STORMWATER MANAGEMENT REPORT

Follins Pond Boat Ramp - Yarmouth, MA

January 2024

Cape Cod Boat Ramp Stormwater Retrofit Project

Partner: Association to Preserve Cape Cod
Owner/Operator: Town of Yarmouth

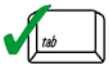
Horsley Witten Group

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.

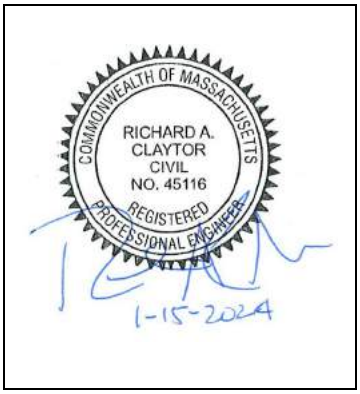
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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



1/15/2024

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): Underground infiltration chambers

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.

STORMWATER MANAGEMENT REPORT

FOLLINS POND BOAT RAMP
CAPE COD BOAT RAMP STORMWATER RETROFIT PROJECT
YARMOUTH, MA

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EXECUTIVE SUMMARY

The purpose of this report is to describe existing and proposed site drainage conditions at the Follins Pond Boat Ramp, as well as measures to prevent stormwater pollution during and after construction. This project is part of a regional effort led by the Association to Preserve Cape Cod (APCC) to improve water quality at public boat ramps on Cape Cod by implementing green stormwater infrastructure (GSI) retrofits. This site is identified as a priority under the Cape Cod Water Resources Restoration Project (CCWRRP) and as such, additional input and review of the design was conducted by the Natural Resources Conservation Science (NRCS) and the Cape Cod Conservation District (CCCD). The main goal for this site is to better capture, manage and treat stormwater runoff from Follins Pond Road and Gun Rock Road prior to entering Follins Pond. Follins Pond Road and Gun Rock Road have steep existing grades and the existing drainage infrastructure (e.g., catchbasins and underground infiltration systems) cannot currently capture all of the runoff in the catchment area. While part of this project is to implement new GSI along Follins Pond Road and Gun Rock Road, the project will also improve the ability of the existing infiltration systems to capture more runoff than it currently does.

The project includes the following structural and non-structural stormwater control measures (SCMs):

- Deep Sump Catchbasins for Pretreatment
- Infiltration Trenches to Store and Infiltrate Runoff
- Underground Infiltration Chambers for Managing Large Storm Events
- Pavement Regrading and Resetting & Replacing Grates of Existing Catchbasins to Capture More Runoff

Since the proposed stormwater management system is a retrofit project undertaken solely to improve water quality at the site, it falls under the redevelopment category in accordance with the Massachusetts Stormwater Management Standards (MASMS 2008), as described in Massachusetts Stormwater Handbook, Volume 1 Chapter 1. As a redevelopment project, the design is required to meet the MASMS standards to the maximum extent practicable (MEP).

As shown in **Table 1,** the proposed project meets or exceeds each standard**,** except the recharge, water quality, and critical areas standards, which is met to the MEP. Each of the proposed treatment SCMs (infiltration trenches) are designed to capture and treat the full one inch of runoff of their contributing drainage areas, either alone or in combination with the existing infiltration systems. Some areas of the site could not be captured due to site constraints, as Follins Pond Road and Gun Rock Road are privately-owned and require abutter approval prior to work being done in the Town-managed right-of-way. However, through the integration of underground infiltration chambers and regrading and resetting the existing catchbasin rims, the proposed design reduces peak runoff flow rates and volumes for the 2-, 10-, 25-, and 100-year storms. Overall, this project will significantly improve conditions at the Follins Pond Boat Ramp and reduce on-going impacts to Follins Pond and downstream resources.

Table 1. Project MASMS Compliance Summary

	Minimum Standard	Type	Compliance	Report Reference(s)
1	**New Stormwater Conveyances**	Narrative	Yes	Section 3.2
2	**Water Quantity**	Calculation	Yes	Section 4.3/Table 6/Appendix B
3	**Recharge**	Calculation	Yes	Section 4.2/Table 5/Appendix B
4	**Water Quality**	Calculation	MEP	Section 4.1/Table 3/Table 4/Appendix B
5	**Land Uses with Higher Potential Pollutant Loading**	Narrative	Not Applicable	Section 2.0
6	**Critical Areas**	Narrative	MEP	Section 4.1
7	**Redevelopment**	Narrative	Yes	Section 4.0
8	**Erosion Control**	Narrative	Yes	Section 4.4/Appendix G
9	**Operation and Maintenance**	Narrative	Yes	Section 4.5/Appendix E
10	**Illicit Discharges**	Narrative	Yes	Section 4.6

1.0 INTRODUCTION

This report provides a summary of the stormwater management systems proposed for the Follins Pond Boat Ramp in Yarmouth, MA, a Town-operated boat ramp (**Figure 1**). The Yarmouth Department of Natural Resources and Department of Public Works are proposing this project in collaboration with the Association to Preserve Cape Cod (APCC) as a part of a regional effort (Cape Cod Boat Ramp Stormwater Retrofit Project) to improve water quality at public boat ramps across Cape Cod. The proposed project has been designed to retrofit existing impervious areas for water quality improvements while also managing runoff from larger storms and improving overall site conditions. This report describes the existing and proposed site conditions and the practices to be implemented to reduce stormwater discharges and pollutants during and after construction. As required for retrofit projects, the stormwater system for the project has been designed to conform to the requirements of the Massachusetts Stormwater Standards (MASMS) to the maximum extent practicable.

1.1 Background

Freshwater ponds and coastal embayments across Cape Cod are significantly degraded by nutrient and bacteria impairment. Land uses, including stormwater runoff and fertilizer use, contribute on average 20% of the controllable nitrogen load within our coastal watersheds (Cape Cod Commission 208 Plan, 2015) and bacterial contamination, including cyanobacteria, regularly causes closures of beaches. In report (APCC's 2022 State of the Waters), 90% of the coastal embayments and 39% of the freshwater ponds assessed received unacceptable water quality scores. These high nutrient loads are of concern for the environment, our coastal economy, and public health as they negatively impact habitat for fish and shellfish and can result in unsafe conditions for swimming, fishing and boating. Public boats ramps are a common source of pollution in areas of high recreational use. As such, these locations have been targeted by APCC's regional project. This site is identified as a priority under the Cape Cod Water Resources Restoration Project (CCWRRP) and as such, additional input and review of the design was conducted by the Natural Resources Conservation Science (NRCS) and the Cape Cod Conservation District (CCCD).

As part of an EPA Southeast New England Program (SNEP) Watershed Grant, APCC and partners first identified 20 public boat ramps across 10 Cape Cod towns in need of improved stormwater management. Concept designs for each of these twenty sites were ranked based on various criteria including potential pollutant removal (i.e., load and drainage area), water quality status of the associated waterbody, construction cost and feasibility, and additional human use and resource benefits (restored shellfish and anadromous fish habitat, proximity to environmental justice communities, improved climate resiliency, opportunity for public education, etc.). With additional funding from a CZM FY23 Coastal Habitat and Water Quality Grant, 25% and 75% designs were developed for seven high-ranking priority sites, including this one at Follins Pond, which has a direct connection to Nantucket Sound via a surface water stream (Bass River).

1.2 Project Goals

The purpose of this project is to improve water quality in Follins Pond and downstream waters by reducing or eliminating pollutant loads from stormwater runoff at the public boat ramp using green stormwater infrastructure (GSI) stormwater control measures (SCMs). Specifically, the project aims to maximize pollutant removal (% bacteria, nitrogen and phosphorus) and water quality volume treated. Follins Pond Road and Gun Rock Road have existing steep grades, so it is difficult to capture all the runoff into the existing drainage infrastructure (e.g., catchbasins and infiltration systems). The project will also help to direct more runoff into the existing infiltration systems to reduce overall flows to Follins Pond. Over time, we hope this work leads to a reduction in the frequency and/or length of prohibitions to shellfish farming/harvesting in the pond and downstream embayments related to bacteria contamination or cyanobacteria blooms; reduction in nutrients and associated algal blooms, including toxic cyanobacteria blooms, in the pond and downstream embayments; and improvements to the Bass River system.

1.3 Design Methodology

The design was completed by the following tasks:

- Preliminary field assessment of the site and contributing drainage area to identify usage, physical and environmental constraints and opportunities, and long-term operation and maintenance concerns;
- Determination of drainage areas and land coverage within the project area;
- Selection of structural and non-structural SCMs best suited to site conditions and project goals;
- Structural SCM sizing and performance estimates (described further below);
- Hydrologic/Hydraulic Modeling (described further below);
- Grading and layout of site plan;
- Erosion control plan development; and
- Operation and maintenance (O&M) plan development.

SCM Performance Estimates

The proposed SCMs were selected and sized to maximize pollutant load removals. Since the waterbodies this site drains to are shellfish growing areas and have water quality impairments and are subject to TMDLs, the SCMs were chosen to maximize not only total suspended solids (TSS) removal, but total nitrogen (TN), total phosphorus (TP) and bacteria load reductions as well. MASMS was used as a reference for TSS removal estimates for infiltration trenches, but the more recently developed pollutant load removal curves (USEPA 2021 & Paradigm Environmental 2019) were used for TP, TN, and bacteria.[1]

Hydrologic/Hydraulic Modeling

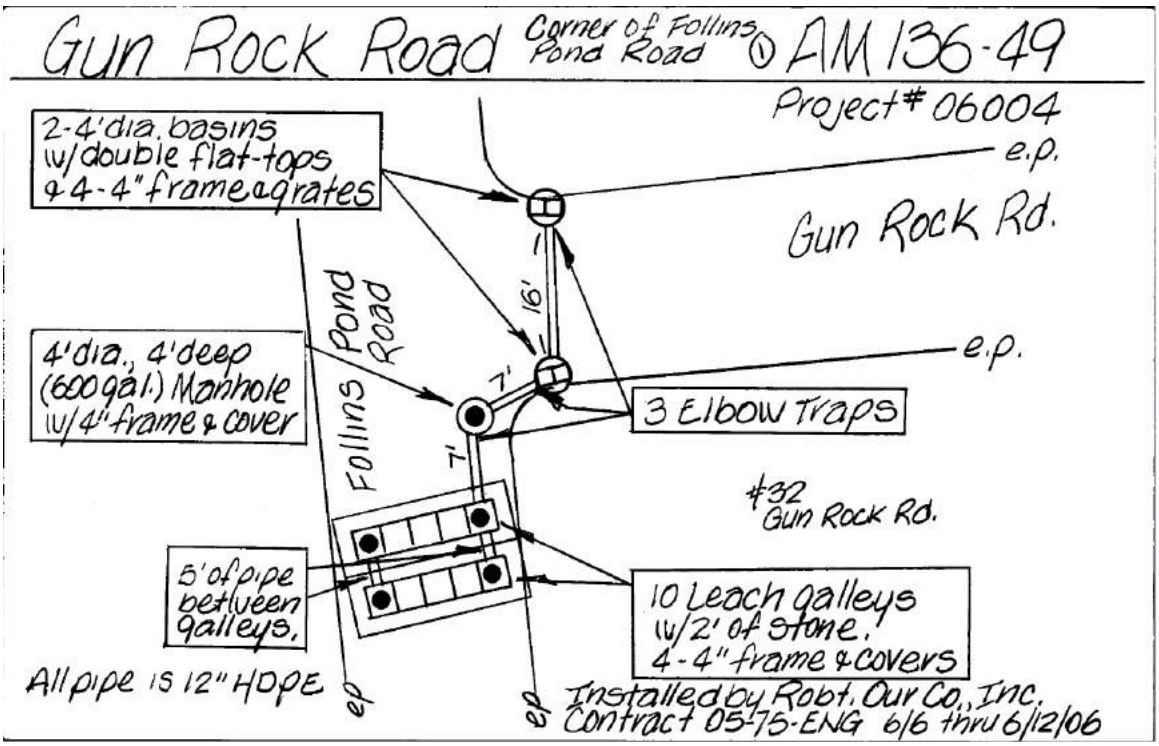
Existing and proposed conditions for the project area were modeled using HydroCAD software, which combines USDA Natural Resources Conservation Service hydrology and hydraulic techniques (commonly known as SCS TR-55 and TR-20) to generate hydrographs. Conditions were evaluated for the water quality event (storm that produces 1 inch of runoff, or a roughly 1.2-inch rain event) as well as larger storm events, including the 2-, 10-, 25- and 100-year 24-hour Type III storm events. The rainfall depths used for each storm event are the NOAA+ values (NOAA Atlas 14 90% Upper Confidence value multiplied by 0.9) (NOAA NWS, 2017). Rainfall values are included in **Appendix A**.

2.0 Existing Conditions

The Follins Pond boat ramp is a water access point on Follins Pond. The area is intended for fishing and boating purposes only. This land use is not classified as a land use with higher potential pollutant loads (LUHPPL) and thus, is not subject to MASWMS **Standard 5**.

The project site includes an access road (Follins Pond Road) down to a boat ramp, with parking predominantly occurring along the west side of the road (**Figure 2**). The existing pavement is in good condition. The Town installed a series of three infiltration systems along Follins Pond Road (see Figure below, which shows the plan for the infiltration system at the intersection of Gun Rock Road and Follins Pond Road), and double catchbasins on either side of the road to capture runoff and provide pretreatment before discharging into the infiltration system located below the road. Follins Pond Road is steep, making it challenging for the existing catchbasins to capture all of the stormwater flowing down the road. Follins Pond Road also has a flat cross slope (e.g., not crowned), so stormwater is not concentrated in a gutter line and often bypasses the existing catchbasins. Furthermore, the catchbasin rims are at the same grade as the road around it.

[1] It is important to note that these curves have a crosswalk to help users determine which specific curve to reference: for infiltrating trenches and infiltration chambers, the appropriate curve is the Infiltration Trench (Soil infiltration rate = 8.27 in/hr) Performance Curve.



2.1 Receiving Water and Watershed

Follins Pond boat ramp discharges stormwater into Follins Pond, an estuarine pond at the headwaters of the Bass River. The pond provides habitat for shellfish growing areas. However, it is listed as impaired for total nitrogen and nutrient/eutrophication biological indicators by the most recent Massachusetts DEP 303(d) – 2018/2020 Integrated list of Waters, and APCC's State of the Waters Report lists it as unacceptable for nutrient loading.

Follins Pond is located in the Bass River Watershed, for which total maximum daily load documents (TMDLs) have been developed for nitrogen. The full list of impairments for this portion of the watershed is listed below, and a map showing these resources is included in **Figure 4**:

- Follins Pond (MA96-114) Yarmouth, Bass River Watershed – Impaired for total nitrogen and nutrient/eutrophication biological indicators; Category 4a (TMDL completed) of the 2018/2020 Integrated List of Waters.
- Kelleys Bay (MA96-113) Yarmouth, Bass River Watershed – Impaired for total nitrogen and nutrient/eutrophication biological indicators; Category 4a (TMDL completed) of the 2018/2020 Integrated List of Waters.
- Dinahs Pond (MA96-112) Yarmouth, Bass River Watershed – Impaired for total nitrogen and nutrient/eutrophication biological indicators; Category 4a (TMDL completed) of the 2018/2020 Integrated List of Waters.

- Bass River (MA96-118) "Grand Cove" portion, Yarmouth, Bass River Watershed – Impaired for total nitrogen and nutrient/eutrophication biological indicators; Category 4a (TMDL completed) of the 2018/2020 Integrated List of Waters.
- Bass River (MA96-12) Headwaters outlet, Yarmouth, Bass River Watershed – Impaired for total nitrogen, fecal coliform, and estuarine bioassessments; Category 4a (TMDL completed) of the 2018/2020 Integrated List of Waters.

2.2 Drainage Area

The boat ramp's existing contributing drainage area is approximately 7.9 acres. This area consists of undisturbed forest, residential properties, small lawn areas, and roads. Based on existing topography and flow paths, the total drainage area was divided into four separate drainage areas: DA0 (southern area that drains to the boat ramp), DA1 (drains to infiltration system 1), DA2 (drains to infiltration system 2), and DA3 (Gun Rock Road and area north that drains to infiltration system 3).

While DA1, DA2, and DA3 were delineated as the areas draining to each existing infiltration system, the existing infiltration systems are not modeled in HydroCAD. Due to the lack of crown in the road and steep slope, most stormwater bypasses the catchbasin inlets to these systems and continues down the road as surface runoff. This has been confirmed by HW and Town staff. As a conservative estimate, HW has assumed the existing systems only account for a 15% reduction in runoff. All drainage areas eventually drain to the pond at the boat ramp, modeled as Study Point 1 (SP1). See the existing conditions drainage area map and a detailed breakdown of land cover in **Appendix A,** as well as the existing HydroCAD model report in **Appendix B.**

2.3 Resource Areas

HW wetland biologists delineated several resource areas at the site in January 2023. A full description of these resource areas is included in **Appendix C**, and their locations and associated buffers are shown on the plans in **Appendix G**. The wetland resource areas identified on or adjacent to the site include Salt Marsh; Coastal Bank; Land Subject to Coastal Storm Flowage (LSCSF); and the 35-foot, 50-foot, and 100-foot Buffer Zones Land Under Waterbodies and Waterways (LUW) and Banks of Land Under the Ocean, Ponds, Streams, Rivers, Lakes, or Creeks that Underlie an Anadromous/Catadromous Fish Run ("Fish Run"). The site also occurs within a Coastal Watershed Area; however, the proposed project activities do not incorporate any of the prohibited practices referenced in section 2.11(1)(b)(1-6) of the Yarmouth Wetland Regulations.

While much of the vegetation at the site is native woodlands, one invasive plant(Asiatic Bittersweet) were present at or near the site but were isolated to a small area of the Coastal Bank just west of Follins Pond Road and limited in abundance.

The project site at the southern end of Follins Pond Road are located within a Special Flood Hazard Area, Zone AE (1% annual chance of flooding, with base flood elevations of 9 feet) (**Appendix C**). Since the site discharges near a shellfish growing area, it is considered a critical area and subject to MASWMS **Standard 6**.

2.4 Soils

Soils data from the Natural Resources Conservation Service (NRCS) indicate that the soils within the drainage area are composed entirely of Carver coarse sand, at 3-35% slopes. Carver coarse sand is hydrologic soil group A (HSG), as shown in **Figure 5**.

Three test pits (TP) were conducted at the site on January 19, 2023 to evaluate subsurface conditions and estimated seasonal high groundwater (ESHGW) based on evidence of mottling or redox. The test pits were witnessed and logged by an HW Massachusetts Title 5 Approved Soil Evaluator; results are shown in **Table 2** below.

Test pits were conducted just in three areas: the western part of Follins Pond Road near the boat ramp (TP-1), the intersection of Follins Pond Road and Gun Rock Road on the eastern side of Follins Pond Road (TP-2), and the curve in Gun Rock Road on the southern side of the road (TP-3). The parent material of the native soil unit, Carver Coarse Sand is sandy glaciofluvial, comprising mostly outwash plain and moraine landforms. Based on the depth of the proposed SCMs, a design infiltration rate (Rawls) of 8.27 in/hr is used. See **Appendix D** for soil test pit logs. No groundwater features were observed in the test pits, so ESHGW was assumed at pit bottom.

Table 2. Test Pit (TP) Results

Test Pit ID	Surface Elevation at TP (ft)	Pit Bottom Elevation (ft)	ESHGW Elevation (ft)	Soil Texture(s) at SCM	Design Infiltration Rate (in/hr)	Notes
TP-1	6.9	-0.6	Below -0.6	Medium sand	8.27	ESHGW placed at pit bottom for design purposes. However, actual ESHGW is likely much lower.
TP-2	34.2	27.7	Below 27.7	Medium sand	8.27	
TP- 3	37.2	29.2	Below 29.2	Fine sand	8.27	

3.0 Proposed Conditions

The proposed project consists of the following stormwater and related site development improvements:

- Regraded and resurfaced parts of Follins Pond Road, including resetting existing catchbasin rims, to better capture runoff;
- Regraded and resurfaced the southern portion of Gun Rock Road to better direct runoff;
- GSI including infiltration trenches and underground infiltration chambers; and
- Protection of as many existing mature trees as possible.

The proposed GSI system is designed to meet the following major objectives:

- Capture, treat, and infiltrate at least the first one inch of runoff; and

- Reduce peak flows and runoff volumes from the site by infiltrating the 25-year storm runoff volume (chambers only).

3.1 Drainage Areas

The boat ramp's contributing drainage area under proposed conditions is very similar to existing, with a total of approximately 7.9 acres. While DA0 (to the Pond) and DA1 (existing Infiltration System 1) remained the same, DA2 and DA3 were subdivided for the proposed conditions in order to model flows to the proposed SCMs. The proposed DA2 drainage areas are DA2 (existing Infiltration System 2), DA2A (new Infiltration Trench 1), and DA2B (new Infiltration Trench 2). The proposed DA3 drainage areas are DA3 (new Infiltration Trench 3), DA3A & DA3B (existing Infiltration System 3), and DA3C (new catch basin and infiltration chambers). The model assumes that all runoff is able to enter the existing infiltration systems due to the retrofits and site improvements. The majority of the site will discharge eventually to Study Point 1 (SP1), similar to in existing conditions.

See the proposed conditions drainage area map and a detailed breakdown of land cover in **Appendix A,** as well as the proposed HydroCAD model report in **Appendix B.**

3.2 Structural Stormwater Control Measures (SCMs)

The proposed stormwater management includes a GSI approach to capture, treat, infiltrate, and detain runoff by using the following SCMs. There are four stormwater GSI practices proposed throughout the site - three of the practices are infiltration trenches and one is an underground infiltration chamber system. Pretreatment will be provided with deep sump catchbasins. The stormwater management systems were designed to meet **Standard 1**, so that no new untreated stormwater runoff will be directed to any off-site areas or resource areas. Runoff from contributing impervious areas will be treated by the proposed practices.

Deep Sump Catchbasin

Deep sump catchbasins have a sump for pretreatment of the runoff from the paved surfaces to allow for sediment and other debris to settle out prior to conveyance into the infiltration trenches or chamber system.

Infiltration Trenches (IT)

An infiltration trench is an underground practice that detains, treats, and infiltrates runoff. It is identical to a tree trench without trees. There three infiltration trenches are proposed in the right of way. The space and grade of the site only allow the addition of trees in one of the infiltration trenches (IT3). The system consists of pretreatment via deep sump catchbasin(s) with a grate, a perforated inflow pipe, the stone storage reservoir, and native plantings. Once the trench reaches capacity, the upstream structure will fill with stormwater and runoff will bypass the catch basin grates and continue down the boat ramp. The infiltration trenches have greater than 2-feet separation to ESHGW as required.

Underground Infiltration Chambers (UICs)

Underground infiltration chambers (UICs) include a range of proprietary, modular structures embedded in clean, crushed stone. They are installed underground, typically under parking or landscaped areas, and create large void spaces for temporary storage of stormwater, allowing it to rapidly fill during storm events and slowly infiltrate into the underlying native soil after a storm event.

One UIC is proposed under Gun Rock Road. It is sized to fully retain and infiltrate runoff from the 25-year storm event for the contributing drainage areas, as requested by the Town. UIC-1 manages runoff from DA3C. Runoff from the 100-year storm will exceed the capacity of these systems, and the excess will discharge down the road to the boat ramp and be captured by a downstream existing infiltration system. UIC-1 has greater than 2-feet separation to ESHGW as required.

Existing Infiltration Systems (IS)

The existing infiltration systems consist of concrete galleys that provide underground temporary storage of stormwater. Like the underground infiltration chambers, the concrete galleys rapidly fill during storm events and allow stormwater to slowly infiltrate into the underlying native soil after a storm event.

There are three of these existing systems, two in the lower section of Follins Pond Road and one at the Follins Pond Road/Gun Rock Road intersection.

3.3 Retrofitting existing drainage infrastructure

As part of this project, improvements will be made to the existing drainage infrastructure, including:

- Regrading and paving of the road to better direct stormwater towards the existing catchbasins,
- Resetting the rim elevations of the existing catchbasins to lower them slightly, and
- Replacing the grates with high-capacity catchbasin grates to better capture runoff directed to the catchbasins.

With these improvements, more stormwater runoff will actually get to and flow into the existing catchbasins and infiltrate through the infiltration systems.

3.4 Non-structural SCMs

The non-structural SCMs proposed at the site include Town management of the existing infiltration systems and street sweeping. The Town will institute a regular inspection schedule of the existing infiltration systems (and associated catchbasins) to ensure they are functioning as designed. The existing infiltration systems are included in this project's O&M Guide (**Appendix E**) to ensure they are inspected, cleaned, and maintained. Leaf litter and sediment was observed on site throughout the year. Regular street sweeping will help remove leaf litter and sediment so that it does not clog the existing or proposed drainage infrastructure.

4.0 Stormwater Design Components

The proposed SCMs were designed to meet a variety of goals and regulatory requirements as discussed above. As a retrofit project for managing existing impervious cover, this design must specifically comply with the redevelopment standard (MASMS **Standard 7)** by meeting all standards to the maximum extent practicable. The project fully meets this standard, as described in detail below.

4.1 Water Quality

The main purpose of this retrofit project is to improve water quality. This section describes the treatment volumes and pollutant load reductions achieved by the proposed design and how they compare to the MASMS standards.

Treatment Volume

Per **Standard 4** of MASMS, the stormwater management system for a new development site discharging to a critical area must be sized to treat the first one inch of runoff from impervious area (IA) and remove 80% or more of the annual post-construction load of total suspended solids (TSS). As a retrofit (falls under **Standard 7** – Redevelopment), the project is only required to meet this to the maximum extent practicable. However, the proposed and retrofitted existing infiltration systems are sized to treat the full one-inch water quality volume (WQV) for their contributing drainage areas where possible, and only a small portion of the site could not be captured and treated at all (DA0). The proposed HydroCAD model results showing treatment of the full water quality volume are included in **Appendix B** and summarized below in **Table 3**.

Table 3. Compliance with Water Quality Volume (WQV) Requirements

DA ID	SCM ID	IA* (ac)	WQv Goal (ac-ft)	WQv Provided (ac-ft)**	% WQv Provided	Meets Requirement?	Notes
DA0	NA	0.17	0.014	0.000	0%	N	Boat Ramp not captured for this retrofit project given space and land use
DA1	IS1	0.06	0.005	0.005	100%	Y	
DA2	IS2	0.03	0.002	0.002	100%	Y	
DA2A	IT1	0.05	0.004	0.004	100%	Y	
DA2B	IT2	0.13	0.011	0.011	100%	Y	
DA3	IT3, IS3	0.18	0.015	0.015	100%	Y	Infiltration trench treats approx. 0.5-inch runoff, remaining runoff is treated in existing system
DA3A	IS3	0.13	0.011	0.011	100%	Y	
DA3B	IS3	0.34	0.028	0.028	100%	Y	
DA3C	C1	0.87	0.073	0.073	100%	Y	
TOTAL SITE:		**1.941**	**0.163**	**0.149**	**91%**	**MEP**	**MEP for Retrofit Projects**

**Impervious Area*

***From HydroCAD results – see Appendix B for volume "discarded" for WQv Event*

Pollutant Load Reductions

The infiltration trenches and chambers exceed the MASMS requirements for TSS removal and maximize removals of the other pollutants of concern. Estimated TSS, phosphorus (TP), nitrogen (TN), and bacteria removals for the proposed project are provided in **Table 4.** The proposed O&M Guide in **Appendix E** was developed to ensure that the stormwater system continues to function as it was designed into the future to maintain these levels of pollutant removal.

Table 4. Compliance with Water Quality Pollutant Load Reduction Requirements

DA ID	SCM ID	IA (ac)	WQv Provided (ac-ft)*	Runoff Depth Treated (in)	TSS Removal (%)**	TP Removal (%)***	TN Removal (%)***	Bacteria Removal (%)****	Meets Reqt?
DA0	NA	0.17	0.000	0.0	0%	0%	0%	0%	N
DA1	IS1	0.06	0.005	1.0	80%	100%	100%	100%	Y
DA2	IS2	0.03	0.002	1.0	80%	100%	100%	100%	Y
DA2A	IT1	0.05	0.004	1.0	80%	100%	100%	100%	Y
DA2B	IT2	0.13	0.011	1.0	80%	100%	100%	100%	Y
DA3	IT3, IS3	0.18	0.015	1.0	80%	100%	100%	100%	Y
DA3A	IS3	0.13	0.011	1.0	80%	100%	100%	100%	Y
DA3B	IS3	0.34	0.028	1.0	80%	100%	100%	100%	Y
DA3C	C1	0.87	0.073	1.0	80%	100%	100%	100%	Y
TOTAL SITE:		**1.94**	**0.149**	**0.9**	**73%**	**91%**	**91%**	**91%**	**Y**

**From HydroCAD results – see Appendix B for volume "discarded" for WQv Event*
***From MASMS*
****From MS4 NPDES Permit Appendix F Attachment 3 (USEPA 2021)*
*****From Paradigm Environmental (2019)*

In addition, since the site is located in a critical area (near a shellfishing area and the site has soils with a rapid infiltration rate) and must meet MASMS **Standard 6** pretreatment to the maximum extent practicable before infiltration. The Town conducts street sweeping twice per year as part of their Massachusetts Municipal Separate Storm Sewer System (MS4) program, which can achieve 10% removal of TSS. The deep sump catchbasins provide 25% pretreatment prior to infiltration, therefore the estimated TSS removal prior to infiltration is 33%. As this is a retrofit, the site meets this standard to the maximum extent practicable.

Long-term Pollution Prevention Plan

Source control is important to ensure long-term functionality of the proposed SCMs and protect downstream resources and habitat. A long-term pollution prevention plan specific to this site is provided as a part of the O&M Guide in **Appendix E**.

4.2 Recharge

Infiltrating treated runoff into the underlying native sands is one of the objectives of this project. For new development projects, the MASMS requires a specific annual "recharge" volume (Rev) based on the HSG of the soil covered by new impervious surfaces, with a higher volume required for sandy soils (HSG A) and lower for silty, clayey soils (HSG D). This project is only required to provide infiltration or recharge to the maximum extent practicable as a redevelopment project.

However, the proposed and retrofitted existing SCMs actually provide more than required by **Standard 3**, as no new impervious area is proposed and additional recharge volume is proposed. Another requirement of **Standard 3** is that infiltrating SCMs must fully drain in 72 hours. The proposed HydroCAD model results showing full recharge of the first inch of runoff by the infiltrating practices and the drawdown times (from full SCM to empty) are included in **Appendix B** and summarized below in **Table 5.** The chambers are sized for the 25-year storm and have a volume of 7,800 cf and a surface area of 1,910 sf. When completely full, the chambers will draw down in less than six hours.

Table 5. Compliance with Recharge Requirements

DA ID	SCM ID	IA (ac)	Soil HSG	Required Recharge Depth (in)	Rev Goal (ac-ft)	Rev Provided (ac-ft)*	% Rev Provided	Draw-down Time (hrs)**	Meets Reqt?	Notes
DA0	NA	0.17	A	0.6	0.008	0.000	0%	NA	N	Boat Ramp not captured for this retrofit project given space and land use
DA1	IS1	0.06	A	0.6	0.003	0.005	170%	12	Y	
DA2	IS2	0.03	A	0.6	0.001	0.002	160%	12	Y	
DA2A	IT1	0.05	A	0.6	0.002	0.004	173%	12	Y	
DA2B	IT2	0.13	A	0.6	0.007	0.011	168%	12	Y	I
DA3	IT3, IS3	0.18	A	0.6	0.009	0.015	167%	12	Y	Infiltration trench recharges approx 0.5-inch runoff, remaining runoff is recharged in existing system
DA3A	IS3	0.13	A	0.6	0.006	0.011	172%	12	Y	
DA3B	IS3	0.34	A	0.6	0.017	0.028	167%	12	Y	
DA3C	C1	0.87	A	0.6	0.044	0.073	168%	12	Y	
TOTAL SITE:		**1.94**			**0.097**	**0.149**	**154%**		**Y**	

**From HydroCAD results – see Appendix B for volume "discarded" for WQv Event*

***From HydroCAD results – see Appendix B for hydrograph showing time from peak elevation to fully drained basins (WQv Event or 25-yr storm for Chambers)*

4.3 Water Quantity

The main goal of this project is to improve water quality and habitat, but reducing water quantity impacts during large storm events was also prioritized. Due to the lack of cross slope on Follins Pond Road (the road is not crowned), the catchbasin capacity and angle, and observations during rain events by Town of Yarmouth and HW staff, the majority of stormwater runoff is not currently being captured by the existing infiltration systems. Therefore, HW did not model the existing infiltration systems in the existing HydroCAD model. However, to model the existing conditions conservatively, HW assumed and

modeled 15% of stormwater runoff entering the existing infiltration systems. The proposed conditions model assumes that all of the runoff will enter the existing infiltration systems due to the road regrading and repaving, and the high capacity catchbasin grates.

The existing and proposed HydroCAD model results for these larger storm events are included in **Appendix B,** and the resulting peak flows and runoff volumes are summarized below in **Table 6** for both existing (EX) and proposed (PR) conditions. These results show that the proposed improvements will reduce or meet peak flows and runoff volumes for all evaluated storms, and thus, fully meet the requirements of **Standard 2** of the MASWMS.

Table 6. Summary of Existing and Proposed Condition Peak Flow Rates and Runoff Volumes

Study Point		Peak Flow, cfs				Runoff Volume, acre-ft			
		2-yr	10-yr	25-yr	100-yr	2-yr	10-yr	25-yr	100-yr
SP1	EX*	4.36	6.42	7.98	11.03	0.54	0.83	1.10	1.67
	EX**	3.71	5.46	6.78	9.38	0.46	0.70	0.94	1.42
	PR*	1.53	3.27	6.34	8.30	0.07	0.17	0.28	0.57
Reduction	**%**	**59%**	**40%**	**7%**	**11%**	**85%**	**76%**	**70%**	**60%**

**From HydroCAD results – see Appendix B*
***HydroCAD results reduced by 15%*

4.4 Erosion Control

Controlling erosion and sedimentation from the construction site is important to meet the overall water quality goals of this retrofit project, as well as to meet MASMS **Standard 8**. Given this site's size (< 1 acre of disturbance), a NPDES Construction General Permit Stormwater Pollution Plan (SWPPP) is not required. However, planning for effective erosion and sediment controls (ESCs) was important to this project's design, and so an ESC Plan is included in the design plans (**Appendix G**), along with a detailed sequence of construction activities and ESC notes. Visibility fence and/or silt socks are proposed at the limit of work to protect off-site areas and trees; silt socks are proposed along the downgradient edges of the area of disturbance. Disturbed areas will be stabilized as soon as possible to minimize erosion and sedimentation with pavement, seeding and/or erosion control blankets, if necessary. A Pollutant Controls During Construction plan is also included in **Appendix F** that discusses these controls in more detail. With these layered ESCs implemented throughout the site, discharge of sediment-laden runoff during construction should be minimized to the maximum extent practicable.

The contractor will be required to establish these erosion controls prior to beginning any other project-related work. The ESC Plan will also establish the limit of work, beyond which the contractor will not be allowed to perform any work. It is the contractor's responsibility to monitor and correct erosion control practices throughout the duration of the project. Erosion control measures will not be removed until the project reaches completion as directed by the project engineer or landscape architect.

4.5 Operation and Maintenance

Ongoing maintenance is vital for long-term success at the site. All SCMs were designed to be low-maintenance in nature. These SCMs will be operated and maintained appropriately during construction and post-construction as required on the construction drawings and O&M Guide per MASMS **Standard 9** (**Appendix E and G**).

4.6 Illicit Discharges

There will be no illicit discharges to the existing system by the proposed project per MASMS **Standard 10**. The Long-Term Pollution Prevention Plan in the O&M Guide (**Appendix E**) includes measures to prevent future illicit discharges.

5.0 REFERENCES

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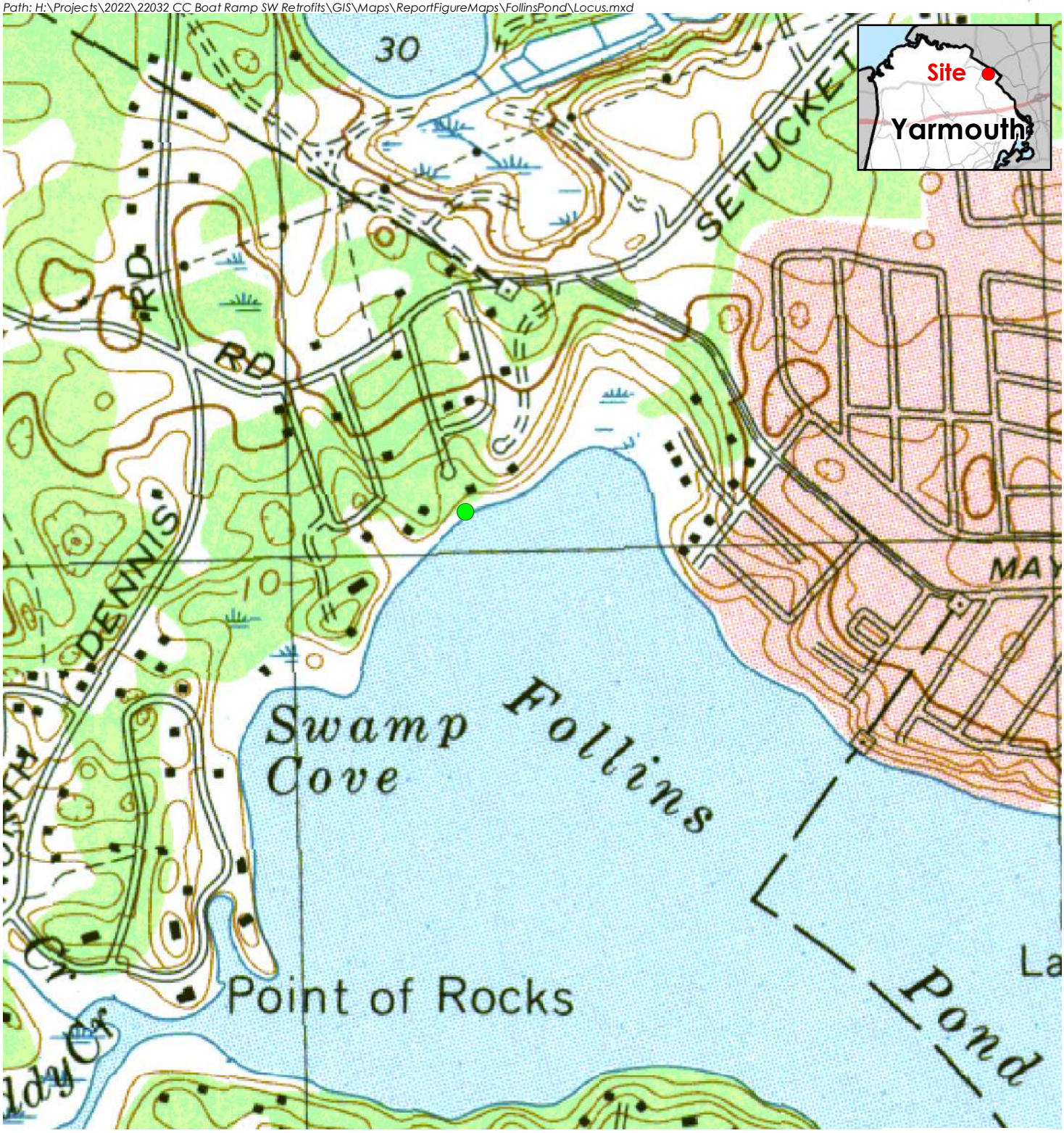
FIGURES

Horsley Witten Group
Sustainable Environmental Solutions

Path: H:\Projects\2022\22032 CC Boat Ramp SW Retrofits\GIS\Maps\ReportFigureMaps\FollinsPond\Locus.mxd



Date: 8/24/2023
Data Sources: Bureau of Geographic Information (MassGIS), ESRI

This map is for informational purposes and may not be suitable for legal, engineering, or surveying purposes.

Follins Pond Boat Ramp

N

Feet
0 300 600

FOLLINS POND Boat Ramp
Cape Cod Boat Ramp Stormwater Retrofit Project
Yarmouth, MA

Figure 1
Locus Map

Horsley Witten Group
Sustainable Environmental Solutions

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Date: 10/17/2023
Data Sources: Bureau of Geographic Information (MassGIS), ESRI

This map is for informational purposes and may not be suitable for legal, engineering, or surveying purposes.

- Follins Pond Boat Ramp

FOLLINS POND Boat Ramp
Cape Cod Boat Ramp Stormwater Retrofit Project
Yarmouth, MA

Figure 2
Aerial

Horsley Witten Group
Sustainable Environmental Solutions

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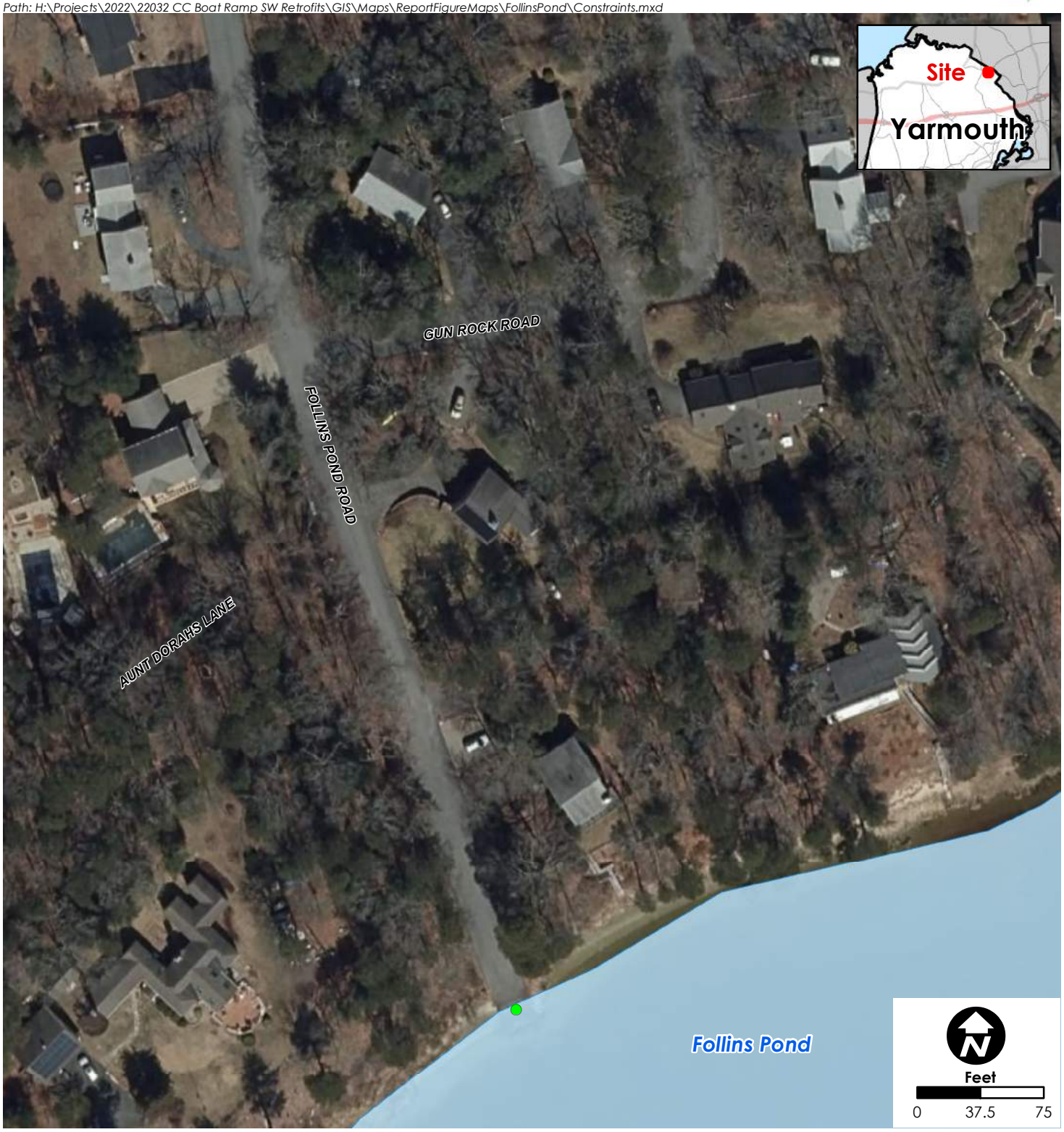

Date: 10/17/2023
Data Sources: Bureau of Geographic Information (MassGIS), ESRI

This map is for informational purposes and may not be suitable for legal, engineering, or surveying purposes.

- Follins Pond Boat Ramp
- Shoreline
- Open Water

FOLLINS POND Boat Ramp
Cape Cod Boat Ramp Stormwater Retrofit Project
Yarmouth, MA

Figure 3
Constraints

Horsley Witten Group
Sustainable Environmental Solutions

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Date: 8/24/2023
Data Sources: Bureau of Geographic Information (MassGIS), ESRI

This map is for informational purposes and may not be suitable for legal, engineering, or surveying purposes.

- Follins Pond Boat Ramp

2018/2020 Integrated List Data

- 4C - Impairment not caused by a pollutant
- 3 - No uses assessed
- 4A - Impaired - TMDL is completed
- 4C - Impairment not caused by a pollutant
- Town Parcels

FOLLINS POND Boat Ramp
Cape Cod Boat Ramp Stormwater Retrofit Project
Yarmouth, MA

Figure 4
Impaired Waters

Horsley Witten Group
Sustainable Environmental Solutions

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Date: 8/24/2023
Data Sources: Bureau of Geographic Information (MassGIS), ESRI

This map is for informational purposes and may not be suitable for legal, engineering, or surveying purposes.

Follins Pond Boat Ramp

Hydrologic Soil Group

<Null>

A

FOLLINS POND Boat Ramp
Cape Cod Boat Ramp Stormwater Retrofit Project
Yarmouth, MA

Figure 5
Soils

APPENDIX A – Drainage Areas

- Existing and Proposed Drainage Areas Maps
- Land Coverage Summaries

LEGEND

DRAINAGE AREA BOUNDARY

WOODS
WATER
ROOFTOP
GRASS
PAVEMENT

IMP. AREA
TOTAL AREA
(ACRES)

1.00
5.00

DA1 DRAINAGE AREA

SP1 STUDY POINT

P1 POND

SOIL BOUNDARY

TIME OF CONCENTRATION FLOW PATH

5' MAJOR CONTOUR

1' MINOR CONTOUR

SOIL TYPES

252B HSG A — CARVER COARSE SAND (HSG A)

252C HSG A — CARVER COARSE SAND (HSG A)

252D HSG A — CARVER COARSE SAND (HSG A)

Horsley Witten Group, Inc.
Sustainable Environmental Solutions
90 Route 6A Sandwich, MA 02563
horsleywittengroup.com

Date: DECEMBER 2023
Design By: EWH
Drawn By: EWH/JLV
Checked By: GK

Plan Set:
FOLLINS POND
CAPE COD BOAT RAMP STORMWATER
RETROFIT PROJECT - PERMITTING PLANS
YARMOUTH, MA

Plan Title:
EXISTING DRAINAGE AREA MAP

Prepared For:
Town of Yarmouth
1146 MA-28
South Yarmouth, MA
Phone:(508) 398-2231

Project Number:
22032A

Sheet Number:
1 of 2

Horsley Witten Group, Inc.
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90 Route 6A Sandwich, MA 02563
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Date: JANUARY 2024
Design By: EWH
Drawn By: EWH/JLV
Checked By: GK

Plan Set:
FOLLINS POND
CAPE COD BOAT RAMP STORMWATER
RETROFIT PROJECT - PERMITTING PLANS
YARMOUTH, MA

Plan Title:
PROPOSED DRAINAGE AREA MAP

Prepared For:
Town of Yarmouth
1146 MA-28
South Yarmouth, MA
Phone:(508) 398-2231

Project Number:
22032A

Sheet Number:
2 of 2

APPENDIX B – Hydrologic/Hydraulic Model Results

HydroCAD® Results

- Existing
- Proposed

CAPE COD BOAT RAMPS - FOLLINS POND YARMOUTH, MA	Calc'd by:	EWH
	Checked by:	
PRE-development Drainage Conditions	Date:	11/1/2023

DRAINAGE AREAS	
DA0	**TO POND**
DA1	**TO INFILTRATION SYSTEM 1**
DA2	**TO INFILTRATION SYSTEM 2**
DA3	**TO INFILTRATION SYSTEM 3**

NOAA 14+ 24-hr Type III (inches)	
WQv	1.21
1-yr	3.05
2-yr	3.60
5-yr	4.51
10-yr	5.27
25-yr	6.53
100-yr	8.59
500-yr	0.00

DA0	**TO POND**		
Cover type	Area, ft^2	Area, *ac*	Note
Paved	4,730	0.109	
Permeable	0	0.000	
Roof	2,460	0.056	
Water	0	0.000	
Woods	29,910	0.687	
Grass	5,370	0.123	
TOTAL	42,470	0.975	

Impervious		
Area, ft^2	Area, *ac*	Percent
7,190	0.165	17

DA1	**TO INFILTRATION SYSTEM 1**		
Cover type	Area, ft^2	Area, *ac*	Note
Paved	2,560	0.059	
Permeable	0	0.000	
Roof	0	0.000	
Water	0	0.000	
Woods	7,610	0.175	
Grass	0	0.000	
TOTAL	10,170	0.233	

Impervious		
Area, ft^2	Area, *ac*	Percent
2,560	0.059	25

DA2	TO INFILTRATION SYSTEM 2					
Cover type	Area, ft^2	Area, *ac*	Note			
Paved	21,750	0.499				
Permeable	0	0.000				
Roof	7,270	0.167				
Water	0	0.000				
Woods	68,330	1.569		**Impervious**		
Grass	25,410	0.583		Area, ft^2	Area, *ac*	Percent
TOTAL	122,760	2.818		29,020	0.666	24

DA3	TO INFILTRATION SYSTEM 3					
Cover type	Area, ft^2	Area, *ac*	Note			
Paved	27,230	0.625				
Permeable	0	0.000				
Roof	18,440	0.423				
Water	0	0.000				
Woods	118,570	2.722		**Impervious**		
Grass	4,090	0.094		Area, ft^2	Area, *ac*	Percent
TOTAL	168,330	3.864		45,670	1.048	27

ALL	***ALL PRE-DEVELOPMENT AREAS COMBINED***					
Cover type	Area, ft^2	Area, *ac*	Note			
Paved	56,270	1.292				
Permeable	0	0.000				
Roof	28,170	0.056				
Water	0	0.000				
Woods	224,420	0.861		**Impervious**		
Grass	34,870	0.123		Area, ft^2	Area, *ac*	Percent
TOTAL	343,730	7.891		84,440	1.938	25

CAPE COD BOAT RAMPS - FOLLINS POND YARMOUTH, MA	Calc'd by:	EWH
	Checked by:	
POST-development Drainage Conditions	Date:	1/15/2024

DRAINAGE AREAS	
DA0	TO POND
DA1	TO INFILTRATION SYSTEM 1
DA2	TO INFILTRATION SYSTEM 2
DA2A	TO TREE TRENCH 1
DA2B	TO TREE TRENCH 2
DA3	TO TREE TRENCH 3 (GUN ROCK)
DA3A	TO TREE TRENCH 3 (EAST FOLLINS)
DA3B	TO TREE TRENCH 3 (WEST FOLLINS)
DA3C	TO CHAMBERS

NOAA 14+ 24-hr Type III (inches)	
WQv	1.21
1-yr	3.05
2-yr	3.60
5-yr	4.51
10-yr	5.27
25-yr	6.53
100-yr	8.59
500-yr	0.00

DA0	TO POND		
Cover type	Area, ft^2	Area, *ac*	Note
Paved	4,730	0.109	
Permeable	0	0.000	
Roof	2,460	0.056	
Water	0	0.000	
Woods	29,910	0.687	
Grass	5,370	0.123	
TOTAL	42,470	0.975	

Impervious		
Area, ft^2	Area, *ac*	Percent
7,190	0.165	17

DA1	TO INFILTRATION SYSTEM 1		
Cover type	Area, ft^2	Area, *ac*	Note
Paved	2,560	0.059	
Permeable	0	0.000	
Roof	0	0.000	
Water	0	0.000	
Woods	7,620	0.175	
Grass	0	0.000	
TOTAL	10,180	0.234	

Impervious		
Area, ft^2	Area, *ac*	Percent
2,560	0.059	25

DA2	TO INFILTRATION SYSTEM 2					
Cover type	Area, ft^2	Area, *ac*	Note			
Paved	740	0.017				
Permeable	0	0.000				
Roof	350	0.008				
Water	0	0.000				
Woods	3,290	0.076		**Impervious**		
Grass	0	0.000		Area, ft^2	Area, *ac*	Percent
TOTAL	4,380	0.101		1,090	0.025	25

DA2A	TO TREE TRENCH 1					
Cover type	Area, ft^2	Area, *ac*	Note			
Paved	1,080	0.025				
Permeable	0	0.000				
Roof	930	0.021				
Water	0	0.000				
Woods	4,130	0.095		**Impervious**		
Grass	0	0.000		Area, ft^2	Area, *ac*	Percent
TOTAL	6,140	0.141		2,010	0.046	33

DA2B	TO TREE TRENCH 2					
Cover type	Area, ft^2	Area, *ac*	Note			
Paved	5,710	0.131				
Permeable	0	0.000				
Roof	0	0.000				
Water	0	0.000				
Woods	12,670	0.291		**Impervious**		
Grass	2,200	0.051		Area, ft^2	Area, *ac*	Percent
TOTAL	20,580	0.472		5,710	0.131	28

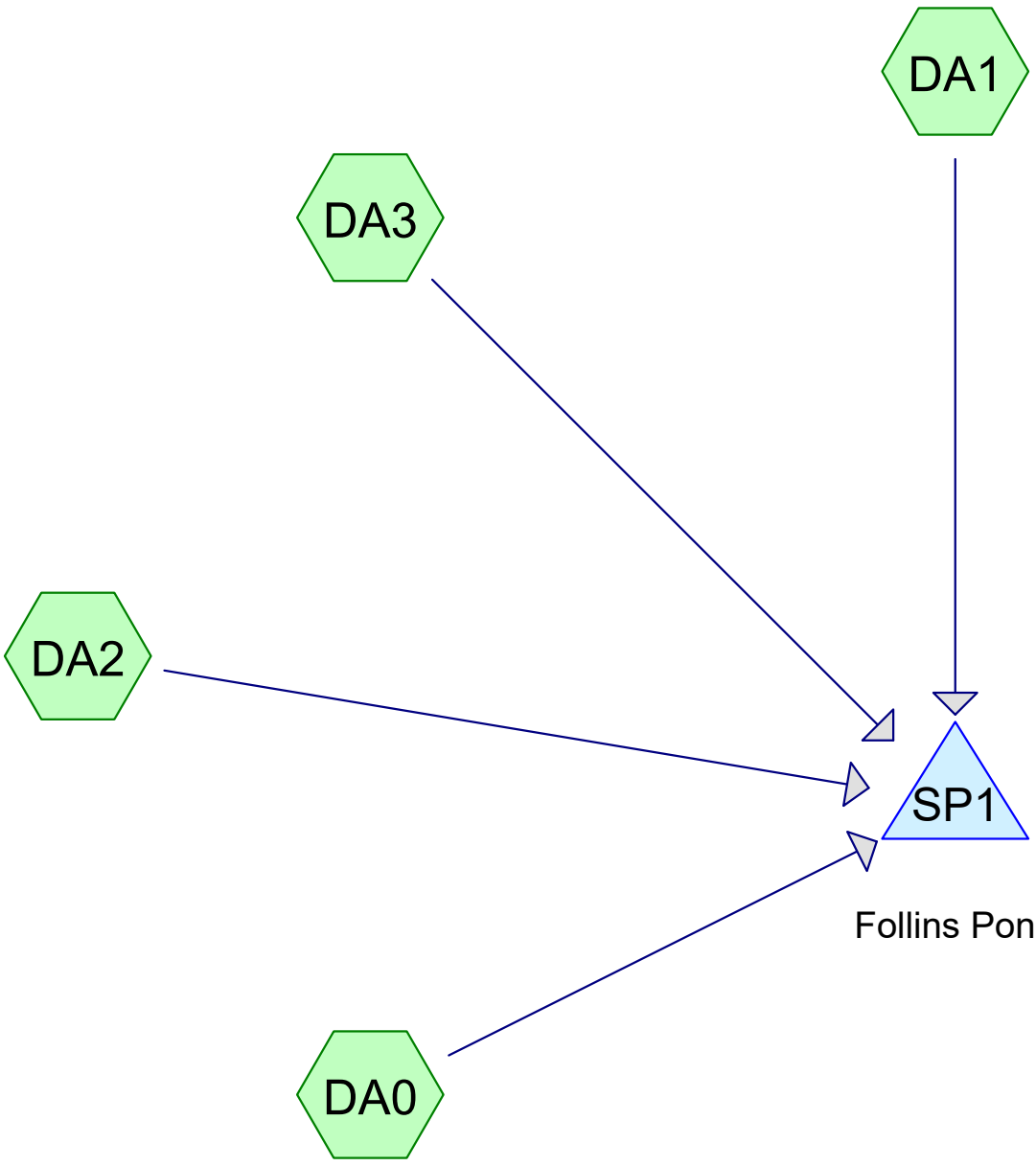
DA3	TO TREE TRENCH 3 (GUN ROCK)					
Cover type	Area, ft^2	Area, *ac*	Note			
Paved	4,210	0.097				
Permeable	0	0.000				
Roof	3,600	0.083				
Water	0	0.000				
Woods	19,080	0.438		**Impervious**		
Grass	0	0.000		Area, ft^2	Area, *ac*	Percent
TOTAL	26,890	0.617		7,810	0.179	29

DA3A	TO TREE TRENCH 3 (EAST FOLLINS)					
Cover type	Area, ft^2	Area, *ac*	Note			
Paved	5,580	0.128				
Permeable	0	0.000				
Roof	0	0.000				
Water	0	0.000				
Woods	13,180	0.303		**Impervious**		
Grass	0	0.000		Area, ft^2	Area, *ac*	Percent
TOTAL	18,760	0.431		5,580	0.128	30

DA3B	TO TREE TRENCH 3 (WEST FOLLINS)					
Cover type	Area, ft^2	Area, *ac*	Note			
Paved	8,650	0.199				
Permeable	0	0.000				
Roof	5,990	0.138				
Water	0	0.000				
Woods	35,050	0.805		**Impervious**		
Grass	23,230	0.533		Area, ft^2	Area, *ac*	Percent
TOTAL	72,920	1.674		14,640	0.336	20

DA3C	TO CHAMBERS					
Cover type	Area, ft^2	Area, *ac*	Note			
Paved	23,130	0.531				
Permeable	0	0.000				
Roof	14,820	0.340				
Water	0	0.000				
Woods	99,540	2.285		**Impervious**		
Grass	3,910	0.090		Area, ft^2	Area, *ac*	Percent
TOTAL	141,400	3.246		37,950	0.871	27

ALL	***ALL POST-DEVELOPMENT AREAS COMBINED***					
Cover type	Area, ft^2	Area, *ac*	Note			
Paved	56,390	1.295				
Permeable	0	0.000				
Roof	28,150	0.646				
Water	0	0.000				
Woods	224,470	5.153		**Impervious**		
Grass	34,710	0.797		Area, ft^2	Area, *ac*	Percent
TOTAL	343,720	7.891		84,540	1.941	25



Subcat Reach Pond Link

Routing Diagram for 22032 FOLLINS EX
Prepared by Horsley Witten Inc, Printed 12/3/2023

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2yr	Type III 24-hr		Default	24.00	1	3.60	2
2	10yr	Type III 24-hr		Default	24.00	1	5.27	2
3	25yr	Type III 24-hr		Default	24.00	1	6.53	2
4	100yr	Type III 24-hr		Default	24.00	1	8.59	2
5	WQV	Type III 24-hr		Default	24.00	1	1.21	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.801	39	>75% Grass cover, Good, HSG A (DA0, DA2, DA3)
1.292	98	Paved parking, HSG A (DA0, DA1, DA2, DA3)
0.647	98	Unconnected roofs, HSG A (DA0, DA2, DA3)
5.152	30	Woods, Good, HSG A (DA0, DA1, DA2, DA3)
7.891	**48**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
7.891	HSG A	DA0, DA1, DA2, DA3
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.000	Other	
7.891		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.801	0.000	0.000	0.000	0.000	0.801	>75% Grass cover, Good	DA0, DA2, DA3
1.292	0.000	0.000	0.000	0.000	1.292	Paved parking	DA0, DA1, DA2, DA3
0.647	0.000	0.000	0.000	0.000	0.647	Unconnected roofs	DA0, DA2, DA3
5.152	0.000	0.000	0.000	0.000	5.152	Woods, Good	DA0, DA1, DA2, DA3
7.891	**0.000**	**0.000**	**0.000**	**0.000**	**7.891**	**TOTAL AREA**	

Time span=1.00-72.00 hrs, dt=0.05 hrs, 1421 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment DA0: Runoff Area=42,470 sf 16.93% Impervious Runoff Depth=0.57"
Flow Length=625' Tc=16.2 min CN=31/98 Runoff=0.43 cfs 0.046 af

Subcatchment DA1: Runoff Area=10,170 sf 25.17% Impervious Runoff Depth=0.85"
Flow Length=235' Tc=11.5 min CN=30/98 Runoff=0.17 cfs 0.016 af

Subcatchment DA2: Runoff Area=122,760 sf 23.64% Impervious Runoff Depth=0.80"
Flow Length=622' Tc=20.2 min CN=32/98 Runoff=1.58 cfs 0.187 af

Subcatchment DA3: Runoff Area=168,330 sf 27.13% Impervious Runoff Depth=0.91"
Flow Length=497' Tc=24.2 min CN=30/98 Runoff=2.31 cfs 0.294 af

Pond SP1: Follins Pond Inflow=4.36 cfs 0.544 af
Primary=4.36 cfs 0.544 af

Total Runoff Area = 7.891 ac Runoff Volume = 0.544 af Average Runoff Depth = 0.83"
75.43% Pervious = 5.952 ac 24.57% Impervious = 1.938 ac

Summary for Subcatchment DA0:

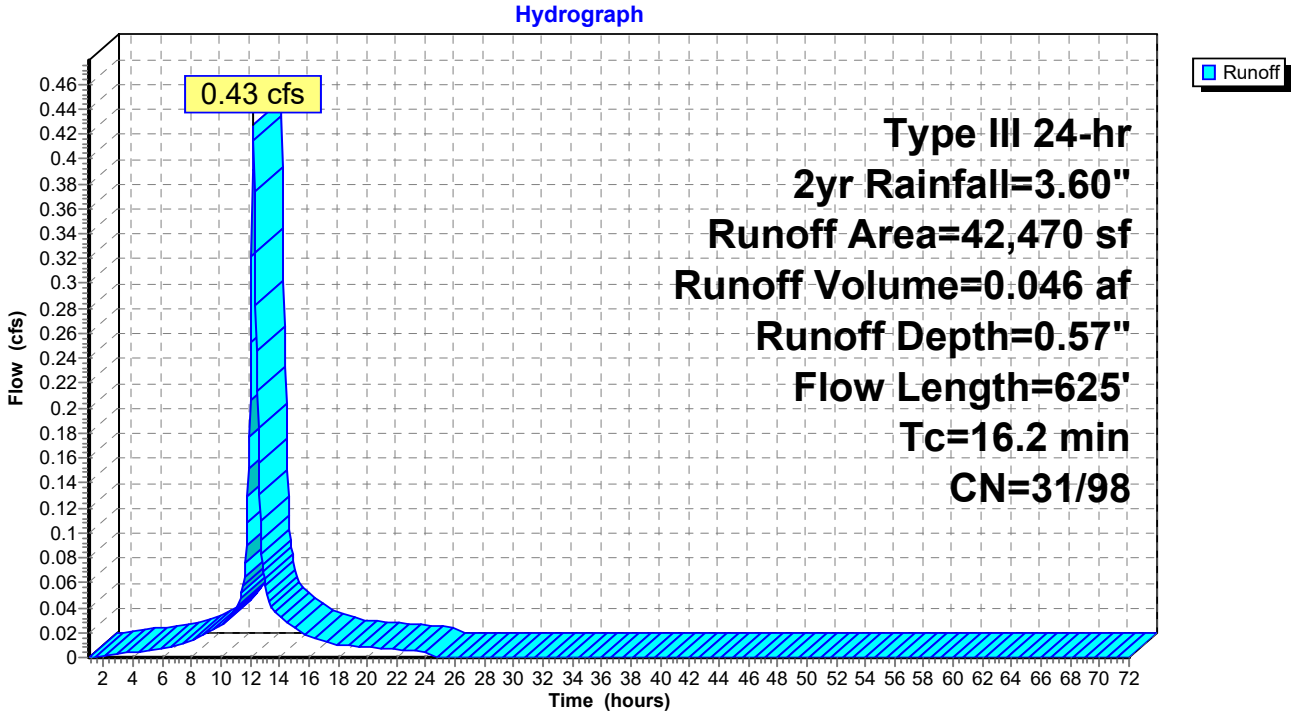
Runoff = 0.43 cfs @ 12.21 hrs, Volume= 0.046 af, Depth= 0.57"
Routed to Pond SP1 : Follins Pond

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2yr Rainfall=3.60"

Area (sf)	CN	Description
4,730	98	Paved parking, HSG A
2,460	98	Unconnected roofs, HSG A
29,910	30	Woods, Good, HSG A
5,370	39	>75% Grass cover, Good, HSG A
42,470	43	Weighted Average
35,280	31	83.07% Pervious Area
7,190	98	16.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.1	100	0.0900	0.15		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
5.0	470	0.1000	1.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	55	0.1100	6.73		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
16.2	625	Total			

Subcatchment DA0:



Summary for Subcatchment DA1:

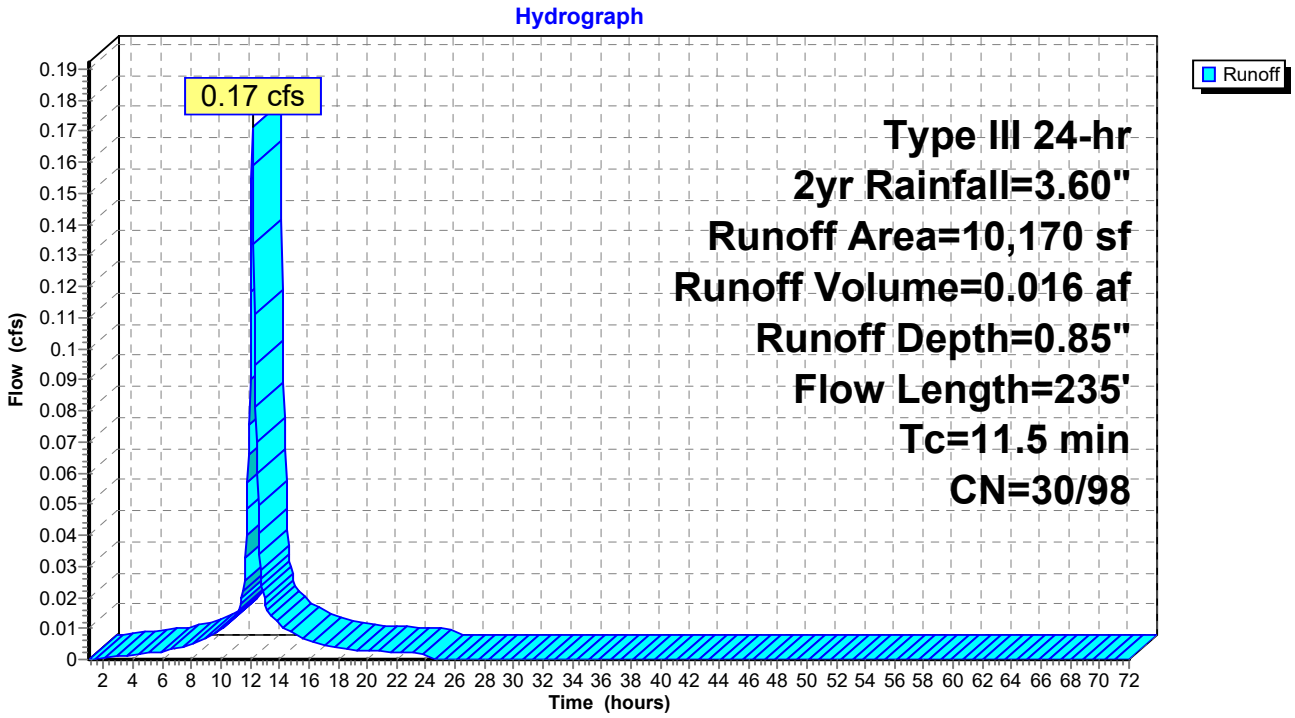
Runoff = 0.17 cfs @ 12.15 hrs, Volume= 0.016 af, Depth= 0.85"
Routed to Pond SP1 : Follins Pond

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2yr Rainfall=3.60"

Area (sf)	CN	Description
2,560	98	Paved parking, HSG A
7,610	30	Woods, Good, HSG A
10,170	47	Weighted Average
7,610	30	74.83% Pervious Area
2,560	98	25.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.6	100	0.1000	0.16		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
0.8	80	0.1200	1.73		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	55	0.1100	6.73		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
11.5	235	Total			

Subcatchment DA1:



Summary for Subcatchment DA2:

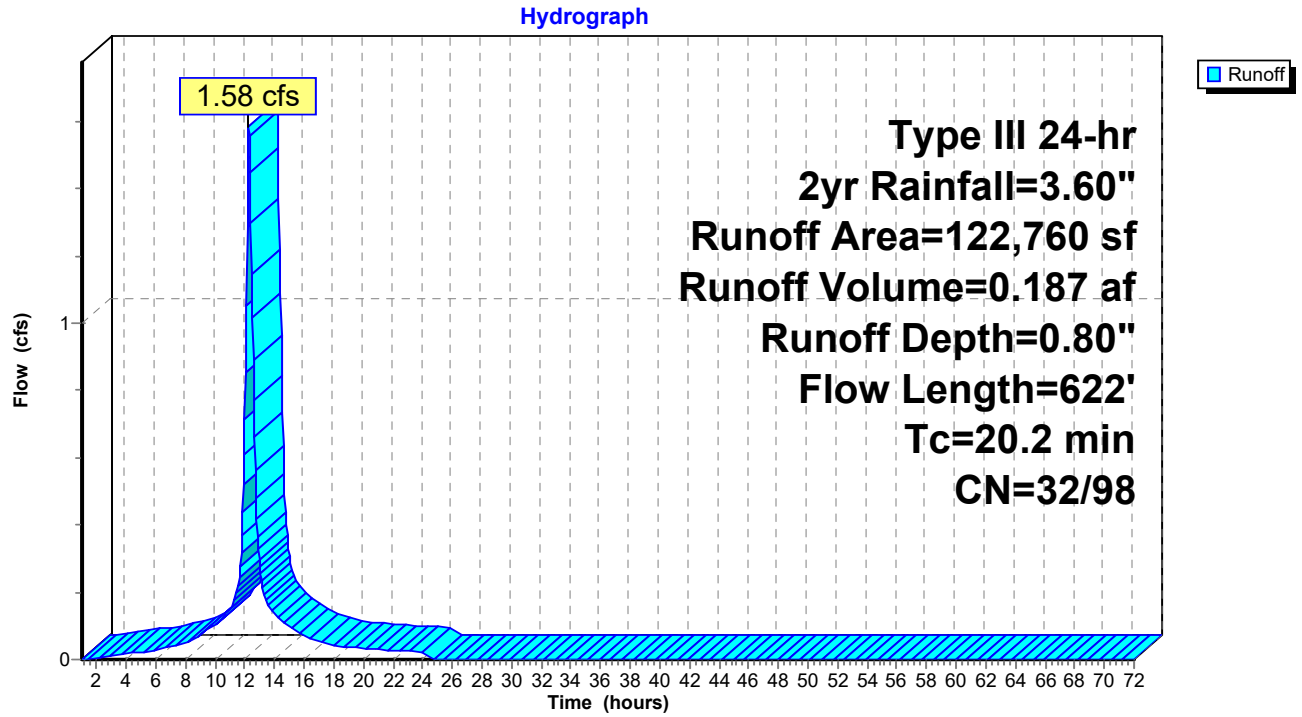
Runoff = 1.58 cfs @ 12.26 hrs, Volume= 0.187 af, Depth= 0.80"
Routed to Pond SP1 : Follins Pond

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2yr Rainfall=3.60"

Area (sf)	CN	Description
21,750	98	Paved parking, HSG A
7,270	98	Unconnected roofs, HSG A
68,330	30	Woods, Good, HSG A
25,410	39	>75% Grass cover, Good, HSG A
122,760	48	Weighted Average
93,740	32	76.36% Pervious Area
29,020	98	23.64% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.2	100	0.0300	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
2.0	155	0.0700	1.32		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.0	367	0.0900	6.09		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
20.2	622	Total			

Subcatchment DA2:



Summary for Subcatchment DA3:

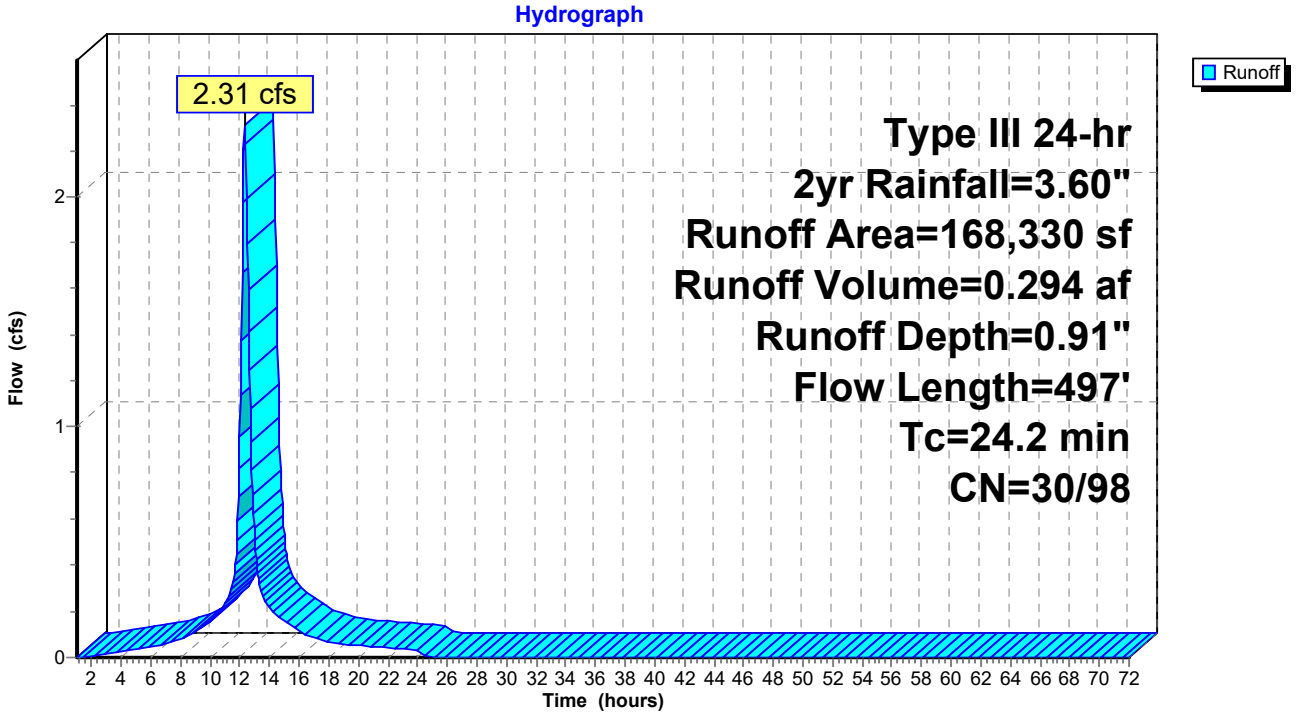
Runoff = 2.31 cfs @ 12.32 hrs, Volume= 0.294 af, Depth= 0.91"
Routed to Pond SP1 : Follins Pond

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2yr Rainfall=3.60"

Area (sf)	CN	Description
27,230	98	Paved parking, HSG A
18,440	98	Unconnected roofs, HSG A
118,570	30	Woods, Good, HSG A
4,090	39	>75% Grass cover, Good, HSG A
168,330	49	Weighted Average
122,660	30	72.87% Pervious Area
45,670	98	27.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.2	100	0.0200	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
3.0	270	0.0900	1.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.0	127	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
24.2	497	Total			

Subcatchment DA3:



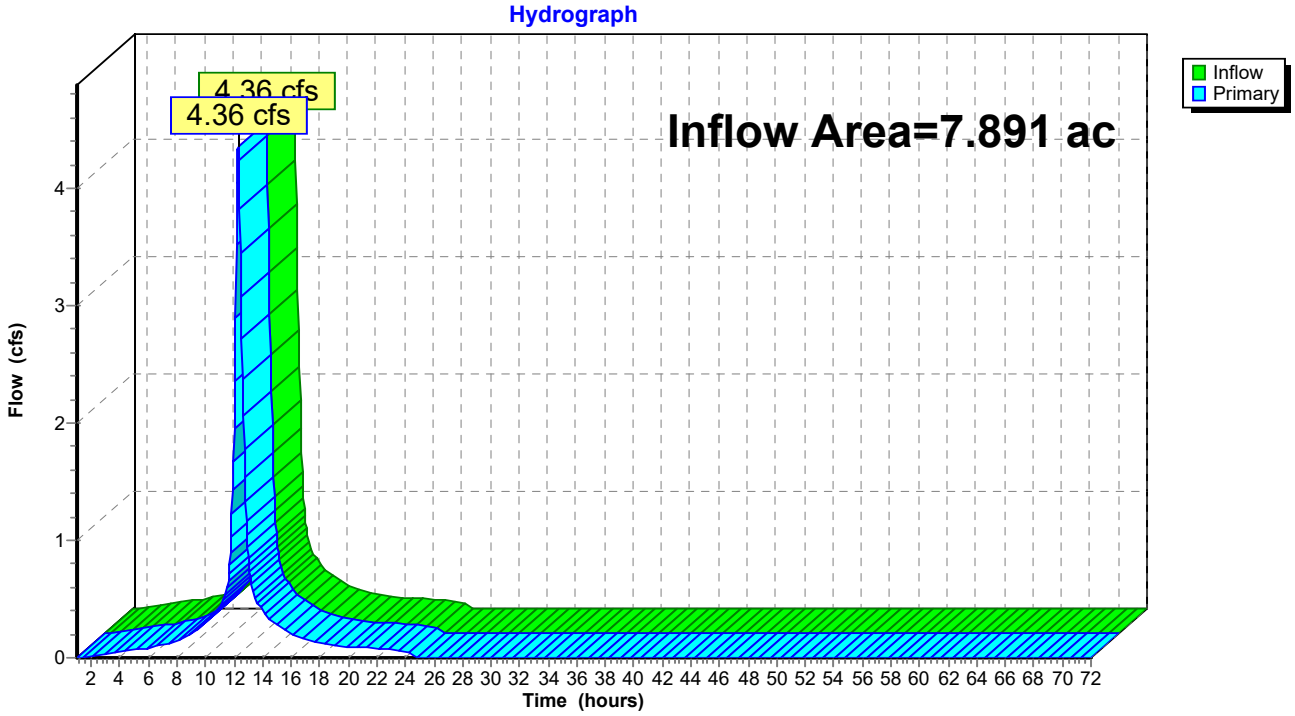
Summary for Pond SP1: Follins Pond

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 7.891 ac, 24.57% Impervious, Inflow Depth = 0.83" for 2yr event
Inflow = 4.36 cfs @ 12.28 hrs, Volume= 0.544 af
Primary = 4.36 cfs @ 12.28 hrs, Volume= 0.544 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs

Pond SP1: Follins Pond



Time span=1.00-72.00 hrs, dt=0.05 hrs, 1421 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment DA0: Runoff Area=42,470 sf 16.93% Impervious Runoff Depth>0.88"
Flow Length=625' Tc=16.2 min CN=31/98 Runoff=0.63 cfs 0.071 af

Subcatchment DA1: Runoff Area=10,170 sf 25.17% Impervious Runoff Depth>1.28"
Flow Length=235' Tc=11.5 min CN=30/98 Runoff=0.25 cfs 0.025 af

Subcatchment DA2: Runoff Area=122,760 sf 23.64% Impervious Runoff Depth>1.23"
Flow Length=622' Tc=20.2 min CN=32/98 Runoff=2.33 cfs 0.288 af

Subcatchment DA3: Runoff Area=168,330 sf 27.13% Impervious Runoff Depth>1.38"
Flow Length=497' Tc=24.2 min CN=30/98 Runoff=3.40 cfs 0.443 af

Pond SP1: Follins Pond Inflow=6.42 cfs 0.827 af
Primary=6.42 cfs 0.827 af

Total Runoff Area = 7.891 ac Runoff Volume = 0.827 af Average Runoff Depth = 1.26"
75.43% Pervious = 5.952 ac 24.57% Impervious = 1.938 ac

Summary for Subcatchment DA0:

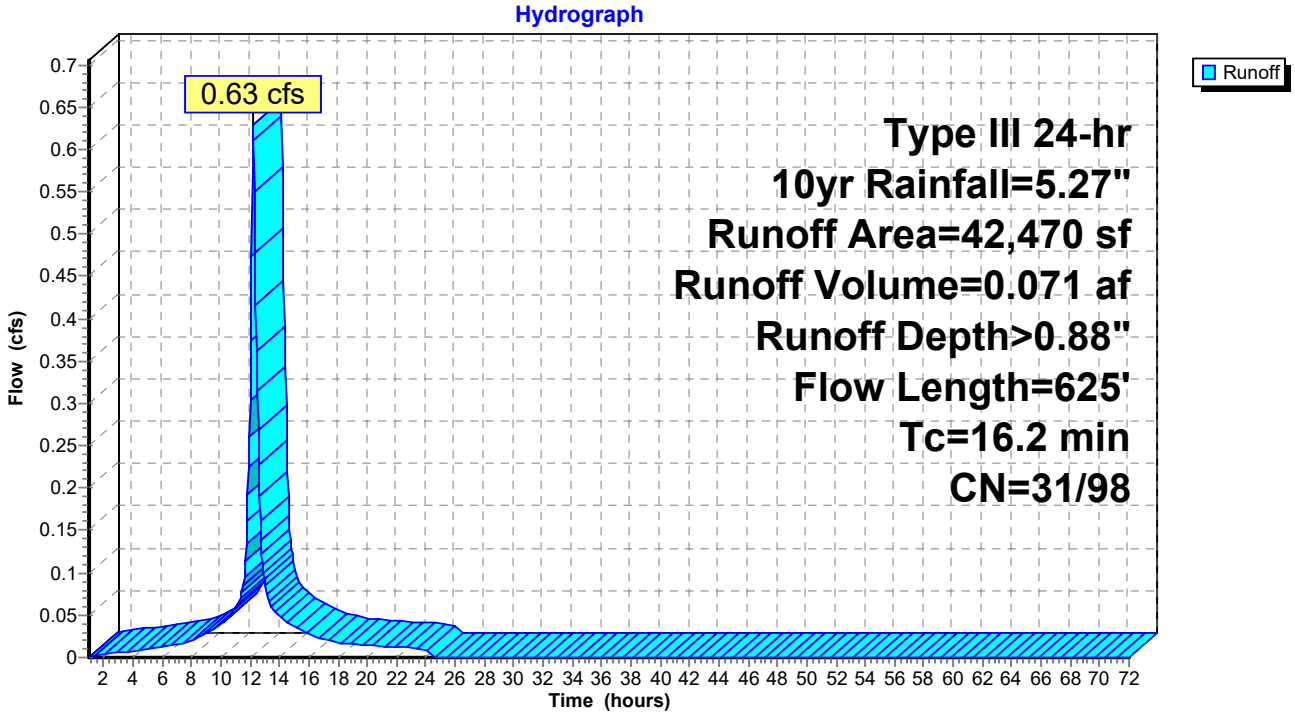
Runoff = 0.63 cfs @ 12.21 hrs, Volume= 0.071 af, Depth> 0.88"
Routed to Pond SP1 : Follins Pond

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10yr Rainfall=5.27"

Area (sf)	CN	Description
4,730	98	Paved parking, HSG A
2,460	98	Unconnected roofs, HSG A
29,910	30	Woods, Good, HSG A
5,370	39	>75% Grass cover, Good, HSG A
42,470	43	Weighted Average
35,280	31	83.07% Pervious Area
7,190	98	16.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.1	100	0.0900	0.15		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
5.0	470	0.1000	1.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	55	0.1100	6.73		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
16.2	625	Total			

Subcatchment DA0:



Summary for Subcatchment DA1:

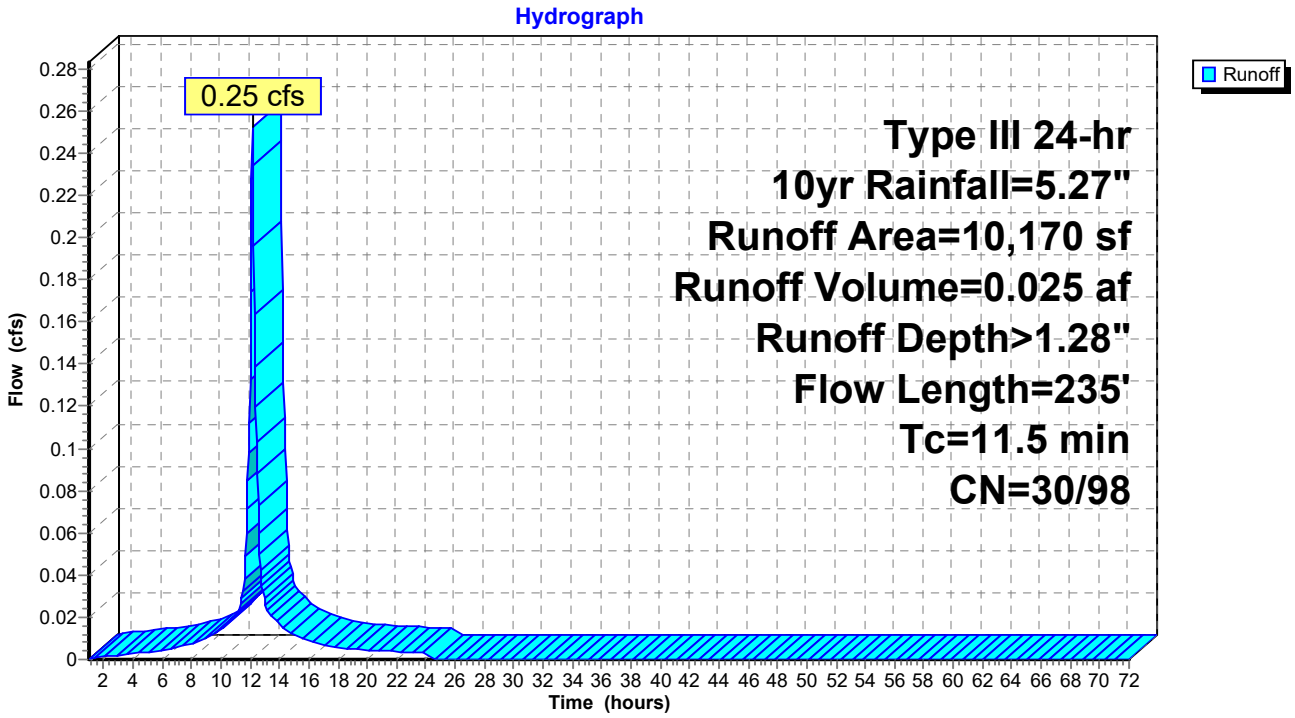
Runoff = 0.25 cfs @ 12.15 hrs, Volume= 0.025 af, Depth> 1.28"
Routed to Pond SP1 : Follins Pond

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10yr Rainfall=5.27"

Area (sf)	CN	Description
2,560	98	Paved parking, HSG A
7,610	30	Woods, Good, HSG A
10,170	47	Weighted Average
7,610	30	74.83% Pervious Area
2,560	98	25.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.6	100	0.1000	0.16		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
0.8	80	0.1200	1.73		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	55	0.1100	6.73		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
11.5	235	Total			

Subcatchment DA1:



Summary for Subcatchment DA2:

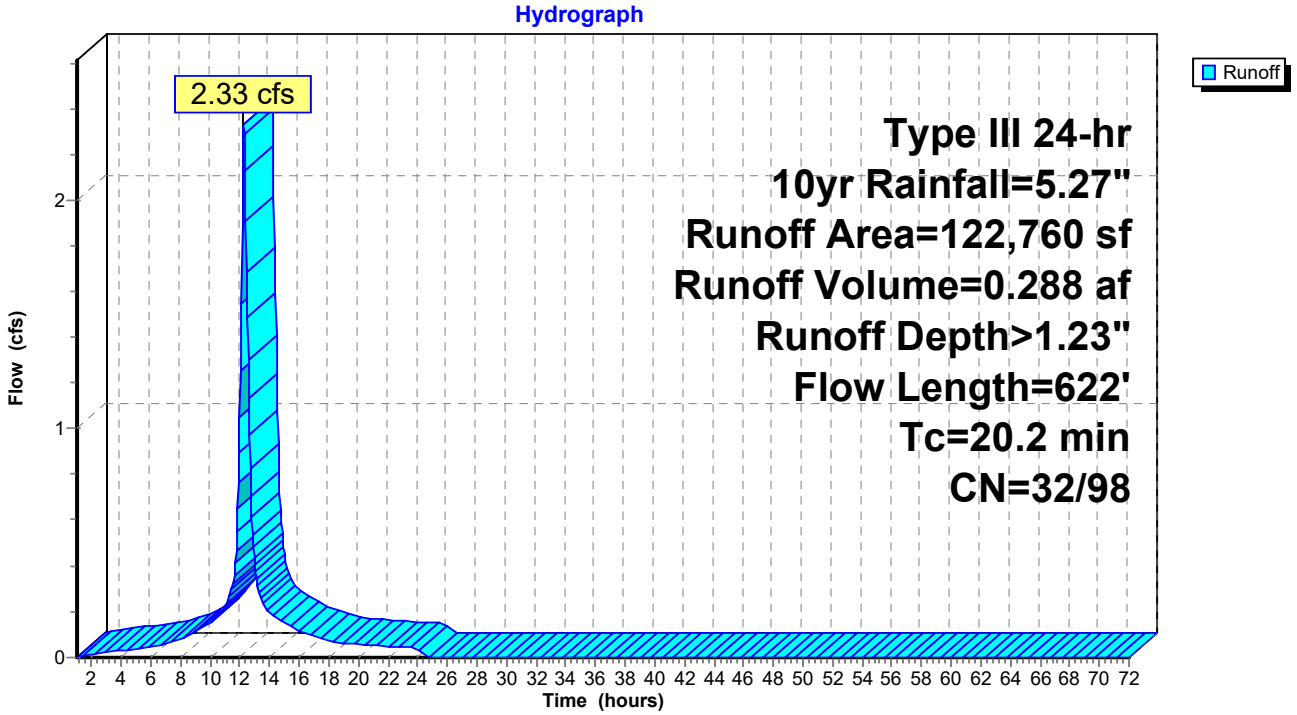
Runoff = 2.33 cfs @ 12.26 hrs, Volume= 0.288 af, Depth> 1.23"
Routed to Pond SP1 : Follins Pond

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10yr Rainfall=5.27"

Area (sf)	CN	Description
21,750	98	Paved parking, HSG A
7,270	98	Unconnected roofs, HSG A
68,330	30	Woods, Good, HSG A
25,410	39	>75% Grass cover, Good, HSG A
122,760	48	Weighted Average
93,740	32	76.36% Pervious Area
29,020	98	23.64% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.2	100	0.0300	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
2.0	155	0.0700	1.32		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.0	367	0.0900	6.09		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
20.2	622	Total			

Subcatchment DA2:



Summary for Subcatchment DA3:

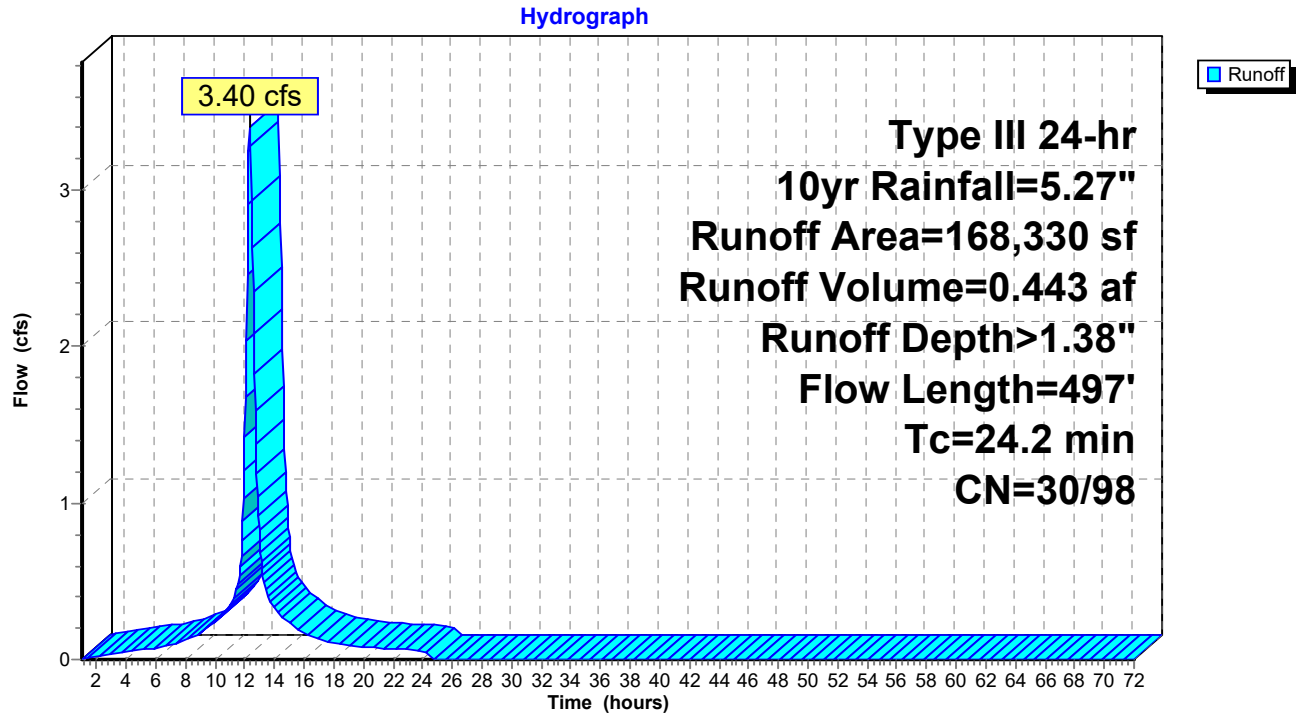
Runoff = 3.40 cfs @ 12.32 hrs, Volume= 0.443 af, Depth> 1.38"
Routed to Pond SP1 : Follins Pond

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10yr Rainfall=5.27"

Area (sf)	CN	Description
27,230	98	Paved parking, HSG A
18,440	98	Unconnected roofs, HSG A
118,570	30	Woods, Good, HSG A
4,090	39	>75% Grass cover, Good, HSG A
168,330	49	Weighted Average
122,660	30	72.87% Pervious Area
45,670	98	27.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.2	100	0.0200	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
3.0	270	0.0900	1.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.0	127	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
24.2	497	Total			

Subcatchment DA3:



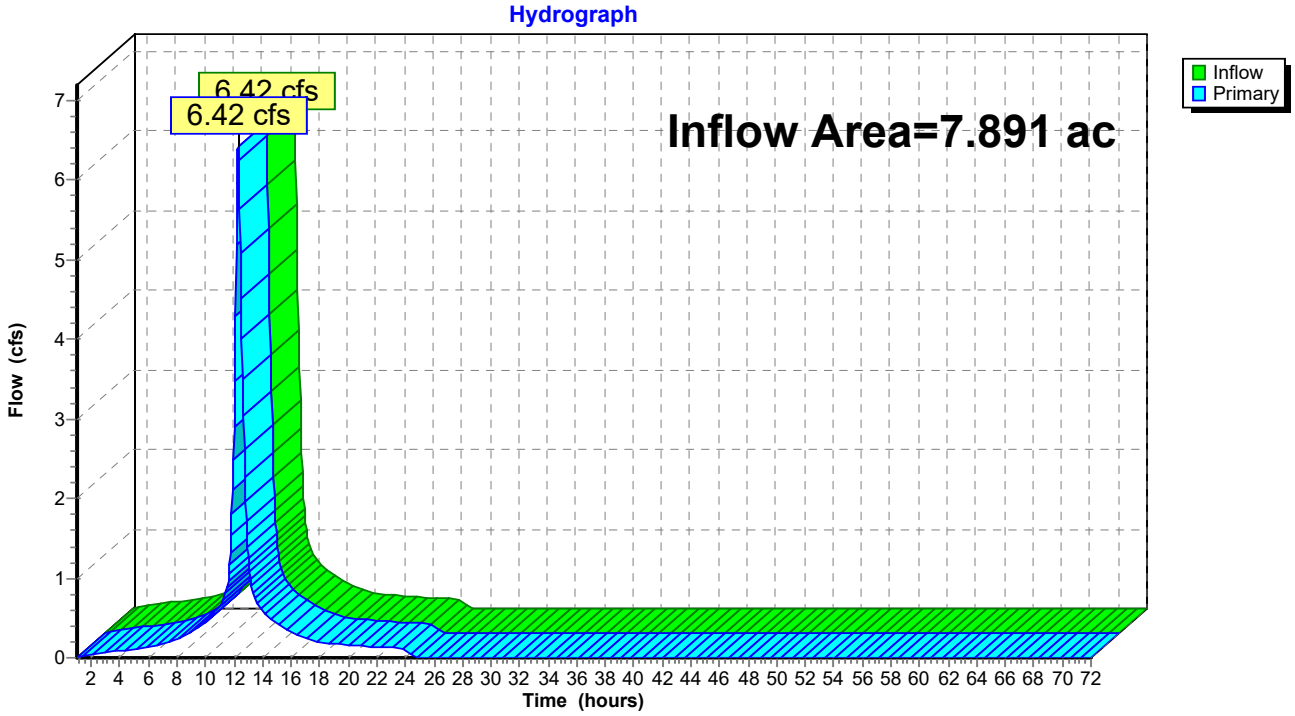
Summary for Pond SP1: Follins Pond

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 7.891 ac, 24.57% Impervious, Inflow Depth > 1.26" for 10yr event
Inflow = 6.42 cfs @ 12.28 hrs, Volume= 0.827 af
Primary = 6.42 cfs @ 12.28 hrs, Volume= 0.827 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs

Pond SP1: Follins Pond



Time span=1.00-72.00 hrs, dt=0.05 hrs, 1421 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment DA0: Runoff Area=42,470 sf 16.93% Impervious Runoff Depth>1.21"
Flow Length=625' Tc=16.2 min CN=31/98 Runoff=0.78 cfs 0.099 af

Subcatchment DA1: Runoff Area=10,170 sf 25.17% Impervious Runoff Depth>1.69"
Flow Length=235' Tc=11.5 min CN=30/98 Runoff=0.31 cfs 0.033 af

Subcatchment DA2: Runoff Area=122,760 sf 23.64% Impervious Runoff Depth>1.66"
Flow Length=622' Tc=20.2 min CN=32/98 Runoff=2.89 cfs 0.389 af

Subcatchment DA3: Runoff Area=168,330 sf 27.13% Impervious Runoff Depth>1.81"
Flow Length=497' Tc=24.2 min CN=30/98 Runoff=4.23 cfs 0.582 af

Pond SP1: Follins Pond Inflow=7.98 cfs 1.102 af
Primary=7.98 cfs 1.102 af

Total Runoff Area = 7.891 ac Runoff Volume = 1.102 af Average Runoff Depth = 1.68"
75.43% Pervious = 5.952 ac 24.57% Impervious = 1.938 ac

Summary for Subcatchment DA0:

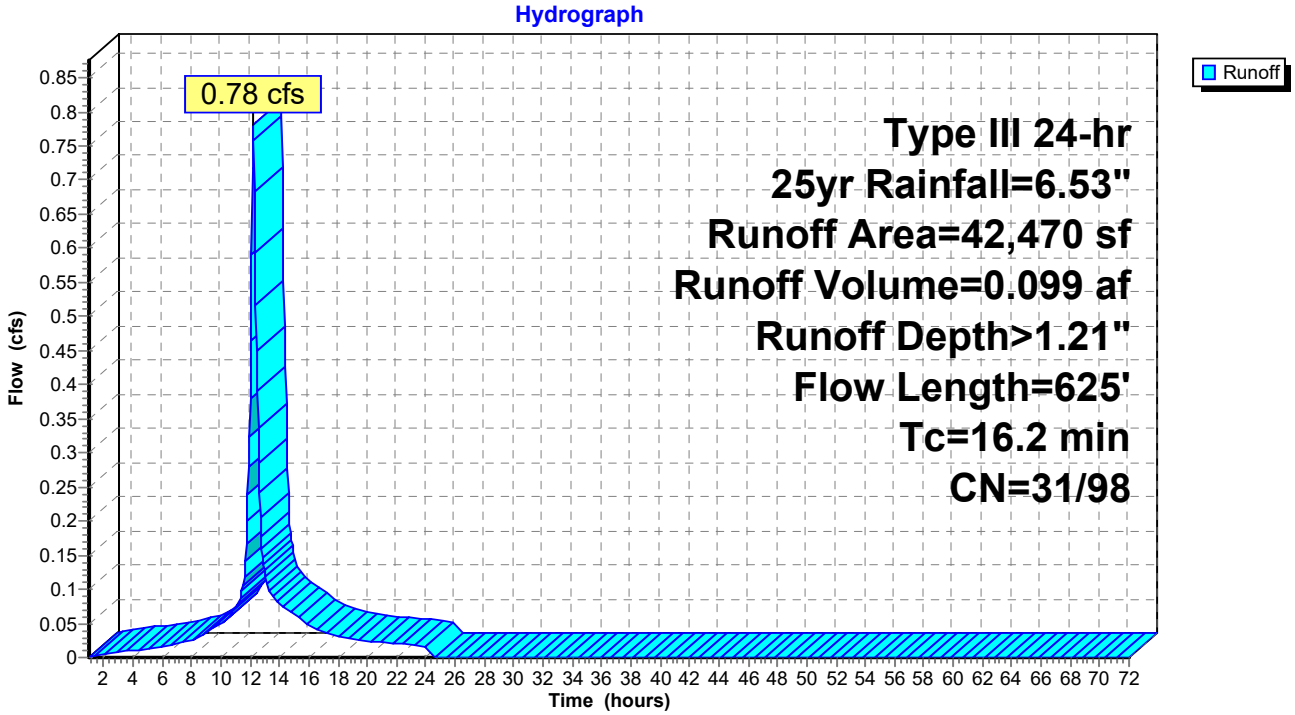
Runoff = 0.78 cfs @ 12.21 hrs, Volume= 0.099 af, Depth> 1.21"
Routed to Pond SP1 : Follins Pond

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25yr Rainfall=6.53"

Area (sf)	CN	Description
4,730	98	Paved parking, HSG A
2,460	98	Unconnected roofs, HSG A
29,910	30	Woods, Good, HSG A
5,370	39	>75% Grass cover, Good, HSG A
42,470	43	Weighted Average
35,280	31	83.07% Pervious Area
7,190	98	16.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.1	100	0.0900	0.15		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
5.0	470	0.1000	1.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	55	0.1100	6.73		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
16.2	625	Total			

Subcatchment DA0:



Summary for Subcatchment DA1:

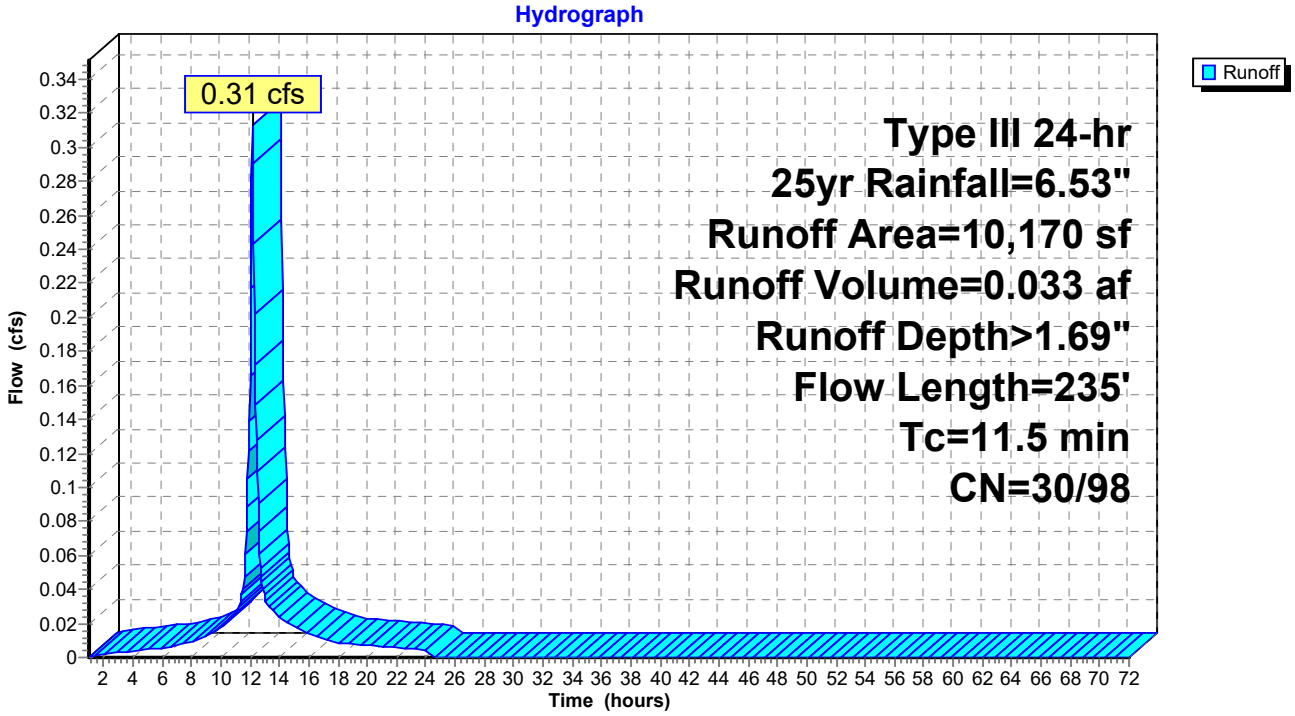
Runoff = 0.31 cfs @ 12.15 hrs, Volume= 0.033 af, Depth> 1.69"
Routed to Pond SP1 : Follins Pond

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25yr Rainfall=6.53"

Area (sf)	CN	Description
2,560	98	Paved parking, HSG A
7,610	30	Woods, Good, HSG A
10,170	47	Weighted Average
7,610	30	74.83% Pervious Area
2,560	98	25.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.6	100	0.1000	0.16		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
0.8	80	0.1200	1.73		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	55	0.1100	6.73		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
11.5	235	Total			

Subcatchment DA1:



Summary for Subcatchment DA2:

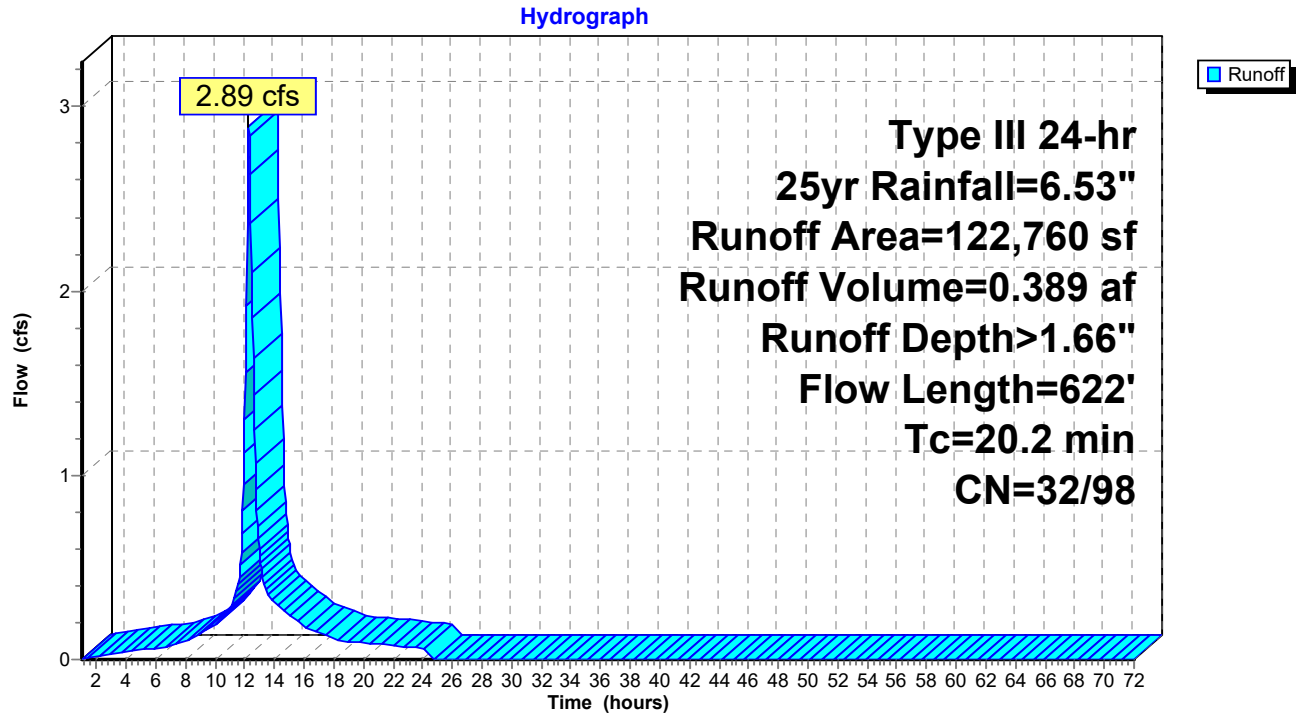
Runoff = 2.89 cfs @ 12.26 hrs, Volume= 0.389 af, Depth> 1.66"
Routed to Pond SP1 : Follins Pond

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25yr Rainfall=6.53"

Area (sf)	CN	Description
21,750	98	Paved parking, HSG A
7,270	98	Unconnected roofs, HSG A
68,330	30	Woods, Good, HSG A
25,410	39	>75% Grass cover, Good, HSG A
122,760	48	Weighted Average
93,740	32	76.36% Pervious Area
29,020	98	23.64% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.2	100	0.0300	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
2.0	155	0.0700	1.32		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.0	367	0.0900	6.09		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
20.2	622	Total			

Subcatchment DA2:



Summary for Subcatchment DA3:

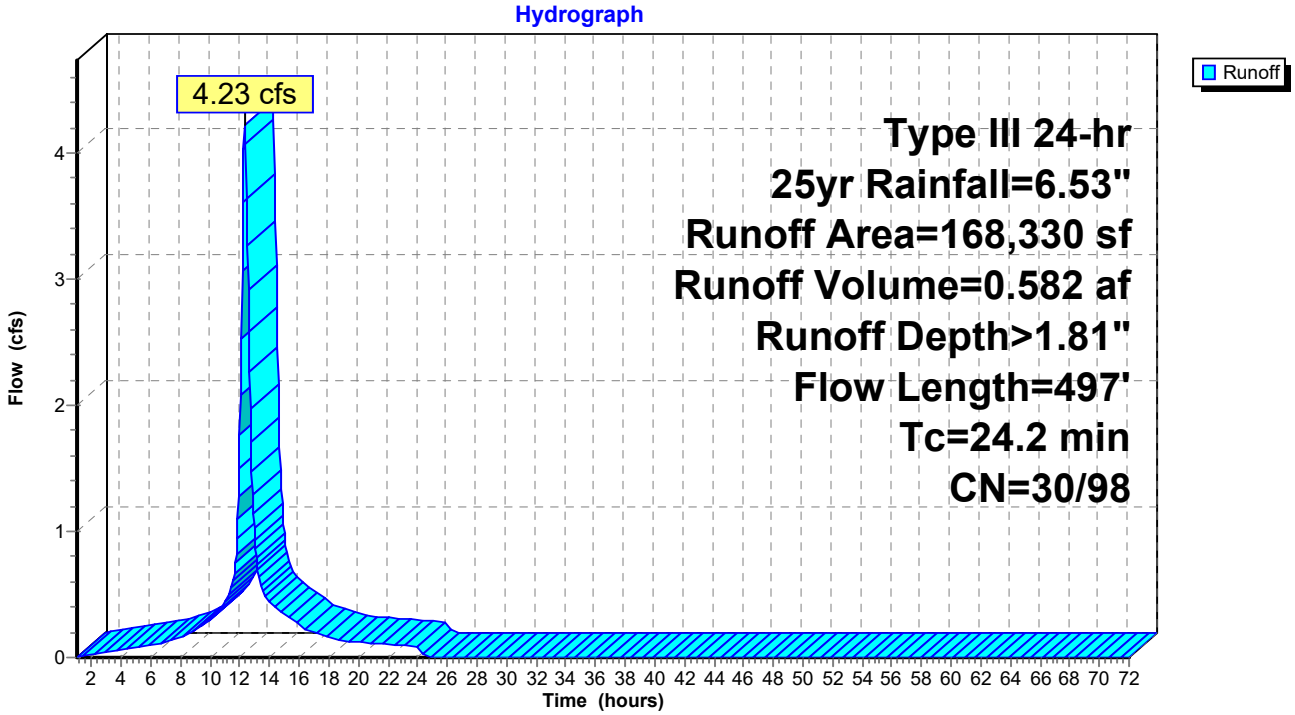
Runoff = 4.23 cfs @ 12.32 hrs, Volume= 0.582 af, Depth> 1.81"
Routed to Pond SP1 : Follins Pond

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25yr Rainfall=6.53"

Area (sf)	CN	Description
27,230	98	Paved parking, HSG A
18,440	98	Unconnected roofs, HSG A
118,570	30	Woods, Good, HSG A
4,090	39	>75% Grass cover, Good, HSG A
168,330	49	Weighted Average
122,660	30	72.87% Pervious Area
45,670	98	27.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.2	100	0.0200	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
3.0	270	0.0900	1.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.0	127	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
24.2	497	Total			

Subcatchment DA3:



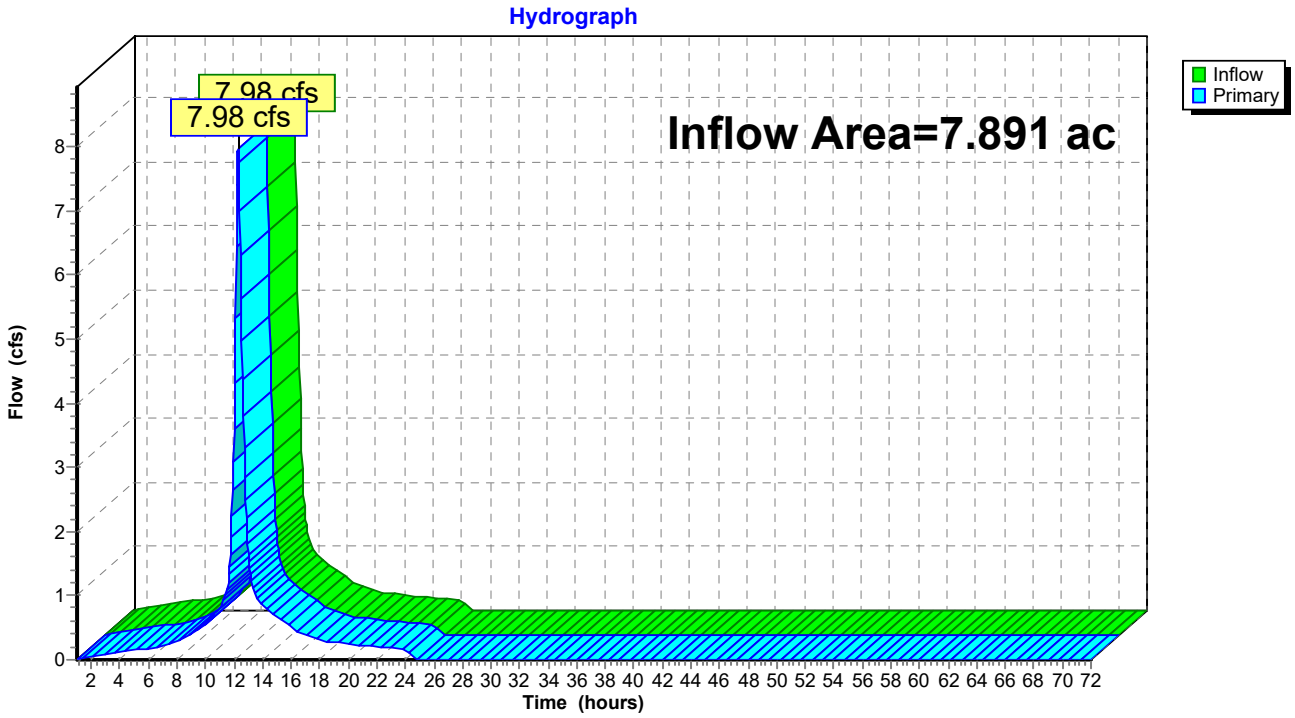
Summary for Pond SP1: Follins Pond

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 7.891 ac, 24.57% Impervious, Inflow Depth > 1.68" for 25yr event
Inflow = 7.98 cfs @ 12.28 hrs, Volume= 1.102 af
Primary = 7.98 cfs @ 12.28 hrs, Volume= 1.102 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs

Pond SP1: Follins Pond



Time span=1.00-72.00 hrs, dt=0.05 hrs, 1421 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment DA0: Runoff Area=42,470 sf 16.93% Impervious Runoff Depth>1.95"
Flow Length=625' Tc=16.2 min CN=31/98 Runoff=1.08 cfs 0.159 af

Subcatchment DA1: Runoff Area=10,170 sf 25.17% Impervious Runoff Depth>2.52"
Flow Length=235' Tc=11.5 min CN=30/98 Runoff=0.42 cfs 0.049 af

Subcatchment DA2: Runoff Area=122,760 sf 23.64% Impervious Runoff Depth>2.54"
Flow Length=622' Tc=20.2 min CN=32/98 Runoff=4.08 cfs 0.595 af

Subcatchment DA3: Runoff Area=168,330 sf 27.13% Impervious Runoff Depth>2.68"
Flow Length=497' Tc=24.2 min CN=30/98 Runoff=5.68 cfs 0.862 af

Pond SP1: Follins Pond Inflow=11.03 cfs 1.665 af
Primary=11.03 cfs 1.665 af

Total Runoff Area = 7.891 ac Runoff Volume = 1.665 af Average Runoff Depth = 2.53"
75.43% Pervious = 5.952 ac 24.57% Impervious = 1.938 ac

Summary for Subcatchment DA0:

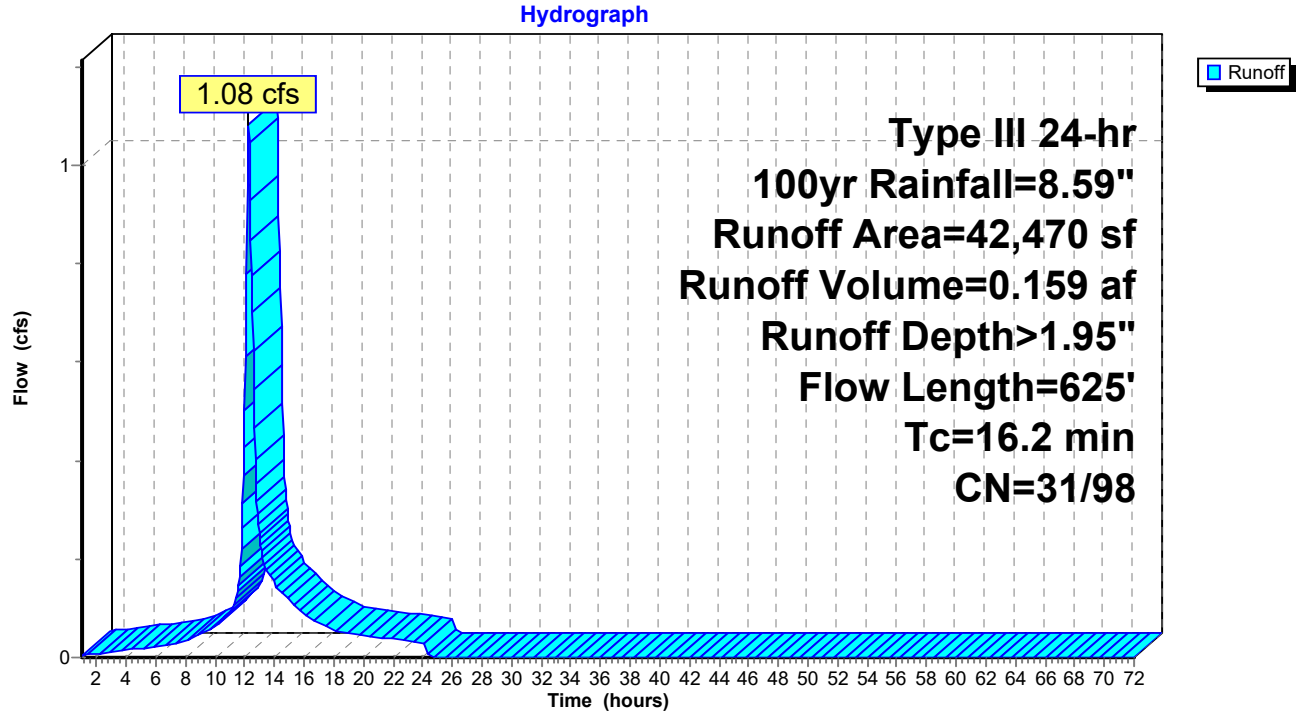
Runoff = 1.08 cfs @ 12.23 hrs, Volume= 0.159 af, Depth> 1.95"
Routed to Pond SP1 : Follins Pond

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100yr Rainfall=8.59"

Area (sf)	CN	Description
4,730	98	Paved parking, HSG A
2,460	98	Unconnected roofs, HSG A
29,910	30	Woods, Good, HSG A
5,370	39	>75% Grass cover, Good, HSG A
42,470	43	Weighted Average
35,280	31	83.07% Pervious Area
7,190	98	16.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.1	100	0.0900	0.15		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
5.0	470	0.1000	1.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	55	0.1100	6.73		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
16.2	625	Total			

Subcatchment DA0:



Summary for Subcatchment DA1:

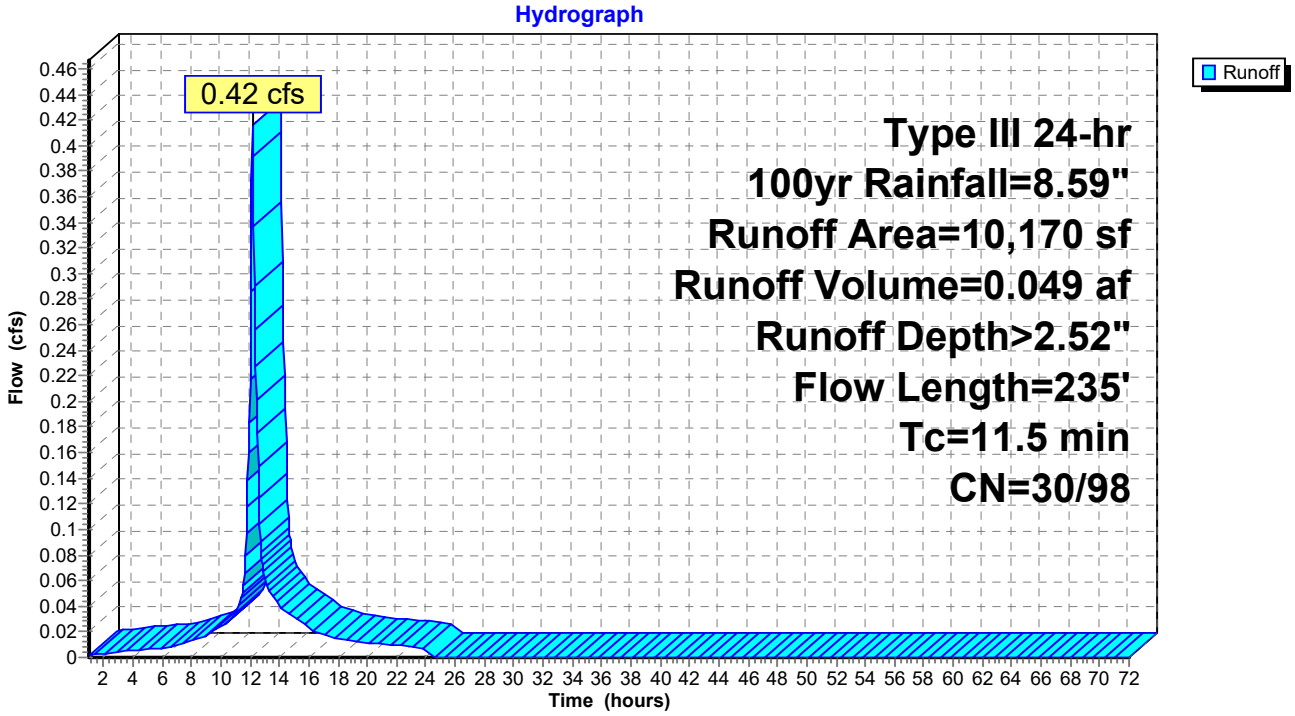
Runoff = 0.42 cfs @ 12.16 hrs, Volume= 0.049 af, Depth> 2.52"
Routed to Pond SP1 : Follins Pond

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100yr Rainfall=8.59"

Area (sf)	CN	Description
2,560	98	Paved parking, HSG A
7,610	30	Woods, Good, HSG A
10,170	47	Weighted Average
7,610	30	74.83% Pervious Area
2,560	98	25.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.6	100	0.1000	0.16		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
0.8	80	0.1200	1.73		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	55	0.1100	6.73		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
11.5	235	Total			

Subcatchment DA1:



Summary for Subcatchment DA2:

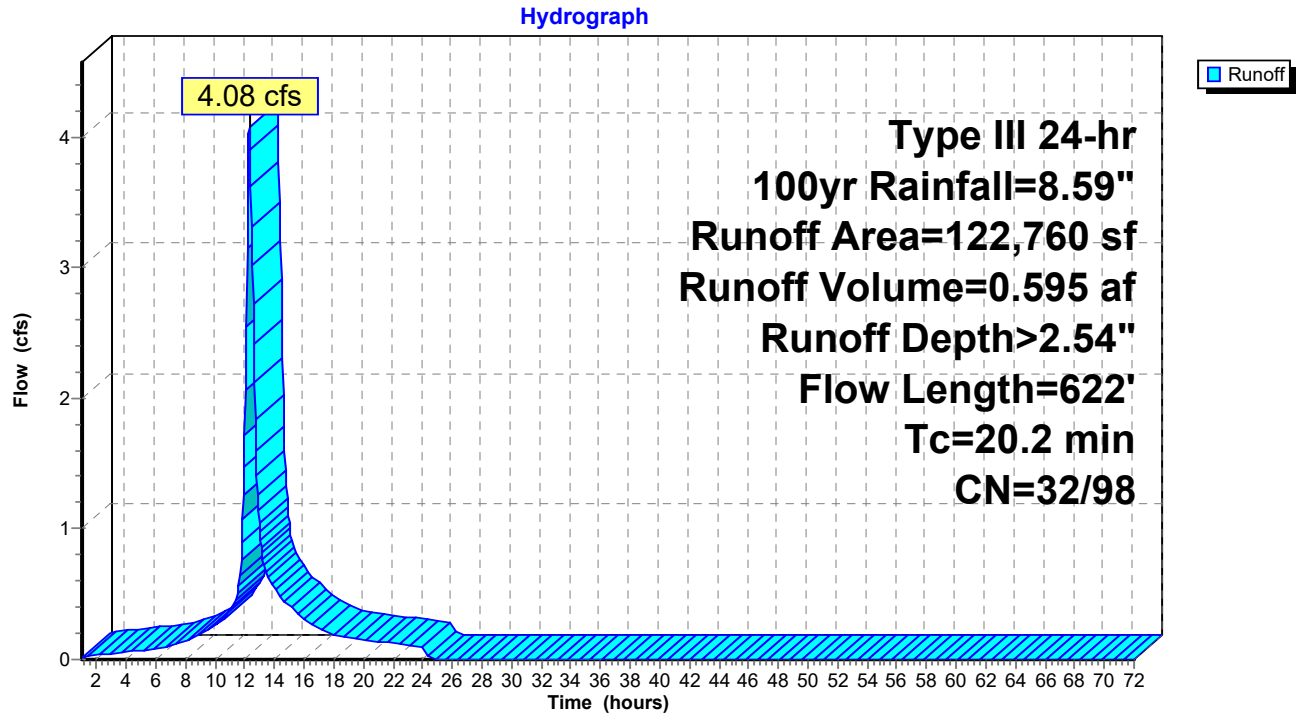
Runoff = 4.08 cfs @ 12.29 hrs, Volume= 0.595 af, Depth> 2.54"
Routed to Pond SP1 : Follins Pond

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100yr Rainfall=8.59"

Area (sf)	CN	Description
21,750	98	Paved parking, HSG A
7,270	98	Unconnected roofs, HSG A
68,330	30	Woods, Good, HSG A
25,410	39	>75% Grass cover, Good, HSG A
122,760	48	Weighted Average
93,740	32	76.36% Pervious Area
29,020	98	23.64% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.2	100	0.0300	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
2.0	155	0.0700	1.32		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.0	367	0.0900	6.09		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
20.2	622	Total			

Subcatchment DA2:



Summary for Subcatchment DA3:

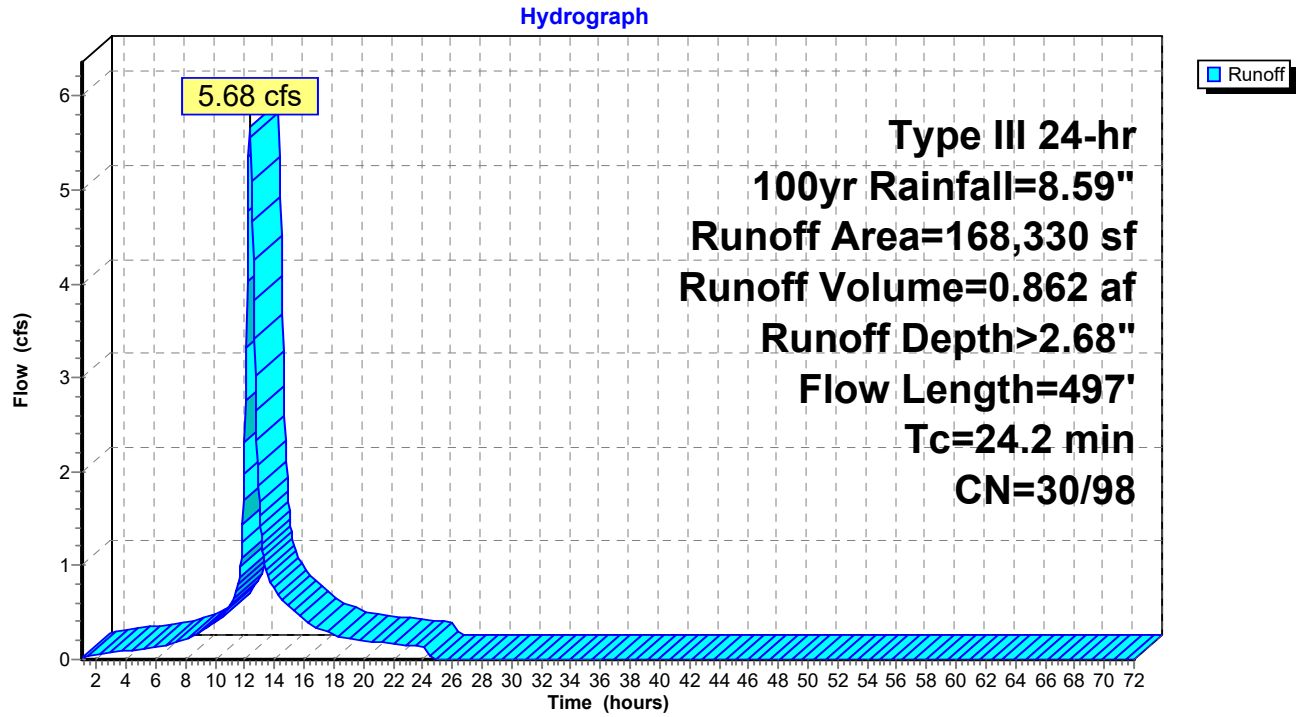
Runoff = 5.68 cfs @ 12.33 hrs, Volume= 0.862 af, Depth> 2.68"
Routed to Pond SP1 : Follins Pond

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100yr Rainfall=8.59"

Area (sf)	CN	Description
27,230	98	Paved parking, HSG A
18,440	98	Unconnected roofs, HSG A
118,570	30	Woods, Good, HSG A
4,090	39	>75% Grass cover, Good, HSG A
168,330	49	Weighted Average
122,660	30	72.87% Pervious Area
45,670	98	27.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.2	100	0.0200	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
3.0	270	0.0900	1.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.0	127	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
24.2	497	Total			

Subcatchment DA3:



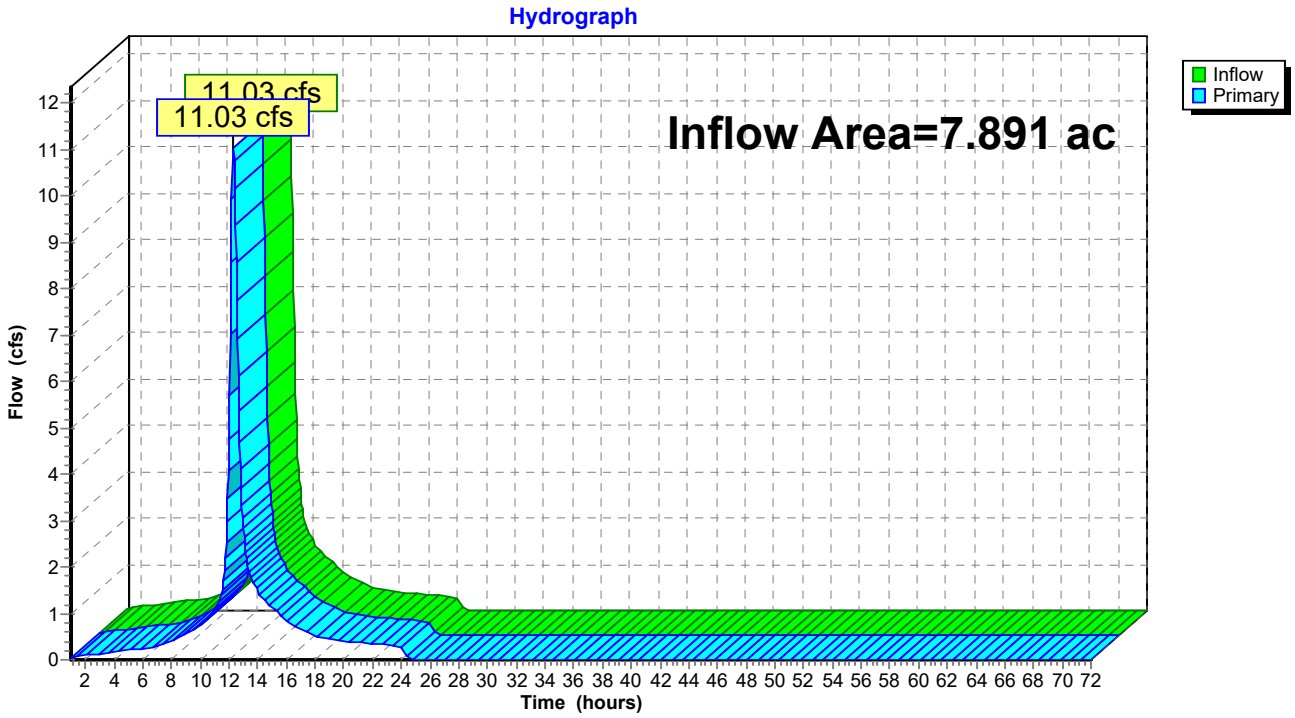
Summary for Pond SP1: Follins Pond

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 7.891 ac, 24.57% Impervious, Inflow Depth > 2.53" for 100yr event
Inflow = 11.03 cfs @ 12.30 hrs, Volume= 1.665 af
Primary = 11.03 cfs @ 12.30 hrs, Volume= 1.665 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs

Pond SP1: Follins Pond



Time span=1.00-72.00 hrs, dt=0.05 hrs, 1421 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment DA0: Runoff Area=42,470 sf 16.93% Impervious Runoff Depth=0.17"
Flow Length=625' Tc=16.2 min CN=31/98 Runoff=0.13 cfs 0.014 af

Subcatchment DA1: Runoff Area=10,170 sf 25.17% Impervious Runoff Depth=0.25"
Flow Length=235' Tc=11.5 min CN=30/98 Runoff=0.05 cfs 0.005 af

Subcatchment DA2: Runoff Area=122,760 sf 23.64% Impervious Runoff Depth=0.24"
Flow Length=622' Tc=20.2 min CN=32/98 Runoff=0.50 cfs 0.055 af

Subcatchment DA3: Runoff Area=168,330 sf 27.13% Impervious Runoff Depth=0.27"
Flow Length=497' Tc=24.2 min CN=30/98 Runoff=0.73 cfs 0.087 af

Pond SP1: Follins Pond Inflow=1.37 cfs 0.161 af
Primary=1.37 cfs 0.161 af

Total Runoff Area = 7.891 ac Runoff Volume = 0.161 af Average Runoff Depth = 0.24"
75.43% Pervious = 5.952 ac 24.57% Impervious = 1.938 ac

Summary for Subcatchment DA0:

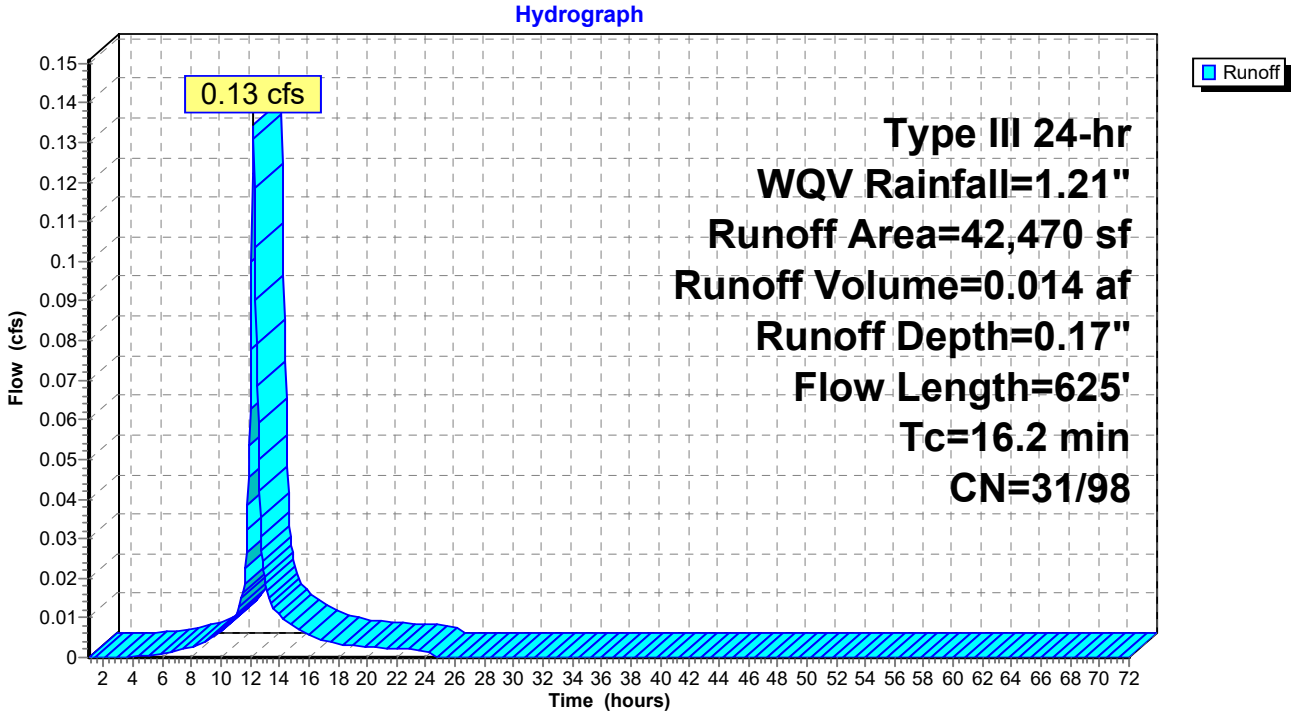
Runoff = 0.13 cfs @ 12.21 hrs, Volume= 0.014 af, Depth= 0.17"
Routed to Pond SP1 : Follins Pond

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr WQV Rainfall=1.21"

Area (sf)	CN	Description
4,730	98	Paved parking, HSG A
2,460	98	Unconnected roofs, HSG A
29,910	30	Woods, Good, HSG A
5,370	39	>75% Grass cover, Good, HSG A
42,470	43	Weighted Average
35,280	31	83.07% Pervious Area
7,190	98	16.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.1	100	0.0900	0.15		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
5.0	470	0.1000	1.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	55	0.1100	6.73		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
16.2	625	Total			

Subcatchment DA0:



Summary for Subcatchment DA1:

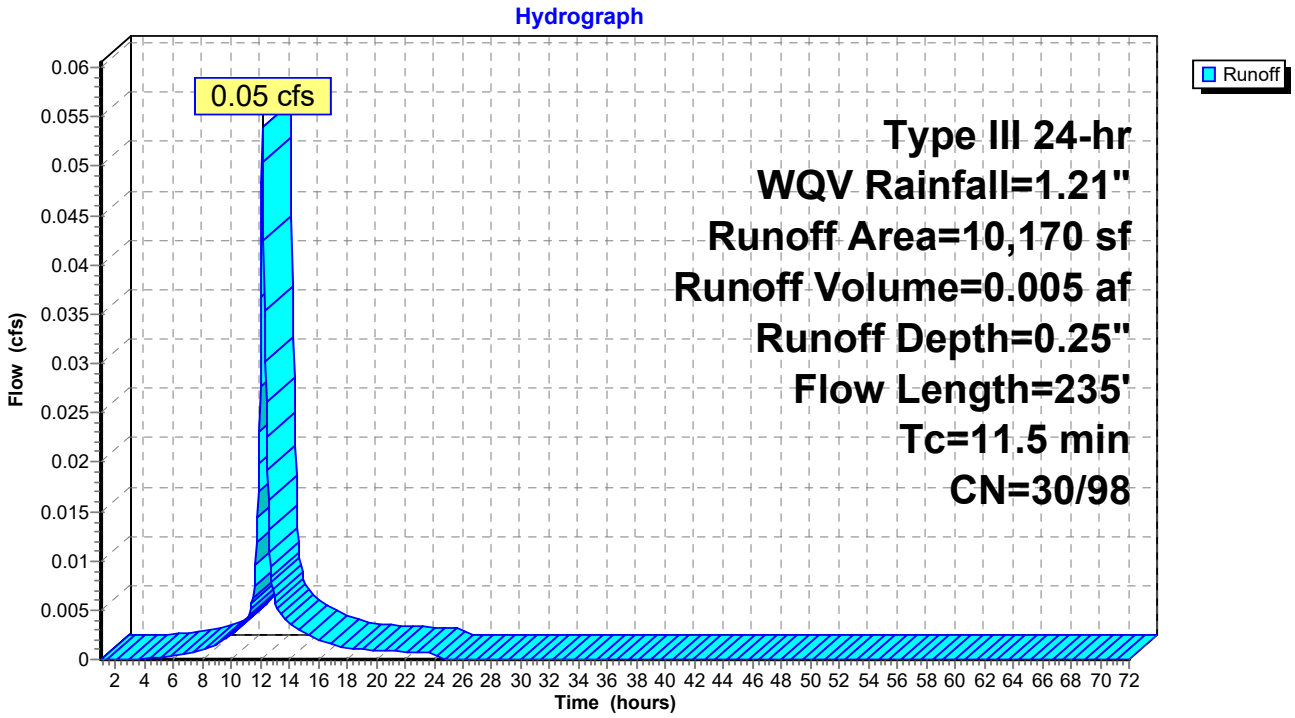
Runoff = 0.05 cfs @ 12.16 hrs, Volume= 0.005 af, Depth= 0.25"
Routed to Pond SP1 : Follins Pond

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr WQV Rainfall=1.21"

Area (sf)	CN	Description
2,560	98	Paved parking, HSG A
7,610	30	Woods, Good, HSG A
10,170	47	Weighted Average
7,610	30	74.83% Pervious Area
2,560	98	25.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.6	100	0.1000	0.16		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
0.8	80	0.1200	1.73		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	55	0.1100	6.73		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
11.5	235	Total			

Subcatchment DA1:



Summary for Subcatchment DA2:

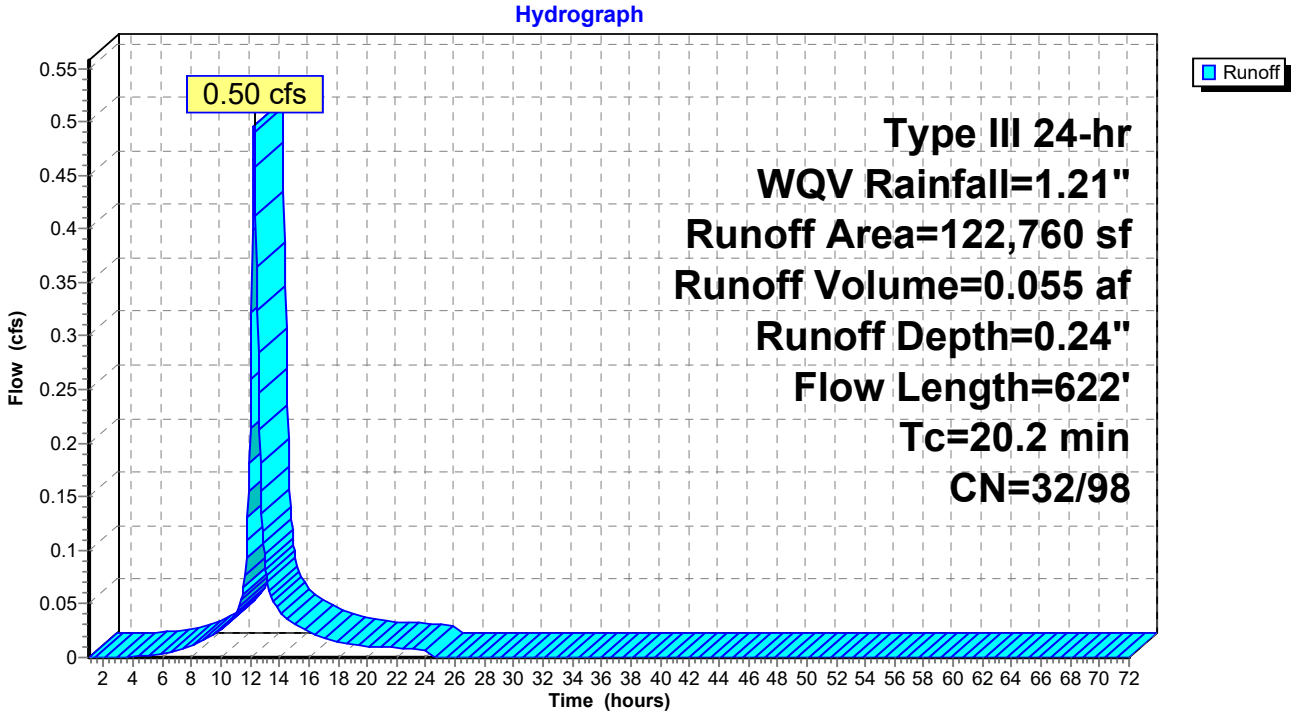
Runoff = 0.50 cfs @ 12.27 hrs, Volume= 0.055 af, Depth= 0.24"
Routed to Pond SP1 : Follins Pond

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr WQV Rainfall=1.21"

Area (sf)	CN	Description
21,750	98	Paved parking, HSG A
7,270	98	Unconnected roofs, HSG A
68,330	30	Woods, Good, HSG A
25,410	39	>75% Grass cover, Good, HSG A
122,760	48	Weighted Average
93,740	32	76.36% Pervious Area
29,020	98	23.64% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.2	100	0.0300	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
2.0	155	0.0700	1.32		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.0	367	0.0900	6.09		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
20.2	622	Total			

Subcatchment DA2:



Summary for Subcatchment DA3:

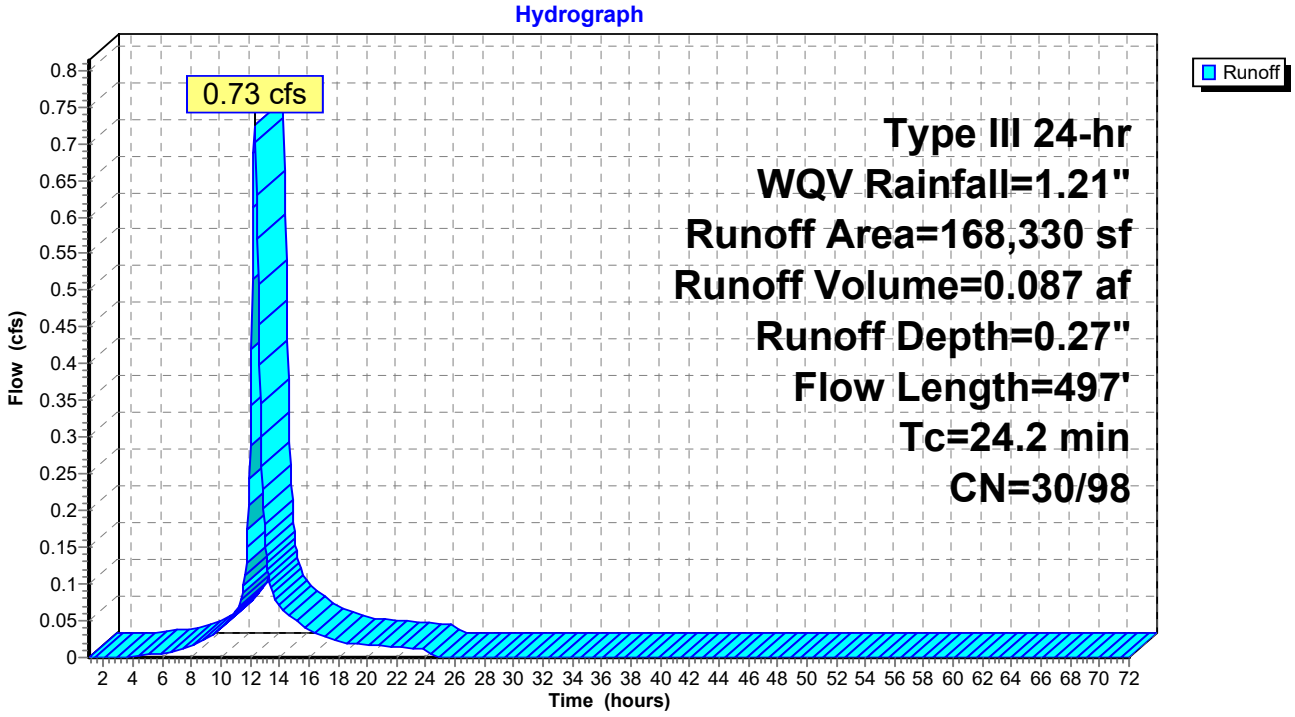
Runoff = 0.73 cfs @ 12.32 hrs, Volume= 0.087 af, Depth= 0.27"
Routed to Pond SP1 : Follins Pond

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr WQV Rainfall=1.21"

Area (sf)	CN	Description
27,230	98	Paved parking, HSG A
18,440	98	Unconnected roofs, HSG A
118,570	30	Woods, Good, HSG A
4,090	39	>75% Grass cover, Good, HSG A
168,330	49	Weighted Average
122,660	30	72.87% Pervious Area
45,670	98	27.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.2	100	0.0200	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
3.0	270	0.0900	1.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.0	127	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
24.2	497	Total			

Subcatchment DA3:



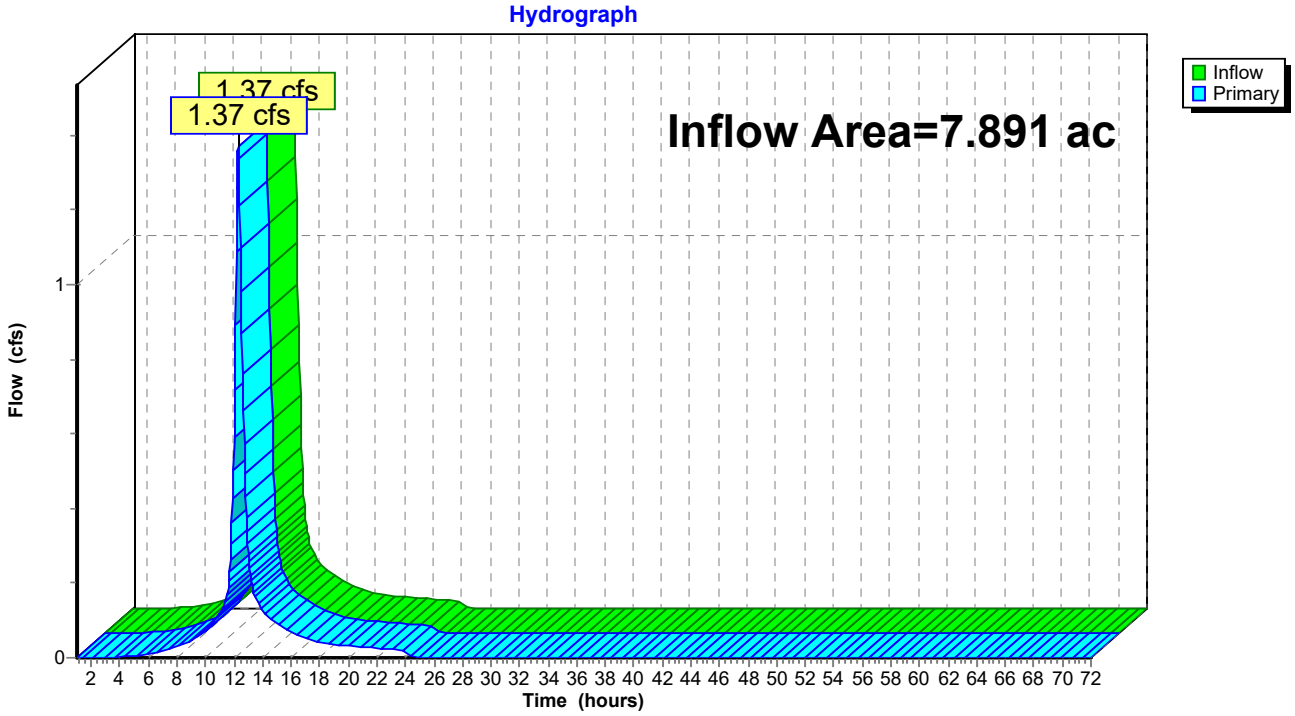
Summary for Pond SP1: Follins Pond

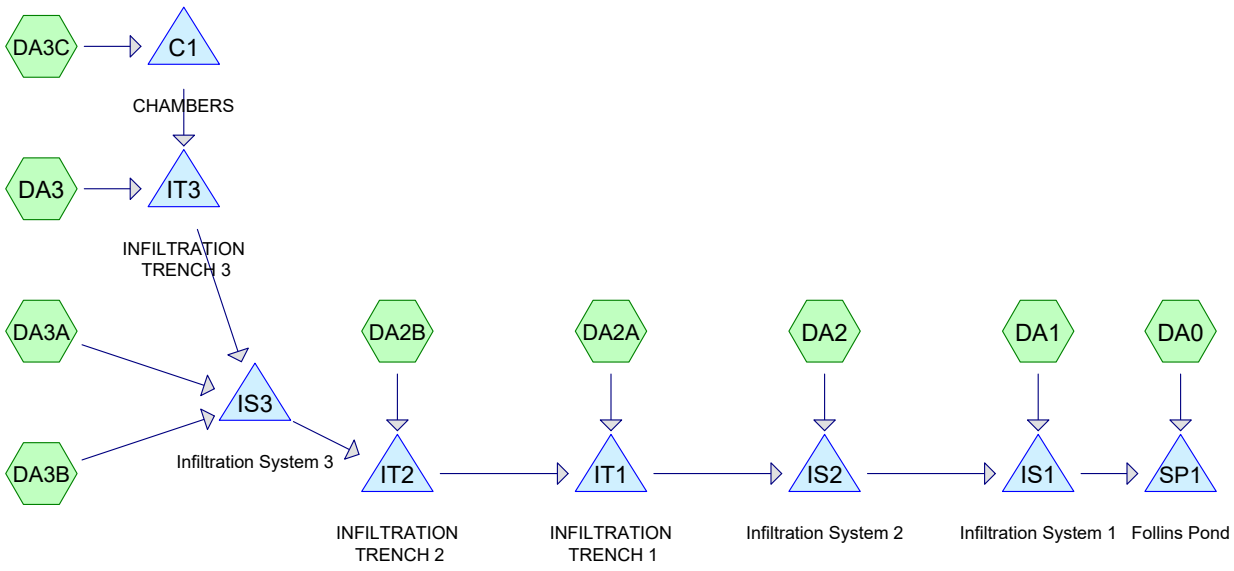
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 7.891 ac, 24.57% Impervious, Inflow Depth = 0.24" for WQV event
Inflow = 1.37 cfs @ 12.28 hrs, Volume= 0.161 af
Primary = 1.37 cfs @ 12.28 hrs, Volume= 0.161 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs

Pond SP1: Follins Pond





Subcat Reach Pond Link

Routing Diagram for 22032 FOLLINS PR
Prepared by Horsley Witten Inc, Printed 1/15/2024

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2yr	Type III 24-hr		Default	24.00	1	3.60	2
2	10yr	Type III 24-hr		Default	24.00	1	5.27	2
3	25yr	Type III 24-hr		Default	24.00	1	6.53	2
4	100yr	Type III 24-hr		Default	24.00	1	8.59	2
5	WQV	Type III 24-hr		Default	24.00	1	1.21	2

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
34,710	39	>75% Grass cover, Good, HSG A (DA0, DA2B, DA3B, DA3C)
56,390	98	Paved parking, HSG A (DA0, DA1, DA2, DA2A, DA2B, DA3, DA3A, DA3B, DA3C)
28,150	98	Unconnected roofs, HSG A (DA0, DA2, DA2A, DA3, DA3B, DA3C)
224,870	30	Woods, Good, HSG A (DA0, DA1, DA2, DA2A, DA2B, DA3, DA3A, DA3B, DA3C)
344,120	**48**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
344,120	HSG A	DA0, DA1, DA2, DA2A, DA2B, DA3, DA3A, DA3B, DA3C
0	HSG B	
0	HSG C	
0	HSG D	
0	Other	
344,120		**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	Sub Num
34,710	0	0	0	0	34,710	>75% Grass cover, Good	
56,390	0	0	0	0	56,390	Paved parking	
28,150	0	0	0	0	28,150	Unconnected roofs	
224,870	0	0	0	0	224,870	Woods, Good	
344,120	**0**	**0**	**0**	**0**	**344,120**	**TOTAL AREA**	

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment DA0: Runoff Area=42,470 sf 16.93% Impervious Runoff Depth=0.57"
Flow Length=625' Tc=16.2 min CN=31/98 Runoff=0.43 cfs 2,017 cf

Subcatchment DA1: Runoff Area=10,180 sf 25.15% Impervious Runoff Depth=0.85"
Flow Length=235' Tc=11.5 min CN=30/98 Runoff=0.17 cfs 718 cf

Subcatchment DA2: Runoff Area=4,780 sf 22.80% Impervious Runoff Depth=0.77"
Tc=5.0 min CN=30/98 Runoff=0.09 cfs 306 cf

Subcatchment DA2A: Runoff Area=6,140 sf 32.74% Impervious Runoff Depth=1.10"
Tc=5.0 min CN=30/98 Runoff=0.17 cfs 564 cf

Subcatchment DA2B: Runoff Area=20,580 sf 27.75% Impervious Runoff Depth=0.93"
Tc=5.0 min CN=31/98 Runoff=0.48 cfs 1,602 cf

Subcatchment DA3: Runoff Area=26,890 sf 29.04% Impervious Runoff Depth=0.98"
Tc=5.0 min CN=30/98 Runoff=0.65 cfs 2,191 cf

Subcatchment DA3A: Runoff Area=18,760 sf 29.74% Impervious Runoff Depth=1.00"
Flow Length=480' Tc=19.7 min CN=30/98 Runoff=0.31 cfs 1,565 cf

Subcatchment DA3B: Runoff Area=72,920 sf 20.08% Impervious Runoff Depth=0.68"
Flow Length=495' Tc=24.2 min CN=34/98 Runoff=0.74 cfs 4,107 cf

Subcatchment DA3C: Runoff Area=141,400 sf 26.84% Impervious Runoff Depth=0.90"
Flow Length=235' Tc=12.7 min CN=30/98 Runoff=2.48 cfs 10,646 cf

Pond C1: CHAMBERS Peak Elev=29.73' Storage=3,205 cf Inflow=2.48 cfs 10,646 cf
Discarded=0.37 cfs 10,639 cf Primary=0.00 cfs 0 cf Outflow=0.37 cfs 10,639 cf

Pond IS1: Infiltration System 1 Peak Elev=13.60' Storage=999 cf Inflow=1.47 cfs 2,589 cf
Discarded=0.06 cfs 1,667 cf Primary=1.09 cfs 922 cf Outflow=1.15 cfs 2,589 cf

Pond IS2: Infiltration System 2 Peak Elev=17.00' Storage=999 cf Inflow=1.73 cfs 3,413 cf
Discarded=0.06 cfs 1,542 cf Primary=1.32 cfs 1,871 cf Outflow=1.38 cfs 3,413 cf

Pond IS3: Infiltration System 3 Peak Elev=30.87' Storage=973 cf Inflow=1.24 cfs 6,399 cf
Discarded=0.06 cfs 3,584 cf Primary=1.19 cfs 2,814 cf Outflow=1.24 cfs 6,399 cf

Pond IT1: INFILTRATION TRENCH 1 Peak Elev=20.69' Storage=134 cf Inflow=1.76 cfs 3,729 cf
Discarded=0.08 cfs 551 cf Primary=1.64 cfs 3,107 cf Outflow=1.72 cfs 3,659 cf

Pond IT2: INFILTRATION TRENCH 2 Peak Elev=23.50' Storage=297 cf Inflow=1.63 cfs 4,416 cf
Discarded=0.04 cfs 1,046 cf Primary=1.59 cfs 3,165 cf Outflow=1.63 cfs 4,211 cf

Pond IT3: INFILTRATION TRENCH 3 Peak Elev=34.14' Storage=341 cf Inflow=0.65 cfs 2,191 cf
Discarded=0.05 cfs 1,242 cf Primary=0.60 cfs 727 cf Outflow=0.65 cfs 1,969 cf

Pond SP1: Follins Pond

Inflow=1.35 cfs 2,939 cf
Primary=1.35 cfs 2,939 cf

Total Runoff Area = 344,120 sf Runoff Volume = 23,715 cf Average Runoff Depth = 0.83"
75.43% Pervious = 259,580 sf 24.57% Impervious = 84,540 sf

Summary for Subcatchment DA0:

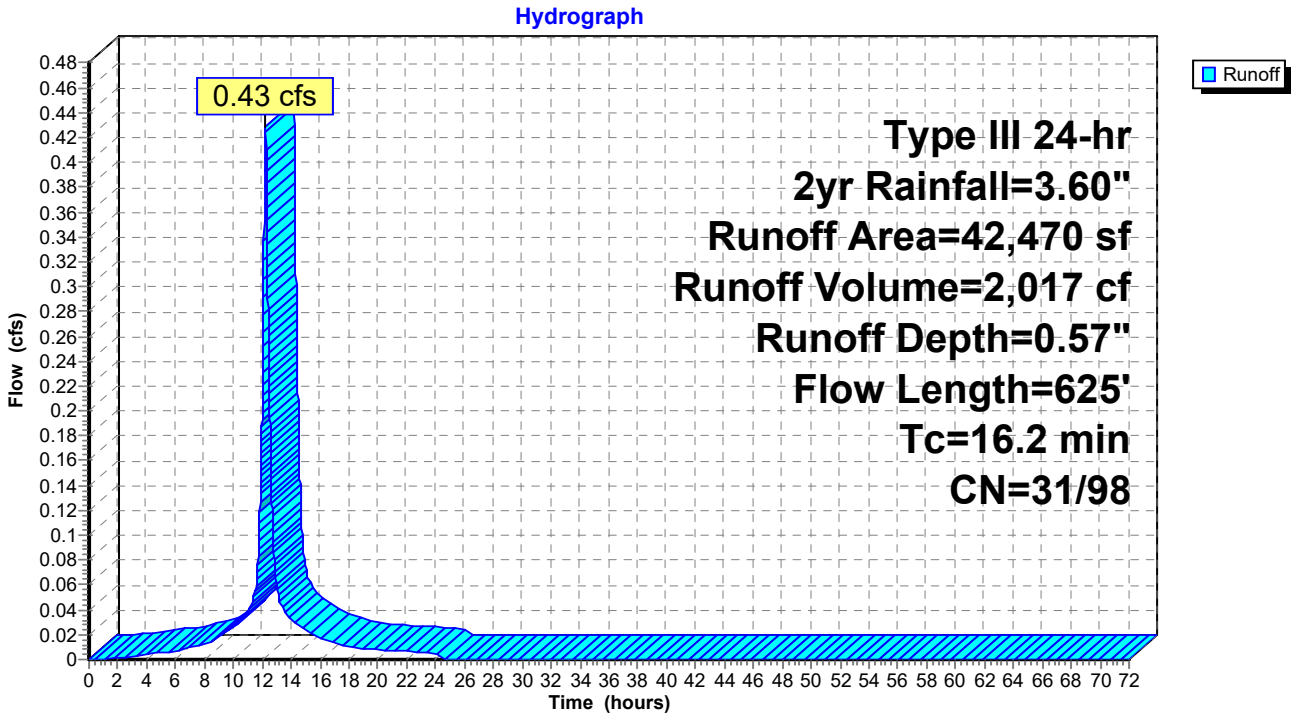
Runoff = 0.43 cfs @ 12.21 hrs, Volume= 2,017 cf, Depth= 0.57"
Routed to Pond SP1 : Follins Pond

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2yr Rainfall=3.60"

Area (sf)	CN	Description
4,730	98	Paved parking, HSG A
2,460	98	Unconnected roofs, HSG A
29,910	30	Woods, Good, HSG A
5,370	39	>75% Grass cover, Good, HSG A
42,470	43	Weighted Average
35,280	31	83.07% Pervious Area
7,190	98	16.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.1	100	0.0900	0.15		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
5.0	470	0.1000	1.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	55	0.1100	6.73		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
16.2	625	Total			

Subcatchment DA0:



Summary for Subcatchment DA1:

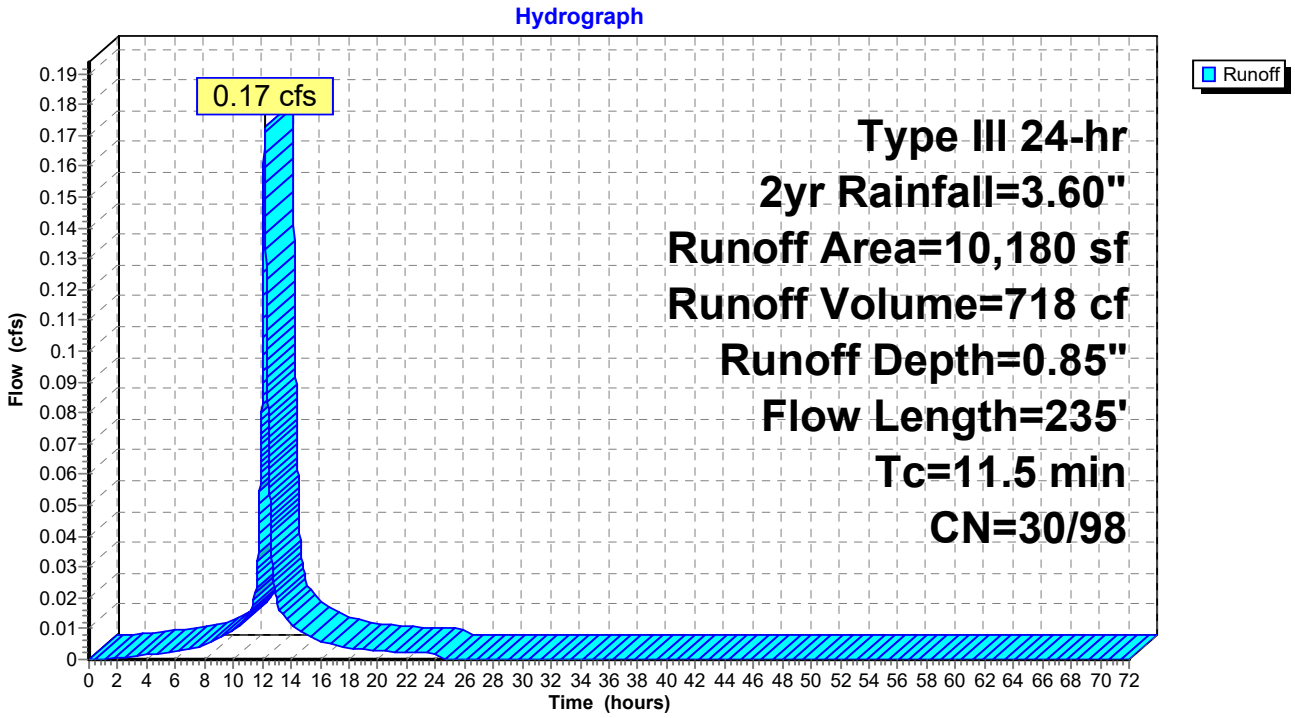
Runoff = 0.17 cfs @ 12.15 hrs, Volume= 718 cf, Depth= 0.85"
Routed to Pond IS1 : Infiltration System 1

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2yr Rainfall=3.60"

Area (sf)	CN	Description
2,560	98	Paved parking, HSG A
7,620	30	Woods, Good, HSG A
10,180	47	Weighted Average
7,620	30	74.85% Pervious Area
2,560	98	25.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.6	100	0.1000	0.16		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
0.8	80	0.1200	1.73		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	55	0.1100	6.73		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
11.5	235	Total			

Subcatchment DA1:



Summary for Subcatchment DA2:

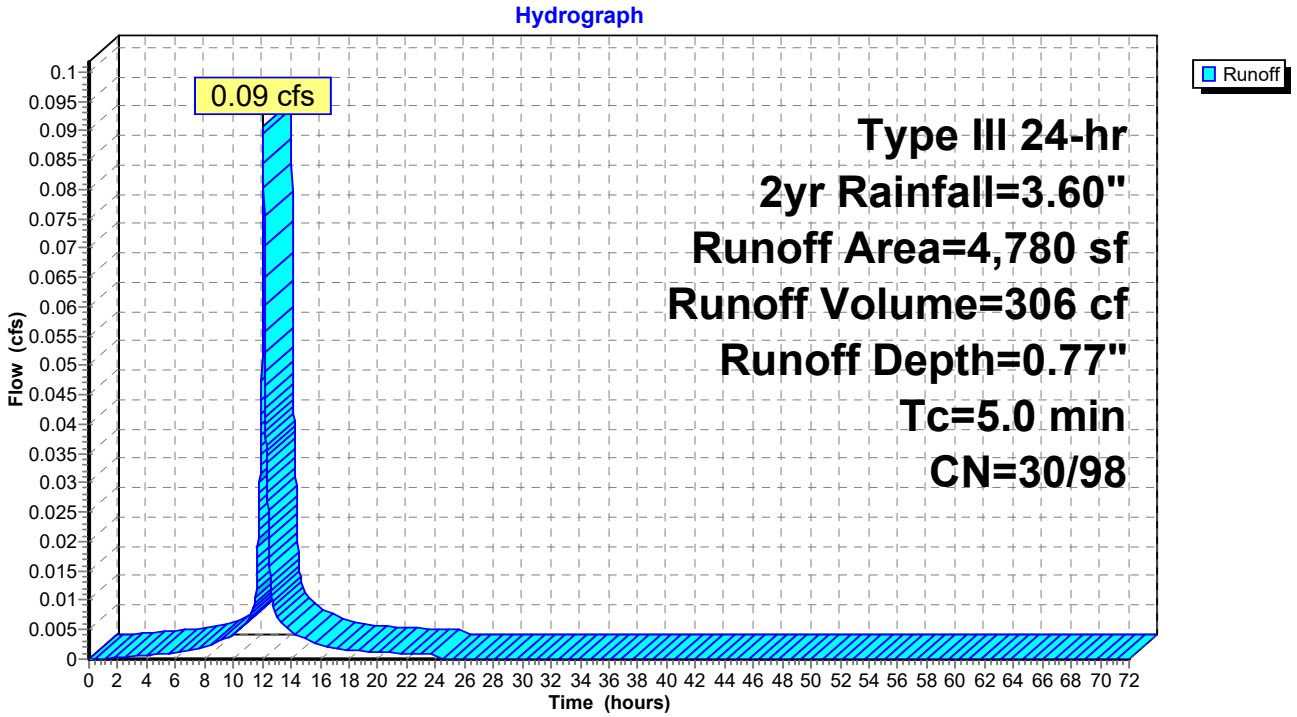
Runoff = 0.09 cfs @ 12.07 hrs, Volume= 306 cf, Depth= 0.77"
Routed to Pond IS2 : Infiltration System 2

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2yr Rainfall=3.60"

Area (sf)	CN	Description
740	98	Paved parking, HSG A
350	98	Unconnected roofs, HSG A
3,690	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
4,780	46	Weighted Average
3,690	30	77.20% Pervious Area
1,090	98	22.80% Impervious Area

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

Subcatchment DA2:



Summary for Subcatchment DA2A:

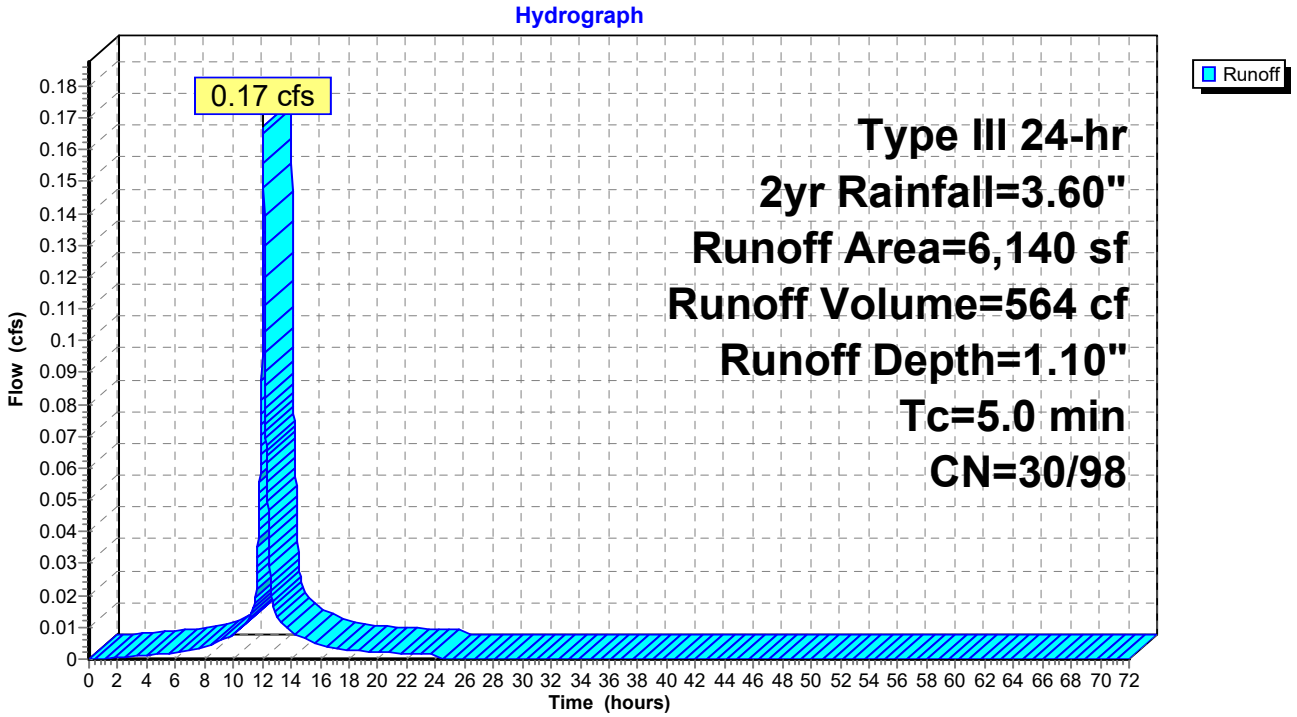
Runoff = 0.17 cfs @ 12.07 hrs, Volume= 564 cf, Depth= 1.10"
Routed to Pond IT1 : INFILTRATION TRENCH 1

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2yr Rainfall=3.60"

Area (sf)	CN	Description
1,080	98	Paved parking, HSG A
930	98	Unconnected roofs, HSG A
4,130	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
6,140	52	Weighted Average
4,130	30	67.26% Pervious Area
2,010	98	32.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 min direct**

Subcatchment DA2A:



Summary for Subcatchment DA2B:

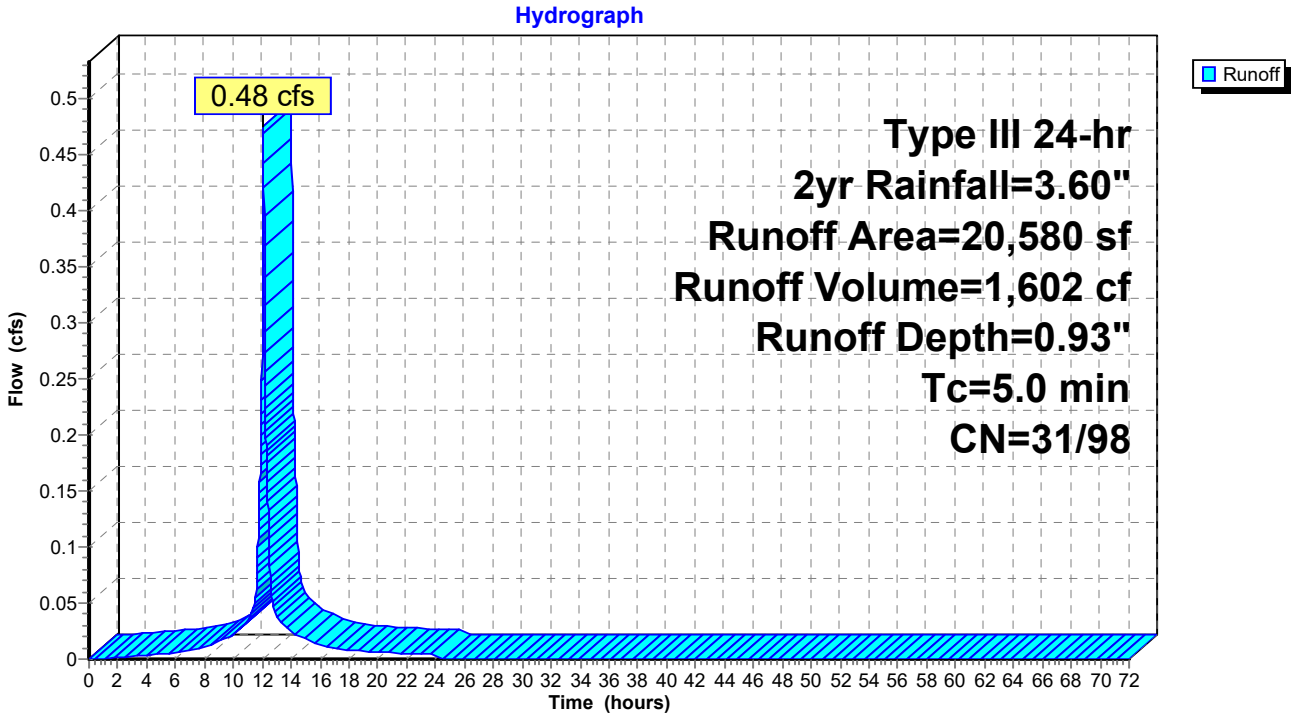
Runoff = 0.48 cfs @ 12.07 hrs, Volume= 1,602 cf, Depth= 0.93"
Routed to Pond IT2 : INFILTRATION TRENCH 2

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2yr Rainfall=3.60"

Area (sf)	CN	Description
5,710	98	Paved parking, HSG A
0	98	Unconnected roofs, HSG A
12,670	30	Woods, Good, HSG A
2,200	39	>75% Grass cover, Good, HSG A
20,580	50	Weighted Average
14,870	31	72.25% Pervious Area
5,710	98	27.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 MIN DIRECT**

Subcatchment DA2B:



Summary for Subcatchment DA3:

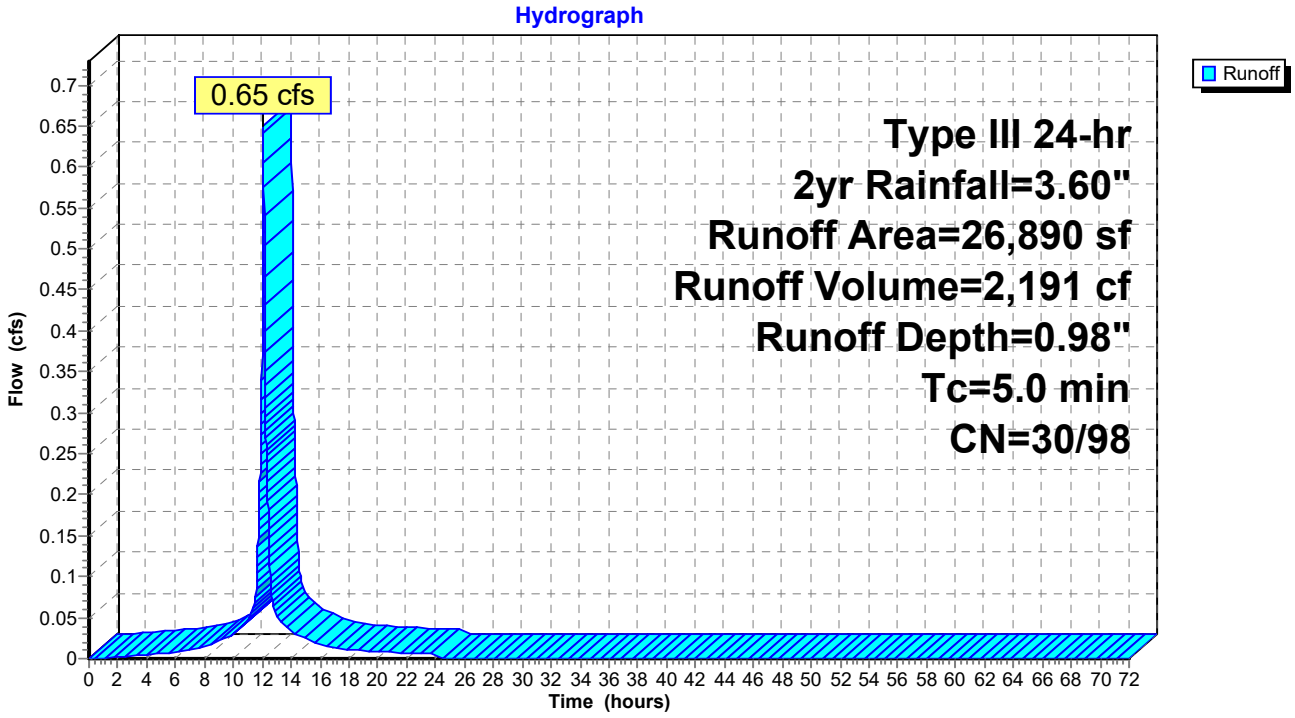
Runoff = 0.65 cfs @ 12.07 hrs, Volume= 2,191 cf, Depth= 0.98"
Routed to Pond IT3 : INFILTRATION TRENCH 3

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2yr Rainfall=3.60"

Area (sf)	CN	Description
4,210	98	Paved parking, HSG A
3,600	98	Unconnected roofs, HSG A
19,080	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
0	98	Water Surface, HSG A
26,890	50	Weighted Average
19,080	30	70.96% Pervious Area
7,810	98	29.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 MIN DIRECT**

Subcatchment DA3:



Summary for Subcatchment DA3A:

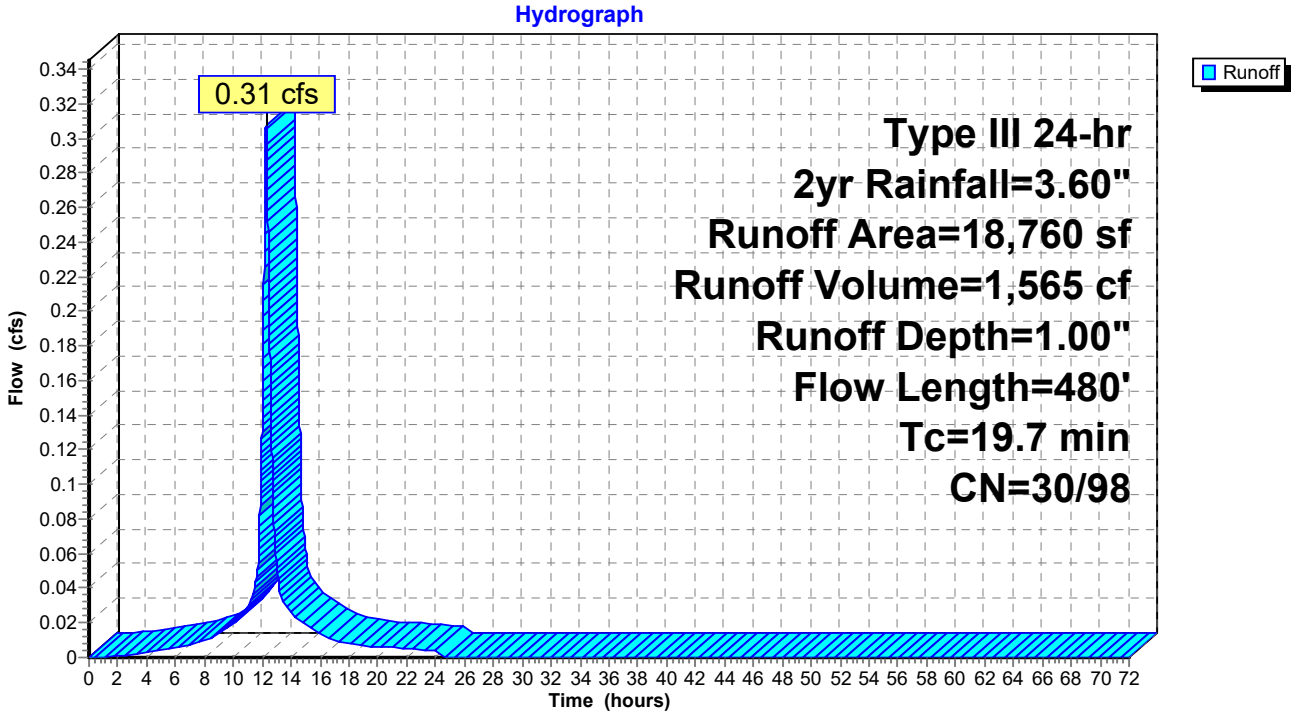
Runoff = 0.31 cfs @ 12.26 hrs, Volume= 1,565 cf, Depth= 1.00"
Routed to Pond IS3 : Infiltration System 3

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2yr Rainfall=3.60"

Area (sf)	CN	Description
5,580	98	Paved parking, HSG A
0	98	Unconnected roofs, HSG A
13,180	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
18,760	50	Weighted Average
13,180	30	70.26% Pervious Area
5,580	98	29.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.2	100	0.0300	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
1.8	155	0.0800	1.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.7	225	0.0800	5.74		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
19.7	480	Total			

Subcatchment DA3A:



Summary for Subcatchment DA3B:

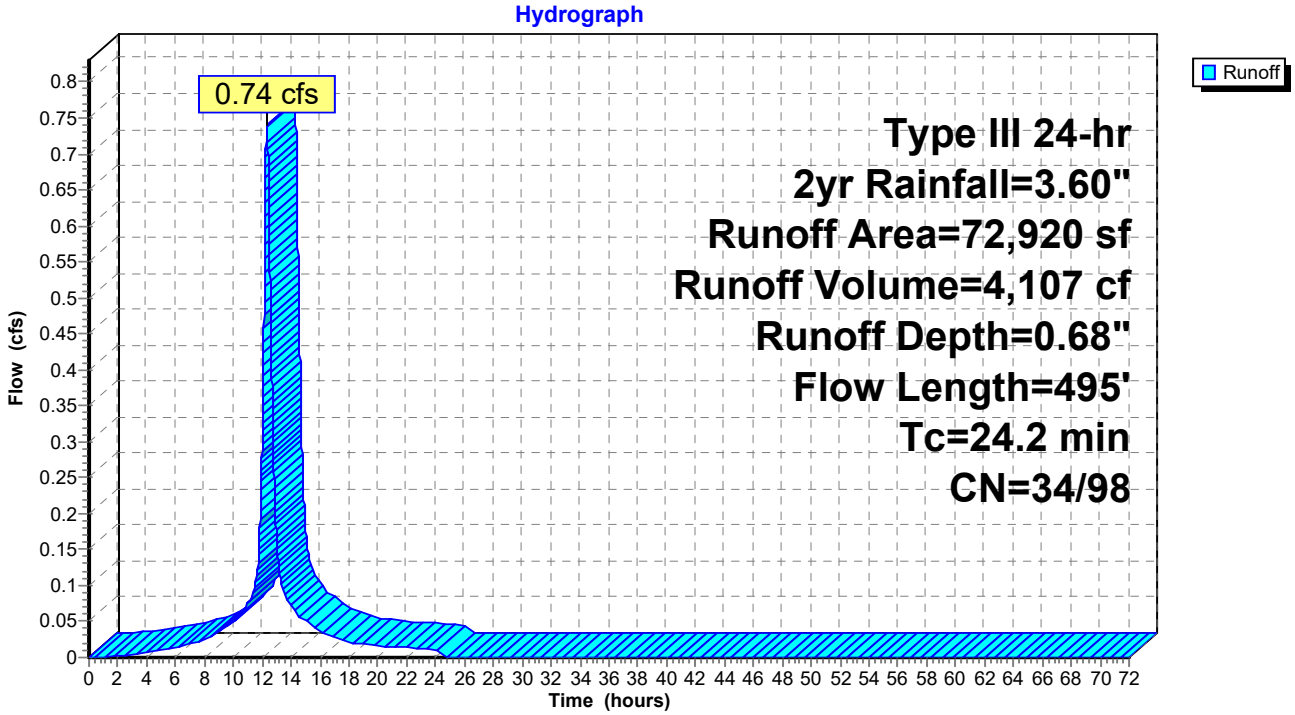
Runoff = 0.74 cfs @ 12.32 hrs, Volume= 4,107 cf, Depth= 0.68"
Routed to Pond IS3 : Infiltration System 3

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2yr Rainfall=3.60"

Area (sf)	CN	Description
8,650	98	Paved parking, HSG A
5,990	98	Unconnected roofs, HSG A
35,050	30	Woods, Good, HSG A
23,230	39	>75% Grass cover, Good, HSG A
72,920	47	Weighted Average
58,280	34	79.92% Pervious Area
14,640	98	20.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.2	100	0.0200	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
3.0	270	0.0900	1.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.0	125	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
24.2	495	Total			

Subcatchment DA3B:



Summary for Subcatchment DA3C:

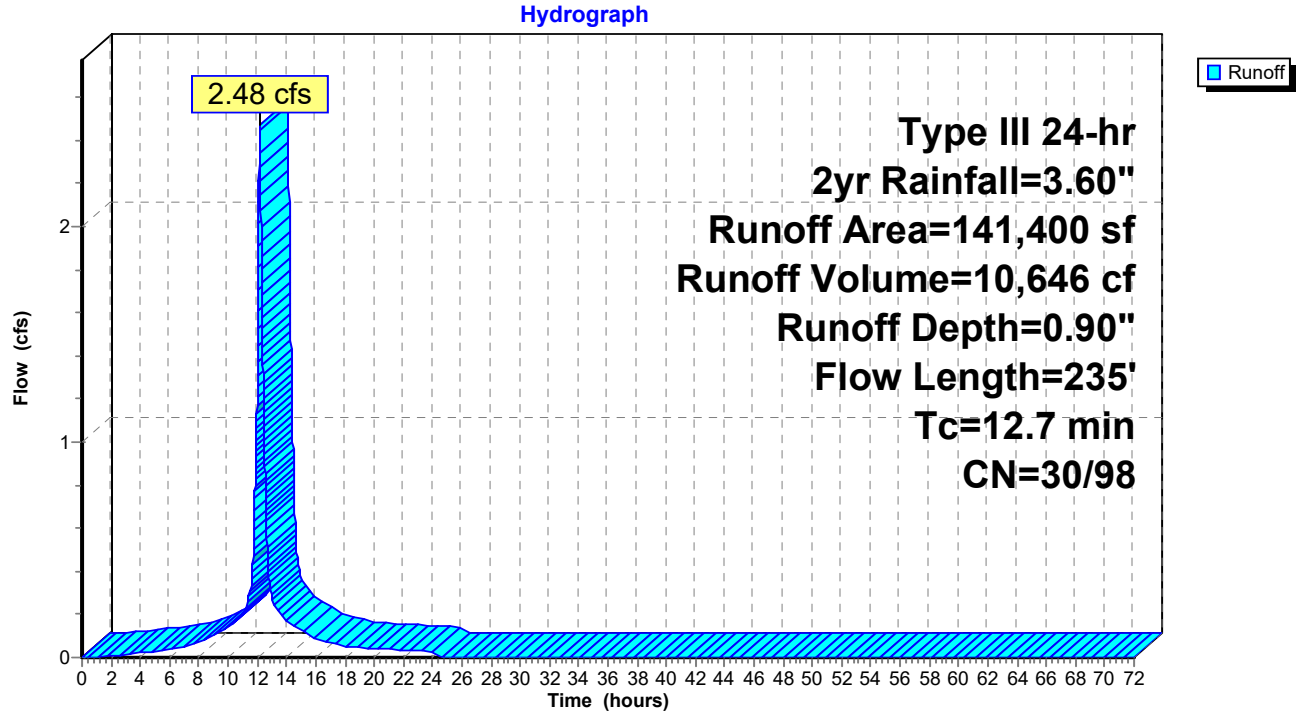
Runoff = 2.48 cfs @ 12.17 hrs, Volume= 10,646 cf, Depth= 0.90"
Routed to Pond C1 : CHAMBERS

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2yr Rainfall=3.60"

Area (sf)	CN	Description
23,130	98	Paved parking, HSG A
14,820	98	Unconnected roofs, HSG A
99,540	30	Woods, Good, HSG A
3,910	39	>75% Grass cover, Good, HSG A
141,400	48	Weighted Average
103,450	30	73.16% Pervious Area
37,950	98	26.84% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.6	100	0.0800	0.14		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
0.1	10	0.1200	1.73		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.0	125	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
12.7	235	Total			

Subcatchment DA3C:



Summary for Pond C1: CHAMBERS

Inflow Area = 141,400 sf, 26.84% Impervious, Inflow Depth = 0.90" for 2yr event
Inflow = 2.48 cfs @ 12.17 hrs, Volume= 10,646 cf
Outflow = 0.37 cfs @ 11.64 hrs, Volume= 10,639 cf, Atten= 85%, Lag= 0.0 min
Discarded = 0.37 cfs @ 11.64 hrs, Volume= 10,639 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Pond IT3 : INFILTRATION TRENCH 3

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 29.73' @ 12.81 hrs Surf.Area= 1,912 sf Storage= 3,205 cf

Plug-Flow detention time= 53.9 min calculated for 10,638 cf (100% of inflow)
Center-of-Mass det. time= 53.5 min (813.7 - 760.2)

Volume	Invert	Avail.Storage	Storage Description
#1B	27.25'	2,581 cf	**19.17'W x 99.75'L x 6.75'H Field B** 12,905 cf Overall - 5,083 cf Embedded = 7,823 cf x 33.0% Voids
#2B	28.00'	5,083 cf	**ADS_StormTech MC-7200 +Cap** x 28 Inside #1 Effective Size= 91.2"W x 60.0"H => 26.68 sf x 6.59'L = 175.9 cf Overall Size= 100.0"W x 60.0"H x 6.95'L with 0.36' Overlap 28 Chambers in 2 Rows Cap Storage= 39.5 cf x 2 x 2 rows = 158.0 cf
#3	27.00'	126 cf	**4.00'D x 10.00'H Vertical Cone/Cylinder**-Impervious
#4	36.10'	327 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)
		8,117 cf	Total Available Storage

Storage Group B created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
36.10	100	0	0
36.25	400	37	37
36.30	600	25	63
36.35	10,000	265	327

Device	Routing	Invert	Outlet Devices
#1	Discarded	27.25'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	36.30'	**20.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.37 cfs @ 11.64 hrs HW=27.25' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.37 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=27.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond C1: CHAMBERS - Chamber Wizard Field B

Chamber Model = ADS_StormTech MC-7200 +Cap (ADS StormTech® MC-7200 with cap volume)
Effective Size= 91.2"W x 60.0"H => 26.68 sf x 6.59'L = 175.9 cf
Overall Size= 100.0"W x 60.0"H x 6.95'L with 0.36' Overlap
Cap Storage= 39.5 cf x 2 x 2 rows = 158.0 cf

100.0" Wide + 6.0" Spacing = 106.0" C-C Row Spacing

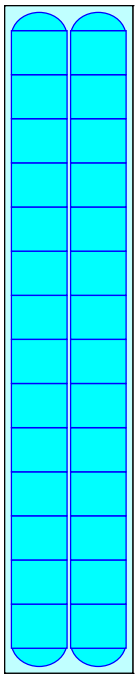
14 Chambers/Row x 6.59' Long +2.73' Cap Length x 2 = 97.75' Row Length +12.0" End Stone x 2 = 99.75' Base Length
2 Rows x 100.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 19.17' Base Width
9.0" Stone Base + 60.0" Chamber Height + 12.0" Stone Cover = 6.75' Field Height

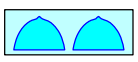
28 Chambers x 175.9 cf + 39.5 cf Cap Volume x 2 x 2 Rows = 5,082.5 cf Chamber Storage

12,905.2 cf Field - 5,082.5 cf Chambers = 7,822.6 cf Stone x 33.0% Voids = 2,581.5 cf Stone Storage

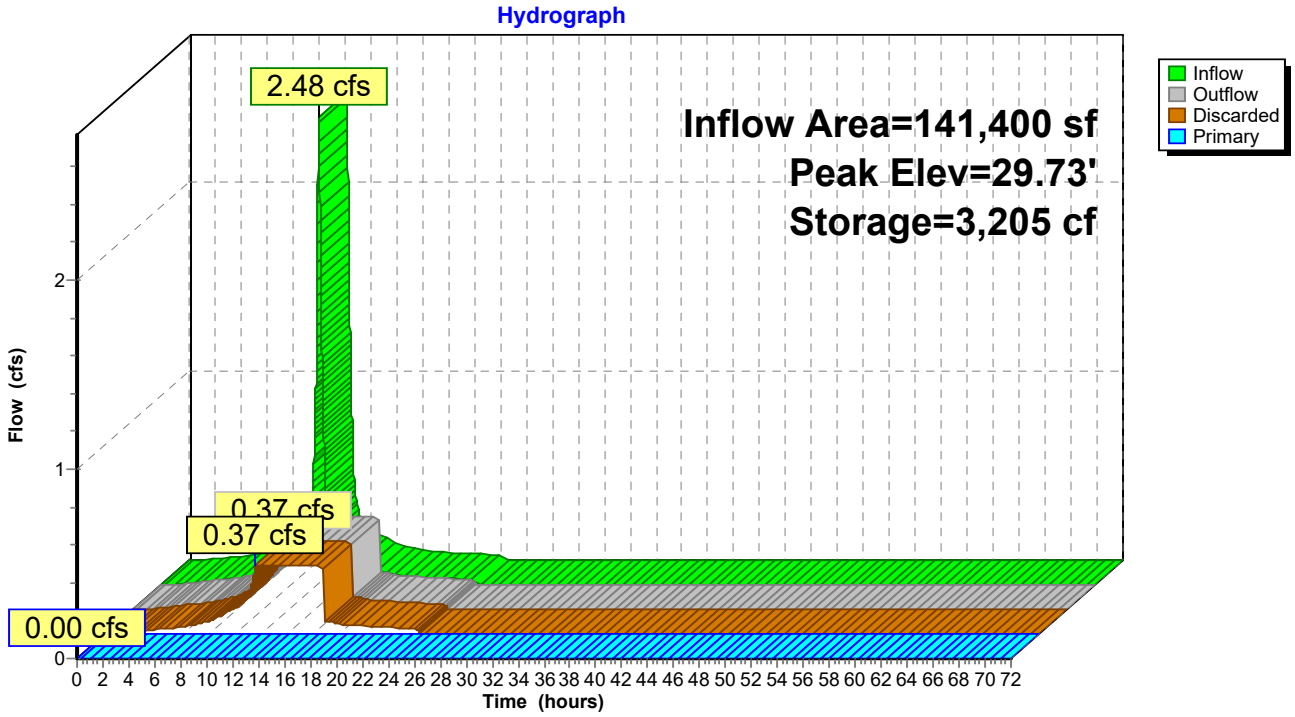
Chamber Storage + Stone Storage = 7,664.0 cf = 0.176 af
Overall Storage Efficiency = 59.4%
Overall System Size = 99.75' x 19.17' x 6.75'

28 Chambers
478.0 cy Field
289.7 cy Stone





Pond C1: CHAMBERS



Summary for Pond IS1: Infiltration System 1

Inflow Area = 301,650 sf, 25.64% Impervious, Inflow Depth = 0.10" for 2yr event
Inflow = 1.47 cfs @ 12.23 hrs, Volume= 2,589 cf
Outflow = 1.15 cfs @ 12.43 hrs, Volume= 2,589 cf, Atten= 22%, Lag= 12.3 min
Discarded = 0.06 cfs @ 11.87 hrs, Volume= 1,667 cf
Primary = 1.09 cfs @ 12.43 hrs, Volume= 922 cf
Routed to Pond SP1 : Follins Pond

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 13.60' @ 12.42 hrs Surf.Area= 288 sf Storage= 999 cf

Plug-Flow detention time= 90.9 min calculated for 2,589 cf (100% of inflow)
Center-of-Mass det. time= 90.9 min (842.9 - 752.0)

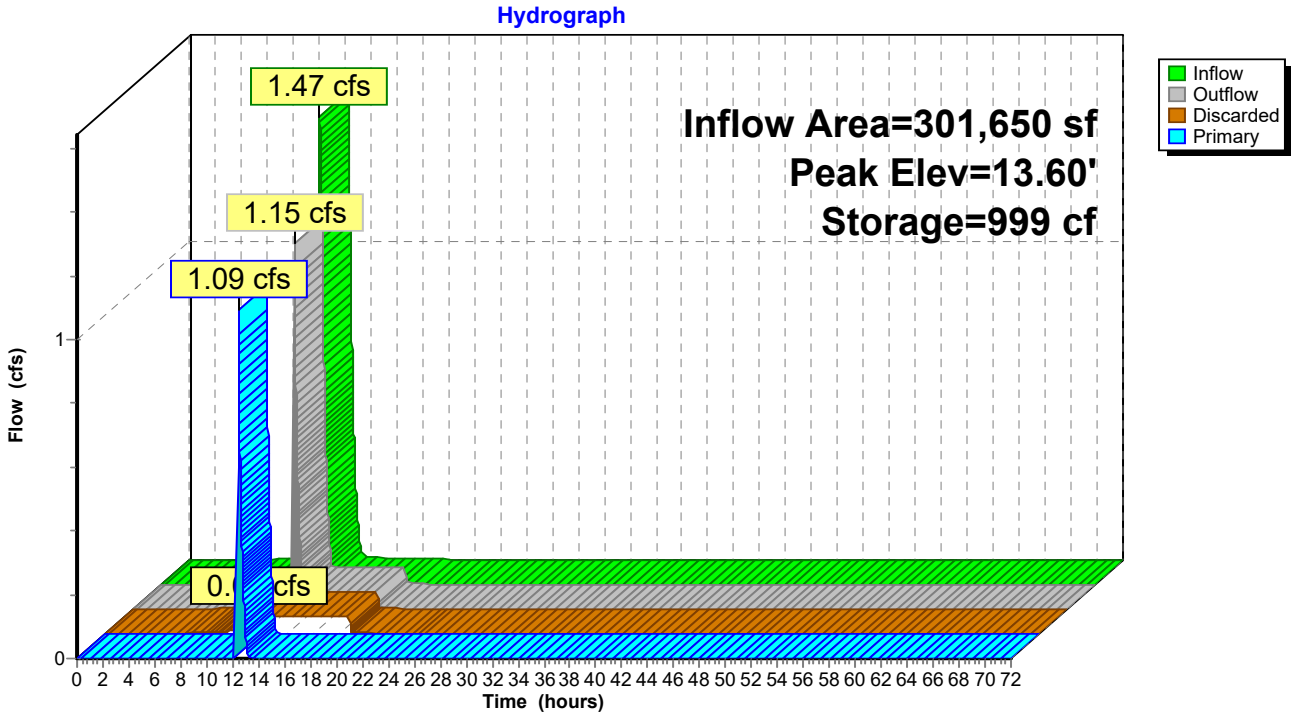
Volume	Invert	Avail.Storage	Storage Description
#1	7.60'	359 cf	**12.00'W x 24.00'L x 6.00'H Prismatoid** 1,728 cf Overall - 640 cf Embedded = 1,088 cf x 33.0% Voids
#2	9.60'	640 cf	**8.00'W x 20.00'L x 4.00'H Prismatoid** Inside #1
		999 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#0	Primary	13.60'	**Automatic Storage Overflow** (Discharged without head)
#1	Discarded	7.60'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	13.55'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.06 cfs @ 11.87 hrs HW=7.66' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=0.31 cfs @ 12.43 hrs HW=13.60' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 0.31 cfs @ 0.63 fps)

Pond IS1: Infiltration System 1



Summary for Pond IS2: Infiltration System 2

Inflow Area = 291,470 sf, 25.66% Impervious, Inflow Depth = 0.14" for 2yr event
Inflow = 1.73 cfs @ 12.09 hrs, Volume= 3,413 cf
Outflow = 1.38 cfs @ 12.23 hrs, Volume= 3,413 cf, Atten= 20%, Lag= 8.4 min
Discarded = 0.06 cfs @ 11.88 hrs, Volume= 1,542 cf
Primary = 1.32 cfs @ 12.23 hrs, Volume= 1,871 cf
Routed to Pond IS1 : Infiltration System 1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 17.00' @ 12.22 hrs Surf.Area= 288 sf Storage= 999 cf

Plug-Flow detention time= 76.0 min calculated for 3,412 cf (100% of inflow)
Center-of-Mass det. time= 76.0 min (821.6 - 745.6)

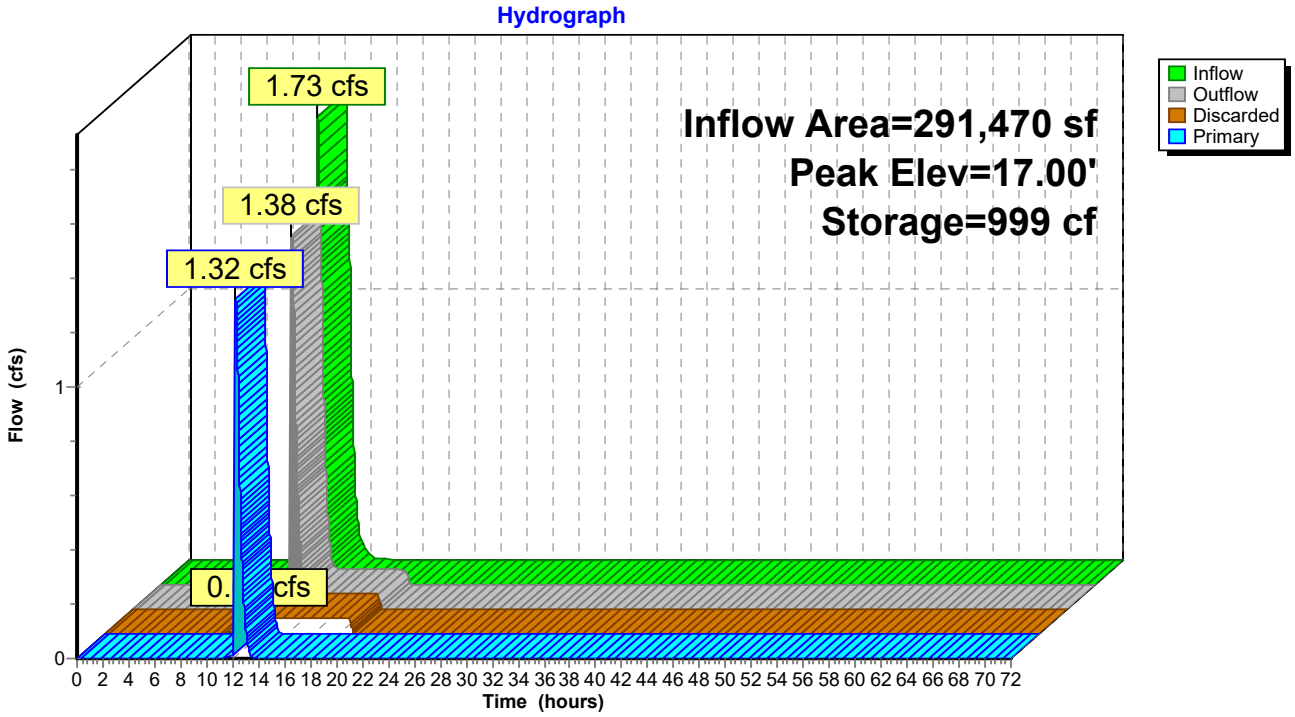
Volume	Invert	Avail.Storage	Storage Description
#1	11.00'	359 cf	**12.00'W x 24.00'L x 6.00'H Prismatoid** 1,728 cf Overall - 640 cf Embedded = 1,088 cf x 33.0% Voids
#2	13.00'	640 cf	**8.00'W x 20.00'L x 4.00'H Prismatoid** Inside #1
		999 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#0	Primary	17.00'	**Automatic Storage Overflow** (Discharged without head)
#1	Discarded	11.00'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	16.95'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.06 cfs @ 11.88 hrs HW=11.10' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=0.31 cfs @ 12.23 hrs HW=17.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 0.31 cfs @ 0.63 fps)

Pond IS2: Infiltration System 2



Summary for Pond IS3: Infiltration System 3

Inflow Area = 259,970 sf, 25.38% Impervious, Inflow Depth = 0.30" for 2yr event
Inflow = 1.24 cfs @ 12.27 hrs, Volume= 6,399 cf
Outflow = 1.24 cfs @ 12.27 hrs, Volume= 6,399 cf, Atten= 0%, Lag= 0.3 min
Discarded = 0.06 cfs @ 9.26 hrs, Volume= 3,584 cf
Primary = 1.19 cfs @ 12.27 hrs, Volume= 2,814 cf
Routed to Pond IT2 : INFILTRATION TRENCH 2

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 30.87' @ 12.27 hrs Surf.Area= 288 sf Storage= 973 cf

Plug-Flow detention time= 83.6 min calculated for 6,398 cf (100% of inflow)
Center-of-Mass det. time= 83.6 min (848.7 - 765.1)

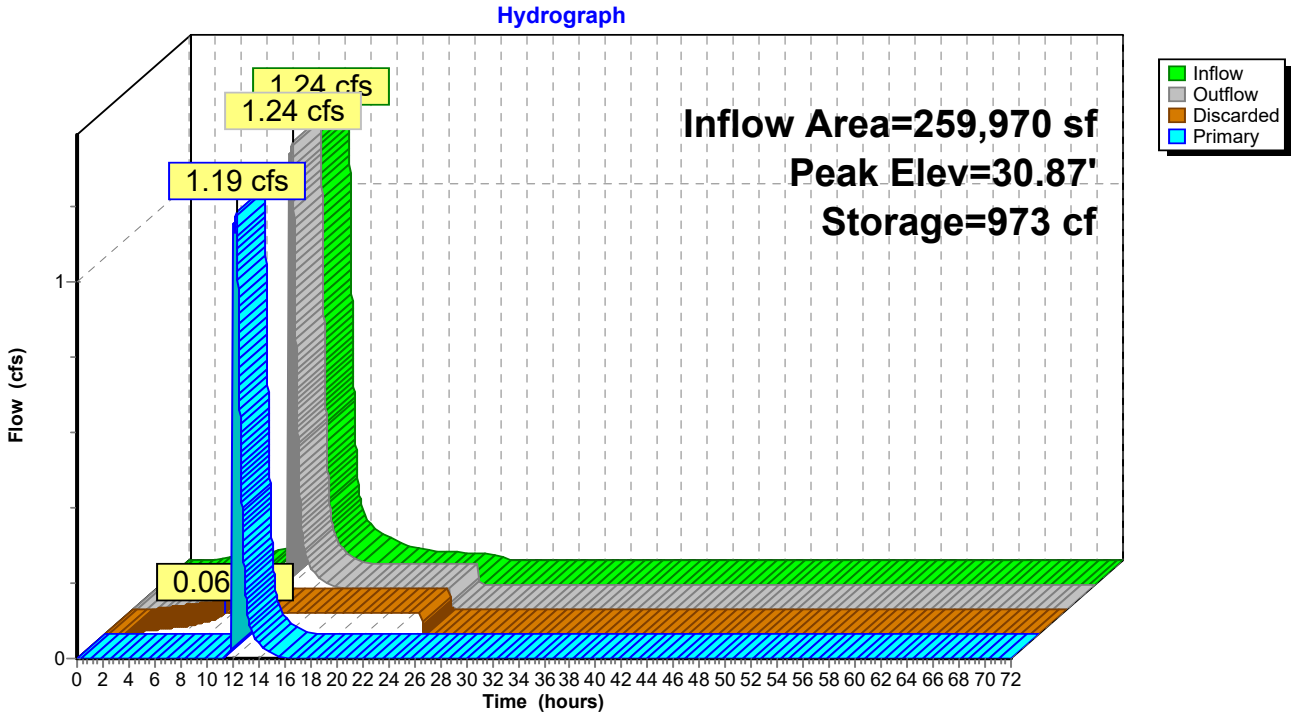
Volume	Invert	Avail.Storage	Storage Description
#1	25.00'	359 cf	**12.00'W x 24.00'L x 6.00'H Prismatoid** 1,728 cf Overall - 640 cf Embedded = 1,088 cf x 33.0% Voids
#2	27.00'	640 cf	**8.00'W x 20.00'L x 4.00'H Prismatoid** Inside #1
		999 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#0	Primary	31.00'	**Automatic Storage Overflow** (Discharged without head)
#1	Discarded	25.00'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	30.75'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.06 cfs @ 9.26 hrs HW=25.06' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=1.17 cfs @ 12.27 hrs HW=30.87' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 1.17 cfs @ 0.97 fps)

Pond IS3: Infiltration System 3



Summary for Pond IT1: INFILTRATION TRENCH 1

Inflow Area = 286,690 sf, 25.71% Impervious, Inflow Depth = 0.16" for 2yr event
Inflow = 1.76 cfs @ 12.08 hrs, Volume= 3,729 cf
Outflow = 1.72 cfs @ 12.09 hrs, Volume= 3,659 cf, Atten= 2%, Lag= 0.6 min
Discarded = 0.08 cfs @ 12.09 hrs, Volume= 551 cf
Primary = 1.64 cfs @ 12.09 hrs, Volume= 3,107 cf
Routed to Pond IS2 : Infiltration System 2

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 20.69' @ 12.09 hrs Surf.Area= 426 sf Storage= 134 cf

Plug-Flow detention time= 16.1 min calculated for 3,658 cf (98% of inflow)
Center-of-Mass det. time= 8.3 min (756.1 - 747.8)

Volume	Invert	Avail.Storage	Storage Description
#1	16.50'	98 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 298 cf Overall x 33.0% Voids
#2	20.00'	25 cf	**4.00'D x 2.00'H Vertical Cone/Cylinder** -Impervious
#3	20.53'	237 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
		361 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
16.50	85	0	0
20.00	85	298	298

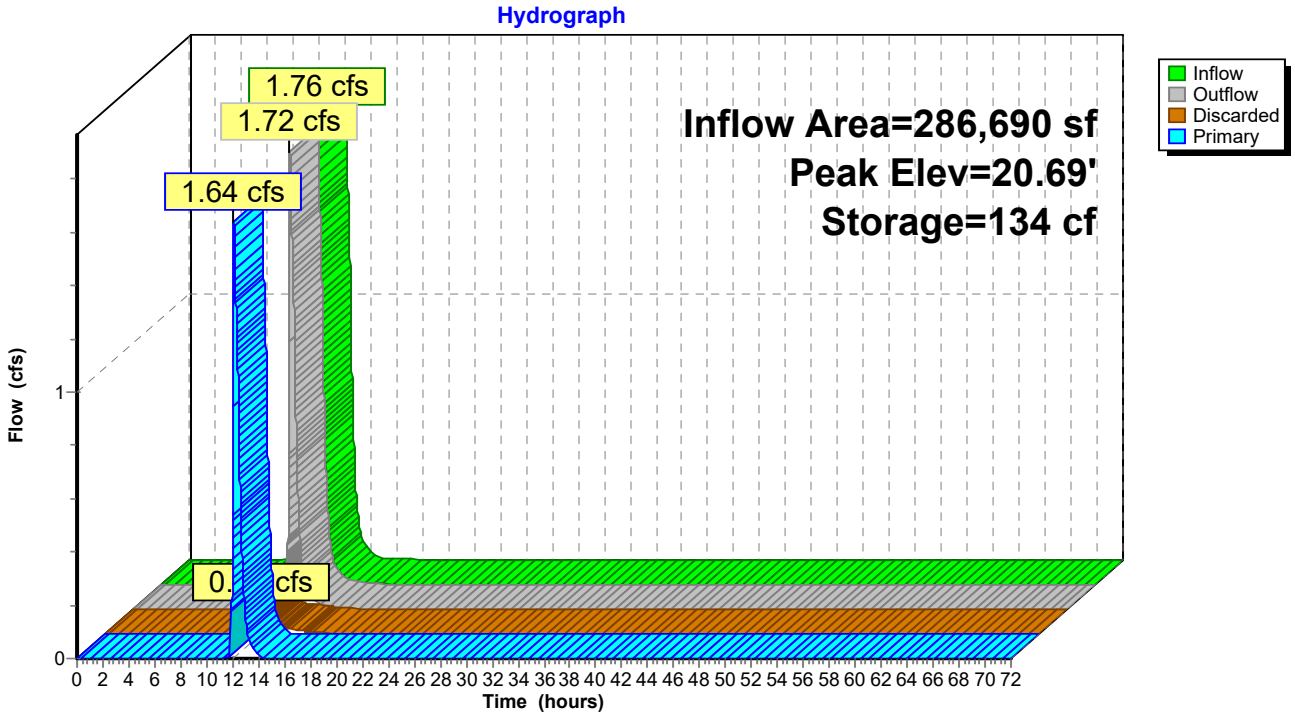
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
20.53	10	0	0
21.00	1,000	237	237

Device	Routing	Invert	Outlet Devices
#1	Discarded	16.50'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Device 1	19.00'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	20.53'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.08 cfs @ 12.09 hrs HW=20.69' (Free Discharge)
↑└**1=Exfiltration** (Exfiltration Controls 0.08 cfs)
↑└**2=Orifice/Grate** (Passes 0.08 cfs of 1.13 cfs potential flow)

Primary OutFlow Max=1.63 cfs @ 12.09 hrs HW=20.69' (Free Discharge)
↑└**3=Orifice/Grate** (Weir Controls 1.63 cfs @ 1.30 fps)

Pond IT1: INFILTRATION TRENCH 1



Summary for Pond IT2: INFILTRATION TRENCH 2

[88] Warning: Qout>Qin may require smaller dt or Finer Routing

Inflow Area = 280,550 sf, 25.55% Impervious, Inflow Depth = 0.19" for 2yr event
Inflow = 1.63 cfs @ 12.08 hrs, Volume= 4,416 cf
Outflow = 1.63 cfs @ 12.08 hrs, Volume= 4,211 cf, Atten= 0%, Lag= 0.0 min
Discarded = 0.04 cfs @ 11.36 hrs, Volume= 1,046 cf
Primary = 1.59 cfs @ 12.08 hrs, Volume= 3,165 cf
Routed to Pond IT1 : INFILTRATION TRENCH 1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 23.50' @ 12.08 hrs Surf.Area= 212 sf Storage= 297 cf

Plug-Flow detention time= 40.5 min calculated for 4,210 cf (95% of inflow)
Center-of-Mass det. time= 21.2 min (775.6 - 754.4)

Volume	Invert	Avail.Storage	Storage Description
#1	19.25'	245 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 742 cf Overall x 33.0% Voids
#2	19.35'	63 cf	**4.00'D x 5.00'H Vertical Cone/Cylinder** -Impervious
		308 cf	Total Available Storage

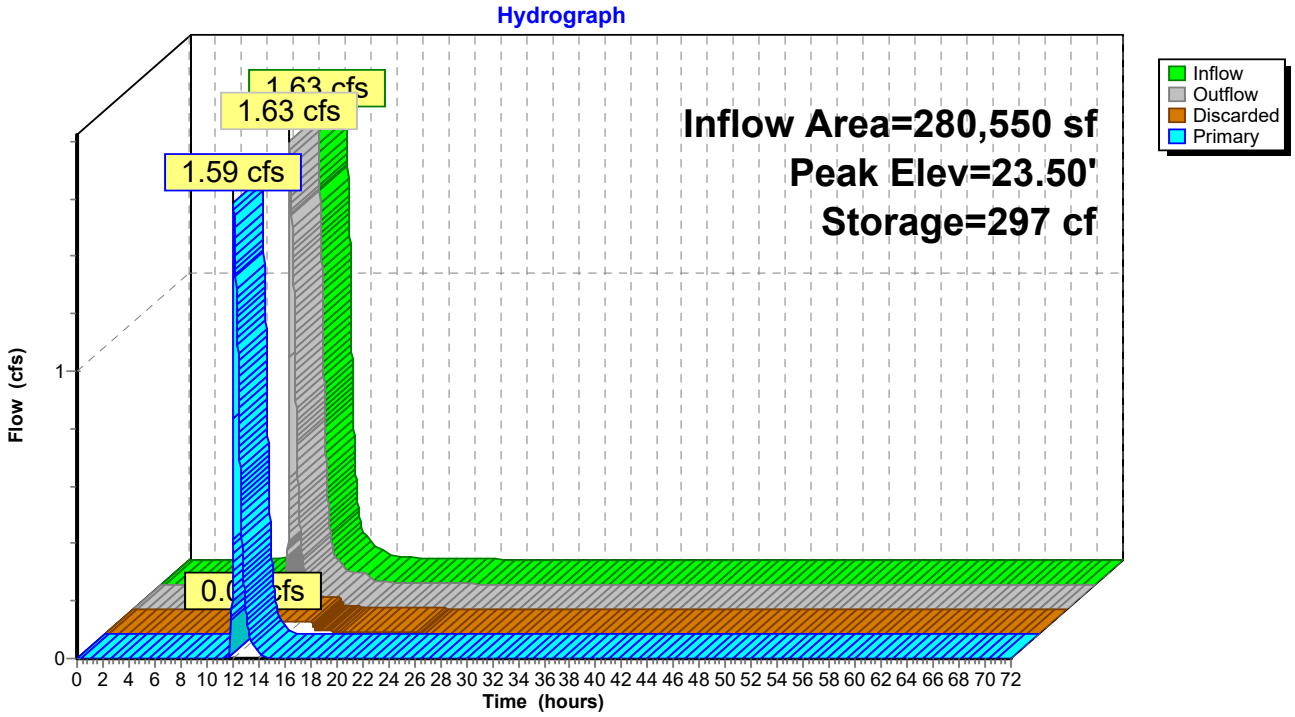
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
19.25	212	0	0
22.75	212	742	742

Device	Routing	Invert	Outlet Devices
#0	Primary	24.35'	**Automatic Storage Overflow** (Discharged without head)
#1	Discarded	19.25'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Device 1	21.75'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	23.35'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.04 cfs @ 11.36 hrs HW=21.90' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.04 cfs)
↑**2=Orifice/Grate** (Passes 0.04 cfs of 0.07 cfs potential flow)

Primary OutFlow Max=1.58 cfs @ 12.08 hrs HW=23.50' (Free Discharge)
↑**3=Broad-Crested Rectangular Weir** (Weir Controls 1.58 cfs @ 1.07 fps)

Pond IT2: INFILTRATION TRENCH 2



Summary for Pond IT3: INFILTRATION TRENCH 3

Inflow Area = 168,290 sf, 27.19% Impervious, Inflow Depth = 0.16" for 2yr event
Inflow = 0.65 cfs @ 12.07 hrs, Volume= 2,191 cf
Outflow = 0.65 cfs @ 12.07 hrs, Volume= 1,969 cf, Atten= 0%, Lag= 0.1 min
Discarded = 0.05 cfs @ 11.13 hrs, Volume= 1,242 cf
Primary = 0.60 cfs @ 12.07 hrs, Volume= 727 cf
Routed to Pond IS3 : Infiltration System 3

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 34.14' @ 12.07 hrs Surf.Area= 240 sf Storage= 341 cf

Plug-Flow detention time= 101.8 min calculated for 1,969 cf (90% of inflow)
Center-of-Mass det. time= 51.8 min (804.9 - 753.1)

Volume	Invert	Avail.Storage	Storage Description
#1	28.50'	277 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 840 cf Overall x 33.0% Voids
#2	29.10'	101 cf	**4.00'D x 8.00'H Vertical Cone/Cylinder** -Impervious
		378 cf	Total Available Storage

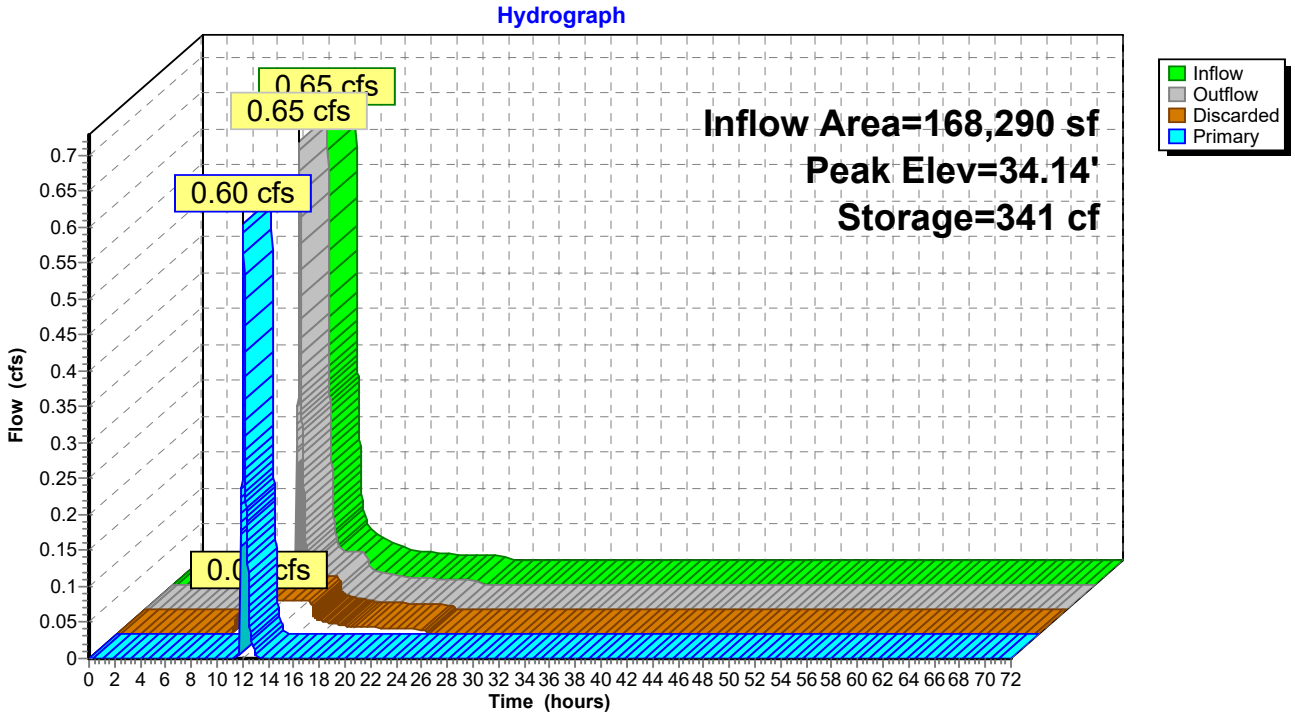
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
28.50	240	0	0
32.00	240	840	840

Device	Routing	Invert	Outlet Devices
#0	Primary	37.10'	**Automatic Storage Overflow** (Discharged without head)
#1	Discarded	28.50'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Device 1	31.00'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	35.40'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#4	Primary	33.70'	**12.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 33.70' / 31.00' S= 0.2700 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Discarded OutFlow Max=0.05 cfs @ 11.13 hrs HW=31.17' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.05 cfs)
└**2=Orifice/Grate** (Passes 0.05 cfs of 0.08 cfs potential flow)

Primary OutFlow Max=0.60 cfs @ 12.07 hrs HW=34.14' (Free Discharge)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
└**4=Culvert** (Inlet Controls 0.60 cfs @ 1.79 fps)

Pond IT3: INFILTRATION TRENCH 3



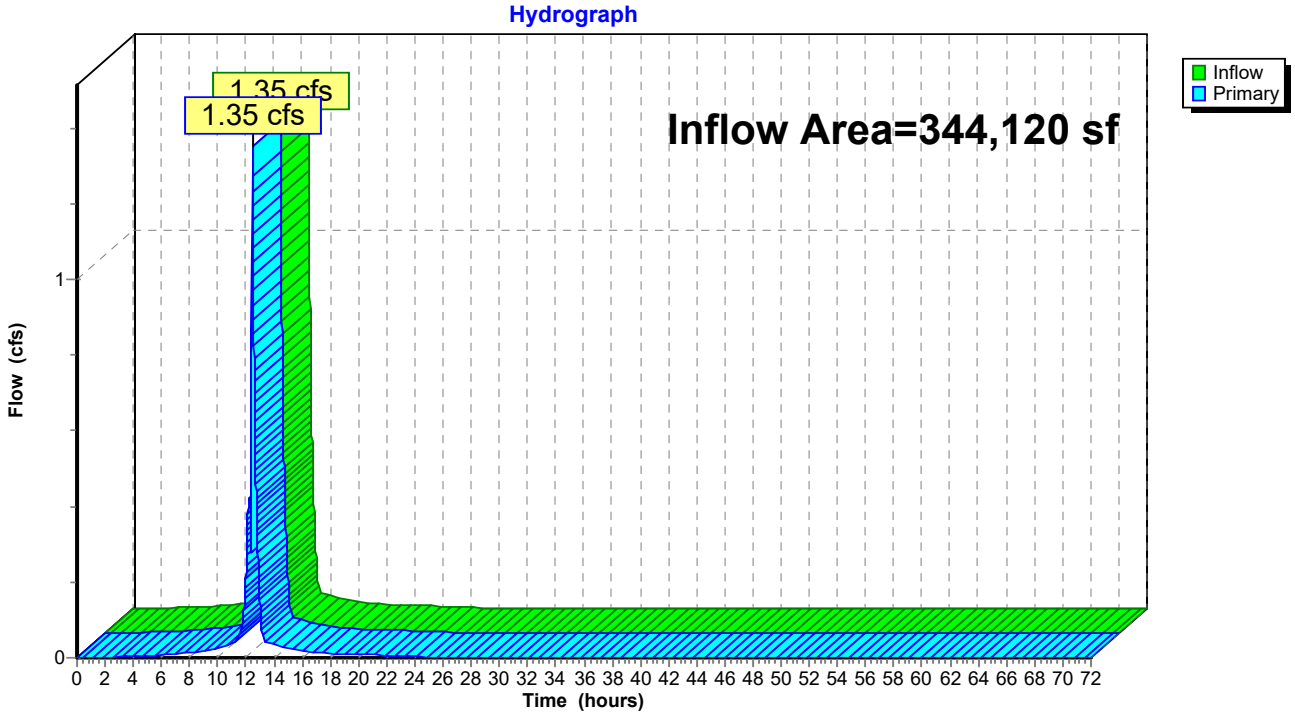
Summary for Pond SP1: Follins Pond

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 344,120 sf, 24.57% Impervious, Inflow Depth = 0.10" for 2yr event
Inflow = 1.35 cfs @ 12.43 hrs, Volume= 2,939 cf
Primary = 1.35 cfs @ 12.43 hrs, Volume= 2,939 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Pond SP1: Follins Pond



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment DA0: Runoff Area=42,470 sf 16.93% Impervious Runoff Depth=0.88"
Flow Length=625' Tc=16.2 min CN=31/98 Runoff=0.63 cfs 3,101 cf

Subcatchment DA1: Runoff Area=10,180 sf 25.15% Impervious Runoff Depth=1.28"
Flow Length=235' Tc=11.5 min CN=30/98 Runoff=0.25 cfs 1,083 cf

Subcatchment DA2: Runoff Area=4,780 sf 22.80% Impervious Runoff Depth=1.16"
Tc=5.0 min CN=30/98 Runoff=0.13 cfs 462 cf

Subcatchment DA2A: Runoff Area=6,140 sf 32.74% Impervious Runoff Depth=1.66"
Tc=5.0 min CN=30/98 Runoff=0.25 cfs 848 cf

Subcatchment DA2B: Runoff Area=20,580 sf 27.75% Impervious Runoff Depth=1.42"
Tc=5.0 min CN=31/98 Runoff=0.70 cfs 2,431 cf

Subcatchment DA3: Runoff Area=26,890 sf 29.04% Impervious Runoff Depth=1.47"
Tc=5.0 min CN=30/98 Runoff=0.96 cfs 3,300 cf

Subcatchment DA3A: Runoff Area=18,760 sf 29.74% Impervious Runoff Depth=1.51"
Flow Length=480' Tc=19.7 min CN=30/98 Runoff=0.45 cfs 2,357 cf

Subcatchment DA3B: Runoff Area=72,920 sf 20.08% Impervious Runoff Depth=1.08"
Flow Length=495' Tc=24.2 min CN=34/98 Runoff=1.09 cfs 6,590 cf

Subcatchment DA3C: Runoff Area=141,400 sf 26.84% Impervious Runoff Depth=1.36"
Flow Length=235' Tc=12.7 min CN=30/98 Runoff=3.65 cfs 16,047 cf

Pond C1: CHAMBERS Peak Elev=31.49' Storage=5,641 cf Inflow=3.65 cfs 16,047 cf
Discarded=0.37 cfs 16,043 cf Primary=0.00 cfs 0 cf Outflow=0.37 cfs 16,043 cf

Pond IS1: Infiltration System 1 Peak Elev=13.60' Storage=999 cf Inflow=2.81 cfs 6,054 cf
Discarded=0.06 cfs 2,001 cf Primary=2.85 cfs 4,053 cf Outflow=2.90 cfs 6,054 cf

Pond IS2: Infiltration System 2 Peak Elev=17.00' Storage=999 cf Inflow=2.64 cfs 6,887 cf
Discarded=0.06 cfs 1,917 cf Primary=2.58 cfs 4,971 cf Outflow=2.64 cfs 6,887 cf

Pond IS3: Infiltration System 3 Peak Elev=30.91' Storage=981 cf Inflow=1.85 cfs 10,303 cf
Discarded=0.06 cfs 4,477 cf Primary=1.80 cfs 5,826 cf Outflow=1.85 cfs 10,303 cf

Pond IT1: INFILTRATION TRENCH 1 Peak Elev=20.74' Storage=156 cf Inflow=2.62 cfs 7,368 cf
Discarded=0.10 cfs 873 cf Primary=2.51 cfs 6,425 cf Outflow=2.61 cfs 7,298 cf

Pond IT2: INFILTRATION TRENCH 2 Peak Elev=23.54' Storage=298 cf Inflow=2.42 cfs 8,257 cf
Discarded=0.04 cfs 1,534 cf Primary=2.38 cfs 6,520 cf Outflow=2.42 cfs 8,054 cf

Pond IT3: INFILTRATION TRENCH 3 Peak Elev=34.26' Storage=342 cf Inflow=0.96 cfs 3,300 cf
Discarded=0.05 cfs 1,721 cf Primary=0.91 cfs 1,356 cf Outflow=0.96 cfs 3,078 cf

Pond SP1: Follins Pond

Inflow=3.17 cfs 7,154 cf
Primary=3.17 cfs 7,154 cf

Total Runoff Area = 344,120 sf Runoff Volume = 36,218 cf Average Runoff Depth = 1.26"
75.43% Pervious = 259,580 sf 24.57% Impervious = 84,540 sf

Summary for Subcatchment DA0:

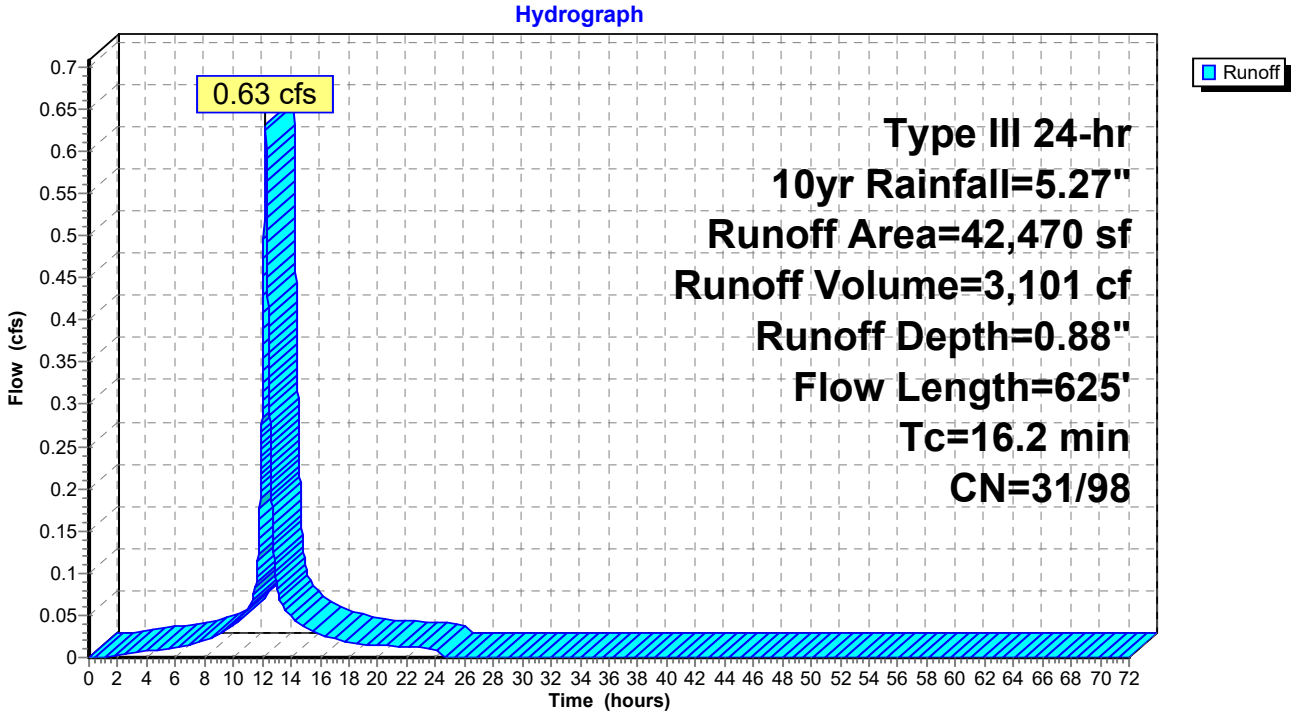
Runoff = 0.63 cfs @ 12.21 hrs, Volume= 3,101 cf, Depth= 0.88"
Routed to Pond SP1 : Follins Pond

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10yr Rainfall=5.27"

Area (sf)	CN	Description
4,730	98	Paved parking, HSG A
2,460	98	Unconnected roofs, HSG A
29,910	30	Woods, Good, HSG A
5,370	39	>75% Grass cover, Good, HSG A
42,470	43	Weighted Average
35,280	31	83.07% Pervious Area
7,190	98	16.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.1	100	0.0900	0.15		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
5.0	470	0.1000	1.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	55	0.1100	6.73		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
16.2	625	Total			

Subcatchment DA0:



Summary for Subcatchment DA1:

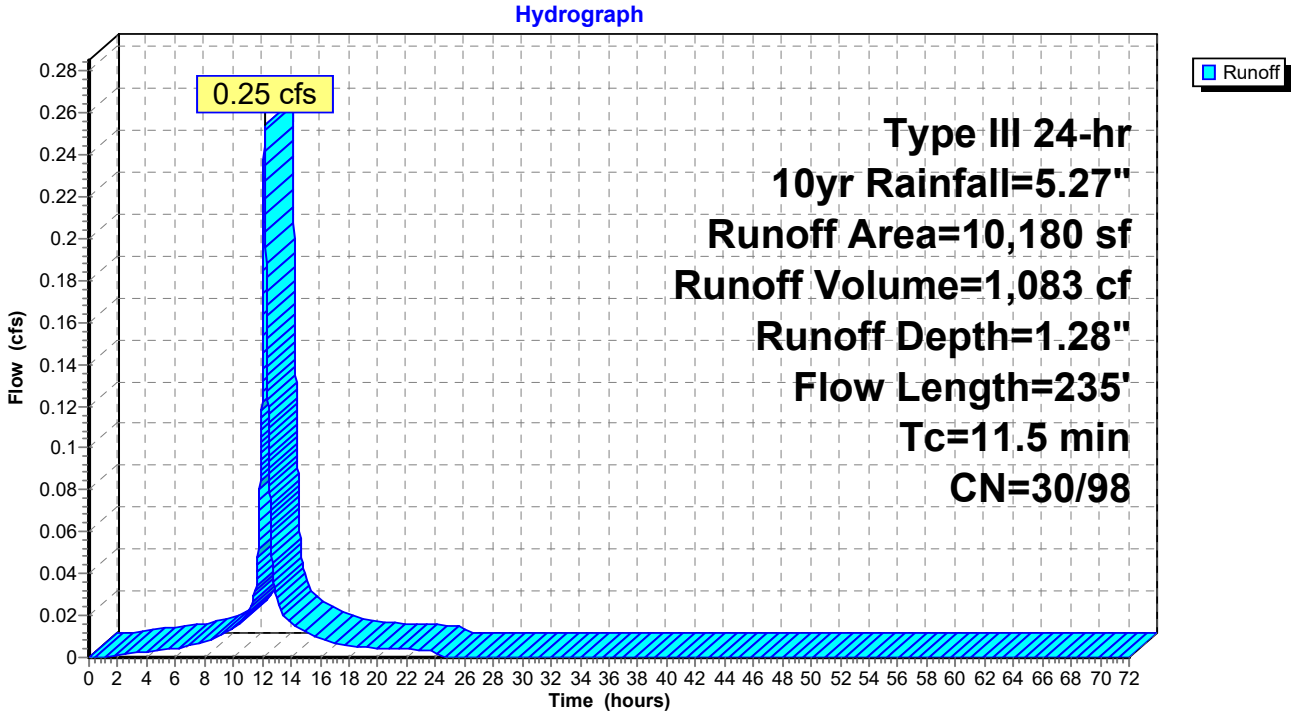
Runoff = 0.25 cfs @ 12.15 hrs, Volume= 1,083 cf, Depth= 1.28"
Routed to Pond IS1 : Infiltration System 1

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10yr Rainfall=5.27"

Area (sf)	CN	Description
2,560	98	Paved parking, HSG A
7,620	30	Woods, Good, HSG A
10,180	47	Weighted Average
7,620	30	74.85% Pervious Area
2,560	98	25.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.6	100	0.1000	0.16		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
0.8	80	0.1200	1.73		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	55	0.1100	6.73		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
11.5	235	Total			

Subcatchment DA1:



Summary for Subcatchment DA2:

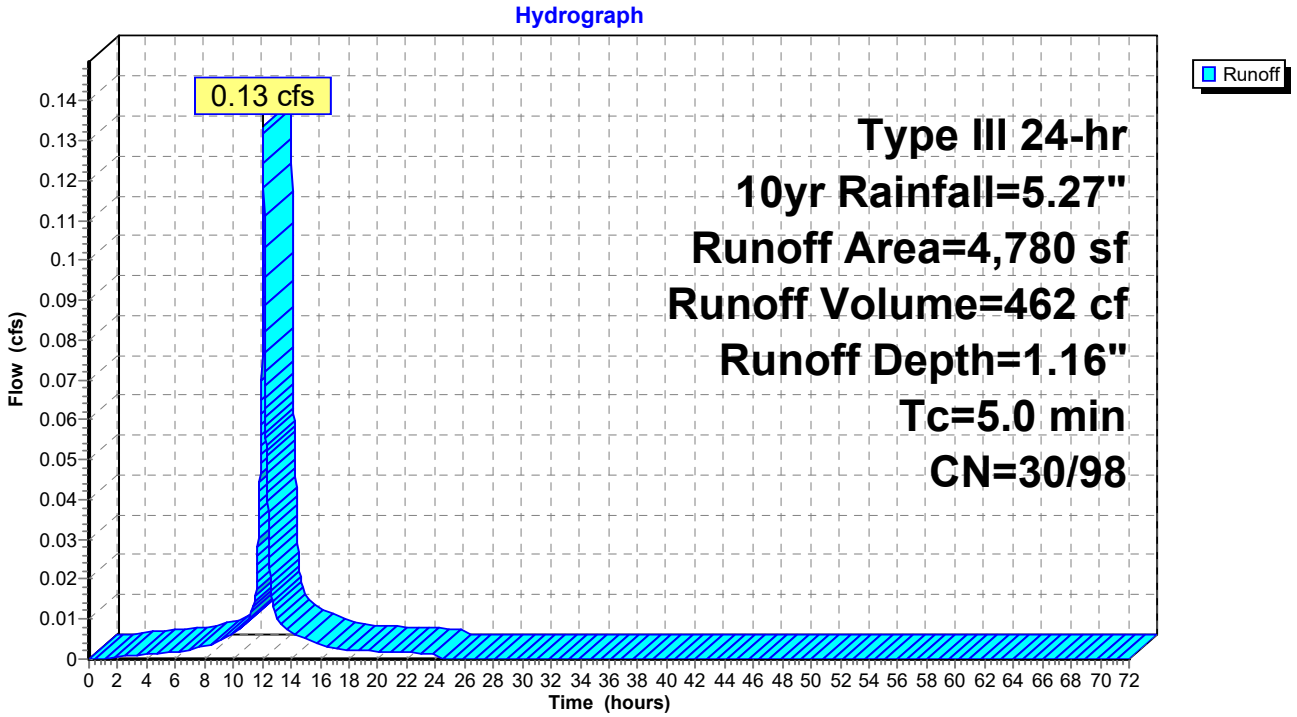
Runoff = 0.13 cfs @ 12.07 hrs, Volume= 462 cf, Depth= 1.16"
Routed to Pond IS2 : Infiltration System 2

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10yr Rainfall=5.27"

Area (sf)	CN	Description
740	98	Paved parking, HSG A
350	98	Unconnected roofs, HSG A
3,690	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
4,780	46	Weighted Average
3,690	30	77.20% Pervious Area
1,090	98	22.80% Impervious Area

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

Subcatchment DA2:



Summary for Subcatchment DA2A:

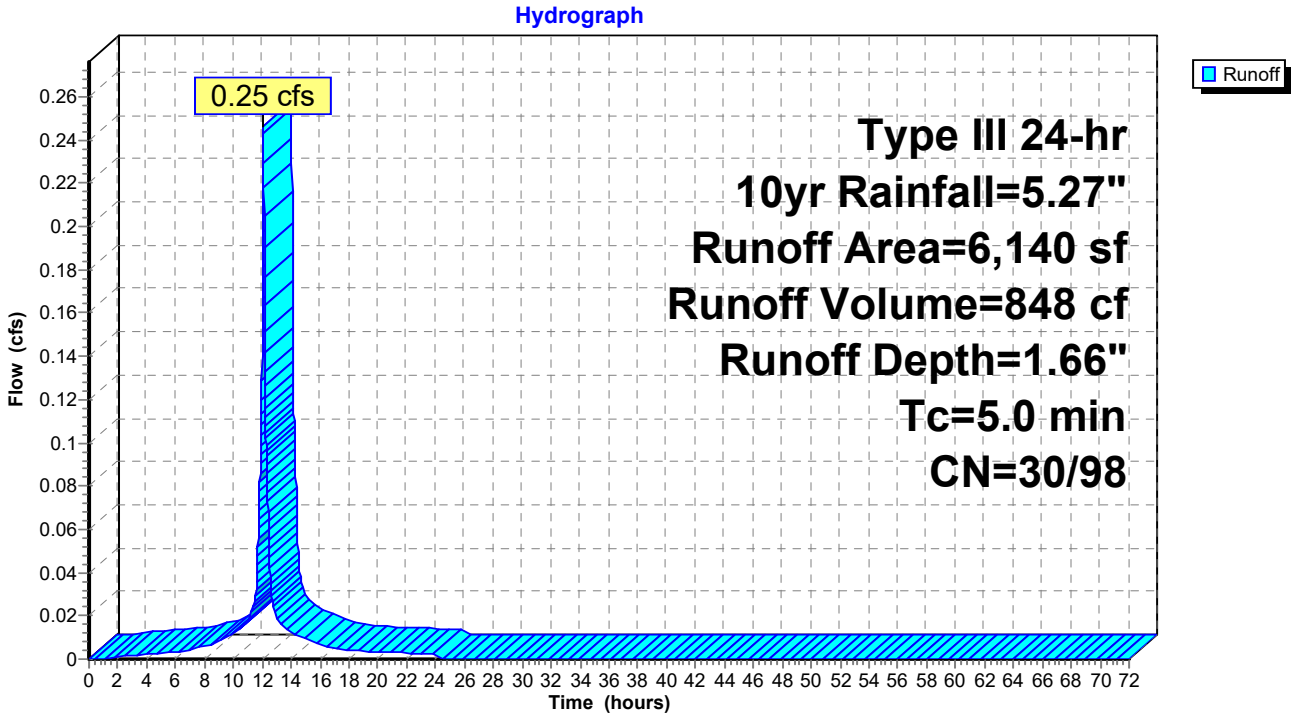
Runoff = 0.25 cfs @ 12.07 hrs, Volume= 848 cf, Depth= 1.66"
Routed to Pond IT1 : INFILTRATION TRENCH 1

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10yr Rainfall=5.27"

Area (sf)	CN	Description
1,080	98	Paved parking, HSG A
930	98	Unconnected roofs, HSG A
4,130	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
6,140	52	Weighted Average
4,130	30	67.26% Pervious Area
2,010	98	32.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 min direct**

Subcatchment DA2A:



Summary for Subcatchment DA2B:

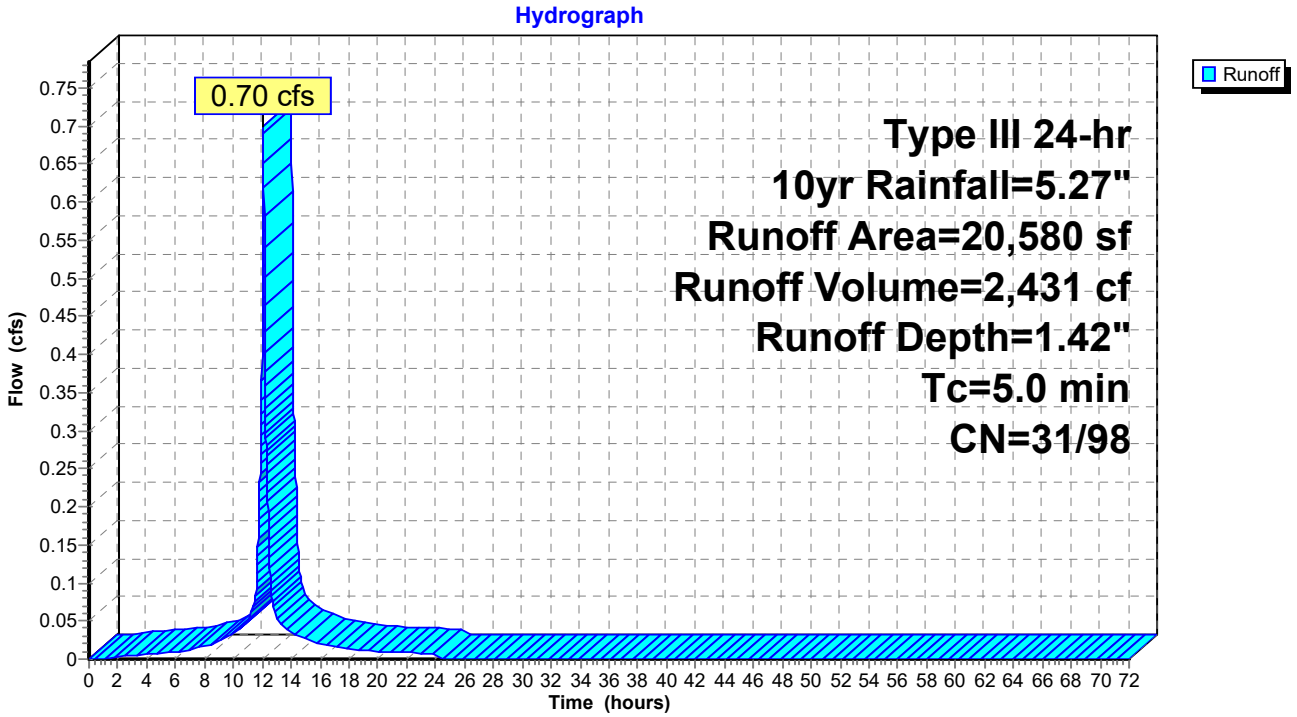
Runoff = 0.70 cfs @ 12.07 hrs, Volume= 2,431 cf, Depth= 1.42"
Routed to Pond IT2 : INFILTRATION TRENCH 2

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10yr Rainfall=5.27"

Area (sf)	CN	Description
5,710	98	Paved parking, HSG A
0	98	Unconnected roofs, HSG A
12,670	30	Woods, Good, HSG A
2,200	39	>75% Grass cover, Good, HSG A
20,580	50	Weighted Average
14,870	31	72.25% Pervious Area
5,710	98	27.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 MIN DIRECT**

Subcatchment DA2B:



Summary for Subcatchment DA3:

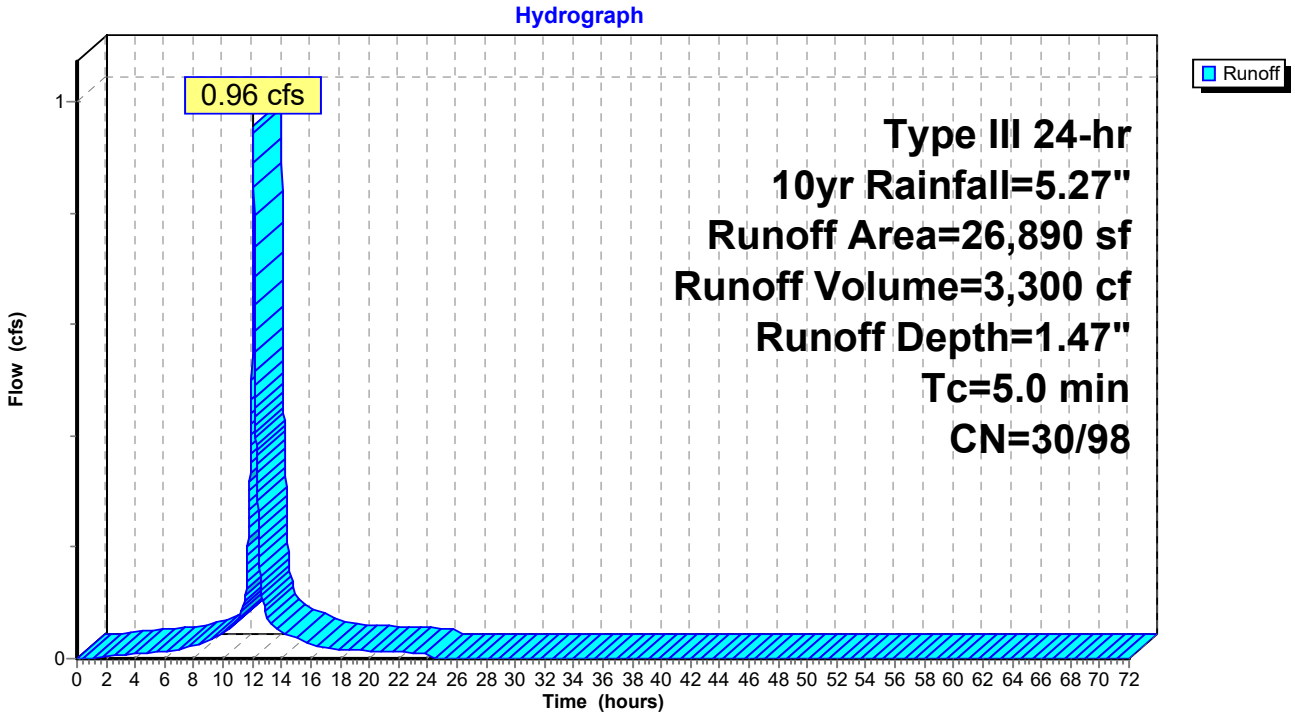
Runoff = 0.96 cfs @ 12.07 hrs, Volume= 3,300 cf, Depth= 1.47"
Routed to Pond IT3 : INFILTRATION TRENCH 3

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10yr Rainfall=5.27"

Area (sf)	CN	Description
4,210	98	Paved parking, HSG A
3,600	98	Unconnected roofs, HSG A
19,080	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
0	98	Water Surface, HSG A
26,890	50	Weighted Average
19,080	30	70.96% Pervious Area
7,810	98	29.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 MIN DIRECT**

Subcatchment DA3:



Summary for Subcatchment DA3A:

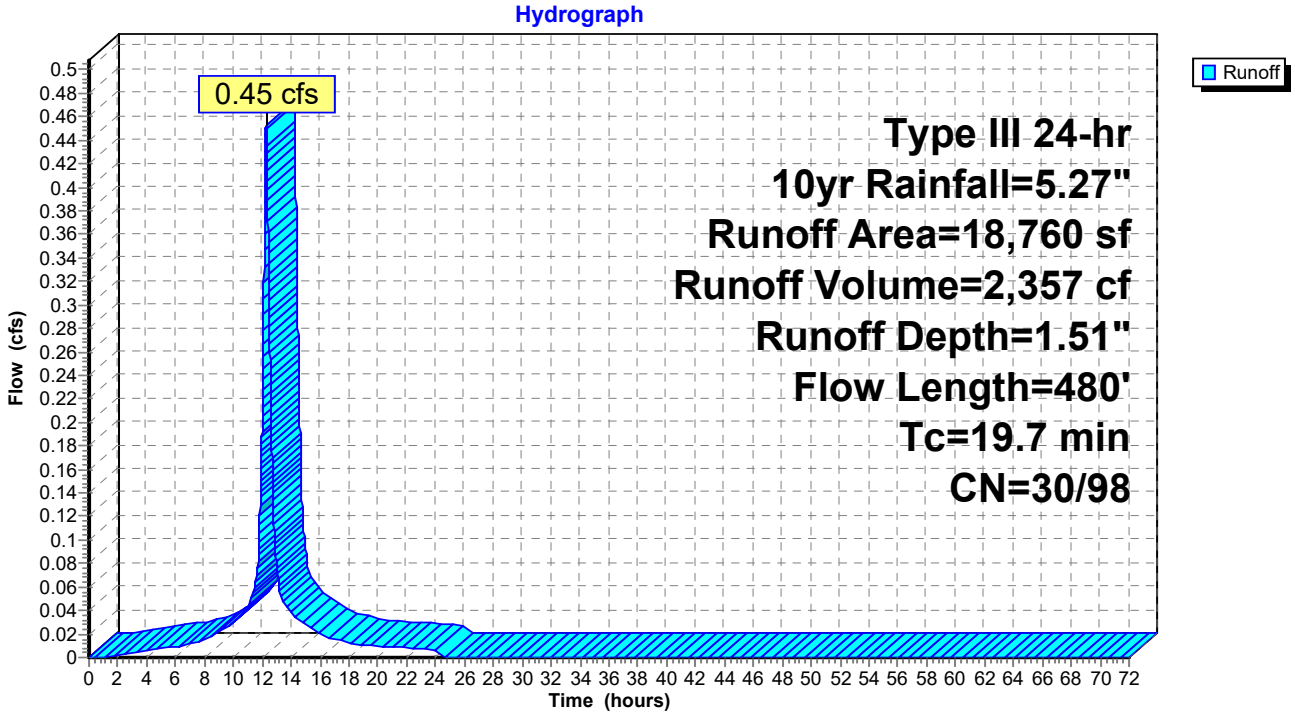
Runoff = 0.45 cfs @ 12.26 hrs, Volume= 2,357 cf, Depth= 1.51"
Routed to Pond IS3 : Infiltration System 3

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10yr Rainfall=5.27"

Area (sf)	CN	Description
5,580	98	Paved parking, HSG A
0	98	Unconnected roofs, HSG A
13,180	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
18,760	50	Weighted Average
13,180	30	70.26% Pervious Area
5,580	98	29.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.2	100	0.0300	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
1.8	155	0.0800	1.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.7	225	0.0800	5.74		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
19.7	480	Total			

Subcatchment DA3A:



Summary for Subcatchment DA3B:

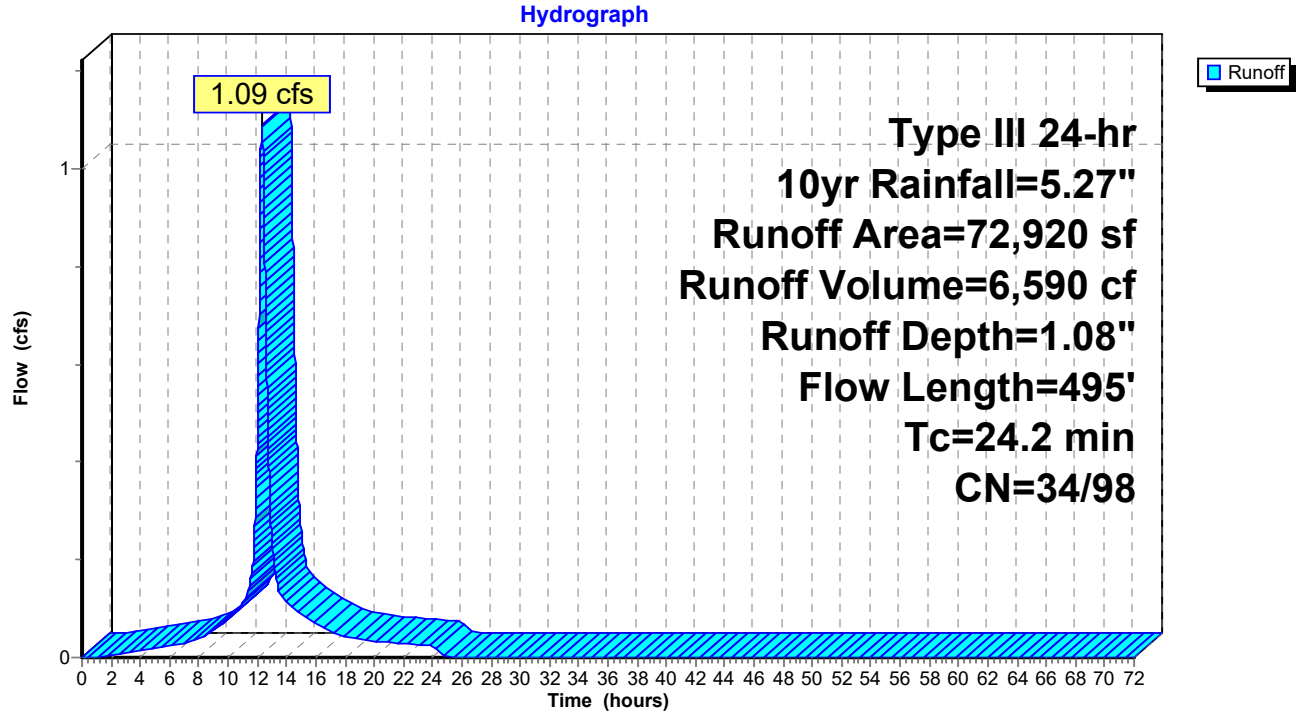
Runoff = 1.09 cfs @ 12.31 hrs, Volume= 6,590 cf, Depth= 1.08"
Routed to Pond IS3 : Infiltration System 3

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10yr Rainfall=5.27"

Area (sf)	CN	Description
8,650	98	Paved parking, HSG A
5,990	98	Unconnected roofs, HSG A
35,050	30	Woods, Good, HSG A
23,230	39	>75% Grass cover, Good, HSG A
72,920	47	Weighted Average
58,280	34	79.92% Pervious Area
14,640	98	20.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.2	100	0.0200	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
3.0	270	0.0900	1.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.0	125	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
24.2	495	Total			

Subcatchment DA3B:



Summary for Subcatchment DA3C:

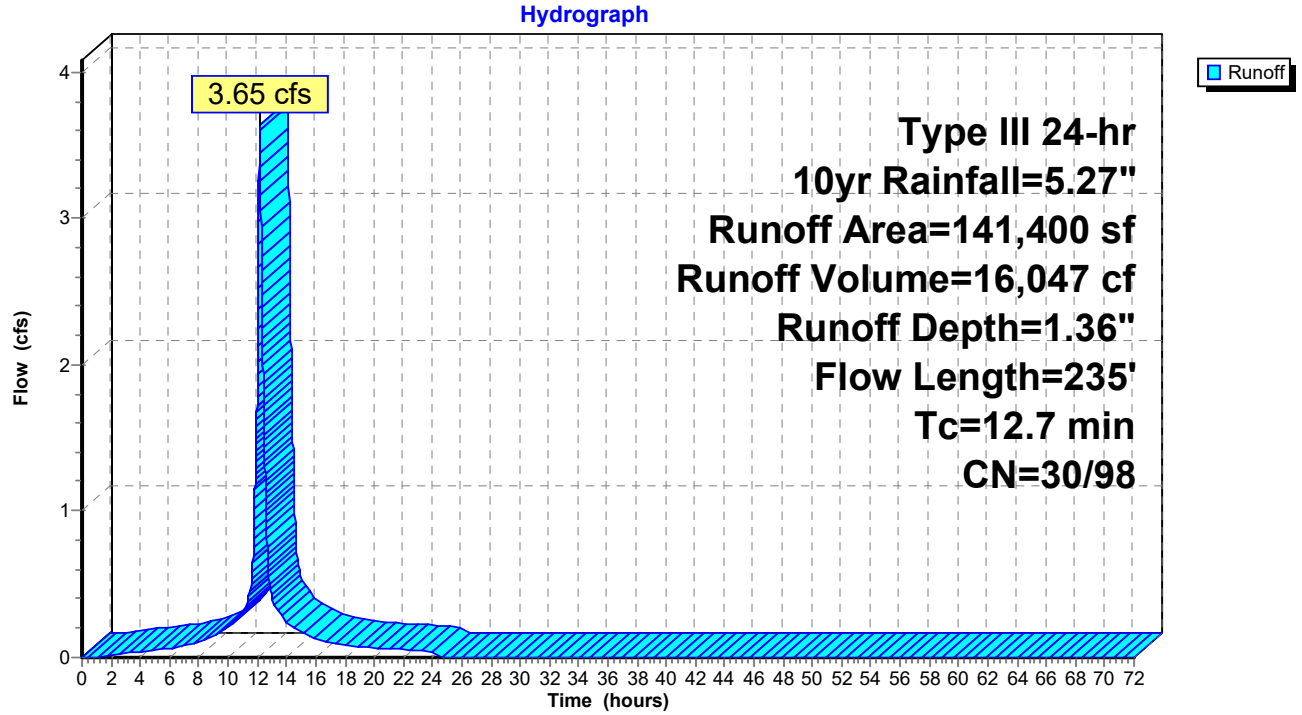
Runoff = 3.65 cfs @ 12.17 hrs, Volume= 16,047 cf, Depth= 1.36"
Routed to Pond C1 : CHAMBERS

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10yr Rainfall=5.27"

Area (sf)	CN	Description
23,130	98	Paved parking, HSG A
14,820	98	Unconnected roofs, HSG A
99,540	30	Woods, Good, HSG A
3,910	39	>75% Grass cover, Good, HSG A
141,400	48	Weighted Average
103,450	30	73.16% Pervious Area
37,950	98	26.84% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.6	100	0.0800	0.14		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
0.1	10	0.1200	1.73		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.0	125	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
12.7	235	Total			

Subcatchment DA3C:



Summary for Pond C1: CHAMBERS

Inflow Area = 141,400 sf, 26.84% Impervious, Inflow Depth = 1.36" for 10yr event
Inflow = 3.65 cfs @ 12.17 hrs, Volume= 16,047 cf
Outflow = 0.37 cfs @ 11.27 hrs, Volume= 16,043 cf, Atten= 90%, Lag= 0.0 min
Discarded = 0.37 cfs @ 11.27 hrs, Volume= 16,043 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Pond IT3 : INFILTRATION TRENCH 3

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 31.49' @ 13.14 hrs Surf.Area= 1,912 sf Storage= 5,641 cf

Plug-Flow detention time= 107.1 min calculated for 16,043 cf (100% of inflow)
Center-of-Mass det. time= 106.9 min (864.3 - 757.4)

Volume	Invert	Avail.Storage	Storage Description
#1B	27.25'	2,581 cf	**19.17'W x 99.75'L x 6.75'H Field B** 12,905 cf Overall - 5,083 cf Embedded = 7,823 cf x 33.0% Voids
#2B	28.00'	5,083 cf	**ADS_StormTech MC-7200 +Cap** x 28 Inside #1 Effective Size= 91.2"W x 60.0"H => 26.68 sf x 6.59'L = 175.9 cf Overall Size= 100.0"W x 60.0"H x 6.95'L with 0.36' Overlap 28 Chambers in 2 Rows Cap Storage= 39.5 cf x 2 x 2 rows = 158.0 cf
#3	27.00'	126 cf	**4.00'D x 10.00'H Vertical Cone/Cylinder**-Impervious
#4	36.10'	327 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)
		8,117 cf	Total Available Storage

Storage Group B created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
36.10	100	0	0
36.25	400	37	37
36.30	600	25	63
36.35	10,000	265	327

Device	Routing	Invert	Outlet Devices
#1	Discarded	27.25'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	36.30'	**20.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.37 cfs @ 11.27 hrs HW=27.25' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.37 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=27.00' (Free Discharge)
↑**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond C1: CHAMBERS - Chamber Wizard Field B

Chamber Model = ADS_StormTech MC-7200 +Cap (ADS StormTech® MC-7200 with cap volume)
Effective Size= 91.2"W x 60.0"H => 26.68 sf x 6.59'L = 175.9 cf
Overall Size= 100.0"W x 60.0"H x 6.95'L with 0.36' Overlap
Cap Storage= 39.5 cf x 2 x 2 rows = 158.0 cf

100.0" Wide + 6.0" Spacing = 106.0" C-C Row Spacing

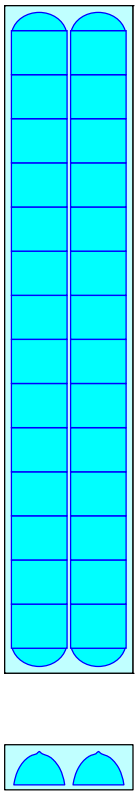
14 Chambers/Row x 6.59' Long +2.73' Cap Length x 2 = 97.75' Row Length +12.0" End Stone x 2 = 99.75' Base Length
2 Rows x 100.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 19.17' Base Width
9.0" Stone Base + 60.0" Chamber Height + 12.0" Stone Cover = 6.75' Field Height

28 Chambers x 175.9 cf + 39.5 cf Cap Volume x 2 x 2 Rows = 5,082.5 cf Chamber Storage

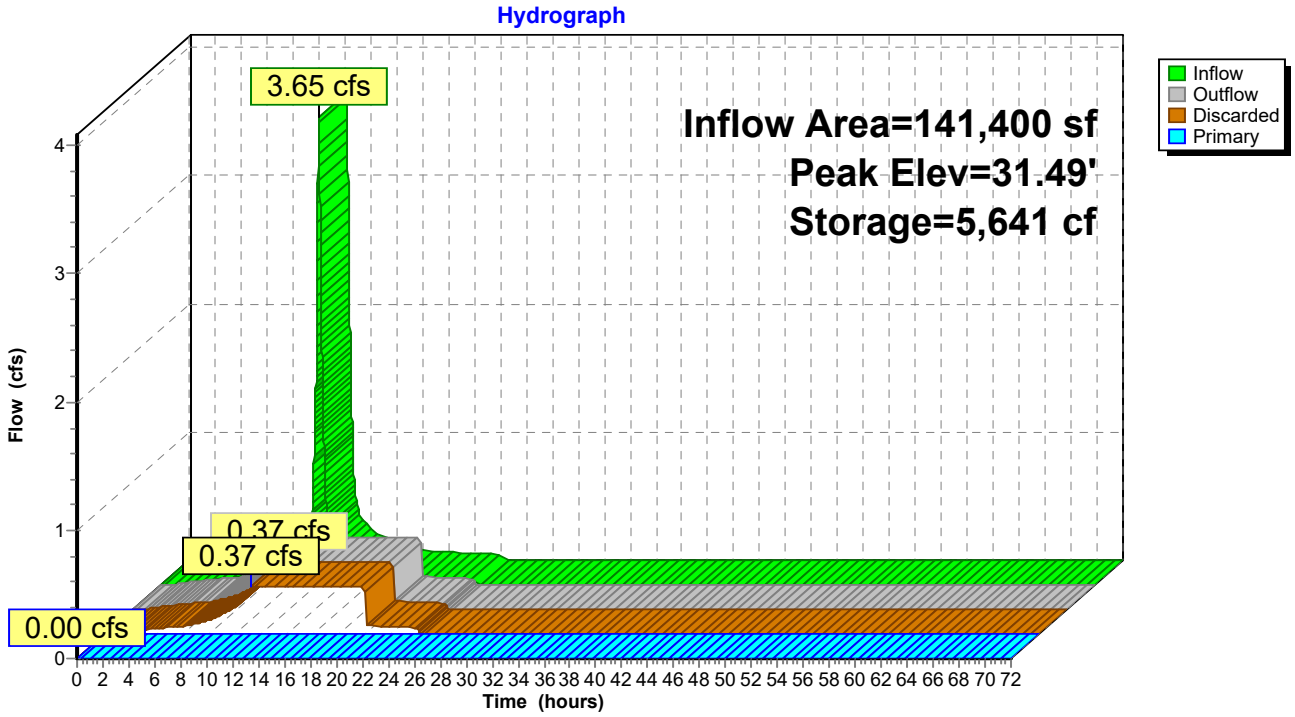
12,905.2 cf Field - 5,082.5 cf Chambers = 7,822.6 cf Stone x 33.0% Voids = 2,581.5 cf Stone Storage

Chamber Storage + Stone Storage = 7,664.0 cf = 0.176 af
Overall Storage Efficiency = 59.4%
Overall System Size = 99.75' x 19.17' x 6.75'

28 Chambers
478.0 cy Field
289.7 cy Stone



Pond C1: CHAMBERS



Summary for Pond IS1: Infiltration System 1

[88] Warning: Qout>Qin may require smaller dt or Finer Routing

Inflow Area = 301,650 sf, 25.64% Impervious, Inflow Depth = 0.24" for 10yr event
Inflow = 2.81 cfs @ 12.10 hrs, Volume= 6,054 cf
Outflow = 2.90 cfs @ 12.14 hrs, Volume= 6,054 cf, Atten= 0%, Lag= 2.8 min
Discarded = 0.06 cfs @ 11.76 hrs, Volume= 2,001 cf
Primary = 2.85 cfs @ 12.14 hrs, Volume= 4,053 cf
Routed to Pond SP1 : Follins Pond

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 13.60' @ 12.13 hrs Surf.Area= 288 sf Storage= 999 cf

Plug-Flow detention time= 51.1 min calculated for 6,053 cf (100% of inflow)
Center-of-Mass det. time= 51.1 min (799.4 - 748.3)

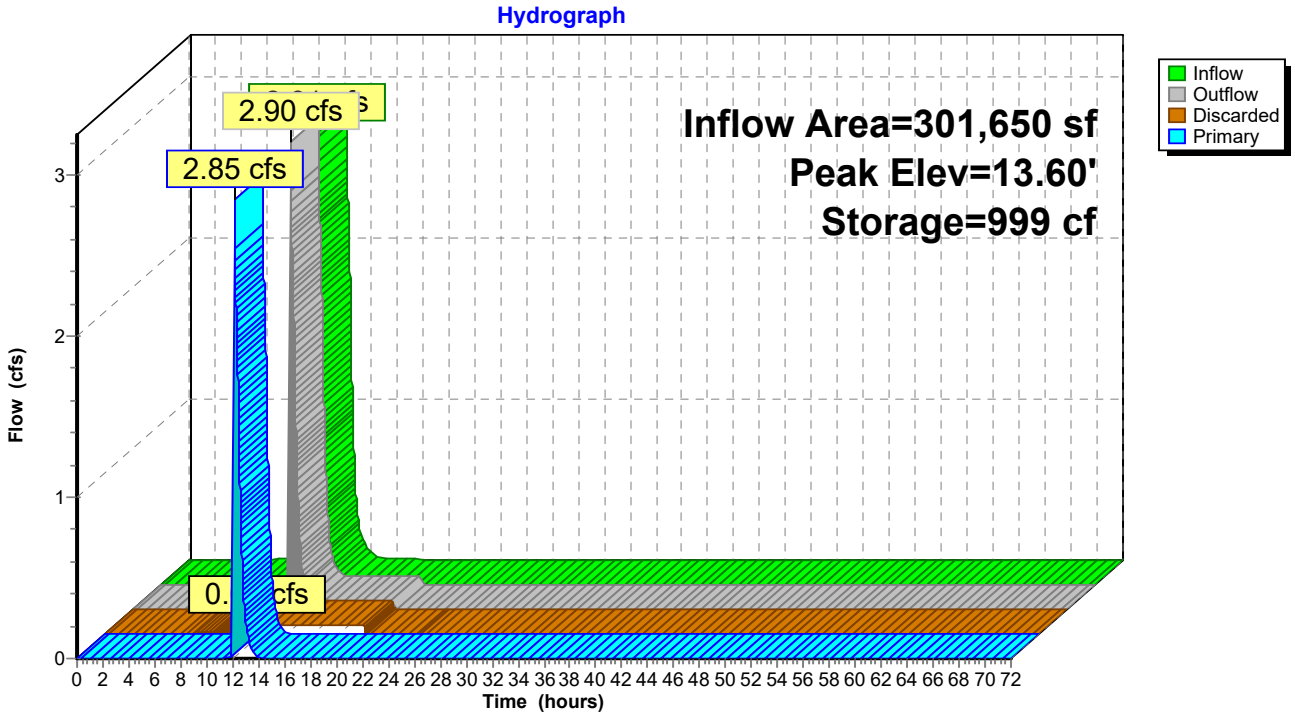
Volume	Invert	Avail.Storage	Storage Description
#1	7.60'	359 cf	**12.00'W x 24.00'L x 6.00'H Prismatoid**
			1,728 cf Overall - 640 cf Embedded = 1,088 cf x 33.0% Voids
#2	9.60'	640 cf	**8.00'W x 20.00'L x 4.00'H Prismatoid** Inside #1
		999 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#0	Primary	13.60'	**Automatic Storage Overflow** (Discharged without head)
#1	Discarded	7.60'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	13.55'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00
			Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.06 cfs @ 11.76 hrs HW=7.66' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=0.31 cfs @ 12.14 hrs HW=13.60' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 0.31 cfs @ 0.63 fps)

Pond IS1: Infiltration System 1



Summary for Pond IS2: Infiltration System 2

Inflow Area = 291,470 sf, 25.66% Impervious, Inflow Depth = 0.28" for 10yr event
Inflow = 2.64 cfs @ 12.09 hrs, Volume= 6,887 cf
Outflow = 2.64 cfs @ 12.09 hrs, Volume= 6,887 cf, Atten= 0%, Lag= 0.3 min
Discarded = 0.06 cfs @ 11.70 hrs, Volume= 1,917 cf
Primary = 2.58 cfs @ 12.09 hrs, Volume= 4,971 cf
Routed to Pond IS1 : Infiltration System 1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 17.00' @ 12.03 hrs Surf.Area= 288 sf Storage= 999 cf

Plug-Flow detention time= 52.7 min calculated for 6,887 cf (100% of inflow)
Center-of-Mass det. time= 52.7 min (801.3 - 748.6)

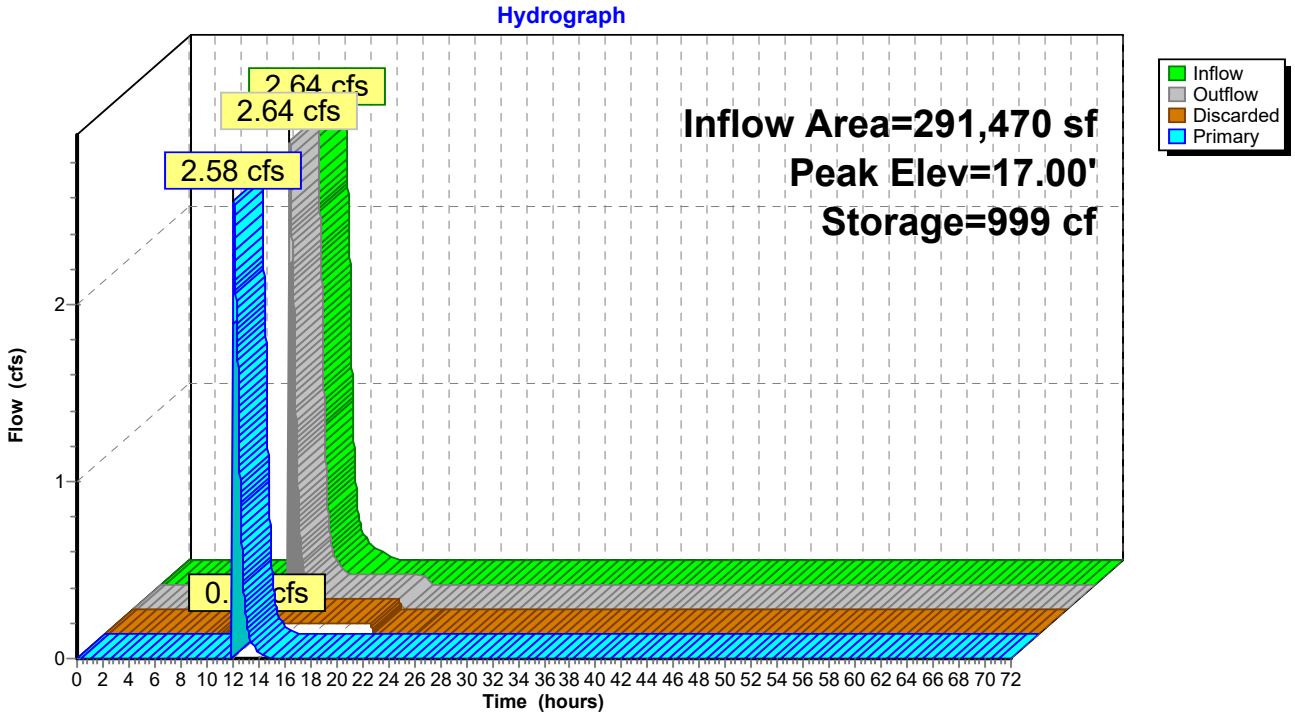
Volume	Invert	Avail.Storage	Storage Description
#1	11.00'	359 cf	**12.00'W x 24.00'L x 6.00'H Prismatoid** 1,728 cf Overall - 640 cf Embedded = 1,088 cf x 33.0% Voids
#2	13.00'	640 cf	**8.00'W x 20.00'L x 4.00'H Prismatoid** Inside #1
		999 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#0	Primary	17.00'	**Automatic Storage Overflow** (Discharged without head)
#1	Discarded	11.00'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	16.95'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.06 cfs @ 11.70 hrs HW=11.07' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=0.31 cfs @ 12.09 hrs HW=17.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 0.31 cfs @ 0.63 fps)

Pond IS2: Infiltration System 2



Summary for Pond IS3: Infiltration System 3

Inflow Area = 259,970 sf, 25.38% Impervious, Inflow Depth = 0.48" for 10yr event
Inflow = 1.85 cfs @ 12.27 hrs, Volume= 10,303 cf
Outflow = 1.85 cfs @ 12.27 hrs, Volume= 10,303 cf, Atten= 0%, Lag= 0.3 min
Discarded = 0.06 cfs @ 8.05 hrs, Volume= 4,477 cf
Primary = 1.80 cfs @ 12.27 hrs, Volume= 5,826 cf
Routed to Pond IT2 : INFILTRATION TRENCH 2

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 30.91' @ 12.27 hrs Surf.Area= 288 sf Storage= 981 cf

Plug-Flow detention time= 76.1 min calculated for 10,302 cf (100% of inflow)
Center-of-Mass det. time= 76.1 min (850.2 - 774.1)

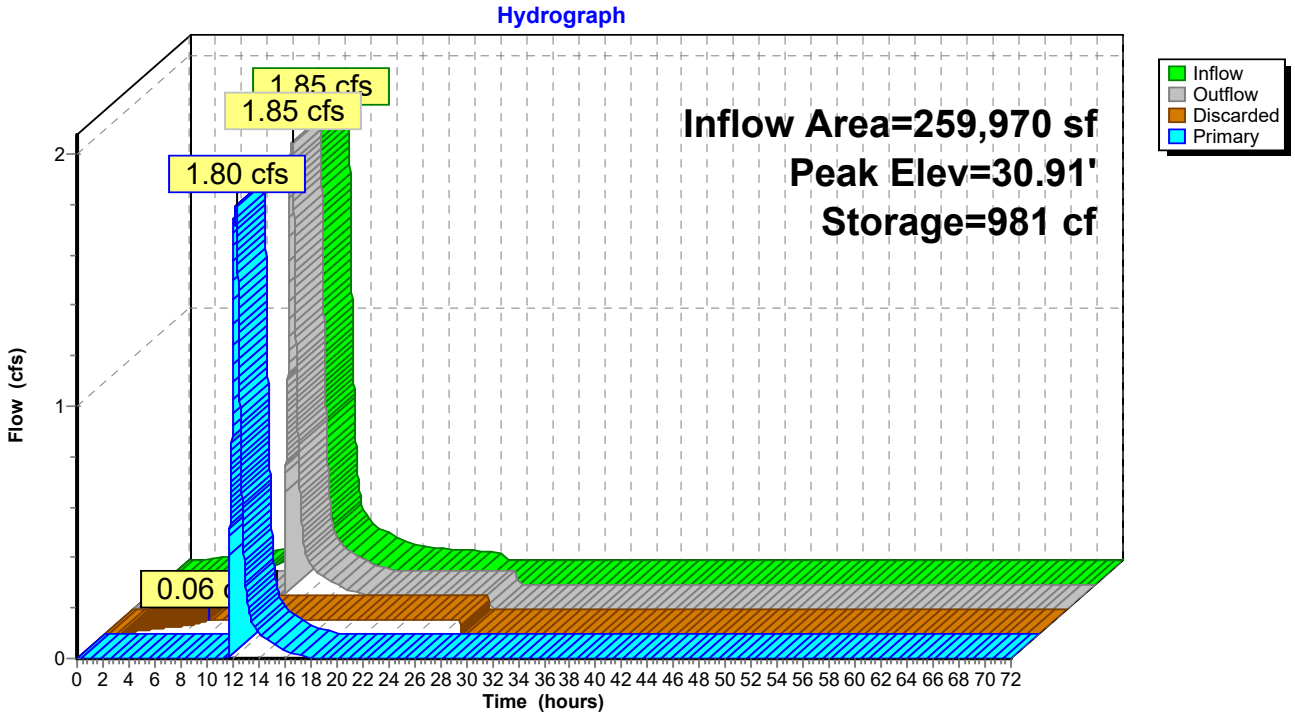
Volume	Invert	Avail.Storage	Storage Description
#1	25.00'	359 cf	**12.00'W x 24.00'L x 6.00'H Prismatoid** 1,728 cf Overall - 640 cf Embedded = 1,088 cf x 33.0% Voids
#2	27.00'	640 cf	**8.00'W x 20.00'L x 4.00'H Prismatoid** Inside #1
		999 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#0	Primary	31.00'	**Automatic Storage Overflow** (Discharged without head)
#1	Discarded	25.00'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	30.75'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.06 cfs @ 8.05 hrs HW=25.06' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=1.77 cfs @ 12.27 hrs HW=30.91' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 1.77 cfs @ 1.12 fps)

Pond IS3: Infiltration System 3



Summary for Pond IT1: INFILTRATION TRENCH 1

Inflow Area = 286,690 sf, 25.71% Impervious, Inflow Depth = 0.31" for 10yr event
Inflow = 2.62 cfs @ 12.08 hrs, Volume= 7,368 cf
Outflow = 2.61 cfs @ 12.09 hrs, Volume= 7,298 cf, Atten= 0%, Lag= 0.5 min
Discarded = 0.10 cfs @ 12.09 hrs, Volume= 873 cf
Primary = 2.51 cfs @ 12.09 hrs, Volume= 6,425 cf
Routed to Pond IS2 : Infiltration System 2

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 20.74' @ 12.09 hrs Surf.Area= 536 sf Storage= 156 cf

Plug-Flow detention time= 10.5 min calculated for 7,298 cf (99% of inflow)
Center-of-Mass det. time= 5.8 min (756.9 - 751.2)

Volume	Invert	Avail.Storage	Storage Description
#1	16.50'	98 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 298 cf Overall x 33.0% Voids
#2	20.00'	25 cf	**4.00'D x 2.00'H Vertical Cone/Cylinder** -Impervious
#3	20.53'	237 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
		361 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
16.50	85	0	0
20.00	85	298	298

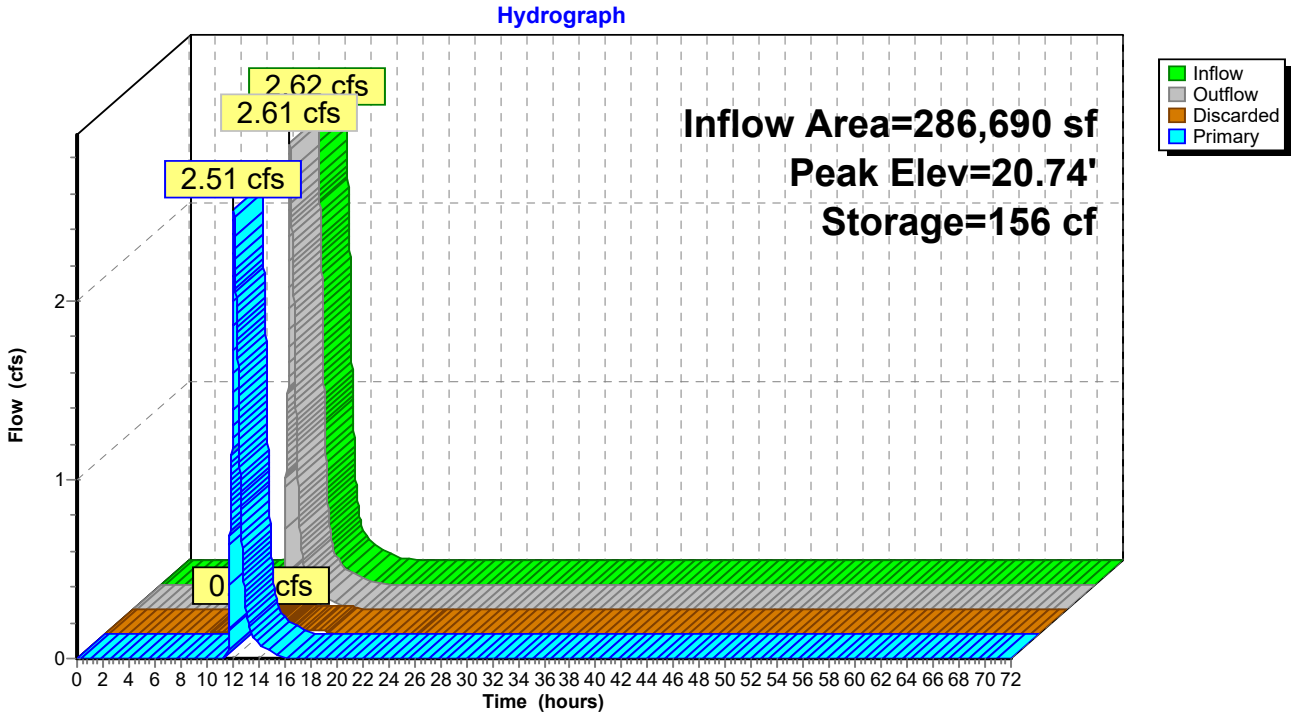
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
20.53	10	0	0
21.00	1,000	237	237

Device	Routing	Invert	Outlet Devices
#1	Discarded	16.50'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Device 1	19.00'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	20.53'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.10 cfs @ 12.09 hrs HW=20.74' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.10 cfs)
↑**2=Orifice/Grate** (Passes 0.10 cfs of 1.15 cfs potential flow)

Primary OutFlow Max=2.50 cfs @ 12.09 hrs HW=20.74' (Free Discharge)
↑**3=Orifice/Grate** (Weir Controls 2.50 cfs @ 1.50 fps)

Pond IT1: INFILTRATION TRENCH 1



Summary for Pond IT2: INFILTRATION TRENCH 2

Inflow Area = 280,550 sf, 25.55% Impervious, Inflow Depth = 0.35" for 10yr event
Inflow = 2.42 cfs @ 12.09 hrs, Volume= 8,257 cf
Outflow = 2.42 cfs @ 12.09 hrs, Volume= 8,054 cf, Atten= 0%, Lag= 0.0 min
Discarded = 0.04 cfs @ 10.65 hrs, Volume= 1,534 cf
Primary = 2.38 cfs @ 12.09 hrs, Volume= 6,520 cf
Routed to Pond IT1 : INFILTRATION TRENCH 1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 23.54' @ 12.09 hrs Surf.Area= 212 sf Storage= 298 cf

Plug-Flow detention time= 27.4 min calculated for 8,053 cf (98% of inflow)
Center-of-Mass det. time= 15.1 min (774.5 - 759.4)

Volume	Invert	Avail.Storage	Storage Description
#1	19.25'	245 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 742 cf Overall x 33.0% Voids
#2	19.35'	63 cf	**4.00'D x 5.00'H Vertical Cone/Cylinder** -Impervious
		308 cf	Total Available Storage

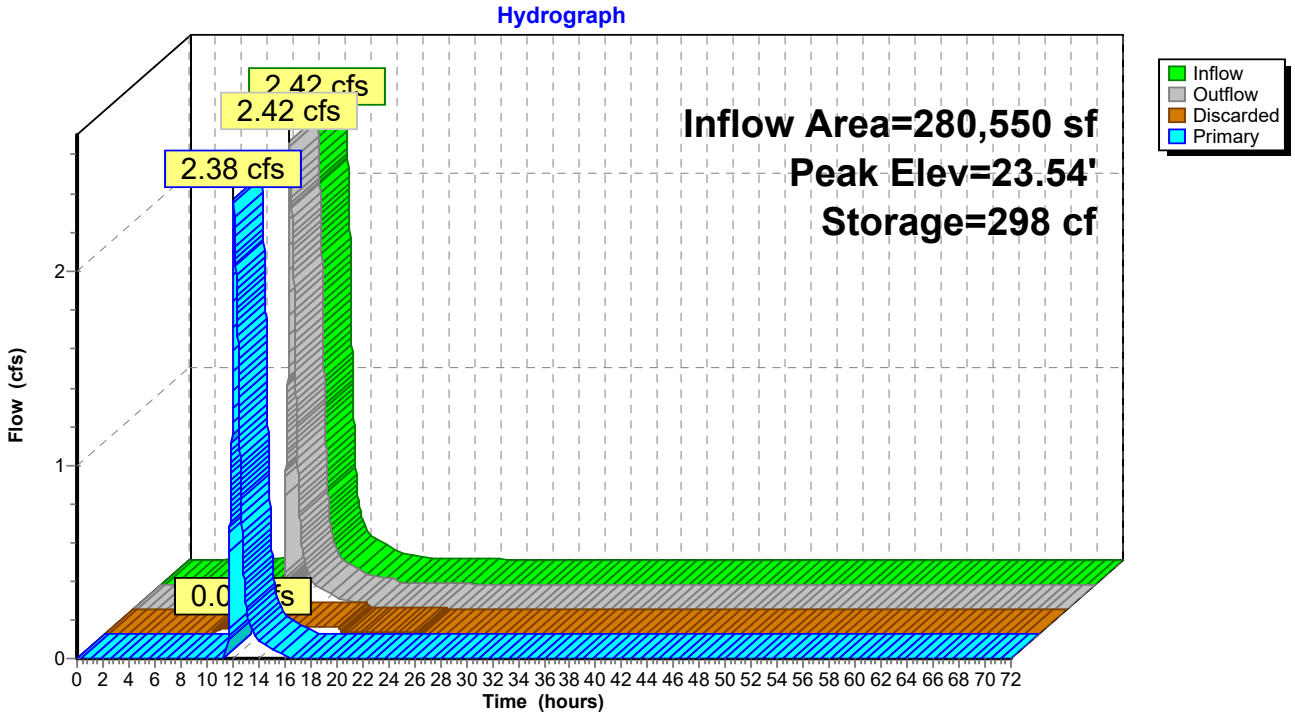
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
19.25	212	0	0
22.75	212	742	742

Device	Routing	Invert	Outlet Devices
#0	Primary	24.35'	**Automatic Storage Overflow** (Discharged without head)
#1	Discarded	19.25'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Device 1	21.75'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	23.35'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.04 cfs @ 10.65 hrs HW=21.90' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.04 cfs)
↑**2=Orifice/Grate** (Passes 0.04 cfs of 0.07 cfs potential flow)

Primary OutFlow Max=2.36 cfs @ 12.09 hrs HW=23.54' (Free Discharge)
↑**3=Broad-Crested Rectangular Weir** (Weir Controls 2.36 cfs @ 1.23 fps)

Pond IT2: INFILTRATION TRENCH 2



Summary for Pond IT3: INFILTRATION TRENCH 3

Inflow Area = 168,290 sf, 27.19% Impervious, Inflow Depth = 0.24" for 10yr event
Inflow = 0.96 cfs @ 12.07 hrs, Volume= 3,300 cf
Outflow = 0.96 cfs @ 12.07 hrs, Volume= 3,078 cf, Atten= 0%, Lag= 0.1 min
Discarded = 0.05 cfs @ 10.18 hrs, Volume= 1,721 cf
Primary = 0.91 cfs @ 12.07 hrs, Volume= 1,356 cf
Routed to Pond IS3 : Infiltration System 3

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 34.26' @ 12.07 hrs Surf.Area= 240 sf Storage= 342 cf

Plug-Flow detention time= 81.5 min calculated for 3,078 cf (93% of inflow)
Center-of-Mass det. time= 43.5 min (793.3 - 749.8)

Volume	Invert	Avail.Storage	Storage Description
#1	28.50'	277 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 840 cf Overall x 33.0% Voids
#2	29.10'	101 cf	**4.00'D x 8.00'H Vertical Cone/Cylinder** -Impervious
		378 cf	Total Available Storage

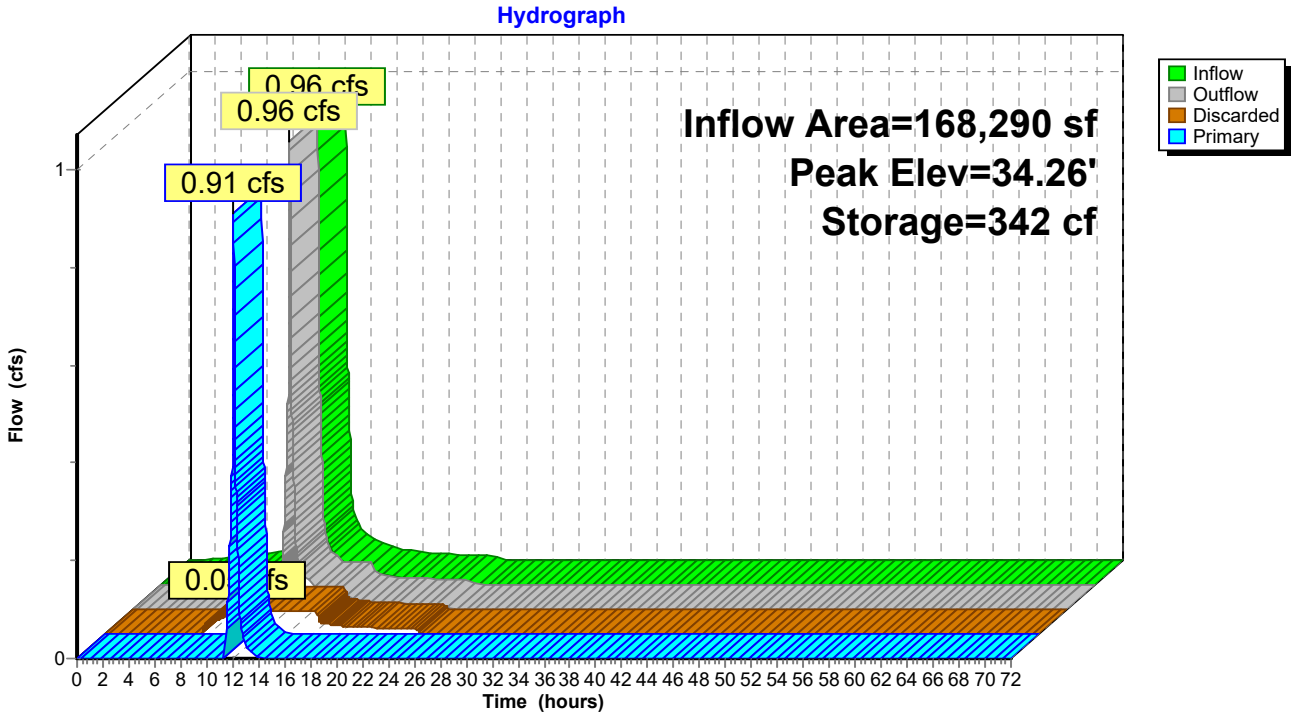
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
28.50	240	0	0
32.00	240	840	840

Device	Routing	Invert	Outlet Devices
#0	Primary	37.10'	**Automatic Storage Overflow** (Discharged without head)
#1	Discarded	28.50'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Device 1	31.00'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	35.40'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#4	Primary	33.70'	**12.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 33.70' / 31.00' S= 0.2700 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Discarded OutFlow Max=0.05 cfs @ 10.18 hrs HW=31.17' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.05 cfs)
└**2=Orifice/Grate** (Passes 0.05 cfs of 0.08 cfs potential flow)

Primary OutFlow Max=0.91 cfs @ 12.07 hrs HW=34.26' (Free Discharge)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
└**4=Culvert** (Inlet Controls 0.91 cfs @ 2.01 fps)

Pond IT3: INFILTRATION TRENCH 3



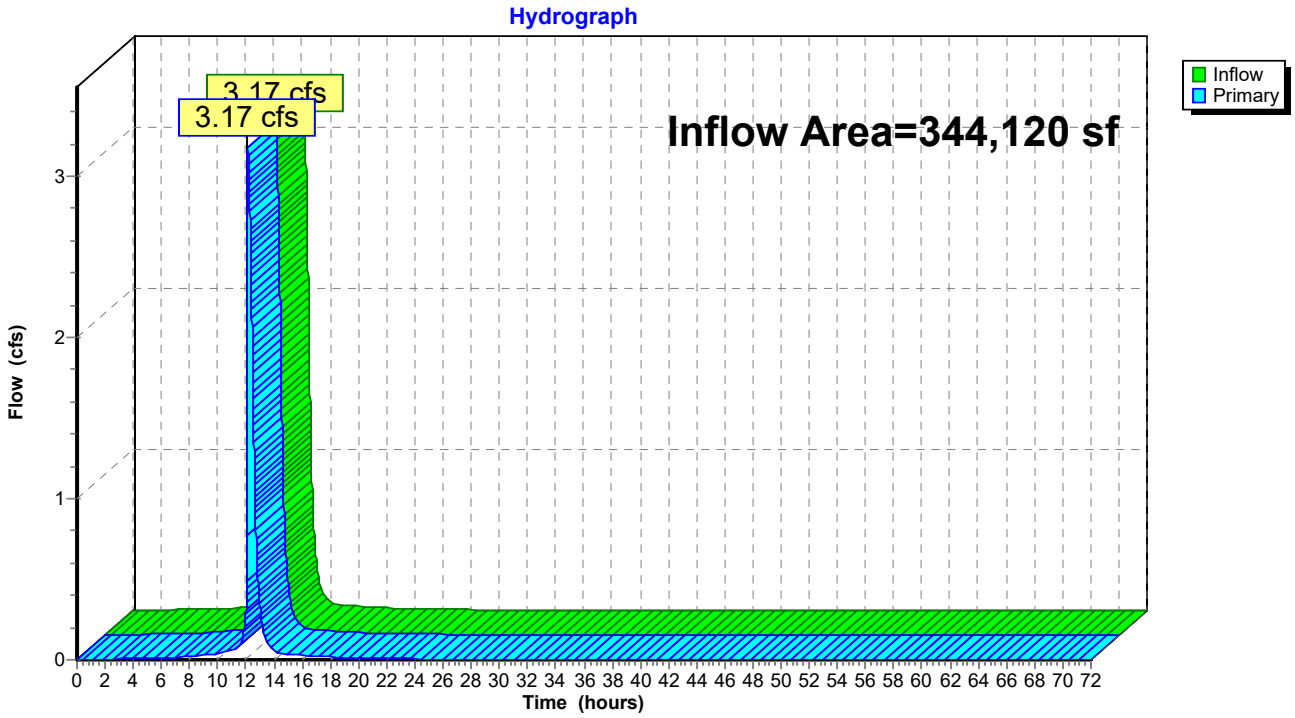
Summary for Pond SP1: Follins Pond

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 344,120 sf, 24.57% Impervious, Inflow Depth = 0.25" for 10yr event
Inflow = 3.17 cfs @ 12.14 hrs, Volume= 7,154 cf
Primary = 3.17 cfs @ 12.14 hrs, Volume= 7,154 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Pond SP1: Follins Pond



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment DA0: Runoff Area=42,470 sf 16.93% Impervious Runoff Depth=1.21"
Flow Length=625' Tc=16.2 min CN=31/98 Runoff=0.78 cfs 4,291 cf

Subcatchment DA1: Runoff Area=10,180 sf 25.15% Impervious Runoff Depth=1.69"
Flow Length=235' Tc=11.5 min CN=30/98 Runoff=0.32 cfs 1,430 cf

Subcatchment DA2: Runoff Area=4,780 sf 22.80% Impervious Runoff Depth=1.54"
Tc=5.0 min CN=30/98 Runoff=0.17 cfs 614 cf

Subcatchment DA2A: Runoff Area=6,140 sf 32.74% Impervious Runoff Depth=2.15"
Tc=5.0 min CN=30/98 Runoff=0.31 cfs 1,101 cf

Subcatchment DA2B: Runoff Area=20,580 sf 27.75% Impervious Runoff Depth=1.87"
Tc=5.0 min CN=31/98 Runoff=0.87 cfs 3,214 cf

Subcatchment DA3: Runoff Area=26,890 sf 29.04% Impervious Runoff Depth=1.93"
Tc=5.0 min CN=30/98 Runoff=1.19 cfs 4,314 cf

Subcatchment DA3A: Runoff Area=18,760 sf 29.74% Impervious Runoff Depth=1.97"
Flow Length=480' Tc=19.7 min CN=30/98 Runoff=0.56 cfs 3,077 cf

Subcatchment DA3B: Runoff Area=72,920 sf 20.08% Impervious Runoff Depth=1.52"
Flow Length=495' Tc=24.2 min CN=34/98 Runoff=1.36 cfs 9,219 cf

Subcatchment DA3C: Runoff Area=141,400 sf 26.84% Impervious Runoff Depth=1.79"
Flow Length=235' Tc=12.7 min CN=30/98 Runoff=4.53 cfs 21,084 cf

Pond C1: CHAMBERS Peak Elev=36.07' Storage=7,778 cf Inflow=4.53 cfs 21,084 cf
Discarded=0.38 cfs 21,085 cf Primary=0.00 cfs 0 cf Outflow=0.38 cfs 21,085 cf

Pond IS1: Infiltration System 1 Peak Elev=13.60' Storage=999 cf Inflow=3.54 cfs 9,792 cf
Discarded=0.06 cfs 2,416 cf Primary=3.48 cfs 7,376 cf Outflow=3.54 cfs 9,792 cf

Pond IS2: Infiltration System 2 Peak Elev=17.00' Storage=999 cf Inflow=3.32 cfs 10,699 cf
Discarded=0.06 cfs 2,337 cf Primary=3.26 cfs 8,362 cf Outflow=3.32 cfs 10,699 cf

Pond IS3: Infiltration System 3 Peak Elev=30.94' Storage=986 cf Inflow=2.31 cfs 14,257 cf
Discarded=0.06 cfs 4,961 cf Primary=2.26 cfs 9,296 cf Outflow=2.31 cfs 14,257 cf

Pond IT1: INFILTRATION TRENCH 1 Peak Elev=20.77' Storage=173 cf Inflow=3.29 cfs 11,374 cf
Discarded=0.12 cfs 1,218 cf Primary=3.16 cfs 10,085 cf Outflow=3.28 cfs 11,303 cf

Pond IT2: INFILTRATION TRENCH 2 Peak Elev=23.57' Storage=298 cf Inflow=3.03 cfs 12,509 cf
Discarded=0.04 cfs 2,033 cf Primary=2.99 cfs 10,272 cf Outflow=3.03 cfs 12,306 cf

Pond IT3: INFILTRATION TRENCH 3 Peak Elev=34.34' Storage=343 cf Inflow=1.19 cfs 4,314 cf
Discarded=0.05 cfs 2,130 cf Primary=1.14 cfs 1,962 cf Outflow=1.19 cfs 4,092 cf

Pond SP1: Follins Pond

Inflow=4.09 cfs 11,667 cf
Primary=4.09 cfs 11,667 cf

Total Runoff Area = 344,120 sf Runoff Volume = 48,343 cf Average Runoff Depth = 1.69"
75.43% Pervious = 259,580 sf 24.57% Impervious = 84,540 sf

Summary for Subcatchment DA0:

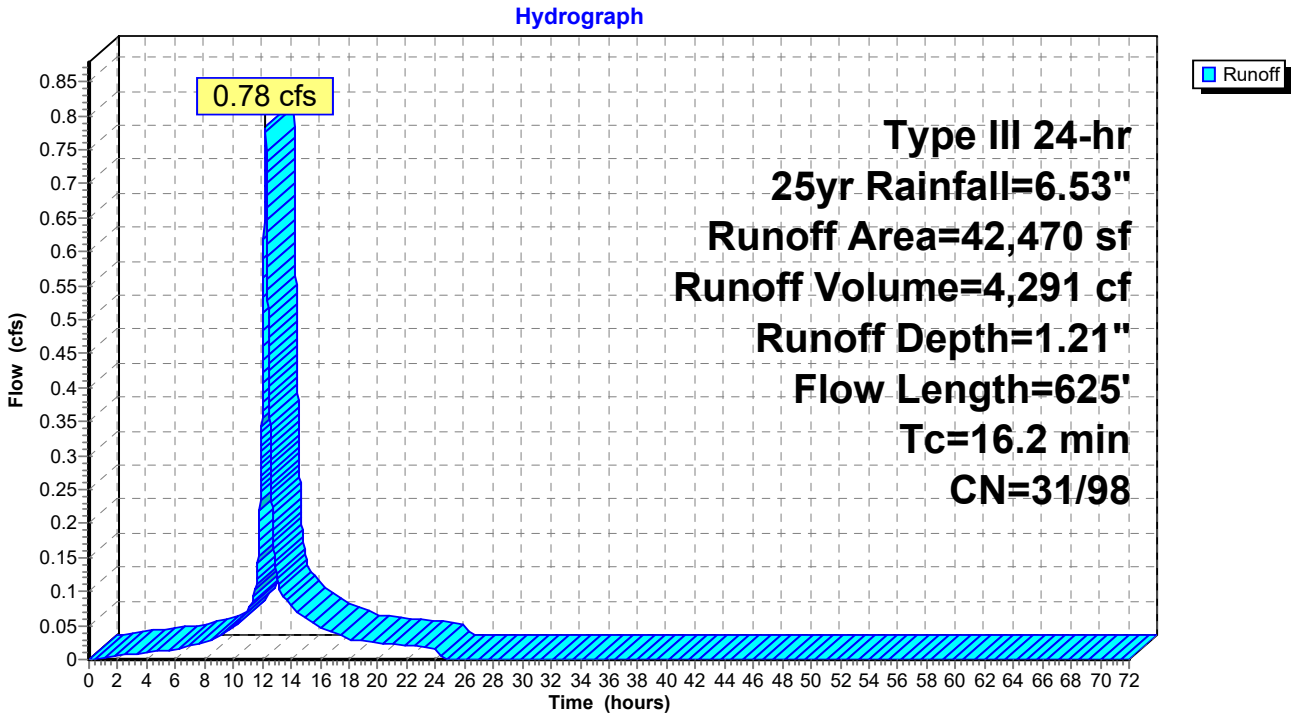
Runoff = 0.78 cfs @ 12.21 hrs, Volume= 4,291 cf, Depth= 1.21"
Routed to Pond SP1 : Follins Pond

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25yr Rainfall=6.53"

Area (sf)	CN	Description
4,730	98	Paved parking, HSG A
2,460	98	Unconnected roofs, HSG A
29,910	30	Woods, Good, HSG A
5,370	39	>75% Grass cover, Good, HSG A
42,470	43	Weighted Average
35,280	31	83.07% Pervious Area
7,190	98	16.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.1	100	0.0900	0.15		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
5.0	470	0.1000	1.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	55	0.1100	6.73		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
16.2	625	Total			

Subcatchment DA0:



Summary for Subcatchment DA1:

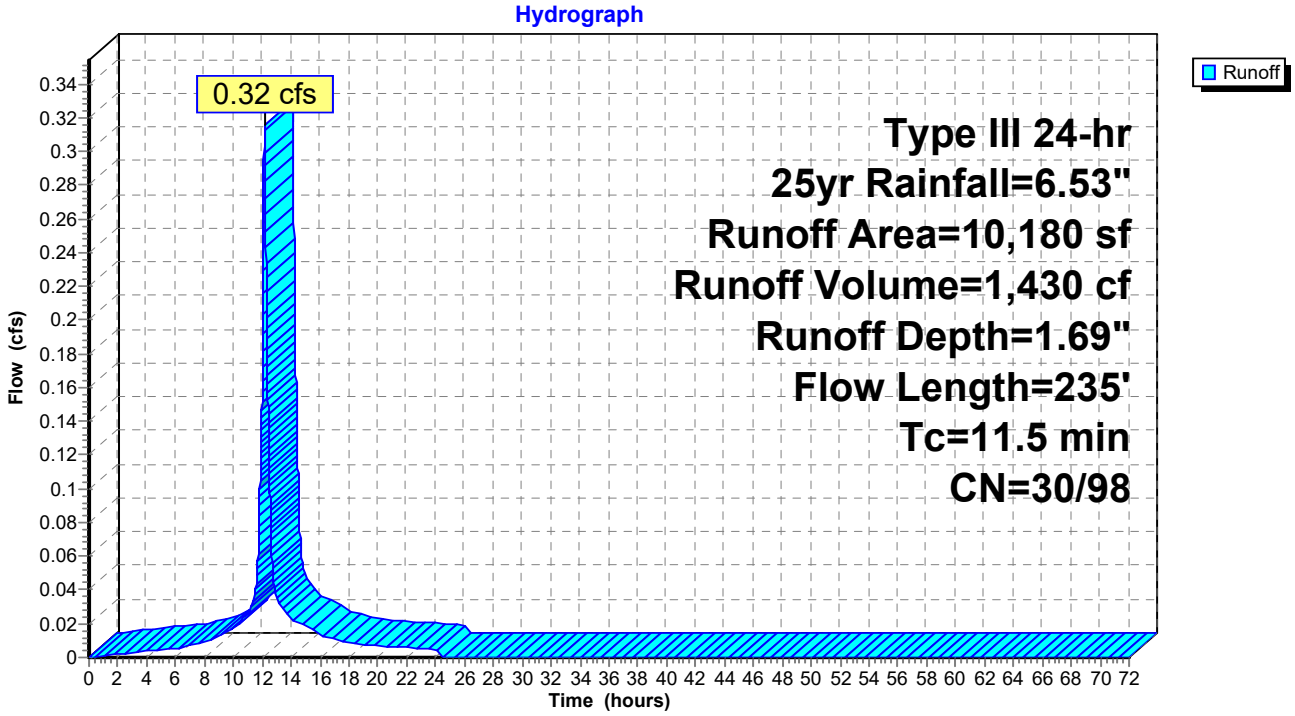
Runoff = 0.32 cfs @ 12.15 hrs, Volume= 1,430 cf, Depth= 1.69"
Routed to Pond IS1 : Infiltration System 1

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25yr Rainfall=6.53"

Area (sf)	CN	Description
2,560	98	Paved parking, HSG A
7,620	30	Woods, Good, HSG A
10,180	47	Weighted Average
7,620	30	74.85% Pervious Area
2,560	98	25.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.6	100	0.1000	0.16		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
0.8	80	0.1200	1.73		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	55	0.1100	6.73		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
11.5	235	Total			

Subcatchment DA1:



Summary for Subcatchment DA2:

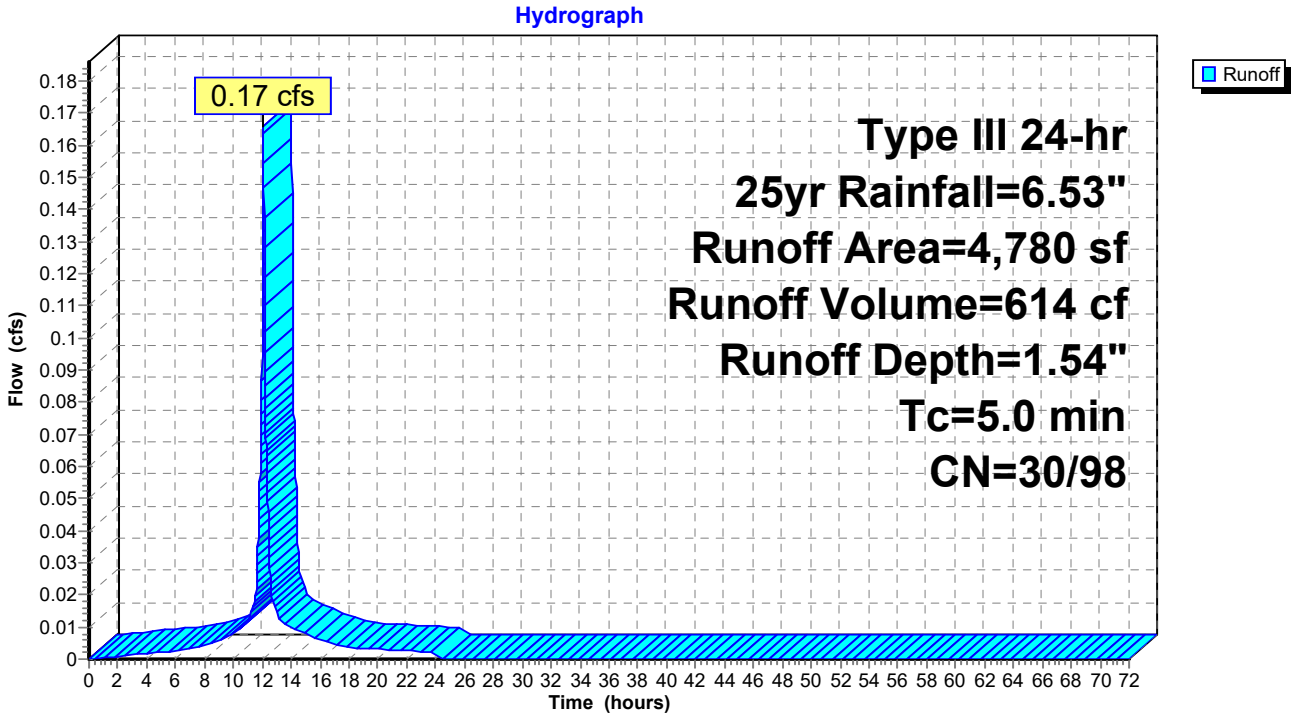
Runoff = 0.17 cfs @ 12.07 hrs, Volume= 614 cf, Depth= 1.54"
Routed to Pond IS2 : Infiltration System 2

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25yr Rainfall=6.53"

Area (sf)	CN	Description
740	98	Paved parking, HSG A
350	98	Unconnected roofs, HSG A
3,690	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
4,780	46	Weighted Average
3,690	30	77.20% Pervious Area
1,090	98	22.80% Impervious Area

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

Subcatchment DA2:



Summary for Subcatchment DA2A:

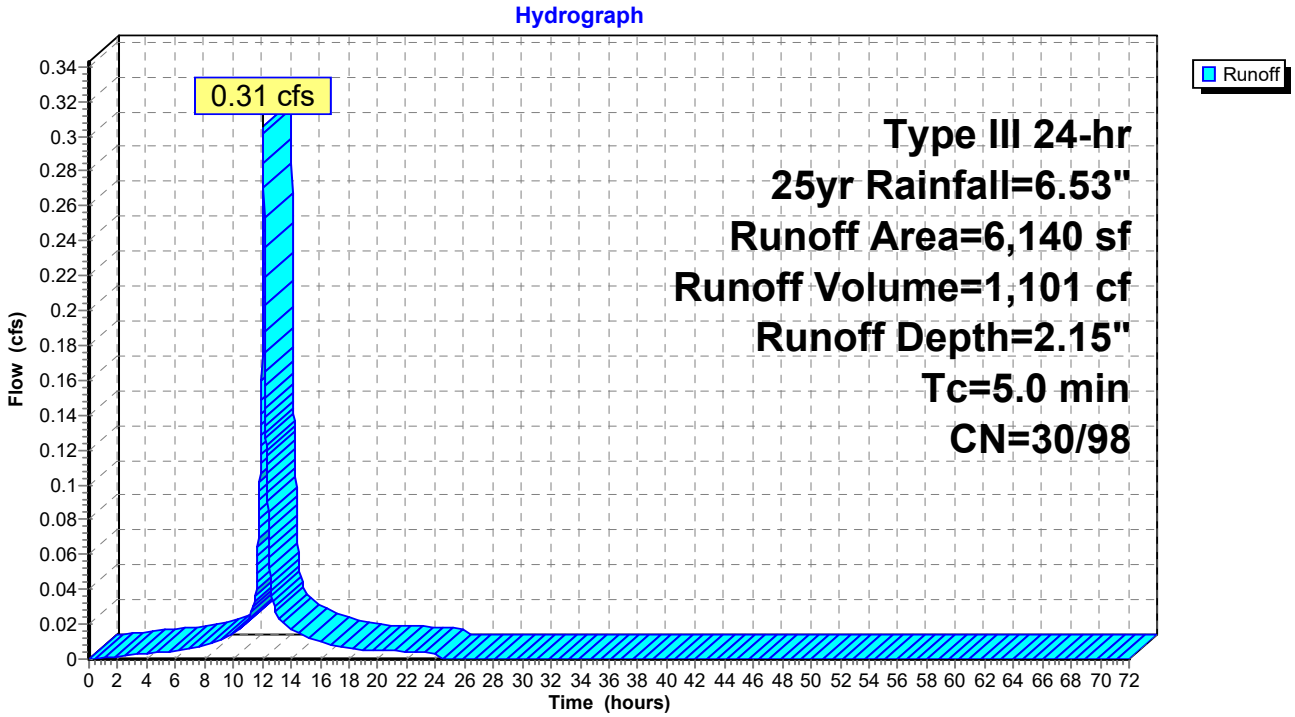
Runoff = 0.31 cfs @ 12.07 hrs, Volume= 1,101 cf, Depth= 2.15"
Routed to Pond IT1 : INFILTRATION TRENCH 1

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25yr Rainfall=6.53"

Area (sf)	CN	Description
1,080	98	Paved parking, HSG A
930	98	Unconnected roofs, HSG A
4,130	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
6,140	52	Weighted Average
4,130	30	67.26% Pervious Area
2,010	98	32.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 min direct**

Subcatchment DA2A:



Summary for Subcatchment DA2B:

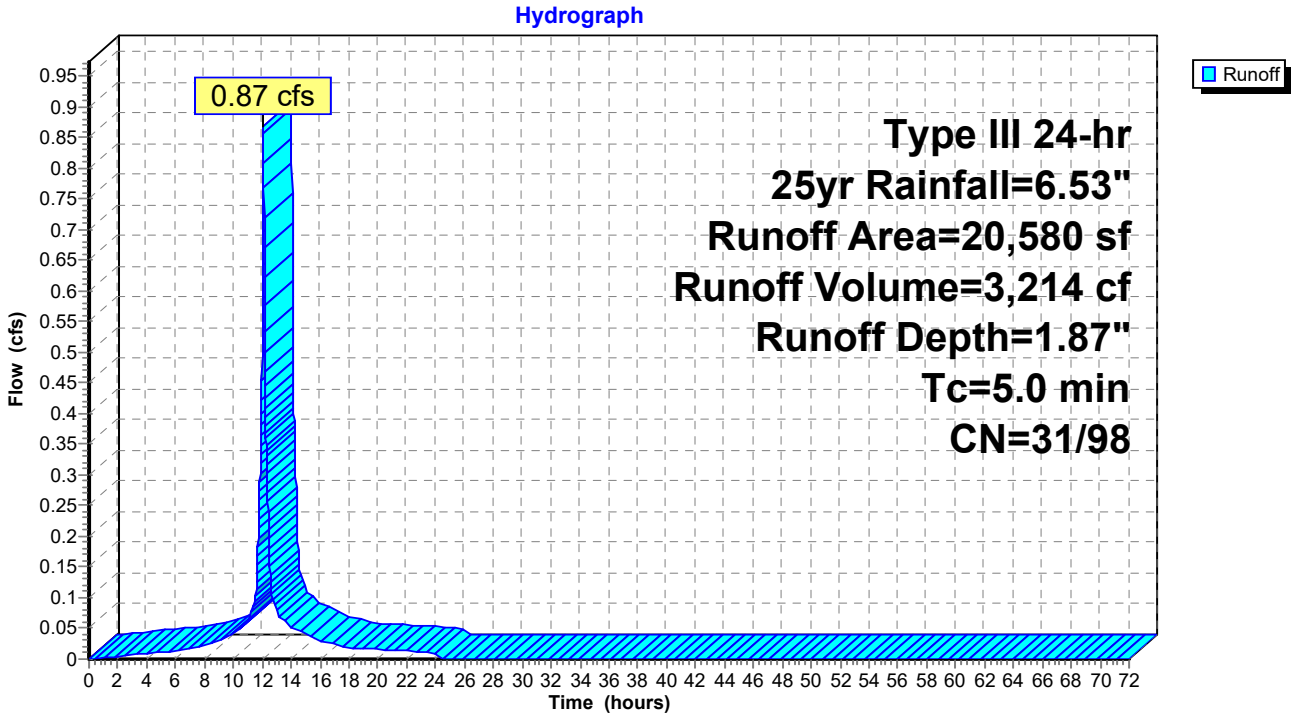
Runoff = 0.87 cfs @ 12.07 hrs, Volume= 3,214 cf, Depth= 1.87"
Routed to Pond IT2 : INFILTRATION TRENCH 2

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25yr Rainfall=6.53"

Area (sf)	CN	Description
5,710	98	Paved parking, HSG A
0	98	Unconnected roofs, HSG A
12,670	30	Woods, Good, HSG A
2,200	39	>75% Grass cover, Good, HSG A
20,580	50	Weighted Average
14,870	31	72.25% Pervious Area
5,710	98	27.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 MIN DIRECT**

Subcatchment DA2B:



Summary for Subcatchment DA3:

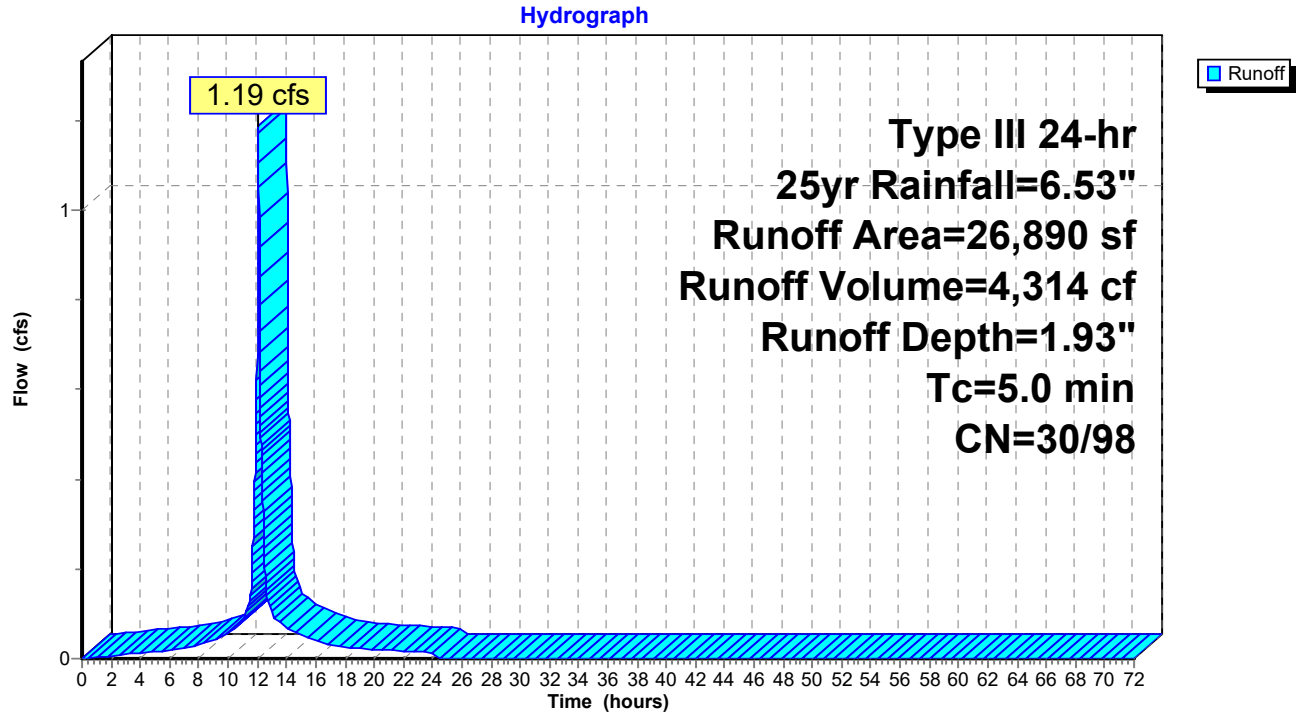
Runoff = 1.19 cfs @ 12.07 hrs, Volume= 4,314 cf, Depth= 1.93"
Routed to Pond IT3 : INFILTRATION TRENCH 3

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25yr Rainfall=6.53"

Area (sf)	CN	Description
4,210	98	Paved parking, HSG A
3,600	98	Unconnected roofs, HSG A
19,080	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
0	98	Water Surface, HSG A
26,890	50	Weighted Average
19,080	30	70.96% Pervious Area
7,810	98	29.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 MIN DIRECT**

Subcatchment DA3:



Summary for Subcatchment DA3A:

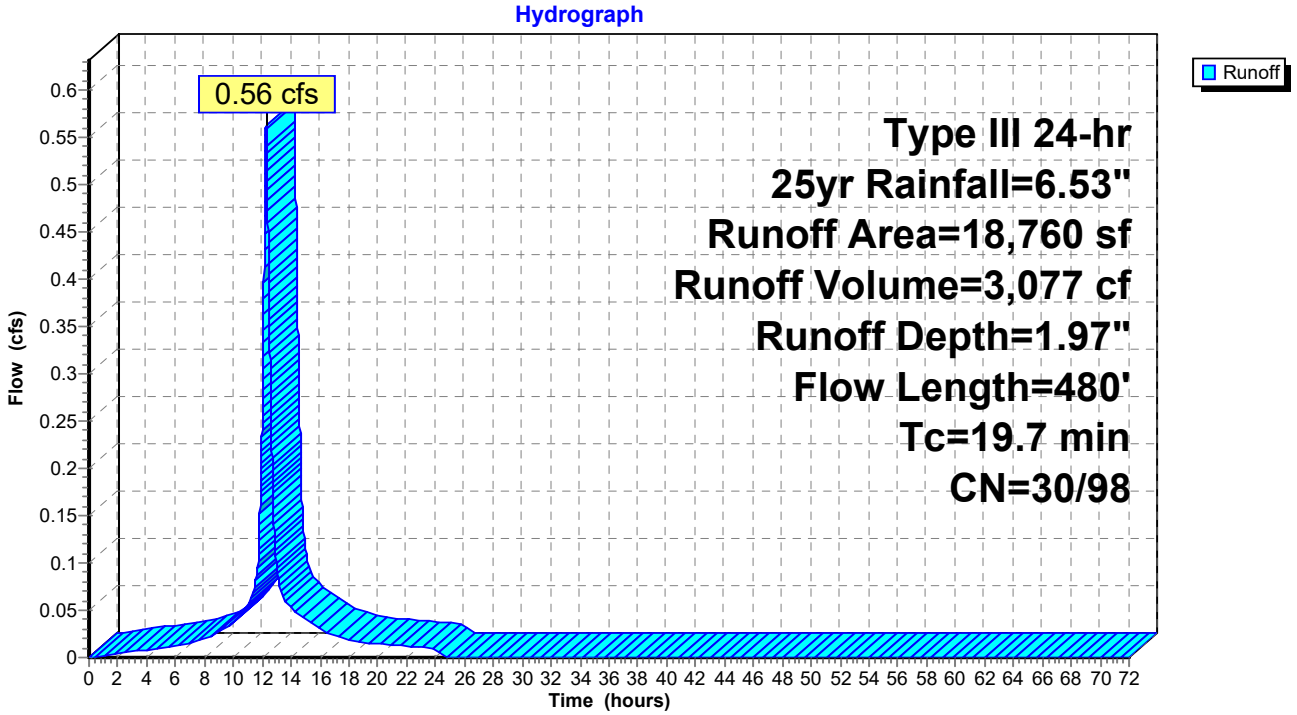
Runoff = 0.56 cfs @ 12.26 hrs, Volume= 3,077 cf, Depth= 1.97"
Routed to Pond IS3 : Infiltration System 3

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25yr Rainfall=6.53"

Area (sf)	CN	Description
5,580	98	Paved parking, HSG A
0	98	Unconnected roofs, HSG A
13,180	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
18,760	50	Weighted Average
13,180	30	70.26% Pervious Area
5,580	98	29.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.2	100	0.0300	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
1.8	155	0.0800	1.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.7	225	0.0800	5.74		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
19.7	480	Total			

Subcatchment DA3A:



Summary for Subcatchment DA3B:

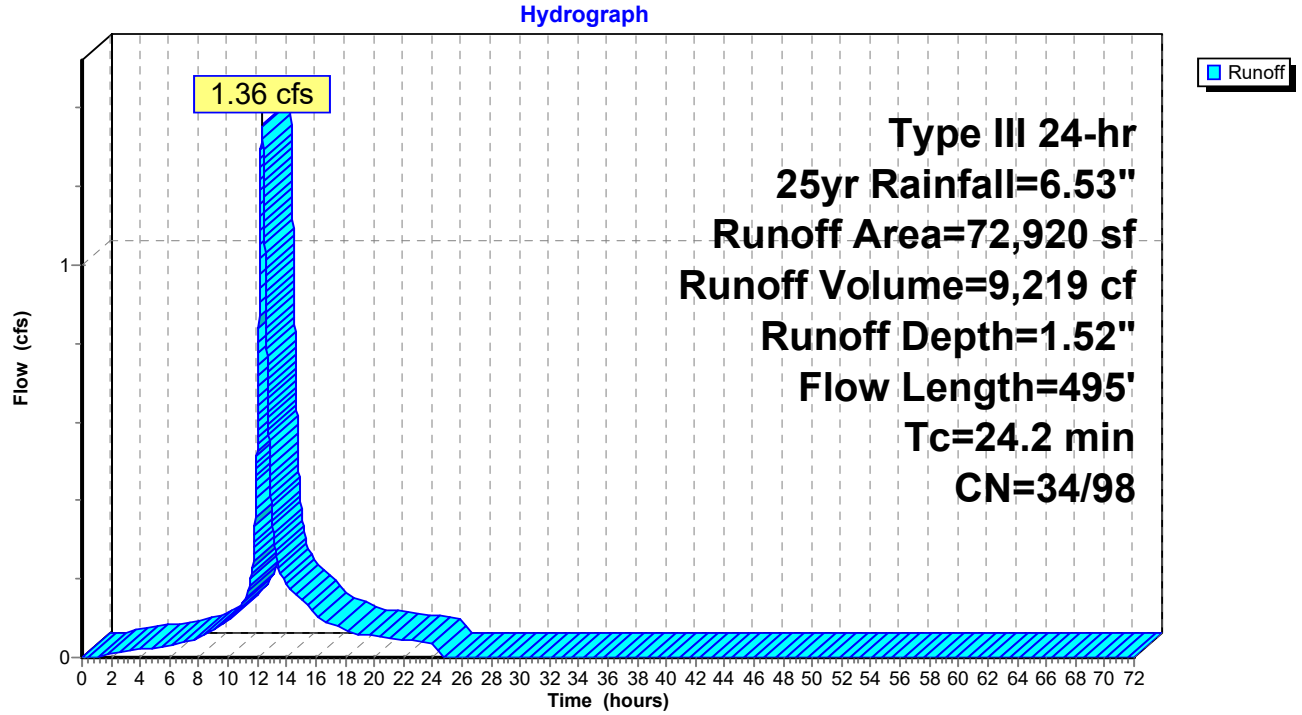
Runoff = 1.36 cfs @ 12.32 hrs, Volume= 9,219 cf, Depth= 1.52"
Routed to Pond IS3 : Infiltration System 3

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25yr Rainfall=6.53"

Area (sf)	CN	Description
8,650	98	Paved parking, HSG A
5,990	98	Unconnected roofs, HSG A
35,050	30	Woods, Good, HSG A
23,230	39	>75% Grass cover, Good, HSG A
72,920	47	Weighted Average
58,280	34	79.92% Pervious Area
14,640	98	20.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.2	100	0.0200	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
3.0	270	0.0900	1.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.0	125	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
24.2	495	Total			

Subcatchment DA3B:



Summary for Subcatchment DA3C:

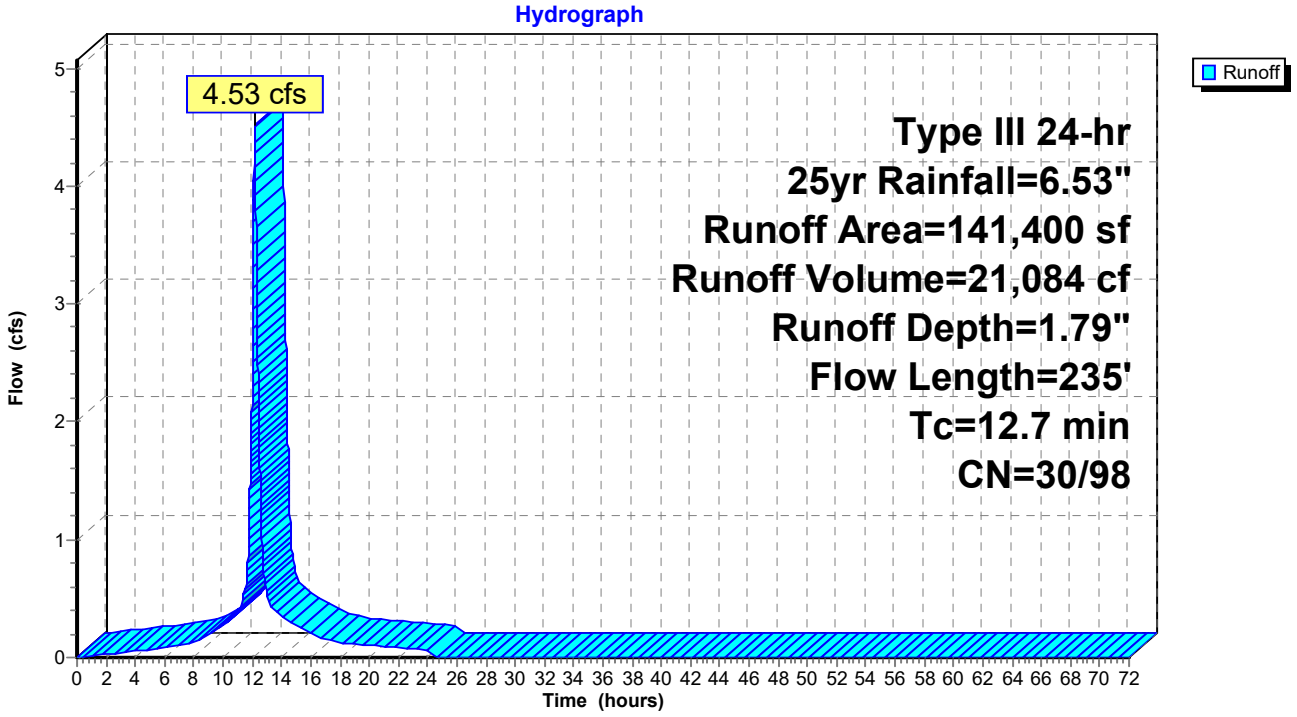
Runoff = 4.53 cfs @ 12.17 hrs, Volume= 21,084 cf, Depth= 1.79"
Routed to Pond C1 : CHAMBERS

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25yr Rainfall=6.53"

Area (sf)	CN	Description
23,130	98	Paved parking, HSG A
14,820	98	Unconnected roofs, HSG A
99,540	30	Woods, Good, HSG A
3,910	39	>75% Grass cover, Good, HSG A
141,400	48	Weighted Average
103,450	30	73.16% Pervious Area
37,950	98	26.84% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.6	100	0.0800	0.14		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
0.1	10	0.1200	1.73		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.0	125	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
12.7	235	Total			

Subcatchment DA3C:



Summary for Pond C1: CHAMBERS

Inflow Area = 141,400 sf, 26.84% Impervious, Inflow Depth = 1.79" for 25yr event
Inflow = 4.53 cfs @ 12.17 hrs, Volume= 21,084 cf
Outflow = 0.38 cfs @ 13.75 hrs, Volume= 21,085 cf, Atten= 92%, Lag= 94.8 min
Discarded = 0.38 cfs @ 13.75 hrs, Volume= 21,085 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Pond IT3 : INFILTRATION TRENCH 3

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 36.07' @ 13.75 hrs Surf.Area= 1,912 sf Storage= 7,778 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 166.0 min (934.4 - 768.4)

Volume	Invert	Avail.Storage	Storage Description
#1B	27.25'	2,581 cf	**19.17'W x 99.75'L x 6.75'H Field B** 12,905 cf Overall - 5,083 cf Embedded = 7,823 cf x 33.0% Voids
#2B	28.00'	5,083 cf	**ADS_StormTech MC-7200 +Cap** x 28 Inside #1 Effective Size= 91.2"W x 60.0"H => 26.68 sf x 6.59'L = 175.9 cf Overall Size= 100.0"W x 60.0"H x 6.95'L with 0.36' Overlap 28 Chambers in 2 Rows Cap Storage= 39.5 cf x 2 x 2 rows = 158.0 cf
#3	27.00'	126 cf	**4.00'D x 10.00'H Vertical Cone/Cylinder**-Impervious
#4	36.10'	327 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)
		8,117 cf	Total Available Storage

Storage Group B created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
36.10	100	0	0
36.25	400	37	37
36.30	600	25	63
36.35	10,000	265	327

Device	Routing	Invert	Outlet Devices
#1	Discarded	27.25'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	36.30'	**20.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.37 cfs @ 13.75 hrs HW=36.07' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.37 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=27.00' (Free Discharge)
↑**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond C1: CHAMBERS - Chamber Wizard Field B

Chamber Model = ADS_StormTech MC-7200 +Cap (ADS StormTech® MC-7200 with cap volume)
Effective Size= 91.2"W x 60.0"H => 26.68 sf x 6.59'L = 175.9 cf
Overall Size= 100.0"W x 60.0"H x 6.95'L with 0.36' Overlap
Cap Storage= 39.5 cf x 2 x 2 rows = 158.0 cf

100.0" Wide + 6.0" Spacing = 106.0" C-C Row Spacing

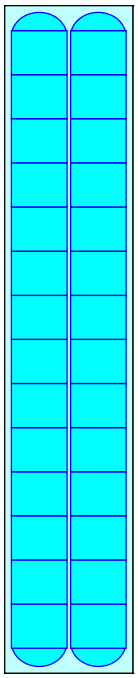
14 Chambers/Row x 6.59' Long +2.73' Cap Length x 2 = 97.75' Row Length +12.0" End Stone x 2 = 99.75' Base Length
2 Rows x 100.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 19.17' Base Width
9.0" Stone Base + 60.0" Chamber Height + 12.0" Stone Cover = 6.75' Field Height

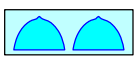
28 Chambers x 175.9 cf + 39.5 cf Cap Volume x 2 x 2 Rows = 5,082.5 cf Chamber Storage

12,905.2 cf Field - 5,082.5 cf Chambers = 7,822.6 cf Stone x 33.0% Voids = 2,581.5 cf Stone Storage

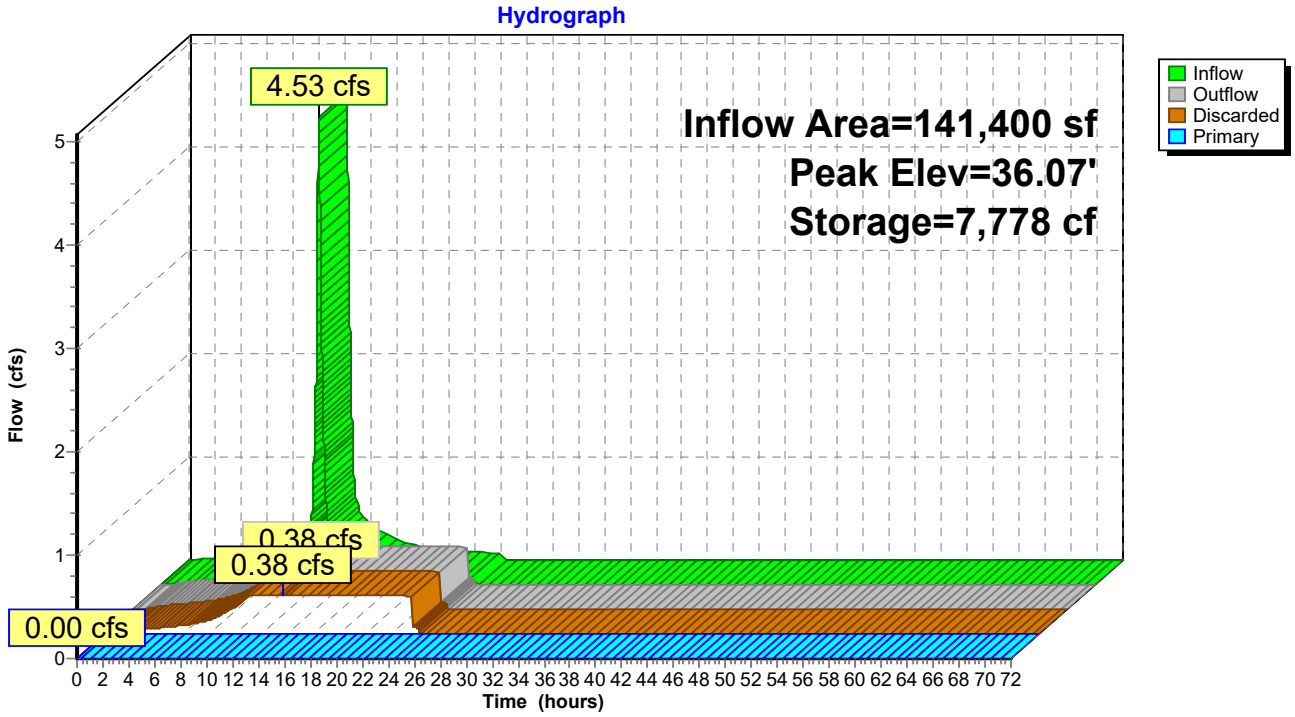
Chamber Storage + Stone Storage = 7,664.0 cf = 0.176 af
Overall Storage Efficiency = 59.4%
Overall System Size = 99.75' x 19.17' x 6.75'

28 Chambers
478.0 cy Field
289.7 cy Stone





Pond C1: CHAMBERS



Summary for Pond IS1: Infiltration System 1

Inflow Area = 301,650 sf, 25.64% Impervious, Inflow Depth = 0.39" for 25yr event
Inflow = 3.54 cfs @ 12.10 hrs, Volume= 9,792 cf
Outflow = 3.54 cfs @ 12.10 hrs, Volume= 9,792 cf, Atten= 0%, Lag= 0.3 min
Discarded = 0.06 cfs @ 11.71 hrs, Volume= 2,416 cf
Primary = 3.48 cfs @ 12.10 hrs, Volume= 7,376 cf
Routed to Pond SP1 : Follins Pond

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 13.60' @ 12.04 hrs Surf.Area= 288 sf Storage= 999 cf

Plug-Flow detention time= 42.5 min calculated for 9,791 cf (100% of inflow)
Center-of-Mass det. time= 42.5 min (800.4 - 757.9)

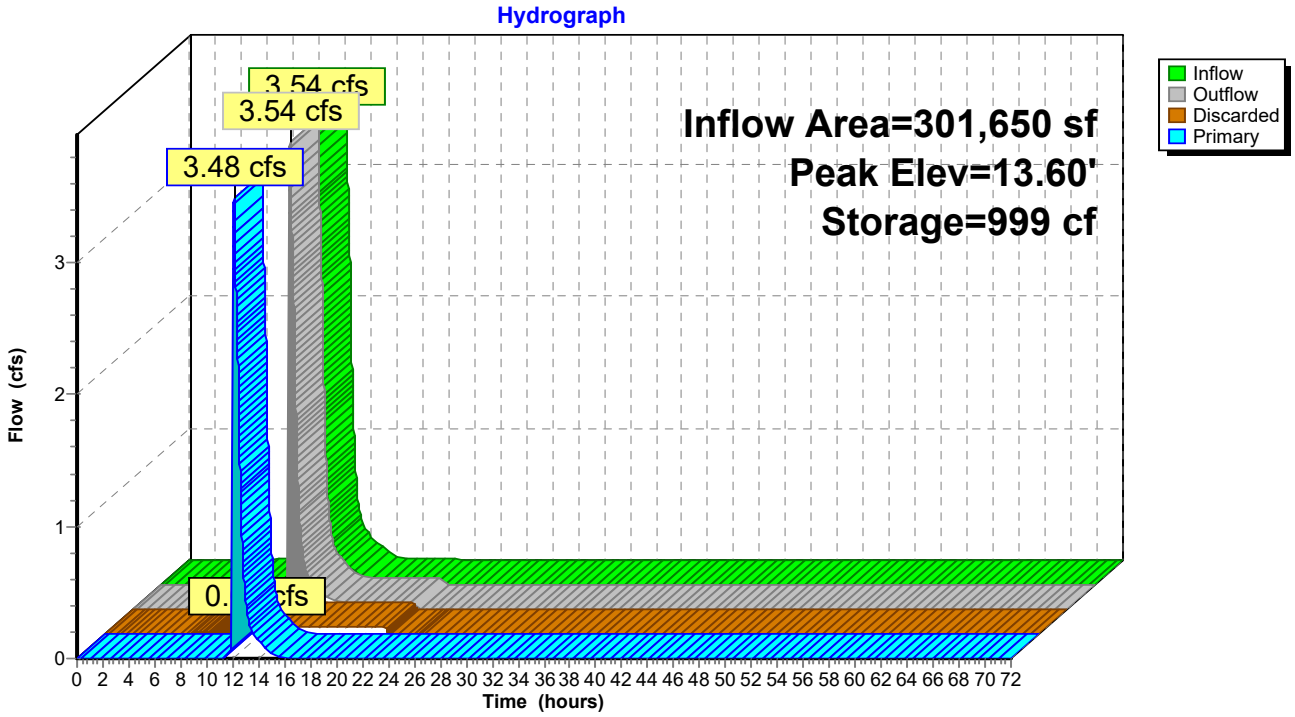
Volume	Invert	Avail.Storage	Storage Description
#1	7.60'	359 cf	**12.00'W x 24.00'L x 6.00'H Prismatoid** 1,728 cf Overall - 640 cf Embedded = 1,088 cf x 33.0% Voids
#2	9.60'	640 cf	**8.00'W x 20.00'L x 4.00'H Prismatoid** Inside #1
		999 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#0	Primary	13.60'	**Automatic Storage Overflow** (Discharged without head)
#1	Discarded	7.60'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	13.55'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.06 cfs @ 11.71 hrs HW=7.66' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=0.31 cfs @ 12.10 hrs HW=13.60' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 0.31 cfs @ 0.63 fps)

Pond IS1: Infiltration System 1



Summary for Pond IS2: Infiltration System 2

Inflow Area = 291,470 sf, 25.66% Impervious, Inflow Depth = 0.44" for 25yr event
Inflow = 3.32 cfs @ 12.09 hrs, Volume= 10,699 cf
Outflow = 3.32 cfs @ 12.09 hrs, Volume= 10,699 cf, Atten= 0%, Lag= 0.3 min
Discarded = 0.06 cfs @ 11.36 hrs, Volume= 2,337 cf
Primary = 3.26 cfs @ 12.09 hrs, Volume= 8,362 cf
Routed to Pond IS1 : Infiltration System 1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 17.00' @ 11.88 hrs Surf.Area= 288 sf Storage= 999 cf

Plug-Flow detention time= 44.7 min calculated for 10,698 cf (100% of inflow)
Center-of-Mass det. time= 44.7 min (805.6 - 760.9)

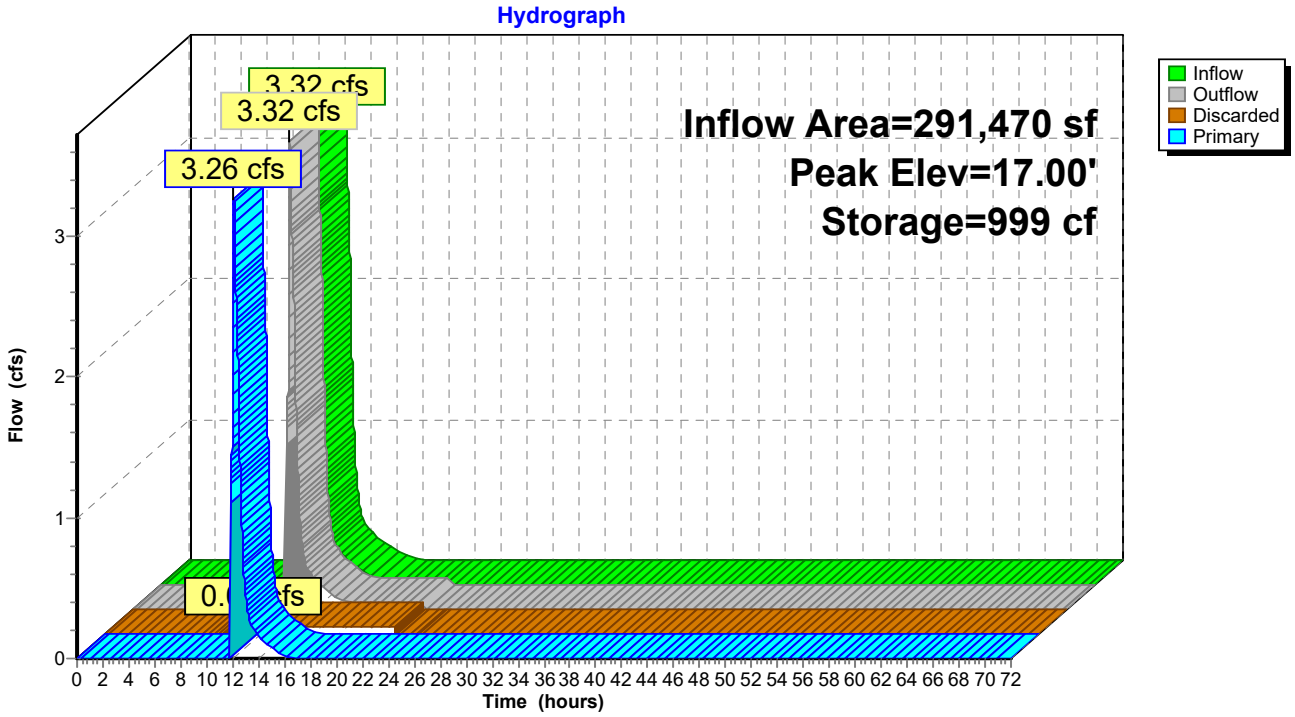
Volume	Invert	Avail.Storage	Storage Description
#1	11.00'	359 cf	**12.00'W x 24.00'L x 6.00'H Prismatoid** 1,728 cf Overall - 640 cf Embedded = 1,088 cf x 33.0% Voids
#2	13.00'	640 cf	**8.00'W x 20.00'L x 4.00'H Prismatoid** Inside #1
		999 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#0	Primary	17.00'	**Automatic Storage Overflow** (Discharged without head)
#1	Discarded	11.00'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	16.95'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.06 cfs @ 11.36 hrs HW=11.08' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=0.31 cfs @ 12.09 hrs HW=17.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 0.31 cfs @ 0.63 fps)

Pond IS2: Infiltration System 2



Summary for Pond IS3: Infiltration System 3

Inflow Area = 259,970 sf, 25.38% Impervious, Inflow Depth = 0.66" for 25yr event
Inflow = 2.31 cfs @ 12.27 hrs, Volume= 14,257 cf
Outflow = 2.31 cfs @ 12.27 hrs, Volume= 14,257 cf, Atten= 0%, Lag= 0.2 min
Discarded = 0.06 cfs @ 7.11 hrs, Volume= 4,961 cf
Primary = 2.26 cfs @ 12.27 hrs, Volume= 9,296 cf
Routed to Pond IT2 : INFILTRATION TRENCH 2

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 30.94' @ 12.27 hrs Surf.Area= 288 sf Storage= 986 cf

Plug-Flow detention time= 65.8 min calculated for 14,255 cf (100% of inflow)
Center-of-Mass det. time= 65.8 min (852.5 - 786.7)

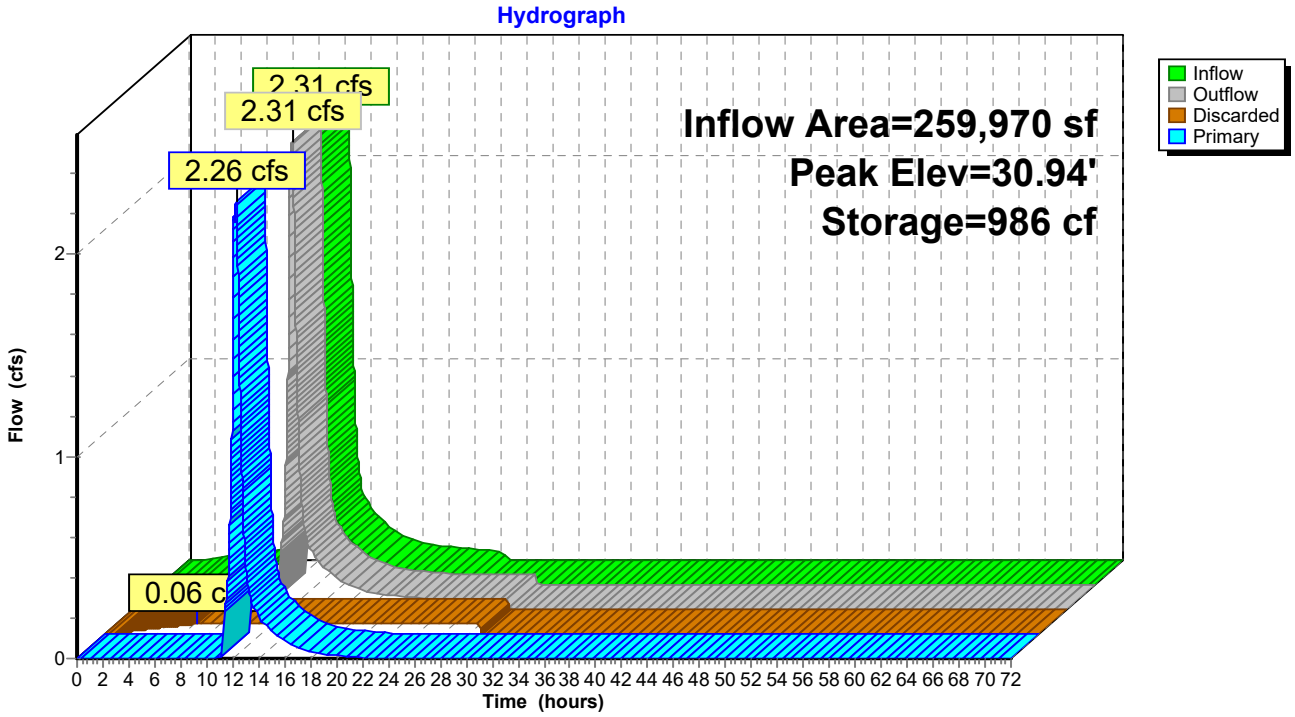
Volume	Invert	Avail.Storage	Storage Description
#1	25.00'	359 cf	**12.00'W x 24.00'L x 6.00'H Prismatoid** 1,728 cf Overall - 640 cf Embedded = 1,088 cf x 33.0% Voids
#2	27.00'	640 cf	**8.00'W x 20.00'L x 4.00'H Prismatoid** Inside #1
		999 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#0	Primary	31.00'	**Automatic Storage Overflow** (Discharged without head)
#1	Discarded	25.00'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	30.75'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.06 cfs @ 7.11 hrs HW=25.06' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=2.25 cfs @ 12.27 hrs HW=30.94' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 2.25 cfs @ 1.21 fps)

Pond IS3: Infiltration System 3



Summary for Pond IT1: INFILTRATION TRENCH 1

Inflow Area = 286,690 sf, 25.71% Impervious, Inflow Depth = 0.48" for 25yr event
Inflow = 3.29 cfs @ 12.08 hrs, Volume= 11,374 cf
Outflow = 3.28 cfs @ 12.09 hrs, Volume= 11,303 cf, Atten= 0%, Lag= 0.5 min
Discarded = 0.12 cfs @ 12.09 hrs, Volume= 1,218 cf
Primary = 3.16 cfs @ 12.09 hrs, Volume= 10,085 cf
Routed to Pond IS2 : Infiltration System 2

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 20.77' @ 12.09 hrs Surf.Area= 609 sf Storage= 173 cf

Plug-Flow detention time= 7.9 min calculated for 11,302 cf (99% of inflow)
Center-of-Mass det. time= 4.6 min (768.9 - 764.3)

Volume	Invert	Avail.Storage	Storage Description
#1	16.50'	98 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 298 cf Overall x 33.0% Voids
#2	20.00'	25 cf	**4.00'D x 2.00'H Vertical Cone/Cylinder** -Impervious
#3	20.53'	237 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
		361 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
16.50	85	0	0
20.00	85	298	298

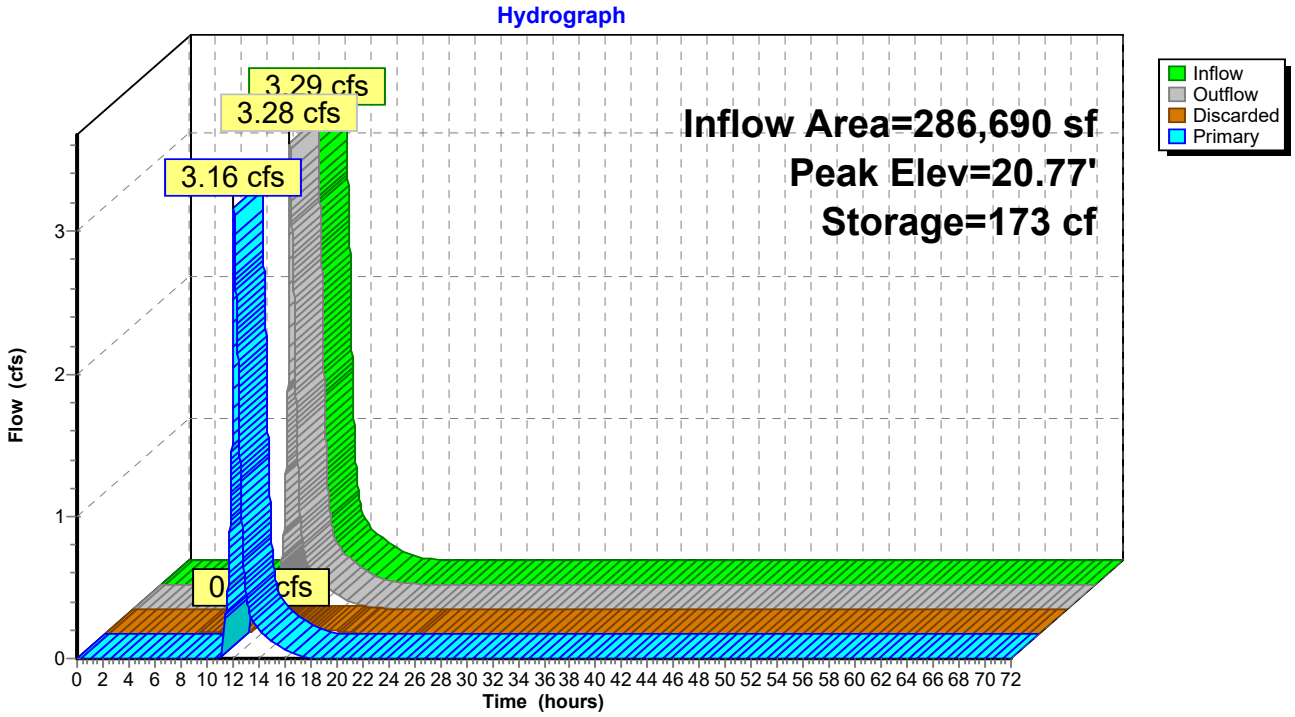
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
20.53	10	0	0
21.00	1,000	237	237

Device	Routing	Invert	Outlet Devices
#1	Discarded	16.50'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Device 1	19.00'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	20.53'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.12 cfs @ 12.09 hrs HW=20.77' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.12 cfs)
↑**2=Orifice/Grate** (Passes 0.12 cfs of 1.17 cfs potential flow)

Primary OutFlow Max=3.15 cfs @ 12.09 hrs HW=20.77' (Free Discharge)
↑**3=Orifice/Grate** (Weir Controls 3.15 cfs @ 1.61 fps)

Pond IT1: INFILTRATION TRENCH 1



Summary for Pond IT2: INFILTRATION TRENCH 2

Inflow Area = 280,550 sf, 25.55% Impervious, Inflow Depth = 0.54" for 25yr event
Inflow = 3.03 cfs @ 12.09 hrs, Volume= 12,509 cf
Outflow = 3.03 cfs @ 12.09 hrs, Volume= 12,306 cf, Atten= 0%, Lag= 0.0 min
Discarded = 0.04 cfs @ 10.11 hrs, Volume= 2,033 cf
Primary = 2.99 cfs @ 12.09 hrs, Volume= 10,272 cf
Routed to Pond IT1 : INFILTRATION TRENCH 1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 23.57' @ 12.09 hrs Surf.Area= 212 sf Storage= 298 cf

Plug-Flow detention time= 21.3 min calculated for 12,304 cf (98% of inflow)
Center-of-Mass det. time= 12.3 min (789.7 - 777.4)

Volume	Invert	Avail.Storage	Storage Description
#1	19.25'	245 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 742 cf Overall x 33.0% Voids
#2	19.35'	63 cf	**4.00'D x 5.00'H Vertical Cone/Cylinder** -Impervious
		308 cf	Total Available Storage

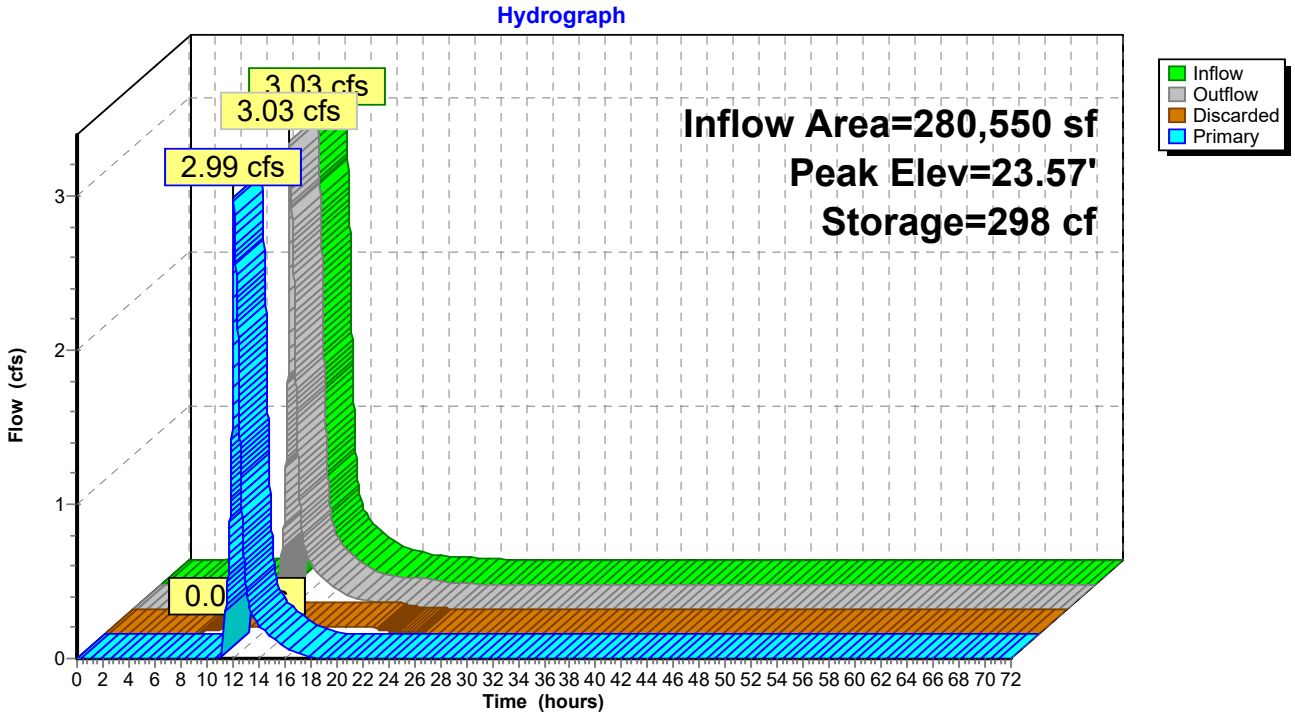
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
19.25	212	0	0
22.75	212	742	742

Device	Routing	Invert	Outlet Devices
#0	Primary	24.35'	**Automatic Storage Overflow** (Discharged without head)
#1	Discarded	19.25'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Device 1	21.75'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	23.35'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.04 cfs @ 10.11 hrs HW=21.90' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.04 cfs)
↑**2=Orifice/Grate** (Passes 0.04 cfs of 0.07 cfs potential flow)

Primary OutFlow Max=2.97 cfs @ 12.09 hrs HW=23.57' (Free Discharge)
↑**3=Broad-Crested Rectangular Weir** (Weir Controls 2.97 cfs @ 1.33 fps)

Pond IT2: INFILTRATION TRENCH 2



Summary for Pond IT3: INFILTRATION TRENCH 3

Inflow Area = 168,290 sf, 27.19% Impervious, Inflow Depth = 0.31" for 25yr event
Inflow = 1.19 cfs @ 12.07 hrs, Volume= 4,314 cf
Outflow = 1.19 cfs @ 12.07 hrs, Volume= 4,092 cf, Atten= 0%, Lag= 0.1 min
Discarded = 0.05 cfs @ 9.39 hrs, Volume= 2,130 cf
Primary = 1.14 cfs @ 12.07 hrs, Volume= 1,962 cf
Routed to Pond IS3 : Infiltration System 3

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 34.34' @ 12.07 hrs Surf.Area= 240 sf Storage= 343 cf

Plug-Flow detention time= 69.8 min calculated for 4,092 cf (95% of inflow)
Center-of-Mass det. time= 39.1 min (798.5 - 759.4)

Volume	Invert	Avail.Storage	Storage Description
#1	28.50'	277 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 840 cf Overall x 33.0% Voids
#2	29.10'	101 cf	**4.00'D x 8.00'H Vertical Cone/Cylinder** -Impervious
		378 cf	Total Available Storage

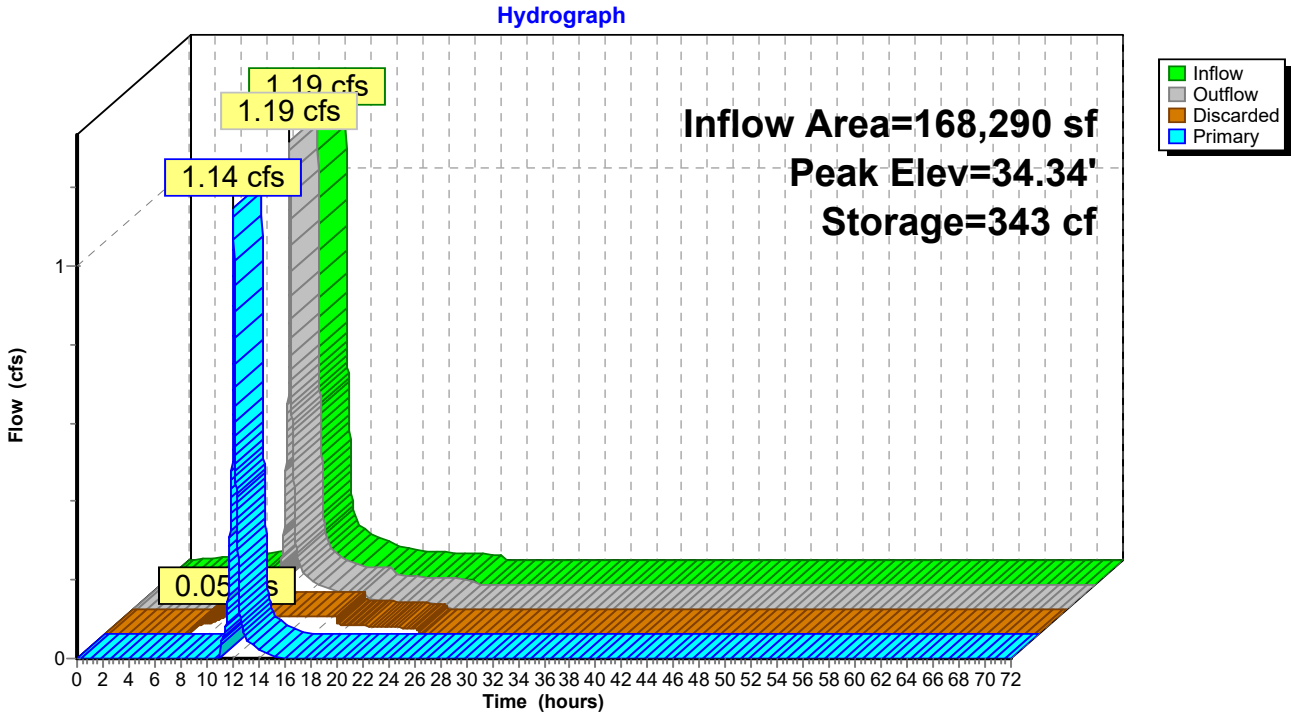
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
28.50	240	0	0
32.00	240	840	840

Device	Routing	Invert	Outlet Devices
#0	Primary	37.10'	**Automatic Storage Overflow** (Discharged without head)
#1	Discarded	28.50'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Device 1	31.00'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	35.40'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#4	Primary	33.70'	**12.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 33.70' / 31.00' S= 0.2700 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Discarded OutFlow Max=0.05 cfs @ 9.39 hrs HW=31.17' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.05 cfs)
└**2=Orifice/Grate** (Passes 0.05 cfs of 0.08 cfs potential flow)

Primary OutFlow Max=1.14 cfs @ 12.07 hrs HW=34.34' (Free Discharge)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
└**4=Culvert** (Inlet Controls 1.14 cfs @ 2.15 fps)

Pond IT3: INFILTRATION TRENCH 3



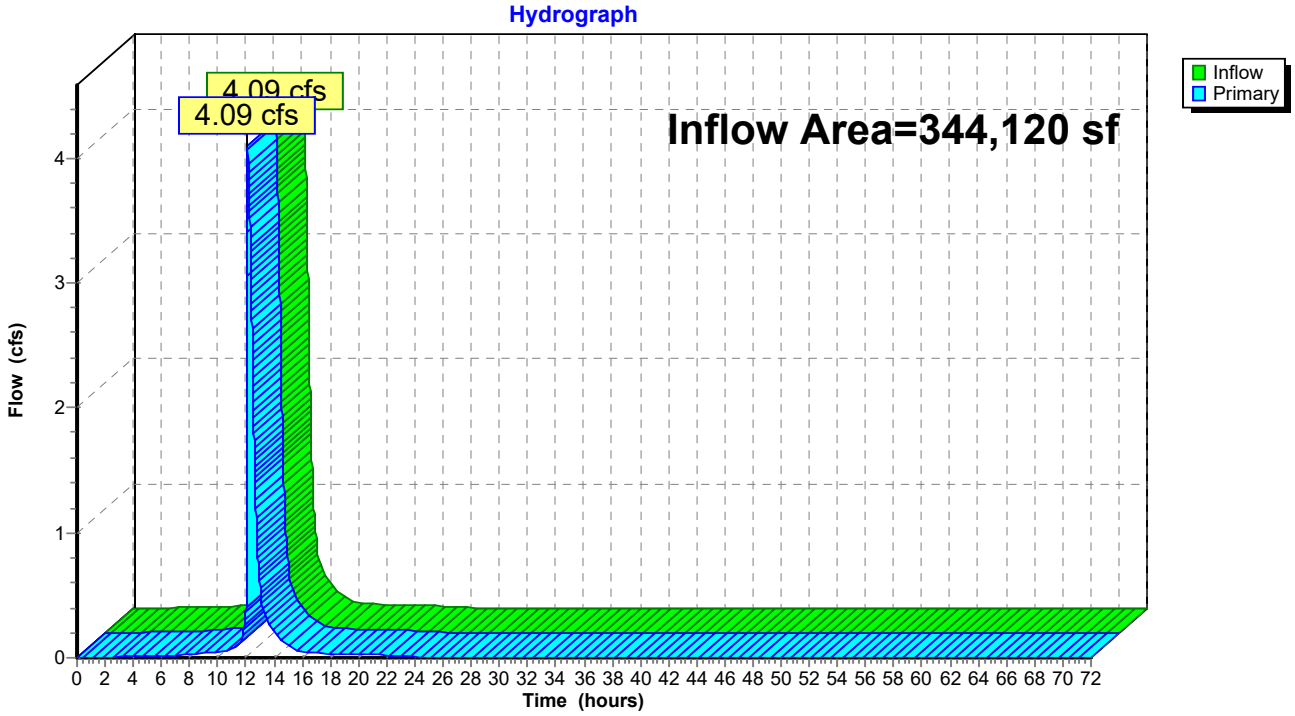
Summary for Pond SP1: Follins Pond

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 344,120 sf, 24.57% Impervious, Inflow Depth = 0.41" for 25yr event
Inflow = 4.09 cfs @ 12.11 hrs, Volume= 11,667 cf
Primary = 4.09 cfs @ 12.11 hrs, Volume= 11,667 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Pond SP1: Follins Pond



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment DA0: Runoff Area=42,470 sf 16.93% Impervious Runoff Depth=1.95"
Flow Length=625' Tc=16.2 min CN=31/98 Runoff=1.09 cfs 6,910 cf

Subcatchment DA1: Runoff Area=10,180 sf 25.15% Impervious Runoff Depth=2.52"
Flow Length=235' Tc=11.5 min CN=30/98 Runoff=0.42 cfs 2,140 cf

Subcatchment DA2: Runoff Area=4,780 sf 22.80% Impervious Runoff Depth=2.34"
Tc=5.0 min CN=30/98 Runoff=0.22 cfs 932 cf

Subcatchment DA2A: Runoff Area=6,140 sf 32.74% Impervious Runoff Depth=3.11"
Tc=5.0 min CN=30/98 Runoff=0.40 cfs 1,593 cf

Subcatchment DA2B: Runoff Area=20,580 sf 27.75% Impervious Runoff Depth=2.79"
Tc=5.0 min CN=31/98 Runoff=1.15 cfs 4,777 cf

Subcatchment DA3: Runoff Area=26,890 sf 29.04% Impervious Runoff Depth=2.83"
Tc=5.0 min CN=30/98 Runoff=1.57 cfs 6,332 cf

Subcatchment DA3A: Runoff Area=18,760 sf 29.74% Impervious Runoff Depth=2.88"
Flow Length=480' Tc=19.7 min CN=30/98 Runoff=0.75 cfs 4,503 cf

Subcatchment DA3B: Runoff Area=72,920 sf 20.08% Impervious Runoff Depth=2.41"
Flow Length=495' Tc=24.2 min CN=34/98 Runoff=2.14 cfs 14,649 cf

Subcatchment DA3C: Runoff Area=141,400 sf 26.84% Impervious Runoff Depth=2.65"
Flow Length=235' Tc=12.7 min CN=30/98 Runoff=6.01 cfs 31,275 cf

Pond C1: CHAMBERS Peak Elev=36.43' Storage=8,110 cf Inflow=6.01 cfs 31,275 cf
Discarded=2.28 cfs 29,955 cf Primary=2.23 cfs 1,321 cf Outflow=4.51 cfs 31,276 cf

Pond IS1: Infiltration System 1 Peak Elev=13.60' Storage=999 cf Inflow=5.46 cfs 20,118 cf
Discarded=0.06 cfs 2,982 cf Primary=5.39 cfs 17,136 cf Outflow=5.45 cfs 20,118 cf

Pond IS2: Infiltration System 2 Peak Elev=17.00' Storage=999 cf Inflow=5.32 cfs 21,178 cf
Discarded=0.06 cfs 3,200 cf Primary=5.22 cfs 17,978 cf Outflow=5.27 cfs 21,178 cf

Pond IS3: Infiltration System 3 Peak Elev=31.00' Storage=999 cf Inflow=5.37 cfs 23,916 cf
Discarded=0.06 cfs 5,244 cf Primary=5.09 cfs 18,672 cf Outflow=5.14 cfs 23,916 cf

Pond IT1: INFILTRATION TRENCH 1 Peak Elev=20.87' Storage=236 cf Inflow=5.63 cfs 22,269 cf
Discarded=0.16 cfs 1,953 cf Primary=5.24 cfs 20,246 cf Outflow=5.40 cfs 22,199 cf

Pond IT2: INFILTRATION TRENCH 2 Peak Elev=23.68' Storage=299 cf Inflow=5.53 cfs 23,449 cf
Discarded=0.04 cfs 2,567 cf Primary=5.48 cfs 20,676 cf Outflow=5.53 cfs 23,243 cf

Pond IT3: INFILTRATION TRENCH 3 Peak Elev=34.91' Storage=350 cf Inflow=2.82 cfs 7,653 cf
Discarded=0.05 cfs 2,668 cf Primary=2.53 cfs 4,763 cf Outflow=2.58 cfs 7,431 cf

Pond SP1: Follins Pond

Inflow=6.27 cfs 24,046 cf
Primary=6.27 cfs 24,046 cf

Total Runoff Area = 344,120 sf Runoff Volume = 73,112 cf Average Runoff Depth = 2.55"
75.43% Pervious = 259,580 sf 24.57% Impervious = 84,540 sf

Summary for Subcatchment DA0:

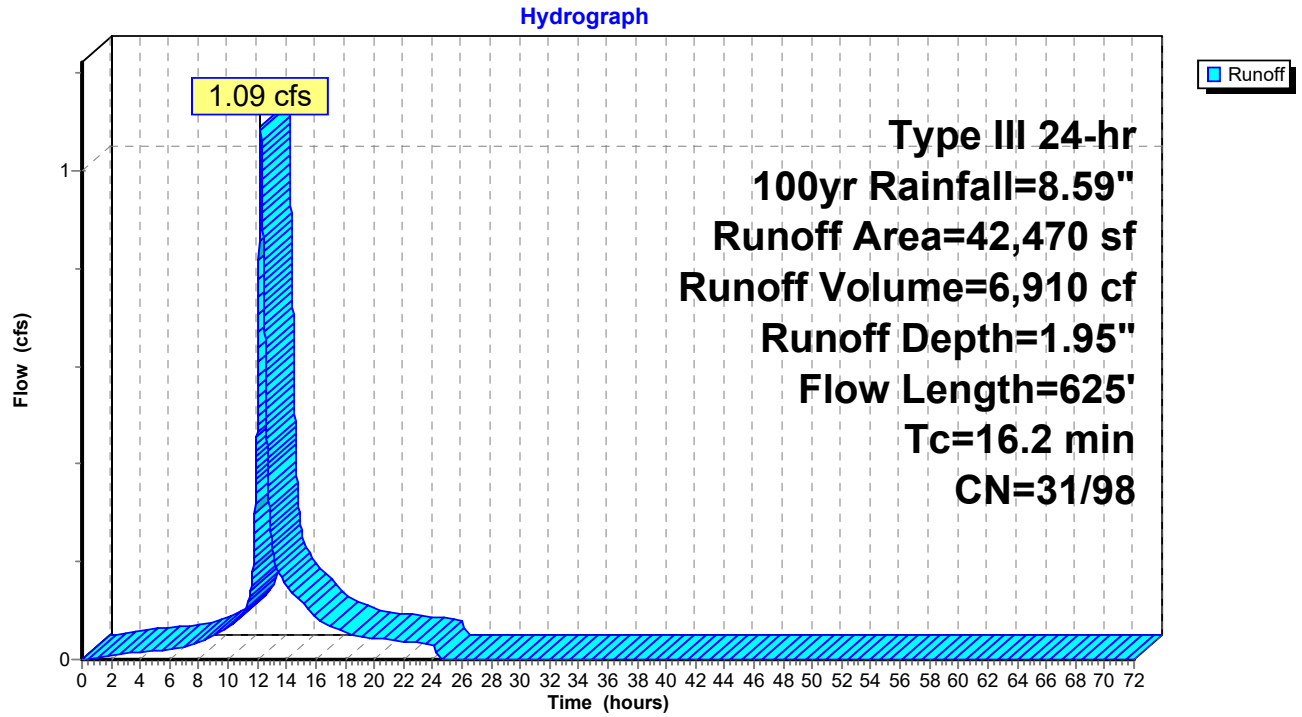
Runoff = 1.09 cfs @ 12.22 hrs, Volume= 6,910 cf, Depth= 1.95"
Routed to Pond SP1 : Follins Pond

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100yr Rainfall=8.59"

Area (sf)	CN	Description
4,730	98	Paved parking, HSG A
2,460	98	Unconnected roofs, HSG A
29,910	30	Woods, Good, HSG A
5,370	39	>75% Grass cover, Good, HSG A
42,470	43	Weighted Average
35,280	31	83.07% Pervious Area
7,190	98	16.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.1	100	0.0900	0.15		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
5.0	470	0.1000	1.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	55	0.1100	6.73		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
16.2	625	Total			

Subcatchment DA0:



Summary for Subcatchment DA1:

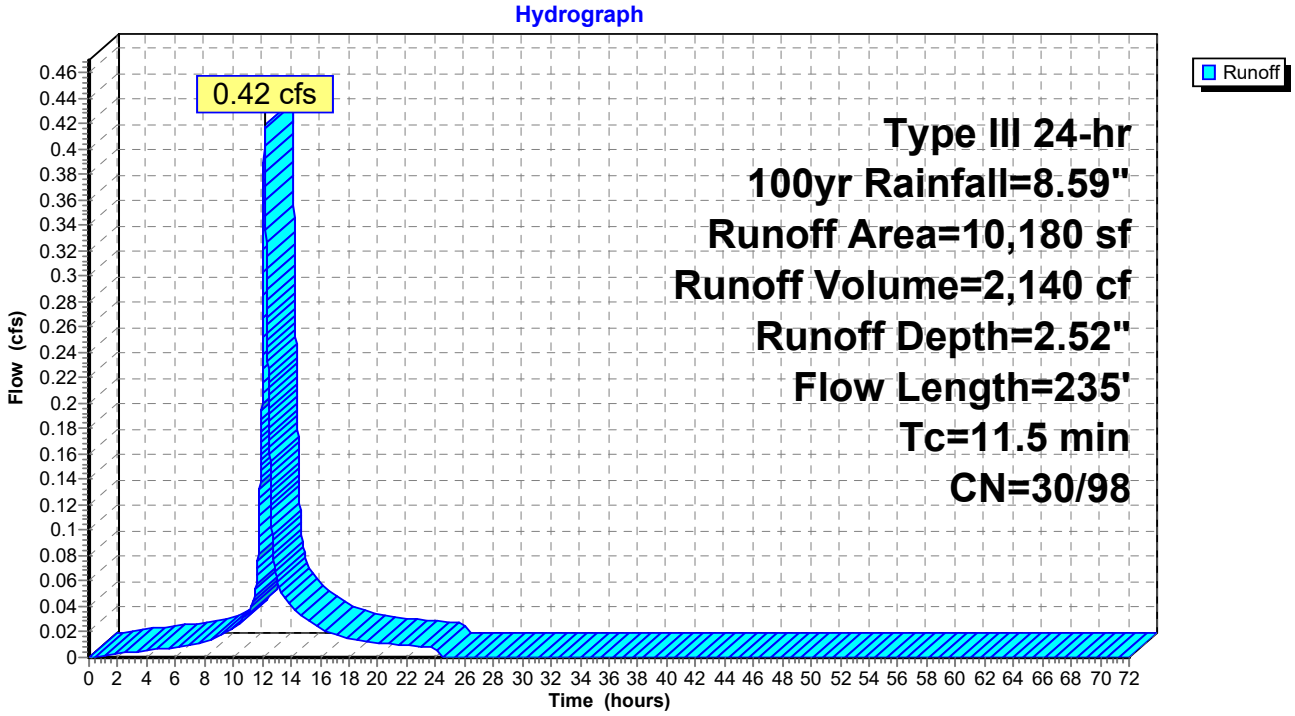
Runoff = 0.42 cfs @ 12.15 hrs, Volume= 2,140 cf, Depth= 2.52"
Routed to Pond IS1 : Infiltration System 1

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100yr Rainfall=8.59"

Area (sf)	CN	Description
2,560	98	Paved parking, HSG A
7,620	30	Woods, Good, HSG A
10,180	47	Weighted Average
7,620	30	74.85% Pervious Area
2,560	98	25.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.6	100	0.1000	0.16		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
0.8	80	0.1200	1.73		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	55	0.1100	6.73		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
11.5	235	Total			

Subcatchment DA1:



Summary for Subcatchment DA2:

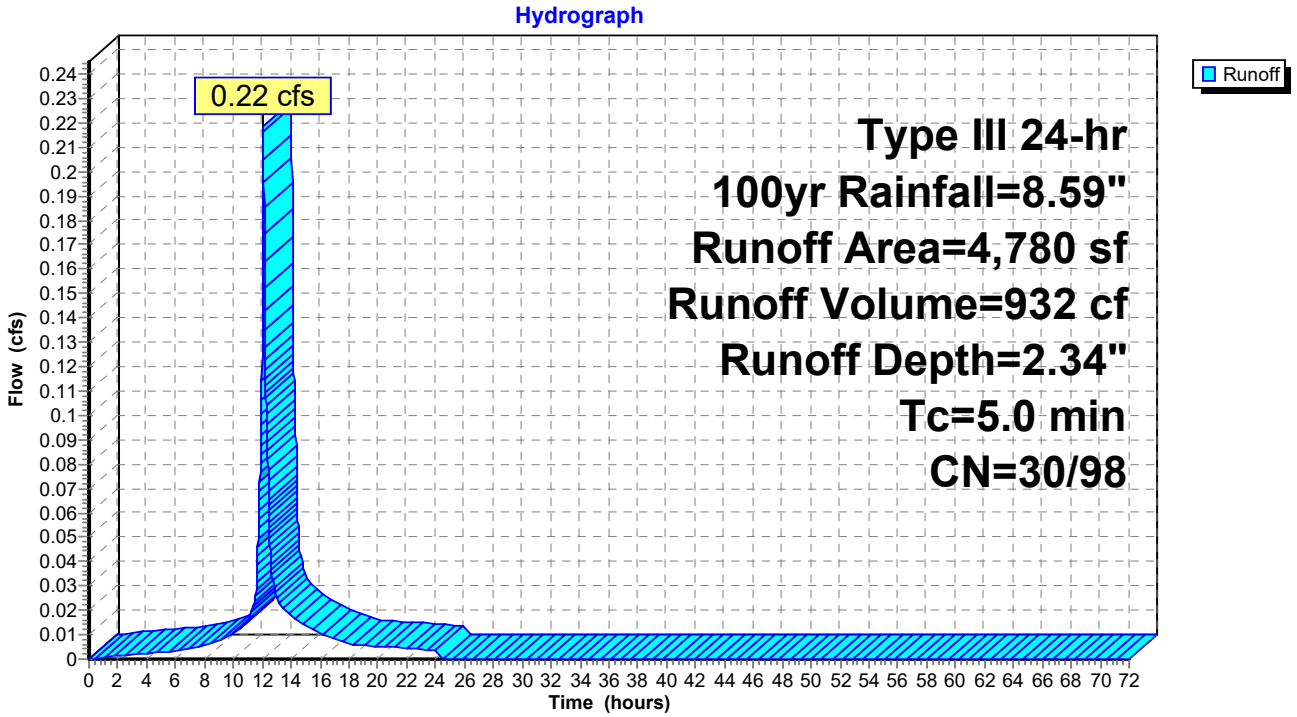
Runoff = 0.22 cfs @ 12.07 hrs, Volume= 932 cf, Depth= 2.34"
Routed to Pond IS2 : Infiltration System 2

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100yr Rainfall=8.59"

Area (sf)	CN	Description
740	98	Paved parking, HSG A
350	98	Unconnected roofs, HSG A
3,690	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
4,780	46	Weighted Average
3,690	30	77.20% Pervious Area
1,090	98	22.80% Impervious Area

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

Subcatchment DA2:



Summary for Subcatchment DA2A:

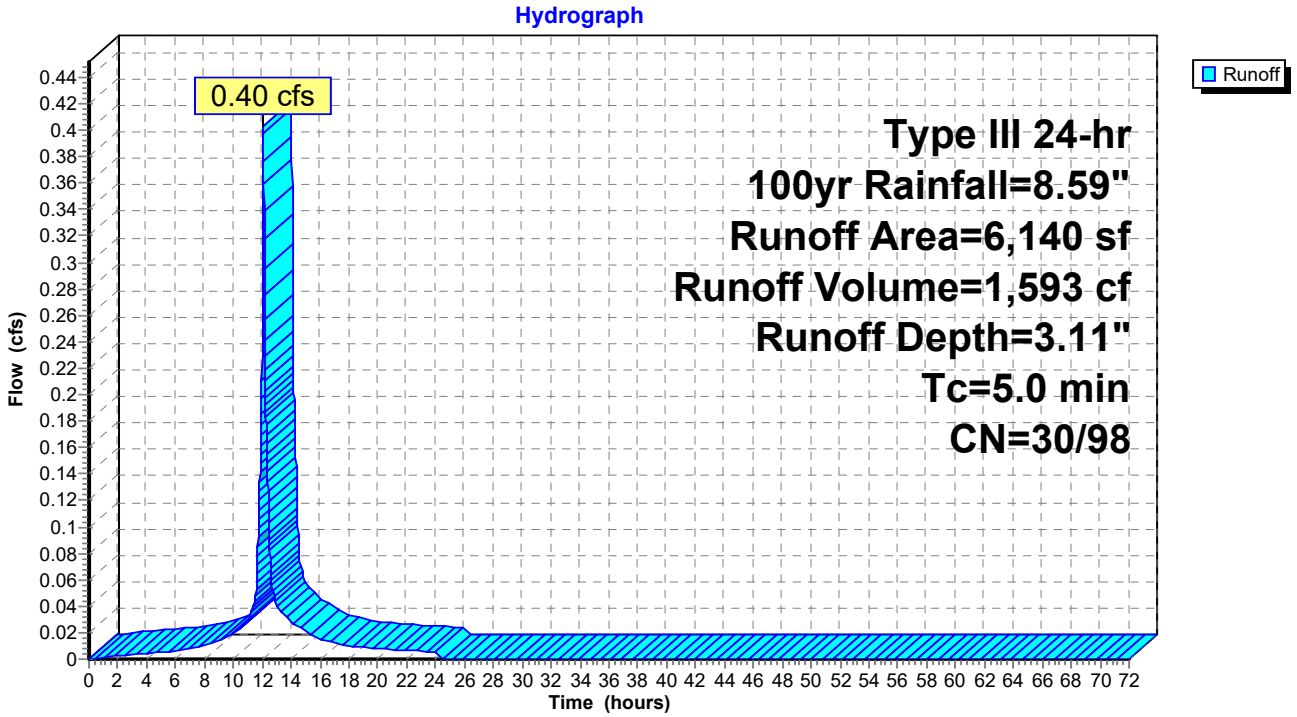
Runoff = 0.40 cfs @ 12.07 hrs, Volume= 1,593 cf, Depth= 3.11"
Routed to Pond IT1 : INFILTRATION TRENCH 1

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100yr Rainfall=8.59"

Area (sf)	CN	Description
1,080	98	Paved parking, HSG A
930	98	Unconnected roofs, HSG A
4,130	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
6,140	52	Weighted Average
4,130	30	67.26% Pervious Area
2,010	98	32.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 min direct**

Subcatchment DA2A:



Summary for Subcatchment DA2B:

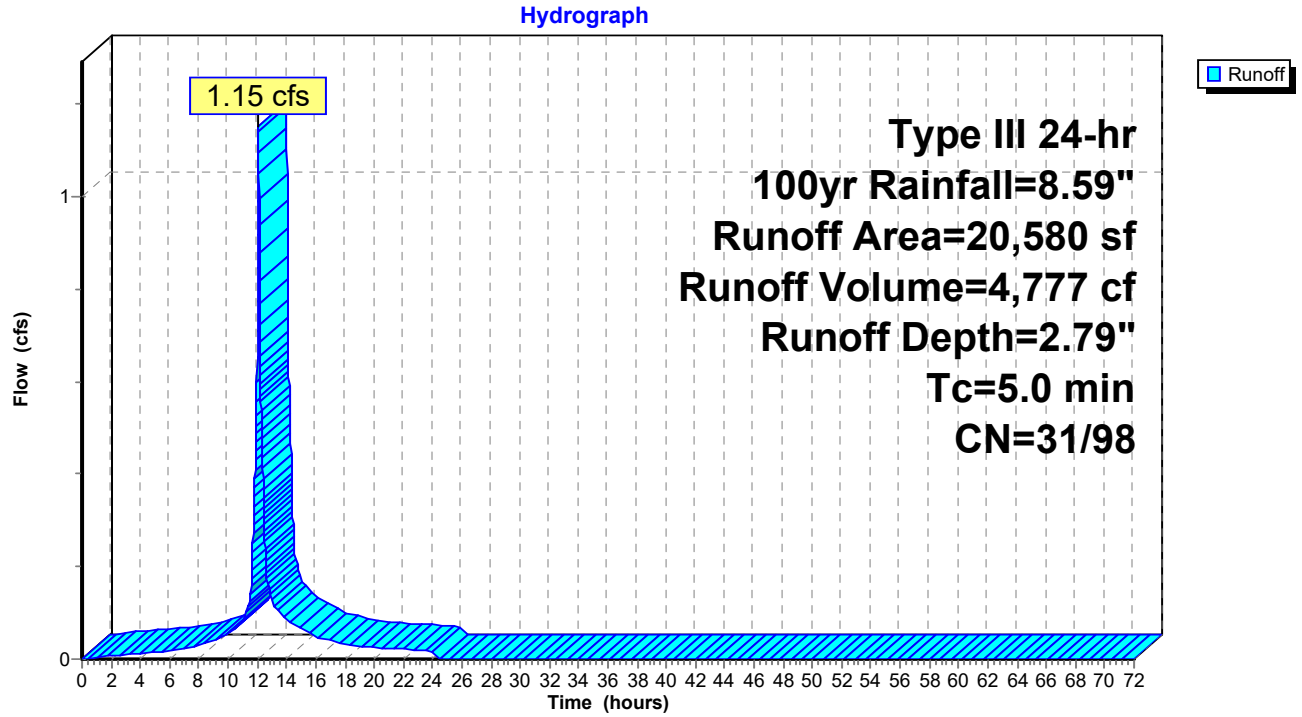
Runoff = 1.15 cfs @ 12.07 hrs, Volume= 4,777 cf, Depth= 2.79"
Routed to Pond IT2 : INFILTRATION TRENCH 2

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100yr Rainfall=8.59"

Area (sf)	CN	Description
5,710	98	Paved parking, HSG A
0	98	Unconnected roofs, HSG A
12,670	30	Woods, Good, HSG A
2,200	39	>75% Grass cover, Good, HSG A
20,580	50	Weighted Average
14,870	31	72.25% Pervious Area
5,710	98	27.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 MIN DIRECT**

Subcatchment DA2B:



Summary for Subcatchment DA3:

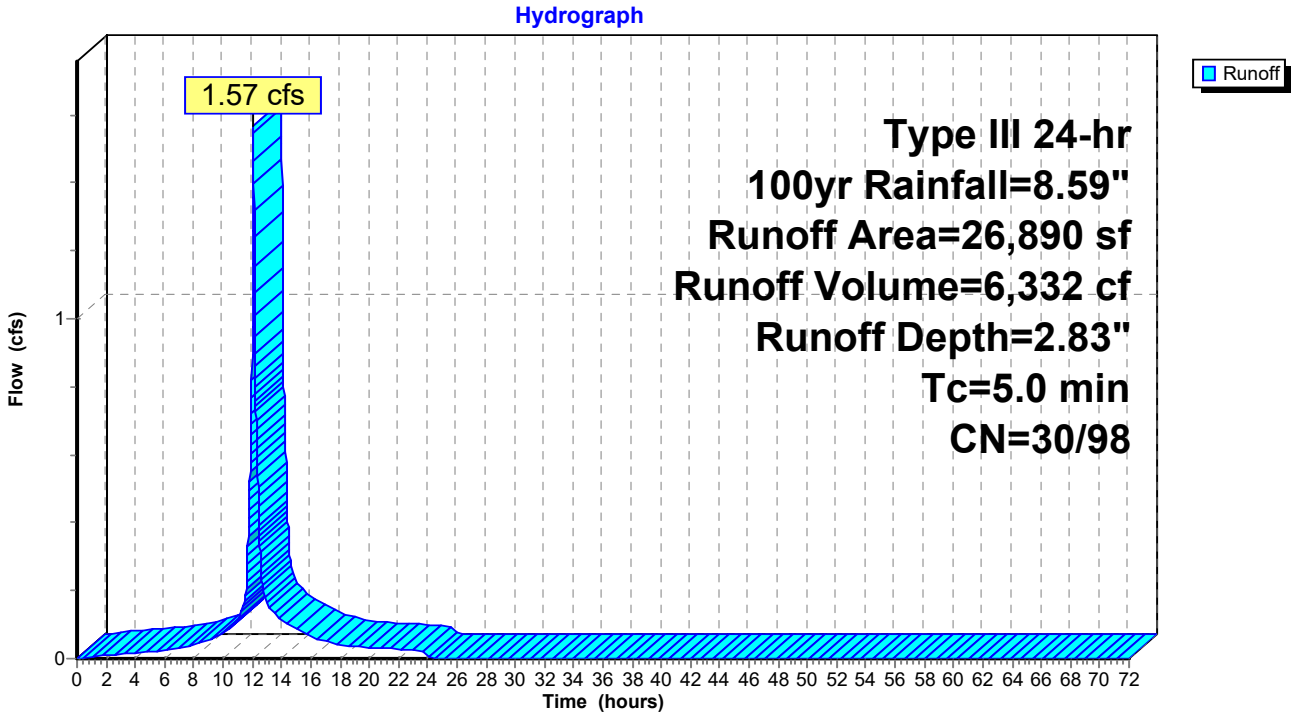
Runoff = 1.57 cfs @ 12.07 hrs, Volume= 6,332 cf, Depth= 2.83"
Routed to Pond IT3 : INFILTRATION TRENCH 3

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100yr Rainfall=8.59"

Area (sf)	CN	Description
4,210	98	Paved parking, HSG A
3,600	98	Unconnected roofs, HSG A
19,080	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
0	98	Water Surface, HSG A
26,890	50	Weighted Average
19,080	30	70.96% Pervious Area
7,810	98	29.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 MIN DIRECT**

Subcatchment DA3:



Summary for Subcatchment DA3A:

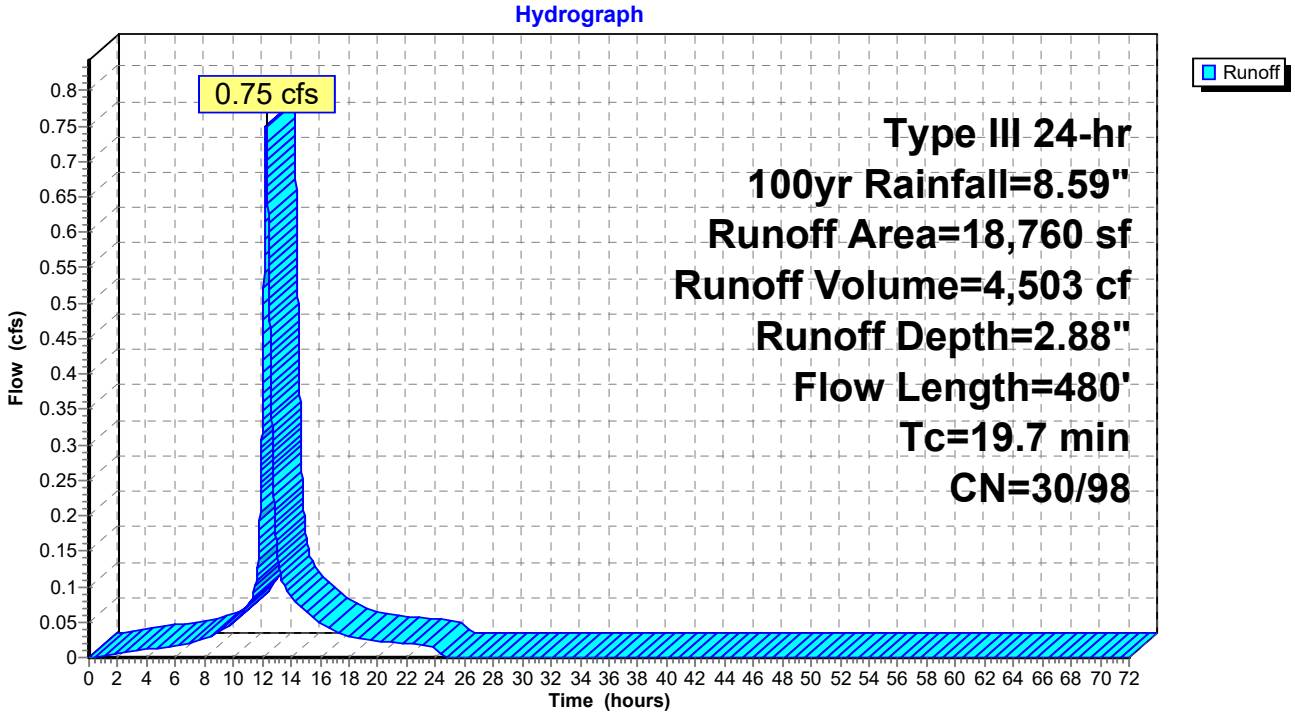
Runoff = 0.75 cfs @ 12.26 hrs, Volume= 4,503 cf, Depth= 2.88"
Routed to Pond IS3 : Infiltration System 3

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100yr Rainfall=8.59"

Area (sf)	CN	Description
5,580	98	Paved parking, HSG A
0	98	Unconnected roofs, HSG A
13,180	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
18,760	50	Weighted Average
13,180	30	70.26% Pervious Area
5,580	98	29.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.2	100	0.0300	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
1.8	155	0.0800	1.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.7	225	0.0800	5.74		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
19.7	480	Total			

Subcatchment DA3A:



Summary for Subcatchment DA3B:

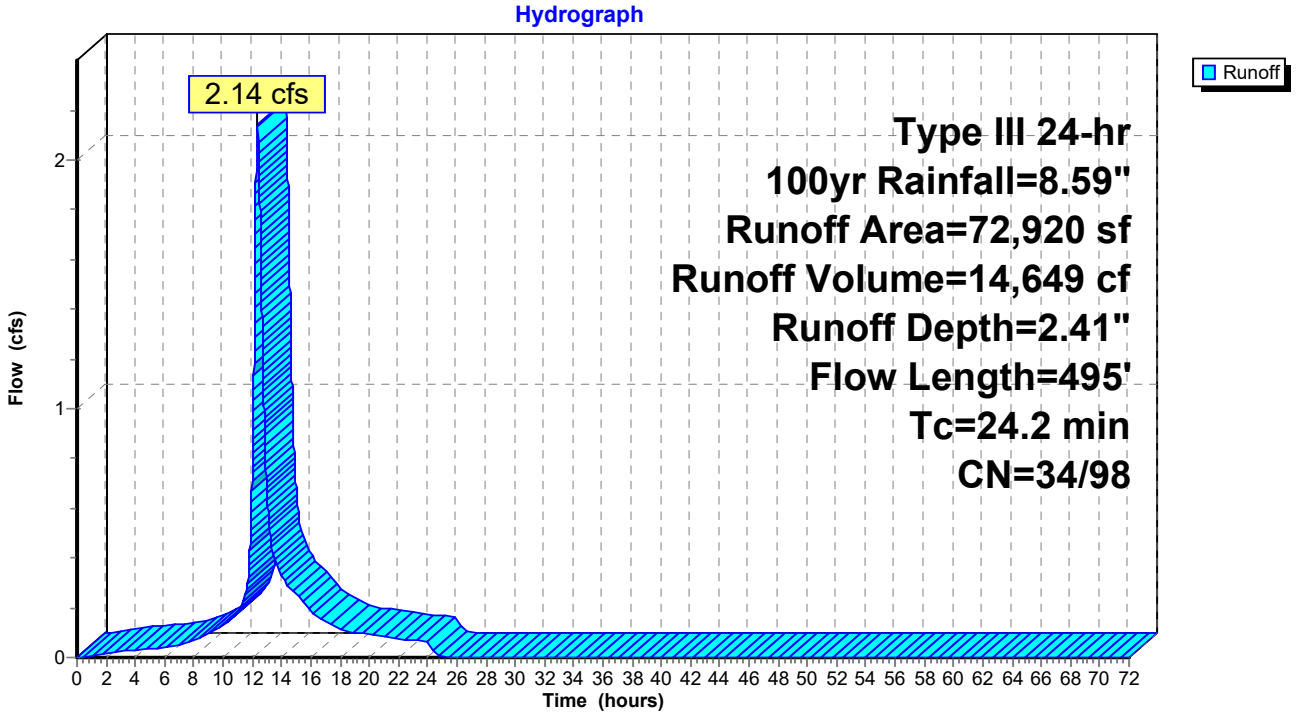
Runoff = 2.14 cfs @ 12.35 hrs, Volume= 14,649 cf, Depth= 2.41"
Routed to Pond IS3 : Infiltration System 3

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100yr Rainfall=8.59"

Area (sf)	CN	Description
8,650	98	Paved parking, HSG A
5,990	98	Unconnected roofs, HSG A
35,050	30	Woods, Good, HSG A
23,230	39	>75% Grass cover, Good, HSG A
72,920	47	Weighted Average
58,280	34	79.92% Pervious Area
14,640	98	20.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.2	100	0.0200	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
3.0	270	0.0900	1.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.0	125	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
24.2	495	Total			

Subcatchment DA3B:



Summary for Subcatchment DA3C:

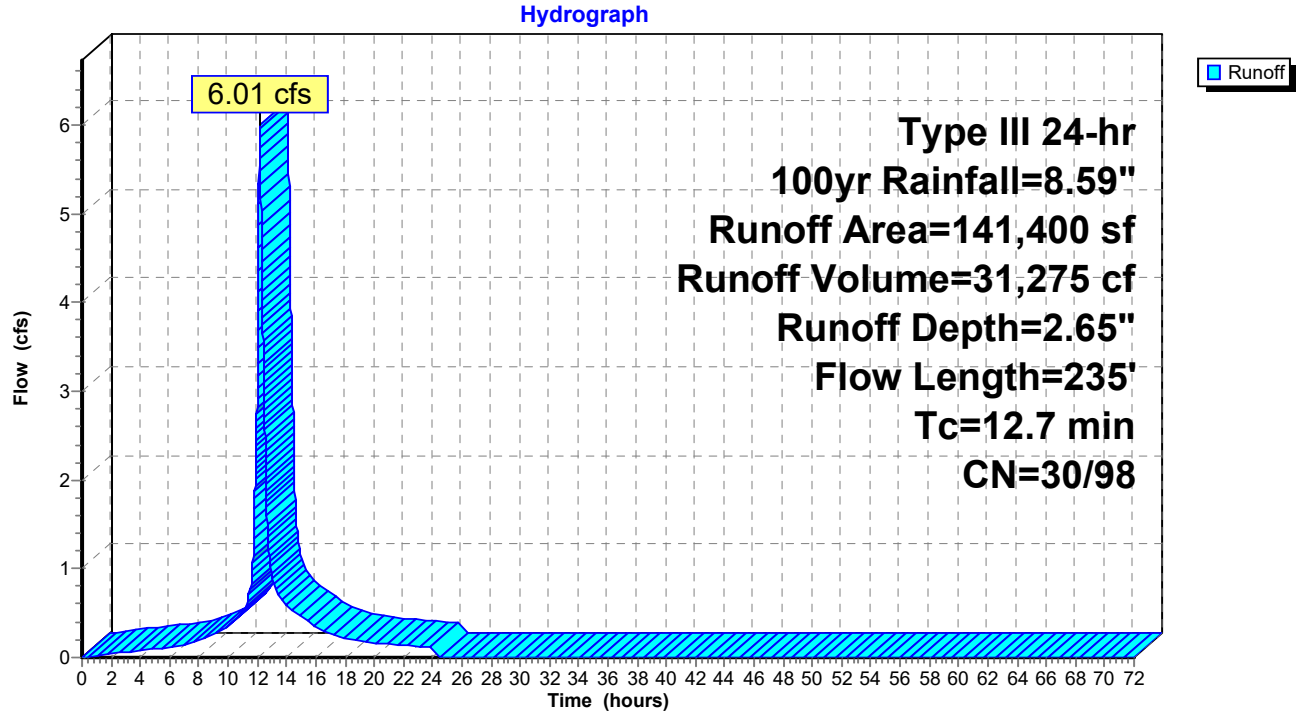
Runoff = 6.01 cfs @ 12.17 hrs, Volume= 31,275 cf, Depth= 2.65"
Routed to Pond C1 : CHAMBERS

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100yr Rainfall=8.59"

Area (sf)	CN	Description
23,130	98	Paved parking, HSG A
14,820	98	Unconnected roofs, HSG A
99,540	30	Woods, Good, HSG A
3,910	39	>75% Grass cover, Good, HSG A
141,400	48	Weighted Average
103,450	30	73.16% Pervious Area
37,950	98	26.84% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.6	100	0.0800	0.14		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
0.1	10	0.1200	1.73		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.0	125	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
12.7	235	Total			

Subcatchment DA3C:



Summary for Pond C1: CHAMBERS

Inflow Area = 141,400 sf, 26.84% Impervious, Inflow Depth = 2.65" for 100yr event
Inflow = 6.01 cfs @ 12.17 hrs, Volume= 31,275 cf
Outflow = 4.51 cfs @ 12.35 hrs, Volume= 31,276 cf, Atten= 25%, Lag= 10.8 min
Discarded = 2.28 cfs @ 12.34 hrs, Volume= 29,955 cf
Primary = 2.23 cfs @ 12.35 hrs, Volume= 1,321 cf
Routed to Pond IT3 : INFILTRATION TRENCH 3

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 36.43' @ 12.35 hrs Surf.Area= 11,912 sf Storage= 8,110 cf

Plug-Flow detention time= 150.8 min calculated for 31,272 cf (100% of inflow)
Center-of-Mass det. time= 150.8 min (933.0 - 782.2)

Volume	Invert	Avail.Storage	Storage Description
#1B	27.25'	2,581 cf	**19.17'W x 99.75'L x 6.75'H Field B** 12,905 cf Overall - 5,083 cf Embedded = 7,823 cf x 33.0% Voids
#2B	28.00'	5,083 cf	**ADS_StormTech MC-7200 +Cap** x 28 Inside #1 Effective Size= 91.2"W x 60.0"H => 26.68 sf x 6.59'L = 175.9 cf Overall Size= 100.0"W x 60.0"H x 6.95'L with 0.36' Overlap 28 Chambers in 2 Rows Cap Storage= 39.5 cf x 2 x 2 rows = 158.0 cf
#3	27.00'	126 cf	**4.00'D x 10.00'H Vertical Cone/Cylinder**-Impervious
#4	36.10'	327 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)
		8,117 cf	Total Available Storage

Storage Group B created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
36.10	100	0	0
36.25	400	37	37
36.30	600	25	63
36.35	10,000	265	327

Device	Routing	Invert	Outlet Devices
#1	Discarded	27.25'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	36.30'	**20.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=2.28 cfs @ 12.34 hrs HW=36.36' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 2.28 cfs)

Primary OutFlow Max=2.03 cfs @ 12.35 hrs HW=36.42' (Free Discharge)
↑**2=Broad-Crested Rectangular Weir** (Weir Controls 2.03 cfs @ 0.82 fps)

Pond C1: CHAMBERS - Chamber Wizard Field B

Chamber Model = ADS_StormTech MC-7200 +Cap (ADS StormTech® MC-7200 with cap volume)
Effective Size= 91.2"W x 60.0"H => 26.68 sf x 6.59'L = 175.9 cf
Overall Size= 100.0"W x 60.0"H x 6.95'L with 0.36' Overlap
Cap Storage= 39.5 cf x 2 x 2 rows = 158.0 cf

100.0" Wide + 6.0" Spacing = 106.0" C-C Row Spacing

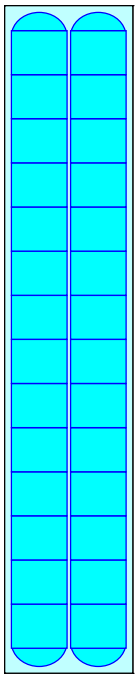
14 Chambers/Row x 6.59' Long +2.73' Cap Length x 2 = 97.75' Row Length +12.0" End Stone x 2 = 99.75' Base Length
2 Rows x 100.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 19.17' Base Width
9.0" Stone Base + 60.0" Chamber Height + 12.0" Stone Cover = 6.75' Field Height

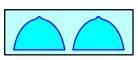
28 Chambers x 175.9 cf + 39.5 cf Cap Volume x 2 x 2 Rows = 5,082.5 cf Chamber Storage

12,905.2 cf Field - 5,082.5 cf Chambers = 7,822.6 cf Stone x 33.0% Voids = 2,581.5 cf Stone Storage

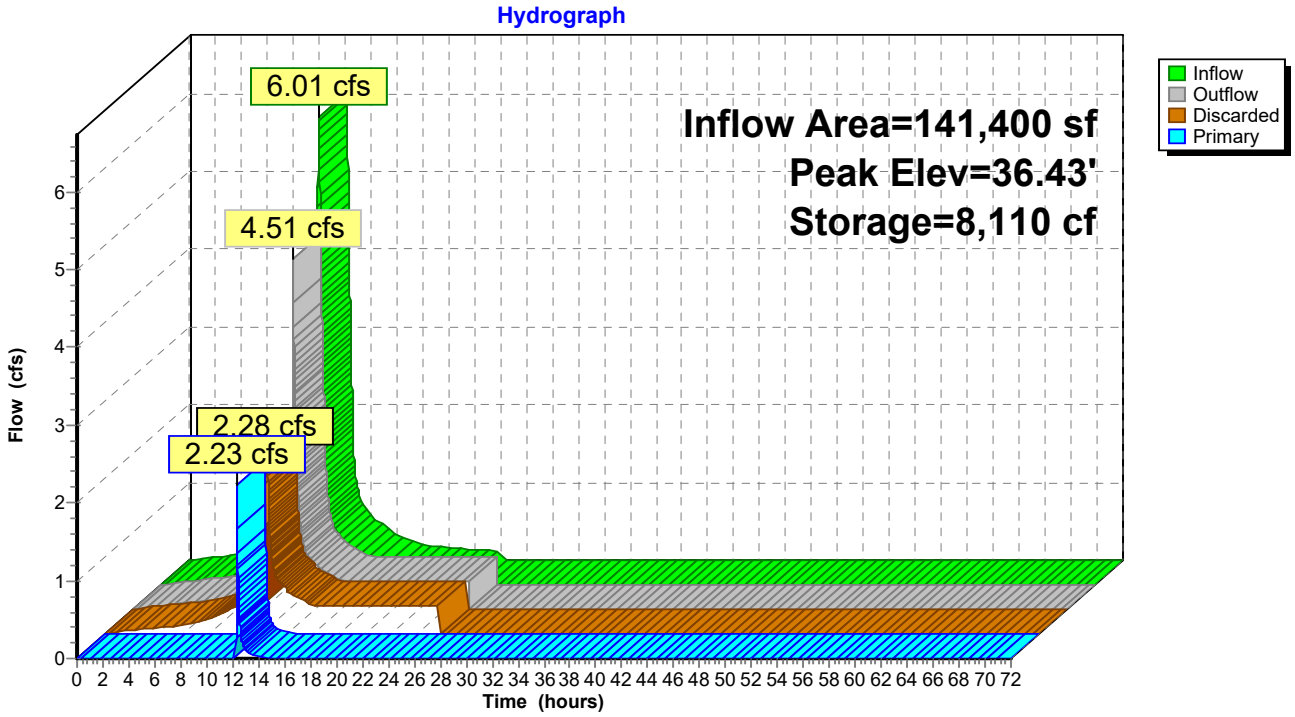
Chamber Storage + Stone Storage = 7,664.0 cf = 0.176 af
Overall Storage Efficiency = 59.4%
Overall System Size = 99.75' x 19.17' x 6.75'

28 Chambers
478.0 cy Field
289.7 cy Stone





Pond C1: CHAMBERS



Summary for Pond IS1: Infiltration System 1

Inflow Area = 301,650 sf, 25.64% Impervious, Inflow Depth = 0.80" for 100yr event
Inflow = 5.46 cfs @ 12.38 hrs, Volume= 20,118 cf
Outflow = 5.45 cfs @ 12.38 hrs, Volume= 20,118 cf, Atten= 0%, Lag= 0.4 min
Discarded = 0.06 cfs @ 11.51 hrs, Volume= 2,982 cf
Primary = 5.39 cfs @ 12.38 hrs, Volume= 17,136 cf
Routed to Pond SP1 : Follins Pond

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 13.60' @ 11.84 hrs Surf.Area= 288 sf Storage= 999 cf

Plug-Flow detention time= 28.4 min calculated for 20,115 cf (100% of inflow)
Center-of-Mass det. time= 28.4 min (802.3 - 773.9)

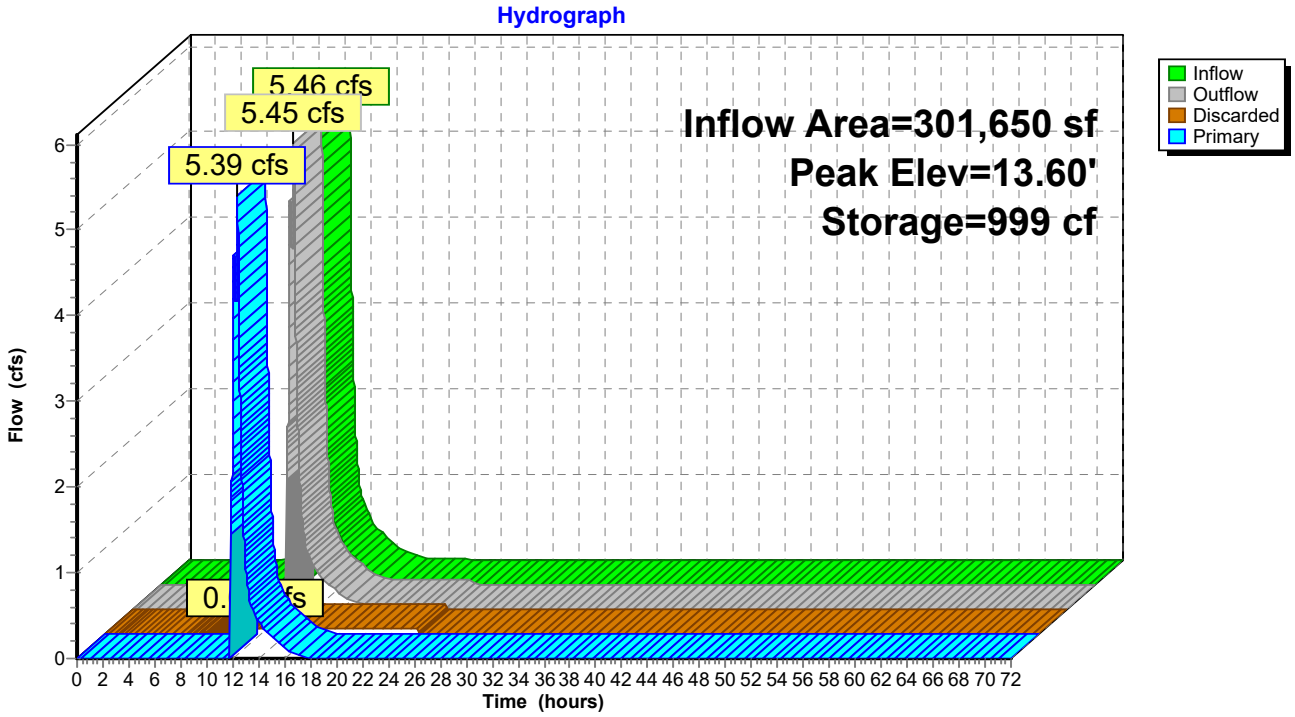
Volume	Invert	Avail.Storage	Storage Description
#1	7.60'	359 cf	**12.00'W x 24.00'L x 6.00'H Prismatoid** 1,728 cf Overall - 640 cf Embedded = 1,088 cf x 33.0% Voids
#2	9.60'	640 cf	**8.00'W x 20.00'L x 4.00'H Prismatoid** Inside #1
		999 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#0	Primary	13.60'	**Automatic Storage Overflow** (Discharged without head)
#1	Discarded	7.60'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	13.55'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.06 cfs @ 11.51 hrs HW=7.73' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=0.31 cfs @ 12.38 hrs HW=13.60' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 0.31 cfs @ 0.63 fps)

Pond IS1: Infiltration System 1



Summary for Pond IS2: Infiltration System 2

Inflow Area = 291,470 sf, 25.66% Impervious, Inflow Depth = 0.87" for 100yr event
Inflow = 5.32 cfs @ 12.37 hrs, Volume= 21,178 cf
Outflow = 5.27 cfs @ 12.38 hrs, Volume= 21,178 cf, Atten= 1%, Lag= 0.4 min
Discarded = 0.06 cfs @ 10.53 hrs, Volume= 3,200 cf
Primary = 5.22 cfs @ 12.38 hrs, Volume= 17,978 cf
Routed to Pond IS1 : Infiltration System 1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 17.00' @ 11.51 hrs Surf.Area= 288 sf Storage= 999 cf

Plug-Flow detention time= 34.3 min calculated for 21,178 cf (100% of inflow)
Center-of-Mass det. time= 34.3 min (816.8 - 782.5)

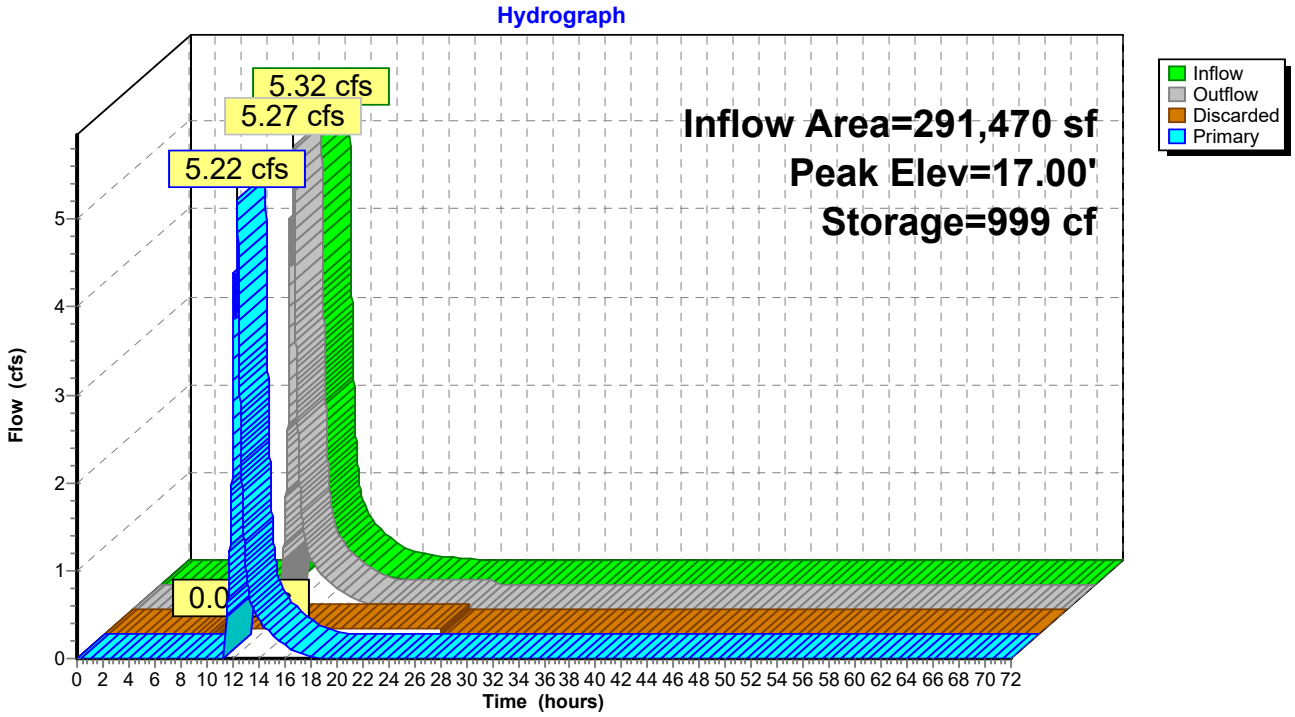
Volume	Invert	Avail.Storage	Storage Description
#1	11.00'	359 cf	**12.00'W x 24.00'L x 6.00'H Prismatoid** 1,728 cf Overall - 640 cf Embedded = 1,088 cf x 33.0% Voids
#2	13.00'	640 cf	**8.00'W x 20.00'L x 4.00'H Prismatoid** Inside #1
		999 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#0	Primary	17.00'	**Automatic Storage Overflow** (Discharged without head)
#1	Discarded	11.00'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	16.95'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.06 cfs @ 10.53 hrs HW=11.09' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=0.31 cfs @ 12.38 hrs HW=17.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 0.31 cfs @ 0.63 fps)

Pond IS2: Infiltration System 2



Summary for Pond IS3: Infiltration System 3

Inflow Area = 259,970 sf, 25.38% Impervious, Inflow Depth = 1.10" for 100yr event
Inflow = 5.37 cfs @ 12.35 hrs, Volume= 23,916 cf
Outflow = 5.14 cfs @ 12.36 hrs, Volume= 23,916 cf, Atten= 4%, Lag= 0.5 min
Discarded = 0.06 cfs @ 5.73 hrs, Volume= 5,244 cf
Primary = 5.09 cfs @ 12.36 hrs, Volume= 18,672 cf
Routed to Pond IT2 : INFILTRATION TRENCH 2

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 31.00' @ 12.33 hrs Surf.Area= 288 sf Storage= 999 cf

Plug-Flow detention time= 42.3 min calculated for 23,916 cf (100% of inflow)
Center-of-Mass det. time= 42.3 min (839.3 - 797.0)

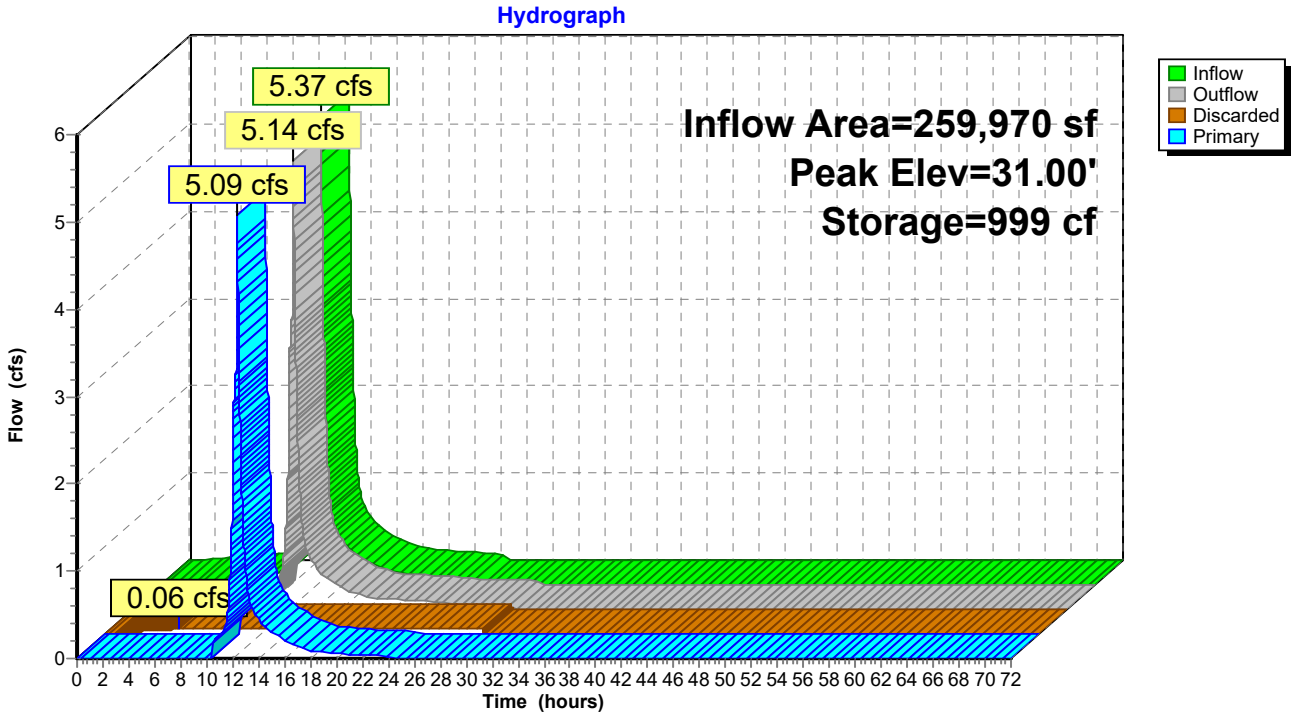
Volume	Invert	Avail.Storage	Storage Description
#1	25.00'	359 cf	**12.00'W x 24.00'L x 6.00'H Prismatoid** 1,728 cf Overall - 640 cf Embedded = 1,088 cf x 33.0% Voids
#2	27.00'	640 cf	**8.00'W x 20.00'L x 4.00'H Prismatoid** Inside #1
		999 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#0	Primary	31.00'	**Automatic Storage Overflow** (Discharged without head)
#1	Discarded	25.00'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	30.75'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.06 cfs @ 5.73 hrs HW=25.06' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=3.54 cfs @ 12.36 hrs HW=31.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 3.54 cfs @ 1.41 fps)

Pond IS3: Infiltration System 3



Summary for Pond IT1: INFILTRATION TRENCH 1

Inflow Area = 286,690 sf, 25.71% Impervious, Inflow Depth = 0.93" for 100yr event
Inflow = 5.63 cfs @ 12.36 hrs, Volume= 22,269 cf
Outflow = 5.40 cfs @ 12.37 hrs, Volume= 22,199 cf, Atten= 4%, Lag= 0.6 min
Discarded = 0.16 cfs @ 12.37 hrs, Volume= 1,953 cf
Primary = 5.24 cfs @ 12.37 hrs, Volume= 20,246 cf
Routed to Pond IS2 : Infiltration System 2

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 20.87' @ 12.37 hrs Surf.Area= 815 sf Storage= 236 cf

Plug-Flow detention time= 5.2 min calculated for 22,196 cf (100% of inflow)
Center-of-Mass det. time= 3.3 min (791.7 - 788.4)

Volume	Invert	Avail.Storage	Storage Description
#1	16.50'	98 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 298 cf Overall x 33.0% Voids
#2	20.00'	25 cf	**4.00'D x 2.00'H Vertical Cone/Cylinder** -Impervious
#3	20.53'	237 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
		361 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
16.50	85	0	0
20.00	85	298	298

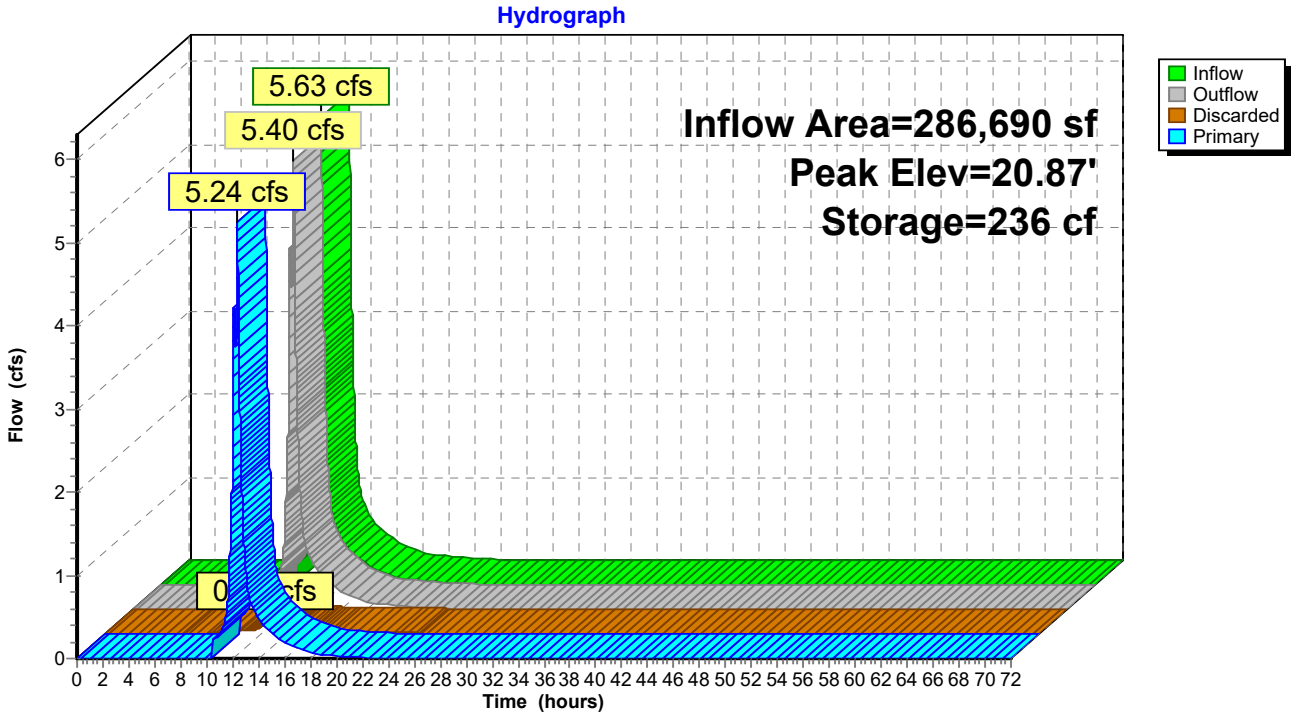
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
20.53	10	0	0
21.00	1,000	237	237

Device	Routing	Invert	Outlet Devices
#1	Discarded	16.50'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Device 1	19.00'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	20.53'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.16 cfs @ 12.37 hrs HW=20.87' (Free Discharge)
↑└**1=Exfiltration** (Exfiltration Controls 0.16 cfs)
↑└**2=Orifice/Grate** (Passes 0.16 cfs of 1.20 cfs potential flow)

Primary OutFlow Max=5.21 cfs @ 12.37 hrs HW=20.87' (Free Discharge)
↑└**3=Orifice/Grate** (Weir Controls 5.21 cfs @ 1.91 fps)

Pond IT1: INFILTRATION TRENCH 1



Summary for Pond IT2: INFILTRATION TRENCH 2

Inflow Area = 280,550 sf, 25.55% Impervious, Inflow Depth = 1.00" for 100yr event
Inflow = 5.53 cfs @ 12.36 hrs, Volume= 23,449 cf
Outflow = 5.53 cfs @ 12.36 hrs, Volume= 23,243 cf, Atten= 0%, Lag= 0.0 min
Discarded = 0.04 cfs @ 9.12 hrs, Volume= 2,567 cf
Primary = 5.48 cfs @ 12.36 hrs, Volume= 20,676 cf
Routed to Pond IT1 : INFILTRATION TRENCH 1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 23.68' @ 12.36 hrs Surf.Area= 212 sf Storage= 299 cf

Plug-Flow detention time= 13.8 min calculated for 23,243 cf (99% of inflow)
Center-of-Mass det. time= 8.4 min (808.4 - 800.0)

Volume	Invert	Avail.Storage	Storage Description
#1	19.25'	245 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 742 cf Overall x 33.0% Voids
#2	19.35'	63 cf	**4.00'D x 5.00'H Vertical Cone/Cylinder** -Impervious
		308 cf	Total Available Storage

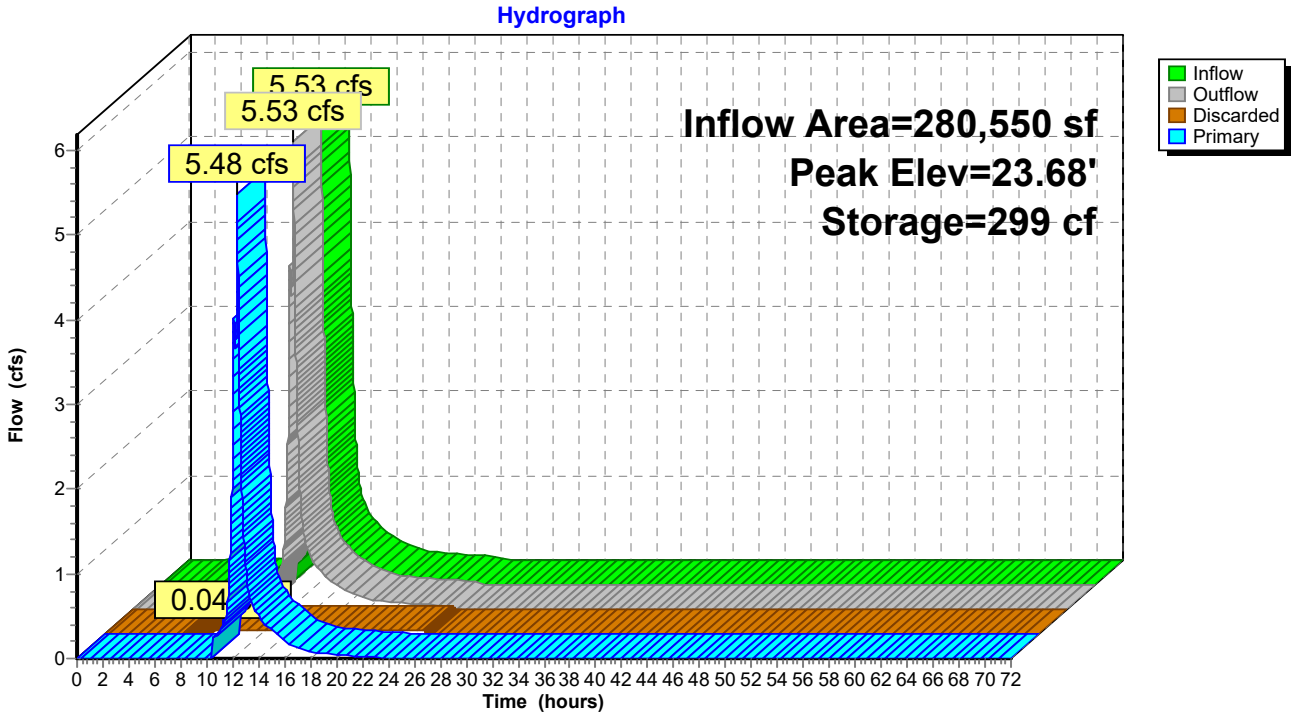
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
19.25	212	0	0
22.75	212	742	742

Device	Routing	Invert	Outlet Devices
#0	Primary	24.35'	**Automatic Storage Overflow** (Discharged without head)
#1	Discarded	19.25'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Device 1	21.75'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	23.35'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.04 cfs @ 9.12 hrs HW=21.90' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.04 cfs)
↑**2=Orifice/Grate** (Passes 0.04 cfs of 0.07 cfs potential flow)

Primary OutFlow Max=5.45 cfs @ 12.36 hrs HW=23.68' (Free Discharge)
↑**3=Broad-Crested Rectangular Weir** (Weir Controls 5.45 cfs @ 1.65 fps)

Pond IT2: INFILTRATION TRENCH 2



Summary for Pond IT3: INFILTRATION TRENCH 3

Inflow Area = 168,290 sf, 27.19% Impervious, Inflow Depth = 0.55" for 100yr event
Inflow = 2.82 cfs @ 12.35 hrs, Volume= 7,653 cf
Outflow = 2.58 cfs @ 12.35 hrs, Volume= 7,431 cf, Atten= 8%, Lag= 0.1 min
Discarded = 0.05 cfs @ 8.55 hrs, Volume= 2,668 cf
Primary = 2.53 cfs @ 12.35 hrs, Volume= 4,763 cf
Routed to Pond IS3 : Infiltration System 3

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 34.91' @ 12.35 hrs Surf.Area= 240 sf Storage= 350 cf

Plug-Flow detention time= 44.2 min calculated for 7,431 cf (97% of inflow)
Center-of-Mass det. time= 26.4 min (796.4 - 770.0)

Volume	Invert	Avail.Storage	Storage Description
#1	28.50'	277 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 840 cf Overall x 33.0% Voids
#2	29.10'	101 cf	**4.00'D x 8.00'H Vertical Cone/Cylinder** -Impervious
		378 cf	Total Available Storage

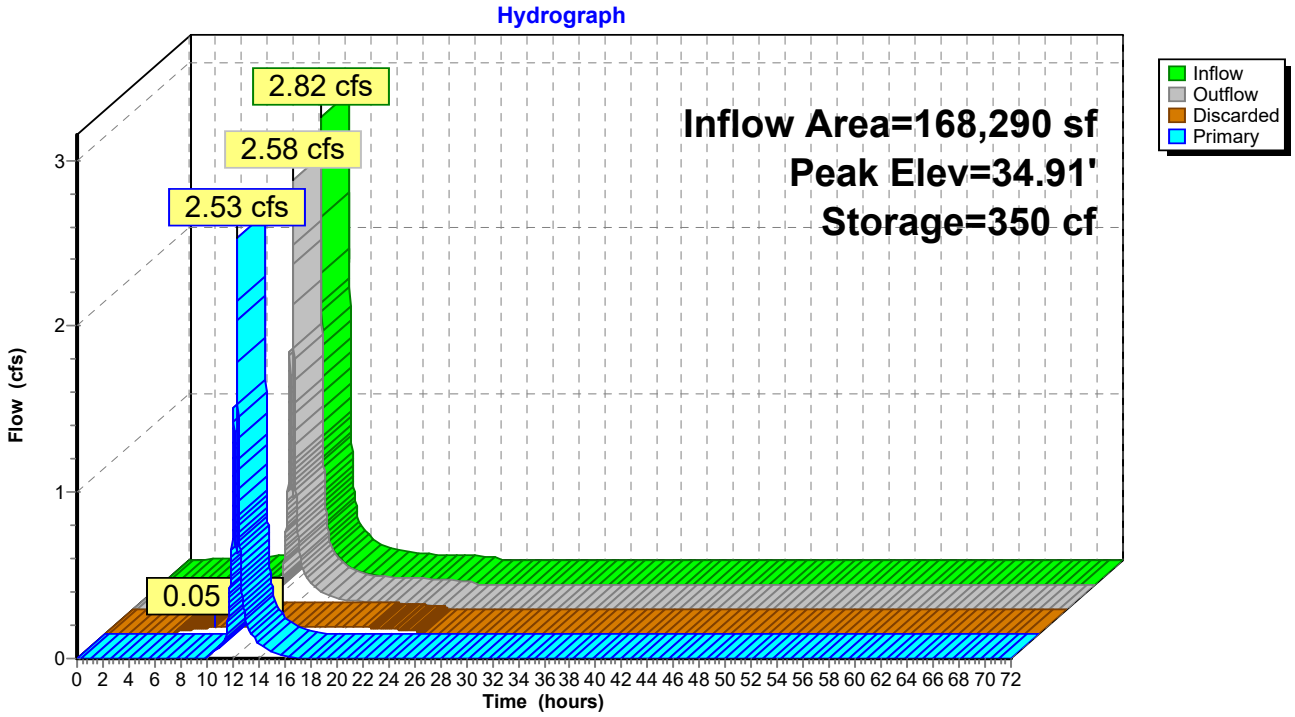
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
28.50	240	0	0
32.00	240	840	840

Device	Routing	Invert	Outlet Devices
#0	Primary	37.10'	**Automatic Storage Overflow** (Discharged without head)
#1	Discarded	28.50'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Device 1	31.00'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	35.40'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#4	Primary	33.70'	**12.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 33.70' / 31.00' S= 0.2700 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Discarded OutFlow Max=0.05 cfs @ 8.55 hrs HW=31.17' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.05 cfs)
└**2=Orifice/Grate** (Passes 0.05 cfs of 0.08 cfs potential flow)

Primary OutFlow Max=2.38 cfs @ 12.35 hrs HW=34.84' (Free Discharge)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
└**4=Culvert** (Inlet Controls 2.38 cfs @ 3.03 fps)

Pond IT3: INFILTRATION TRENCH 3



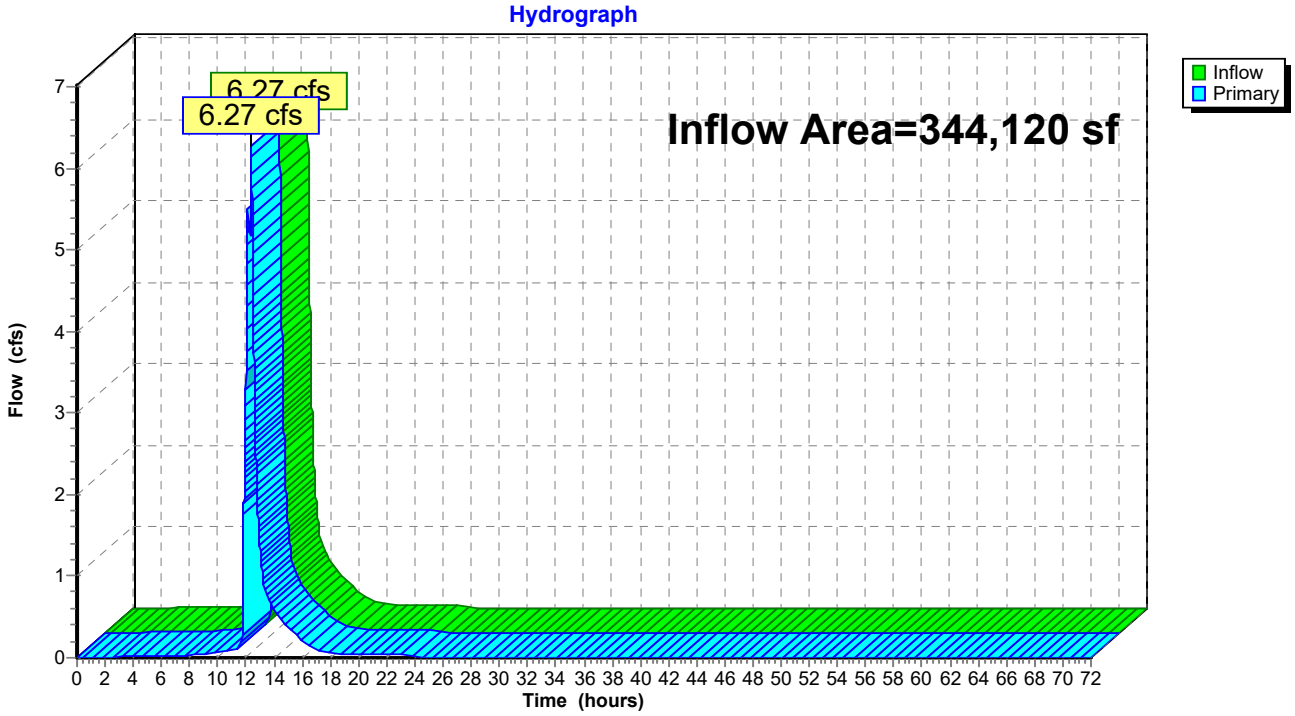
Summary for Pond SP1: Follins Pond

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 344,120 sf, 24.57% Impervious, Inflow Depth = 0.84" for 100yr event
Inflow = 6.27 cfs @ 12.38 hrs, Volume= 24,046 cf
Primary = 6.27 cfs @ 12.38 hrs, Volume= 24,046 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Pond SP1: Follins Pond



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment DA0: Runoff Area=42,470 sf 16.93% Impervious Runoff Depth=0.17"
Flow Length=625' Tc=16.2 min CN=31/98 Runoff=0.14 cfs 596 cf

Subcatchment DA1: Runoff Area=10,180 sf 25.15% Impervious Runoff Depth=0.25"
Flow Length=235' Tc=11.5 min CN=30/98 Runoff=0.05 cfs 212 cf

Subcatchment DA2: Runoff Area=4,780 sf 22.80% Impervious Runoff Depth=0.23"
Tc=5.0 min CN=30/98 Runoff=0.03 cfs 90 cf

Subcatchment DA2A: Runoff Area=6,140 sf 32.74% Impervious Runoff Depth=0.33"
Tc=5.0 min CN=30/98 Runoff=0.05 cfs 167 cf

Subcatchment DA2B: Runoff Area=20,580 sf 27.75% Impervious Runoff Depth=0.28"
Tc=5.0 min CN=31/98 Runoff=0.15 cfs 474 cf

Subcatchment DA3: Runoff Area=26,890 sf 29.04% Impervious Runoff Depth=0.29"
Tc=5.0 min CN=30/98 Runoff=0.21 cfs 648 cf

Subcatchment DA3A: Runoff Area=18,760 sf 29.74% Impervious Runoff Depth=0.30"
Flow Length=480' Tc=19.7 min CN=30/98 Runoff=0.10 cfs 463 cf

Subcatchment DA3B: Runoff Area=72,920 sf 20.08% Impervious Runoff Depth=0.20"
Flow Length=495' Tc=24.2 min CN=34/98 Runoff=0.23 cfs 1,214 cf

Subcatchment DA3C: Runoff Area=141,400 sf 26.84% Impervious Runoff Depth=0.27"
Flow Length=235' Tc=12.7 min CN=30/98 Runoff=0.78 cfs 3,148 cf

Pond C1: CHAMBERS Peak Elev=27.77' Storage=341 cf Inflow=0.78 cfs 3,148 cf
Discarded=0.37 cfs 3,149 cf Primary=0.00 cfs 0 cf Outflow=0.37 cfs 3,149 cf

Pond IS1: Infiltration System 1 Peak Elev=7.66' Storage=5 cf Inflow=0.05 cfs 212 cf
Discarded=0.05 cfs 212 cf Primary=0.00 cfs 0 cf Outflow=0.05 cfs 212 cf

Pond IS2: Infiltration System 2 Peak Elev=11.03' Storage=3 cf Inflow=0.03 cfs 90 cf
Discarded=0.03 cfs 90 cf Primary=0.00 cfs 0 cf Outflow=0.03 cfs 90 cf

Pond IS3: Infiltration System 3 Peak Elev=28.83' Storage=560 cf Inflow=0.33 cfs 1,677 cf
Discarded=0.06 cfs 1,677 cf Primary=0.00 cfs 0 cf Outflow=0.06 cfs 1,677 cf

Pond IT1: INFILTRATION TRENCH 1 Peak Elev=19.46' Storage=83 cf Inflow=0.05 cfs 167 cf
Discarded=0.02 cfs 97 cf Primary=0.00 cfs 0 cf Outflow=0.02 cfs 97 cf

Pond IT2: INFILTRATION TRENCH 2 Peak Elev=22.23' Storage=244 cf Inflow=0.15 cfs 474 cf
Discarded=0.04 cfs 269 cf Primary=0.00 cfs 0 cf Outflow=0.04 cfs 269 cf

Pond IT3: INFILTRATION TRENCH 3 Peak Elev=33.43' Storage=332 cf Inflow=0.21 cfs 648 cf
Discarded=0.05 cfs 426 cf Primary=0.00 cfs 0 cf Outflow=0.05 cfs 426 cf

Pond SP1: Follins Pond

Inflow=0.14 cfs 596 cf
Primary=0.14 cfs 596 cf

Total Runoff Area = 344,120 sf Runoff Volume = 7,013 cf Average Runoff Depth = 0.24"
75.43% Pervious = 259,580 sf 24.57% Impervious = 84,540 sf

Summary for Subcatchment DA0:

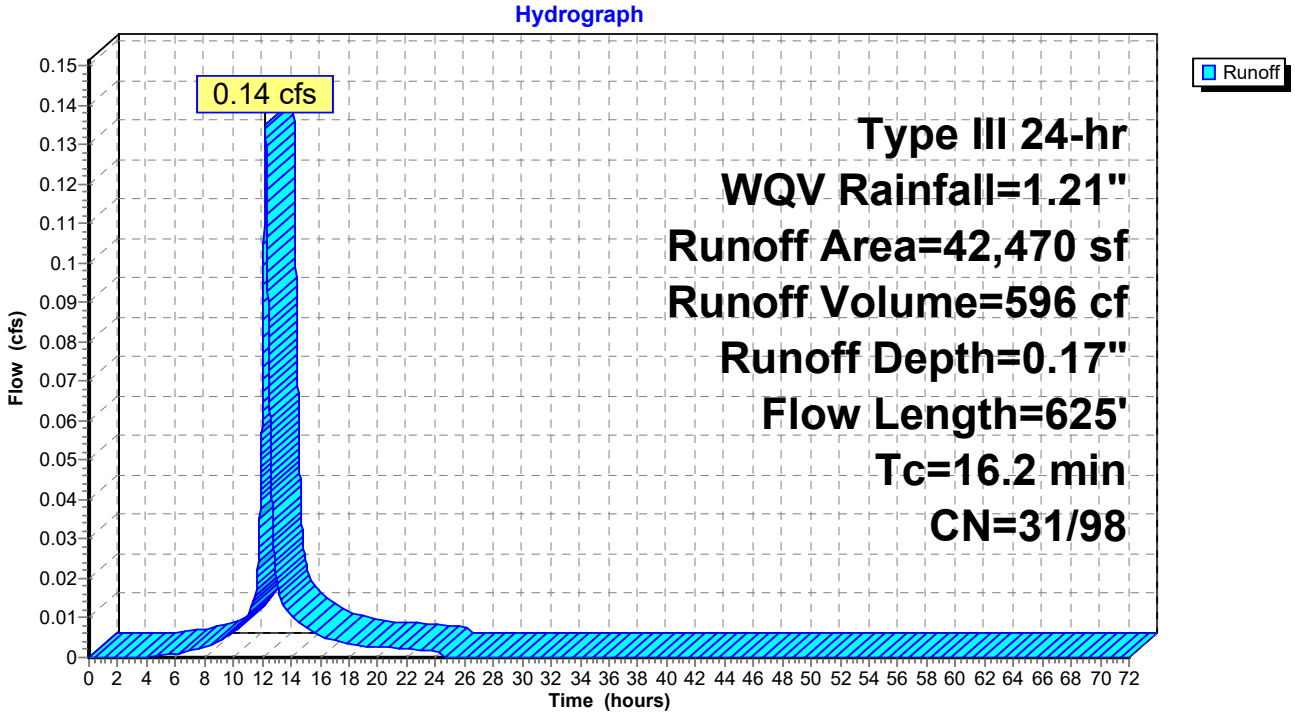
Runoff = 0.14 cfs @ 12.22 hrs, Volume= 596 cf, Depth= 0.17"
Routed to Pond SP1 : Follins Pond

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr WQV Rainfall=1.21"

Area (sf)	CN	Description
4,730	98	Paved parking, HSG A
2,460	98	Unconnected roofs, HSG A
29,910	30	Woods, Good, HSG A
5,370	39	>75% Grass cover, Good, HSG A
42,470	43	Weighted Average
35,280	31	83.07% Pervious Area
7,190	98	16.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.1	100	0.0900	0.15		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
5.0	470	0.1000	1.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	55	0.1100	6.73		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
16.2	625	Total			

Subcatchment DA0:



Summary for Subcatchment DA1:

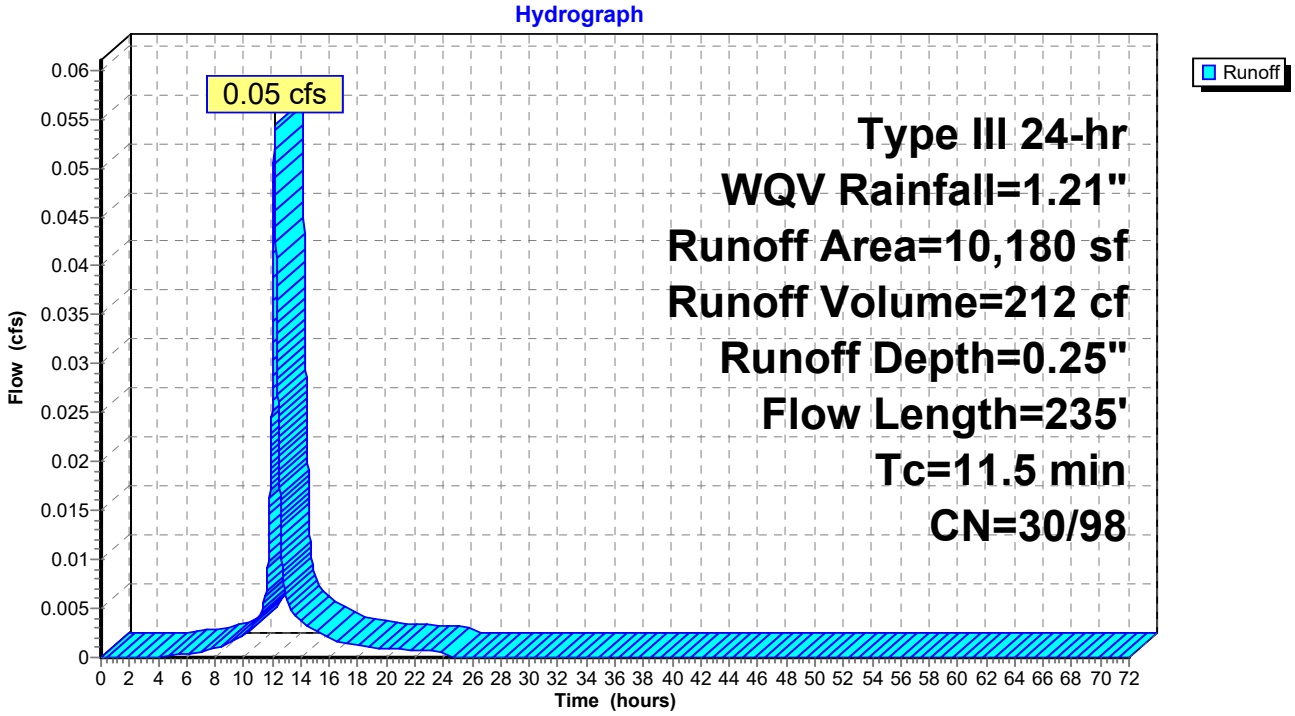
Runoff = 0.05 cfs @ 12.15 hrs, Volume= 212 cf, Depth= 0.25"
Routed to Pond IS1 : Infiltration System 1

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr WQV Rainfall=1.21"

Area (sf)	CN	Description
2,560	98	Paved parking, HSG A
7,620	30	Woods, Good, HSG A
10,180	47	Weighted Average
7,620	30	74.85% Pervious Area
2,560	98	25.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.6	100	0.1000	0.16		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
0.8	80	0.1200	1.73		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	55	0.1100	6.73		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
11.5	235	Total			

Subcatchment DA1:



Summary for Subcatchment DA2:

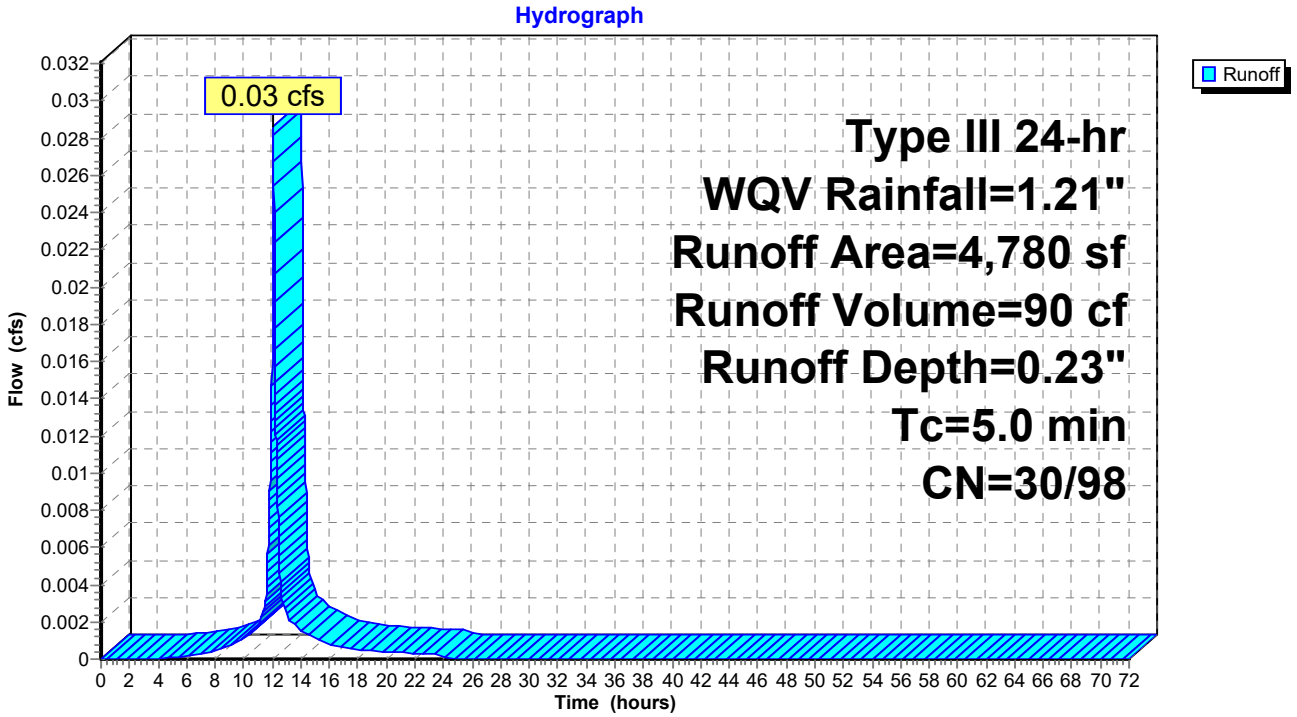
Runoff = 0.03 cfs @ 12.07 hrs, Volume= 90 cf, Depth= 0.23"
Routed to Pond IS2 : Infiltration System 2

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr WQV Rainfall=1.21"

Area (sf)	CN	Description
740	98	Paved parking, HSG A
350	98	Unconnected roofs, HSG A
3,690	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
4,780	46	Weighted Average
3,690	30	77.20% Pervious Area
1,090	98	22.80% Impervious Area

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

Subcatchment DA2:



Summary for Subcatchment DA2A:

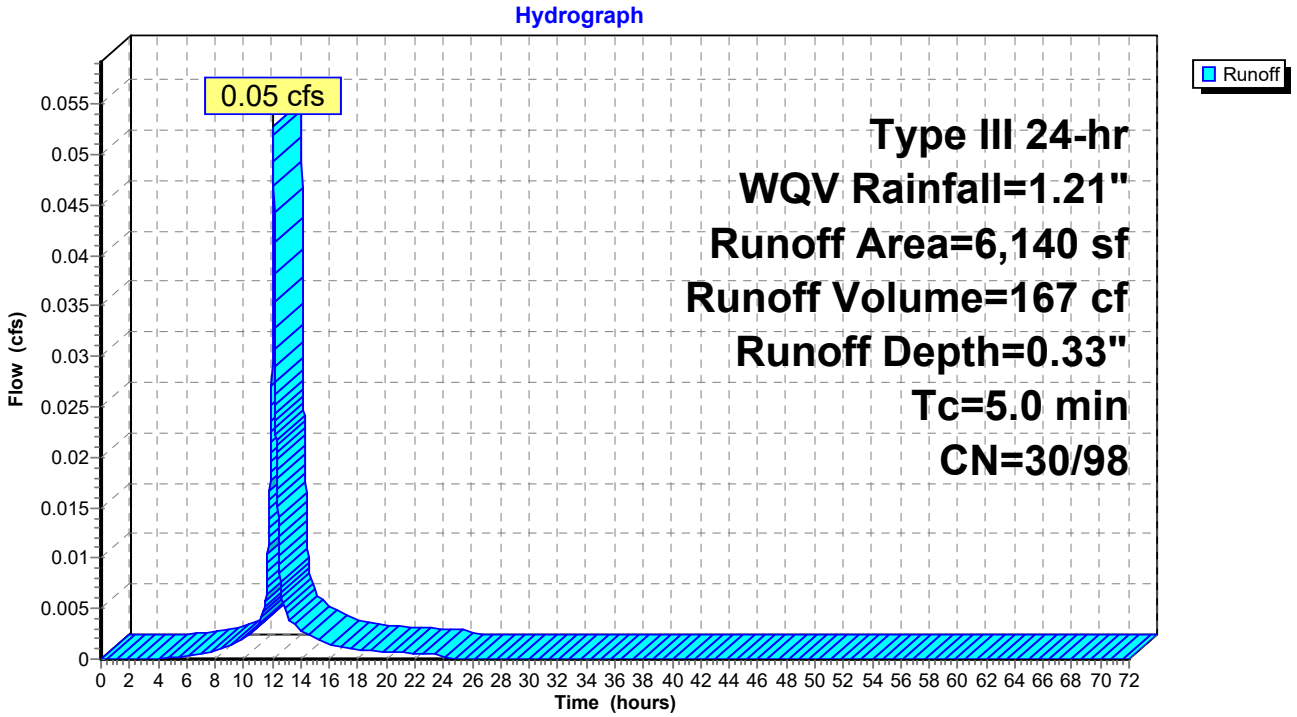
Runoff = 0.05 cfs @ 12.07 hrs, Volume= 167 cf, Depth= 0.33"
Routed to Pond IT1 : INFILTRATION TRENCH 1

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr WQV Rainfall=1.21"

Area (sf)	CN	Description
1,080	98	Paved parking, HSG A
930	98	Unconnected roofs, HSG A
4,130	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
6,140	52	Weighted Average
4,130	30	67.26% Pervious Area
2,010	98	32.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 min direct**

Subcatchment DA2A:



Summary for Subcatchment DA2B:

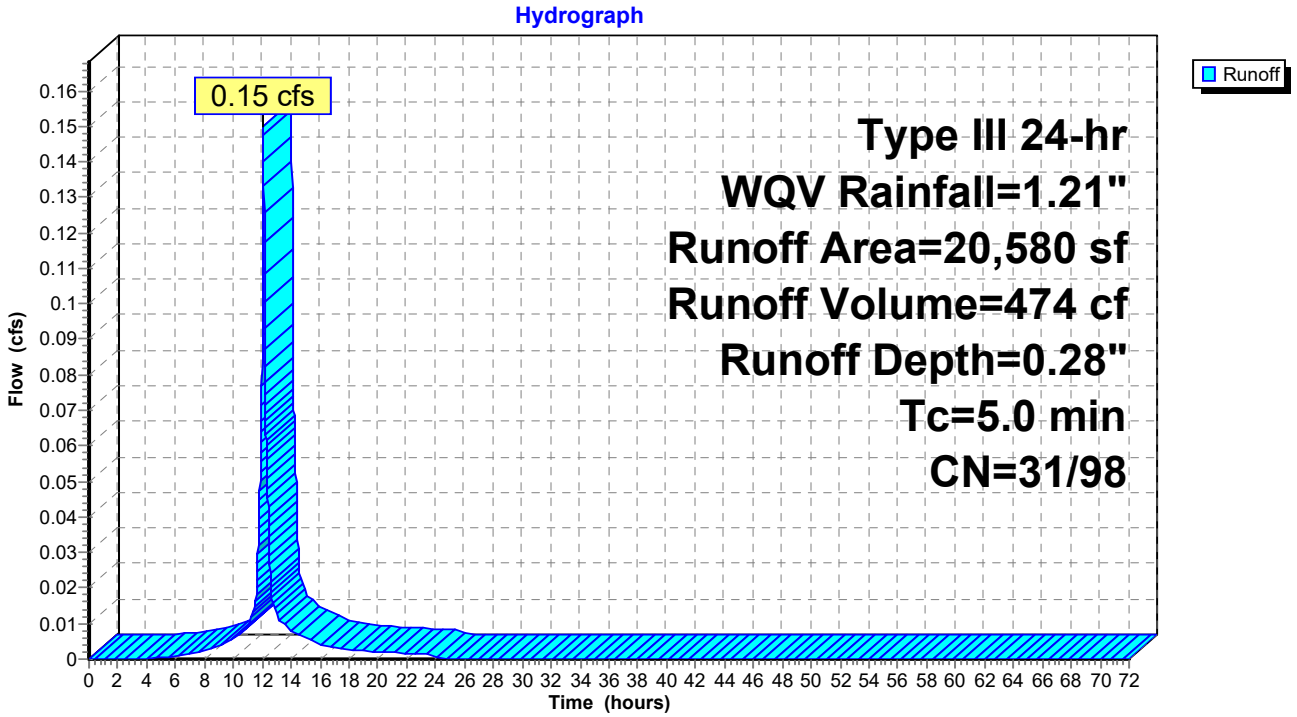
Runoff = 0.15 cfs @ 12.07 hrs, Volume= 474 cf, Depth= 0.28"
Routed to Pond IT2 : INFILTRATION TRENCH 2

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr WQV Rainfall=1.21"

Area (sf)	CN	Description
5,710	98	Paved parking, HSG A
0	98	Unconnected roofs, HSG A
12,670	30	Woods, Good, HSG A
2,200	39	>75% Grass cover, Good, HSG A
20,580	50	Weighted Average
14,870	31	72.25% Pervious Area
5,710	98	27.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 MIN DIRECT**

Subcatchment DA2B:



Summary for Subcatchment DA3:

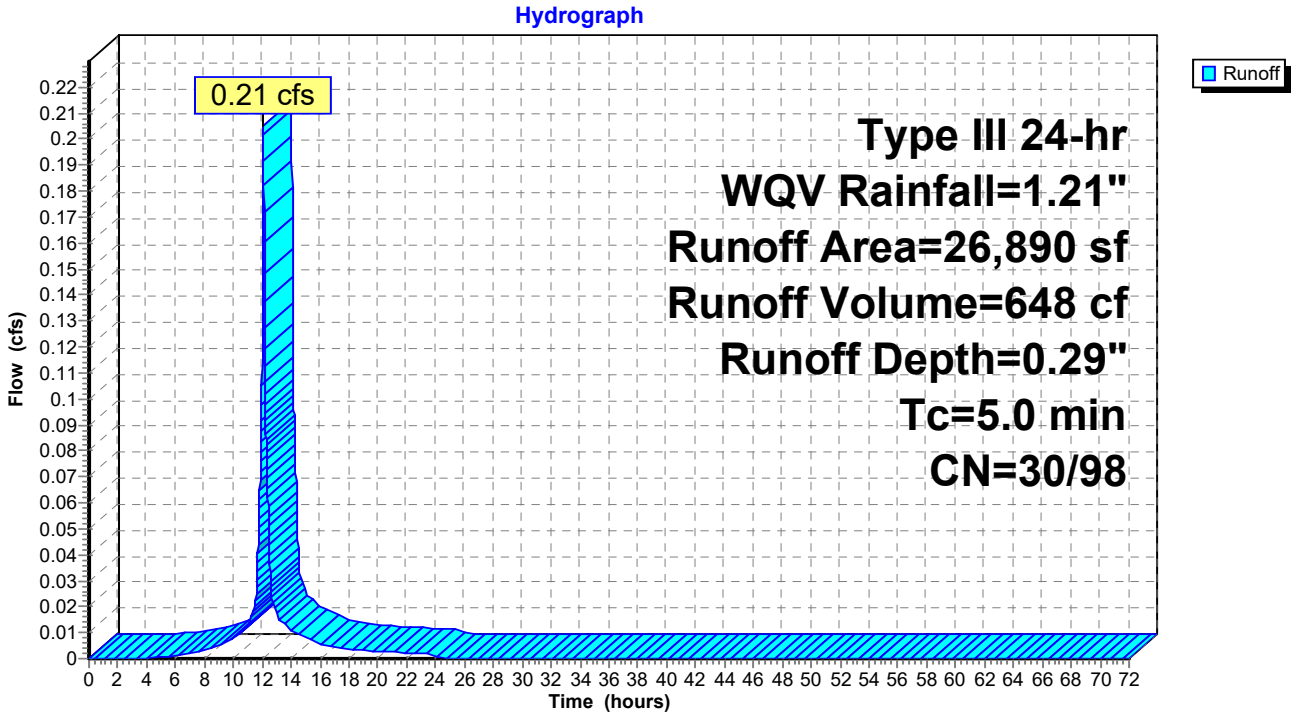
Runoff = 0.21 cfs @ 12.07 hrs, Volume= 648 cf, Depth= 0.29"
Routed to Pond IT3 : INFILTRATION TRENCH 3

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr WQV Rainfall=1.21"

Area (sf)	CN	Description
4,210	98	Paved parking, HSG A
3,600	98	Unconnected roofs, HSG A
19,080	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
0	98	Water Surface, HSG A
26,890	50	Weighted Average
19,080	30	70.96% Pervious Area
7,810	98	29.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 MIN DIRECT**

Subcatchment DA3:



Summary for Subcatchment DA3A:

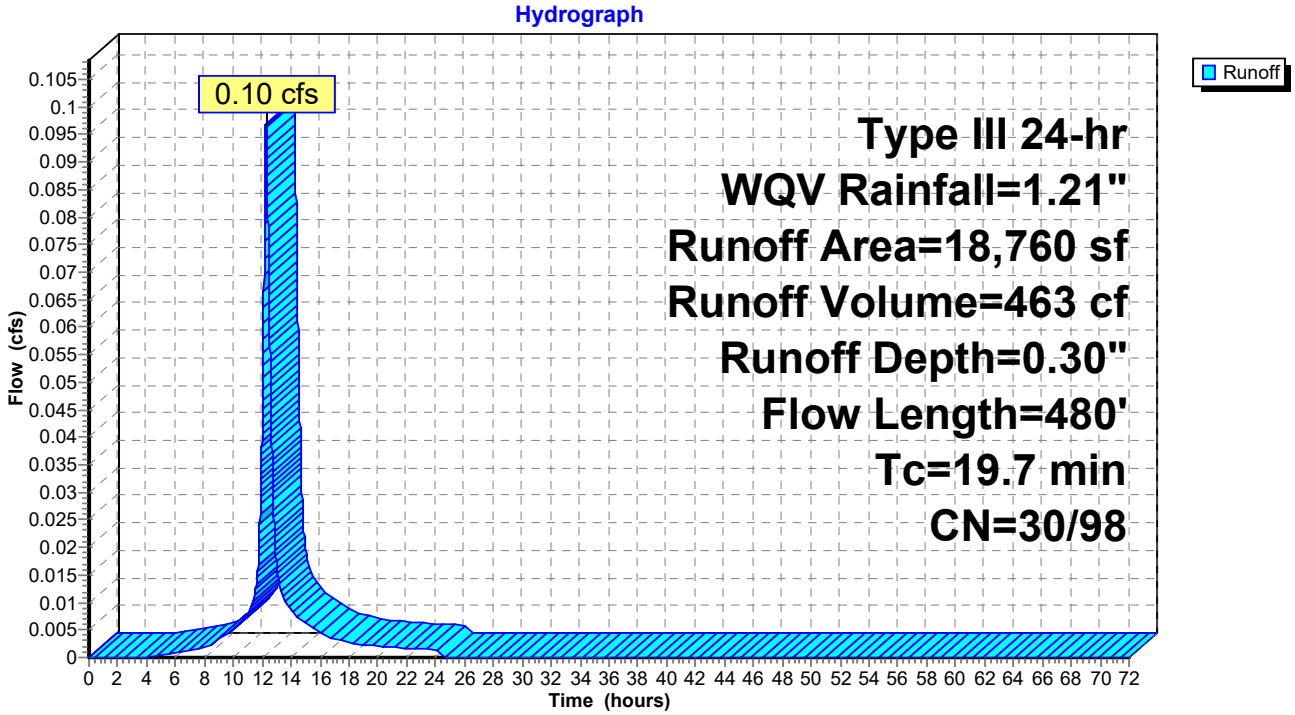
Runoff = 0.10 cfs @ 12.26 hrs, Volume= 463 cf, Depth= 0.30"
Routed to Pond IS3 : Infiltration System 3

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr WQV Rainfall=1.21"

Area (sf)	CN	Description
5,580	98	Paved parking, HSG A
0	98	Unconnected roofs, HSG A
13,180	30	Woods, Good, HSG A
0	39	>75% Grass cover, Good, HSG A
18,760	50	Weighted Average
13,180	30	70.26% Pervious Area
5,580	98	29.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.2	100	0.0300	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
1.8	155	0.0800	1.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.7	225	0.0800	5.74		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
19.7	480	Total			

Subcatchment DA3A:



Summary for Subcatchment DA3B:

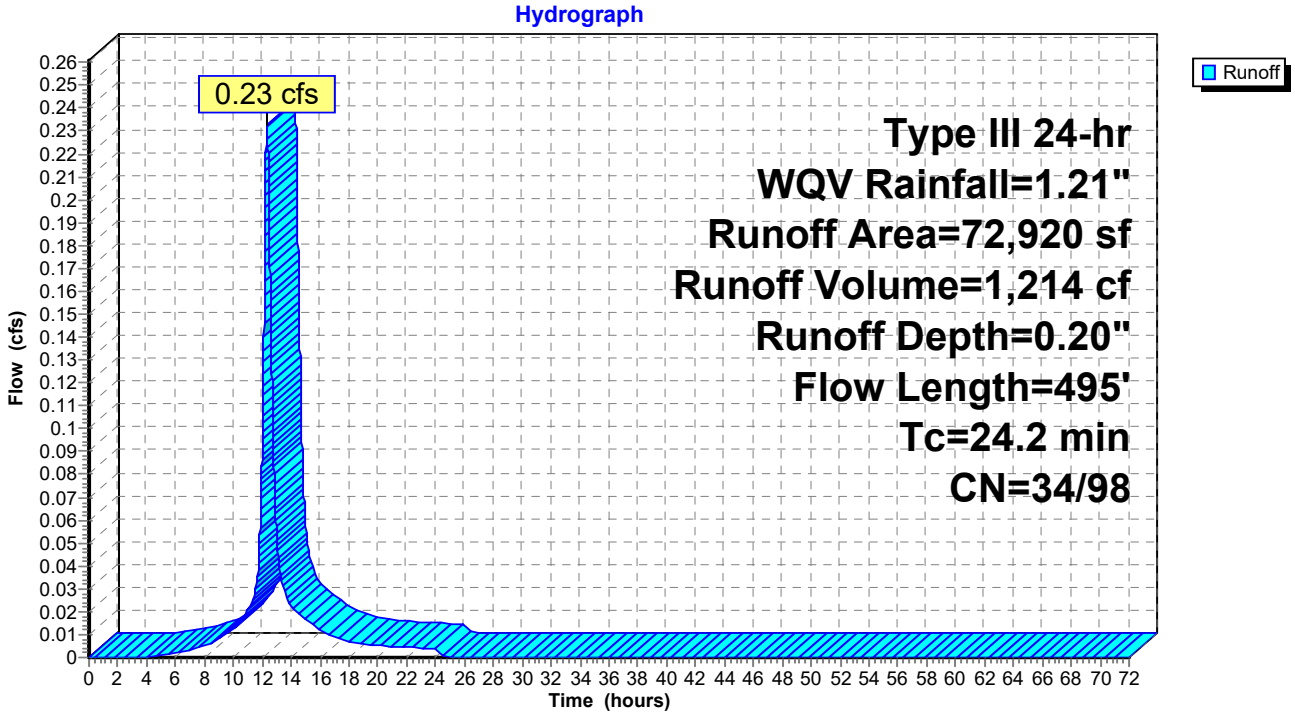
Runoff = 0.23 cfs @ 12.32 hrs, Volume= 1,214 cf, Depth= 0.20"
Routed to Pond IS3 : Infiltration System 3

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr WQV Rainfall=1.21"

Area (sf)	CN	Description
8,650	98	Paved parking, HSG A
5,990	98	Unconnected roofs, HSG A
35,050	30	Woods, Good, HSG A
23,230	39	>75% Grass cover, Good, HSG A
72,920	47	Weighted Average
58,280	34	79.92% Pervious Area
14,640	98	20.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.2	100	0.0200	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
3.0	270	0.0900	1.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.0	125	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
24.2	495	Total			

Subcatchment DA3B:



Summary for Subcatchment DA3C:

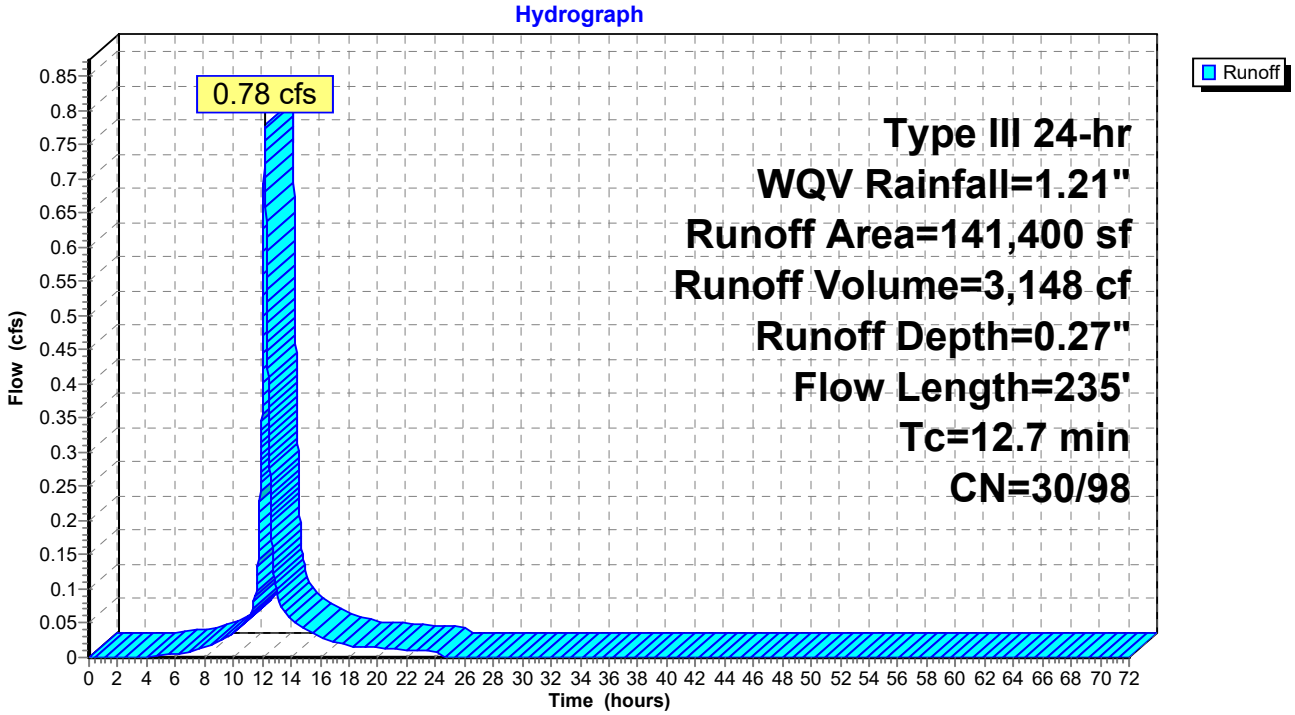
Runoff = 0.78 cfs @ 12.17 hrs, Volume= 3,148 cf, Depth= 0.27"
Routed to Pond C1 : CHAMBERS

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr WQV Rainfall=1.21"

Area (sf)	CN	Description
23,130	98	Paved parking, HSG A
14,820	98	Unconnected roofs, HSG A
99,540	30	Woods, Good, HSG A
3,910	39	>75% Grass cover, Good, HSG A
141,400	48	Weighted Average
103,450	30	73.16% Pervious Area
37,950	98	26.84% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.6	100	0.0800	0.14		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
0.1	10	0.1200	1.73		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.0	125	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
12.7	235	Total			

Subcatchment DA3C:



Summary for Pond C1: CHAMBERS

Inflow Area = 141,400 sf, 26.84% Impervious, Inflow Depth = 0.27" for WQV event
Inflow = 0.78 cfs @ 12.17 hrs, Volume= 3,148 cf
Outflow = 0.37 cfs @ 11.99 hrs, Volume= 3,149 cf, Atten= 53%, Lag= 0.0 min
Discarded = 0.37 cfs @ 11.99 hrs, Volume= 3,149 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Pond IT3 : INFILTRATION TRENCH 3

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 27.77' @ 12.44 hrs Surf.Area= 1,912 sf Storage= 341 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 4.1 min (792.0 - 788.0)

Volume	Invert	Avail.Storage	Storage Description
#1B	27.25'	2,581 cf	**19.17'W x 99.75'L x 6.75'H Field B** 12,905 cf Overall - 5,083 cf Embedded = 7,823 cf x 33.0% Voids
#2B	28.00'	5,083 cf	**ADS_StormTech MC-7200 +Cap** x 28 Inside #1 Effective Size= 91.2"W x 60.0"H => 26.68 sf x 6.59'L = 175.9 cf Overall Size= 100.0"W x 60.0"H x 6.95'L with 0.36' Overlap 28 Chambers in 2 Rows Cap Storage= 39.5 cf x 2 x 2 rows = 158.0 cf
#3	27.00'	126 cf	**4.00'D x 10.00'H Vertical Cone/Cylinder**-Impervious
#4	36.10'	327 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)
		8,117 cf	Total Available Storage

Storage Group B created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
36.10	100	0	0
36.25	400	37	37
36.30	600	25	63
36.35	10,000	265	327

Device	Routing	Invert	Outlet Devices
#1	Discarded	27.25'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	36.30'	**20.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.37 cfs @ 11.99 hrs HW=27.25' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.37 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=27.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond C1: CHAMBERS - Chamber Wizard Field B

Chamber Model = ADS_StormTech MC-7200 +Cap (ADS StormTech® MC-7200 with cap volume)
Effective Size= 91.2"W x 60.0"H => 26.68 sf x 6.59'L = 175.9 cf
Overall Size= 100.0"W x 60.0"H x 6.95'L with 0.36' Overlap
Cap Storage= 39.5 cf x 2 x 2 rows = 158.0 cf

100.0" Wide + 6.0" Spacing = 106.0" C-C Row Spacing

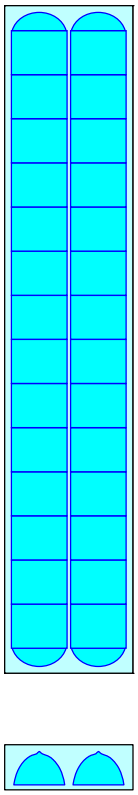
14 Chambers/Row x 6.59' Long +2.73' Cap Length x 2 = 97.75' Row Length +12.0" End Stone x 2 = 99.75' Base Length
2 Rows x 100.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 19.17' Base Width
9.0" Stone Base + 60.0" Chamber Height + 12.0" Stone Cover = 6.75' Field Height

28 Chambers x 175.9 cf + 39.5 cf Cap Volume x 2 x 2 Rows = 5,082.5 cf Chamber Storage

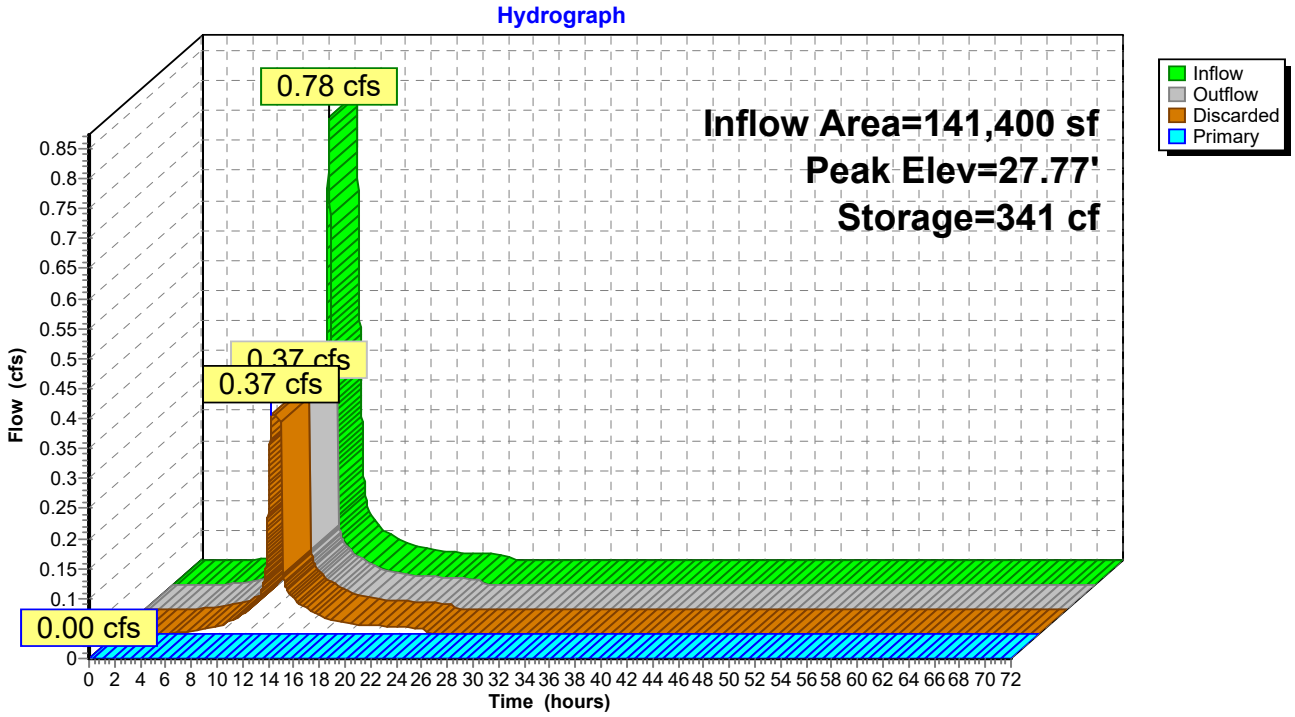
12,905.2 cf Field - 5,082.5 cf Chambers = 7,822.6 cf Stone x 33.0% Voids = 2,581.5 cf Stone Storage

Chamber Storage + Stone Storage = 7,664.0 cf = 0.176 af
Overall Storage Efficiency = 59.4%
Overall System Size = 99.75' x 19.17' x 6.75'

28 Chambers
478.0 cy Field
289.7 cy Stone



Pond C1: CHAMBERS



Summary for Pond IS1: Infiltration System 1

Inflow Area = 301,650 sf, 25.64% Impervious, Inflow Depth = 0.01" for WQV event
Inflow = 0.05 cfs @ 12.15 hrs, Volume= 212 cf
Outflow = 0.05 cfs @ 12.18 hrs, Volume= 212 cf, Atten= 3%, Lag= 1.7 min
Discarded = 0.05 cfs @ 12.18 hrs, Volume= 212 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Pond SP1 : Follins Pond

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 7.66' @ 12.18 hrs Surf.Area= 288 sf Storage= 5 cf

Plug-Flow detention time= 1.7 min calculated for 212 cf (100% of inflow)
Center-of-Mass det. time= 1.7 min (788.6 - 786.9)

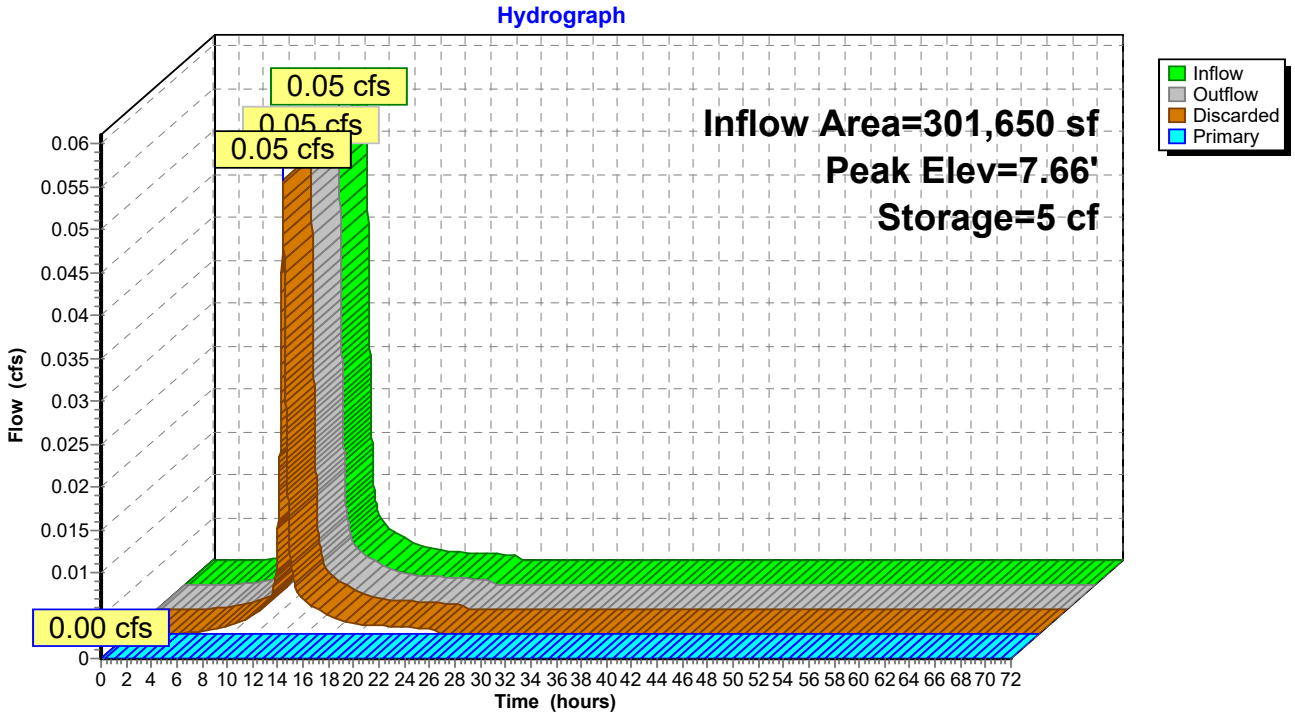
Volume	Invert	Avail.Storage	Storage Description
#1	7.60'	359 cf	**12.00'W x 24.00'L x 6.00'H Prismatoid** 1,728 cf Overall - 640 cf Embedded = 1,088 cf x 33.0% Voids
#2	9.60'	640 cf	**8.00'W x 20.00'L x 4.00'H Prismatoid** Inside #1
		999 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#0	Primary	13.60'	**Automatic Storage Overflow** (Discharged without head)
#1	Discarded	7.60'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	13.55'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.06 cfs @ 12.18 hrs HW=7.66' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=7.60' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond IS1: Infiltration System 1



Summary for Pond IS2: Infiltration System 2

Inflow Area = 291,470 sf, 25.66% Impervious, Inflow Depth = 0.00" for WQV event
Inflow = 0.03 cfs @ 12.07 hrs, Volume= 90 cf
Outflow = 0.03 cfs @ 12.10 hrs, Volume= 90 cf, Atten= 5%, Lag= 1.6 min
Discarded = 0.03 cfs @ 12.10 hrs, Volume= 90 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Pond IS1 : Infiltration System 1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 11.03' @ 12.10 hrs Surf.Area= 288 sf Storage= 3 cf

Plug-Flow detention time= 1.7 min calculated for 90 cf (100% of inflow)
Center-of-Mass det. time= 1.7 min (782.5 - 780.8)

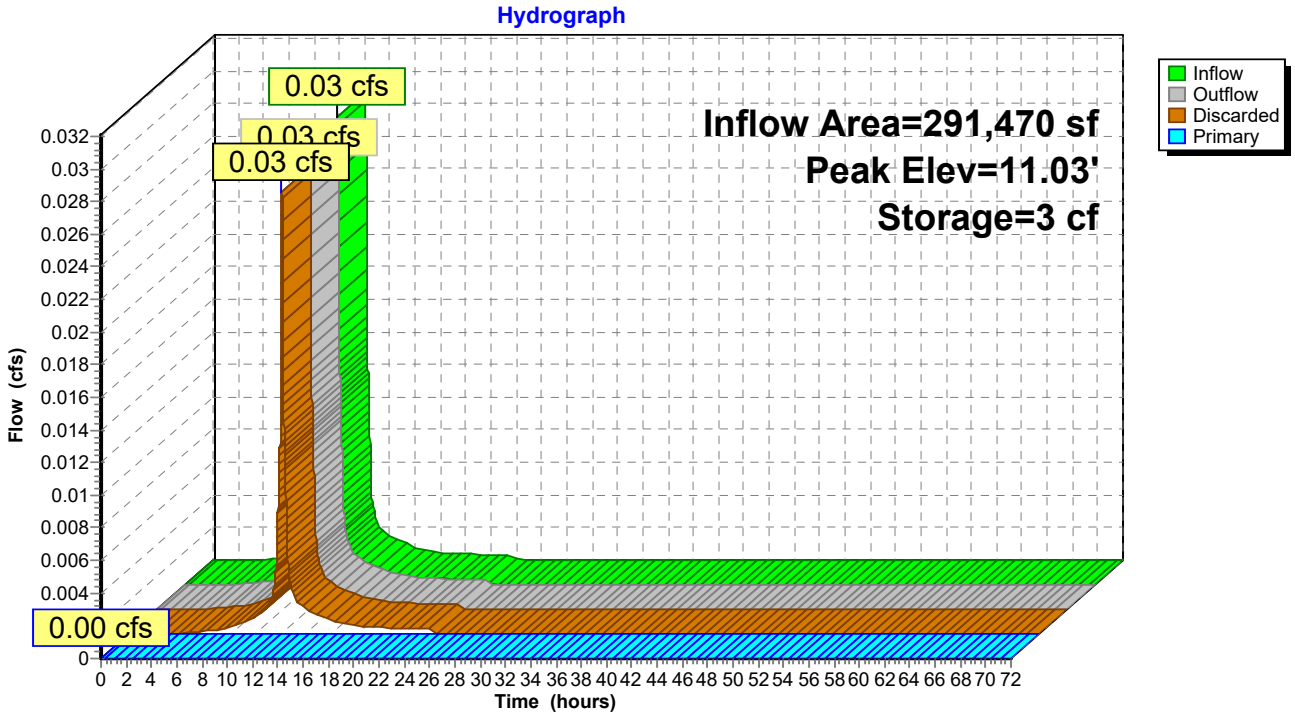
Volume	Invert	Avail.Storage	Storage Description
#1	11.00'	359 cf	**12.00'W x 24.00'L x 6.00'H Prismatoid** 1,728 cf Overall - 640 cf Embedded = 1,088 cf x 33.0% Voids
#2	13.00'	640 cf	**8.00'W x 20.00'L x 4.00'H Prismatoid** Inside #1
		999 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#0	Primary	17.00'	**Automatic Storage Overflow** (Discharged without head)
#1	Discarded	11.00'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	16.95'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.06 cfs @ 12.10 hrs HW=11.03' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=11.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond IS2: Infiltration System 2



Summary for Pond IS3: Infiltration System 3

Inflow Area = 259,970 sf, 25.38% Impervious, Inflow Depth = 0.08" for WQV event
Inflow = 0.33 cfs @ 12.29 hrs, Volume= 1,677 cf
Outflow = 0.06 cfs @ 11.75 hrs, Volume= 1,677 cf, Atten= 83%, Lag= 0.0 min
Discarded = 0.06 cfs @ 11.75 hrs, Volume= 1,677 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Pond IT2 : INFILTRATION TRENCH 2

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 28.83' @ 13.14 hrs Surf.Area= 288 sf Storage= 560 cf

Plug-Flow detention time= 71.2 min calculated for 1,677 cf (100% of inflow)
Center-of-Mass det. time= 71.2 min (868.7 - 797.5)

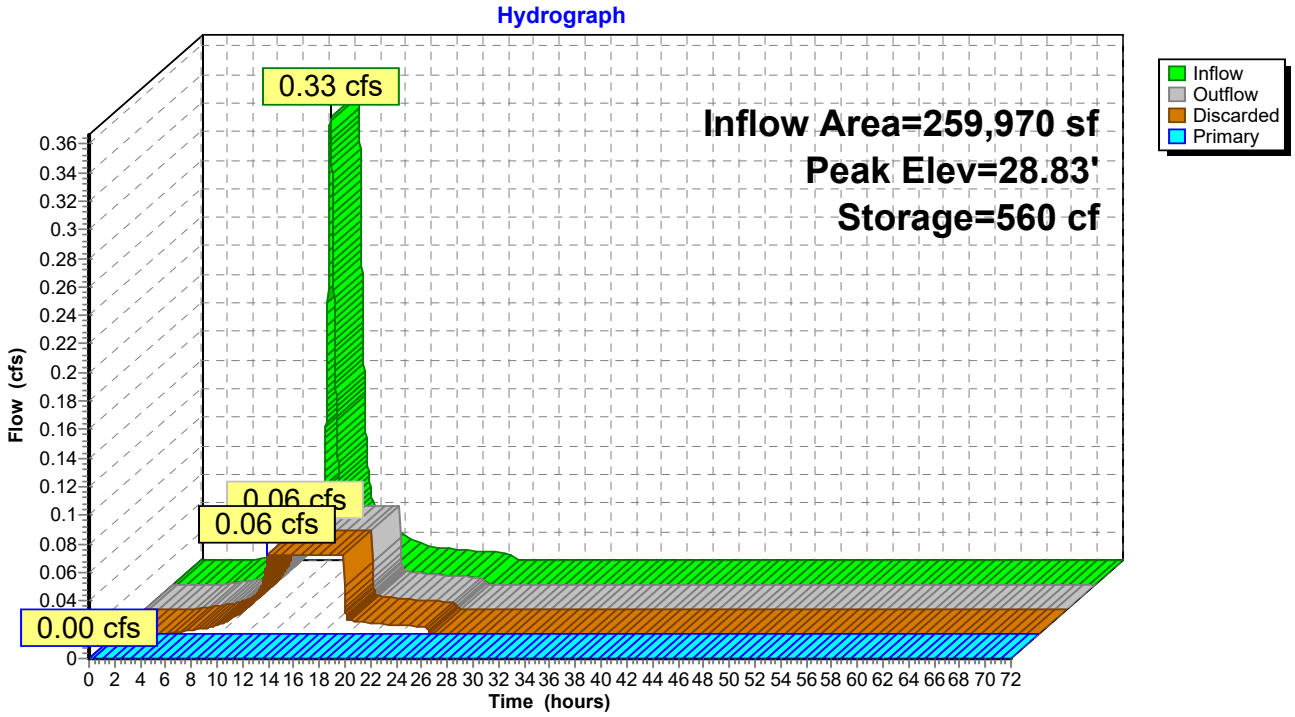
Volume	Invert	Avail.Storage	Storage Description
#1	25.00'	359 cf	**12.00'W x 24.00'L x 6.00'H Prismatoid** 1,728 cf Overall - 640 cf Embedded = 1,088 cf x 33.0% Voids
#2	27.00'	640 cf	**8.00'W x 20.00'L x 4.00'H Prismatoid** Inside #1
		999 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#0	Primary	31.00'	**Automatic Storage Overflow** (Discharged without head)
#1	Discarded	25.00'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	30.75'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.06 cfs @ 11.75 hrs HW=25.06' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=25.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond IS3: Infiltration System 3



Summary for Pond IT1: INFILTRATION TRENCH 1

Inflow Area = 286,690 sf, 25.71% Impervious, Inflow Depth = 0.01" for WQV event
Inflow = 0.05 cfs @ 12.07 hrs, Volume= 167 cf
Outflow = 0.02 cfs @ 12.10 hrs, Volume= 97 cf, Atten= 69%, Lag= 1.7 min
Discarded = 0.02 cfs @ 12.10 hrs, Volume= 97 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Pond IS2 : Infiltration System 2

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 19.46' @ 12.37 hrs Surf.Area= 85 sf Storage= 83 cf

Plug-Flow detention time= 204.3 min calculated for 97 cf (58% of inflow)
Center-of-Mass det. time= 98.7 min (879.5 - 780.8)

Volume	Invert	Avail.Storage	Storage Description
#1	16.50'	98 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 298 cf Overall x 33.0% Voids
#2	20.00'	25 cf	**4.00'D x 2.00'H Vertical Cone/Cylinder** -Impervious
#3	20.53'	237 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
		361 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
16.50	85	0	0
20.00	85	298	298

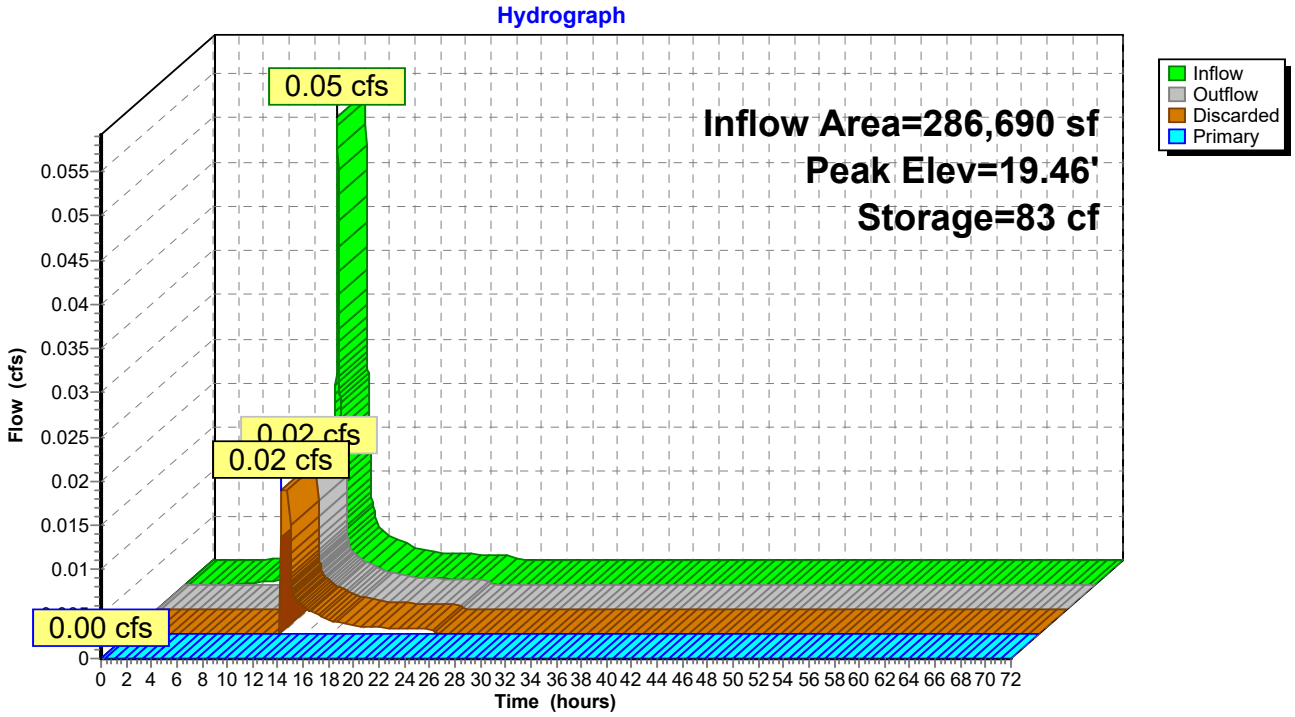
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
20.53	10	0	0
21.00	1,000	237	237

Device	Routing	Invert	Outlet Devices
#1	Discarded	16.50'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Device 1	19.00'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	20.53'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.02 cfs @ 12.10 hrs HW=19.11' (Free Discharge)
↑└**1=Exfiltration** (Exfiltration Controls 0.02 cfs)
↑└**2=Orifice/Grate** (Passes 0.02 cfs of 0.04 cfs potential flow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=16.50' (Free Discharge)
↑└**3=Orifice/Grate** (Controls 0.00 cfs)

Pond IT1: INFILTRATION TRENCH 1



Summary for Pond IT2: INFILTRATION TRENCH 2

Inflow Area = 280,550 sf, 25.55% Impervious, Inflow Depth = 0.02" for WQV event
Inflow = 0.15 cfs @ 12.07 hrs, Volume= 474 cf
Outflow = 0.04 cfs @ 12.13 hrs, Volume= 269 cf, Atten= 73%, Lag= 3.5 min
Discarded = 0.04 cfs @ 12.13 hrs, Volume= 269 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Pond IT1 : INFILTRATION TRENCH 1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 22.23' @ 12.41 hrs Surf.Area= 212 sf Storage= 244 cf

Plug-Flow detention time= 211.9 min calculated for 269 cf (57% of inflow)
Center-of-Mass det. time= 104.9 min (885.8 - 780.8)

Volume	Invert	Avail.Storage	Storage Description
#1	19.25'	245 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 742 cf Overall x 33.0% Voids
#2	19.35'	63 cf	**4.00'D x 5.00'H Vertical Cone/Cylinder** -Impervious
		308 cf	Total Available Storage

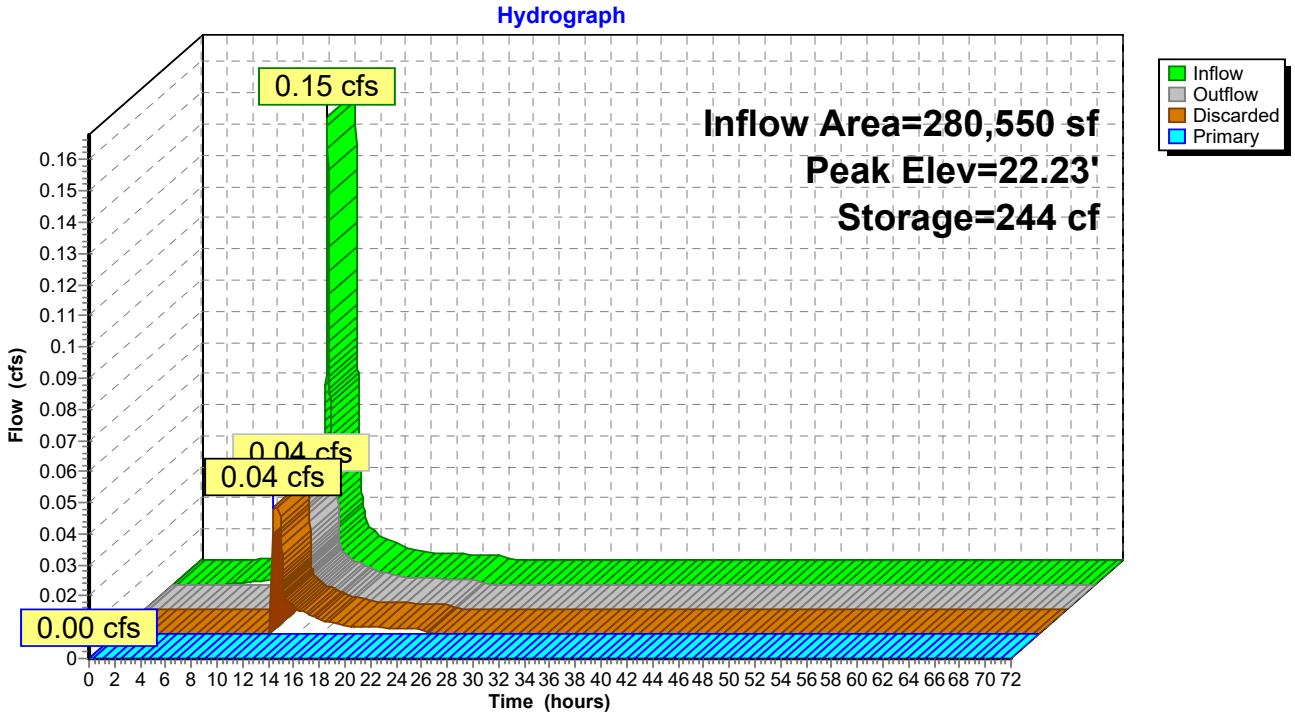
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
19.25	212	0	0
22.75	212	742	742

Device	Routing	Invert	Outlet Devices
#0	Primary	24.35'	**Automatic Storage Overflow** (Discharged without head)
#1	Discarded	19.25'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Device 1	21.75'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	23.35'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.04 cfs @ 12.13 hrs HW=21.93' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.04 cfs)
↑**2=Orifice/Grate** (Passes 0.04 cfs of 0.09 cfs potential flow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=19.25' (Free Discharge)
↑**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond IT2: INFILTRATION TRENCH 2



Summary for Pond IT3: INFILTRATION TRENCH 3

Inflow Area = 168,290 sf, 27.19% Impervious, Inflow Depth = 0.05" for WQV event
Inflow = 0.21 cfs @ 12.07 hrs, Volume= 648 cf
Outflow = 0.05 cfs @ 12.04 hrs, Volume= 426 cf, Atten= 78%, Lag= 0.0 min
Discarded = 0.05 cfs @ 12.04 hrs, Volume= 426 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Pond IS3 : Infiltration System 3

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 33.43' @ 12.46 hrs Surf.Area= 240 sf Storage= 332 cf

Plug-Flow detention time= 188.9 min calculated for 426 cf (66% of inflow)
Center-of-Mass det. time= 91.7 min (872.6 - 780.8)

Volume	Invert	Avail.Storage	Storage Description
#1	28.50'	277 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 840 cf Overall x 33.0% Voids
#2	29.10'	101 cf	**4.00'D x 8.00'H Vertical Cone/Cylinder** -Impervious
		378 cf	Total Available Storage

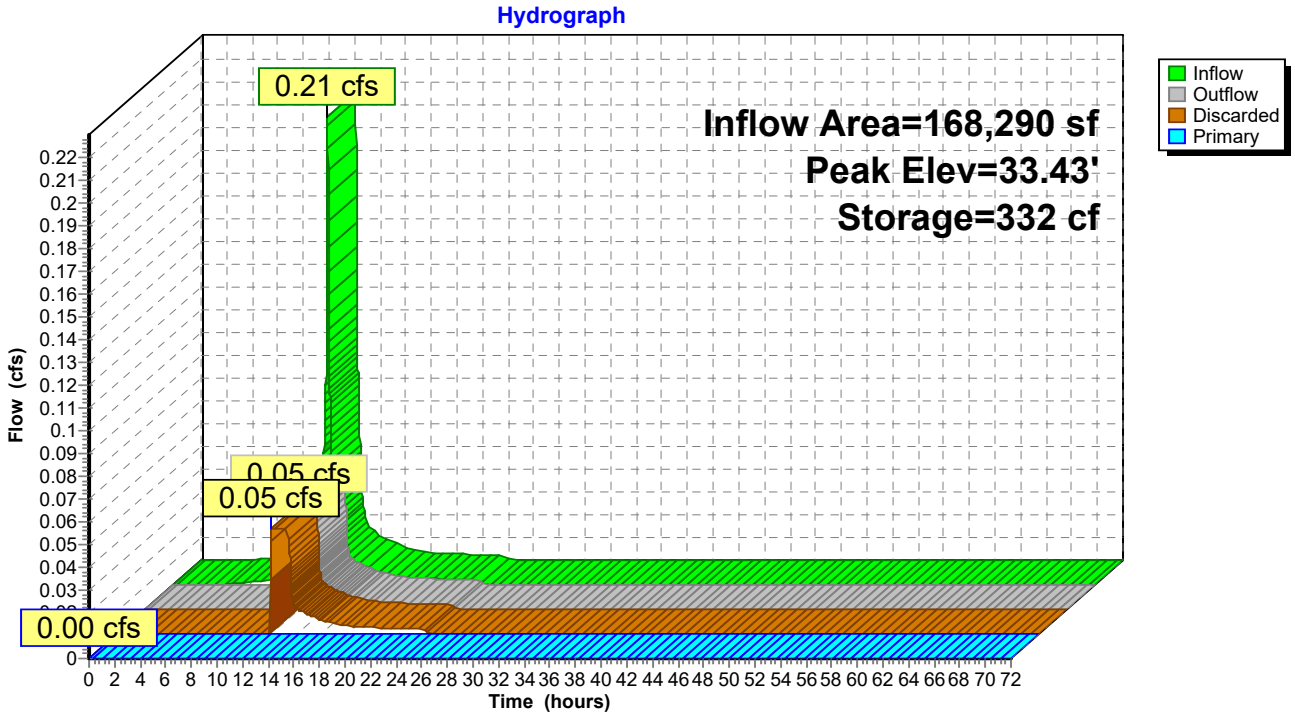
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
28.50	240	0	0
32.00	240	840	840

Device	Routing	Invert	Outlet Devices
#0	Primary	37.10'	**Automatic Storage Overflow** (Discharged without head)
#1	Discarded	28.50'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Device 1	31.00'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	35.40'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#4	Primary	33.70'	**12.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 33.70' / 31.00' S= 0.2700 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Discarded OutFlow Max=0.05 cfs @ 12.04 hrs HW=31.20' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.05 cfs)
└**2=Orifice/Grate** (Passes 0.05 cfs of 0.11 cfs potential flow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=28.50' (Free Discharge)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
└**4=Culvert** (Controls 0.00 cfs)

Pond IT3: INFILTRATION TRENCH 3



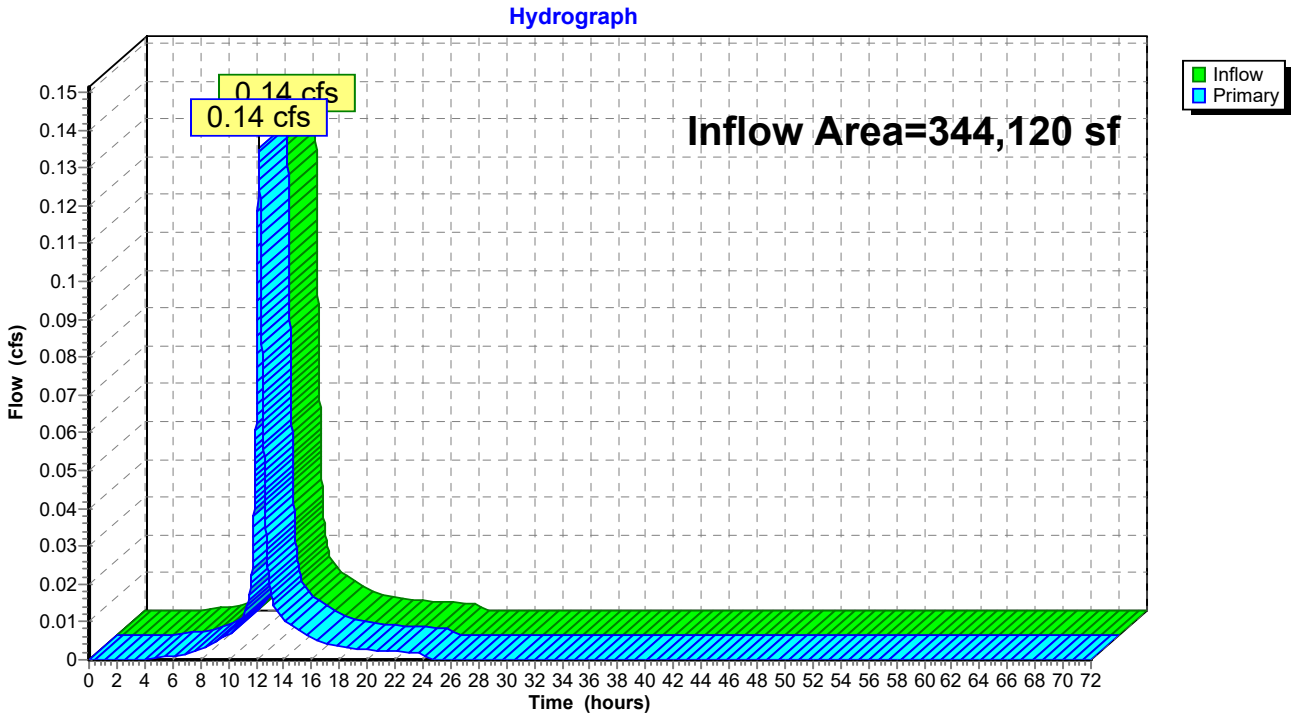
Summary for Pond SP1: Follins Pond

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 344,120 sf, 24.57% Impervious, Inflow Depth = 0.02" for WQV event
Inflow = 0.14 cfs @ 12.22 hrs, Volume= 596 cf
Primary = 0.14 cfs @ 12.22 hrs, Volume= 596 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Pond SP1: Follins Pond



APPENDIX C – Wetland Resources Summary Memo

Horsley Witten Group
Sustainable Environmental Solutions
90 Route 6A • Unit 1 • Sandwich, MA 02563
508-833-6600 • horsleywitten.com

MEMORANDUM

To: Jordan Mora, APCC

From: Ben Wollman, Wetland Scientist

Date: April 24, 2023

Re: Wetland Resources – Follins Pond Road Boat Ramp Stormwater Retrofit Site, Yarmouth, MA

HW has prepared the following memo and site figures to document the wetland resource areas at the referenced site and to provide regulatory context for future work.

General Site Description

The project site has proposed elements located at the southern end of Follins Pond Road, as well as on Gun Rock Road, adjacent to the properties at 22 and 26 Gun Rock Road in Yarmouth, Massachusetts, and is focused on stormwater management improvements in both of these locations.

FEMA Designation

According to the FEMA National Flood Hazard Map (Community Panel No. 25001C0579J, effective July 16, 2014), the portion of the site located at the southern end of Follins Pond Road is located within a Special Flood Hazard Area, Zone AE (1% annual chance of flooding, with base flood elevations of 9 feet) (**Figure 1**).

State-listed Rare Species Habitat and Open Space

According to the most recent version of the *Massachusetts Natural Heritage Atlas* (15th Edition, August 1, 2021), there are no areas of *Estimated Habitat of Rare Wildlife and Certified Vernal Pools* or *Priority Habitat of Rare Species* located at the site, as designated by the Massachusetts Natural Heritage and Endangered Species Program (NHESP).

Wetland Resource Areas

The site supports coastal wetland resource areas, as defined under the Massachusetts *Wetlands Protection Act* (M.G.L. Ch. 131 § 40) and the Town of Yarmouth Wetlands Protection By-law (Chapter 143) and their respective regulations. Horsley Witten Group, Inc. (HW) wetland biologists identified and delineated these resource areas during a site visit on January 10, 2023. Jurisdictional areas identified on or adjacent to the site include Salt Marsh; Coastal Bank; Land Subject to Coastal Storm Flowage (LSCSF); and the 35-foot, 50-foot, and 100-foot Buffer Zones to Salt Marsh and Coastal Bank. Additional resource areas present adjacent to the site include

Figure 1. Excerpt from Federal Emergency Management Agency (FEMA) FIRMette for the subject site.

Land Under Waterbodies and Waterways (LUW) and Banks of Land Under the Ocean, Ponds, Streams, Rivers, Lakes, or Creeks that Underlie an Anadromous/Catadromous Fish Run ("Fish Run"). The site also occurs within a Coastal Watershed Area; however, the proposed project activities do not incorporate any of the prohibited practices referenced in section 2.11(1)(b)(1-6) of the Yarmouth Wetland Regulations. HW followed wetland resource area identification and on-site delineation procedure guidelines described in the Massachusetts Department of Environmental Protection (MassDEP) handbook, entitled *Delineating Bordering Vegetated Wetlands Under the Massachusetts Wetlands Protection Act* (March, 1995), Massachusetts Wetlands Protection Act (M.G.L. Ch. 131 § 40), and its implementing Regulations (310 CMR 10.00), and the Town of Yarmouth *Wetlands Protection By-law* (Chapter 143) and associated Town of Yarmouth Wetland Protection Regulations. Additionally, State Coastal Bank determinations were made following the DEP Program Policy 92-1: Coastal Banks (March 1992).

Prior to conducting field delineations, HW reviewed existing source data, including USGS Geological Survey 7.5 minute topographic maps, Massachusetts Department of Environmental Protection (MassDEP) wetlands source data available through the Massachusetts Geographic Information System (MassGIS), USDA Natural Resources Conservation Service (NRCS) soils survey, U.S. Fish and Wildlife Service National Wetland Inventory (NWI) maps, and other source data to identify the presence of jurisdictional wetlands and waters of the United States within the site. This information was used to compile base mapping to assist in the understanding of the hydrologic variables, soils conditions, and vegetation communities (where applicable).

A brief description of the regulatory definitions and the observed resources areas is provided below.

Salt Marsh

Salt Marsh is defined at 310 CMR 10.32(2) as *"a coastal wetland that extends landward up to the highest high tide line, that is, the highest spring tide of the year, and is characterized by plants that are well adapted to or prefer living in, saline soils. Dominant plants within salt marshes are salt meadow cord grass (Spartina patens) and/or saltmarsh cordgrass (Spartina alterniflora). A salt marsh may contain tidal creeks, ditches and pools."* The Town of Yarmouth Wetland Protection Regulations defines Salt Marsh similarly.

The site supports Salt Marsh areas to the east and west sides of the boat ramp at the end of Follins Pond Road. To the west of the boat ramp the Salt Marsh vegetation is relatively dense and continuous within the tidal zone, extending up to the base of the Coastal Bank where the slope then rises steeply to the north and the vegetation transitions to upland species. To the east of the boat ramp the Salt Marsh vegetation covers most of the land surface within the tidal zone, but the area is more of a mosaic of coverage types, with patches of Coastal Beach areas present between sections of the Salt Marsh, which is comprised of a mix of sand and pebble material. This mosaic of coverage types also extends landward to the base of the Coastal Bank, where there is a similar steep slope rising to the north. Common species observed in the Salt Marsh at the site include smooth cordgrass (*Spartina alterniflora*), saltmarsh rush (*Juncus gerardii*), maritime marsh-elder (*Iva frutescens*), and eastern false willow (*Baccharis halimifolia*).

HW delineated the landward boundary of the Salt Marsh with a series of consecutively numbered blue flagging stations labeled SM 1 – SM 4 (west of the boat ramp) and SM 5 – SM 10 (east of the boat ramp).

Photo 1. View of the Salt Marsh to the west of the boat ramp.

Photo 2. View of the Salt Marsh to the east of the boat ramp.

Coastal Bank

Coastal Bank is defined at 310 CMR 10.30(2) as "*the seaward face or side of any elevated landform, other than a coastal dune, which lies at the landward edge of a coastal beach, land subject to tidal action, or other wetland.*"

Coastal Bank is defined by at 2.05(2) of the Yarmouth Wetland Protection Regulations as *"the seaward face or side of any elevated landform, other than a coastal dune, which lies at the landward edge of a coastal beach, land subject to tidal action or storm flowage, or other wetland. Any minor discontinuity of the slope notwithstanding, the top of the bank shall be the first significant break in slope that occurs above the relevant 100 year flood plain elevation.*"

Coastal Bank is present at the site along the east and west sides of southern end of Follins Pond Road, at the 36 Follins Pond Road and 53 Aunt Dorahs Lane properties, respectively. The Coastal Bank on both sides of the road is primarily vegetated with native trees, with some sections along the western bank containing a mix of native and non-native vines. Near the top of the eastern Coastal Bank there is a stone wall and landscape beds associated with the 36 Follins Pond Road residence. Additionally, there is a set of wooden stairs that traverse the bank at the 36 Follins Pond Road property, to provide water access to the residents, and there appears to be a maintained view corridor in line with the dwelling in the vicinity of the stairway. The area landward of the Coastal Bank on the west side of the road remains relatively naturally vegetated at the western side of the 53 Aunt Dorahs property, with similar species to those growing on the face of the Coastal Banks; however, there is also an apparent view corridor in line with the dwelling, where vegetation is actively being maintained. The two most common species observed along the Coastal Banks include pitch pine (*Pinus rigida*) and black oak (*Quercus velutina*), with additional smaller quantities of species noted that include white pine (*Pinus* strobus), poison ivy (*Toxicodendron radicans*), roundleaf greenbrier (*Smilax rotundifolia*), Virginia creeper (*Parthenocissus quinquefolia*), and Asiatic bittersweet (*Celastrus orbiculatus*).

To determine the State regulatory limits of the Coastal Bank, HW established transects along the face of the Coastal Bank (with white flagging stations) on both sides of Follins Pond Road in accordance with the DEP Program Policy 92-1. Transect 1 (T1) is located on the east side of the road and Transect 2 (T2) is located on the west side of the road. Both Transect 1 and Transect 2 conform to Figure 2 of DEP's Program Policy 92-1.

To determine the local regulatory limits of the Coastal Bank, HW established a series of consecutively numbered white flagging stations along the landward boundary of the Coastal Banks where the first significant break in slope occurred. The flagging stations were labeled TOCB 1 – TOCB 5 (west side of the road) and TOCB 6 – TOCB 9 (east side of the road).

Photo 3. View of the Coastal Bank present along the east side of Follins Pond Road.

Photo 4. View of the Coastal Bank present along the west side of Follins Pond Road.

Land Subject to Coastal Storm Flowage

Land Subject to Coastal Storm Flowage is defined at 310 CMR 10.04 as "*land subject to any inundation caused by coastal storms up to and including that caused by the 100-year storm, surge of record or storm of record, which ever is greater.*"

The project site elements at the southern end of Follins Pond Road are located within a Special Flood Hazard Area, Zone AE (1% annual chance of flooding, with base flood elevations of 9 feet) (see **Figure 1** above).

Invasive Species

Invasive plants (as defined by the Massachusetts Invasive Plant Advisory Group) were present at or near the site but were isolated to a small area of the Coastal Bank just west of Follins Pond Road and limited in abundance. Asiatic bittersweet was the only invasive species noted to be present in this location. The Massachusetts Invasive Plant Advisory Group identifies invasive plant species as "non-native species that have spread into native or minimally managed plant systems in Massachusetts," and which "cause economic or environmental harm by developing self-sustaining populations and becoming dominant and/or disruptive to those systems." For future planning purposes, the Town may wish to develop a management plan for reducing or eliminating these plants at this site to allow for the establishment of naturally vegetated protective buffers to the wetland resource areas.

If you have any questions regarding our findings, or if HW may be of further assistance, please do not hesitate to contact me directly at bwollman@horsleywitten.com or at (508) 833-6600.

APPENDIX D – Soil Test Pit Logs

Commonwealth of Massachusetts

City/Town of Yarmouth

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review

Deep Observation Hole Number: 1 (Hole #) | 2/20/23 (Date) | 9:00 am (Time) | 40F, raining (Weather) | 41°42'36.8"N (Latitude) | 70°11'12.3"W (Longitude)

1. Land Use: Road Shoulder (e.g. woodland, agricultural field, vacant lot, etc.) | None (Vegetation) | Few (Surface Stones (e.g. cobbles, stones, boulders, etc.)) | 8-10% (Slope (%))

Description of Location: West side of Follins Pond Road

2. Soil Parent Material: Sandy Glaciofluvial deposits | Outwash plain (Landform) | Footslope (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances From: Open Water Body ~50 feet | Drainage Way feet | Wetlands 20 (salt marsh) feet | Property Line ~5 feet | Drinking Water Well feet | Other feet

4. Unsuitable Materials Present: ☐ Yes ☑ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☑ No If Yes: _____ Depth weeping from pit _____ Depth standing water in hole (after 1 hour)

Soil Log

Depth (in)	Soil Horizon/ Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles/Stones			
0-14	A	MS	10 YR 3/2	-	-	-	5	-	GR	VFR	
14-22	Bw	MS	7.5 YR 6/8	-	-	-	-	-	SG	L	
22-48	C1	MS	10 YR 6/2	-	-	-	-	-	SG	L	
48-90	C2	MS	10 YR 8/2	-	-	-	-	-	SG	L	

Additional Notes: Moist soil at 90" but not wet. Stopped at 90" due to cave in

Commonwealth of Massachusetts

City/Town of Yarmouth

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review

Deep Observation Hole Number: 2 (Hole #) | 2/20/23 (Date) | 8:30 a (Time) | 40F, raining (Weather) | 41°42'40.2"N (Latitude) | 70°11'13.3"W (Longitude)

1. Land Use: Road Shoulder (e.g. woodland, agricultural field, vacant lot, etc.) | Grass, mulch (Vegetation) | Few (Surface Stones (e.g. cobbles, stones, boulders, etc.)) | 8-10% (Slope (%))

Description of Location: Southeast corner of intersection of Follins Pond Road/Gun Rock Road

2. Soil Parent Material: Sandy Glaciofluvial deposits | Outwash plain (Landform) | Backslope (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances From:
Open Water Body >100 ft feet | Drainage Way feet | Wetlands >100 ft feet
Property Line ~5 feet | Drinking Water Well feet | Other feet

4. Unsuitable Materials Present: ☑ Yes ☐ No If Yes: ☐ Disturbed Soil ☑ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☑ No If Yes: _____ Depth weeping from pit _____ Depth standing water in hole (after 1 hour)

Soil Log

Depth (in)	Soil Horizon/ Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles/Stones			
0-4	A	MS	10 YR 3/2	-	-	-	5	-	GR	VFR	
4-14	HTM	MS	10 yr 6/2	-	-	-	-	-	SG	L	
14-22	HTM	Dense Grade	-	-	-	-	-	-	-	-	
22-48	Bw	MS	10 YR 6/4	-	-	-	-	-	SG	L	
48-78	C	MS	10 YR 8/2	-	-	-	-	-	SG	L	

Additional Notes: Stopped at 78" due to cave in

Commonwealth of Massachusetts

City/Town of Yarmouth

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review

Deep Observation Hole Number: 3 (Hole #) | 2/20/23 (Date) | 1 PM (Time) | 40F, cloudy (Weather) | 41°42'40.2"N (Latitude) | 70°11'10.4"W (Longitude)

1. Land Use: Road (e.g. woodland, agricultural field, vacant lot, etc.) | None (Vegetation) | None (paved) (Surface Stones (e.g. cobbles, stones, boulders, etc.)) | 1-3% (Slope (%))

Description of Location: Southeast corner of bend in Gun Rock Road

2. Soil Parent Material: Sandy Glaciofluvial deposits | Outwash plain (Landform) | Backslope (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances From:

Open Water Body	>100 ft feet	Drainage Way	feet	Wetlands	>100 ft feet		
Property Line	5-10 ft feet	Drinking Water Well	feet	Other	feet		

4. Unsuitable Materials Present: ☑ Yes ☐ No If Yes: ☐ Disturbed Soil ☑ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☑ No If Yes: _____ Depth weeping from pit _____ Depth standing water in hole (after 1 hour)

Soil Log

Depth (in)	Soil Horizon/ Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles/Stones			
0-4	Pavement	-	-	-	-	-	-	-	-	-	
4-10	Bw	MLS	10 YR 3/4	-	-	-	5	-	SG	L	
10-56	C1	MS	10 YR 5/6	-	-	-	5	5	SG	L	
56-96	C2	FS	2.5 YR 7/3	-	-	-	5	5	SG	L	

Additional Notes:

APPENDIX E – Operation and Maintenance Guide

Stormwater Operations & Maintenance Guide

Follins Pond Boat Ramp

Table of Contents

APPENDICES

1. INTRODUCTION

This document provides a general description along with the operation and maintenance requirements for the Follins Pond Boat Ramp Stormwater Retrofit project at Follins Pond Road and Gun Rock Road. The responsible parties are required to inspect and maintain all measures as outlined in this maintenance guide throughout the year. Site maintenance is divided into three categories as outlined below.

1. Green Stormwater Infrastructure
    - Structural Components
    - Structural Maintenance Schedule
    - Planting
    - Landscape Maintenance Schedule
    - Weed Guide

2. General Site Maintenance
    - Trash & Debris
    - Pet Waste
    - Pavement Sweeping
    - Contributing Drainage Areas
    - Snow Removal
    - De-icing

3. Long-Term Pollution Prevention Measures

2. RESPONSIBLE PARTIES AND BUDGET

The Follins Pond Boat Ramp is a Town-owned and operated boat ramp. The Town will provide staff, volunteers as possible, and funding for the long-term O&M at the site. The estimated average annual O&M budget for the proposed system is shown below:

- **Infiltration Trench (3):** **$3,000**
  ($1,000/trench)
- **Infiltration Chambers (1):** **$1,500**
  ($1,500/chamber system)

Owner contact information is provided below:

Owner: **Town of Yarmouth**
Contact: **Department of Public Works**
Amanda Lima, Town Engineer
74 Town Brook Road
West Yarmouth, MA 02673
508-398-2231

Contact: **Division of Natural Resources**
Bill Bonnetti
424 Route 28
West Yarmouth, MA 02673
508-760-4800

Owner - Signature:_____ Date:_____

Owner - Signature:_____ Date:_____

3. GREEN STORMWATER INFRASTRUCTURE

3.1. How Does Green Infrastructure Work?

Green Stormwater Infrastructure (GSI) is a nature-based approach to stormwater treatment and management. These stormwater practices or "treatment areas" are designed to mimic nature and use the natural filtration properties of soil and plants to remove pollutants from stormwater runoff prior to discharging to the municipal drainage system or waterbodies.

GSI relies on the following basic steps to function properly. Structural components of the practices facilitate the functioning of the steps. If one of these steps, or components, does not work properly, the entire system can be compromised and the GSI practice itself could be contributing to maintenance problems. This can lead to landscape nuisances, more frequent maintenance, and costly repairs/improvement. The steps are:

1. ***Collect*** (Inlets)
2. ***Move Water*** (Conveyance) if needed, can come after capturing sediment
3. ***Capture Sediment*** (Pretreatment)
4. ***Treat and Manage*** (Filter, Infiltrate or Store)
5. ***Overflow*** (Structures and Spillways)

3.2. What is required for Maintenance?

As these are nature-based systems that rely on plant upkeep, the maintenance for GSI typically falls under landscape and general site maintenance services. Proper operation and maintenance (O&M) are vital to its long-term viability. Regularly scheduled maintenance can prevent system failures due to sediment build-up, damage, or deterioration. The maintenance requirements outlined in this guide are critical to ensure proper treatment, maintain storage capacity and preserve the visual integrity.

General maintenance includes the following:

1. Removing sediment from the pretreatment practices used to capture sediment.
2. Maintaining the proper drainage function and pollutant removal capacity of the systems.
3. Maintaining healthy native trees, plants, and vegetative cover as well as the removal of unwanted weeds and invasive species.

It is recommended that all practices be maintained regularly as part of the routine landscape maintenance or at a minimum four times per year and after major rain events:

- **Early Spring**: during spring cleanup
- **Summer:** during lawn mowing and other routine site maintenance
- **Early Fall:** when leaves begin to fall
- **Late Fall/Early Winter:** after all the leaves have fallen during leaf removal
- **After major storm events**: 2" of rain or greater.

The following sections describe the general function and landscape maintenance of each practice on the site. Included in the appendices is a specific Inspection Report for the site (**Appendix A**) along with a plan showing the location of the items to be inspected and maintained (**Appendix B**).

3.3. What practices are used at this site?

The following practices are present at this site:

a. Infiltration Trench: Infiltration Trenches are used for temporary underground storage of stormwater in a stone reservoir, allowing it to infiltrate into the underlying native soil.

b. Stormwater Underground Infiltration Chambers (UICs): UICs include a range of proprietary, modular structures embedded in clean, crushed stone. They are installed underground, typically under parking or landscaped areas, and create large void spaces for temporary storage of stormwater, allowing it to infiltrate into the underlying native soil.

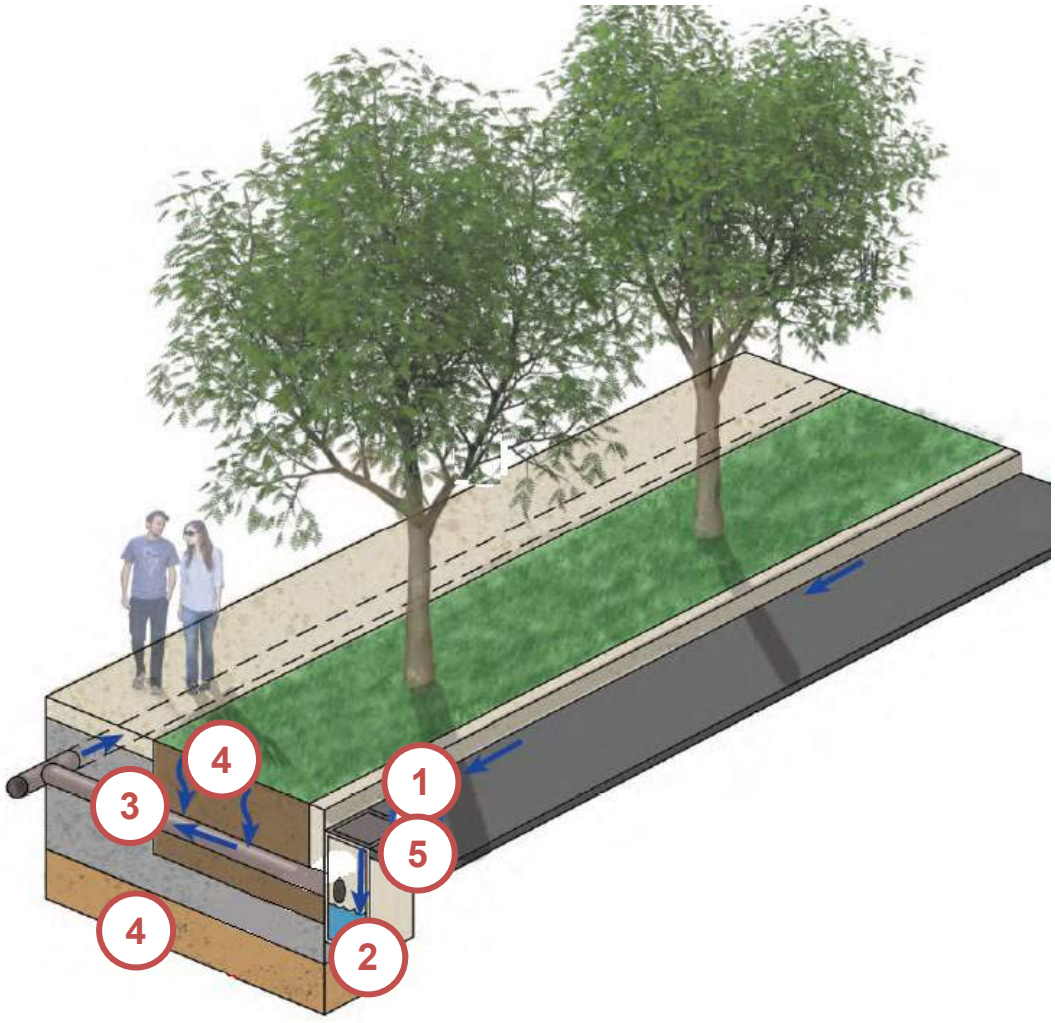
The maintenance for the green infrastructure is divided into two categories:

a. The **Structural Components** that make up the basic steps of a functioning system.

b. The **Plantings** that are the landscape and filtration element.

Each category is further described in the sections below. In addition, maintenance of the existing infiltration systems is important for the overall function of the stormwater management at this site. The Town previously received the Operations and Maintenance Plan for the existing infiltration systems along Follins Pond Road, prepared by Norfolk Ram Group, LLC., which is provided in Appendix E of this report.

4. STRUCTURAL COMPONENTS: INFILTRATION TRENCH



1. ***Collect***: Stormwater runoff is collected along the road gutter via overland flow through a water quality unit inlet.

2. ***Capture Sediment***: The water quality unit with catch basin grate captures sediment, trash, and debris.

3. ***Move Water:*** Stormwater runoff flows through the 8" perforated underdrain pipe which discharges to the stone reservoir.

4. ***Infiltrate***: Stormwater is infiltrated into the subsoils.

5. ***Overflow***: During larger rain events, once the stone reservoir and water quality unit have reached capacity, runoff will continue down the boat ramp.

MAINTENANCE SCHEDULE: INFILTRATION TRENCH

A site inspection of the infiltration trench components shall be conducted at least twice a year in the Spring and Fall, and after major storm events (2" of rain or greater). Debris and trash should be removed monthly (between April and November) and sediment removal should occur during the two site inspections and during the monthly debris and trash inspections as needed. See the calendar below and the Inspection Report in **Appendix A** for more information.

Infiltration Trench General Maintenance Schedule												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**July**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Task	**Frequency & Time of the Year**											
Site Inspection				**X**							**X**	
Debris & Trash Removal				**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	
Sediment Removal				**X**	x	x	x	x	x	x	**X**	

should **also** be completed after major storm events

X required inspection

x as needed

- After rain event look for:
  - If standing water does not drain after 48 hours. See Inspection Report for action items.

See Plantings section for information on plantings maintenance of the infiltration basin. Use the plantings maintenance calendar to combine maintenance efforts.

5. STRUCTURAL COMPONENTS: STORMTECH INFILTRATION CHAMBERS

See **Appendix C** for the Stormtech Owner's Manual.

6. PLANTINGS

6.1. Plantings

The planting design for the site consists of three landscape maintenance areas. The “mow” area which consists of turf, the “no mow” areas. The plantings maintenance checklist is included in **Appendix A**, and the full planting plan is available in **Appendix D**.

“Mow” Areas

No “Mow” Area

PLANTINGS: "MOW" AREAS MAINTENANCE

There is an area of the site that is allowed to be maintained as "mowed" lawn as necessary. Landscape maintenance of "mowed" lawn areas includes the following:

Seeding

Loam and reseed bare spots with a seed mix that matches existing species.

Mowing/Weed Whacking

Cut only 1/3 of vegetation. Do not mow during drought periods or when excessively wet. Depending on height of grasses and the time of year, grass cuttings/stalks may need to be raked and removed from site.

Watering

Allowing the lawn areas to "brown" is desired. Water only during drought conditions or during reseeding establishment period.

Fertilizing

No fertilizer shall be used.

Weeding

Weeding should be limited to invasive and weedy species (see section 3.6 Weed Identification below and the Weed Guide at https://web.uri.edu/riss/files/In-the-Weeds.pdf). Non-chemical methods (hand pulling and hoeing) are required; chemical herbicides should be avoided. Properly remove and dispose of all invasive species off site as to prevent colonization elsewhere, this includes disposal on land beyond the project area.

Monitoring

During the establishment period, walk the mow areas monthly during the first year to look for invasive species, bare spots and identify potential pest or disease problems. Properly remove and dispose of all invasive species as to prevent colonization elsewhere, this includes disposal on land beyond the project area.

Debris & Trash

Remove and properly dispose litter from all areas prior to mowing.

PLANTINGS: NO "MOW" AREA MAINTENANCE (INFILTRATION TRENCHES)

By design, plants in no "mow" areas are meant to flourish throughout the growing season, leaving dry standing stalks during the dormant months. Plants do not require fertilizers or watering (except during drought or establishment period). Frequent mowing would eliminate selected species, may promote the growth of undesirable plants, and require additional maintenance and watering. It is recommended that herbaceous materials in this area be cut back no more than one time per year and only as necessary. Remove and replace vegetation as necessary, using the appropriate species as shown on the Planting Plan. The best time to plant is in early to mid-fall or early to mid-spring. Specific maintenance activities of the "no mow" area include:

Seeding

Loam and reseed bare spots with the specified seed mix as shown on the Planting Plan.

Cutting Back

Cut herbaceous materials with shears a maximum of once a year in early spring. Otherwise, allow herbaceous materials to grow to their natural heights (12" to 36") to maintain a natural appearance. Do NOT cut area lower than 6" – maintain sporadic wooden stakes on site at 6" height to provide visual cues during cutting. Depending on height of grasses and the time of year, grass cuttings/stalks may need to be raked and removed from site so as not to clog drainage. Use a leaf blower as needed to assist in clean-up.

Mulching

Replenish mulched areas once per year to maintain a minimum mulch depth of 3". Use locally sourced double-shredded wood or bark mulch free of weed seed and dyes.

Pruning

Prune trees and shrubs to remove deadwood and low hanging branches.

Watering

Water only during drought conditions or during reseeding establishment period.

Fertilizing

No fertilizer shall be used.

Weeding

Weeding should be limited to invasive and weedy species (see section on Weed Identification below and the Weed Guide at https://web.uri.edu/riss/files/In-the-Weeds.pdf). Non-chemical methods (hand pulling and hoeing) are required; chemical herbicides should be avoided. Properly remove and dispose off site all invasive species as to prevent colonization elsewhere; this includes disposal on land beyond the project area.

Monitoring

During the establishment period, walk the "no mow" areas monthly without the intent to cut, but to look for invasive species, bare spots and identify potential pest or disease problems.

Debris & Trash

Remove and properly dispose of litter from all areas.

PLANTINGS: REPLACEMENTS

The plants that thrive in infiltration trenches are typically quite drought tolerant due to the filter profile having a top layer of planting soil and sandy soil media below. They need to be able to withstand periods of inundation after storm events; however, when it doesn't rain, there will be less water held naturally in the sand than in other soil types for the plants to use, so they need to tolerate dry periods as well.

Specifying plants native to the area increases the ecosystem benefits by helping to support native wildlife like pollinators.

If replacements are needed, use the planting plan as a guide (see **Appendix D**). However, if all the plants of a certain species have not done well in the infiltration trenches or other locations on the site, do not replace with that same species. Rather, replant with one or more of the other species that has thrived under the conditions or have a plant professional choose a different species based on current photos of the site.

Site specific considerations for plants in infiltration trenches should be:

- Preferably native and pollinator-friendly
- Drought tolerant
- Tolerant of inundation for 24 hours
- Salt and wind tolerant
- A mix of different types of plants that will create a resilient plant community: cold & warm season grasses, perennials, groundcovers in all areas.

PLANTINGS: MAINTENANCE SCHEDULE

By design, plants in the infiltration trenches are meant to help uptake nutrients from the stormwater and flourish throughout the growing season. The plants do not require fertilizers or mulch, and, after establishment, only need water during periods of drought. Remove and replace vegetation as necessary, using the appropriate species as discussed in the no-mow section above. Weeding and monitoring for invasive species should occur quarterly during the growing season. An annual spring "clean up" includes cutting last season's growth of the perennials and pruning as needed. See the calendar below, the Plantings Maintenance Checklist in **Appendix A**, the Weed Identification section, and the Weed Identification Guide at https://web.uri.edu/riss/files/In-the-Weeds.pdf for more information.

Infiltration Trenches Landscape Maintenance Schedule												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Task	**Frequency & Time of the Year**											
Cutting/Mulching				**X**								
Mowing				x	**X**	x	x	x	x	x	x	
Weeding				**X**		**X**			**X**		**X**	
Monitoring				**X**		**X**			**X**		**X**	
Watering						x		x		x		
Seeding				x	x				x	x		
Plant Replacement				x	x				x	x		

"Mow" Areas
No "Mow" Areas
All areas

X required
x as needed

- Trash and debris are removed during monthly structural component inspections but can also be completed during landscape maintenance visits for weeding and monitoring.

Yellow Toadflax *(Linaris vulgaris)*

Redroot Pigweed- (*Amaranthus retroflexus)*

Smartweed *(Polygonum lapathifolium)*

Dandelion *(Taraxacum officinale)*

Fireweed *(Erechtites hieracifolia)*

Spotted Spurge (Euphorbia maculata)

Crabgrass *(Digitaria ischaemum)*

Crabgrass with seedheads

Ragweed (*Ambrosia artemisiifolia*)

Japanese Knotweed (Polygonum cuspidatum)

Ragweed (*Ambrosia artemisiifolia*)

Oriental Bittersweet (*Celastrus orbiculatus*)

Green Foxtail (Setaria viridis)

Norway Maple Tree Seedling (Acer platanoides)

Catalpa Tree Seedling (Catalpa speciosa)

Purple Loosestrife (*Lythrum salicaria*)

Field Bindweed (*Convolvulus arvensis*)

Black Swallow-wort (*Cynanchum louisea*)

7. GENERAL SITE MAINTENANCE

General site maintenance includes the following requirements:

Trash & Debris

Remove and properly dispose of all trash and debris.

Pet Waste

Visitors to the site are encouraged to pick up after their pets. Remove and properly dispose of all pet waste left behind. Pet waste should be picked up and disposed of properly to reduce bacteria and nutrient levels in stormwater.

Pavement Sweeping

Paved roadways should be mechanically swept, at a minimum of once per year in early spring, to remove accumulated sand and sediment debris. There is a lot of leaf litter at this site, so it is recommended to remove leaf litter a few times during the fall months.

Snow Removal

Due to the potential for plant damage, snow piling and or removal is NOT recommended in the infiltration trenches.

De-Icing

When de-icing compounds are necessary for areas draining to the green stormwater infrastructure, the least harmful chemicals should be used. Excessive salting should be avoided. Use of large amounts of sand should also be avoided, since it may obstruct the conveyance system. Ice removal is NOT permitted in the infiltration trenches.

8. LONG-TERM POLLUTION PREVENTION MEASURES

Long-term pollution prevention measures implemented at the site reduce pollutants in stormwater discharges. The following precautions will be employed on an on-going basis.

Spill Prevention & Control Measures

To minimize the risk of spills or other accidental exposure of materials and substances to stormwater runoff, the following material management is to be used when working on site.

- Any materials stored on-site will be stored in a neat, orderly manner in their appropriate containers.
- Products will be kept in their original containers with the original manufacturer's label.
- Substances will not be mixed with one another unless recommended by the manufacturer.
- Manufacturers' recommendations for proper use and disposal will be followed.
- The contractor's supervisor will be issued this Guide to ensure proper use and disposal of materials.

Materials or substances listed below may be present on-site for maintenance and care should be taken to avoid spills:

  - Petroleum Based Products

The following product-specific measures will be followed on-site:

- *Petroleum Products* - All on-site vehicles will be monitored for leaks and receive preventative maintenance to reduce the chance of leakage.
- *Grass Clipping, Leaf Litter and Plant Debris* – are to be removed from the property and not disposed on site.

APPENDIX A – Inspection Checklists

- Infiltration Trenches
- Underground Infiltration Chambers
- Landscaping

Operation and Maintenance Checklist
Follins Pond Boat Ramp

Date:

Time:

Inspector:

Maintenance Item	Description	Maintenance (Y/N)
1, 2 & 3. Catch Basins		
Debris Cleanout	Remove all trash, leaf litter and debris from the catch basins, inlet flumes, and forebays.	
Sediment/Organic Debris Removal	Check for clogging and sediment accumulation that impacts inflow and outflow. Remove and properly dispose of when sediment is >3" in forebays. Remove/cut any vegetation that sprouts through voids in stone, pavement, or pavers.	
Erosion	Check for areas of erosion (gullies, animal burrowing, or overtopping), particularly near check dam weirs, perimeter, and guard rail posts. Repair as necessary and return to design grades.	
Actions to be taken:		
4 & 5. Infiltration Trenches and Underground Infiltration Chambers		
Debris Cleanout	Remove trash and debris from the surface.	
Erosion	Signs of erosion gullies, animal burrowing, or overtopping are observed. Repair as necessary.	
Sediment/Organic Debris Removal	Remove sediment accumulation and properly dispose when accumulation is greater than or equal to 3 inches.*	
Water Draining properly	Check for leaf litter, debris, and sediment accumulation in overflow structures that impact inflow to underground infiltration features. If accumulation present, schedule cleaning. Check for sediment accumulation and/or standing water that indicates clogging in the infiltration trench. If sediment or standing water is observed in the trench for more than 48 hours after a storm event, clean out infiltration trench. Check for sediment accumulation and/or standing water that indicates clogging in the chambers. If sediment or standing water is observed in chambers (use inspection ports) for more than 48 hours after a storm event, clean out chambers per manufacturer's instructions in Appendix C.*	
Actions to be taken:		

Operation and Maintenance Checklist
Follins Pond Boat Ramp

General Site Maintenance		
Debris Removal	Remove trash from perimeter areas.	
Pet Waste Removal	Remove any pet waste from perimeter areas.	
Pavement Sweeping	Sweep road minimum once a year after spring thaw.	
Contributing drainage area	Confirm that contributing drainage area stabilized – stabilize as necessary.	
Snow Removal	Ensure snow piles do no block inlet structures and are not placed in the green stormwater infrastructure.	
De-Icing	If needed on road, use de-icing compounds with the least harmful chemicals. Avoid excessive salting or large amounts of sand.	
Actions to be taken:		

*Sediment shall be disposed of offsite in a pre-approved location.

Plantings Maintenance Checklist
Follins Pond Boat Ramp

Location:

Date:

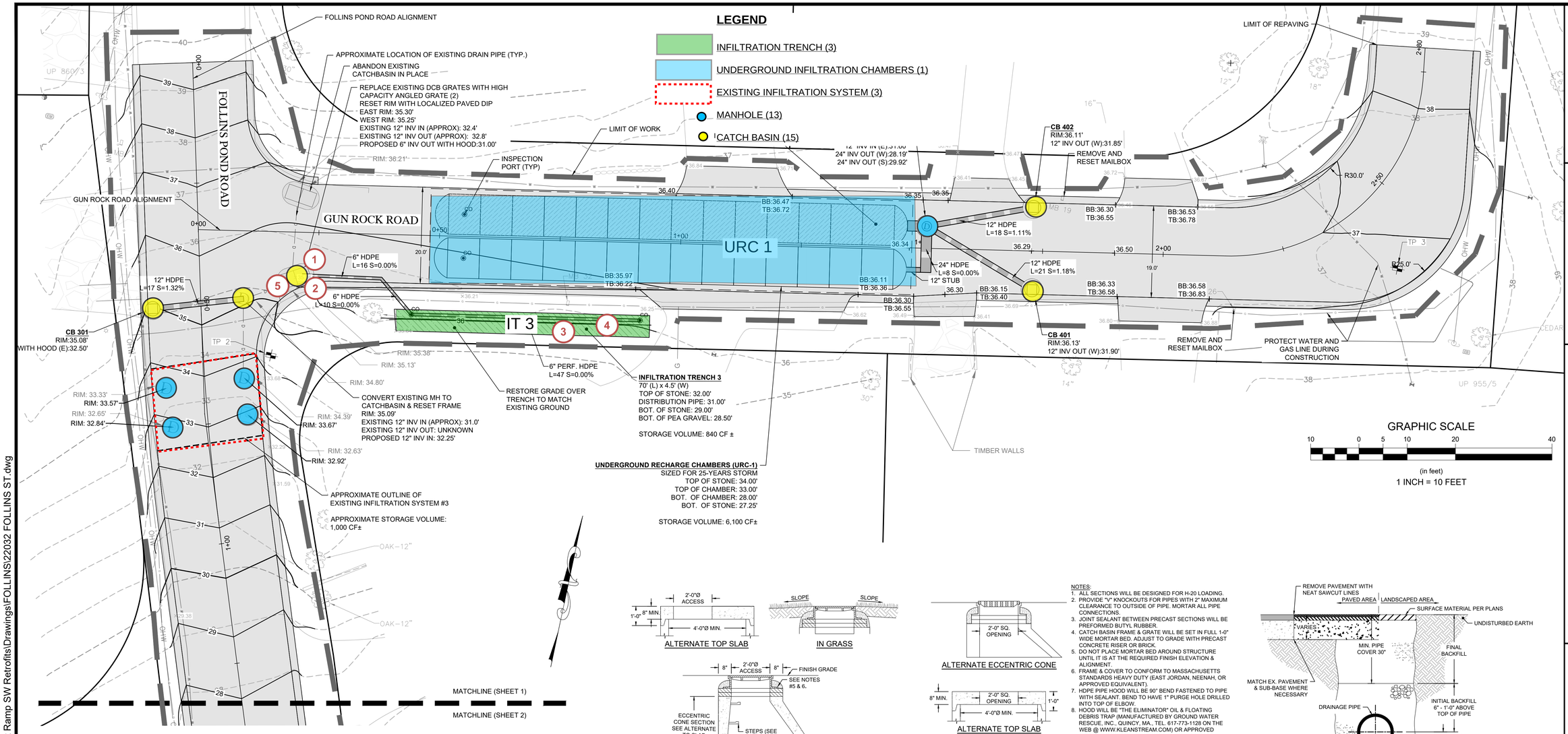
Inspector:

Task	Description	Complete (Y/N)
Cutting	• Cut with shears once a year in the early spring. • Do not cut lower than 6". • Blow out leaves and cuttings for easy removal. • Remove cuttings so the bioretention area does not clog.	
Mowing	• Mow twice a year or more frequently as needed with a mulching mower or weed whacker depending on the frequency of cutting. • Bag clippings as needed and dispose of off site. • Maintain a cutting height of 3" or greater. • Leave the grass taller in the warmer months. • Trim edges when necessary.	
Weeding	• Weeding should be limited to invasive and exotic species, which can overwhelm the desired plant community.* • Non-chemical methods including hand pulling and hoeing are recommended. • Chemical herbicides are not allowed.	
Monitoring	• Look for potential invasive species and identify potential disease. Remove and dispose of all invasive species.* (see weeding)	
Watering	• During establishment or drought conditions, plants should be watered a minimum of once every seven to ten days.	
Seeding	• Loam and re-seed bare spots with the specified seed mix as shown on the Planting Plan.	
Plant Replacement	• Replace/replant diseases, unhealthy or dead plans to maintain a healthy plant community	
Fertilizing	NONE	
Mulch	NONE	
Actions to be taken:		

*Invasive species shall be disposed of offsite in a pre-approved location.

"Mowed" Areas
No "Mow" Areas (Bioretention Areas)
All areas

APPENDIX B – Overall SCM Locations



GRAPHIC SCALE

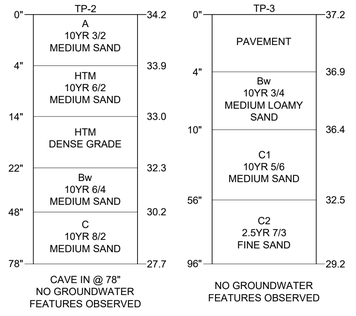
10 0 5 10 20 40

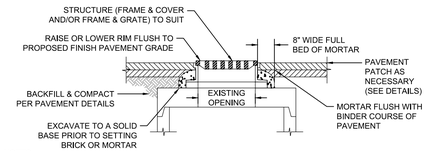
(in feet)

1 INCH = 10 FEET

SOIL TEST PIT DATA

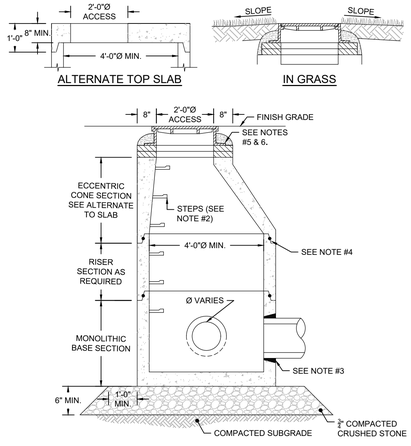
PERFORMED BY:E HOFFMAN HORSLEY WITTEN GROUP, INC.
DATE:JANUARY 19, 2023





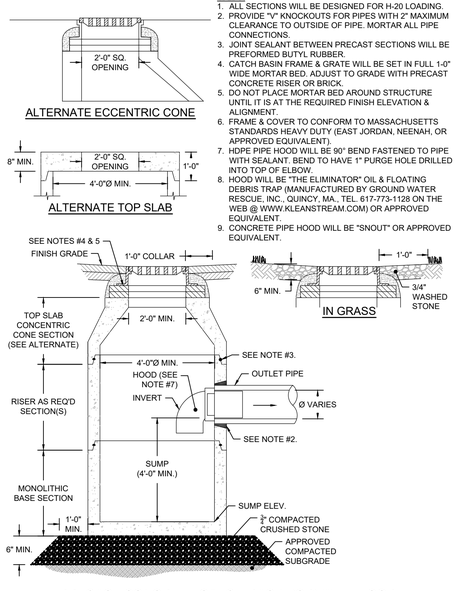
NOTES:
1. ANY REPLACEMENT STRUCTURES (FRAME & COVERS AND/OR FRAME & GRATE) TO BE DESIGNED FOR HS-20 LOADING.
2. REPLACEMENT STRUCTURES TO CONFORM TO MASSACHUSETTS STANDARDS WITH DIMENSIONS TO SUIT, (LEBARON FOUNDRY, NEENAH CASTINGS, OR APPR, EQUIVALENT).
3. ALL STRUCTURES TO BE SET IN FULL MORTAR BED FLUSH WITH THE BINDER COURSE OF PAVEMENT. ADJUST TO GRADE WITH CLAY BRICK AND MORTAR (2 BRICK COURSES TYPICALLY, 5 BRICK COURSES MAXIMUM) OR PRECAST CONCRETE RISER.
4. RIM TO BE FLUSH WITH TOP COAT AND ALL MORTAR TO BE COMPLETELY COVERED WITH A LAYER OF TOP COAT PER THE DETAILS.

MANHOLE COVER OR CATCH BASIN FRAME & GRATE ADJUSTMENT
NOT TO SCALE



NOTES:
1. ALL SECTIONS WILL BE DESIGNED FOR H-20 LOADING.
2. COPOLYMER MANHOLE STEPS WILL BE INSTALLED AT 1'-0" O.C. FOR THE FULL DEPTH OF THE STRUCTURE.
3. PROVIDE "V" KNOCKOUTS FOR PIPES WITH 2" MAXIMUM CLEARANCE TO OUTSIDE OF PIPE. MORTAR ALL PIPE CONNECTIONS.
4. JOINT SEALANT BETWEEN PRECAST SECTIONS WILL BE PREFORMED BUTYL RUBBER.
5. DRAIN MANHOLE FRAME & COVER WILL BE SET IN FULL 1'-0" MORTAR BED. ADJUST TO GRADE WITH PRECAST CONCRETE RISER OR BRICK.
6. DO NOT PLACE MORTAR BED AROUND STRUCTURE UNTIL IT IS AT THE REQUIRED FINISH ELEVATION & ALIGNMENT.
7. FRAME & COVER TO CONFORM TO MASSACHUSETTS STANDARDS HEAVY DUTY (EAST JORDAN, NEENAH, OR APPROVED EQUIVALENT).

PRECAST DRAIN MANHOLE (DMH)
NOT TO SCALE



NOTES:
1. ALL SECTIONS WILL BE DESIGNED FOR H-20 LOADING.
2. PROVIDE "V" KNOCKOUTS FOR PIPES WITH 2" MAXIMUM CLEARANCE TO OUTSIDE OF PIPE. MORTAR ALL PIPE CONNECTIONS.
3. JOINT SEALANT BETWEEN PRECAST SECTIONS WILL BE PREFORMED BUTYL RUBBER.
4. CATCH BASIN FRAME & GRATE WILL BE SET IN FULL 1-0" WIDE MORTAR BED. ADJUST TO GRADE WITH PRECAST CONCRETE RISER OR BRICK.
5. DO NOT PLACE MORTAR BED AROUND STRUCTURE UNTIL IT IS AT THE REQUIRED FINISH ELEVATION & ALIGNMENT.
6. FRAME & COVER TO CONFORM TO MASSACHUSETTS STANDARDS HEAVY DUTY (EAST JORDAN, NEENAH, OR APPROVED EQUIVALENT).
7. HDPE PIPE HOOD WILL BE 90° BEND FASTENED TO PIPE WITH SEALANT. BEND TO HAVE 1" PURGE HOLE DRILLED INTO TOP OF ELBOW.
8. HOOD WILL BE "THE ELIMINATOR" OIL & FLOATING DEBRIS TRAP (MANUFACTURED BY GROUND WATER RESCUE, INC., QUINCY, MA., TEL. 617-773-1128 ON THE WEB @ WWW.KLEANSTREAM.COM) OR APPROVED EQUIVALENT.
9. CONCRETE PIPE HOOD WILL BE "SNOUT" OR APPROVED EQUIVALENT.

PRECAST CONCRETE CATCH BASIN (CB) WITH HOOD
NOT TO SCALE

NOTES:
1. INSTALL DRAIN PIPE & FITTINGS IN STRICT ACCORDANCE WITH THE INSTALLATION RECOMMENDATIONS OF THE PIPE FITTING MANUFACTURER. SUCH INSTRUCTIONS INCLUDE BUT ARE NOT LIMITED TO CUTTING, SOLVENT CEMENTING & PRIMING, JOINTS, CONNECTIONS, TRANSITIONS & ALLOWANCE FOR THERMAL EXPANSION.
2. FOUNDATION: WHERE THE TRENCH BOTTOM IS UNSTABLE, THE CONTRACTOR WILL EXCAVATE TO A DEPTH REQUIRED BY THE ENGINEER & REPLACE WITH A SUITABLE COMPACTED GRAVEL MATERIAL OR AS AN ALTERNATIVE & AT THE DISCRETION OF THE ENGINEER. THE TRENCH BOTTOM MAY BE STABILIZED USING A WOVEN GEOTEXTILE FABRIC.
3. BEDDING, HAUNCHING & INITIAL BACKFILL: SUITABLE MATERIAL WILL CONSIST OF CLEAN, HARD, PARTICLES OF GRAVEL MEETING THE FOLLOWING:

SIEVE SIZE	PERCENT PASSING
3/4"	85-95
# 4	5-15
# 8	0-3

4. BEDDING: UNLESS OTHERWISE APPROVED BY ENGINEER, MATERIAL WILL BE INSTALLED AS REQUIRED IN ASTM D2321, LATEST EDITION. UNLESS OTHERWISE SPECIFIED BY THE ENGINEER, MINIMUM BEDDING THICKNESS WILL BE 4" FOR 4" - 2'-0" PIPE, 6" FOR 2'-6" - 3'-6 PIPE", & 1'-0" FOR 4'-0" & LARGER PIPE.
5. FINAL BACKFILL: COMPACTED NATIVE GRAVEL OR FLOWABLE FILL.
6. GENERAL BACKFILLING: (INCLUDING DISTURBED AREAS SURROUNDING TRENCHES) WILL BE PLACED & COMPACTED IN 1'-0" MAXIMUM VERTICAL LIFTS. CONTRACTOR WILL ACHIEVE 95% COMPACTION FOR THE BEDDING UNLESS OTHERWISE APPROVED BY THE ENGINEER.
7. TRENCH WIDTH: UNLESS OTHERWISE SPECIFIED BY THE ENGINEER, MINIMUM TRENCH WIDTHS WILL BE AS FOLLOWS:

NOMINAL Ø	MIN. RECOMMENDED TRENCH WIDTH
8"	2'-6"
10"	3'-0"
1'-3"	3'-0"
>1'-6"	3'-6"
	5'-0"

DRAINAGE PIPE TRENCH
NOT TO SCALE

PERMITTING SET ONLY
NOT FOR CONSTRUCTION

Revisions

Rev.	Date	By	Appr.	Description

Horsley Witten Group, Inc.
Sustainable Environmental Solutions
www.horsleywitten.com
90 Route 6A
Sandwich, MA 02563
508-833-6600 voice
508-833-3150 fax

Checked By: GK
Drawn By: EHH
Designed By: EHH
Date: JANUARY 2024

Plan Set: CAPE COD BOAT RAMP STORMWATER RETROFIT PROJECT - PERMITTING PLANS
YARMOUTH, MA

Plan Title: SITE AND GRADING PLAN (1)

Prepared For:
Town of Yarmouth
1146 MA-28
South Yarmouth, MA
Phone: (508) 398-2231
Fax: —

Survey Provided By:
Horsley Witten Group, Inc.
90 Route 6A
Sandwich, MA 02563
Phone: (508) 833-6600
Fax: (508) 833-3150
Dated: January 25, 2023

Registration:

Project Number: 22032A
Sheet : 4 of 10

Sheet Number: C - 4

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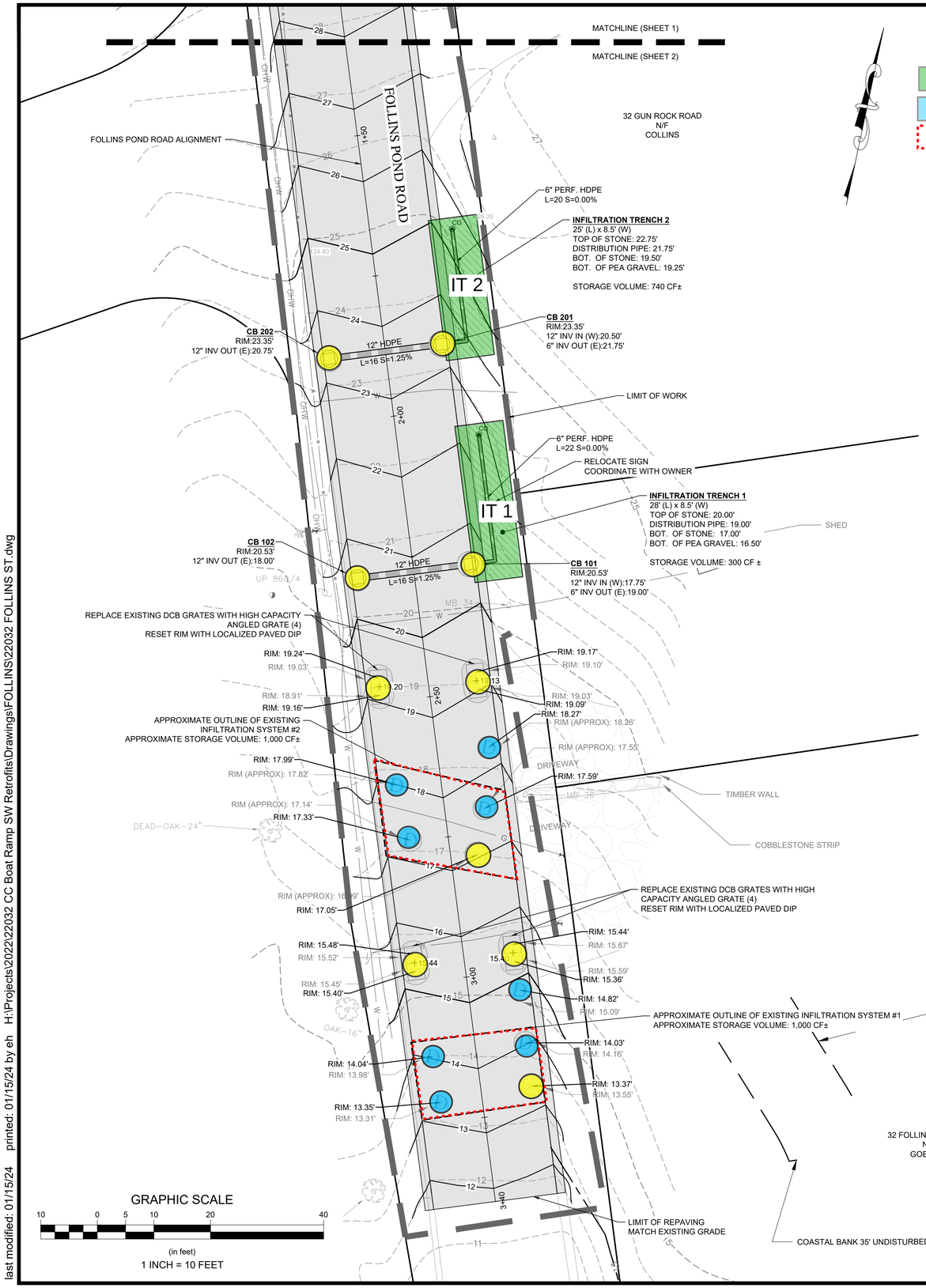
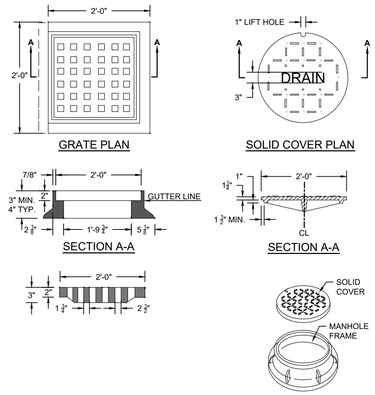


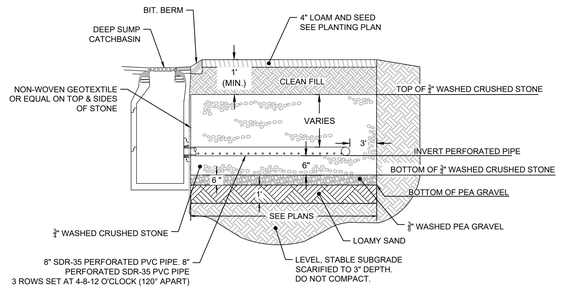
LEGEND

- INFILTRATION TRENCH
- UNDERGROUND INFILTRATION CHAMBERS
- EXISTING INFILTRATION SYSTEM
- MANHOLE
- CATCH BASIN

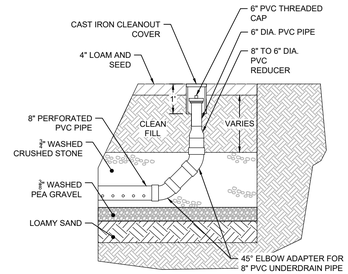


NOTES:
1. FRAME & COVER TO CONFORM TO MASSDOT (EAST JORDAN, NEENAH OR APPROVED EQUIVALENT).
2. ALL H20 LOADING.
3. MINIMUM FRAME WEIGHT:
   4" FLANGE 295 LBS
   3" FLANGE 265 LBS
4. MATERIAL-CAST IRON.
5. MINIMUM GRATE WEIGHT: 200LBS.
6. SEE CATCH BASIN & MANHOLE DETAILS FOR INSTALLATION.

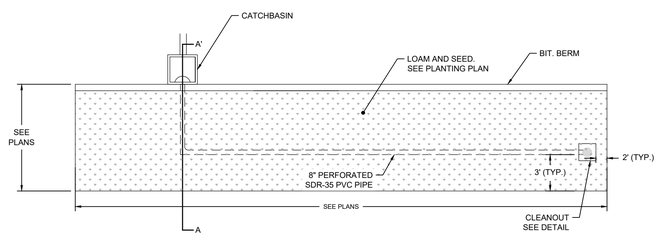
DRAINAGE STRUCTURE FRAME & COVER/GRATE
NOT TO SCALE



INFILTRATION TRENCH CROSS SECTION A-A'
NOT TO SCALE



CLEANOUT (CO)
NOT TO SCALE



INFILTRATION TRENCH PLAN VIEW
NOT TO SCALE

PERMITTING SET ONLY
NOT FOR CONSTRUCTION

Revisions

Rev.	Date	By	Appr.	Description

Horsley Witten Group, Inc.
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Sandwich, MA 02563
508-833-6600 voice
508-833-3150 fax

Checked By: GK
Drawn By: EHH
Designed By: EHH
Date: JANUARY 2024

Plan Set:
FOLLINS POND
CAPE COD BOAT RAMP STORMWATER
RETROFIT PROJECT - PERMITTING PLANS
YARMOUTH, MA

Plan Title:
SITE AND GRADING PLAN (2)

Prepared For:
Town of Yarmouth
1146 MA-28
South Yarmouth, MA
Phone: (508) 398-2231
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Survey Provided By:
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Dated: January 25, 2023

Registration:

Project Number: 22032A
Sheet : 5 of 10
Sheet Number: C - 5

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APPENDIX C –Underground Infiltration Chambers

- Sample Manufacturer's O&M Manual

Isolator® Row Plus
O&M Manual

ADS StormTech™

The Isolator® Row Plus

Introduction

An important component of any Stormwater Pollution Prevention Plan is inspection and maintenance. The StormTech Isolator Row Plus is a technique to inexpensively enhance Total Suspended Solids (TSS), Total Phosphorus (TP), Total Petroluem Hydrocarbons (TPH) and Total Nitrogen (TN) removal with easy access for inspection and maintenance.

The Isolator Row Plus

The Isolator Row Plus is a row of StormTech chambers, either SC-160, SC-310, SC-310-3, SC-740, DC-780, MC-3500, MC-4500 or MC-7200 models, are lined with filter fabric and connected to a closely located manhole for easy access. The fabric lined chambers provide for sediment settling and filtration as stormwater rises in the Isolator Row Plus and passes through the filter fabric. The open bottom chambers allow stormwater to flow both vertically out of the chambers. Sediments are captured in the Isolator Row Plus protecting the adjacent stone and chambers storage areas from sediment accumulation.

ADS Isolator Row and Plus fabric are placed between the stone and the Isolator Row Plus chambers. The woven geotextile provides a media for stormwater filtration, a durable surface for maintenance, prevents scour of the underlying stone and remains intact during high pressure jetting.

The Isolator Row Plus is designed to capture the “first flush” runoff and offers the versatility to be sized on a volume basis or a flow-rate basis. An upstream manhole provides access to the Isolator Row Plus and includes a high/low concept such that stormwater flow rates or volumes that exceed the capacity of the Isolator Row Plus bypass through a manifold to the other chambers. This is achieved with an elevated bypass manifold or a high-flow weir. This creates a differential between the Isolator Row Plus row of chambers and the manifold to the rest of the system, thus allowing for settlement time in the Isolator Row Plus. After Stormwater flows through the Isolator Row Plus and into the rest of the chamber system it is either exfiltrated into the soils below or passed at a controlled rate through an outlet manifold and outlet control structure.

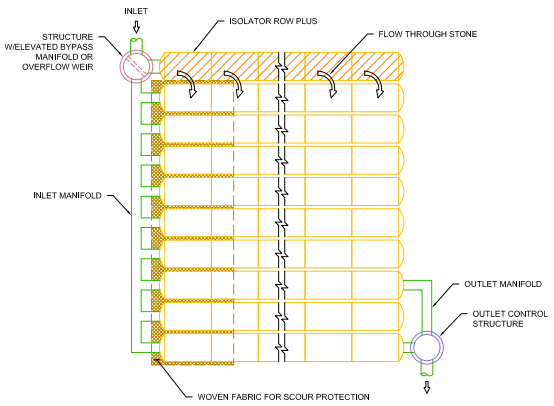
The Isolator Row Plus Flamp™ is a flared end ramp apparatus attached to the inlet pipe on the inside of the chamber end cap. The FLAMP provides a smooth transition from pipe invert to fabric bottom. It is configured to improve chamber function performance by enhancing outflow of solid debris that would otherwise collect at the chamber's end, or more difficult to remove and require confined space entry into the chamber area. It also serves to improve the fluid and solid flow into the access pipe during maintenance and cleaning and to guide cleaning and inspection equipment back into the inlet pipe when complete.

The Isolator Row Plus may be part of a treatment train system. The treatment train design and pretreatment device selection by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, StormTech recommend using the Isolator Row Plus to minimize maintenance requirements and maintenance costs.

Note: *See the StormTech Design Manual for detailed information on designing inlets for a StormTech system, including the Isolator Row Plus.*

Looking down the Isolator Row PLUS from the manhole opening, ADS PLUS Fabric is shown between the chamber and stone base.

StormTech Isolator Row PLUS with Overflow Structure (not to scale)



Isolator Row Plus Inspection/Maintenance

Inspection

The frequency of inspection and maintenance varies by location. A routine inspection schedule needs to be established for each individual location based upon site specific variables. The type of land use (i.e. industrial, commercial, residential), anticipated pollutant load, percent imperviousness, climate, etc. all play a critical role in determining the actual frequency of inspection and maintenance practices.

At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row Plus should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

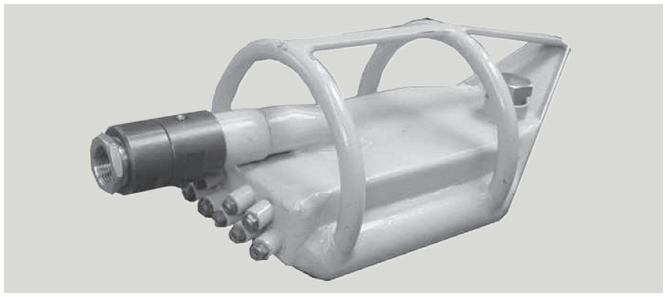
The Isolator Row Plus incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

If upon visual inspection it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 3 inches throughout the length of the Isolator Row Plus, clean-out should be performed.

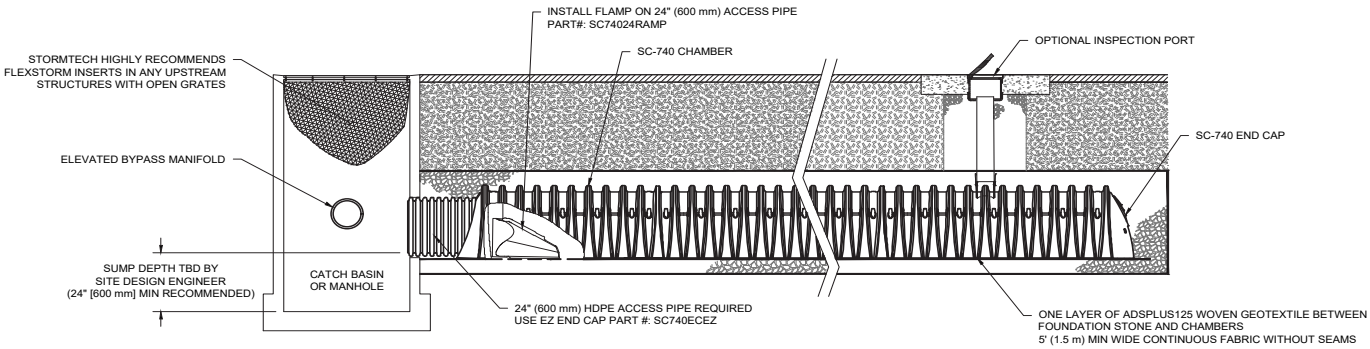
Maintenance

The Isolator Row Plus was designed to reduce the cost of periodic maintenance. By “isolating” sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via a manhole(s) located on the end(s) of the row for cleanout. If entry into the manhole is required, please follow local and OSHA rules for a confined space entry.

Maintenance is accomplished with the JetVac process. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row Plus while scouring and suspending sediments. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Selection of an appropriate JetVac nozzle will improve maintenance efficiency. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45” are best. StormTech recommends a maximum nozzle pressure of 2000 psi be utilized during cleaning. JetVac reels can vary in length. For ease of maintenance, ADS recommends Isolator Row Plus lengths up to 200' (61 m). **The JetVac process shall only be performed on StormTech Isolator Row Plus that have ADS Plus Fabric (as specified by StormTech) over their angular base stone.**



StormTech Isolator Row PLUS (*not to scale*)



Isolator Row Plus Step By Step Maintenance Procedures

Step 1

Inspect Isolator Row Plus for sediment.

A) Inspection ports (if present)
- i. Remove lid from floor box frame
- ii. Remove cap from inspection riser
- iii. Using a flashlight and stadia rod,measure depth of sediment and record results on maintenance log.
- iv. If sediment is at or above 3 inch depth, proceed to Step 2. If not, proceed to Step 3.

B) All Isolator Row Plus
- i. Remove cover from manhole at upstream end of Isolator Row Plus
- ii. Using a flashlight, inspect down Isolator Row Plus through outlet pipe
  1. Mirrors on poles or cameras may be used to avoid a confined space entry
  2. Follow OSHA regulations for confined space entry if entering manhole
- iii. If sediment is at or above the lower row of sidewall holes (approximately 3 inches), proceed to Step 2.
  If not, proceed to Step 3.

Step 2

Clean out Isolator Row Plus using the JetVac process.

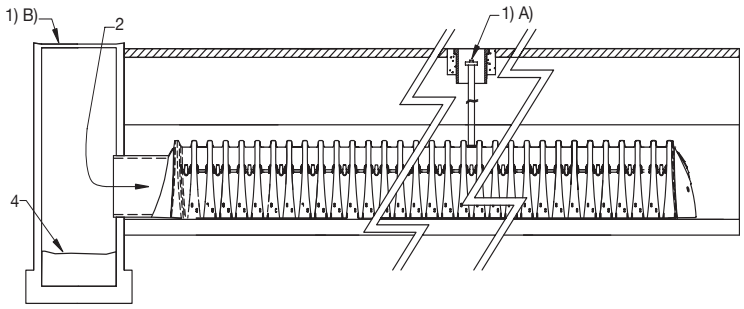
A) A fixed floor cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable
B) Apply multiple passes of JetVac until backflush water is clean
C) Vacuum manhole sump as required

Step 3

Replace all caps, lids and covers, record observations and actions.

Step 4

Inspect & clean catch basins and manholes upstream of the StormTech system.

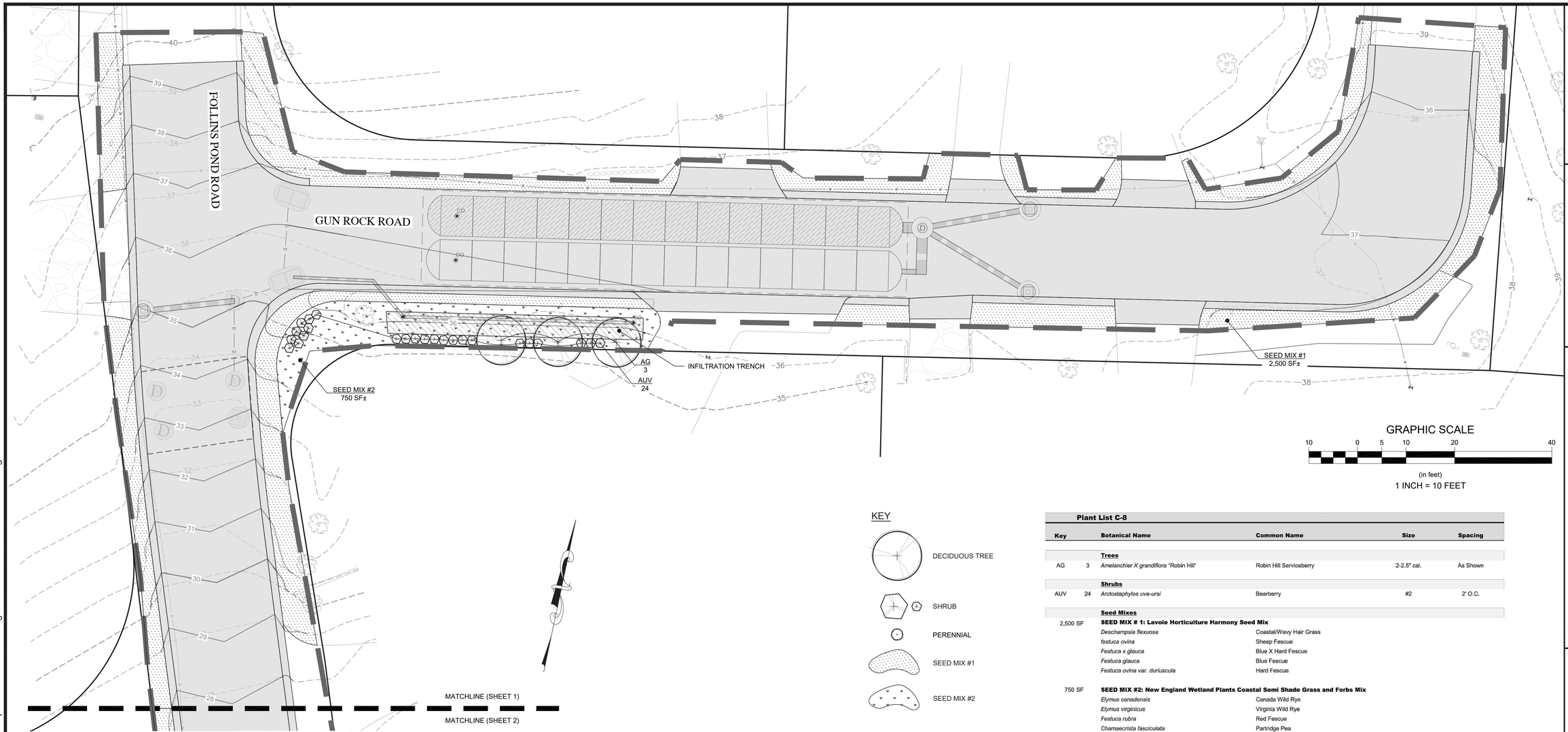


Sample Maintenance Log

Date	Stadia Rod Readings		Sediment Depth (1)–(2)	Observations/Actions	Inspector
	Fixed point to chamber bottom (1)	Fixed point to top of sediment (2)			
3/15/11	6.3 ft	none		New installation. Fixed point is CI frame at grade	DJM
9/24/11		6.2	0.1 ft	Some grit felt	SM
6/20/13		5.8	0.5 ft	Mucky feel, debris visible in manhole and in Isolator Row PLUS, maintenance due	NV
7/7/13	6.3 ft		0	System jetted and vacuumed	DJM

adspipe.com
800-821-6710

APPENDIX D –Planting Plan



GRAPHIC SCALE

10 0 5 10 20 40

(in feet)
1 INCH = 10 FEET

KEY

DECIDUOUS TREE

SHRUB

PERENNIAL

SEED MIX #1

SEED MIX #2

Plant List C-8

Key		Botanical Name	Common Name	Size	Spacing
		Trees			
AG	3	*Amelanchier X grandiflora* 'Robin Hill'	Robin Hill Serviceberry	2-2.5" cal.	As Shown
		Shrubs			
AUV	24	*Arctostaphylos uva-ursi*	Bearberry	#2	2' O.C.
		Seed Mixes			
2,500 SF		**SEED MIX # 1: Lavoie Horticulture Harmony Seed Mix**			
		Deschampsia flexuosa	Coastal/Wavy Hair Grass		
		festuca ovina	Sheep Fescue		
		Festuca x glauca	Blue X Hard Fescue		
		Festuca glauca	Blue Fescue		
		Festuca ovina var. duriuscula	Hard Fescue		
750 SF		**SEED MIX #2: New England Wetland Plants Coastal Semi Shade Grass and Forbs Mix**			
		Elymus canadensis	Canada Wild Rye		
		Elymus virginicus	Virginia Wild Rye		
		Festuca rubra	Red Fescue		
		Chamaecrista fasciculata	Partridge Pea		
		Liatris spicata	Marsh Blazing Star		
		Onoclea sensibilis	Sensetive Fern		
		Aster prenanthoides	Zigzag Aster		
		Eupatorium fistulosum	Hollow-stem Joe Pye Weed		
		Geum canadense	White Avens		
		Aquilegia canadensis	Eastern Columbine		
		Juncus tenuis	Path Rush		

PERMITTING SET ONLY
NOT FOR CONSTRUCTION

Revisions

Rev.	Date	By	Appr.	Description

Horsley Witten Group, Inc.
Sustainable Environmental Solutions
www.horsleywitten.com
90 Route 6A
Sandwich, MA 02563
508-833-6600 voice
508-833-3150 fax

Checked By: HLG
Drawn By: MEHoK
Designed By: MEHoK
Date: JANUARY 2024

Plan Set:
FOLLINS POND
CAPE COD BOAT RAMP STORMWATER
RETROFIT PROJECT - PERMITTING PLANS
YARMOUTH, MA

Plan Title:
PLANTING PLAN (1)

Prepared For:
Town of Yarmouth
1146 MA-28
South Yarmouth, MA
Phone: (508) 398-2231
Fax: ----

Survey Provided By:
Horsley Witten Group, Inc.
90 Route 6A
Sandwich, MA 02563
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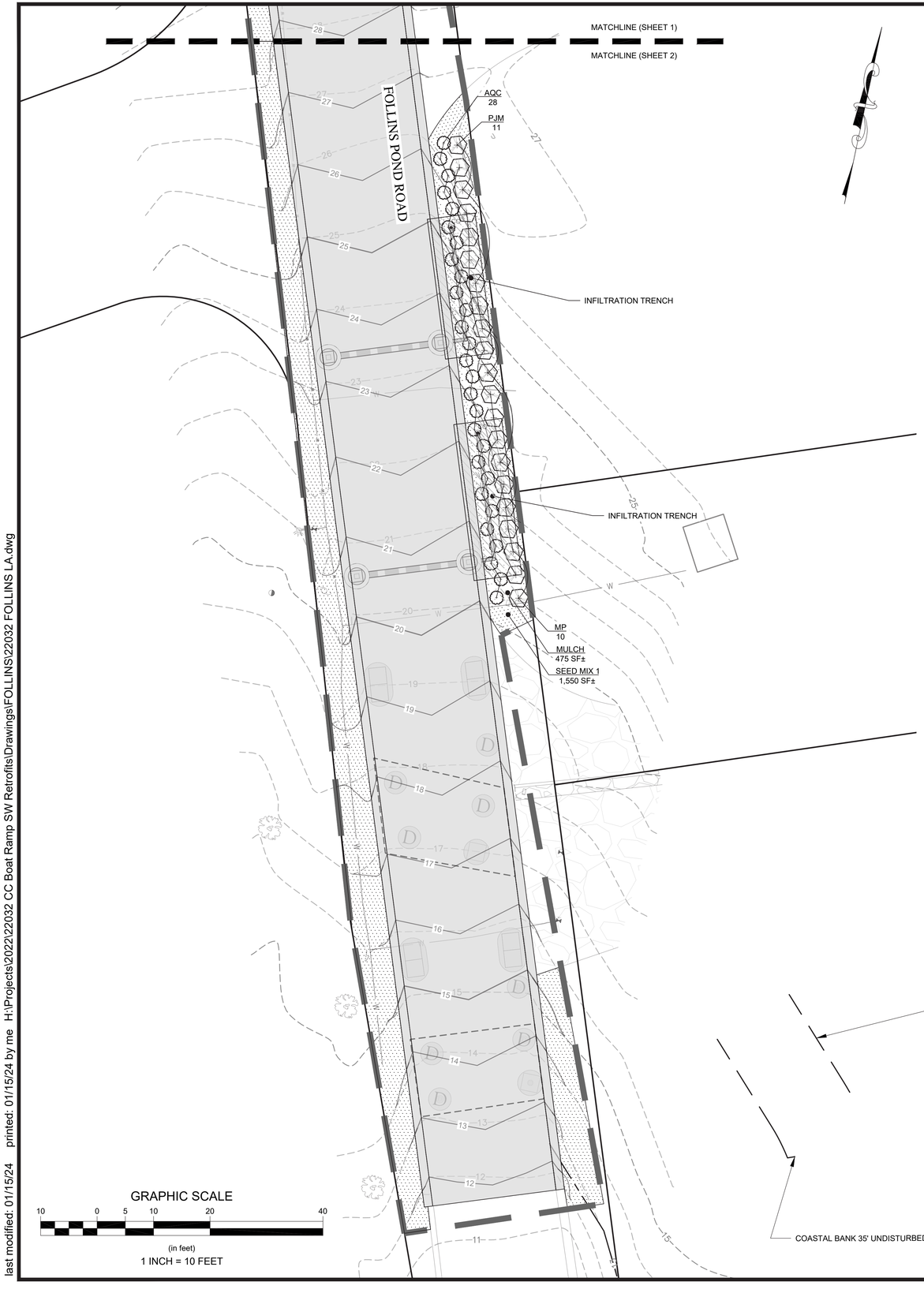
Fax: (508) 833-3150
Dated: January 25, 2023

Registration:

COMMONWEALTH OF MASSACHUSETTS
JOHN R. KLOCKE
NO. 1519
REGISTERED LANDSCAPE ARCHITECT
1/15/24

Project Number: 22032A
Sheet: 8 of 10

Sheet Number:
C - 8



Plant List C-9

Key		Botanical Name	Common Name	Size	Spacing
		Shrubs			
MP	10	*Myrica pensylvanica*	Bayberry	3'/4' B&B	As Shown
PJM	11	*Rhododendron* 'PJM Elite'	PJM Elite Rhododendron	2-2.5" cal.	As Shown
		Ground Cover/Grasses/Perennials			
AQC	28	*Aquilegia canadensis*	Red Columbine	#1	As Shown
		Seed Mixes			
1,550 SF		**SEED MIX #1: Lavoie Horticulture Harmony Seed Mix**			
		Deschampsia flexuosa	Coastal/Wavy Hair Grass		
		festuca ovina	Sheep Fescue		
		Festuca x glauca	Blue X Hard Fescue		
		Festuca glauca	Blue Fescue		
		Festuca ovina var. duriuscula	Hard Fescue		

Master Plant List

Key		Botanical Name	Common Name	Size	Spacing
		Trees			
AG	3	*Amelanchier X grandiflora* 'Robin Hill'	Robin Hill Serviceberry	2-2.5" cal.	As Shown
Subtotal	***3***				
		Shrubs			
AUV	24	*Arctostaphylos uva-ursi*	Bearberry	#2	2' O.C.
MP	10	*Myrica pensylvanica*	Bayberry	3'/4' B&B	As Shown
PJM	11	*Rhododendron* 'PJM Elite'	PJM Elite Rhododendron	2-2.5" cal.	As Shown
Subtotal	***45***				
		Ground Cover/Grasses/Perennials			
AQC	28	*Aquilegia canadensis*	Red Columbine	#1	12" O.C.
Subtotal	***28***				
		Seed Mixes			
4,600 SF		**SEED MIX # 1: Lavoie Horticulture Harmony Seed Mix**			
		Deschampsia flexuosa	Coastal/Wavy Hair Grass		
		festuca ovina	Sheep Fescue		
		Festuca x glauca	Blue X Hard Fescue		
		Festuca glauca	Blue Fescue		
		Festuca ovina var. duriuscula	Hard Fescue		
750 SF		**SEED MIX #2: New England Wetland Plants Coastal Semi Shade Grass and Forbs Mix**			
		Elymus canadensis	Canada Wild Rye		
		Elymus virginicus	Virginia Wild Rye		
		Festuca rubra	Red Fescue		
		Chamaecrista fasciculata	Partridge Pea		
		Liatris spicata	Marsh Blazing Star		
		Onoclea sensibilis	Sensetive Fern		
		Aster prenanthoides	Zigzag Aster		
		Eupatorium fistulosum	Hollow-stem Joe Pye Weed		
		Geum canadense	White Avens		
		Aquilegia canadensis	Eastern Columbine		
		Juncus tenuis	Path Rush		

PERMITTING SET ONLY
NOT FOR CONSTRUCTION

Revisions

Rev.	Date	By	Appr.	Description

Horsley Witten Group, Inc.
Sustainable Environmental Solutions
www.horsleywitten.com
90 Route 6A
Sandwich, MA 02563
508-833-6600 voice
508-833-3150 fax

Checked By: HLG
Drawn By: MEHJK
Designed By: MEHJK
Date: JANUARY 2024

Plan Set: CAPE COD BOAT RAMP STORMWATER RETROFIT PROJECT - PERMITTING PLANS
FOLLINS POND
YARMOUTH, MA

Plan Title: PLANTING PLAN (2)

Prepared For:
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South Yarmouth, MA
Phone: (508) 398-2231
Fax: ----

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Dated: January 25, 2023

Registration:
COMMONWEALTH of MASSACHUSETTS
JOSHUA R. KUKES
NO. 1513
REGISTERED LANDSCAPE ARCHITECT
1/15/24

Project Number: 22032A
Sheet : 9 of 10
Sheet Number: C - 9

last modified: 01/15/24 printed: 01/15/24 by me H:\Projects\2022\22032 CC Boat Ramp SW Retrofits\Drawings\FOLLINS\22032 FOLLINS LA.dwg

APPENDIX E –O&M Plan for Existing Infiltration Systems

Operations and Maintenance Plan

1.0 Introduction

The Town of Yarmouth (Town) has implemented a program to reduce the impact of Non-Point Source Pollution Discharge on the Bass River Watershed. The treatment and reduction of stormwater discharges from residential streets discharging into Bass River/Follins Pond have been identified as priorities for improving water quality in the Watershed. The stormwater system components utilized in the CPR projects consist of deep sump catch basins, manholes, pipes, and leaching chambers.

2.0 Purpose

This Operations & Maintenance Plan (O&M Plan) provides a mechanism for the consistent inspection and maintenance of stormwater system components installed during the course of the CPR projects. Included in this O&M Plan is a description of the stormwater system components, the location of each component, an inspection schedule for each stormwater system component, and forms to be utilized to document the inspection and maintenance of each stormwater system component.

3.0 Stormwater System Descriptions and Locations

3.1 Description

There are numerous stormwater systems located in the Bass River/Follins Pond watershed. See as-built plans in Appendix B.

3.2 Locations

This plan can be amended by listing new locations below and adding the as-built plans to O&M Binder referenced in Section 6.

Follins Pond Road (3 systems) – installed 2006
Longview Drive (2 systems) – installed 2007
Wing Avenue (1 system) – installed 2007

4.0 Inspection Frequency, Safety, and Schedule

4.1 Inspection Frequency:

A complete and thorough inspection of the systems using the inspection and maintenance forms provided will be performed once a month during the first six (6) months and then on an annual basis (once in the spring) and after major rain

events (approximately 2.0 inches of rain). See Section 5.0 Implementation and Maintenance Procedures for a description of the inspection activities.

4.2 Inspection Safety:

The inspector performing the inspections on the drainage structures will have the proper safety equipment (heavy duty gloves, steel-toed boots, hard hat, and first aid kits, etc.) and training before conducting any inspections. If the drainage structures reveal any safety problems the site activities may need to be modified to reduce or eliminate the safety risk. All inspections will be in accordance with the Town of Yarmouth's DPW safety program. This program is reviewed annually by the DPW for compliance with State and Federal requirements.

4.3 Maintenance:

- All maintenance work will be done in accordance with Town of Yarmouth's DPW safety program.

5.0 Implementation and Maintenance Procedures

The Yarmouth Department of Public Works (DPW) is responsible for inspecting and maintaining the stormwater system components. Inspections and maintenance will be funded in the DPW's annual operating budget. The following list of inspections and maintenance will be performed on the required schedule. All sediment, debris, and hydrocarbons that are removed during the maintenance of the stormwater system components will be properly handled and disposed.

5.1 Catch Basins/Manholes:

Inspections will be performed once during the spring. It is important to remove the sediment that has accumulated during the winter months before the spring precipitation.

5.2 Drainage Pipes:

Inspections will be performed along with the catch basins yearly checks. Drainage pipes will be checked for clogs and cleaned as needed.

5.3 Leaching Chambers:

For the first six (6) months inspections will be performed once a month. As long as everything is working properly, the inspection frequency can be decreased to once a year, in early spring. The leaching facility will be inspected after the first several

storms and after major storms (approximately 2-inches). The inlet and outlet pipe will be inspected for clogging of sediment leaves, and debris.

During the inspection the inspector will look for signs of ponding of water inside of the chambers after 24 hours or several days after a rain event. If water is present it may be a sign that the bottom of the trench is clogged.

In the event that the ponding of the system is evident, the system will be pumped and an investigation program developed to identify the source of the pondng and remedial activities.

5.4 Street Sweeping:

Street sweeping will be performed monthly during construction and then annually in the early spring using a conventional mechanical sweeper or a newer vacuum-type sweeper.

6.0 Inspections and Record Keeping

An inspection form will be filled out each and every time an inspection and/or maintenance work is performed. A record of the date of sediment removal and the quantity removed will be part of the record.

A three-ring loose leaf binder will be kept at the Town's Highway Division / Department of Public Works Office located on Buck Island Road in West Yarmouth that contains all of the completed inspections forms and/or photos and related material. This binder will be maintained for a minimum of three years, include photo documentation of the inspections, and will be available for review by the Massachusetts Office of Coastal Zone Management.

A review of all Operation & Maintenance actions will take place annually to ensure that these Stormwater BMP's are being taken care of in the manner illustrated in this Operation & Maintenance plan.

APPENDIX F – Pollutant Controls During Construction

POLLUTANT CONTROLS DURING CONSTRUCTION

1.1 Structural Practices

The following are the structural practices that will be implemented as part of the construction activity.

- Visibility Fence/Sediment Silt Sock Barrier will be installed prior to commencement of construction. The visibility fence will keep construction equipment within the limit of work, and the silt sock will be used on the downgradient portions of the limit of work to allow water to flow through it while keeping sediment on site. The Town will be informed upon their installation so that they may inspect these barriers prior to construction. Portions of these barriers will be replaced and/or repaired as necessary. Barriers will be installed parallel to land slope at the perimeter of the work site, as shown on the Plans. Details are provided in the Plans.

- Silt Sacks (or approved equivalent) will be installed at existing and proposed inlet and overflow structures to prevent sedimentation during construction. The silt sack will be emptied/replaced and disposed of off-site if damage is observed.

- Slope Stabilization will occur immediately upon obtaining final grades as shown on the project site plans. Areas that fail to stabilize will be re-graded to final grade and stabilized as necessary. Amount of land disturbed will be minimized to reduce potential for erosion and sedimentation. Stabilization measures shall be initiated within 14 days following the end of construction at each portion of the site and as soon as practicable.

The entire stormwater management system including pipe, structures, infiltration trenches, and underground infiltration chambers will be inspected upon completion of construction. Sediment will be removed from all elements of the stormwater management system. All control measures must be installed and maintained in accordance with manufacturer's specifications, good engineering practices, and in accordance with this report (every seven calenpdar days and after storm events). If inspections show that a control has failed or been installed incorrectly, the Operator must replace or modify it within 24 hours.

1.2 Stabilization Practices

The amount of land disturbed during construction will be minimized to reduce the potential for erosion and sedimentation. Prompt surface stabilization will be provided to control erosion in areas where disturbances cannot be avoided during construction. Stabilization measures shall be initiated within 14 days following the end of construction at each portion of the site. Exceptions to this requirement are allowable when snow cover prevents the initiation of stabilization within 14 days, in which case such measures shall be undertaken as soon as possible.

Stabilization measures that will be, or may be, used during construction are described below:

- Temporary Seeding – Temporary seeding of disturbed surfaces with fast-growing grasses (annual rye) to provide greater resistance to stormwater runoff and/or wind erosion for areas where construction has temporarily ceased.

- Permanent Seeding – Permanent seeding of surfaces with vegetation, including but not limited to grass, trees, bushes, and shrubs, to stabilize the soil. Establishing a permanent and sustainable ground cover at a site stabilizes the soil while reducing the sediment content in runoff.

- Permanent Planting –establish all planting as required at the completion of the project.

- Erosion Control Blankets - install erosion control blankets along all slopes greater than 3:1.

- Mulching – materials, including but not limited to hay, grass, woodchips, straw, and gravel will be placed on the soil surface to cover and hold in place disturbed soils.

Temporary seeding or other soil stabilization measures will be provided where construction activities have ceased at the site. Topsoil stockpiles will be temporarily seeded or covered to prevent erosion and will be surrounded with silt fence or silt sock. When the site's final grade has been established, permanent vegetation will be planted on the disturbed areas. The vegetation will consist of grass, shrubs, bushes, and trees in the locations indicated on the plans.

1.3 Other Types of Controls

Additional controls/practices will be undertaken to reduce pollution in stormwater runoff flows which include, but are not limited to, control of off-site mud tracking from construction site, dust suppression, proper sanitary waste disposal, earthwork procedures timed and conducted in manners aimed to minimize erosion and sedimentation, snow removal plans, proper management of waste materials, proper management of hazardous waste, proper material stockpiling, and spill prevention and control measures.

- Dust Suppression – Water sprays shall be used to control dust during extended dry periods during construction.

- Earthwork – The exposure of disturbed surfaces to stormwater and potential stormwater erosion will be minimized by well-organized earthwork procedures. Stabilization procedures shall be undertaken in accordance with this report. Grubbing during wet seasons will be avoided if feasible.

- Snow Removal Plan – Plowed snow collected from the roadway and parking areas will be deposited onto free draining, pervious surfaces, away from the sites drainage conveyance structures to maximize infiltration.

- Waste Materials – Dumpsters rented from a licensed solid waste management company will be used to store solid waste and debris that cannot be recycled, reused or salvaged. The dumpsters will meet all local and state solid waste management regulations. Dumpsters will be covered when refuse is not being directly deposited or withdrawn from them. Potentially hazardous wastes will be separated from normal wastes, including segregation of storage areas and proper labeling of containers. Removal of all waste from the site will be performed by licensed contractors in accordance with applicable regulatory requirements and disposed of at either local or regional approved facilities. Waste materials will not be buried on-site. All site personnel will be instructed regarding the correct procedures for waste disposal. Notices stating these procedures will be posted at the site. Solvents and flushing materials used during construction and pre-operational cleaning will be provided, handled, managed, and removed by the contractor for appropriate off-site disposal.

- Hazardous Waste Materials – Any disposal of hazardous materials will be completed using the required paperwork. Copies will be provided to the Engineer and to the city.

- Spill Prevention and Control Measures – To minimize the risk of spills or other accidental exposure of materials and substances to stormwater runoff, the following material management practices will be used throughout the project:

    - An effort will be made to store only enough products required to do the job.

    - All materials stored on-site will be stored in a neat, orderly manner in their appropriate containers and, if possible, under a roof or other enclosure.

    - Products will be kept in their original containers with the original manufacturer's label.

    - Substances will not be mixed with one another unless recommended by the manufacturer.

    - Whenever possible, the maximum amount of a product will be used before disposing of the container.

    - Manufacturers' recommendations for proper use and disposal will be followed.

    - The site superintendent will conduct daily inspections to ensure proper use and disposal of materials.

    To reduce the risk associated with hazardous materials used on the site, the following practices will be used:

        - Products will be kept in original containers unless they are not resealable.

        - Original labels and material safety data sheets will be retained and kept on-site; they contain important product information.

- If surplus product must be disposed of, manufacturers' or local and state recommended methods for proper disposal will be followed.

- Materials List - Materials or substances listed below are expected to be present on-site during construction:

- Concrete	- Fertilizers
- Asphalt	- Petroleum Based Products
- Paints (enamel and latex)	- Cleaning Solvents
- Metal Studs	- Wood
- Concrete	- Tar
- Sealants	- Adhesives

  The following product-specific practices will be followed on-site:

  Petroleum Products - All on-site vehicles will be monitored for leaks and receive preventative maintenance to reduce the chance of leakage. Petroleum products will be stored in tightly sealed containers which area clearly labeled. Any asphalt substances used on-site will be applied according to the manufacturers' recommendations.

  Paints – All containers will be tightly sealed and stored indoors when not required for use. Excess paint will not be discharged to the storm sewer system but will be properly disposed of according to the manufacturers' instructions or state and local regulations.

  Concrete Trucks – Concrete trucks will not be allowed to wash out or discharge surplus concrete or drum wash water on the site.

In addition to the good housekeeping and material management practices discussed in the previous sections of this plan, the following practices will be followed for spill prevention and cleanup:

- Manufacturers' recommended methods for spill cleanup will be clearly posted, and site personnel will be made aware of the procedures and location of the information and cleanup supplies.

- Materials and equipment necessary for spill cleanup will be kept in the material storage area on-site. Equipment and materials will include, but not be limited to, brooms, dust pans, mops, rags, gloves, goggles, speedi-dry, sand, sawdust, and plastic and metal trash containers specifically for this purpose.

- All spills will be cleaned up immediately after discovery. Spills large enough to reach the storm water system will be reported to the National Response Center at 1-800-424-8802.

- The spill area will be kept well ventilated and personnel will wear appropriate protective clothing to prevent injury from contact with a hazardous substance.
- Spills of toxic or hazardous material will be reported to the appropriate state or local government agency, regardless of the size.
- The site superintendent responsible for the day-to-day site operations will be the spill prevention and clean-up coordinator. He will designate at least three other site personnel who will receive spill prevention and cleanup training. These individuals will each become responsible for a particular phase of prevention and cleanup. The names of responsible spill personnel will be posted in the material storage area and in the on-site office trailer.

APPENDIX G – Site Plans