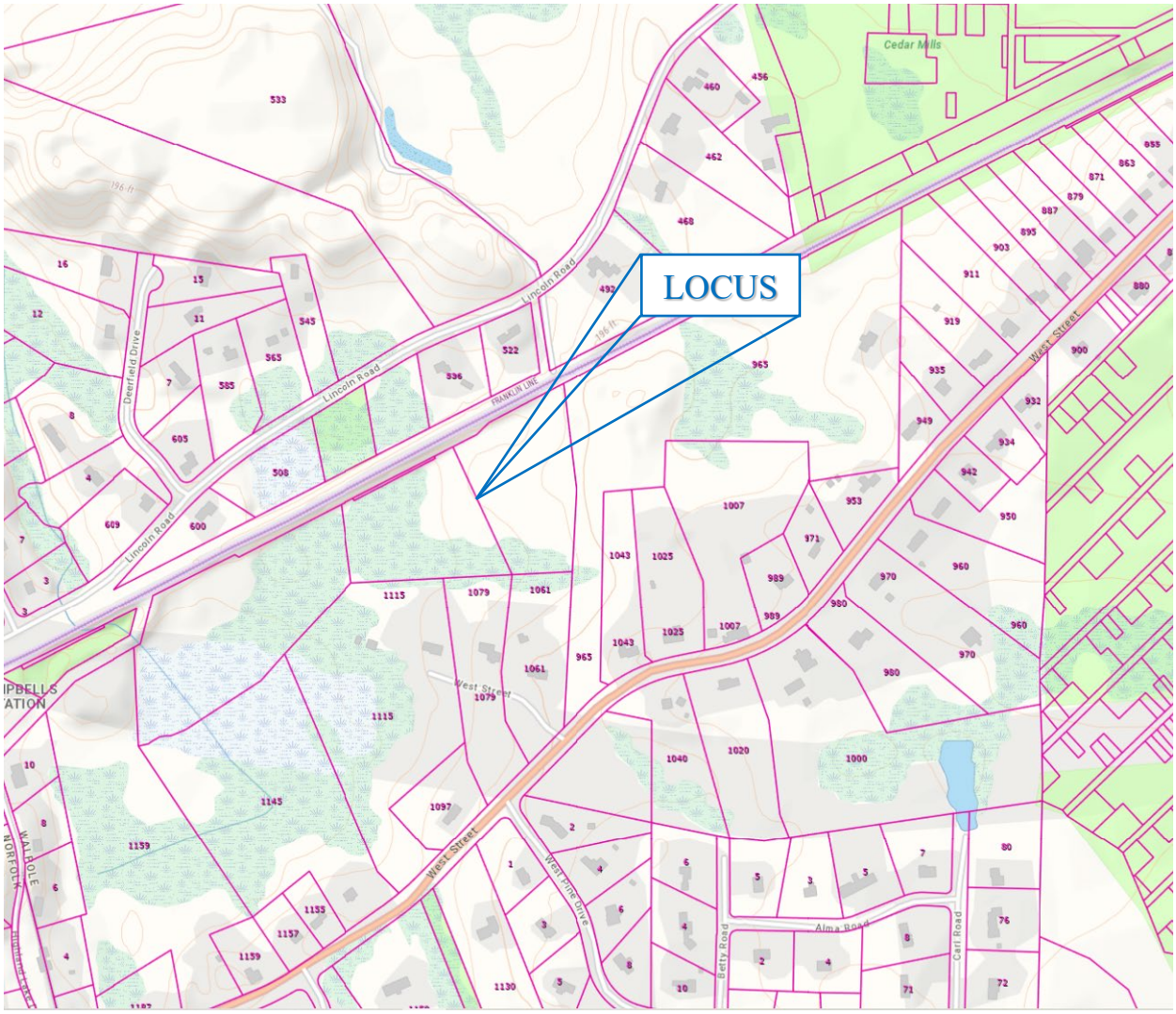
☒ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

Appendix B

Locus Map

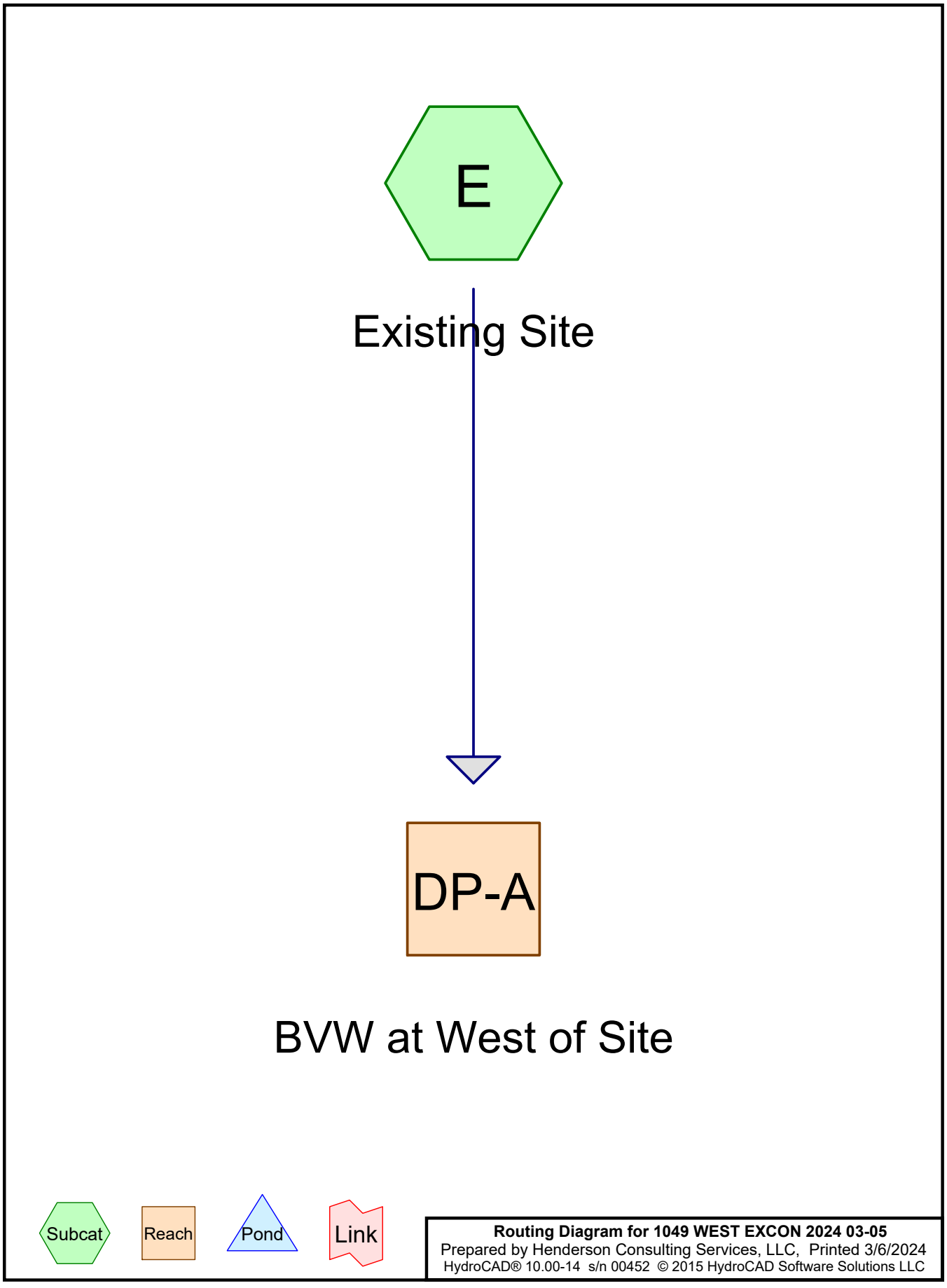
Locus Map

MF Nursery Expansion
1049 West Street, Walpole, MA



Appendix C

Pre-Development Drainage Calculations



Routing Diagram for 1049 WEST EXCON 2024 03-05
Prepared by Henderson Consulting Services, LLC, Printed 3/6/2024

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
181,288	55	Woods, Good, HSG B (E)
127,933	77	Woods, Good, HSG D (E)
309,221	**64**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
181,288	HSG B	E
0	HSG C	
127,933	HSG D	E
0	Other	
309,221		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Subcatchment Numbers
0	181,288	0	127,933	0	309,221	Woods, Good	E
0	**181,288**	**0**	**127,933**	**0**	**309,221**	**TOTAL AREA**	

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

Subcatchment E: Existing Site Runoff Area=309,221 sf 0.00% Impervious Runoff Depth=0.12"
Flow Length=890' Slope=0.0360 '/' Tc=23.8 min CN=64 Runoff=0.21 cfs 3,035 cf

Reach DP-A: BVW at West of Site Inflow=0.21 cfs 3,035 cf
Outflow=0.21 cfs 3,035 cf

Total Runoff Area = 309,221 sf Runoff Volume = 3,035 cf Average Runoff Depth = 0.12"
100.00% Pervious = 309,221 sf 0.00% Impervious = 0 sf

Summary for Subcatchment E: Existing Site

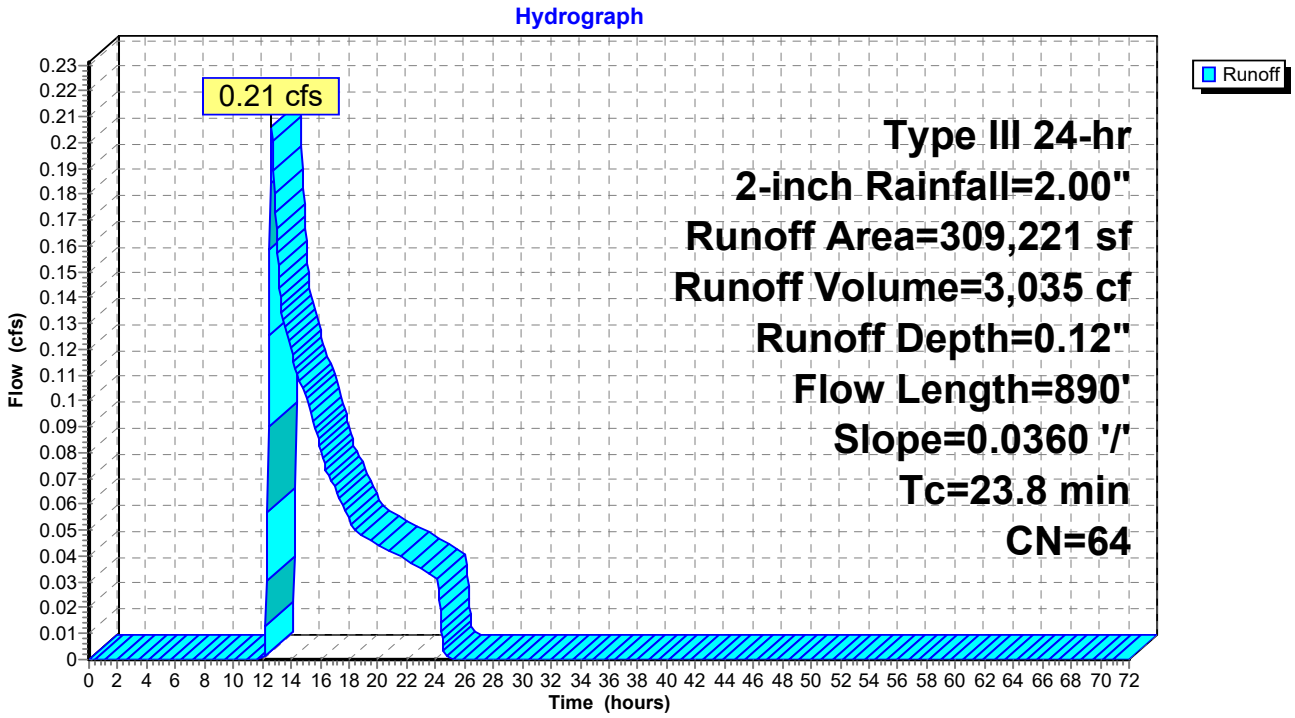
Runoff = 0.21 cfs @ 12.66 hrs, Volume= 3,035 cf, Depth= 0.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-inch Rainfall=2.00"

Area (sf)	CN	Description
127,933	77	Woods, Good, HSG D
181,288	55	Woods, Good, HSG B
309,221	64	Weighted Average
309,221		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.8	890	0.0360	0.62		**Lag/CN Method, LAG Tc**

Subcatchment E: Existing Site

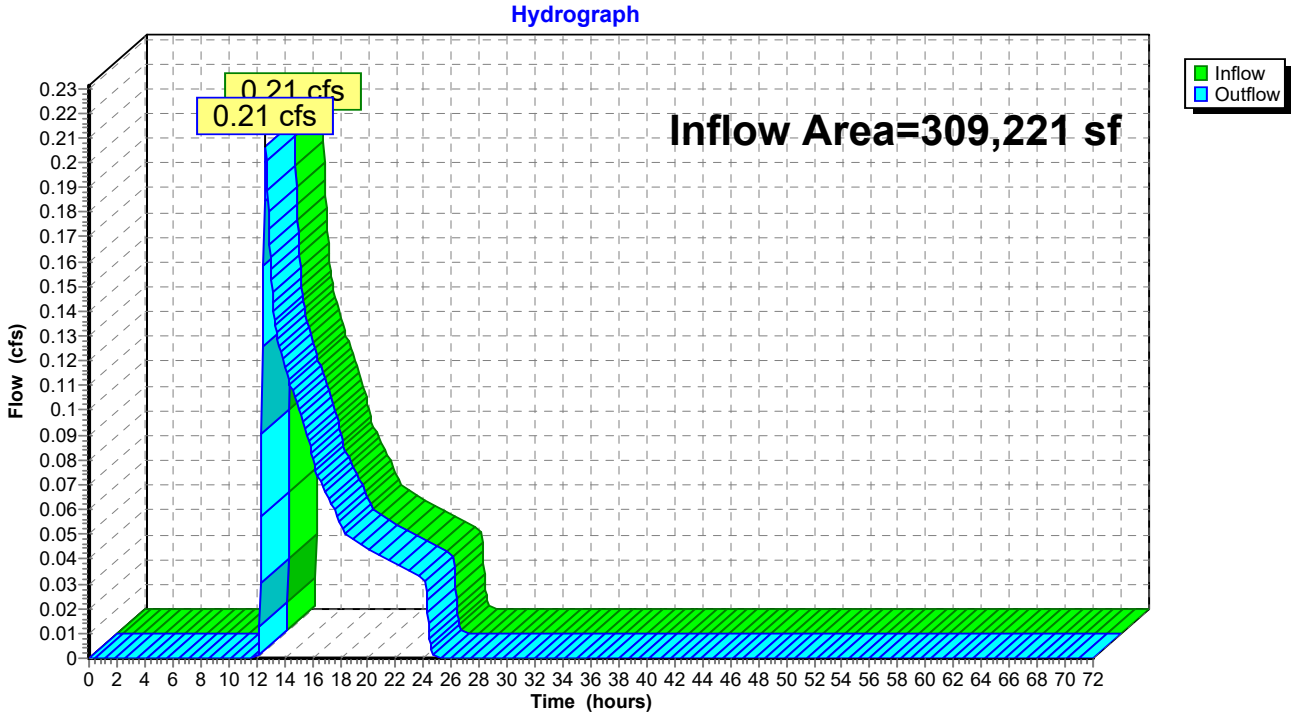


Summary for Reach DP-A: BVW at West of Site

Inflow Area = 309,221 sf, 0.00% Impervious, Inflow Depth = 0.12" for 2-inch event
Inflow = 0.21 cfs @ 12.66 hrs, Volume= 3,035 cf
Outflow = 0.21 cfs @ 12.66 hrs, Volume= 3,035 cf, Atten= 0%, Lag= 0.0 min

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

Reach DP-A: BVW at West of Site



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

Subcatchment E: Existing Site Runoff Area=309,221 sf 0.00% Impervious Runoff Depth=0.59"
Flow Length=890' Slope=0.0360 '/' Tc=23.8 min CN=64 Runoff=2.36 cfs 15,136 cf

Reach DP-A: BVW at West of Site Inflow=2.36 cfs 15,136 cf
Outflow=2.36 cfs 15,136 cf

Total Runoff Area = 309,221 sf Runoff Volume = 15,136 cf Average Runoff Depth = 0.59"
100.00% Pervious = 309,221 sf 0.00% Impervious = 0 sf

Summary for Subcatchment E: Existing Site

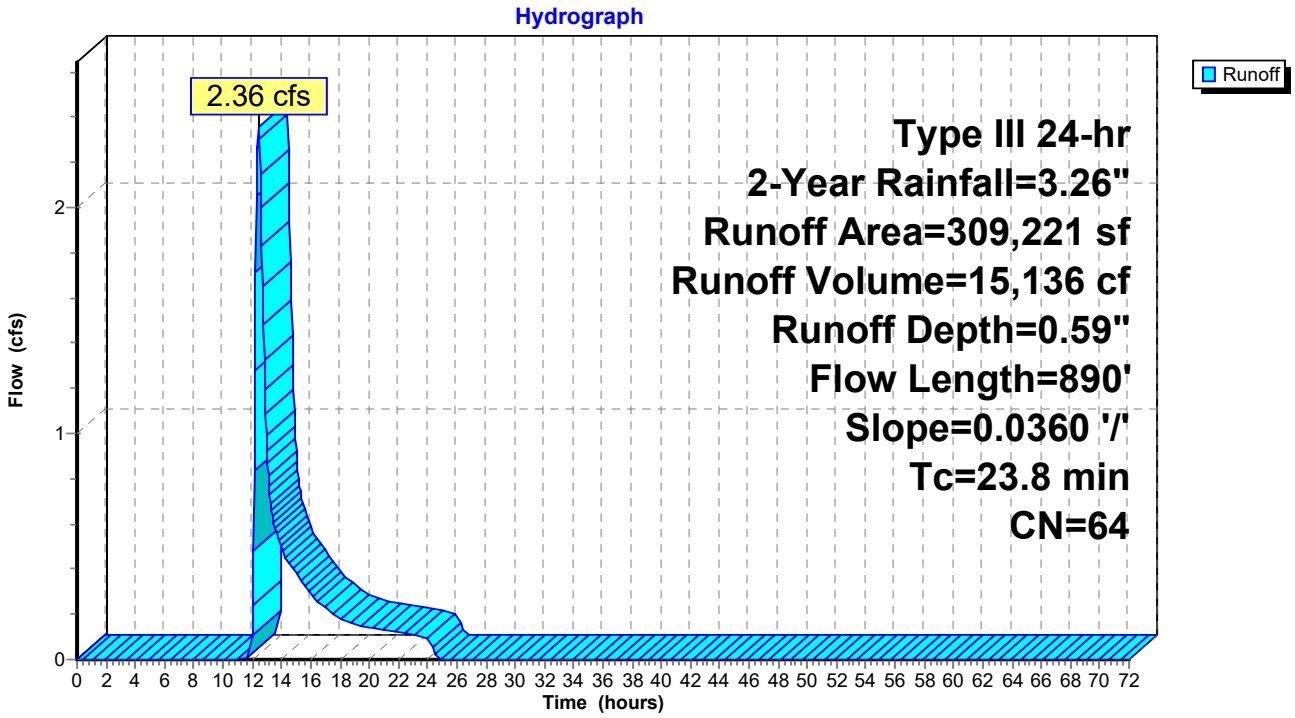
Runoff = 2.36 cfs @ 12.42 hrs, Volume= 15,136 cf, Depth= 0.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.26"

Area (sf)	CN	Description
127,933	77	Woods, Good, HSG D
181,288	55	Woods, Good, HSG B
309,221	64	Weighted Average
309,221		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.8	890	0.0360	0.62		**Lag/CN Method, LAG Tc**

Subcatchment E: Existing Site

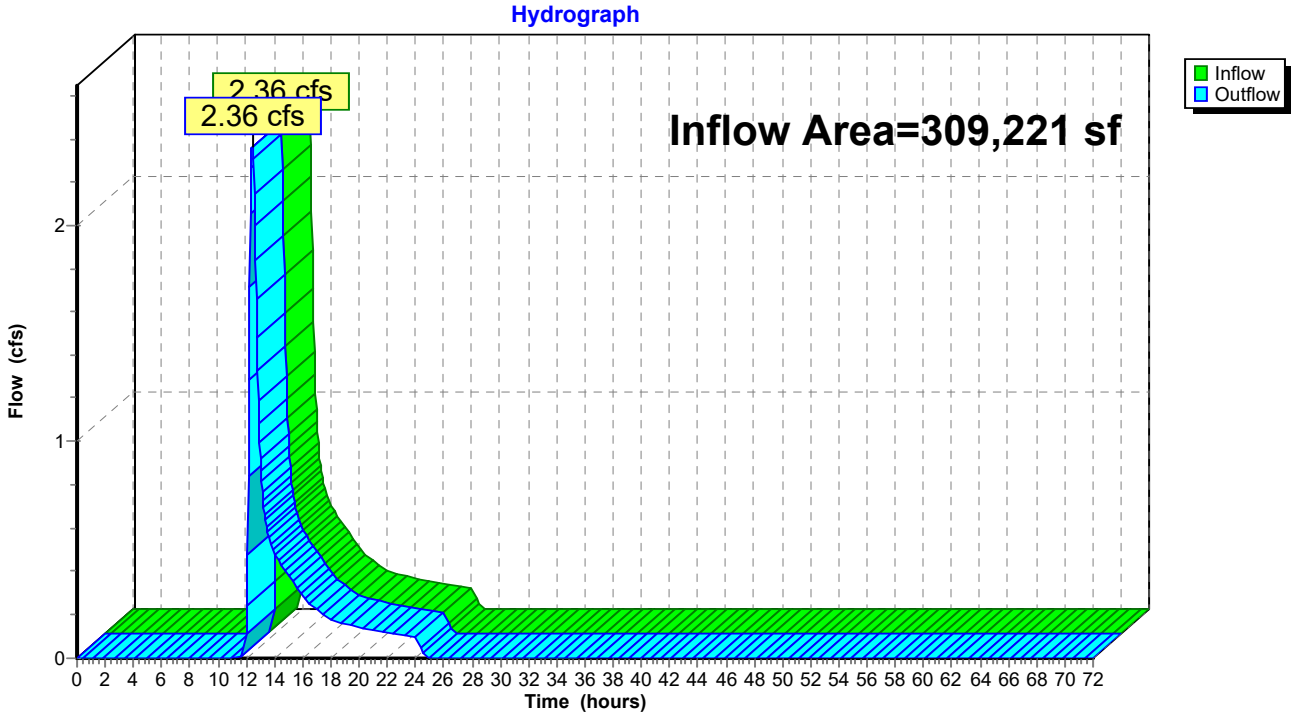


Summary for Reach DP-A: BVW at West of Site

Inflow Area = 309,221 sf, 0.00% Impervious, Inflow Depth = 0.59" for 2-Year event
Inflow = 2.36 cfs @ 12.42 hrs, Volume= 15,136 cf
Outflow = 2.36 cfs @ 12.42 hrs, Volume= 15,136 cf, Atten= 0%, Lag= 0.0 min

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

Reach DP-A: BVW at West of Site



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

Subcatchment E: Existing Site Runoff Area=309,221 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=890' Slope=0.0360 '/' Tc=23.8 min CN=64 Runoff=7.50 cfs 39,729 cf

Reach DP-A: BVW at West of Site Inflow=7.50 cfs 39,729 cf
Outflow=7.50 cfs 39,729 cf

Total Runoff Area = 309,221 sf Runoff Volume = 39,729 cf Average Runoff Depth = 1.54"
100.00% Pervious = 309,221 sf 0.00% Impervious = 0 sf

Summary for Subcatchment E: Existing Site

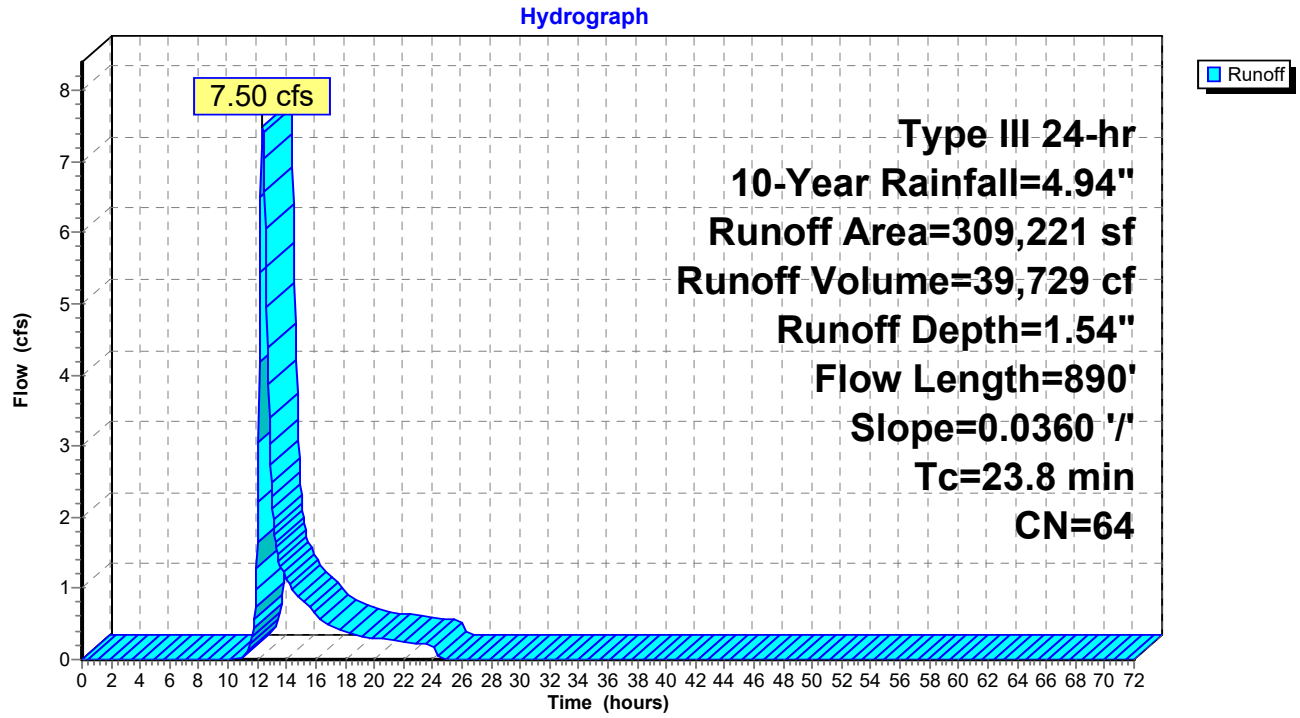
Runoff = 7.50 cfs @ 12.36 hrs, Volume= 39,729 cf, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.94"

Area (sf)	CN	Description
127,933	77	Woods, Good, HSG D
181,288	55	Woods, Good, HSG B
309,221	64	Weighted Average
309,221		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.8	890	0.0360	0.62		**Lag/CN Method, LAG Tc**

Subcatchment E: Existing Site

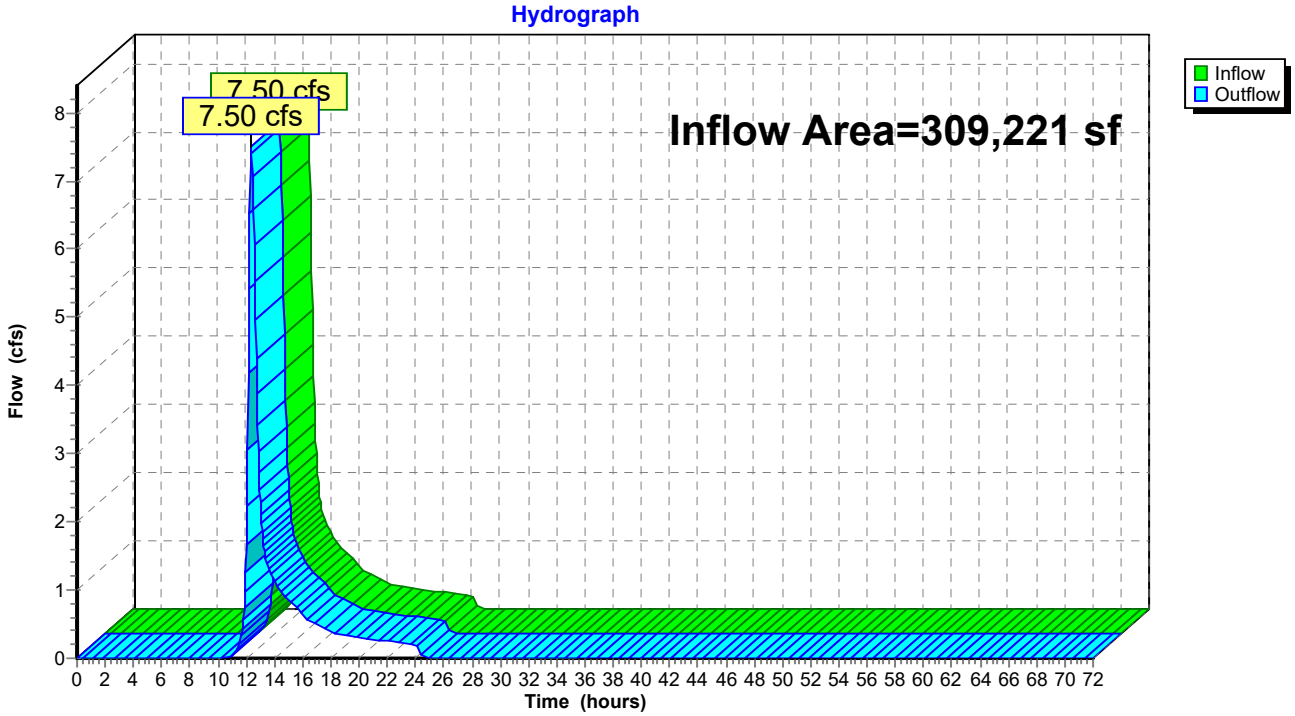


Summary for Reach DP-A: BVW at West of Site

Inflow Area = 309,221 sf, 0.00% Impervious, Inflow Depth = 1.54" for 10-Year event
Inflow = 7.50 cfs @ 12.36 hrs, Volume= 39,729 cf
Outflow = 7.50 cfs @ 12.36 hrs, Volume= 39,729 cf, Atten= 0%, Lag= 0.0 min

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

Reach DP-A: BVW at West of Site



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

Subcatchment E: Existing Site Runoff Area=309,221 sf 0.00% Impervious Runoff Depth=2.46"
Flow Length=890' Slope=0.0360 '/' Tc=23.8 min CN=64 Runoff=12.44 cfs 63,335 cf

Reach DP-A: BVW at West of Site Inflow=12.44 cfs 63,335 cf
Outflow=12.44 cfs 63,335 cf

Total Runoff Area = 309,221 sf Runoff Volume = 63,335 cf Average Runoff Depth = 2.46"
100.00% Pervious = 309,221 sf 0.00% Impervious = 0 sf

Summary for Subcatchment E: Existing Site

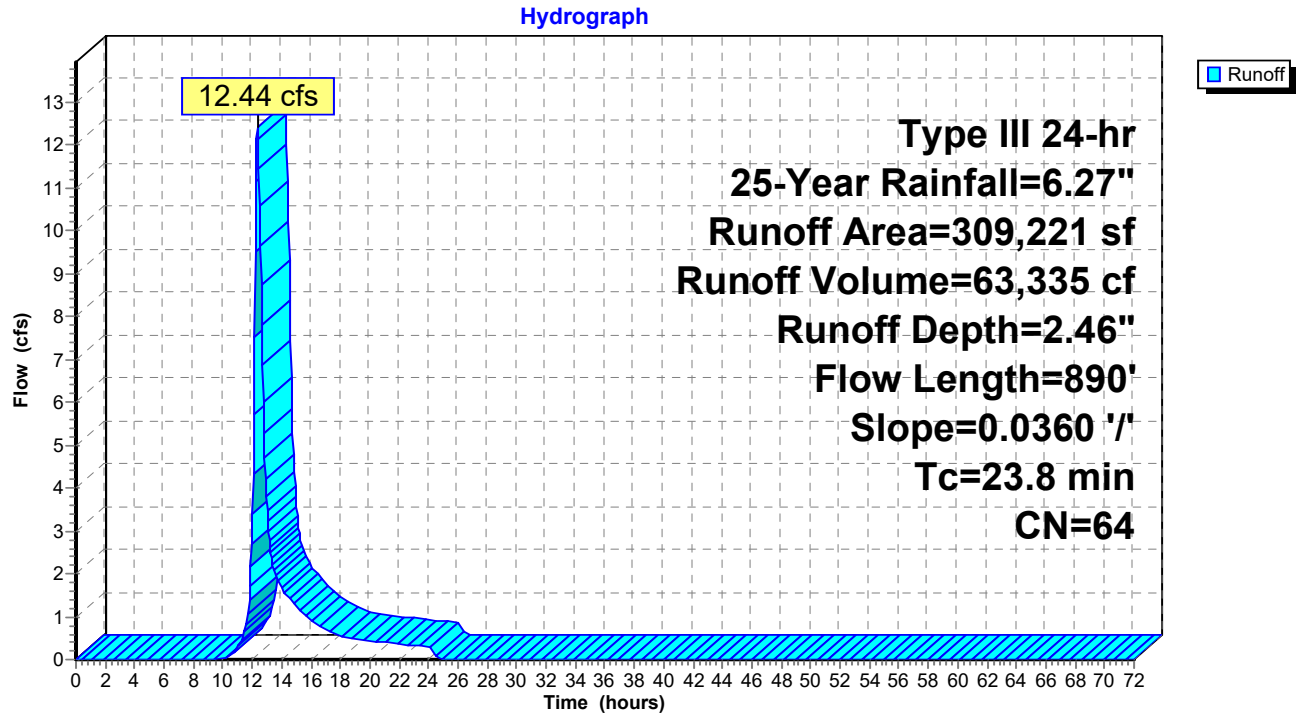
Runoff = 12.44 cfs @ 12.35 hrs, Volume= 63,335 cf, Depth= 2.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.27"

Area (sf)	CN	Description
127,933	77	Woods, Good, HSG D
181,288	55	Woods, Good, HSG B
309,221	64	Weighted Average
309,221		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.8	890	0.0360	0.62		**Lag/CN Method, LAG Tc**

Subcatchment E: Existing Site

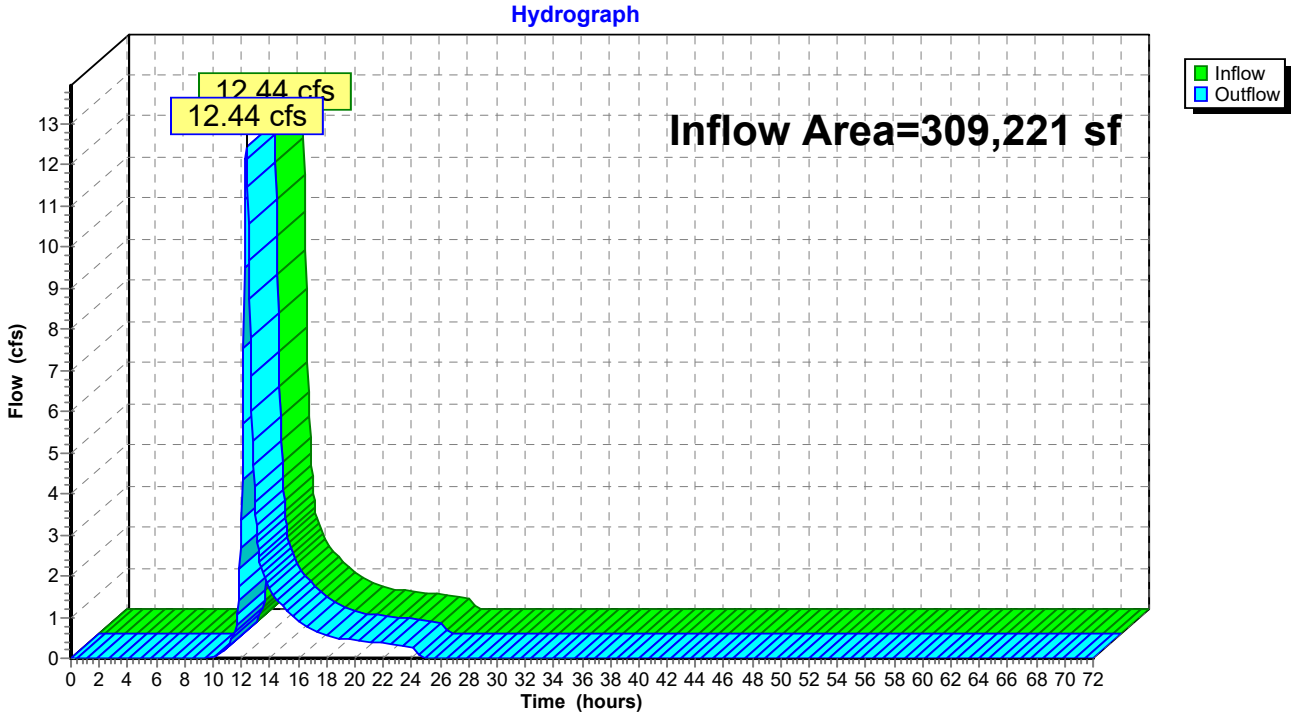


Summary for Reach DP-A: BVW at West of Site

Inflow Area = 309,221 sf, 0.00% Impervious, Inflow Depth = 2.46" for 25-Year event
Inflow = 12.44 cfs @ 12.35 hrs, Volume= 63,335 cf
Outflow = 12.44 cfs @ 12.35 hrs, Volume= 63,335 cf, Atten= 0%, Lag= 0.0 min

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

Reach DP-A: BVW at West of Site



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

Subcatchment E: Existing Site Runoff Area=309,221 sf 0.00% Impervious Runoff Depth=4.61"
Flow Length=890' Slope=0.0360 '/' Tc=23.8 min CN=64 Runoff=23.90 cfs 118,800 cf

Reach DP-A: BVW at West of Site Inflow=23.90 cfs 118,800 cf
Outflow=23.90 cfs 118,800 cf

Total Runoff Area = 309,221 sf Runoff Volume = 118,800 cf Average Runoff Depth = 4.61"
100.00% Pervious = 309,221 sf 0.00% Impervious = 0 sf

Summary for Subcatchment E: Existing Site

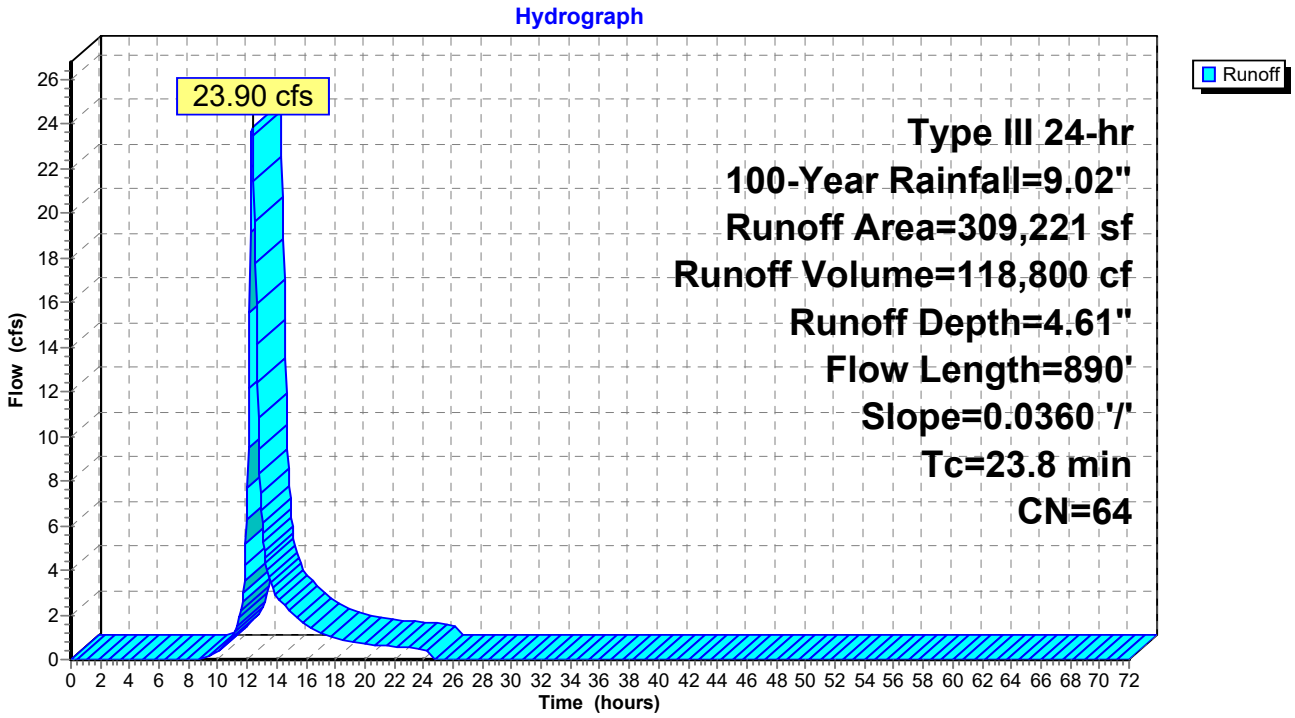
Runoff = 23.90 cfs @ 12.34 hrs, Volume= 118,800 cf, Depth= 4.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=9.02"

Area (sf)	CN	Description
127,933	77	Woods, Good, HSG D
181,288	55	Woods, Good, HSG B
309,221	64	Weighted Average
309,221		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.8	890	0.0360	0.62		**Lag/CN Method, LAG Tc**

Subcatchment E: Existing Site

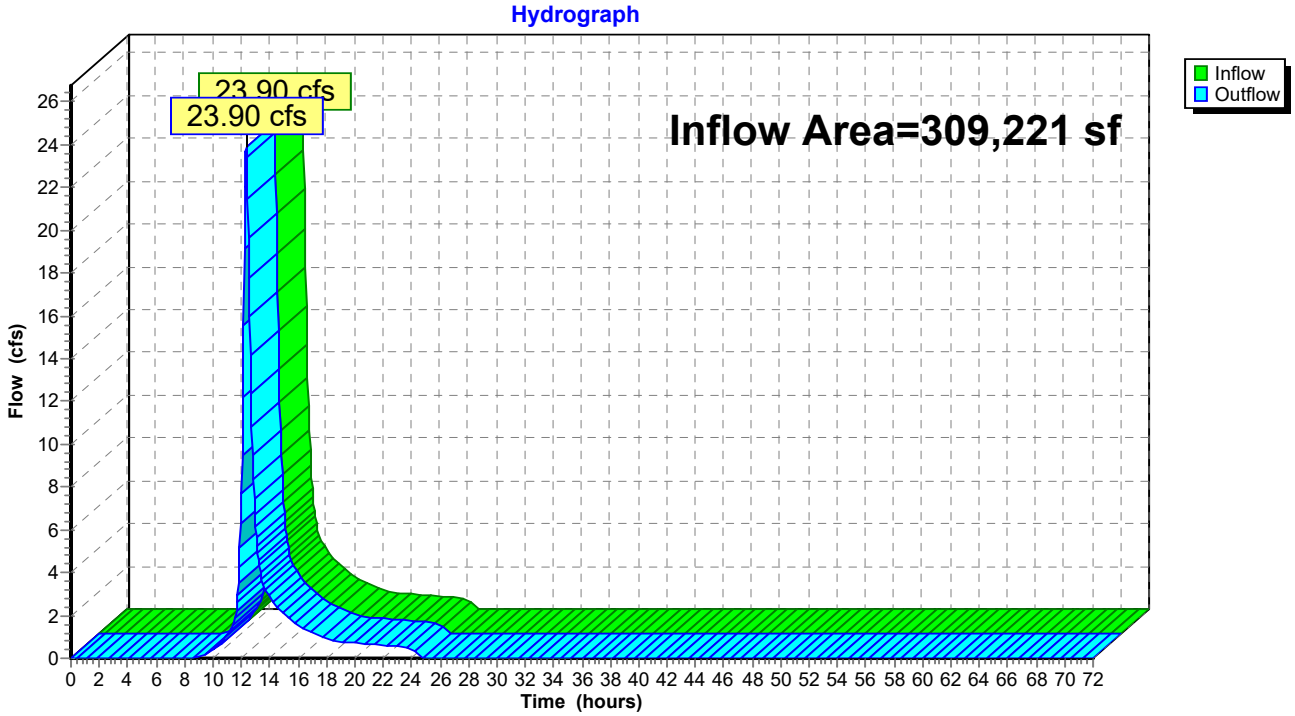


Summary for Reach DP-A: BVW at West of Site

Inflow Area = 309,221 sf, 0.00% Impervious, Inflow Depth = 4.61" for 100-Year event
Inflow = 23.90 cfs @ 12.34 hrs, Volume= 118,800 cf
Outflow = 23.90 cfs @ 12.34 hrs, Volume= 118,800 cf, Atten= 0%, Lag= 0.0 min

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

Reach DP-A: BVW at West of Site



Appendix D

Post-Development Drainage Calculations

DPA

P2

P1

DELINEATED WETFLAG MARKERS, TYPICAL

WAG18 WAG19 WAG20 WAG21 WAG21A WAG22

WAG17 WAG16 WAG15 WAG14 WAG13 WAG12 WAG11 WAG10 WAG9 WAG8 WAG7 WAG6 WAG5 WAG4 WAG3 WAG2

25' BUFFER

100' BUFFER

50' BUFFER

BORDERING VEGETATED WETLAND

BORDERING VEGETATED WETLAND

SWALE

BUILDING SETBACK LINE, TYPICAL

C1 C2 C3 C4 C5 C6 C7 C8 C9 C10

EXISTING NURSERY SITE WATERSHED ANALYZED UNDER PRIOR STORMWATER PERMIT (CALCULATED REDUCTION IN STORMWATER RUNOFF DETAILED IN HYDROLOGIC CALCULATIONS PROVIDED FOR EFFECTIVE PERMIT)

OVERFLOW FROM NURSERY SITE STORMWATER BASIN ROUTED AWAY FROM PROPOSED EXPANSION AREA STORMWATER BASIN

CONCRETE OUTLET STRUCTURE

12" HDPE INV=88.99

TOP 15" PIPE ELEV=92.67

12" HDPE INV=94.10

12" HDPE INV=88.07

TOP 15" PIPE ELEV=93.45

12" HDPE INV=94.36

.5" PERF

RIP-RAP

DOUBLE CATCH BASIN RIM=96.69

DMH RIM=97.77

DMH RIM=97.17

0 40 80

1 inch = 80 ft.

LEGEND

TIME OF CONCENTRATION FLOW PATH

LIMIT OF WATERSHED

ISSUE DATE: APRIL 16, 2024

SCALE: 1"=80'

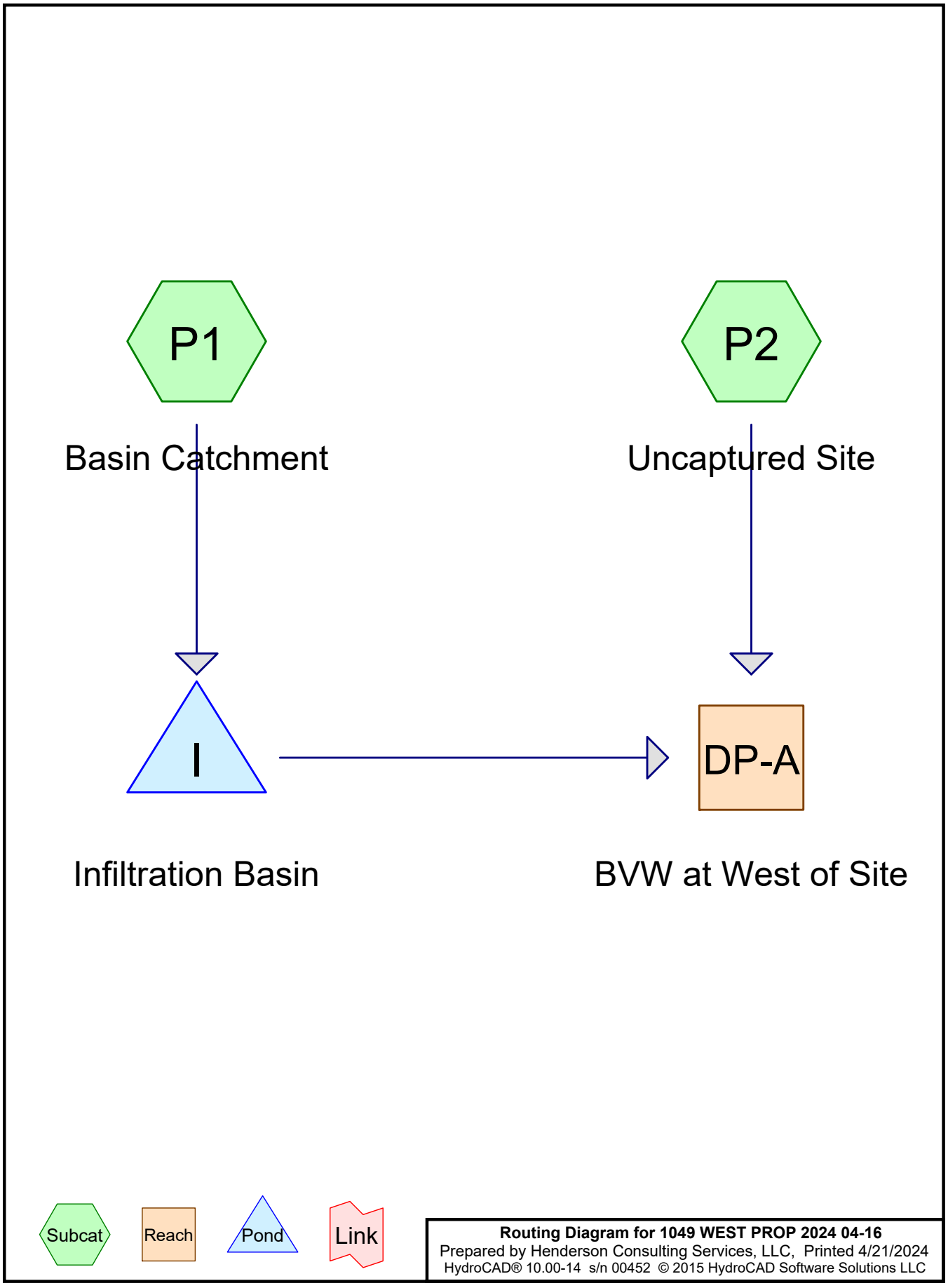
HENDERSON CONSULTING SERVICES, LLC

Professional Civil Engineering & Land Planning

P.O. Box 626, Lexington, MA 02420

DRAWING TITLE

POST-DEVELOPMENT WATERSHED PLAN
1049 WEST ST, WALPOLE - NURSERY EXPANSION



Routing Diagram for 1049 WEST PROP 2024 04-16
Prepared by Henderson Consulting Services, LLC, Printed 4/21/2024

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
22,192	82	Gravel roads, HSG B (P1)
134,066	58	Meadow, non-grazed, HSG B (P1, P2)
25,030	55	Woods, Good, HSG B (P2)
127,933	77	Woods, Good, HSG D (P2)
309,221	**67**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
181,288	HSG B	P1, P2
0	HSG C	
127,933	HSG D	P2
0	Other	
309,221		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Subcatc Numbers
0	22,192	0	0	0	22,192	Gravel roads	
0	134,066	0	0	0	134,066	Meadow, non-grazed	
0	25,030	0	127,933	0	152,963	Woods, Good	
0	**181,288**	**0**	**127,933**	**0**	**309,221**	**TOTAL AREA**	

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

Subcatchment P1: Basin Catchment Runoff Area=77,377 sf 0.00% Impervious Runoff Depth=0.08"
Flow Length=420' Tc=9.3 min CN=65 Runoff=0.02 cfs 530 cf

Subcatchment P2: Uncaptured Site Runoff Area=231,844 sf 0.00% Impervious Runoff Depth=0.14"
Tc=23.8 min CN=68 Runoff=0.18 cfs 2,626 cf

Reach DP-A: BVW at West of Site Inflow=0.18 cfs 2,626 cf
Outflow=0.18 cfs 2,626 cf

Pond I: Infiltration Basin Peak Elev=64.36' Storage=83 cf Inflow=0.02 cfs 530 cf
Discarded=0.02 cfs 530 cf Primary=0.00 cfs 0 cf Outflow=0.02 cfs 530 cf

Total Runoff Area = 309,221 sf Runoff Volume = 3,156 cf Average Runoff Depth = 0.12"
100.00% Pervious = 309,221 sf 0.00% Impervious = 0 sf

Summary for Subcatchment P1: Basin Catchment

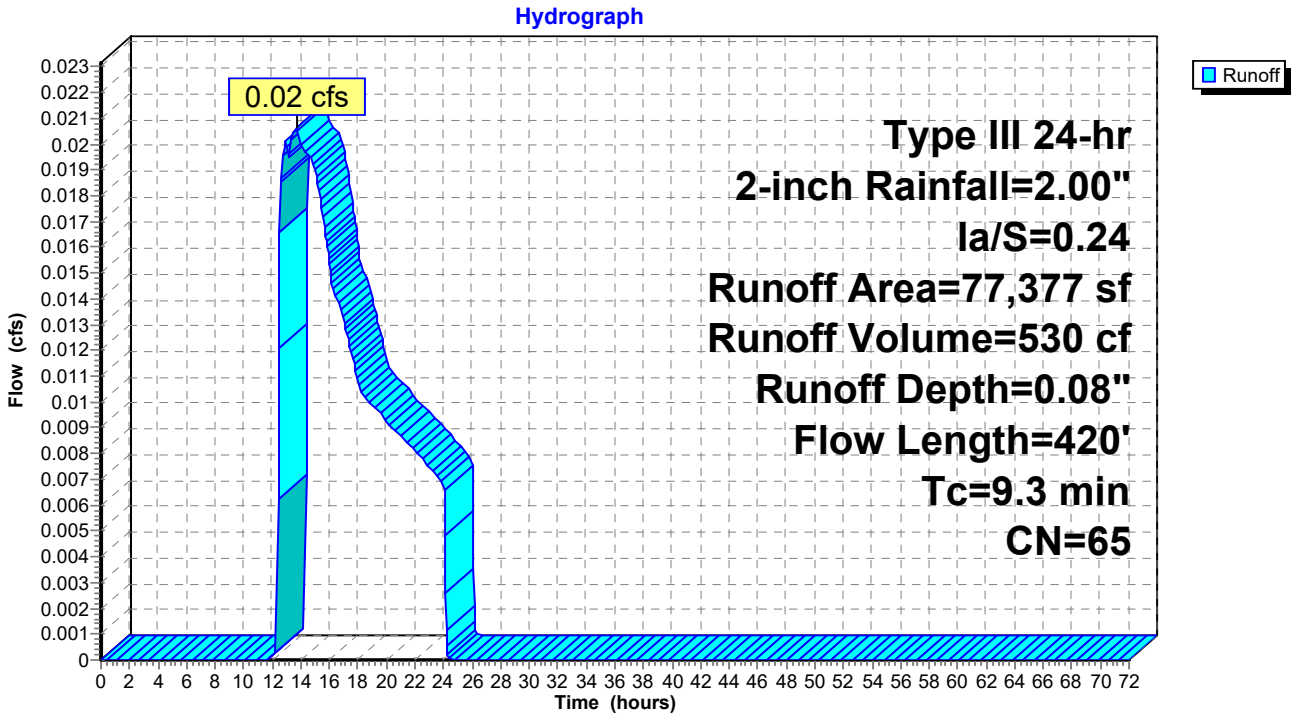
Runoff = 0.02 cfs @ 13.68 hrs, Volume= 530 cf, Depth= 0.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-inch Rainfall=2.00", Ia/S=0.24

	Area (sf)	CN	Description
	55,185	58	Meadow, non-grazed, HSG B
*	22,192	82	Gravel roads, HSG B
	77,377	65	Weighted Average
	77,377		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.7	150	0.0650	1.48		**Sheet Flow, Sheet Flow** n= 0.020 P2= 3.20"
0.3	80	0.0600	3.94		**Shallow Concentrated Flow, SCF** Unpaved Kv= 16.1 fps
7.3	190	0.0300	0.43		**Shallow Concentrated Flow, SCF** Forest w/Heavy Litter Kv= 2.5 fps
9.3	420	Total			

Subcatchment P1: Basin Catchment



Summary for Subcatchment P2: Uncaptured Site

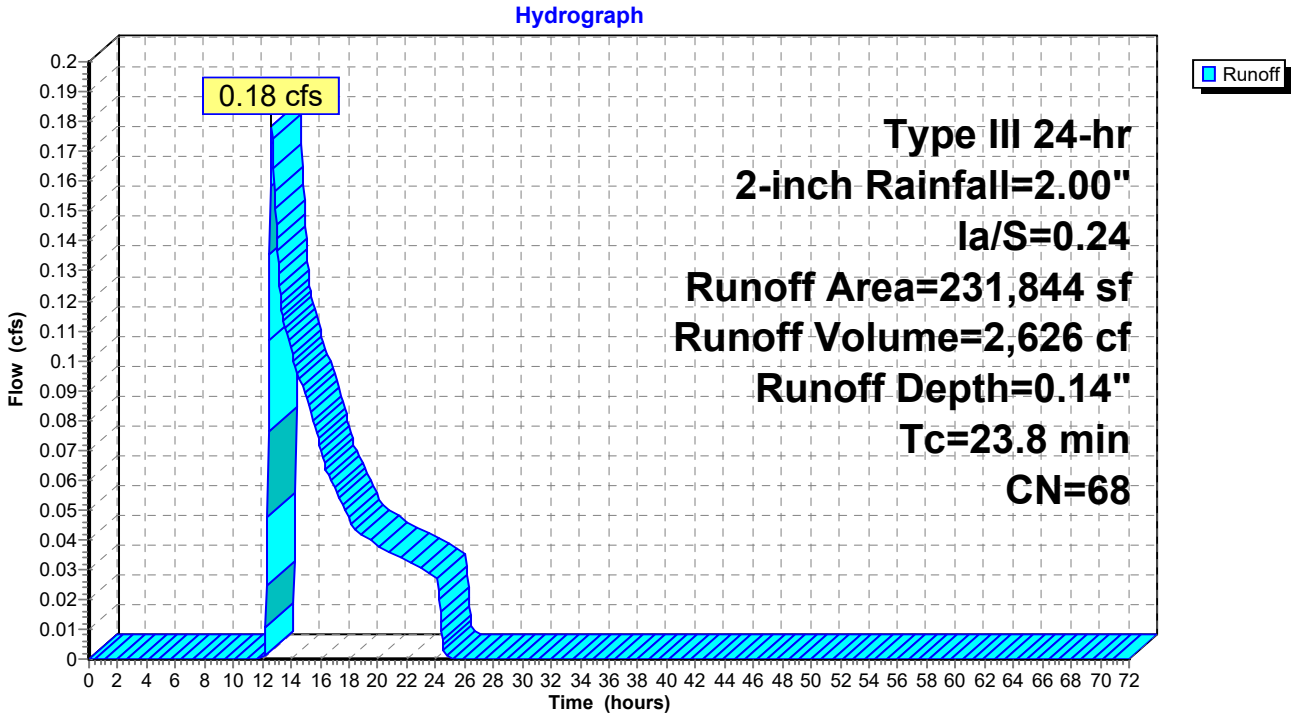
Runoff = 0.18 cfs @ 12.66 hrs, Volume= 2,626 cf, Depth= 0.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-inch Rainfall=2.00", Ia/S=0.24

Area (sf)	CN	Description
127,933	77	Woods, Good, HSG D
25,030	55	Woods, Good, HSG B
78,881	58	Meadow, non-grazed, HSG B
231,844	68	Weighted Average
231,844		100.00% Pervious Area

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

Subcatchment P2: Uncaptured Site

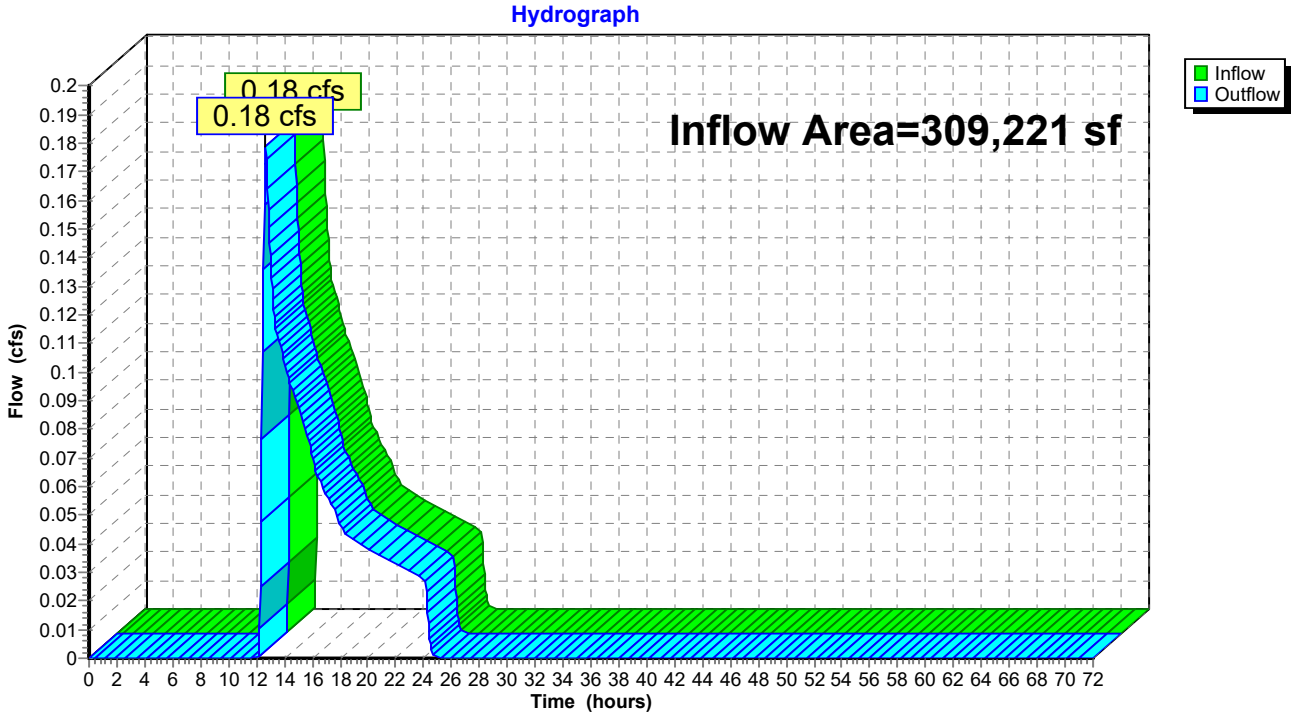


Summary for Reach DP-A: BVW at West of Site

Inflow Area = 309,221 sf, 0.00% Impervious, Inflow Depth = 0.10" for 2-inch event
Inflow = 0.18 cfs @ 12.66 hrs, Volume= 2,626 cf
Outflow = 0.18 cfs @ 12.66 hrs, Volume= 2,626 cf, Atten= 0%, Lag= 0.0 min

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

Reach DP-A: BVW at West of Site



Summary for Pond I: Infiltration Basin

Inflow Area = 77,377 sf, 0.00% Impervious, Inflow Depth = 0.08" for 2-inch event
Inflow = 0.02 cfs @ 13.68 hrs, Volume= 530 cf
Outflow = 0.02 cfs @ 15.75 hrs, Volume= 530 cf, Atten= 21%, Lag= 124.7 min
Discarded = 0.02 cfs @ 15.75 hrs, Volume= 530 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 64.36' @ 15.75 hrs Surf.Area= 695 sf Storage= 83 cf

Plug-Flow detention time= 72.1 min calculated for 530 cf (100% of inflow)
Center-of-Mass det. time= 72.2 min (1,096.2 - 1,024.1)

Volume	Invert	Avail.Storage	Storage Description
#1	64.00'	22,131 cf	**Custom Stage Data (Conic)**Listed below (Recalc)

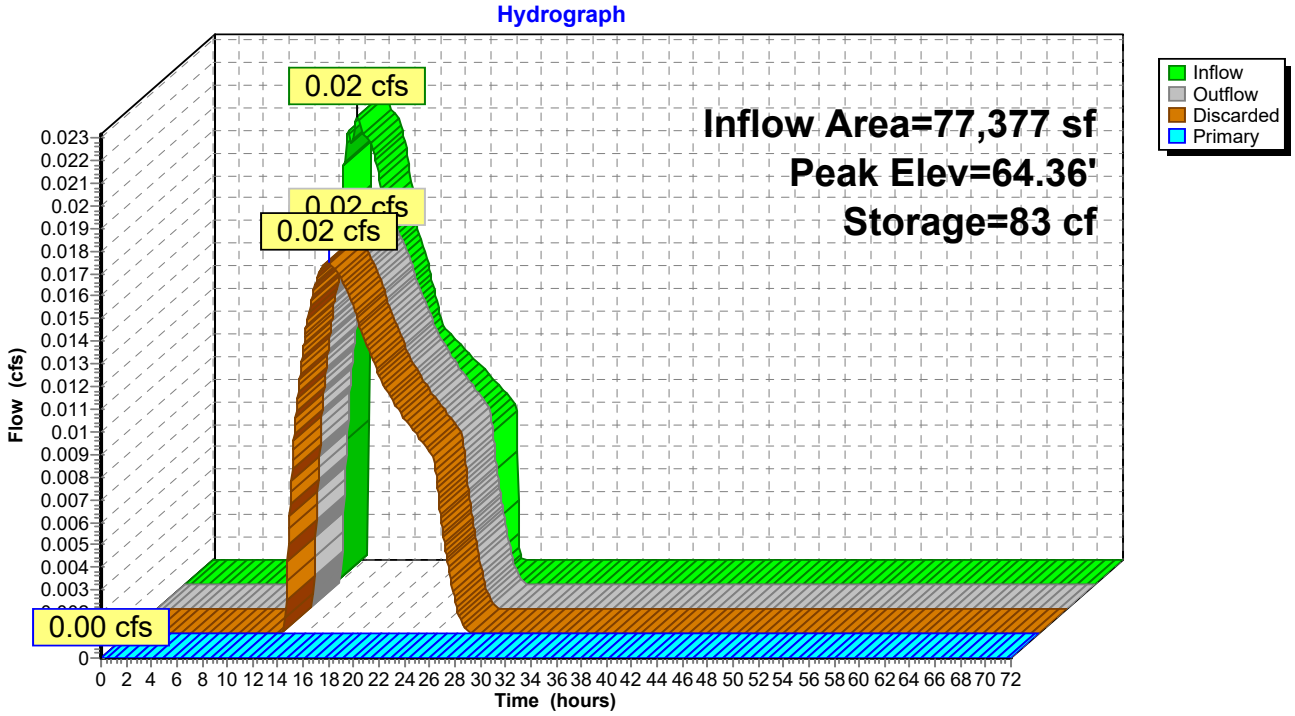
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
64.00	0	0	0	0
64.50	1,350	225	225	1,350
65.00	2,000	832	1,057	2,004
66.00	2,650	2,317	3,375	2,676
67.00	4,200	3,395	6,770	4,240
68.00	5,960	5,054	11,824	6,018
69.00	7,050	6,497	18,322	7,145
69.50	8,200	3,809	22,131	8,305

Device	Routing	Invert	Outlet Devices
#1	Discarded	64.00'	**1.020 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 0.00'
#2	Primary	64.00'	**12.0" Round Culvert** L= 35.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 64.00' / 63.25' S= 0.0214 '/' Cc= 0.900 n= 0.011, Flow Area= 0.79 sf
#3	Device 2	65.75'	**0.5' long x 3.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.02 cfs @ 15.75 hrs HW=64.36' (Free Discharge)
└**1=Exfiltration** (Controls 0.02 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=64.00' TW=0.00' (Dynamic Tailwater)
└**2=Culvert** (Controls 0.00 cfs)
└**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond I: Infiltration Basin



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

Subcatchment P1: Basin Catchment Runoff Area=77,377 sf 0.00% Impervious Runoff Depth=0.53"
Flow Length=420' Tc=9.3 min CN=65 Runoff=0.62 cfs 3,396 cf

Subcatchment P2: Uncaptured Site Runoff Area=231,844 sf 0.00% Impervious Runoff Depth=0.66"
Tc=23.8 min CN=68 Runoff=2.04 cfs 12,829 cf

Reach DP-A: BVW at West of Site Inflow=2.04 cfs 12,829 cf
Outflow=2.04 cfs 12,829 cf

Pond I: Infiltration Basin Peak Elev=65.29' Storage=1,657 cf Inflow=0.62 cfs 3,396 cf
Discarded=0.05 cfs 3,396 cf Primary=0.00 cfs 0 cf Outflow=0.05 cfs 3,396 cf

Total Runoff Area = 309,221 sf Runoff Volume = 16,224 cf Average Runoff Depth = 0.63"
100.00% Pervious = 309,221 sf 0.00% Impervious = 0 sf

Summary for Subcatchment P1: Basin Catchment

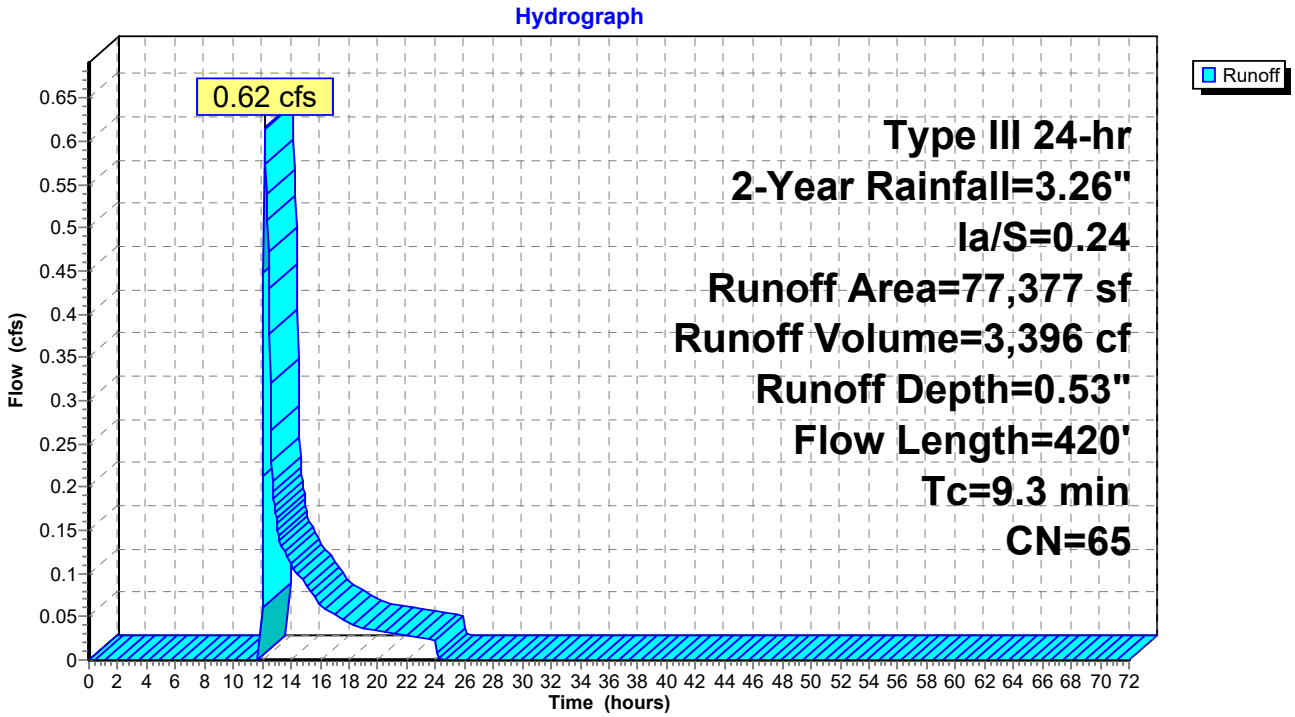
Runoff = 0.62 cfs @ 12.18 hrs, Volume= 3,396 cf, Depth= 0.53"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.26", Ia/S=0.24

	Area (sf)	CN	Description
	55,185	58	Meadow, non-grazed, HSG B
*	22,192	82	Gravel roads, HSG B
	77,377	65	Weighted Average
	77,377		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.7	150	0.0650	1.48		**Sheet Flow, Sheet Flow** n= 0.020 P2= 3.20"
0.3	80	0.0600	3.94		**Shallow Concentrated Flow, SCF** Unpaved Kv= 16.1 fps
7.3	190	0.0300	0.43		**Shallow Concentrated Flow, SCF** Forest w/Heavy Litter Kv= 2.5 fps
9.3	420	Total			

Subcatchment P1: Basin Catchment



Summary for Subcatchment P2: Uncaptured Site

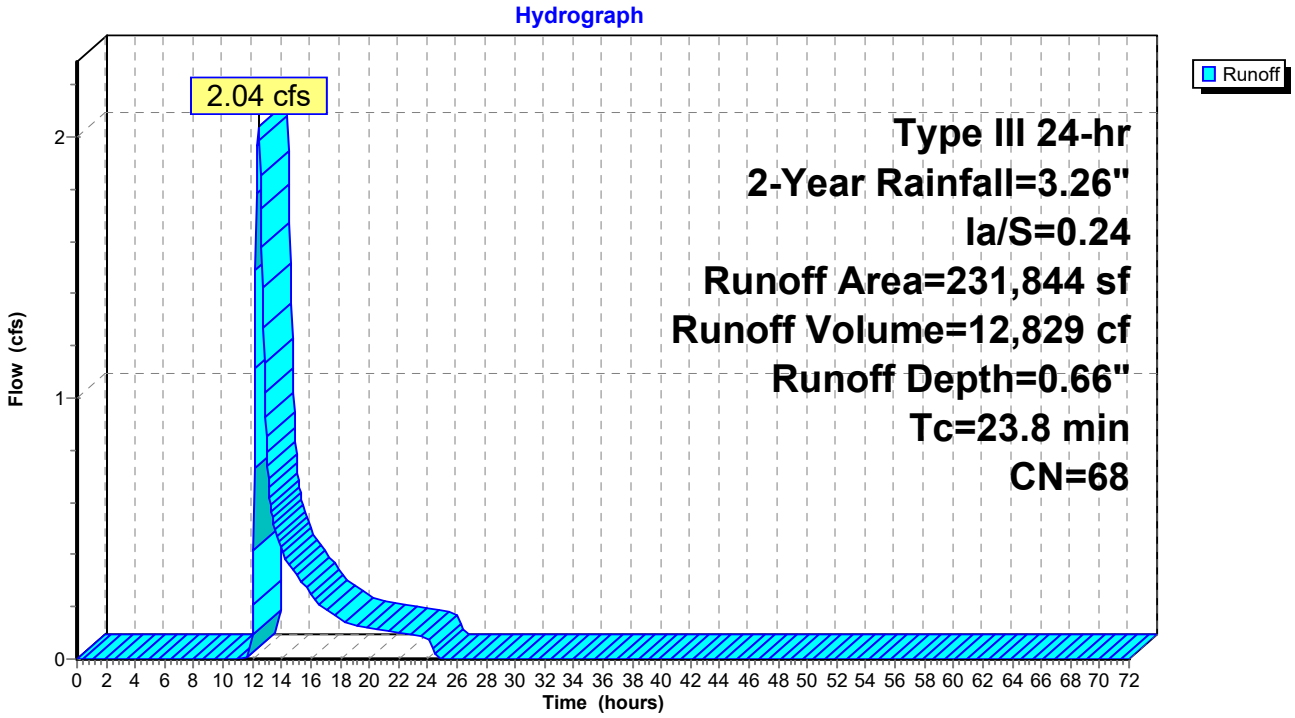
Runoff = 2.04 cfs @ 12.42 hrs, Volume= 12,829 cf, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.26", Ia/S=0.24

Area (sf)	CN	Description
127,933	77	Woods, Good, HSG D
25,030	55	Woods, Good, HSG B
78,881	58	Meadow, non-grazed, HSG B
231,844	68	Weighted Average
231,844		100.00% Pervious Area

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

Subcatchment P2: Uncaptured Site

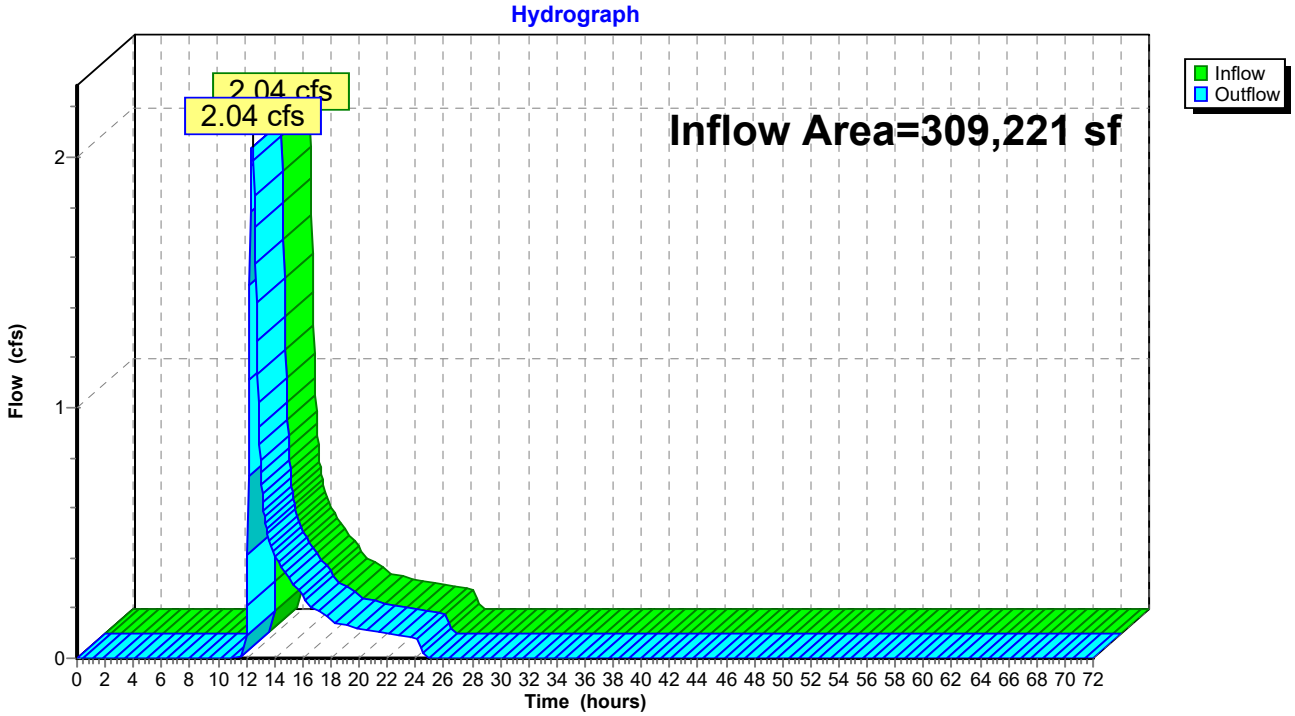


Summary for Reach DP-A: BVW at West of Site

Inflow Area = 309,221 sf, 0.00% Impervious, Inflow Depth = 0.50" for 2-Year event
Inflow = 2.04 cfs @ 12.42 hrs, Volume= 12,829 cf
Outflow = 2.04 cfs @ 12.42 hrs, Volume= 12,829 cf, Atten= 0%, Lag= 0.0 min

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

Reach DP-A: BVW at West of Site



Summary for Pond I: Infiltration Basin

Inflow Area = 77,377 sf, 0.00% Impervious, Inflow Depth = 0.53" for 2-Year event
Inflow = 0.62 cfs @ 12.18 hrs, Volume= 3,396 cf
Outflow = 0.05 cfs @ 17.05 hrs, Volume= 3,396 cf, Atten= 92%, Lag= 291.9 min
Discarded = 0.05 cfs @ 17.05 hrs, Volume= 3,396 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 65.29' @ 17.05 hrs Surf.Area= 2,177 sf Storage= 1,657 cf

Plug-Flow detention time= 391.2 min calculated for 3,393 cf (100% of inflow)
Center-of-Mass det. time= 391.4 min (1,305.9 - 914.4)

Volume	Invert	Avail.Storage	Storage Description
#1	64.00'	22,131 cf	**Custom Stage Data (Conic)**Listed below (Recalc)

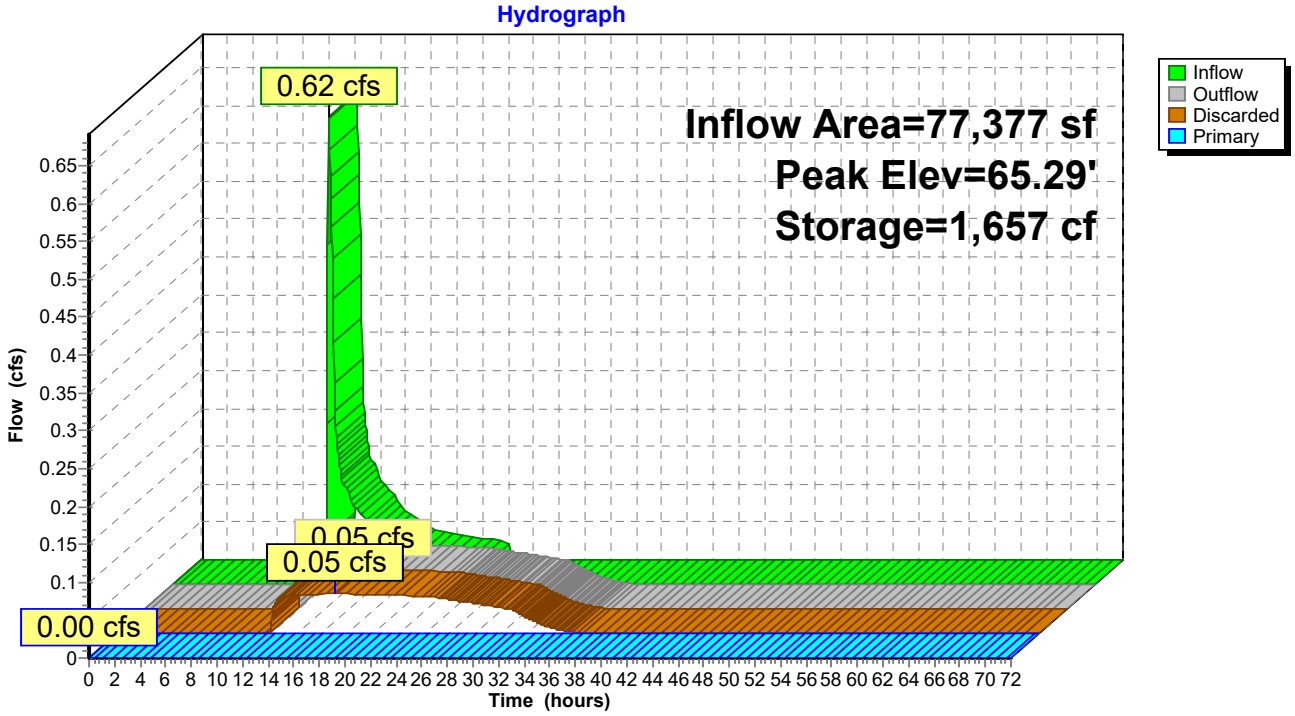
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
64.00	0	0	0	0
64.50	1,350	225	225	1,350
65.00	2,000	832	1,057	2,004
66.00	2,650	2,317	3,375	2,676
67.00	4,200	3,395	6,770	4,240
68.00	5,960	5,054	11,824	6,018
69.00	7,050	6,497	18,322	7,145
69.50	8,200	3,809	22,131	8,305

Device	Routing	Invert	Outlet Devices
#1	Discarded	64.00'	**1.020 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 0.00'
#2	Primary	64.00'	**12.0" Round Culvert** L= 35.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 64.00' / 63.25' S= 0.0214 '/' Cc= 0.900 n= 0.011, Flow Area= 0.79 sf
#3	Device 2	65.75'	**0.5' long x 3.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.05 cfs @ 17.05 hrs HW=65.29' (Free Discharge)
└**1=Exfiltration** (Controls 0.05 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=64.00' TW=0.00' (Dynamic Tailwater)
└**2=Culvert** (Controls 0.00 cfs)
└**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond I: Infiltration Basin



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

Subcatchment P1: Basin Catchment Runoff Area=77,377 sf 0.00% Impervious Runoff Depth=1.47"
Flow Length=420' Tc=9.3 min CN=65 Runoff=2.49 cfs 9,499 cf

Subcatchment P2: Uncaptured Site Runoff Area=231,844 sf 0.00% Impervious Runoff Depth=1.71"
Tc=23.8 min CN=68 Runoff=6.34 cfs 32,941 cf

Reach DP-A: BVW at West of Site Inflow=6.36 cfs 36,938 cf
Outflow=6.36 cfs 36,938 cf

Pond I: Infiltration Basin Peak Elev=66.14' Storage=3,759 cf Inflow=2.49 cfs 9,499 cf
Discarded=0.07 cfs 5,502 cf Primary=0.34 cfs 3,997 cf Outflow=0.41 cfs 9,499 cf

Total Runoff Area = 309,221 sf Runoff Volume = 42,440 cf Average Runoff Depth = 1.65"
100.00% Pervious = 309,221 sf 0.00% Impervious = 0 sf

Summary for Subcatchment P1: Basin Catchment

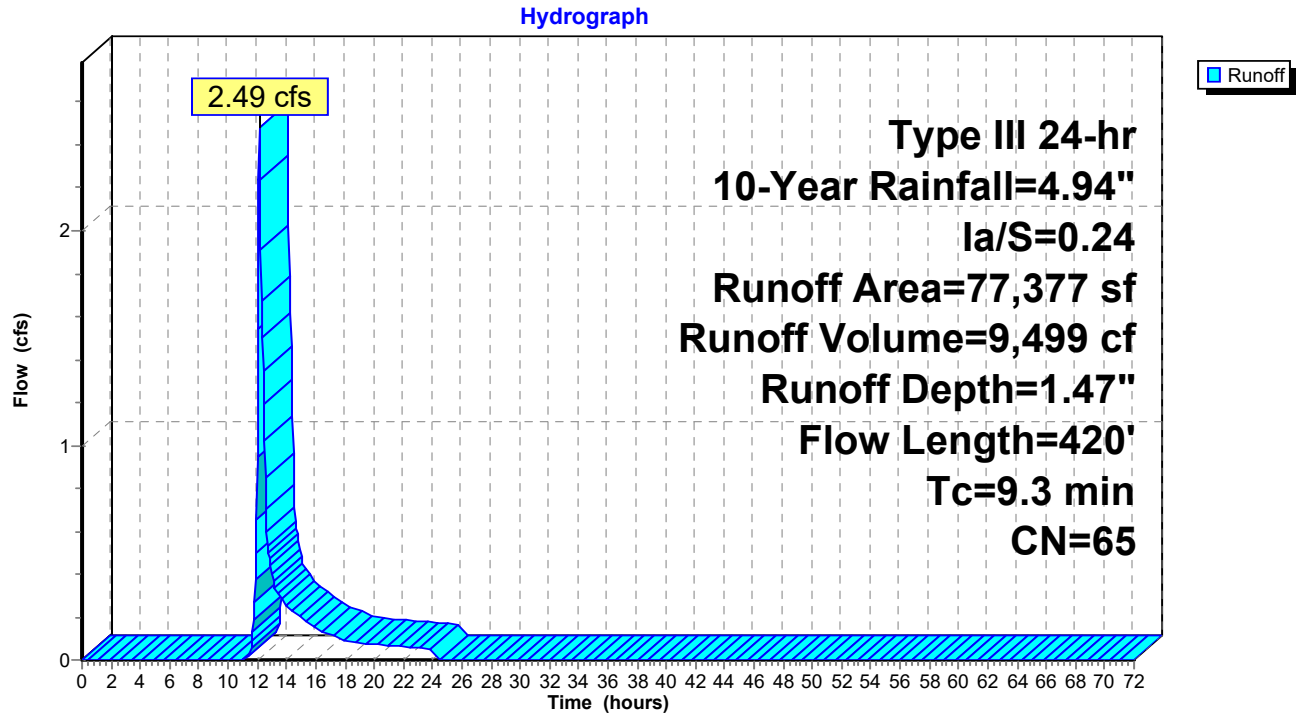
Runoff = 2.49 cfs @ 12.15 hrs, Volume= 9,499 cf, Depth= 1.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.94", Ia/S=0.24

	Area (sf)	CN	Description
	55,185	58	Meadow, non-grazed, HSG B
*	22,192	82	Gravel roads, HSG B
	77,377	65	Weighted Average
	77,377		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.7	150	0.0650	1.48		**Sheet Flow, Sheet Flow** n= 0.020 P2= 3.20"
0.3	80	0.0600	3.94		**Shallow Concentrated Flow, SCF** Unpaved Kv= 16.1 fps
7.3	190	0.0300	0.43		**Shallow Concentrated Flow, SCF** Forest w/Heavy Litter Kv= 2.5 fps
9.3	420	Total			

Subcatchment P1: Basin Catchment



Summary for Subcatchment P2: Uncaptured Site

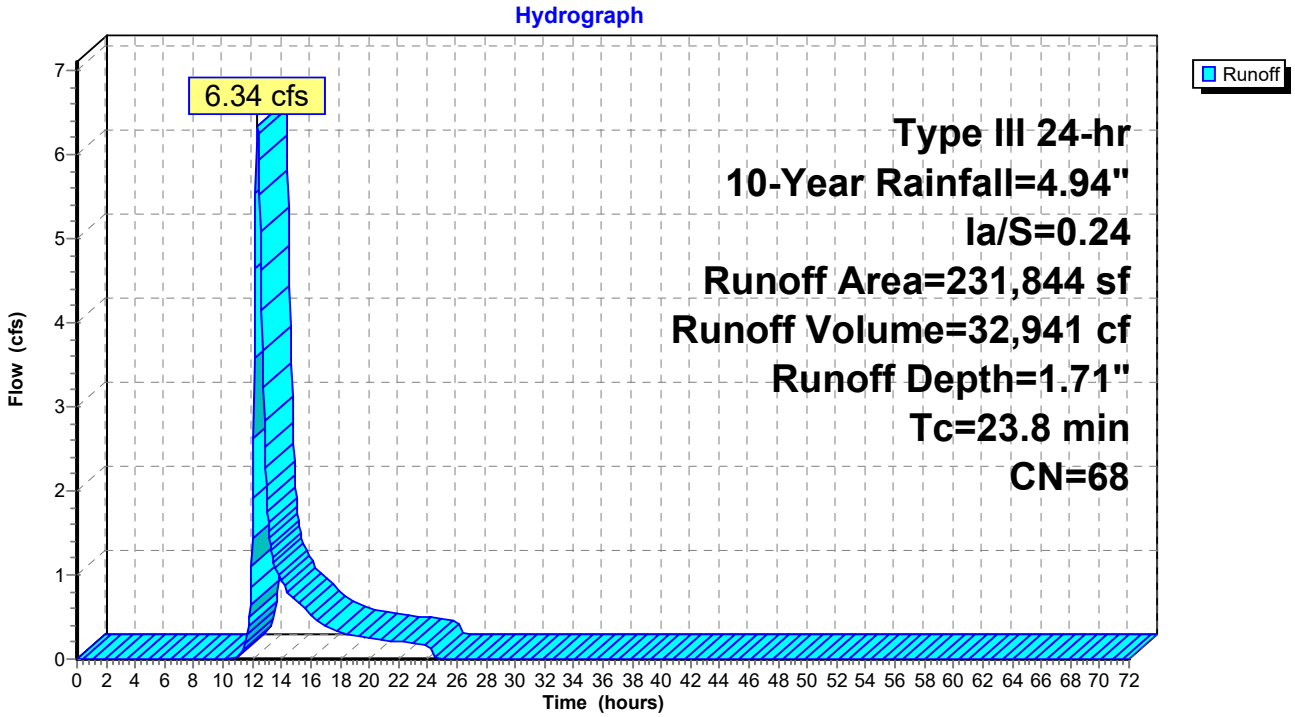
Runoff = 6.34 cfs @ 12.36 hrs, Volume= 32,941 cf, Depth= 1.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.94", Ia/S=0.24

Area (sf)	CN	Description
127,933	77	Woods, Good, HSG D
25,030	55	Woods, Good, HSG B
78,881	58	Meadow, non-grazed, HSG B
231,844	68	Weighted Average
231,844		100.00% Pervious Area

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

Subcatchment P2: Uncaptured Site

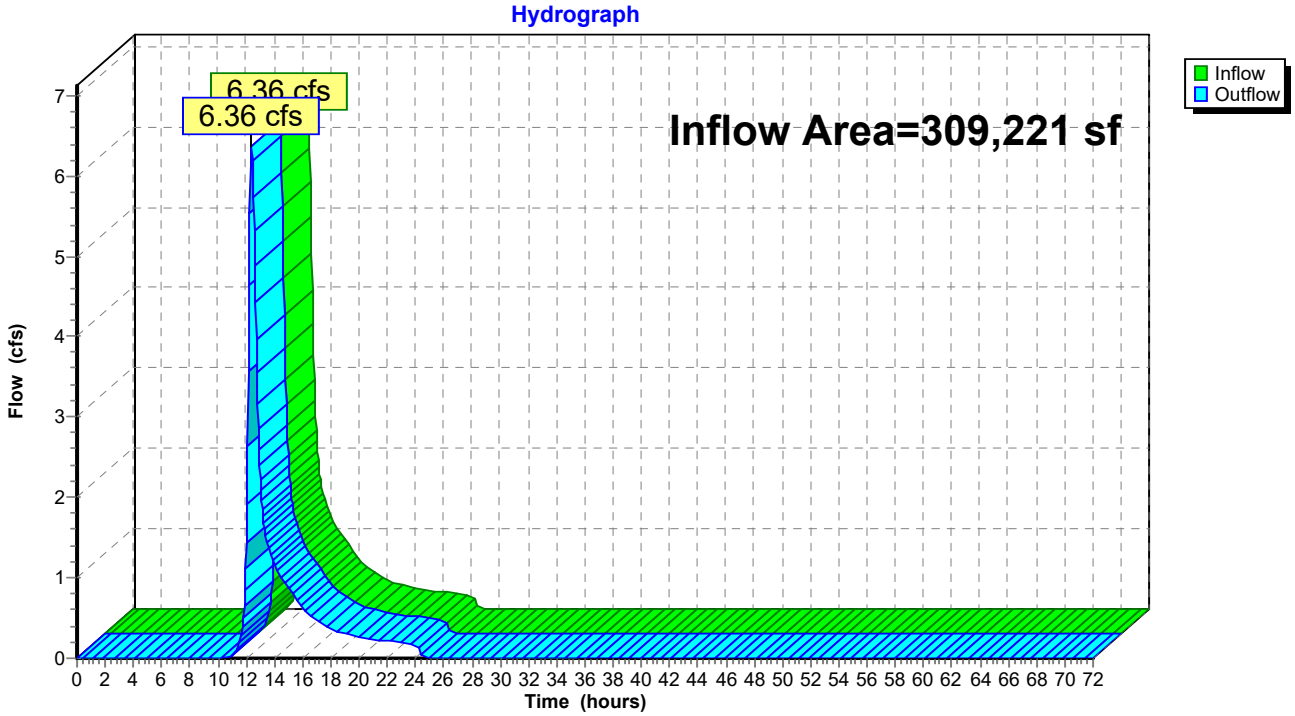


Summary for Reach DP-A: BVW at West of Site

Inflow Area = 309,221 sf, 0.00% Impervious, Inflow Depth = 1.43" for 10-Year event
Inflow = 6.36 cfs @ 12.37 hrs, Volume= 36,938 cf
Outflow = 6.36 cfs @ 12.37 hrs, Volume= 36,938 cf, Atten= 0%, Lag= 0.0 min

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

Reach DP-A: BVW at West of Site



Summary for Pond I: Infiltration Basin

Inflow Area = 77,377 sf, 0.00% Impervious, Inflow Depth = 1.47" for 10-Year event
Inflow = 2.49 cfs @ 12.15 hrs, Volume= 9,499 cf
Outflow = 0.41 cfs @ 12.97 hrs, Volume= 9,499 cf, Atten= 84%, Lag= 49.2 min
Discarded = 0.07 cfs @ 12.97 hrs, Volume= 5,502 cf
Primary = 0.34 cfs @ 12.97 hrs, Volume= 3,997 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 66.14' @ 12.97 hrs Surf.Area= 2,846 sf Storage= 3,759 cf

Plug-Flow detention time= 360.9 min calculated for 9,492 cf (100% of inflow)
Center-of-Mass det. time= 361.4 min (1,235.5 - 874.1)

Volume	Invert	Avail.Storage	Storage Description
#1	64.00'	22,131 cf	**Custom Stage Data (Conic)**Listed below (Recalc)

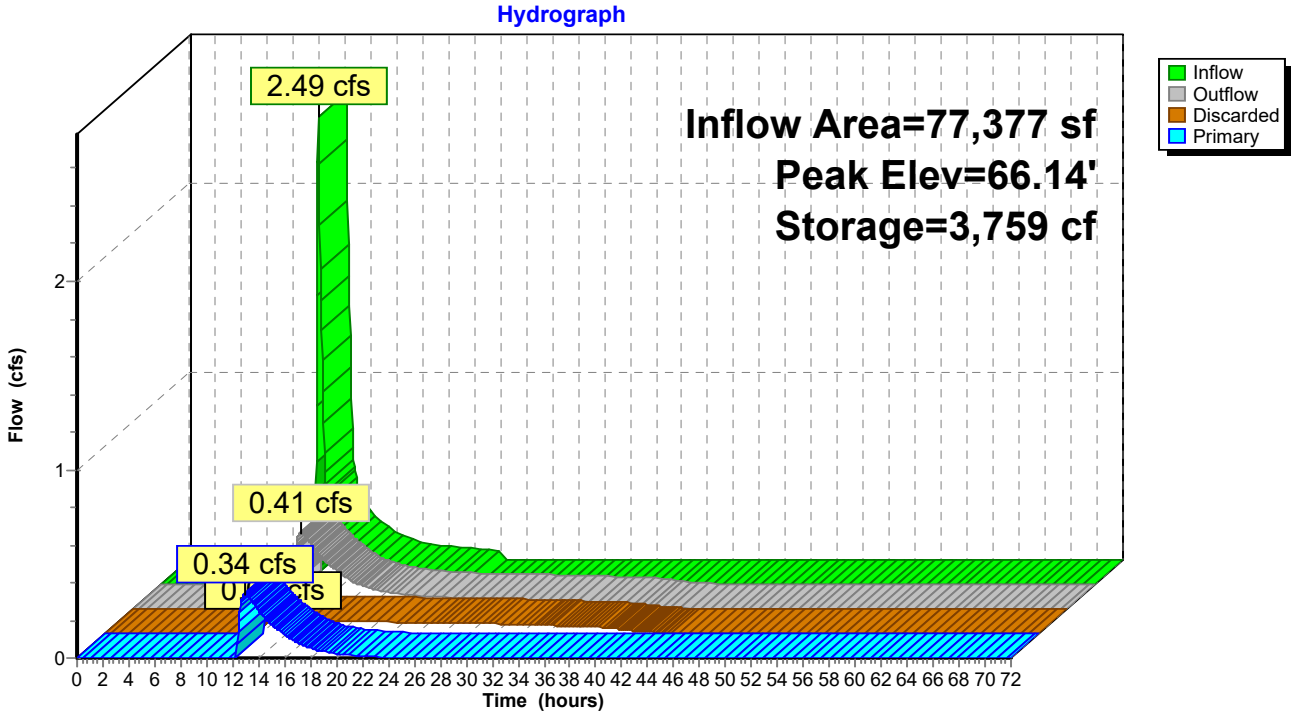
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
64.00	0	0	0	0
64.50	1,350	225	225	1,350
65.00	2,000	832	1,057	2,004
66.00	2,650	2,317	3,375	2,676
67.00	4,200	3,395	6,770	4,240
68.00	5,960	5,054	11,824	6,018
69.00	7,050	6,497	18,322	7,145
69.50	8,200	3,809	22,131	8,305

Device	Routing	Invert	Outlet Devices
#1	Discarded	64.00'	**1.020 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 0.00'
#2	Primary	64.00'	**12.0" Round Culvert** L= 35.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 64.00' / 63.25' S= 0.0214 '/' Cc= 0.900 n= 0.011, Flow Area= 0.79 sf
#3	Device 2	65.75'	**0.5' long x 3.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.07 cfs @ 12.97 hrs HW=66.14' (Free Discharge)
└**1=Exfiltration** (Controls 0.07 cfs)

Primary OutFlow Max=0.34 cfs @ 12.97 hrs HW=66.14' TW=0.00' (Dynamic Tailwater)
└**2=Culvert** (Passes 0.34 cfs of 4.84 cfs potential flow)
└**3=Sharp-Crested Rectangular Weir** (Weir Controls 0.34 cfs @ 2.04 fps)

Pond I: Infiltration Basin



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

Subcatchment P1: Basin Catchment Runoff Area=77,377 sf 0.00% Impervious Runoff Depth=2.39"
Flow Length=420' Tc=9.3 min CN=65 Runoff=4.28 cfs 15,418 cf

Subcatchment P2: Uncaptured Site Runoff Area=231,844 sf 0.00% Impervious Runoff Depth=2.68"
Tc=23.8 min CN=68 Runoff=10.35 cfs 51,851 cf

Reach DP-A: BVW at West of Site Inflow=11.14 cfs 61,403 cf
Outflow=11.14 cfs 61,403 cf

Pond I: Infiltration Basin Peak Elev=66.73' Storage=5,685 cf Inflow=4.28 cfs 15,418 cf
Discarded=0.09 cfs 5,866 cf Primary=0.96 cfs 9,552 cf Outflow=1.05 cfs 15,418 cf

Total Runoff Area = 309,221 sf Runoff Volume = 67,269 cf Average Runoff Depth = 2.61"
100.00% Pervious = 309,221 sf 0.00% Impervious = 0 sf

Summary for Subcatchment P1: Basin Catchment

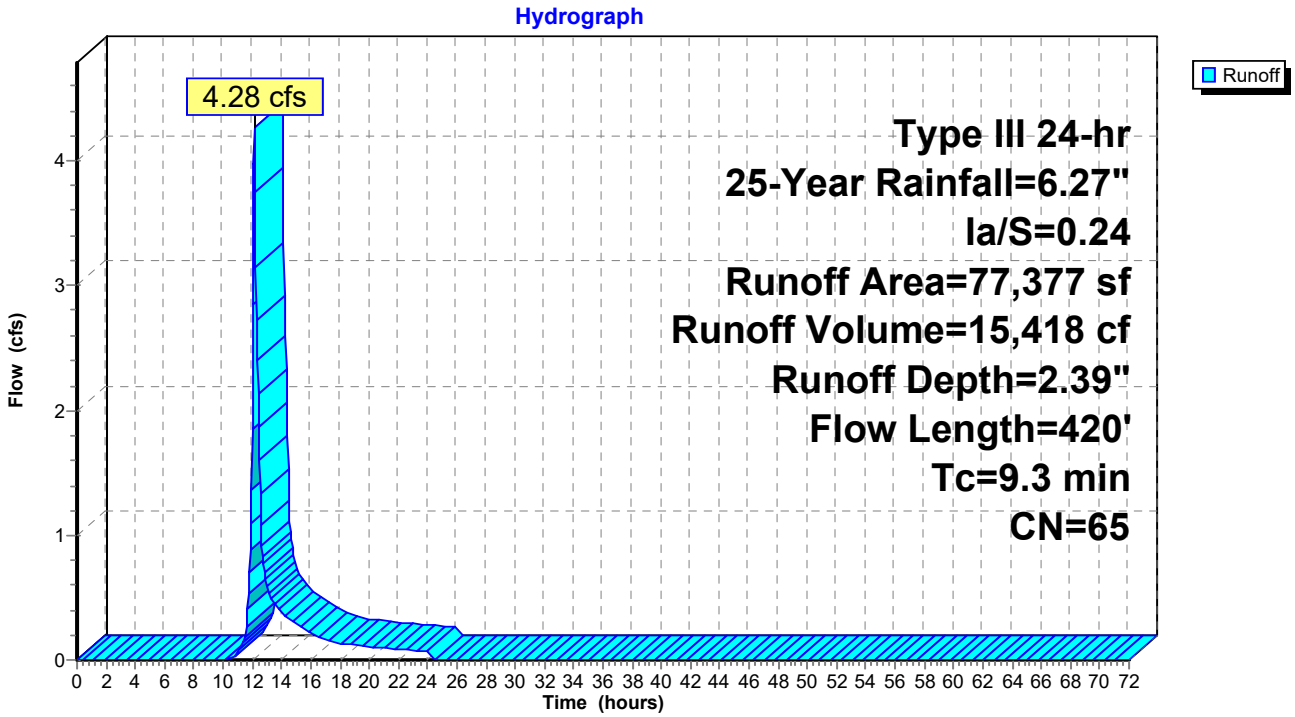
Runoff = 4.28 cfs @ 12.14 hrs, Volume= 15,418 cf, Depth= 2.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.27", Ia/S=0.24

	Area (sf)	CN	Description
	55,185	58	Meadow, non-grazed, HSG B
*	22,192	82	Gravel roads, HSG B
	77,377	65	Weighted Average
	77,377		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.7	150	0.0650	1.48		**Sheet Flow, Sheet Flow** n= 0.020 P2= 3.20"
0.3	80	0.0600	3.94		**Shallow Concentrated Flow, SCF** Unpaved Kv= 16.1 fps
7.3	190	0.0300	0.43		**Shallow Concentrated Flow, SCF** Forest w/Heavy Litter Kv= 2.5 fps
9.3	420	Total			

Subcatchment P1: Basin Catchment



Summary for Subcatchment P2: Uncaptured Site

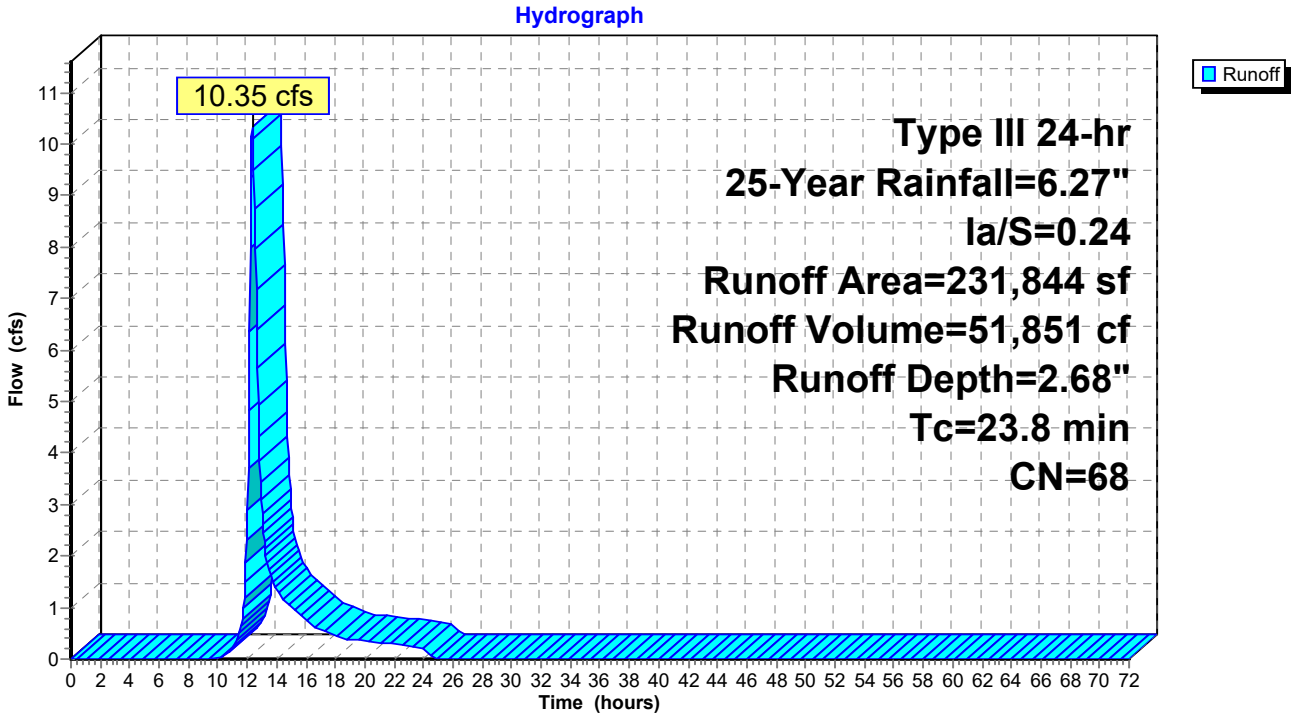
Runoff = 10.35 cfs @ 12.35 hrs, Volume= 51,851 cf, Depth= 2.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.27", Ia/S=0.24

Area (sf)	CN	Description
127,933	77	Woods, Good, HSG D
25,030	55	Woods, Good, HSG B
78,881	58	Meadow, non-grazed, HSG B
231,844	68	Weighted Average
231,844		100.00% Pervious Area

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

Subcatchment P2: Uncaptured Site

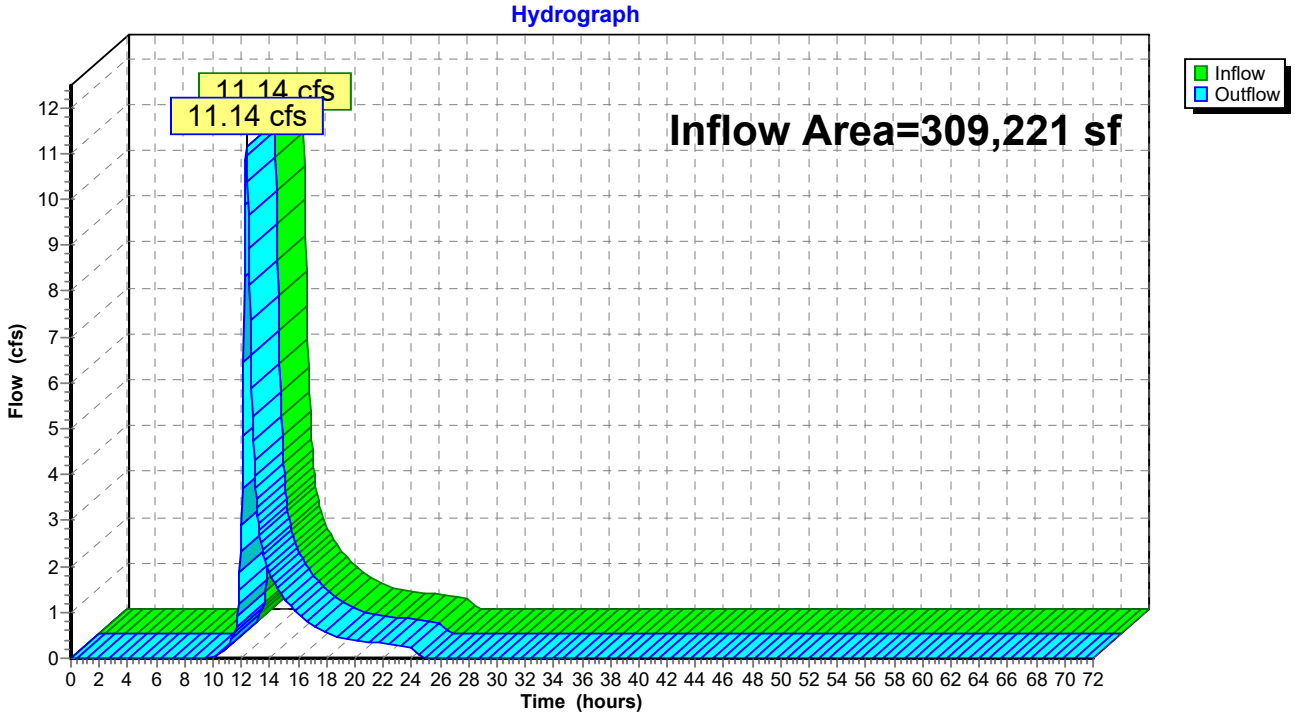


Summary for Reach DP-A: BVW at West of Site

Inflow Area = 309,221 sf, 0.00% Impervious, Inflow Depth = 2.38" for 25-Year event
Inflow = 11.14 cfs @ 12.36 hrs, Volume= 61,403 cf
Outflow = 11.14 cfs @ 12.36 hrs, Volume= 61,403 cf, Atten= 0%, Lag= 0.0 min

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

Reach DP-A: BVW at West of Site



Summary for Pond I: Infiltration Basin

Inflow Area = 77,377 sf, 0.00% Impervious, Inflow Depth = 2.39" for 25-Year event
Inflow = 4.28 cfs @ 12.14 hrs, Volume= 15,418 cf
Outflow = 1.05 cfs @ 12.61 hrs, Volume= 15,418 cf, Atten= 75%, Lag= 28.2 min
Discarded = 0.09 cfs @ 12.61 hrs, Volume= 5,866 cf
Primary = 0.96 cfs @ 12.61 hrs, Volume= 9,552 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 66.73' @ 12.61 hrs Surf.Area= 3,741 sf Storage= 5,685 cf

Plug-Flow detention time= 247.3 min calculated for 15,407 cf (100% of inflow)
Center-of-Mass det. time= 248.0 min (1,106.0 - 858.0)

Volume	Invert	Avail.Storage	Storage Description
#1	64.00'	22,131 cf	**Custom Stage Data (Conic)**Listed below (Recalc)

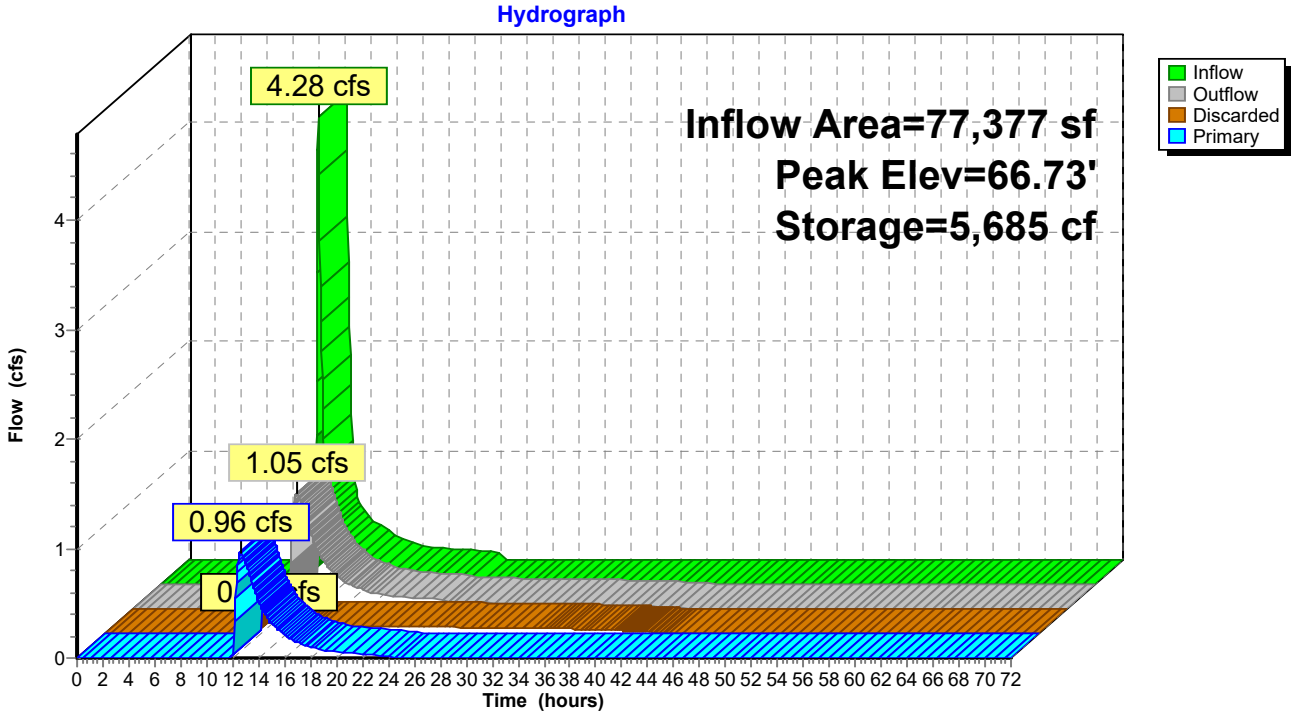
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
64.00	0	0	0	0
64.50	1,350	225	225	1,350
65.00	2,000	832	1,057	2,004
66.00	2,650	2,317	3,375	2,676
67.00	4,200	3,395	6,770	4,240
68.00	5,960	5,054	11,824	6,018
69.00	7,050	6,497	18,322	7,145
69.50	8,200	3,809	22,131	8,305

Device	Routing	Invert	Outlet Devices
#1	Discarded	64.00'	**1.020 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 0.00'
#2	Primary	64.00'	**12.0" Round Culvert** L= 35.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 64.00' / 63.25' S= 0.0214 '/' Cc= 0.900 n= 0.011, Flow Area= 0.79 sf
#3	Device 2	65.75'	**0.5' long x 3.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.09 cfs @ 12.61 hrs HW=66.73' (Free Discharge)
└**1=Exfiltration** (Controls 0.09 cfs)

Primary OutFlow Max=0.96 cfs @ 12.61 hrs HW=66.73' TW=0.00' (Dynamic Tailwater)
└**2=Culvert** (Passes 0.96 cfs of 5.64 cfs potential flow)
└**3=Sharp-Crested Rectangular Weir** (Weir Controls 0.96 cfs @ 3.23 fps)

Pond I: Infiltration Basin



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

Subcatchment P1: Basin Catchment Runoff Area=77,377 sf 0.00% Impervious Runoff Depth=4.55"
Flow Length=420' Tc=9.3 min CN=65 Runoff=8.39 cfs 29,366 cf

Subcatchment P2: Uncaptured Site Runoff Area=231,844 sf 0.00% Impervious Runoff Depth=4.94"
Tc=23.8 min CN=68 Runoff=19.42 cfs 95,496 cf

Reach DP-A: BVW at West of Site Inflow=21.63 cfs 118,240 cf
Outflow=21.63 cfs 118,240 cf

Pond I: Infiltration Basin Peak Elev=67.82' Storage=10,799 cf Inflow=8.39 cfs 29,366 cf
Discarded=0.14 cfs 6,622 cf Primary=2.44 cfs 22,744 cf Outflow=2.58 cfs 29,366 cf

Total Runoff Area = 309,221 sf Runoff Volume = 124,862 cf Average Runoff Depth = 4.85"
100.00% Pervious = 309,221 sf 0.00% Impervious = 0 sf

Summary for Subcatchment P1: Basin Catchment

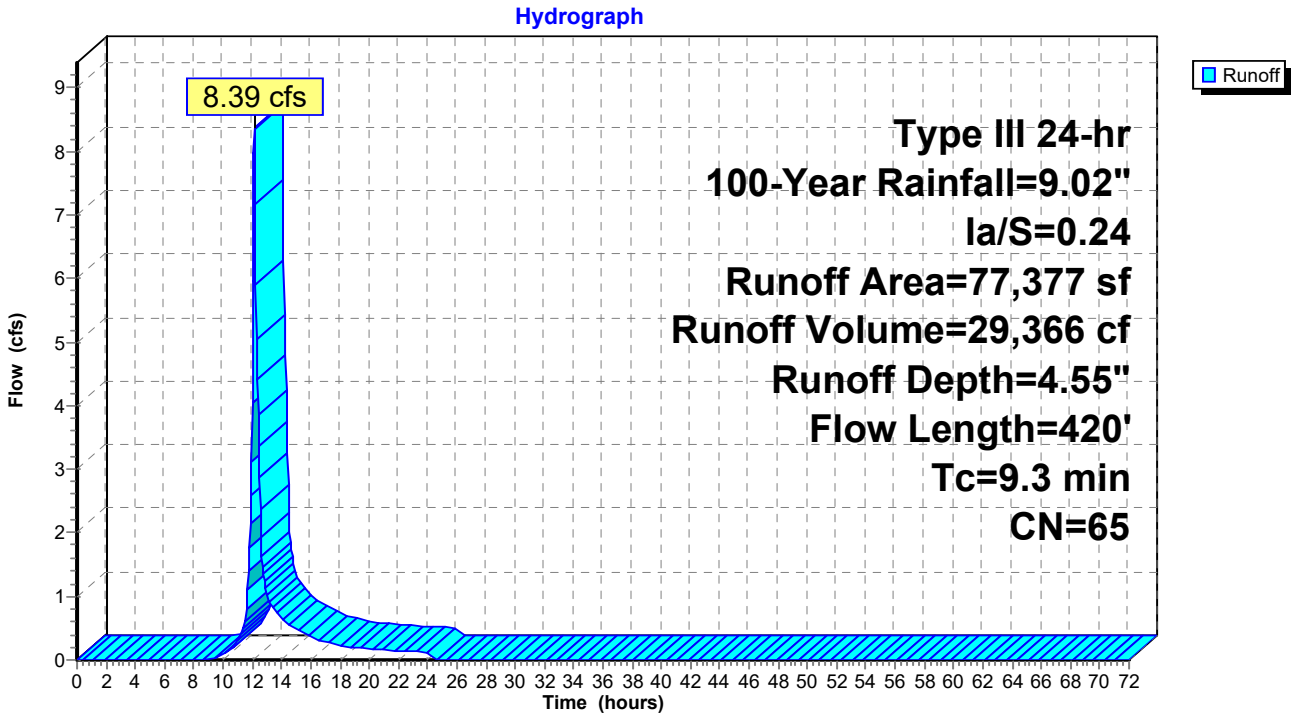
Runoff = 8.39 cfs @ 12.14 hrs, Volume= 29,366 cf, Depth= 4.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=9.02", Ia/S=0.24

	Area (sf)	CN	Description
	55,185	58	Meadow, non-grazed, HSG B
*	22,192	82	Gravel roads, HSG B
	77,377	65	Weighted Average
	77,377		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.7	150	0.0650	1.48		**Sheet Flow, Sheet Flow** n= 0.020 P2= 3.20"
0.3	80	0.0600	3.94		**Shallow Concentrated Flow, SCF** Unpaved Kv= 16.1 fps
7.3	190	0.0300	0.43		**Shallow Concentrated Flow, SCF** Forest w/Heavy Litter Kv= 2.5 fps
9.3	420	Total			

Subcatchment P1: Basin Catchment



Summary for Subcatchment P2: Uncaptured Site

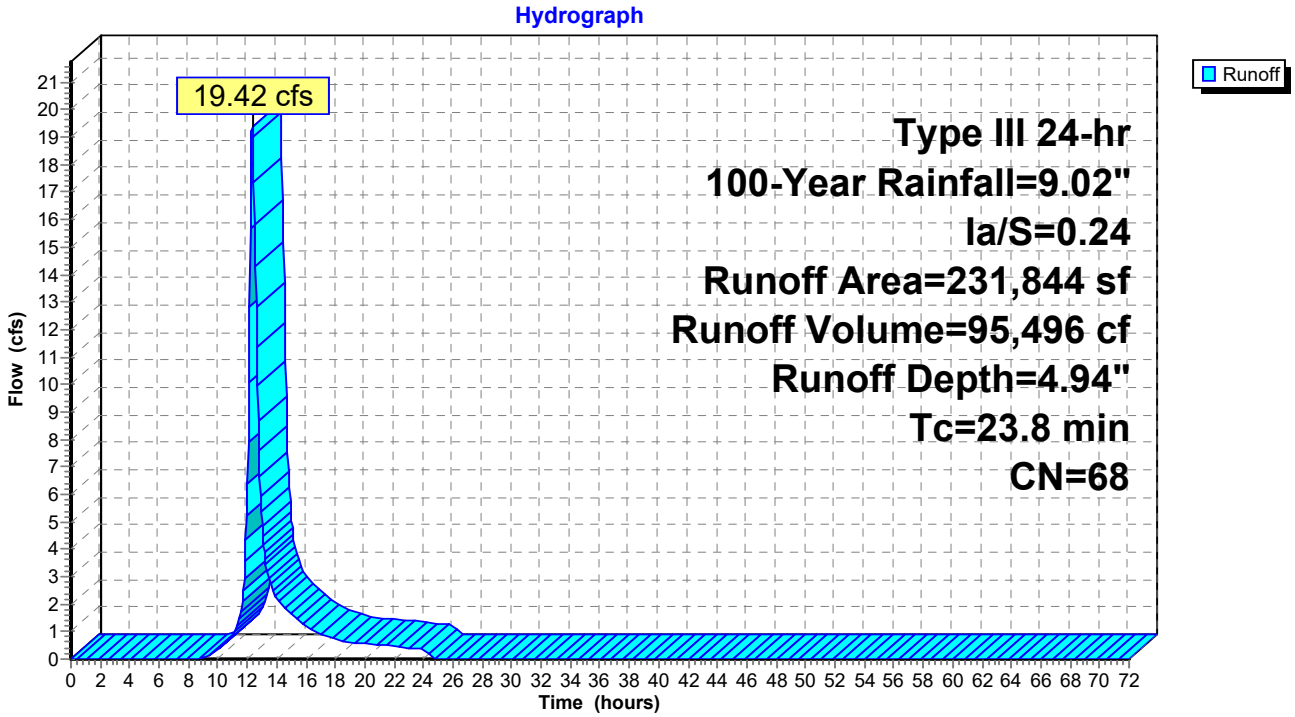
Runoff = 19.42 cfs @ 12.33 hrs, Volume= 95,496 cf, Depth= 4.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=9.02", Ia/S=0.24

Area (sf)	CN	Description
127,933	77	Woods, Good, HSG D
25,030	55	Woods, Good, HSG B
78,881	58	Meadow, non-grazed, HSG B
231,844	68	Weighted Average
231,844		100.00% Pervious Area

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

Subcatchment P2: Uncaptured Site

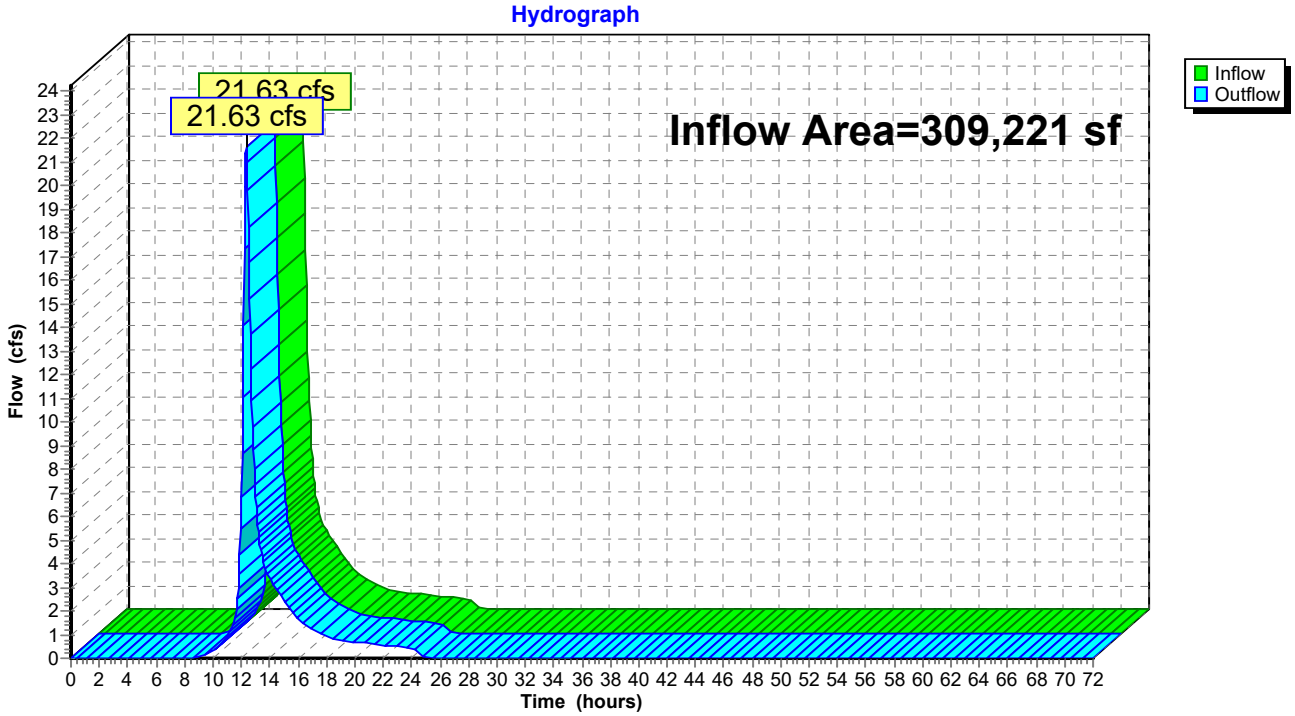


Summary for Reach DP-A: BVW at West of Site

Inflow Area = 309,221 sf, 0.00% Impervious, Inflow Depth = 4.59" for 100-Year event
Inflow = 21.63 cfs @ 12.34 hrs, Volume= 118,240 cf
Outflow = 21.63 cfs @ 12.34 hrs, Volume= 118,240 cf, Atten= 0%, Lag= 0.0 min

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

Reach DP-A: BVW at West of Site



Summary for Pond I: Infiltration Basin

Inflow Area = 77,377 sf, 0.00% Impervious, Inflow Depth = 4.55" for 100-Year event
Inflow = 8.39 cfs @ 12.14 hrs, Volume= 29,366 cf
Outflow = 2.58 cfs @ 12.53 hrs, Volume= 29,366 cf, Atten= 69%, Lag= 23.5 min
Discarded = 0.14 cfs @ 12.53 hrs, Volume= 6,622 cf
Primary = 2.44 cfs @ 12.53 hrs, Volume= 22,744 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 67.82' @ 12.53 hrs Surf.Area= 5,626 sf Storage= 10,799 cf

Plug-Flow detention time= 160.5 min calculated for 29,346 cf (100% of inflow)
Center-of-Mass det. time= 161.2 min (999.3 - 838.1)

Volume	Invert	Avail.Storage	Storage Description
#1	64.00'	22,131 cf	**Custom Stage Data (Conic)**Listed below (Recalc)

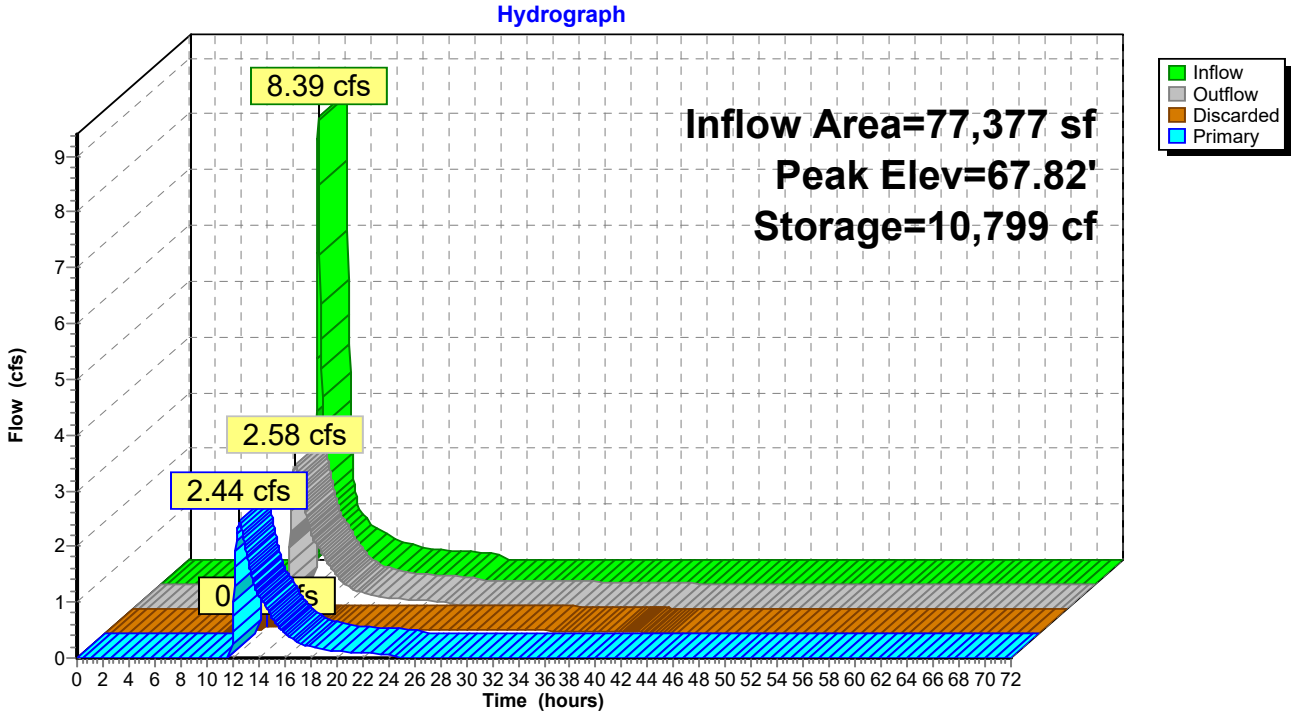
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
64.00	0	0	0	0
64.50	1,350	225	225	1,350
65.00	2,000	832	1,057	2,004
66.00	2,650	2,317	3,375	2,676
67.00	4,200	3,395	6,770	4,240
68.00	5,960	5,054	11,824	6,018
69.00	7,050	6,497	18,322	7,145
69.50	8,200	3,809	22,131	8,305

Device	Routing	Invert	Outlet Devices
#1	Discarded	64.00'	**1.020 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 0.00'
#2	Primary	64.00'	**12.0" Round Culvert** L= 35.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 64.00' / 63.25' S= 0.0214 '/' Cc= 0.900 n= 0.011, Flow Area= 0.79 sf
#3	Device 2	65.75'	**0.5' long x 3.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.14 cfs @ 12.53 hrs HW=67.82' (Free Discharge)
└**1=Exfiltration** (Controls 0.14 cfs)

Primary OutFlow Max=2.44 cfs @ 12.53 hrs HW=67.82' TW=0.00' (Dynamic Tailwater)
└**2=Culvert** (Passes 2.44 cfs of 6.89 cfs potential flow)
└**3=Sharp-Crested Rectangular Weir** (Weir Controls 2.44 cfs @ 4.71 fps)

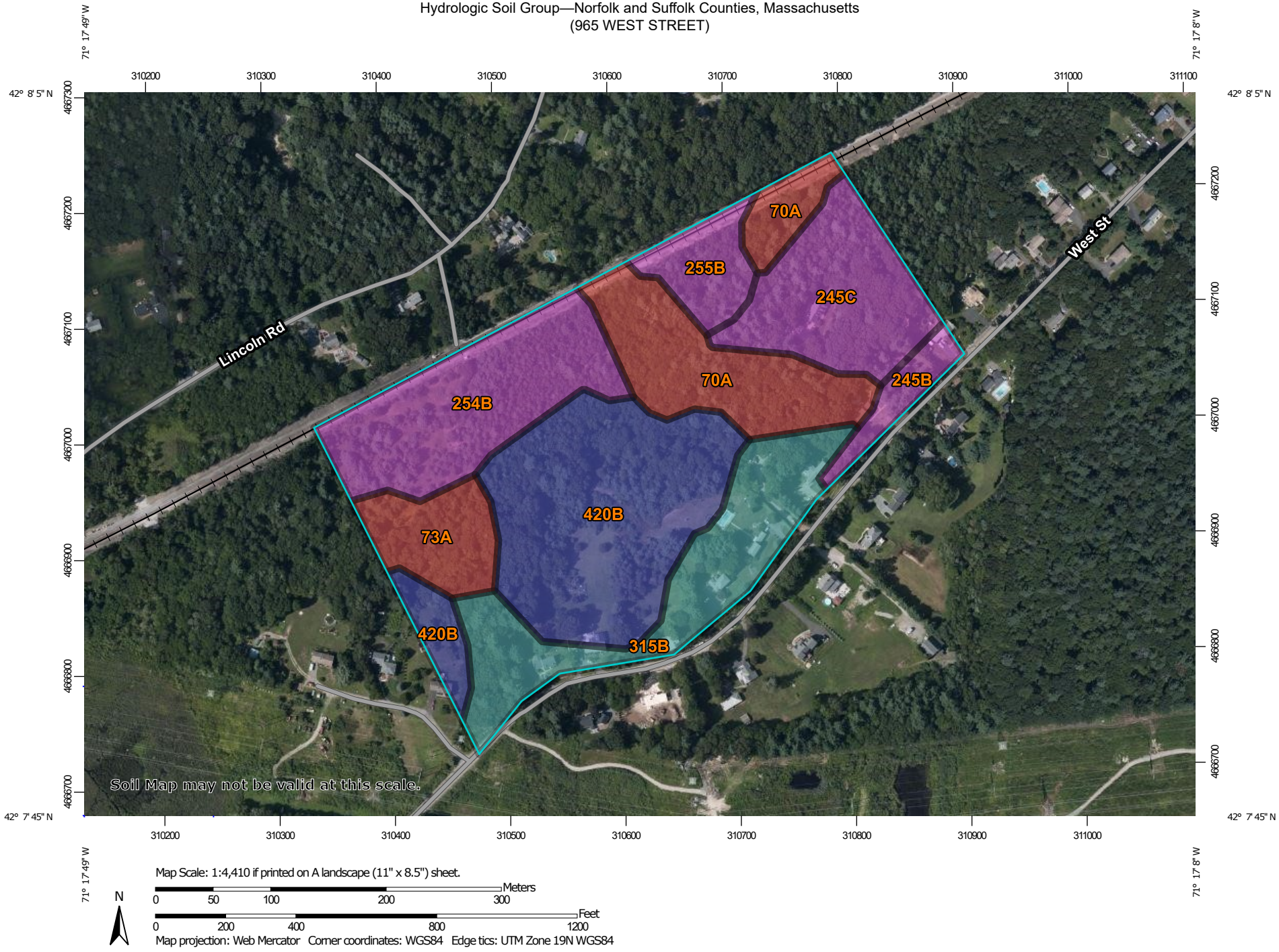
Pond I: Infiltration Basin



Appendix E

Soil Data

Hydrologic Soil Group—Norfolk and Suffolk Counties, Massachusetts
(965 WEST STREET)



Map Scale: 1:4,410 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 50 100 200 300

Feet
0 200 400 800 1200

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

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

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

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

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

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
70A	Ridgebury fine sandy loam, 0 to 3 percent slopes	D	5.5	15.2%
73A	Whitman fine sandy loam, 0 to 3 percent slopes, extremely stony	D	2.2	6.1%
245B	Hinckley loamy sand, 3 to 8 percent slopes	A	1.0	2.8%
245C	Hinckley loamy sand, 8 to 15 percent slopes	A	4.6	12.7%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	A	5.8	16.2%
255B	Windsor loamy sand, 3 to 8 percent slopes	A	1.7	4.7%
315B	Scituate fine sandy loam, 3 to 8 percent slopes	C	5.5	15.3%
420B	Canton fine sandy loam, 3 to 8 percent slopes	B	9.7	26.9%
Totals for Area of Interest			**36.0**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Appendix F

Supporting Calculations & Forms

HENDERSON CONSULTING SERVICES, INC.
Professional Civil Engineering & Land Planning
P.O. Box 626
Lexington, MA 02420
(774)993-9903 · hcscivil@gmail.com

Standard 3: Required Recharge Volume

Soil Type:	HSG B - NRCS Soil Survey & Soil Evaluation	
Infiltration Rate:	2.41	Inches/Hour in Infiltration Basin
Target Depth Factor:	0.35	Inch
Impervious Area:	39,623	S.F.
Captured Impervious Area:	39,623	S.F.
Req'd Recharge Volume Multiplier	1.00	
Recharge Volume:	1,156	C.F.

Recharge Provided:		Contributing Impervious Area	Required Storage Volume	Provided Storage Below Outlet
(before overflow)	Infiltration Basin	39,623 S.F.	1,156 C.F.	1,966 C.F.

Standard 4: Water Quality Volume

Rainfall Depth:	0.5	Inch
Impervious Area:	39,623	S.F.
Water Quality Volume	1,651	C.F.

Treatment Provided:		Contributing Impervious Area	Required Treatment Volume	Provided Storage Below Outlet
(80% w/ pretreatment)	Infiltration Basin	39,623 S.F.	1,651 C.F.	1,966 C.F.

Drawdown Rate (72 Hours Maximum)

Infiltration Basin	Bottom Area	Infiltration Rate	Drawdown Rate	Maximum Volume	Drawdown Time
	2223 S.F.	2.41 IN/HR	446.5 C.F./HR	1966 C.F.	4.4 Hours

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Lexington, MA 02420
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TOTAL LIMIT OF WORK [S.F.]
156258

Phosphorus Loads

Agriculture Impervious	1.52	lb/ac/yr
DevPerv HSGB	0.12	lb/ac/yr
Forest HSGB	0.13	lb/ac/yr
Forest Impervious	1.52	lb/ac/yr

EXISTING

	Area [S.F.]	Annual Load Rate [lb/ac/yr]	Annual Load [lb/yr]
FOREST	156258	0.13	0.466
		TOTAL	**0.466**

PROPOSED

60% REQUIRED AREAS — *Entire Expansion Limit of Work*

	Area [S.F.]	Annual Load Rate [lb/ac/yr]	Annual Load [lb/yr]	% Removal Required	Load Removal Required [lb/yr]
Agr Impervious	39623	1.52	1.383	60.0%	0.830
DevPervB	116635	0.12	0.321	60.0%	0.193

TOTAL POST-DEVELOPMENT LOAD	**1.704 lb/yr**
TOTAL REMOVAL REQUIRED	**1.022 lb/yr**
NET PERCENTAGE REQUIRED	**60.0%**

BMP REMOVAL CALCULATIONS

Infiltration Basin Catchment — *2" Storage = 100% P Removal*

	Area [S.F.]	Annual Load Rate [lb/ac/yr]	% Removal	Removal Provided [lb/yr]
Agr Impervious	39623	1.52	100.0%	1.383
DevPervB	37754	0.12	100.0%	0.104

TOTAL REMOVAL PROVIDED	**1.487 lb/yr**
NET PERCENTAGE PROVIDED	**87.2%**

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

Version 1, Automated: Mar. 4, 2008

Location: Infiltration System Removal

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Sediment Forebay	0.25	1.00	0.25	0.75
Infiltration Basin	0.80	0.75	0.60	0.15
	0.00	0.15	0.00	0.15
	0.00	0.15	0.00	0.15
	0.00	0.15	0.00	0.15

Total TSS Removal = 85%

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

Project: MF Expansion
Prepared By: SPH
Date: 3/5/2024

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

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

1. From MassDEP Stormwater Handbook Vol. 1

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

Version 1, Automated: Mar. 4, 2008

Location: Infiltration System Pretreatment

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Vegetated Filter Strip >50 feet	**0.45**	**1.00**	**0.45**	**0.55**
	0.00	**0.55**	**0.00**	**0.55**
	0.00	**0.55**	**0.00**	**0.55**
	0.00	**0.55**	**0.00**	**0.55**
	0.00	**0.55**	**0.00**	**0.55**

Total TSS Removal = **45%**

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

Project: **MF Expansion**
Prepared By: **SPH**
Date: **3/5/2024**

*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

Appendix G

Construction Period Operation & Maintenance Plan

Construction Period Stormwater Operation & Maintenance Plan

Site Development
MF Nursery Expansion
1049 West Street, Walpole, MA

March 5, 2024

Prepared By: Scott P. Henderson, PE

HENDERSON
Consulting Services

P.O. Box 626
Lexington, MA 02420
hcscivil@gmail.com
774-993-9903

Erosion and Sedimentation will be controlled at the site by utilizing Structural Practices, Stabilization Practices, and Dust Control. These practices correspond with plans entitled "Site Development Plan, 1049 West St, Walpole, MA" dated March 5, 2024, as revised and approved, prepared by Henderson Consulting Services, hereinafter referred to as the Site Plans.

Responsible Party

MF Nursery – Michael Freiberger, Owner
965 West Street
Walpole, MA 02081

Project Summary

The project proponent, Michael Freiberger, is constructing a material (soil, brush, nursery stock, etc.) stockpile area on property adjacent to MF Nursery on West Street in Walpole. This involves clearing an existing wooded lot, installing a compacted gravel storage area, and replanting the remaining cleared area with meadow grasses. An infiltration basin will be constructed at the downhill edge of the project site to control runoff from the gravel area.

Erosion & Sedimentation Control Practices

Structural Practices:

1) **Silt Sock Erosion Control Barrier** – A sediment fence/hay bale barrier combination will be constructed along downward slopes at the limit of work in locations shown on the plans. The sediment fence portion will be upland of the hay bale portion. This control will be installed prior to major soil disturbance on the site. The sediment fence should be installed as shown on the Erosion Control Detail Plan and be Amoco woven polypropylene 1198 or equivalent.

Hay Bale Barrier Design/Installation Requirements *
* (included on Inspection/Evaluation Checklist)

a) Hay bales should be placed in a single row, lengthwise on the contour, with the ends of adjacent bales tightly abutting one another.
b) All individual bales should be either wire-bound or string-tied. Straw bales should be installed so that the bindings are oriented around the sides rather than along the tops and bottoms of the bales in order to prevent deterioration of the bindings.
c) The barrier should be entrenched and backfilled. A trench should be excavated the width of a bale and the length of the proposed barrier to a minimum depth of 4 inches and maximum depth of 6 inches. The trench must be deep enough to remove all grass and other material, which might allow underflow. After the bales are staked and chinked (filled by wedging), the excavated soil should be backfilled against the barrier. Backfill soil should conform to the ground level on the downhill side and should be built up to 4 inches against the uphill side of the barrier.
d) Each bale should be securely anchored by at least 2 stakes or re-bars driven through the bale. The first stake in each bale should be driven toward the previously laid bale to force the bales together. Stakes or re-bars should be driven deep enough into the ground to securely anchor the bales. For safety reasons, stakes should not extend above the bales but should be driven in flush with the top of the bale.
e) The gaps between the bales should be chinked (filled by wedging) with straw to prevent water from escaping between the bales. Wedging must be done carefully in order not to separate the bales.

f) Hay bale barriers should be removed when they have served their usefulness, but not before the upslope areas have been permanently stabilized.

Hay Bale Barrier Inspection/Maintenance *

a) Hay bale barriers should be inspected immediately after each runoff-producing rainfall and at least daily during prolonged rainfall.
b) Close attention should be paid to the repair of damaged bales, undercutting beneath bales, and flow around the ends of the bales.
c) Necessary repairs to barriers or replacement of bales should be accomplished promptly.
d) Sediment deposits should be checked after each runoff-producing rainfall. They must be removed when the level of deposition reaches approximately one-half the height of the barrier.
e) Any sediment deposits remaining in place after the hay bale barrier is no longer required should be dressed to conform to the existing grade, prepared and seeded.

Sediment Fence Design/Installation Requirements *

a) Locate the fence upland of the hay bale barriers and where identified on the plans.
b) The fence line should be nearly level through most of its length to impound a broad, temporary pool. The last 10 to 20 feet at each end of the fence should be swung slightly uphill (approximately 0.5 feet in elevation) to provide storage capacity.
c) Excavate a trench approximately 8 inches deep and 4 inches wide, or a V-trench; along the line of the fence, upslope side.
d) Fasten support wire fence (14 gauge with 6-inch mesh) securely to the upslope side of the fence posts with wire ties or staples. Wire should extend 6 inches into the trench.
e) Attach continuous length of fabric to upslope side of fence posts. Avoid joints, particularly at low points in the fence line. Where joints are necessary, fasten fabric securely to support posts and overlap to the next post.
f) Place the bottom one foot of fabric in the trench. Backfill with compacted earth or gravel.
g) Filter cloth shall be fastened securely to the woven wire fence with ties spaced every 24 inches at the top, mid-section, and bottom.
h) Sediment fences should be removed when they have served their useful purpose, but not before the upslope area has been permanently stabilized through one growing season. Retained sediment must be removed and properly disposed of, or mulched and seeded.

Sediment Fence Inspection/Maintenance *

a) Silt fences should be inspected immediately after each rainfall event of 1-inch or greater, and at least daily during prolonged rainfall. Inspect the depth of sediment, fabric tears, if the fabric is securely attached to the fence posts, and to see that the fence posts are firmly in the ground. Repair or replace as necessary.
b) Remove sediment deposits promptly after storm events to provide adequate storage volume for the next rain and to reduce pressure on the fence. Sediment will be removed from behind the sediment fence when it becomes about ½ foot deep at the fence. Take care to avoid undermining fence during cleanout.
c) If the fabric tears, decomposes, or in any way becomes ineffective, replace it immediately.
d) Remove all fencing materials after the contributing drainage area has been properly stabilized. Sediment deposits remaining after the fabric has been removed should be graded to conform with the existing topography and vegetated.

2) **Stabilized Construction Entrance** – A stabilized construction entrance may be needed at the entry point to the stockpile area; however, the existing nursery site may be adequate for construction access.

Construction Entrance Design/Construction Requirements *

a) Grade foundation for positive drainage towards the temporary sedimentation area along the side of the roadway.

b) Stone for a stabilized construction entrance shall consist of 1 to 3-inch stone placed on a stable foundation.

c) Pad dimensions: The minimum length of the gravel pad should be 50 feet. The pad should extend the full width of the proposed roadway, or wide enough so that the largest construction vehicle will fit in the entrance with room to spare; whichever is greater. If a large amount of traffic is expected at the entrance, then the stabilized construction entrance should be wide enough to fit two vehicles across with room to spare.

d) A geotextile filter fabric shall be placed between the stone fill and the earth surface below the pad to reduce the migration of soil particles from the underlying soil into the stone and vice versa. The filter fabric should be Amoco woven polypropylene 1198 or equivalent.

e) Washing: If the site conditions are such that the majority of mud is not removed from the vehicle tires by the gravel pad, then the tires should be washed before the vehicle enters the street. The wash area should be a level area with 3-inch washed stone minimum, or a commercial rack.

f) Water employed in the washing process shall be directed to a sediment trap or approved sediment-trapping device prior to discharge to the temporary sedimentation basin along the site entrance drive. Sediment should be prevented from entering any watercourses.

Construction Entrance Inspection/Maintenance *

a) The entrance should be maintained in a condition that will prevent tracking or flowing of sediment onto protected areas. This may require periodic topdressing with additional stone

b) The construction entrance and sediment disposal area shall be inspected weekly and after heavy rains or heavy use.

c) Mud and sediment tracked or washed onto public road shall be immediately removed by sweeping.

d) Once mud and soil particles clog the voids in the gravel and the effectiveness of the gravel pad is no longer satisfactory, the pad must be topdressed with new stone. Replacement of the entire pad may be necessary when the pad becomes completely clogged.

e) If washing facilities are used, the sediment traps should be cleaned out as often as necessary to assure that adequate trapping efficiency and storage volume is available.

f) The pad shall be reshaped as needed for drainage and runoff control.

g) All temporary erosion and sediment control measures shall be removed within 30 days after final site stabilization is achieved or after the temporary practices are no longer needed. Trapped sediment shall be removed or stabilized on site. Disturbed soil areas resulting from removal shall be permanently stabilized.

3) **Temporary Sediment Basins** – A temporary sediment basins shall be constructed throughout the site as required and dictated by site conditions. The temporary sediment basins will handle storm water, filtering out sediment until the permanent stormwater drainage system is functioning properly. The temporary sediment basins will be lined with typical erosion controls.

Sediment Basin Design/Installation Requirements

a) Divert runoff from undisturbed areas away from basins.

b) The sediment basins should have a minimum volume based on ½ inch of storage for each acre of drainage area.

c) The length-to-width ratio should be 2:1 or greater; divert inflow to upper end of basin to avoid short-circuiting flow. Length is defined as the average distance from the inlet to the outlet of the trap.

d) Utilize side slopes of 3:1.

e) The sediment basins should be located as close to the sediment source as site conditions permit considering soils, pool area, dam length, and spillway conditions.

f) Line bottom with gravel and stabilize as soon as possible.

Sediment Basin Inspection/Maintenance *

a) The sediment basins should be readily accessible for maintenance and sediment removal. The sediment basins should remain in operation and be properly maintained until the site area is permanently stabilized by vegetation and/or when permanent structures are in place.

b) Inspect the sediment basins after each significant rainfall.

c) Remove and properly dispose of sediment when it accumulates to one-half design volume (level marked by reference stake). The effectiveness of a sediment pond is based less on its size than on regular sediment removal.

d) Check embankment and outlet for erosion damage.

e) Check embankment for: settlement, seepage, or slumping along the toe. Repair immediately. Remove trash and other debris from principal spillway and pool area.

f) Clean or replace gravel when sediment pool does not drain properly.

4) **Inlet Protection** – Inlet Protection will be utilized around the catch basin grates. The inlet protection will allow the storm drain inlets to be used before final stabilization. This structural practice will allow early use of the drainage system if the detention basin is already stabilized. Siltsack or equivalent will be utilized for the inlet protection. Siltsack is manufactured by ACF Environmental. The telephone number is 1-800-437-6746. Regular flow siltsack will be utilized, and if it does not allow enough storm water flow, hi-flow siltsack will be utilized.

Silt Sack (or equivalent) Inlet Protection Inspection/Maintenance Requirements *

a) All trapping devices and the structures they protect should be inspected after every rain storm and repairs made as necessary.

b) Sediment should be removed from the trapping devices after the sediment has reached a maximum depth of one-half the depth of the trap.

c) Oil build-up should be removed by using a small portable pump and disposed of in accordance with all applicable local, state, and federal regulations.

d) Sediment should be disposed of in a suitable area and protected from erosion by either structural or vegetative means. Sediment removed shall be disposed of in accordance with all applicable local, state, and federal regulations.

e) The silt sack must be replaced if it is ripped or torn in any way.

f) Temporary traps should be removed and the area repaired as soon as the contributing drainage area to the inlet has been completely stabilized.

Stabilization Practices:

Stabilization measures shall be implemented as soon as practicable in portions of the site where construction activities have temporarily or permanently ceased, but in no case more than 14 days after the construction activity in that portion of the site has temporarily or permanently ceased, with the following exceptions.

- Where the initiation of stabilization measures by the 14th day after construction activity temporary or permanently cease is precluded by snow cover, stabilization measures shall be initiated as soon as practicable.
- Where construction activity will resume on a portion of the site within 21 days from when activities ceased, (e.g. the total time period that construction activity is temporarily ceased is less than 21 days) then stabilization measures do not have to be initiated on that portion of the site by the 14th day after construction activity temporarily ceased.

1) **Temporary Seeding** – Temporary seeding will allow a short-term vegetative cover on disturbed site areas that may be in danger of erosion. Temporary seeding will be done at stock piles and disturbed portions of the site where construction activity will temporarily cease for at least 21 days. The temporary seedings will stabilize cleared and unvegetated areas that will not be brought into final grade for several weeks or months.

Temporary Seeding Planting Procedures *

a) Planting should preferably be done between April 1st and June 30th, and September 1st through September 31st. If planting is done in the months of July and August, irrigation may be required. If planting is done between October 1st and March 31st, mulching should be applied immediately after planting. If seeding is done during the summer months, irrigation of some sort will probably be necessary.

b) Before seeding, install structural practice controls. Utilize Amoco supergro or equivalent.

c) The seedbed should be firm with a fairly fine surface. Perform all cultural operations across or at right angles to the slope. A minimum of 2 to 4-inches of tilled topsoil is required. The topsoil must have a sandy loam to silt loam texture with 15% to 20% organic content.

d) Apply uniformly 2 tons of ground limestone per acre (100 lbs. Per 1,000 sq.ft.) or according to soil test. Apply uniformly 10-10-10 analysis fertilizer at the rate of 400 lbs. per acre (14 lbs. per 1,000 sq.ft.) or as indicated by soil test. Forty percent of the nitrogen should be in organic form. Work in lime and fertilizer to a depth of 4-inches using any suitable equipment.

e) Select the appropriate seed species for temporary cover from the following table.

Species	Seeding Rate (lbs/1,000 sq.ft.)	Seeding Rate (lbs/acre)	Recommended Seeding Dates	Seed Cover required
Annual Ryegrass	1	40	April 1st to June 1st August 15th to Sept. 15th	¼ inch
Foxtail Millet	0.7	30	May 1st to June 30th	½ to ¾ inch
Oats	2	80	April 1st to July 1st August 15th to Sept. 15th	1 to 1-½ inch
Winter Rye	3	120	August 15th to Oct. 15th	1 to 1-½ inch

Apply the seed uniformly by hydroseeding, broadcasting, or by hand.

f) Use an effective mulch, such as clean grain straw; tacked and/or tied with netting to protect seedbed and encourage plant growth.

Temporary Seeding Inspection/Maintenance *

a) Inspect within 6 weeks of planting to see if stands are adequate. Check for damage within 24 hours of the end to a heavy rainfall, defined as a 2-year storm event (i.e., 3.2 inches of rainfall within a twenty-four hour period). Stands should be uniform and dense. Fertilize, reseed, and mulch damaged and sparse areas immediately. Tack or tie down mulch as necessary.

b) Seeds should be supplied with adequate moisture. Furnish water as needed, especially in abnormally hot or dry weather. Water application rates should be controlled to prevent runoff.

2) **Geotextiles** - Geotextiles such as jute netting will be used in combination with other practices such as mulching to stabilize slopes. The following geotextile materials or equivalent are to be utilized for structural and nonstructural controls as shown in the following table.

Practice	Manufacturer	Product	Remarks
Sediment Fence	Amoco	Woven polypropylene 1198 or equivalent	0.425 mm opening
Construction Entrance	Amoco	Woven polypropylene 2002 or equivalent	0.300 mm opening
Outlet Protection	Amoco	Nonwoven polypropylene 4551 or equivalent	0.150 mm opening
Erosion Control (slope stability)	Amoco	Supergro or equivalent	Erosion control revegetation mix, open polypropylene fiber on degradable polypropylene net scrim

Amoco may be reached at (800) 445-7732

Geotextile Installation

a) Netting and matting require firm, continuous contact between the materials and the soil. If there is no contact, the material will not hold the soil and erosion will occur underneath the material.

Geotextile Inspection/Maintenance *

a) In the field, regular inspections should be made to check for cracks, tears, or breaches in the fabric. The appropriate repairs should be made.

3) **Mulching and Netting** – Mulching will provide immediate protection to exposed soils during the period of short construction delays, or over winter months through the application of plant residues, or other suitable materials, to exposed soil areas. In areas, which have been seeded either for temporary or permanent cover, mulching should immediately follow seeding. On steep slopes, mulch must be supplemented with netting. The preferred mulching material is straw.

Mulch (Hay or Straw) Materials and Installation

a) Straw has been found to be one of the most effective organic mulch materials. The specifications for straw are described below, but other material may be appropriate. The straw should be air-dried; free of undesirable seeds & coarse materials. The application rate per 1,000 sq.ft. is 90-100 lbs. (2-3 bales) and the application rate per acre is 2 tons (100-120 bales). The application should cover about 90% of the surface. The use of straw mulch is appropriate where mulch is maintained for more than three months. Straw mulch is subject to wind blowing unless anchored, is the most commonly used mulching material, and has the best microenvironment for germinating seeds.

Mulch Maintenance *

a) Inspect after rainstorms to check for movement of mulch or erosion. If washout, breakage, or erosion occurs, repair surface, reseed, remulch, and install new netting.

b) Straw or grass mulches that blow or wash away should be repaired promptly.

c) If plastic netting is used to anchor mulch, care should be taken during initial mowings to keep the mower height high. Otherwise, the netting can wrap up on the mower blade shafts. After a period of time, the netting degrades and becomes less of a problem.

d) Continue inspections until vegetation is well established.

4) **Land Grading** – Grading on fill slopes, cut slopes, and stockpile areas will be done with full siltation controls in place.

Land Grading Design/Installation Requirements

a) Areas to be graded should be cleared and grubbed of all timber, logs, brush, rubbish, and vegetated matter that will interfere with the grading operation. Topsoil should be stripped and stockpiled for use on critical disturbed areas for establishment of vegetation. Cut slopes to be topsoiled should be thoroughly scarified to a minimum depth of 3-inches prior to placement of topsoil.

b) Fill materials should be generally free of brush, rubbish, rocks, and stumps. Frozen materials or soft and easily compressible materials should not be used in fills intended to support buildings, parking lots, roads, conduits, or other structures.

c) Earth fill intended to support structural measures should be compacted to a minimum of 90 percent of Standard Proctor Test density with proper moisture control, or as otherwise specified

by the engineer responsible for the design. Compaction of other fills should be to the density required to control sloughing, erosion or excessive moisture content. Maximum thickness of fill layers prior to compaction should not exceed 9 inches.

d) The uppermost one foot of fill slopes should be compacted to at least 85 percent of the maximum unit weight (based on the modified AASHTO compaction test). This is usually accomplished by running heavy equipment over the fill.

e) Fill should consist of material from borrow areas and excess cut will be stockpiled in areas shown on the Site Plans. All disturbed areas should be free draining, left with a neat and finished appearance, and should be protected from erosion.

Land Grading Stabilization Inspection/Maintenance *

a) All slopes should be checked periodically to see that vegetation is in good condition. Any rills or damage from erosion and animal burrowing should be repaired immediately to avoid further damage.

b) If seeps develop on the slopes, the area should be evaluated to determine if the seep will cause an unstable condition. Subsurface drains or a gravel mulch may be required to solve seep problems. However, no seeps are anticipated.

c) Areas requiring revegetation should be repaired immediately. Slopes should be limed and fertilized as necessary to keep vegetation healthy. Control undesirable vegetation such as weeds and woody growth to avoid bank stability problems in the future.

Dust Control *:

Dust control will be utilized throughout the entire construction process of the site. For example, keeping disturbed surfaces moist during windy periods will be an effective control measure, especially for construction haul roads. The use of dust control will prevent the movement of soil to offsite areas. However, care must be taken to not create runoff from excessive use of water to control dust. The following are methods of Dust Control that may be used on-site:

- Vegetative Cover – The most practical method for disturbed areas not subject to traffic.
- Calcium Chloride – Calcium chloride may be applied by mechanical spreader as loose, dry granules or flakes at a rate that keeps the surface moist but not so high as to cause water pollution or plant damage.
- Sprinkling – The site may be sprinkled until the surface is wet. Sprinkling will be effective for dust control on haul roads and other traffic routes.
- Stone – Stone will be used to stabilize construction roads; will also be effective for dust control.

Non-Stormwater Discharges:

During construction activities at the site, some water from the site will be suitable for discharge to the detention areas and/or temporary sediment basin areas. Non-stormwater discharges will be directed to recharge groundwater and to replenish wetland resource areas.

The construction de-watering and all non-stormwater discharges will be directed into a sediment dirt bag (or equivalent inlet protection) or a sediment basin. Sediment material removed shall be disposed of in accordance with all applicable local, state, and federal regulations.

The developer and site general contractor will comply with the E.P.A.'s Final General Permit for Construction De-watering Discharges, (N.P.D.E.S., Section 402 and 40 C.F.R. 122.26(b)(14)(x).

Soil Stockpiling *:

Topsoil and subsoil from the roadway grading will be stockpiled in locations shown on the plans.

Stockpile Material Construction Procedure

1) Topsoil and subsoil that are stripped will be stockpiled for later distribution on disturbed areas.
2) The stockpiles will be located as shown on the plans. These locations will allow them to not interfere with work on the site.
3) Seed the stockpiles with a temporary erosion control mix if the stockpile is to remain undisturbed for more than 30 days. The stockpiles must be stable and the side slopes should not exceed 2:1.
4) Sediment Fence/Hay Bale Barrier erosion control measures should be placed surrounding each stockpile.
5) As needed, the stockpiled topsoil and subsoil are redistributed throughout the site.

Appendix H

Post-Construction Operation & Maintenance Plan

Post-Construction Stormwater Operation & Maintenance Plan

Site Development
MF Nursery Expansion
1049 West Street, Walpole, MA

March 5, 2024

Prepared By: Scott P. Henderson, PE

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Best Management Practices (BMPs) recommended by the MA DEP Stormwater Management Handbook and accepted design practice have been implemented and utilized for the project. The following information provided is to be used as a guideline for monitoring and maintaining the performance of the drainage facilities constructed as part of the site development. The structural Best Management Practices (BMPs) shall be inspected during rainfall conditions annually to verify functionality.

Responsible Party

MF Nursery – Michael Freiberger, Owner
965 West Street
Walpole, MA 02081

BMPs included in the design consist of the use of:

- Sediment Forebay
- Detention and Infiltration basins
- Vegetated Filter Strip
- Outlet protection
- Restrictions on the use of pesticides and herbicides within the 100 foot buffer zone

Operation:

Once the detention/infiltration basins have been constructed and the site has been permanently stabilized and the stormwater facilities are online, the operation of the stormwater management system will function as intended. Stormwater runoff is directed from the gravel stockpile area across the rip-rap stone diaphragm and vegetated filter strip and into the sediment forebay adjacent to the infiltration basin. Overflow from the infiltration basin is controlled by an outlet control structure routed to a culvert that discharges just outside of the 25-foot BVW buffer.

The following maintenance should be performed as prescribed to ensure proper operation of the stormwater management system.

Maintenance:

Sediment Forebay – The runoff directed into the stormwater basin first flows through a sediment forebay. This sub-basin, which is demarcated by the stone rip-rap check dam that retains incoming runoff, allows solids within the stormwater to settle onto the basin surface. It is imperative that this forebay is maintained regularly to prevent premature failure of the stormwater basin.

The forebay should be cleaned of accumulated sediment monthly during regular landscape maintenance. The bottom of the forebay is planted with the same grass as the infiltration basin and should be maintained by mowing such that the grass height is always between 3 and 6 inches.

Annual Cost Estimate: $1,500

Detention / Infiltration Basins – The detention and infiltration basins shall be checked for debris accumulation on a quarterly basis. Additional inspections should be scheduled during the first few months after construction to make sure that the vegetation becomes adequately established. Trash, leaves, branches, etc. shall be removed from facility. Silt, sand and sediment, if significant accumulation occurs,

shall be removed by hand annually. Material removed from the basin or swale shall be disposed of in accordance with all applicable local, state, and federal regulations. The detention and infiltration basins shall be kept free of woody vegetation by mowing at least once per year. Reseeding, weed control, and invasive species removal may need to be performed periodically to maintain healthy vegetation and maintain the pollutant removal efficiency of the facilities.

In the case that water remains in the infiltration section of the basin for greater than three (3) days after a storm event, an inspection is warranted and necessary maintenance repairs to the subsurface layers of the basin to restore the infiltration function are required.

Any slope erosion within the facilities shall be stabilized and repaired as soon as practical. The outlet structure and embankment shall be inspected annually for structural integrity. The inspections shall be conducted by a licensed engineer or qualified professional (inspector).

Annual Cost Estimate: $1,000

Vegetated Filter Strip & Rip-Rap Diaphragm – The stone diaphragm and vegetated filter strip between the gravel area and the sediment forebay should be cleaned regularly to ensure proper pre-treatment of runoff. Clean debris and sediment build-up from the filter strip monthly and re-seed bare spots as needed. Mowing the grass filter-strip monthly to a height of 4" minimum is recommended to ensure that TSS removal is maintained.

Annual Cost Estimate: $1,000

Outlet Protection - All outfall protection structures shall be inspected quarterly and following major storm events defined as a storm event exceeding one inch of rainfall within a twenty-four hour period to check for signs for erosion. Any necessary repairs shall be performed promptly and cleaned to remove accumulated sediment as necessary. Material removed shall be disposed of in accordance with all applicable local, state, and federal regulations. Rip-Rap overflow structure shall be weeded and cleaned on a quarterly basis to ensure that water overflowing the spillway will not become obstructed by debris.

Annual Cost Estimate: $500

Pesticides, Herbicides and Fertilizers: - Pesticides and herbicides shall not be used within the limits 100-foot buffer. In addition, fertilizers that are used within this zone should be restricted to the use of organic fertilizers only.

Maintenance Responsibilities:

All post construction maintenance activities will be documented and kept on file. Annual inspection reports in the form of an Evaluation Checklist, see attached form, will be submitted to the Town of Walpole Conservation Commission upon request. Inspections shall be performed by a licensed engineer or similar professional (inspector).

All post construction maintenance activities shall survive the Order of Conditions and shall run with the title of the property.

Long-Term Pollution Prevention Plan

Good Housekeeping:

To develop and implement an operation and maintenance program with the goal of preventing or reducing pollutant runoff by keeping potential pollutants from coming into contact with stormwater or being transported off site without treatment, the following efforts will be made:

- Property Management awareness and training on how to incorporate pollution prevention techniques into maintenance operations.
- Follow appropriate best management practices (BMPs) by proper maintenance and inspection procedures.
- Resident education outreach, including promoting recycling.

Storage and Disposal of Household Waste and Toxics:

This management measure involves educating the general public on the management considerations for hazardous materials. Failure to properly store hazardous materials dramatically increases the probability that they will end up in local waterways. Many people have hazardous chemicals stored throughout their homes. Practices such as covering hazardous materials or even storing them properly, can have dramatic impacts. Property owners are encouraged to support the household hazardous product collection events sponsored by the Town of Walpole.

MADEP has prepared several materials for homeowners on how to properly use and dispose of household hazardous materials:

http://www.mass.gov/dep/recycle/reduce/househol.htm

For consumer questions on household hazardous waste call the following number:

DEP Household Hazardous Waste Hotline 800-343-3420

The following is a list of commonly used hazardous materials used in the household:

Batteries – automotive and rechargeable
nickel cadmium batteries
(no alkaline batteries)
Gasoline
Oil-based paints
Fluorescent light bulbs and lamps
Pool chemicals
Propane tanks
Lawn chemicals,
fertilizers and weed killers
Turpentine
Bug sprays
Antifreeze
Paint thinners, strippers, varnishes and stains
Arts and crafts chemicals
Charcoal lighter fluid

Disinfectant
Drain clog dissolvers
Driveway sealer
Flea dips, sprays and collars
Houseplant insecticides
Metal polishes
Mothballs
Motor oil and filters
Muriatic acid (concrete cleaner)
Nail polishes and nail polish removers
Oven cleaner
Household pest and rat poisons
Rug and upholstery cleaners
Shoe polish
Windshield wiper fluid

Vehicle Washing:

Vehicle washing on the property will be prohibited.

Landscape Maintenance:

This management measure seeks to control the storm water impacts of landscaping and lawn care practices through education and outreach on methods that reduce nutrient loadings and the amount of storm water runoff generated from lawns. Nutrient loads generated by fertilizer use on suburban lawns can be significant, and recent research has shown that lawns produce more surface runoff than previously thought.

Using proper landscaping techniques can effectively increase the value of a property while benefiting the environment. These practices can benefit the environment by reducing water use; decreasing energy use (because less water pumping and treatment is required); minimizing runoff of storm and irrigation water that transports soils, fertilizers, and pesticides; and creating additional habitat for plants and wildlife. The following lawn and landscaping management practices will be encouraged:

- Mow lawns at the highest recommended height.
- Abide by water restrictions and other conservation measures implemented by the Town of Walpole.
- Water only when necessary.
- Use automatic irrigation systems to reduce water use.

Integrated Pest Management (IPM):

This management measure seeks to limit the adverse impacts of insecticides and herbicides by providing information on alternative pest control techniques other than chemicals or explaining how to determine the correct dosages needed to manage pests.

The presence of pesticides in stormwater runoff has a direct impact on the health of aquatic organisms and can present a threat to humans through contamination of drinking water supplies. The pesticides of greatest concern are insecticides, such as diazinon and chloropyrifos, which even at very low levels can be harmful to aquatic life. The major source of pesticides to urban steams is home application of products designed to kill insects and weeds in the lawn and garden. The following IPM practices will be encouraged:

- Raise public awareness by referring homeowners to “A Homeowner’s Guide to Environmentally Sound Lawncare, Maintaining a Healthy Lawn the IPM Way”, Massachusetts Department of Food and Agriculture, Pesticide Bureau.

Pet Waste Management:

Pet waste management involves using a combination of pet waste collection programs, pet awareness and education, to alert residents to the proper disposal techniques for pet droppings. The following management practices will be encouraged:

- Raise awareness of homeowners that are also pet owners that they are encouraged to pick up after their pets and dispose of the waste either in the trash.

Proper Management of Deicing Chemicals and Snow:

Parking areas and roadways shall be maintained by the Developer/Property Owners in perpetuity. The following deicing chemicals and snow storage practices will be encouraged:

- Select effective snow disposal sites adjacent to or on pervious surfaces where possible. At these locations, the snow meltwater can filter in to the soil, leaving behind sand and debris, which can be removed in the springtime.
- No roadway deicing materials shall be stockpiled on site unless all storage areas are protected from exposure to rain, snow, snowmelt and runoff.
- Avoid disposing of snow on top of storm drain catch basins.