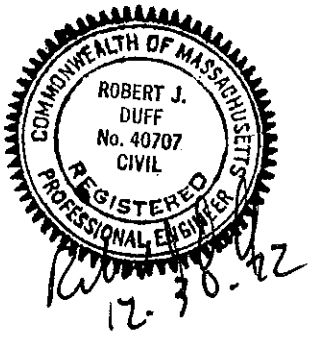
Stormwater Report
North Street & Blackstone Street
Bellingham, MA



Date: DECEMBER 30, 2022

Prepared For:
RAVEN HOMES, INC.
22 BUCKHILL ROAD
NORTHBOROUGH, MA 01532

Prepared By:
Guerriere & Halnon, Inc.
55 West Central Street
Franklin, MA 02038

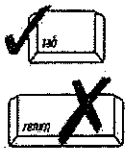
G&H Project F4457

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

Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

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

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

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

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

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

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

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.

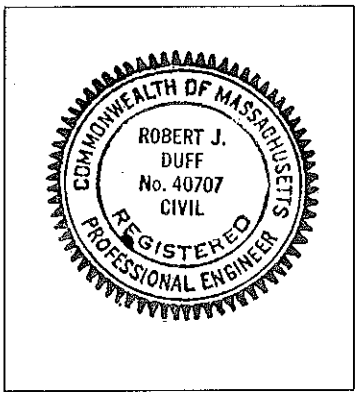
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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



Robert J Duff 12-30-22
Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

- ☒ No disturbance to any Wetland Resource Areas
- ☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- ☐ Reduced Impervious Area (Redevelopment Only)
- ☒ Minimizing disturbance to existing trees and shrubs
- ☐ LID Site Design Credit Requested:
  - ☐ Credit 1
  - ☐ Credit 2
  - ☐ Credit 3
- ☐ Use of "country drainage" versus curb and gutter conveyance and pipe
- ☐ Bioretention Cells (includes Rain Gardens)
- ☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- ☐ Treebox Filter
- ☐ Water Quality Swale
- ☐ Grass Channel
- ☐ Green Roof
- ☐ Other (describe): _____

Standard 1: No New Untreated Discharges

- ☒ No new untreated discharges
- ☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- ☒ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☐ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

☒ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☐ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

- ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
- ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
- ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
- ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

[1] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☒ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☒ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

- ☐ is within the Zone II or Interim Wellhead Protection Area
- ☐ is near or to other critical areas
- ☒ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
- ☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☒ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

☒ The BMP is sized (and calculations provided) based on:

- ☒ The ½" or 1" Water Quality Volume or
- ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☐ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☐ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☐ Critical areas and BMPs are identified in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

☐ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- ☐ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☐ Bike Path and/or Foot Path
- ☐ Redevelopment Project
- ☐ Redevelopment portion of mix of new and redevelopment.

☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☒ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☐ The project is ***not*** covered by a NPDES Construction General Permit.

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☒ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☒ Name of the stormwater management system owners;
- ☒ Party responsible for operation and maintenance;
- ☒ Schedule for implementation of routine and non-routine maintenance tasks;
- ☒ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☐ Description and delineation of public safety features;
- ☐ Estimated operation and maintenance budget; and
- ☒ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

☒ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☒ An Illicit Discharge Compliance Statement is attached;

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

Project Description

The project locus is a 20.8± acre site located adjacent to North Street, and Blackstone Street. It is in the Agricultural District Zone. The property will be divided into two lots. Lot 1 contains approximately 8.2± acres of land which will be fully developed and Lot 2 consists of approximately 12.6± acres of conservation land which will remain undeveloped. Run-off from this property generally flows from west to east ultimately captured within Bordering Vegetative Wetland (BVW) located in the easterly portion of the property. See Appendix 1/Locus Map.

Soils on site are in three categories – a Canton fine sandy loam 422B, 0 to 8% slopes, extremely stony, Hydrologic Group B, Canton fine sandy loam 420B, 3 to 8% slopes, Hydrologic Group B, and Merrimac fine sandy loam 254B, 3 to 8% slopes, Hydrologic Group A based on the web soil survey and site observations - See Appendix 2 / NRCS Soil Report.

The project proponent intends to construct a 1,035± foot long roadway with bituminous concrete curbing and sidewalk. The proposed road will be 22' wide paved surface with access to North Street and Blackstone Street and will serve 12-3-unit Townhouses. Each unit will have public water service and all units will be connected to a shared septic system for sewer. Storm water run-off will be collected by catch basin to manhole drainage system. A majority of run-off captured within the development will be sent to an infiltration basin, while the remaining runoff, including runoff from Lot-1 will be captured and conveyed through a series of drainage pipes. Ultimately all the runoff generated from this development will be discharged to the existing wetlands located on the property to the east.

Pre-development drainage runoff from the developed 8.2± acre portion of the site and was analyzed as one watershed - See Appendix 10 / Drainage Area Plans.

- EX-1 – This watershed drainage area includes approximately 8.2± acres onsite. Runoff from this watershed flows toward the easterly property line, discharging to the bordering vegetative wetlands located on Lot 2 of the overall property and is identified at the point of analysis (AP-1).

The Post-Development Drainage Analysis regards the area as two watersheds –
See Appendix 10 / Drainage Area Plans.

- PR-1 watershed consists of a proposed paved roadway, sidewalks, driveways, roofs, and lawn areas of the proposed development which will be collected by the proposed drainage system. The entirety of the proposed drainage system is collected by street catch basins and conveyed by drainage pipes and manholes to the proposed infiltration basin located in the southeast corner of Lot-1 ultimately discharging to the wetlands located to the east on Lot-2 and is identified as point of analysis (AP-1).

- PR-2 watershed includes primarily the undeveloped portion of the property located along the northern, southern, and easterly property lines. Topography and runoff

patterns remain generally unchanged from the pre-development conditions. Runoff generated in this sub catchment flows via surface flow in a way like the predevelopment conditions and discharges to the wetlands located to the east on Lot-2 and is identified as point of analysis (AP-1).

Post development stormwater runoff will be treated and attenuated by a standard catch basin to manhole collection system. The site has soils that are considered to have high stormwater runoff potential as identified in the NRCS Web Soil Survey information provided in Appendix 2. The site is designed to be in conformance with the Massachusetts Stormwater Management Guidelines, Massachusetts Wetlands Protection Act and Bellingham Conservation Commission.

Compliance with the 10 Stormwater Standards

Standard 1: No new untreated Discharges

The proposed development results in two distinct stormwater discharge locations. The first includes the stormwater runoff from the proposed road and driveways which will discharge into the proposed infiltration basin. Also, contributing to this location is the runoff from the undeveloped portion of the site to the west, which sheet flows to the adjacent property. The second area is mainly the undeveloped portion of the site to the east, and runoff from the rear of the lots. The majority of impervious pavement is collected in deep sump hooded catch basins and discharged to a forebay and finally to an infiltration basin, appropriately sized to treat for 80% TSS removal, prior to discharge to the adjacent properties. Clean roof drainage is designed to be collected and discharged to proposed underground infiltration chambers.

Standard 2: Peak Rate Attenuation

HydroCAD, a stormwater design program based on TR-55, was used to evaluate the pre-development and post development peak discharge rates for the 2-, 10-, 25- and 100-year Type III - 24-hour storm events. The rainfall depths (3.2, 4.9, 6.2 and 8.7 inches) associated with the TP-40 rainfall data for storms (2, 10, 25 and 100-year) respectively, were entered into HydroCAD.

To get an accurate model of the stormwater infiltration and surface flows, the underlying soils, surface cover and slopes are considered. The NRCS Soil Survey for the site, included in Appendix 2, depicts the soils on site are in three categories – Canton fine sandy loam 422B, 0 to 8% slopes, extremely stony, Hydrologic Group B, Canton fine sandy loam 420B, 3 to 8% slopes, Hydrologic Group B, and Merrimac fine sandy loam 254B, 3 to 8% slopes, Hydrologic Group A. The existing soils are depicted relative to the surface cover, defined watershed areas and corresponding Time-of-Concentrations on the Pre-Development drainage plan in Appendix 10.

The HydroCAD model also requires information regarding the site. The existing conditions, or pre-development condition, was modeled using one watershed EX-1 used to model the stormwater being discharged to the easterly property line, ultimately discharging to analysis

point AP-1. The post development condition was evaluated using two watershed areas, PR-1 and PR-2, PR-3 and PR-4 and one discharge point for analysis, AP-1.

The post development watershed PR-1 consist of paved driveways, sidewalks, roofs, and lawn areas. All generated runoff is collected in catch basins and discharges into an infiltration basin at the southeast corner of Lot-1 via pipes. PR-2 topography and runoff patterns are mainly unchanged from the pre-development conditions, except for some minor lot grading. Runoff generated within PR-2 sub-catchment area flows via surface flow in a way like the predevelopment conditions and discharges to the east toward the existing bordering vegetated wetlands located on Lot-2. The Post-Development drainage plan, including defined watershed areas and corresponding time-of-concentrations, is included in Appendix 10. The detailed HydroCAD report included in Appendix 4 includes the calculations demonstrating the post-Development peak flows do not exceed the Pre-Development peak flows.

Runoff rates at the discharge points are required to be maintained to that of existing conditions by reducing the runoff areas and/or temporarily holding runoff in a detention basin and releasing it at slower rates to meet existing peak flow rates. Runoff volumes are also required to be maintained in a similar fashion. Additionally, a surface basin is to be sized assuming frozen conditions within the basin, with no infiltration during a 25-year storm event. See Tables 1A and 1B for a complete summary.

Table 1A: Peak Rate Attenuation Summary

	2-yr Storm	**10-yr Storm**	**25-yr Storm**	**25-yr Storm**	**100-yr Storm**
				Frozen Cond.	
Flow to Analysis Point (AP-1)					
Pre-Development	0.00 cfs	0.08 cfs	12.23 cfs	11.97 cfs	38.10 cfs
Post-Development	0.00 cfs	0.02 cfs	0.14 cfs	6.39 cfs	20.58 cfs
Flow to Analysis Point (AP-2)					
Pre-Development	0.19 cfs	1.24 cfs	2.39 cfs	N/A	5.20 cfs
Post-Development	0.17 cfs	0.76 cfs	1.36 cfs	N/A	2.78 cfs

Table 1B: Runoff Volume

	2-yr Storm	**10-yr Storm**	**25-yr Storm**	**25-yr Storm**	**100-yr Storm**
Flow to Analysis Point (AP-1)				**Frozen Cond.**	
Pre-Development	0.000 af	0.018 af	0.898 af	1.638 af	3.406 af
Post-Development	0.000 af	0.012 af	0.034 af	1.972 af	1.676 af
Flow to Analysis Point (AP-2)					
Pre-Development	0.049 af	0.162 af	0.278 af	N/A	0.564 af
Post-Development	0.032 af	0.093 af	0.154 af	N/A	0.301 af

In addition to peak rate attenuation and volume reduction, an on-site storm drain collection system was designed based on the "Rational Method" using Manning's equation to carry a minimum 25-year storm event through the site. The proposed drainage pipes will be Class III reinforced concrete pipe (RCP) and where cover is less than 3.0 ft Class V RCP will be used. On-site storm drainage calculations are included in Appendix 11 / Supplemental Attachments.

Standard 3: Recharge

Soil Evaluation

Soil evaluation is broken down into two stages. Stage 1 identifies the underlying soils just beneath the surface that contribute to how much runoff is generated as stormwater falls and moves across the surface. Stage 2 evaluates the soils in direct contact with the proposed infiltration BMPs. Appendix 2 includes the NRCS Soil Survey used for Stage 1 while Appendix 3 includes the on-site soil textural analysis in the specific locations that infiltration is proposed. The information from the NRCS Soil Survey is on the Pre and Post Development drainage plans in Appendix 10.

Recharge Volume

The required recharge volume is determined by calculating the proposed impervious area over the corresponding soil identified in the NRCS Soil Survey. As previously stated, the NRCS Soil Survey lists the site as Canton Fine Sandy Loam, 0 to 8 percent slopes, HSG B, Canton Fine Sandy Loam, 3 to 8 percent slopes, HSG B, and Merrimac Fine Sandy Loam, 3 to 8 percent slopes, HSG A. While the site consists of an existing undeveloped residential lot, the project is considered a new development project, as noted in Standard 7, therefore the recharge volume was calculated for the total impervious area.

Table 2: Required Recharge Volume Calculation

	Recharge	**Impervious**	**Volume**
Hydrologic Group	(in/sqft)	(sqft)	(cf)
A - *sand*	0.60	48,279	2,414
B - *loam*	0.35	50,745	1,481
C - *silty loam*	0.25	None	0
D - *clay*	0.10	None	0
		Required Recharge Volume Total	**3,895 cf**

Stormwater Basin Sizing

There are three ways of determining the recharge volume provided by a storm water basin (Static, Simple Dynamic and Dynamic Field). The Static Method, used here, includes the volume of water that can be stored beneath the lowest outlet of the basin. This, the most

conservative method of determining the recharge volume, does not account for any infiltration that takes place while the basin is filling with water and is less dependent on maintenance of the basin since the only way for the water below the lowest invert can leave the basin is though infiltration. The following table summarizes the recharge volume provided by the infiltration basin. Detailed volume calculations for the basins are included in Appendix 5 / Stage-Area-Storage Calculations.

Table 3: Basin Recharge Volume

	Recharge Volume
Basin 1	19,945 cf
Total	19,945 cf

72-hour Drawdown

When using the conservative Static Method to determine infiltration volume provided, the Rawls Rate is used to represent the infiltration rate in place of a hydraulic conductivity rate. The specific rate chosen is based on the textural analysis of the in-situ soil performed by a competent soil professional.

A Massachusetts Certified Soil Evaluator performed an evaluation of the soil at the proposed infiltration BMP. The soil textural analysis for the infiltration BMP is listed below with the associated Rawls Rate used in the calculations. Where textural analysis varied within any single BMP, the most restrictive textural evaluation and Rawls Rate were used. Soil logs of the in-situ soil evaluation are included in Appendix 3 / Field Soils Evaluation.

Table 4: Rawls Rate

	Most Restrictive Soil Texture	Rawls Rate (in/hour)
Basin 1, 2, and 3	Sand	8.27 in/hr

Drawdown time for the infiltration basin is determined by applying the Rawls Rate across the bottom area of the infiltration basin. The volume required for drawdown includes the entire volume below in the lowest outlet in the infiltration basin. The following table summarizes the drawdown time for the basin to show it will drawdown within the 72-hour maximum.

Table 5: Basin Drawdown

	Storage Volume	Bottom Area	Time for Drawdown
Basin 1	19,945 cf	8,356 sf	4 hour

Standard 4: Water Quality

Water Quality Volume

The required water quality volume is determined through a calculation of the proposed impervious pavement throughout the site and a determination of whether the site is in a critical area, or the proposed use is considered to produce a high pollutant load. As noted in Standards 5 and 6, the land use does not qualify as a use with high pollutant load and no critical area was identified for this site. However, the required water quality volume is based on 1.0" as the soil recharge rate is 8.27 in/hr, meeting the threshold rate of 2.4 in/hr or greater, therefore, the water quality volume is calculated at 1.0" over the area of new proposed impervious pavement. Since roof runoff is considered clean and not considered to contribute contaminants to stormwater runoff, the impervious the areas associated with the roof is not included in the required water quality volume.

The area of impervious pavement within the proposed site is calculated from the information entered HydroCAD and can be found in Appendix 4. One inch across 56,242 square feet of impervious pavement requires a water quality volume of 4,687 cubic feet. Detailed calculations for the infiltration basin are included in Appendix 5 / Stage-Area-Storage Calculations.

Removal of Total Suspended Solids

The water quality volume, as calculated in the previous section, is treated through "Treatment Trains" to provide a minimum of 80 percent TSS removal including 44 percent TSS removal for pretreatment prior to discharging to the infiltration BMP. The TSS Removal Worksheets are included in Appendix 6 for the proposed treatment train. The infiltration basin in conjunction with deep sump hooded catch basins and sediment forebay complete the treatment trains at a minimum of 80 percent and 44 percent TSS removal.

Forebay Sizing

All the stormwater from the impervious pavement is collected and discharged to the proposed sediment forebay which is sized to treat 0.1" of runoff from the 56,242-sf impervious pavement contributing to the basin. Detailed calculations for the sediment forebay are included in Appendix 5 / Stage-Area-Storage Calculations.

0.1"/12" per foot x 56,242 sf = 469 cf of storage required

Table 6: Sediment Forebay Sizing

	Impervious Area being Discharged	Required Volume	Provided Volume
Basin 1	56,242 cf	469 c.f.	1,709c.f.

Standard 5: Land Uses with Higher Potential Pollutant Loads

The proposed project is not a use that would qualify as a LUHPPL.

Standard 6: Critical Areas

The proposed project is not within, nor does it discharge stormwater to an identified Critical Area.

Standard 7: Redevelopment Project

This project is not a redevelopment project.

Standard 8: Construction Period Controls

A Construction Period Pollution Control Plan is included in Appendix 8 will be followed to prevent discharge of erosion to abutting properties.

Standard 9: Operation and Maintenance Plan

The Operation and Maintenance Plan included in Appendix 7 address the responsibilities of maintaining the stormwater BMPs.

Standard 10: Illicit Discharges to Drainage System

It is the intent of the developer to follow the Construction Period Pollution Prevention Control Plan and the Order of Conditions to mitigate the affects of the proposed project on the adjacent environment. Following completion of construction, the Operation and Maintenance Plan will be provided to the property manager who will continue, the maintenance of the project. The Illicit Discharge Statement is included in Appendix 9.

Locus Map

Appendix 1

U.S.G.S. Quadrangle

Scale: 1"=2000'

0 2000' 4000' 6000' 8000'

LOCUS MAP

North Street & Blackstone Street
Bellingham, Massachusetts

Date: August 8, 2022	*Project No. F4457*

Guerriere & Halnon, Inc.
Engineering & Land Surveying
333 WEST STREET, MILFORD, MA 01757
(508) 473-6630 FAX: (508) 473-8243
WWW.GANDHENGINEERING.COM

NRCS Soils Report

Appendix 2

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

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

Custom Soil Resource Report for Norfolk and Suffolk Counties, Massachusetts

North Street & Blackstone Street

August 10, 2022

Preface

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

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

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

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

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

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

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Contents

Preface.....2
How Soil Surveys Are Made.....5
Soil Map.....8
Soil Map.....9
Legend.....10
Map Unit Legend.....11
Map Unit Descriptions.....11
Norfolk and Suffolk Counties, Massachusetts.....13
53—Freetown muck, ponded, 0 to 1 percent slopes.....13
254B—Merrimac fine sandy loam, 3 to 8 percent slopes.....14
420B—Canton fine sandy loam, 3 to 8 percent slopes.....16
422B—Canton fine sandy loam, 0 to 8 percent slopes, extremely stony....18
References.....20

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

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

Custom Soil Resource Report
Soil Map

Map Scale: 1:3,080 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 45 90 180 270

Feet: 0 100 200 400 600

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

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Norfolk and Suffolk Counties, Massachusetts
Survey Area Data: Version 17, Sep 3, 2021

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

Date(s) aerial images were photographed: May 24, 2020—Jul 18, 2020

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
53	Freetown muck, ponded, 0 to 1 percent slopes	2.0	9.5%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	12.8	61.3%
420B	Canton fine sandy loam, 3 to 8 percent slopes	1.3	6.1%
422B	Canton fine sandy loam, 0 to 8 percent slopes, extremely stony	4.8	23.1%
Totals for Area of Interest		**20.8**	**100.0%**

Map Unit Descriptions

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

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

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

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

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

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

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

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

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

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

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

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

Norfolk and Suffolk Counties, Massachusetts

53—Freetown muck, ponded, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2t2qc
Elevation: 0 to 1,140 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Freetown, Ponded

Setting

Landform: Kettles, marshes, depressions, depressions, bogs, swamps
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Highly decomposed organic material

Typical profile

Oe - 0 to 2 inches: mucky peat
Oa - 2 to 79 inches: muck

Properties and qualities

Slope: 0 to 1 percent
Surface area covered with cobbles, stones or boulders: 0.0 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: Rare
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: Very high (about 19.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Ecological site: F144AY043MA - Acidic Organic Wetlands
Hydric soil rating: Yes

Minor Components

Whitman, ponded

Percent of map unit: 5 percent
Landform: Depressions on ground moraines

Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Scarboro

Percent of map unit: 5 percent
Landform: Drainageways, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Swansea, ponded

Percent of map unit: 5 percent
Landform: Bogs, swamps, marshes, depressions, depressions, kettles
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

254B—Merrimac fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2tyqs
Elevation: 0 to 1,290 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

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

Description of Merrimac

Setting

Landform: Outwash plains, outwash terraces, moraines, eskers, kames
Landform position (two-dimensional): Summit, shoulder, backslope, footslope
Landform position (three-dimensional): Crest, side slope, riser, tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy glaciofluvial deposits derived from granite, schist, and gneiss over sandy and gravelly glaciofluvial deposits derived from granite, schist, and gneiss

Typical profile

Ap - 0 to 10 inches: fine sandy loam
Bw1 - 10 to 22 inches: fine sandy loam
Bw2 - 22 to 26 inches: stratified gravel to gravelly loamy sand
2C - 26 to 65 inches: stratified gravel to very gravelly sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 2 percent
Maximum salinity: Nonsaline (0.0 to 1.4 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water supply, 0 to 60 inches: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: A
Ecological site: F145XY008MA - Dry Outwash
Hydric soil rating: No

Minor Components

Hinckley

Percent of map unit: 5 percent
Landform: Deltas, kames, eskers, outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Head slope, nose slope, crest, side slope, rise
Down-slope shape: Convex
Across-slope shape: Convex, linear
Hydric soil rating: No

Sudbury

Percent of map unit: 5 percent
Landform: Deltas, terraces, outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Windsor

Percent of map unit: 3 percent
Landform: Outwash terraces, dunes, deltas, outwash plains
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Tread, riser
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex

Hydric soil rating: No

Agawam

Percent of map unit: 2 percent
Landform: Outwash plains, outwash terraces, moraines, stream terraces, eskers, kames
Landform position (three-dimensional): Rise
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

420B—Canton fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2w81b
Elevation: 0 to 1,180 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

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

Description of Canton

Setting

Landform: Hills, moraines, ridges
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Coarse-loamy over sandy melt-out till derived from gneiss, granite, and/or schist

Typical profile

Ap - 0 to 7 inches: fine sandy loam
Bw1 - 7 to 15 inches: fine sandy loam
Bw2 - 15 to 26 inches: gravelly fine sandy loam
2C - 26 to 65 inches: gravelly loamy sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 19 to 39 inches to strongly contrasting textural stratification
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)

Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: B
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Scituate

Percent of map unit: 10 percent
Landform: Hills, drumlins, ground moraines
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Montauk

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

Charlton

Percent of map unit: 4 percent
Landform: Ridges, ground moraines, hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Swansea

Percent of map unit: 1 percent
Landform: Marshes, depressions, bogs, swamps, kettles
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

422B—Canton fine sandy loam, 0 to 8 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 2w818
Elevation: 0 to 1,180 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Canton, Extremely Stony

Setting

Landform: Moraines, hills, ridges
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Coarse-loamy over sandy melt-out till derived from gneiss, granite, and/or schist

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
A - 2 to 5 inches: fine sandy loam
Bw1 - 5 to 16 inches: fine sandy loam
Bw2 - 16 to 22 inches: gravelly fine sandy loam
2C - 22 to 67 inches: gravelly loamy sand

Properties and qualities

Slope: 0 to 8 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 19 to 39 inches to strongly contrasting textural stratification
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: B
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Charlton, extremely stony
Percent of map unit: 6 percent
Landform: Ridges, ground moraines, hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Scituate, extremely stony
Percent of map unit: 6 percent
Landform: Hills, ground moraines, drumlins
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Swansea
Percent of map unit: 4 percent
Landform: Marshes, depressions, bogs, swamps, kettles
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Montauk, extremely stony
Percent of map unit: 4 percent
Landform: Recessionial moraines, ground moraines, hills, drumlins
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

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Field Soils Evaluation

Appendix 3

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Deep Observation Hole Number: DTH #8

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-8	A	10YR 3/3	-	-	-	S.L.	0	0	-	-	-
8-24	B	10YR 5/6	-	-	-	S.L.	0	0	-	-	-
24-103	C	2.5Y 5/4	-	-	-	SAND	20	20	-	-	-

Additional Notes WATER @ 92"

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Deep Observation Hole Number: DTH #9

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-48	F	-	-	-	-	-	-	-	-	-	-
48-108	C	2.5Y 5/4	-	-	-	SAND	20	20	-	-	-

Additional Notes WEEPING @ 80"

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

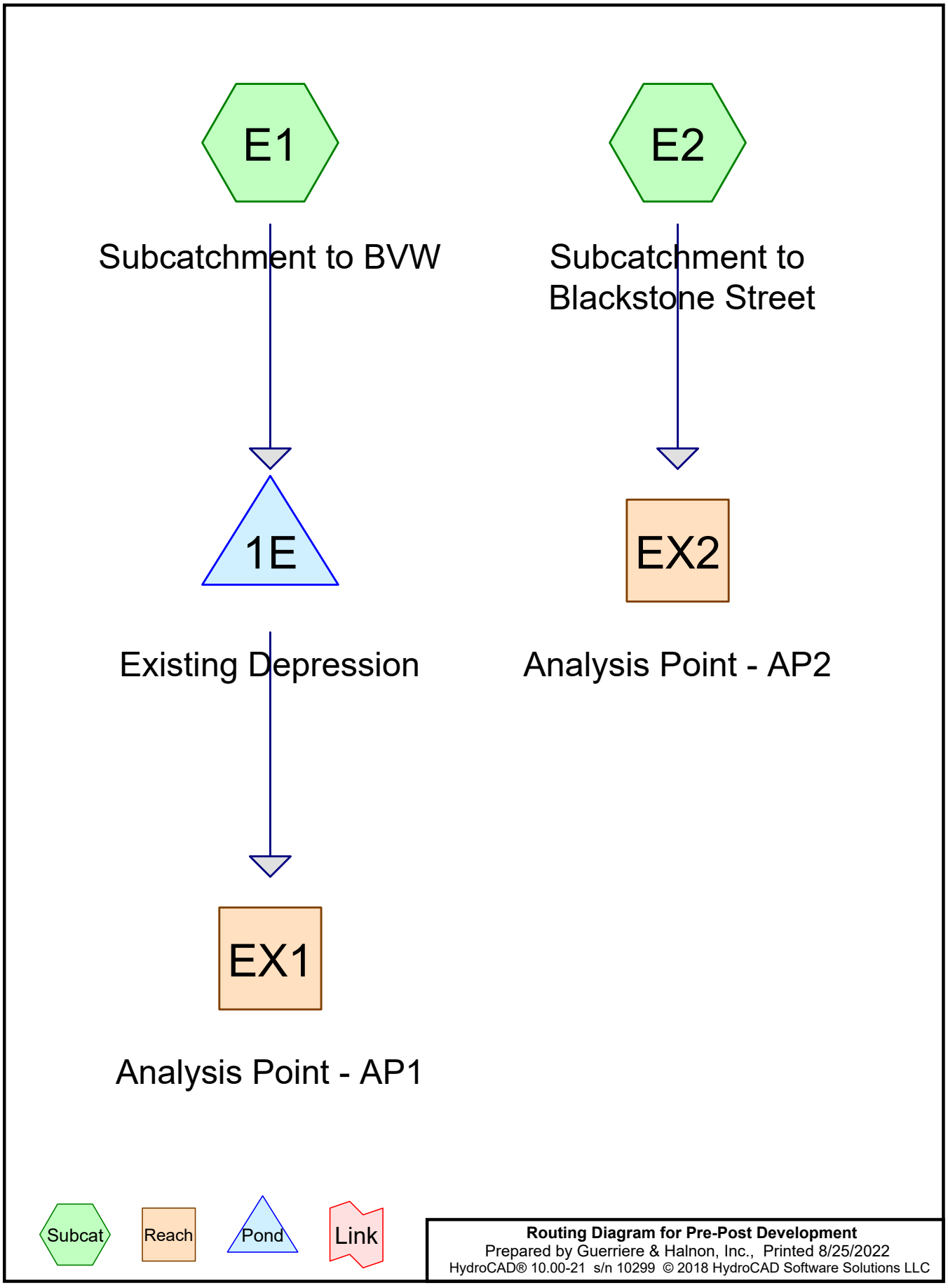
Deep Observation Hole Number: DTH #10

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-14	A	10YR 3/3	-	-	-	S.L.	0	0	-	-	-
14-28	B	10YR 5/6	-	-	-	S.L.	0	0	-	-	-
28-42	C1	2.5Y 6/2	-	-	-	S.L.	0	0	-	-	-
42-100	C2	2.5Y 5/4	48"	-	-	SAND	20	20	-	-	-

Additional Notes WEEPING @ 86"

HydroCAD Calculations

Appendix 4



Routing Diagram for Pre-Post Development
Prepared by Guerriere & Halnon, Inc., Printed 8/25/2022

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
4.118	39	>75% Grass cover, Good, HSG A (E1, E2)
0.892	61	>75% Grass cover, Good, HSG B (E1, E2)
0.183	30	Woods, Good, HSG A (E1, E2)
16.187	55	Woods, Good, HSG B (E1, E2)
21.380	**52**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
4.301	HSG A	E1, E2
17.079	HSG B	E1, E2
0.000	HSG C	
0.000	HSG D	
0.000	Other	
21.380		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
4.118	0.892	0.000	0.000	0.000	5.010	>75% Grass cover, Good	E1, E2
0.183	16.187	0.000	0.000	0.000	16.370	Woods, Good	E1, E2
4.301	**17.079**	**0.000**	**0.000**	**0.000**	**21.380**	**TOTAL AREA**	

Summary for Subcatchment E1: Subcatchment to BVW

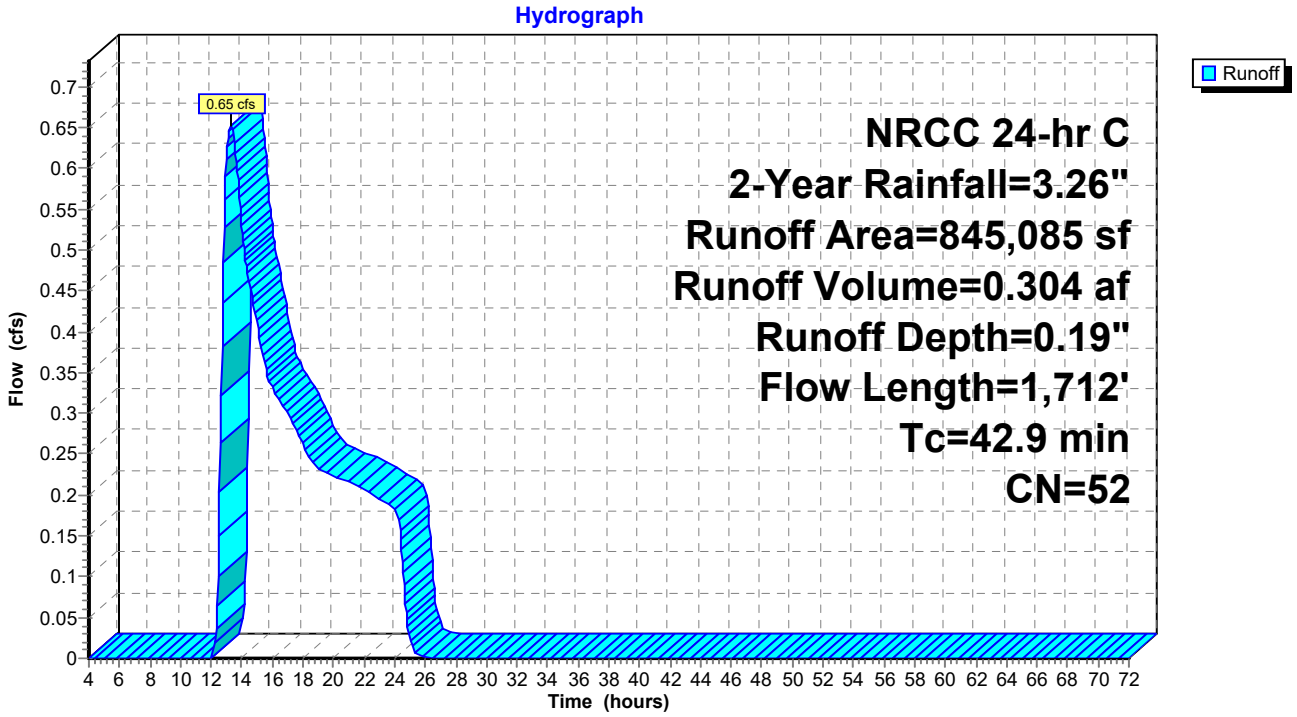
Runoff = 0.65 cfs @ 13.28 hrs, Volume= 0.304 af, Depth= 0.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.26"

Area (sf)	CN	Description
636,164	55	Woods, Good, HSG B
22,971	61	>75% Grass cover, Good, HSG B
178,444	39	>75% Grass cover, Good, HSG A
7,506	30	Woods, Good, HSG A
845,085	52	Weighted Average
845,085		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.2	50	0.0800	0.07		**Sheet Flow, Segment A-B** Woods: Dense underbrush n= 0.800 P2= 3.26"
0.9	78	0.0800	1.41		**Shallow Concentrated Flow, Segment B-C** Woodland Kv= 5.0 fps
12.7	592	0.0240	0.77		**Shallow Concentrated Flow, Segment C-D** Woodland Kv= 5.0 fps
10.0	581	0.0190	0.96		**Shallow Concentrated Flow, Segment D-E** Short Grass Pasture Kv= 7.0 fps
7.1	411	0.0190	0.96		**Shallow Concentrated Flow, Segment E-F** Short Grass Pasture Kv= 7.0 fps
42.9	1,712	Total			

Subcatchment E1: Subcatchment to BVW



Summary for Subcatchment E2: Subcatchment to Blackstone Street

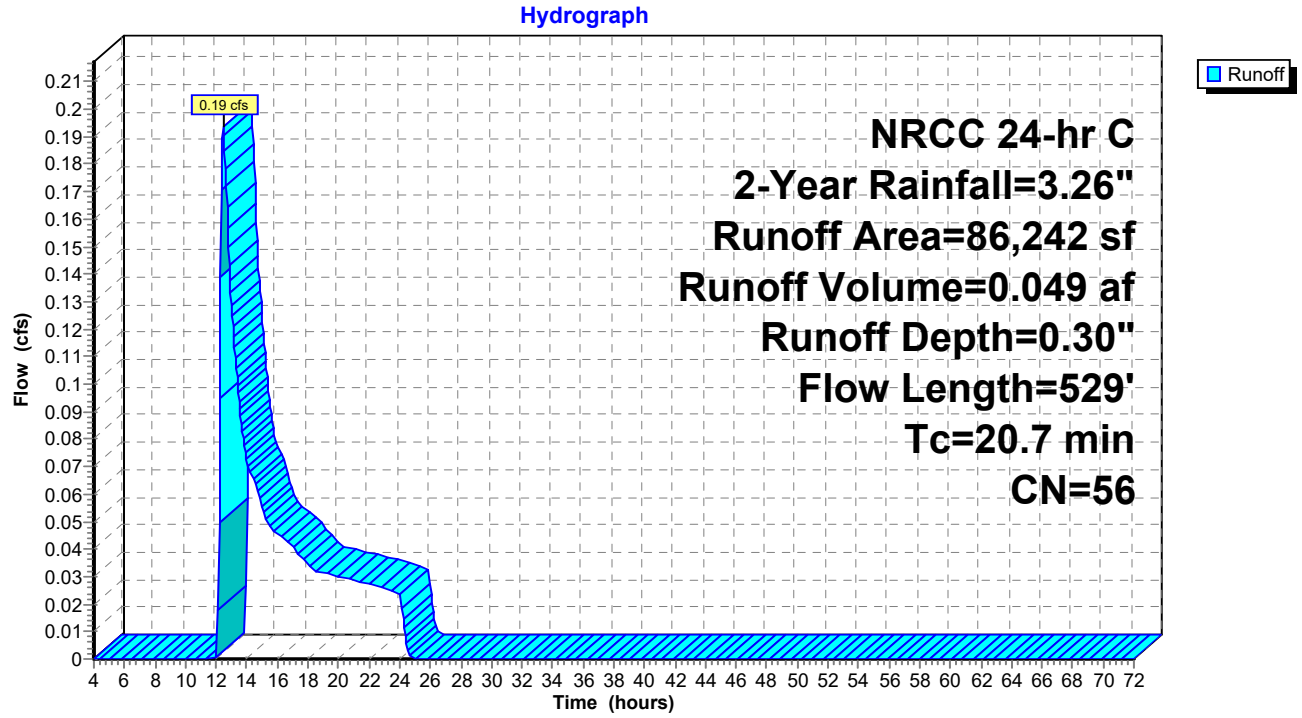
Runoff = 0.19 cfs @ 12.45 hrs, Volume= 0.049 af, Depth= 0.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.26"

Area (sf)	CN	Description
68,935	55	Woods, Good, HSG B
15,889	61	>75% Grass cover, Good, HSG B
934	39	>75% Grass cover, Good, HSG A
484	30	Woods, Good, HSG A
86,242	56	Weighted Average
86,242		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.6	50	0.0610	0.06		**Sheet Flow, Segment A-B** Woods: Dense underbrush n= 0.800 P2= 3.26"
2.8	215	0.0640	1.26		**Shallow Concentrated Flow, Segment B-C** Woodland Kv= 5.0 fps
2.2	103	0.0240	0.77		**Shallow Concentrated Flow, Segment C-D** Woodland Kv= 5.0 fps
2.1	161	0.0340	1.29		**Shallow Concentrated Flow, Segment D-E** Short Grass Pasture Kv= 7.0 fps
20.7	529	Total			

Subcatchment E2: Subcatchment to Blackstone Street

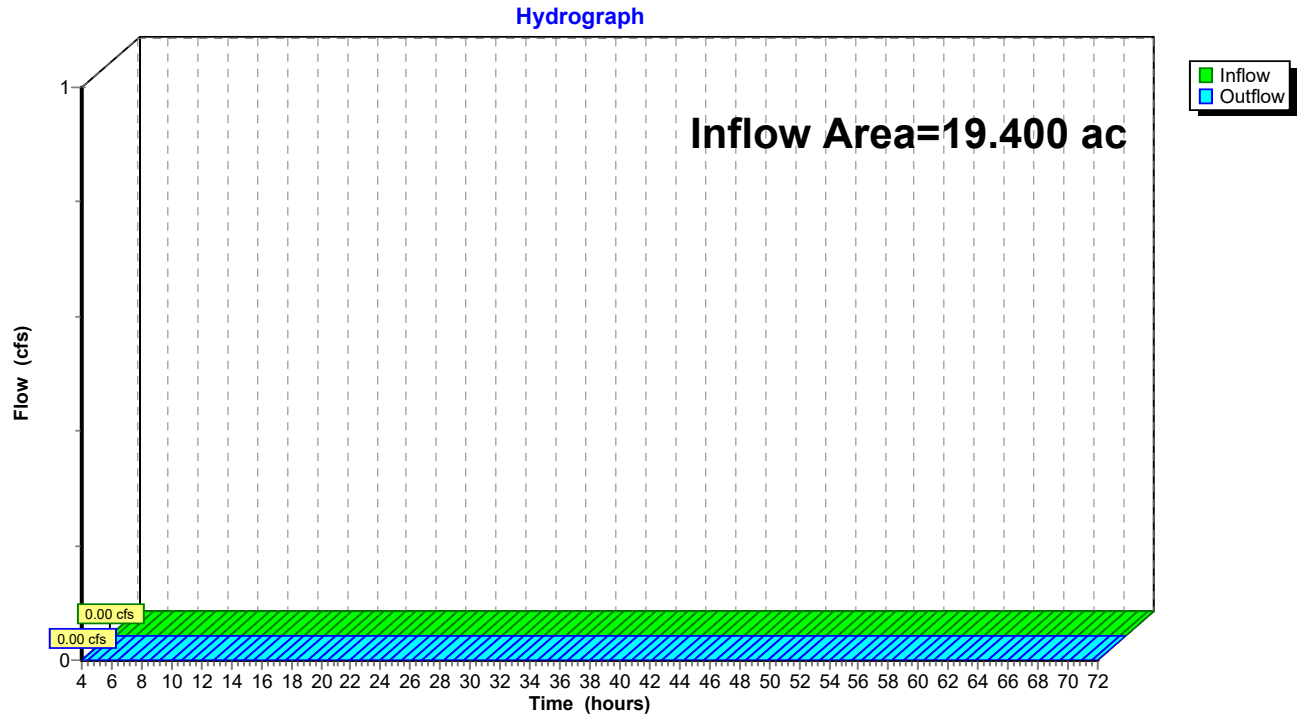


Summary for Reach EX1: Analysis Point - AP1

Inflow Area = 19.400 ac, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 4.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 4.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs

Reach EX1: Analysis Point - AP1

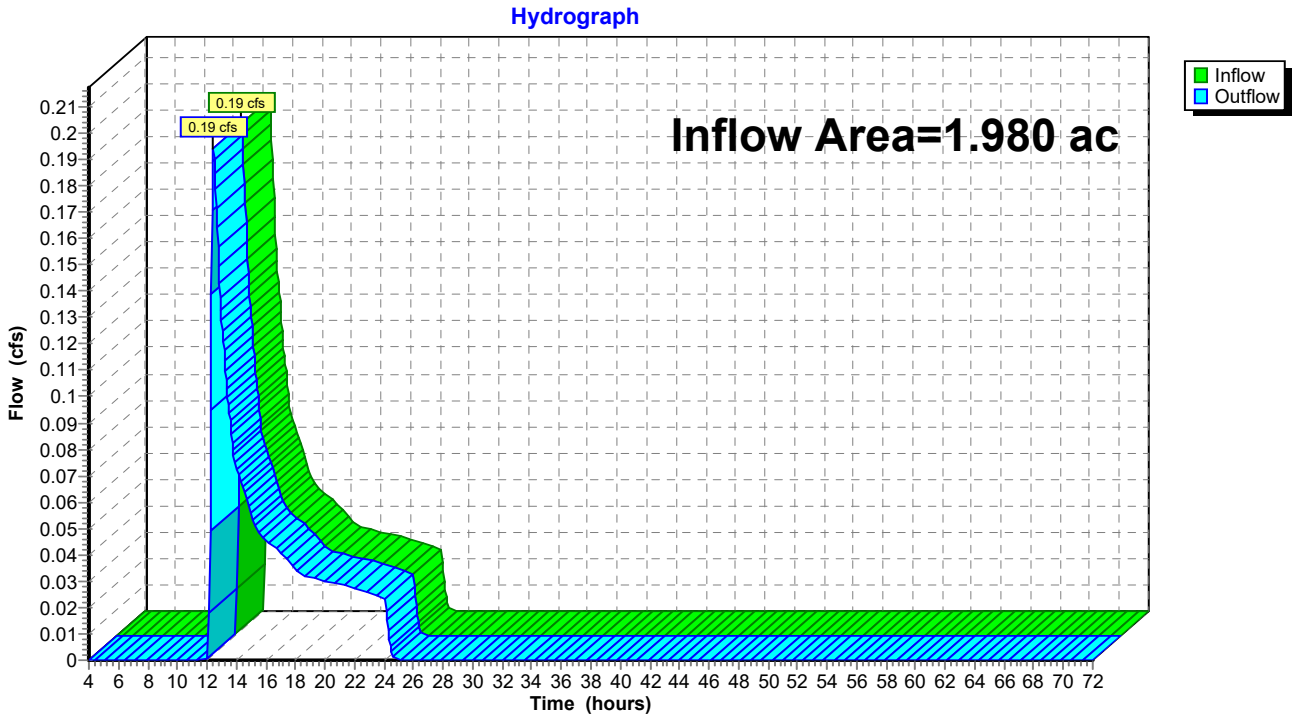


Summary for Reach EX2: Analysis Point - AP2

Inflow Area = 1.980 ac, 0.00% Impervious, Inflow Depth = 0.30" for 2-Year event
Inflow = 0.19 cfs @ 12.45 hrs, Volume= 0.049 af
Outflow = 0.19 cfs @ 12.45 hrs, Volume= 0.049 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs

Reach EX2: Analysis Point - AP2



Summary for Pond 1E: Existing Depression

Inflow Area = 19.400 ac, 0.00% Impervious, Inflow Depth = 0.19" for 2-Year event
Inflow = 0.65 cfs @ 13.28 hrs, Volume= 0.304 af
Outflow = 0.26 cfs @ 18.03 hrs, Volume= 0.304 af, Atten= 60%, Lag= 285.1 min
Discarded = 0.26 cfs @ 18.03 hrs, Volume= 0.304 af
Primary = 0.00 cfs @ 4.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 308.00' @ 18.03 hrs Surf.Area= 11,088 sf Storage= 3,878 cf
Flood Elev= 309.20' Surf.Area= 30,032 sf Storage= 26,478 cf

Plug-Flow detention time= 208.6 min calculated for 0.303 af (100% of inflow)
Center-of-Mass det. time= 208.8 min (1,245.6 - 1,036.9)

Volume	Invert	Avail.Storage	Storage Description
#1	307.30'	26,478 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

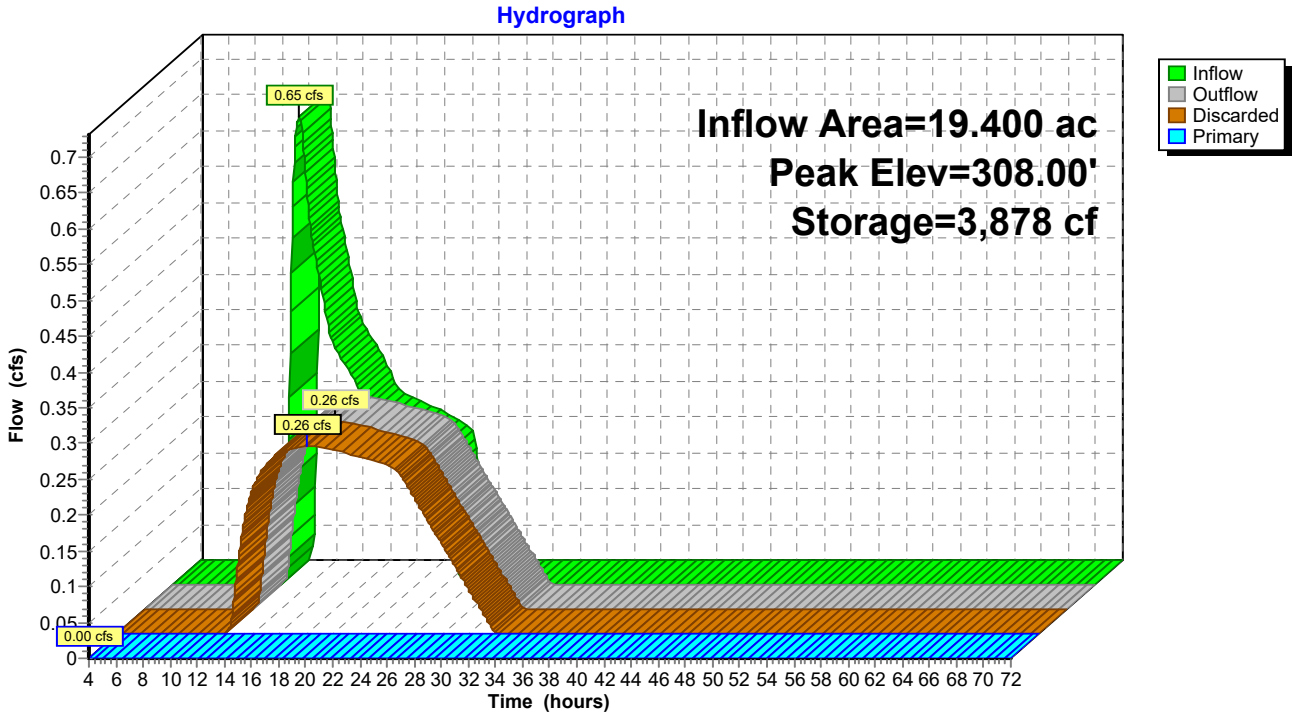
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
307.30	48	0	0
308.00	11,143	3,917	3,917
309.00	28,160	19,652	23,568
309.10	30,032	2,910	26,478

Device	Routing	Invert	Outlet Devices
#1	Discarded	307.30'	**1.020 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	309.05'	**5.0' 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

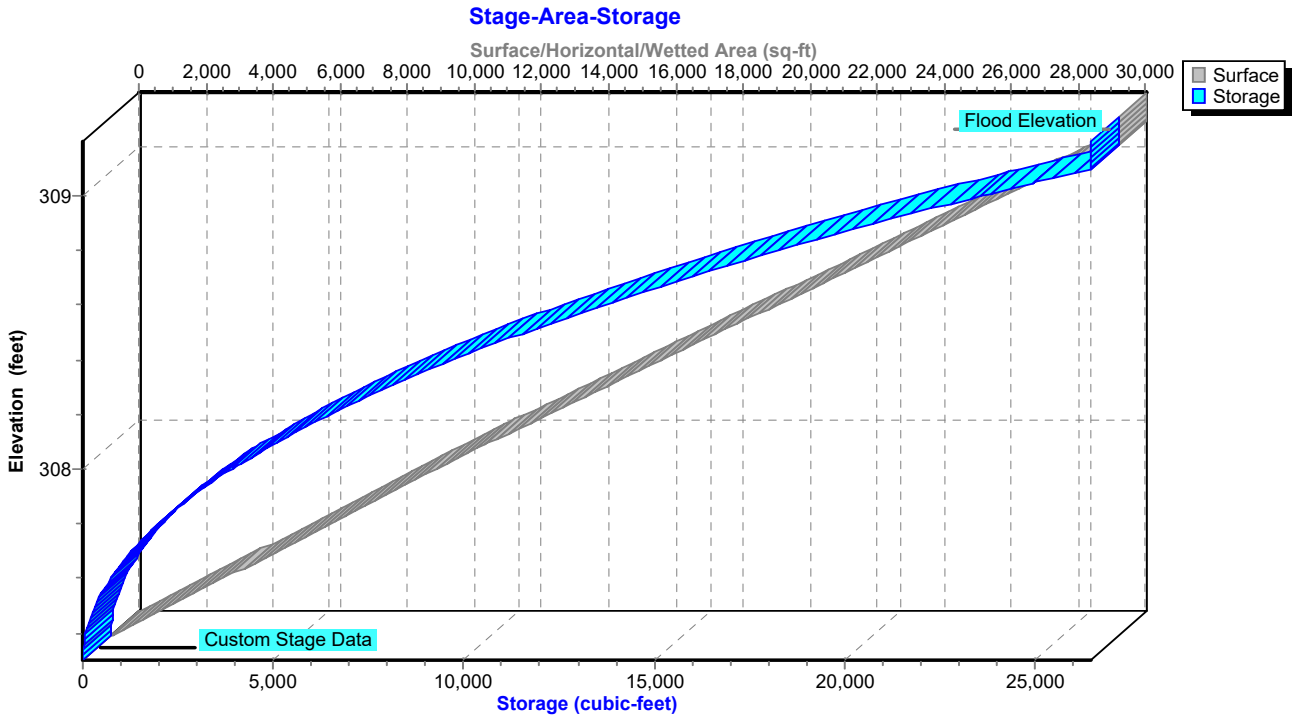
Discarded OutFlow Max=0.26 cfs @ 18.03 hrs HW=308.00' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.26 cfs)

Primary OutFlow Max=0.00 cfs @ 4.00 hrs HW=307.30' TW=0.00' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1E: Existing Depression



Pond 1E: Existing Depression



Summary for Subcatchment E1: Subcatchment to BVW

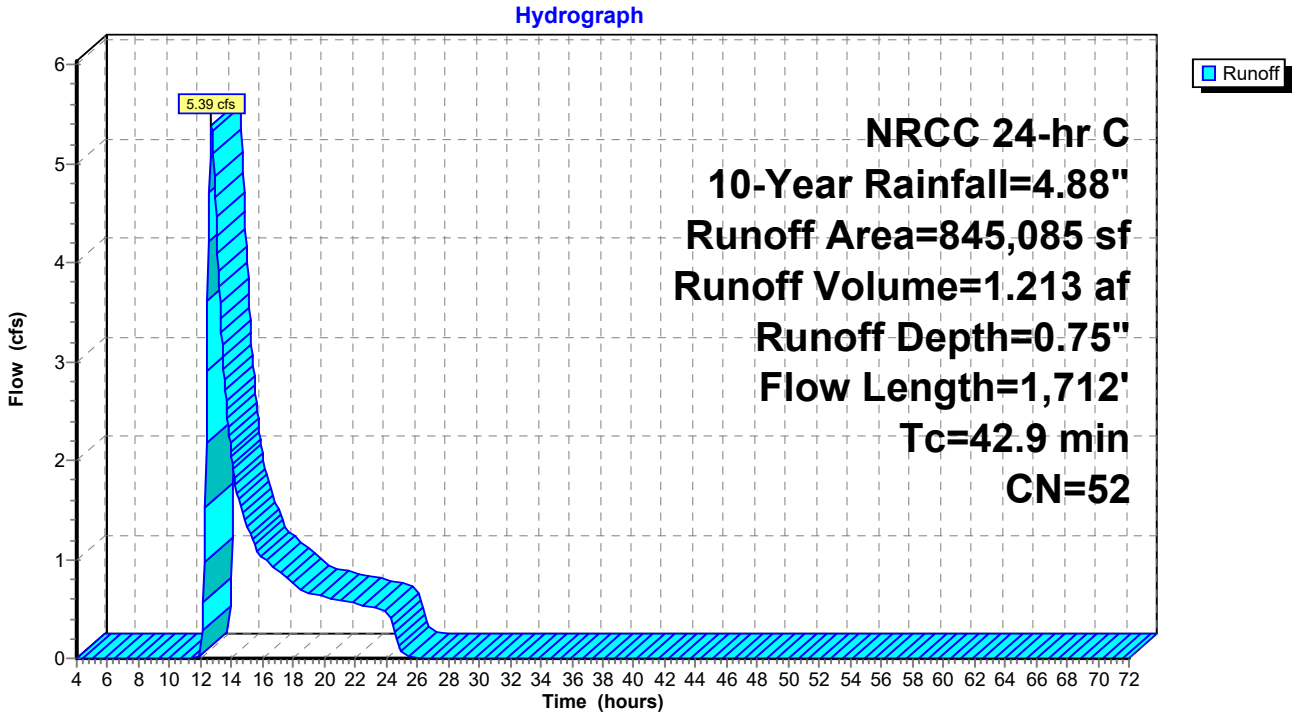
Runoff = 5.39 cfs @ 12.72 hrs, Volume= 1.213 af, Depth= 0.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.88"

Area (sf)	CN	Description
636,164	55	Woods, Good, HSG B
22,971	61	>75% Grass cover, Good, HSG B
178,444	39	>75% Grass cover, Good, HSG A
7,506	30	Woods, Good, HSG A
845,085	52	Weighted Average
845,085		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.2	50	0.0800	0.07		**Sheet Flow, Segment A-B** Woods: Dense underbrush n= 0.800 P2= 3.26"
0.9	78	0.0800	1.41		**Shallow Concentrated Flow, Segment B-C** Woodland Kv= 5.0 fps
12.7	592	0.0240	0.77		**Shallow Concentrated Flow, Segment C-D** Woodland Kv= 5.0 fps
10.0	581	0.0190	0.96		**Shallow Concentrated Flow, Segment D-E** Short Grass Pasture Kv= 7.0 fps
7.1	411	0.0190	0.96		**Shallow Concentrated Flow, Segment E-F** Short Grass Pasture Kv= 7.0 fps
42.9	1,712	Total			

Subcatchment E1: Subcatchment to BVW



Summary for Subcatchment E2: Subcatchment to Blackstone Street

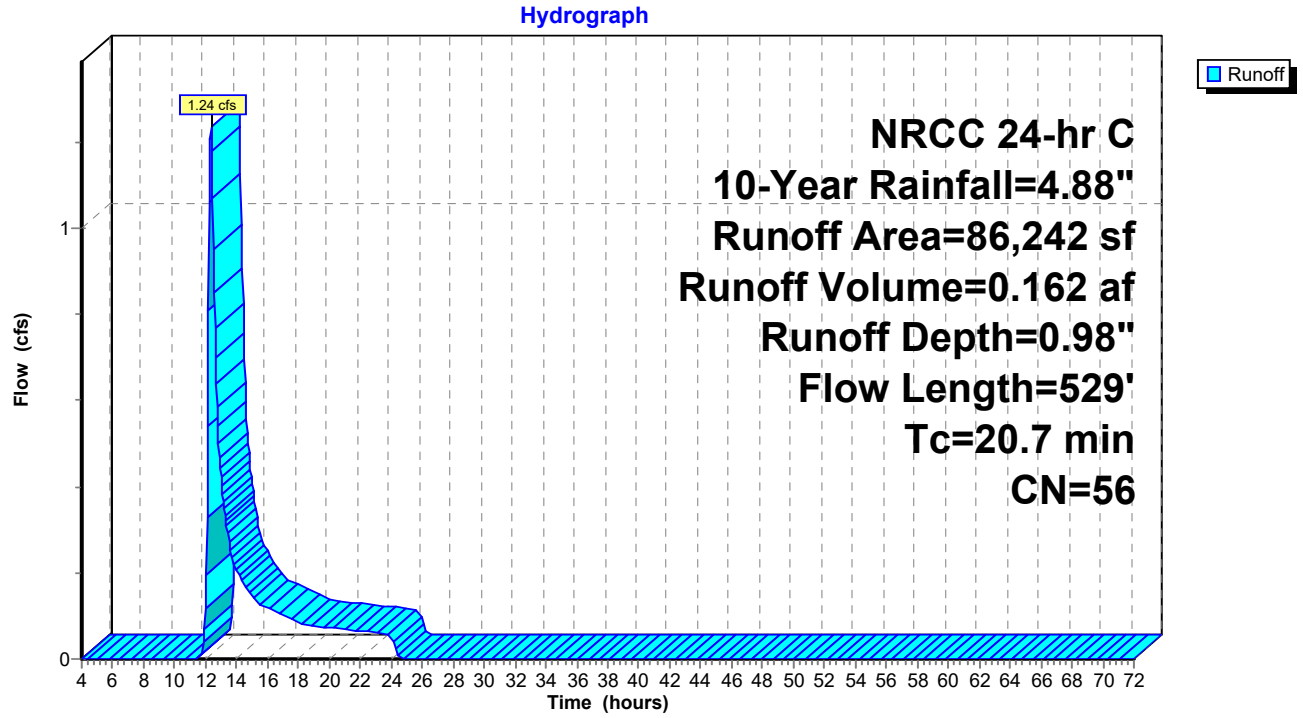
Runoff = 1.24 cfs @ 12.34 hrs, Volume= 0.162 af, Depth= 0.98"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.88"

Area (sf)	CN	Description
68,935	55	Woods, Good, HSG B
15,889	61	>75% Grass cover, Good, HSG B
934	39	>75% Grass cover, Good, HSG A
484	30	Woods, Good, HSG A
86,242	56	Weighted Average
86,242		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.6	50	0.0610	0.06		**Sheet Flow, Segment A-B** Woods: Dense underbrush n= 0.800 P2= 3.26"
2.8	215	0.0640	1.26		**Shallow Concentrated Flow, Segment B-C** Woodland Kv= 5.0 fps
2.2	103	0.0240	0.77		**Shallow Concentrated Flow, Segment C-D** Woodland Kv= 5.0 fps
2.1	161	0.0340	1.29		**Shallow Concentrated Flow, Segment D-E** Short Grass Pasture Kv= 7.0 fps
20.7	529	Total			

Subcatchment E2: Subcatchment to Blackstone Street

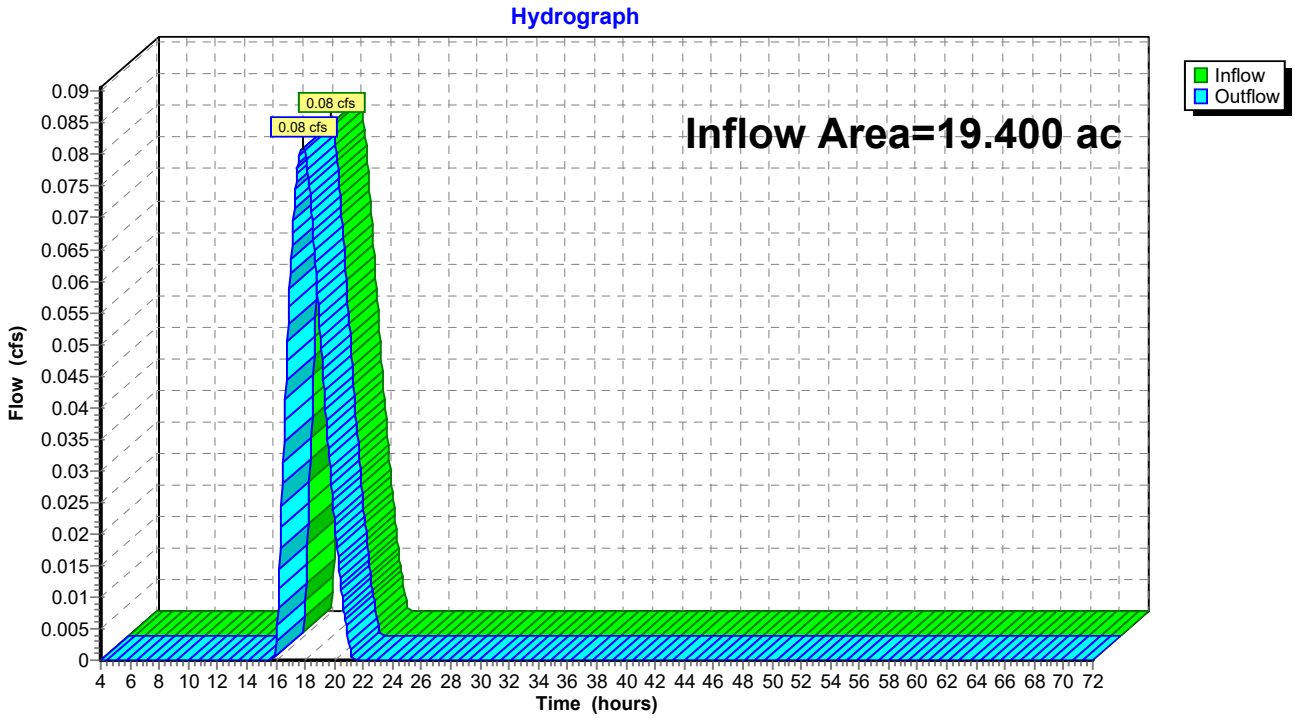


Summary for Reach EX1: Analysis Point - AP1

Inflow Area = 19.400 ac, 0.00% Impervious, Inflow Depth = 0.01" for 10-Year event
Inflow = 0.08 cfs @ 17.82 hrs, Volume= 0.018 af
Outflow = 0.08 cfs @ 17.82 hrs, Volume= 0.018 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs

Reach EX1: Analysis Point - AP1

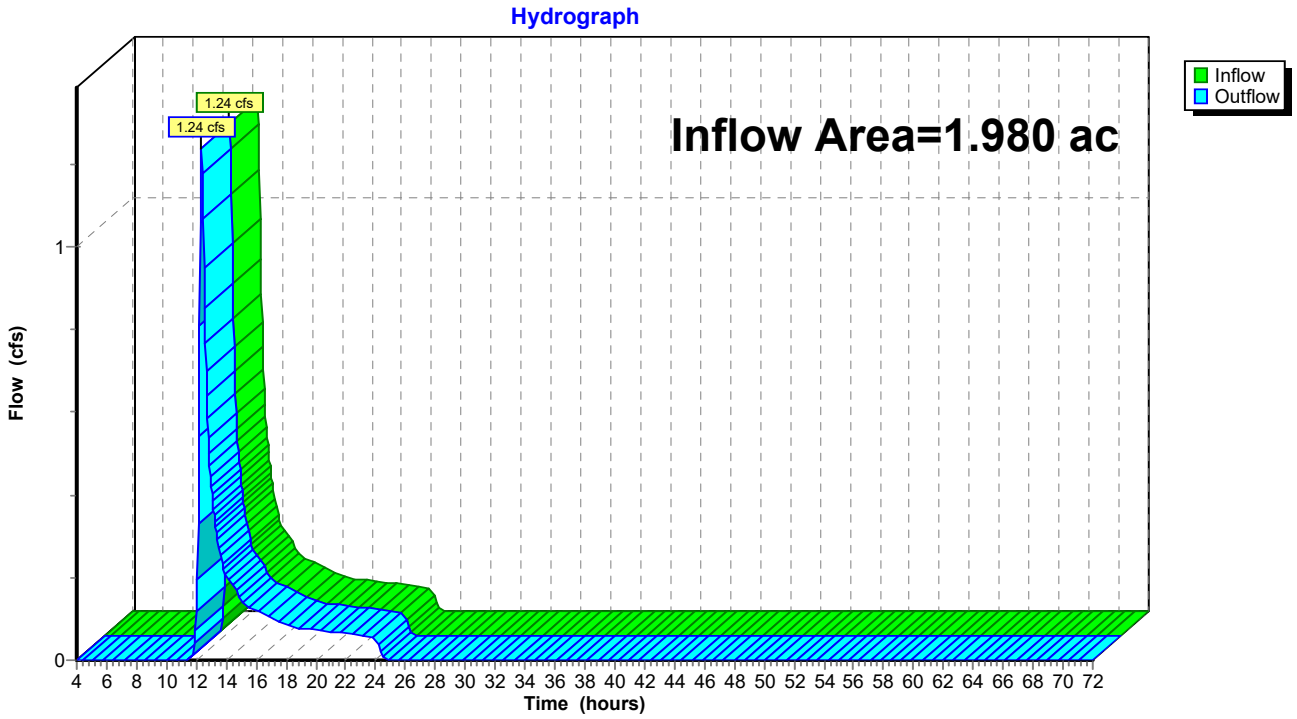


Summary for Reach EX2: Analysis Point - AP2

Inflow Area = 1.980 ac, 0.00% Impervious, Inflow Depth = 0.98" for 10-Year event
Inflow = 1.24 cfs @ 12.34 hrs, Volume= 0.162 af
Outflow = 1.24 cfs @ 12.34 hrs, Volume= 0.162 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs

Reach EX2: Analysis Point - AP2



Summary for Pond 1E: Existing Depression

Inflow Area = 19.400 ac, 0.00% Impervious, Inflow Depth = 0.75" for 10-Year event
Inflow = 5.39 cfs @ 12.72 hrs, Volume= 1.213 af
Outflow = 0.78 cfs @ 17.82 hrs, Volume= 1.213 af, Atten= 85%, Lag= 305.9 min
Discarded = 0.70 cfs @ 17.82 hrs, Volume= 1.195 af
Primary = 0.08 cfs @ 17.82 hrs, Volume= 0.018 af

Routing by Dyn-Stor-Ind method, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 309.09' @ 17.82 hrs Surf.Area= 29,776 sf Storage= 26,068 cf
Flood Elev= 309.20' Surf.Area= 30,032 sf Storage= 26,478 cf

Plug-Flow detention time= 492.7 min calculated for 1.212 af (100% of inflow)
Center-of-Mass det. time= 493.2 min (1,452.4 - 959.3)

Volume	Invert	Avail.Storage	Storage Description
#1	307.30'	26,478 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

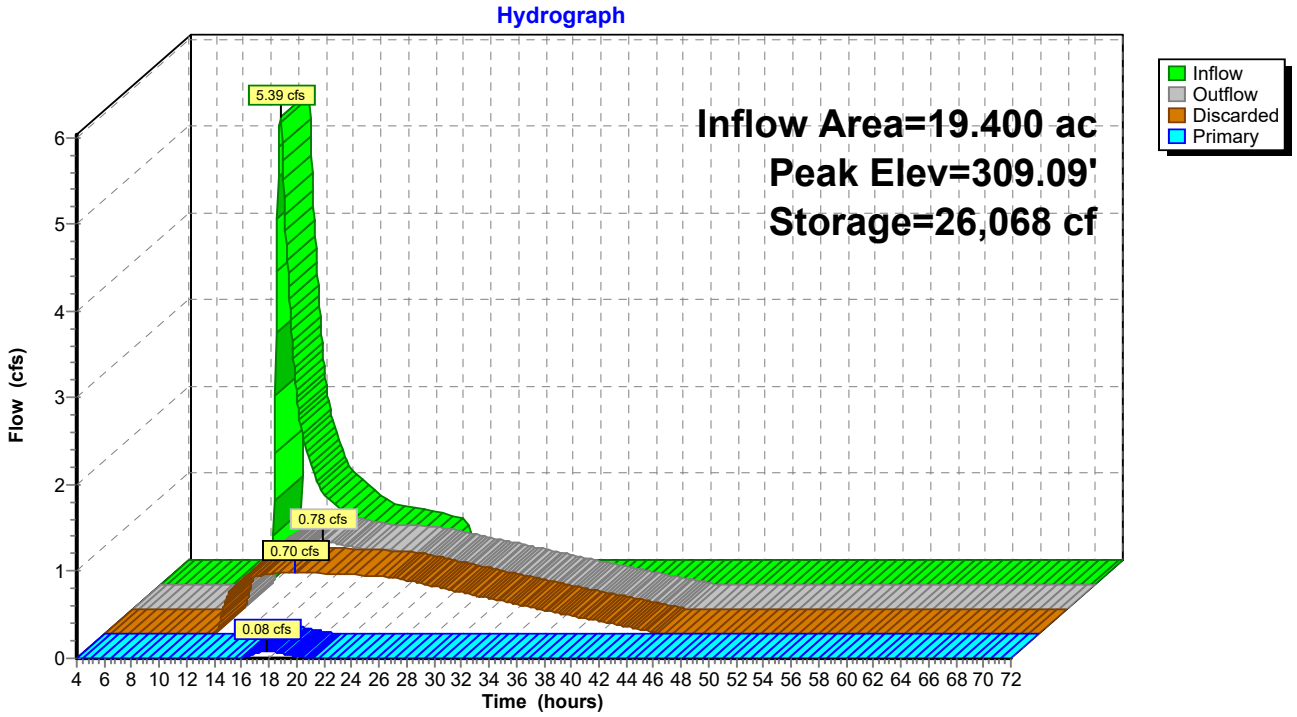
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
307.30	48	0	0
308.00	11,143	3,917	3,917
309.00	28,160	19,652	23,568
309.10	30,032	2,910	26,478

Device	Routing	Invert	Outlet Devices
#1	Discarded	307.30'	**1.020 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	309.05'	**5.0' 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

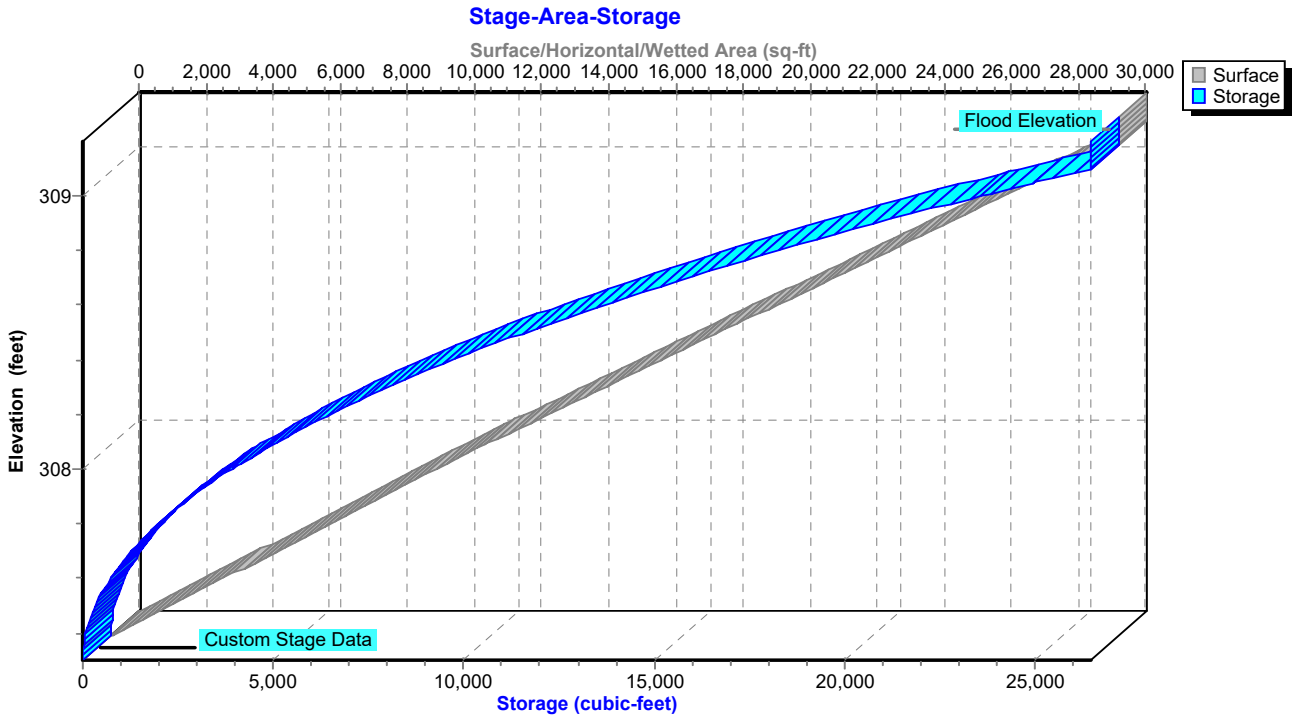
Discarded OutFlow Max=0.70 cfs @ 17.82 hrs HW=309.09' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.70 cfs)

Primary OutFlow Max=0.08 cfs @ 17.82 hrs HW=309.09' TW=0.00' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 0.08 cfs @ 0.45 fps)

Pond 1E: Existing Depression



Pond 1E: Existing Depression



Summary for Subcatchment E1: Subcatchment to BVW

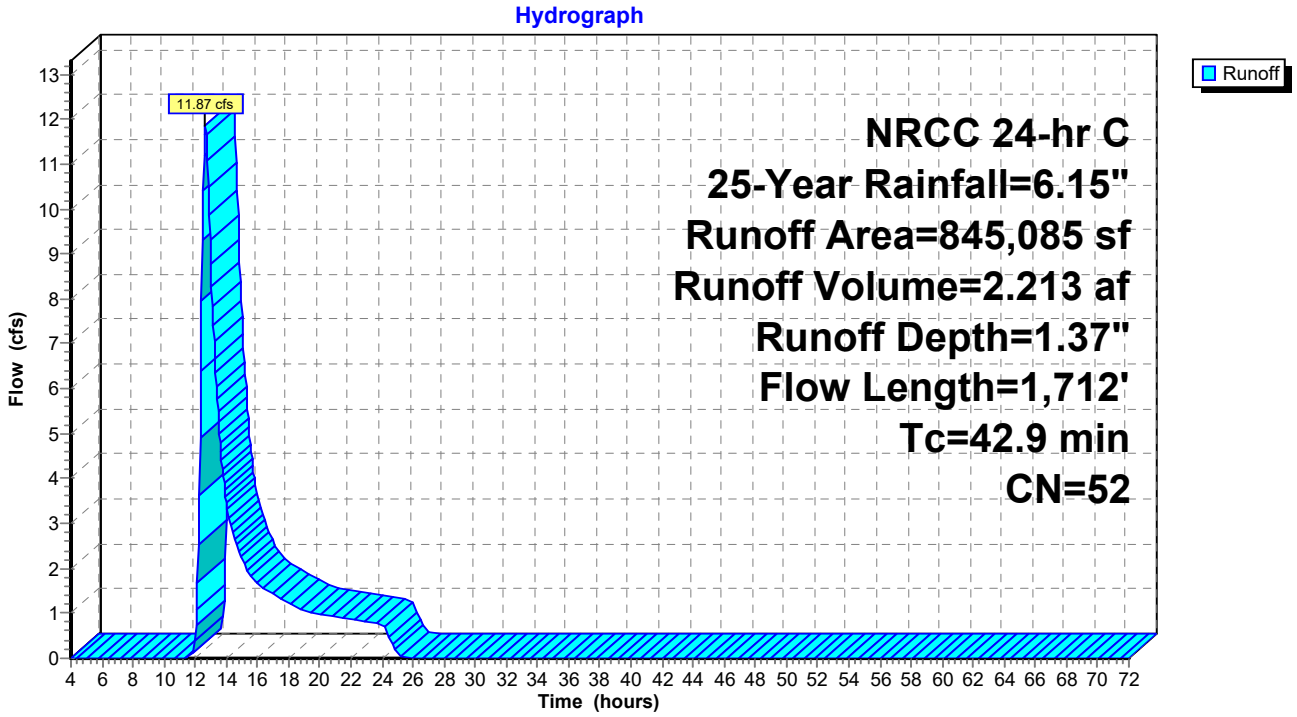
Runoff = 11.87 cfs @ 12.66 hrs, Volume= 2.213 af, Depth= 1.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.15"

Area (sf)	CN	Description
636,164	55	Woods, Good, HSG B
22,971	61	>75% Grass cover, Good, HSG B
178,444	39	>75% Grass cover, Good, HSG A
7,506	30	Woods, Good, HSG A
845,085	52	Weighted Average
845,085		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.2	50	0.0800	0.07		**Sheet Flow, Segment A-B** Woods: Dense underbrush n= 0.800 P2= 3.26"
0.9	78	0.0800	1.41		**Shallow Concentrated Flow, Segment B-C** Woodland Kv= 5.0 fps
12.7	592	0.0240	0.77		**Shallow Concentrated Flow, Segment C-D** Woodland Kv= 5.0 fps
10.0	581	0.0190	0.96		**Shallow Concentrated Flow, Segment D-E** Short Grass Pasture Kv= 7.0 fps
7.1	411	0.0190	0.96		**Shallow Concentrated Flow, Segment E-F** Short Grass Pasture Kv= 7.0 fps
42.9	1,712	Total			

Subcatchment E1: Subcatchment to BVW



Summary for Subcatchment E2: Subcatchment to Blackstone Street

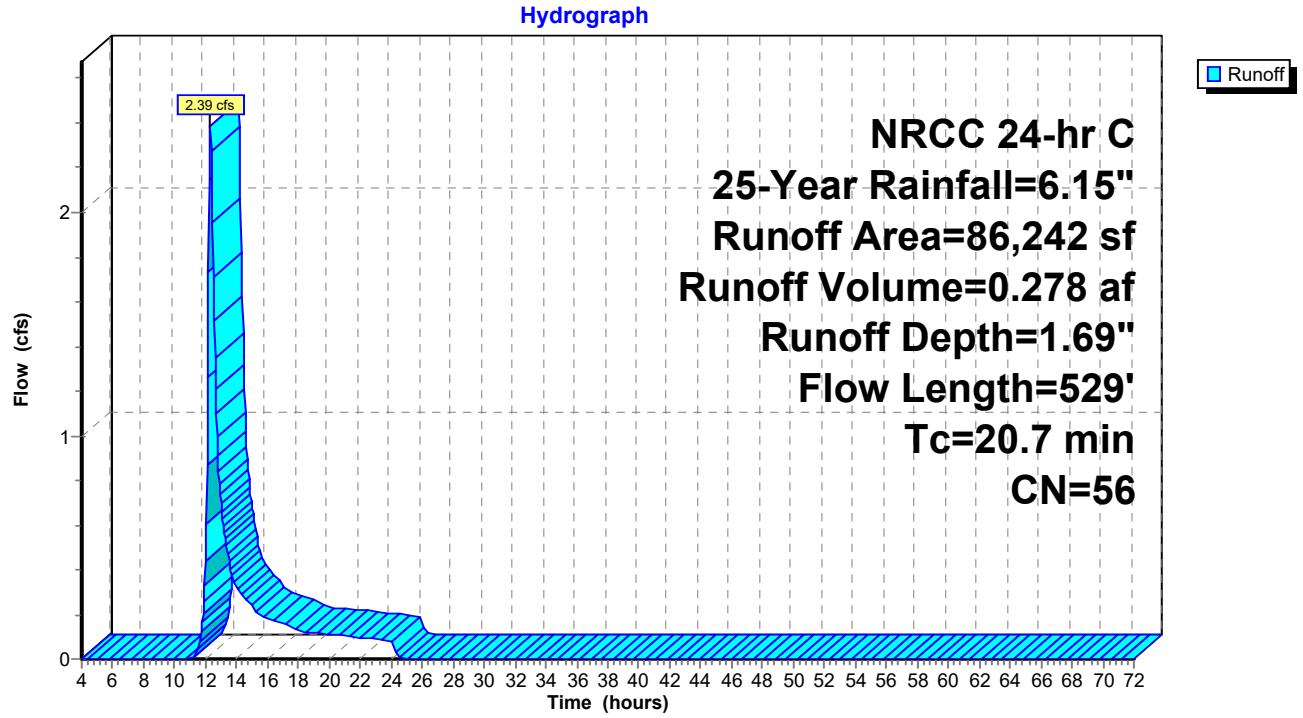
Runoff = 2.39 cfs @ 12.32 hrs, Volume= 0.278 af, Depth= 1.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.15"

Area (sf)	CN	Description
68,935	55	Woods, Good, HSG B
15,889	61	>75% Grass cover, Good, HSG B
934	39	>75% Grass cover, Good, HSG A
484	30	Woods, Good, HSG A
86,242	56	Weighted Average
86,242		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.6	50	0.0610	0.06		**Sheet Flow, Segment A-B** Woods: Dense underbrush n= 0.800 P2= 3.26"
2.8	215	0.0640	1.26		**Shallow Concentrated Flow, Segment B-C** Woodland Kv= 5.0 fps
2.2	103	0.0240	0.77		**Shallow Concentrated Flow, Segment C-D** Woodland Kv= 5.0 fps
2.1	161	0.0340	1.29		**Shallow Concentrated Flow, Segment D-E** Short Grass Pasture Kv= 7.0 fps
20.7	529	Total			

Subcatchment E2: Subcatchment to Blackstone Street

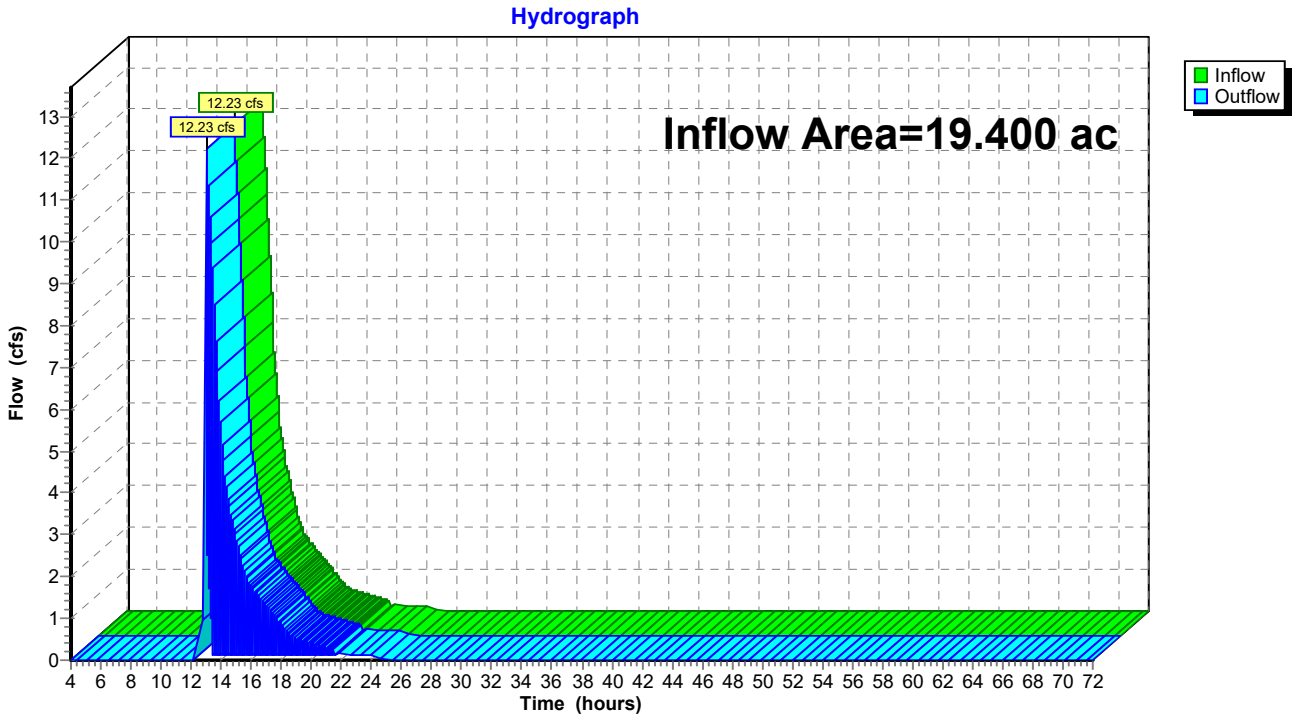


Summary for Reach EX1: Analysis Point - AP1

Inflow Area = 19.400 ac, 0.00% Impervious, Inflow Depth = 0.56" for 25-Year event
Inflow = 12.23 cfs @ 13.05 hrs, Volume= 0.898 af
Outflow = 12.23 cfs @ 13.05 hrs, Volume= 0.898 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs

Reach EX1: Analysis Point - AP1

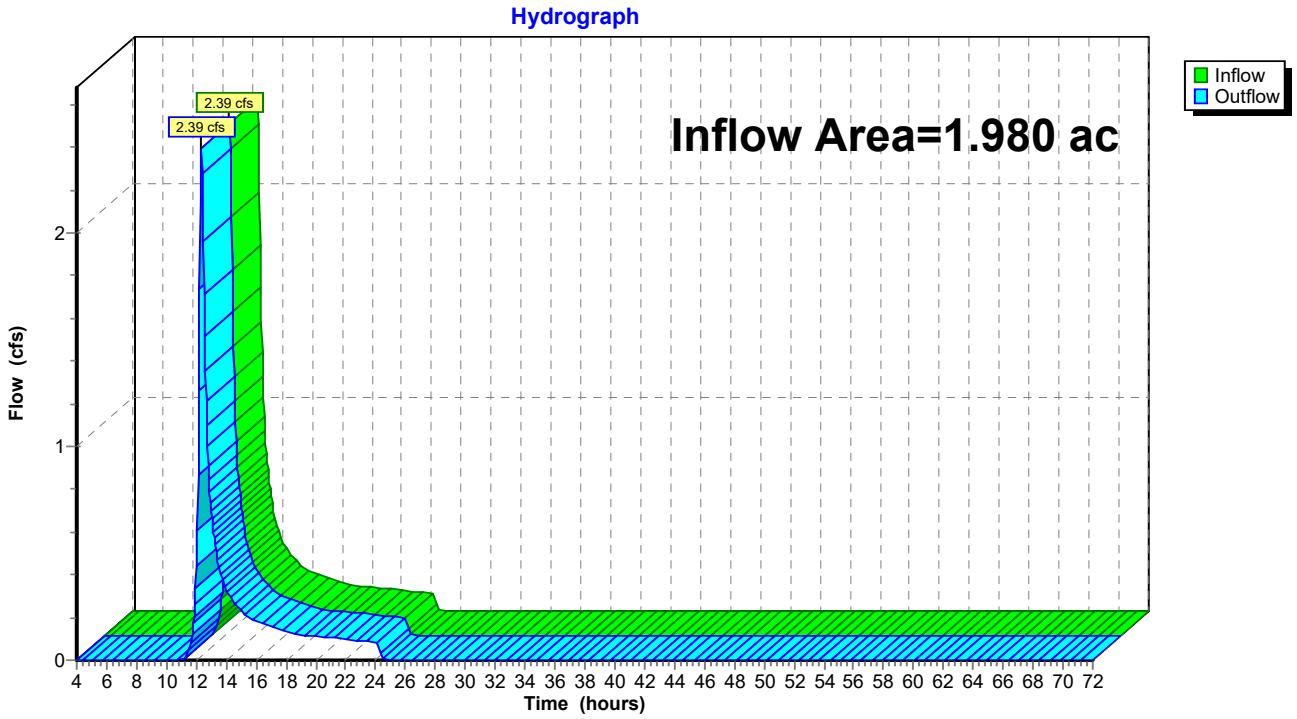


Summary for Reach EX2: Analysis Point - AP2

Inflow Area = 1.980 ac, 0.00% Impervious, Inflow Depth = 1.69" for 25-Year event
Inflow = 2.39 cfs @ 12.32 hrs, Volume= 0.278 af
Outflow = 2.39 cfs @ 12.32 hrs, Volume= 0.278 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs

Reach EX2: Analysis Point - AP2



Summary for Pond 1E: Existing Depression

Inflow Area = 19.400 ac, 0.00% Impervious, Inflow Depth = 1.37" for 25-Year event
Inflow = 11.87 cfs @ 12.66 hrs, Volume= 2.213 af
Outflow = 12.93 cfs @ 13.05 hrs, Volume= 2.213 af, Atten= 0%, Lag= 23.5 min
Discarded = 0.71 cfs @ 13.05 hrs, Volume= 1.314 af
Primary = 12.23 cfs @ 13.05 hrs, Volume= 0.898 af

Routing by Dyn-Stor-Ind method, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 309.99' @ 13.05 hrs Surf.Area= 30,032 sf Storage= 26,478 cf
Flood Elev= 309.20' Surf.Area= 30,032 sf Storage= 26,478 cf

Plug-Flow detention time= 310.5 min calculated for 2.211 af (100% of inflow)
Center-of-Mass det. time= 311.2 min (1,245.3 - 934.1)

Volume	Invert	Avail.Storage	Storage Description
#1	307.30'	26,478 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

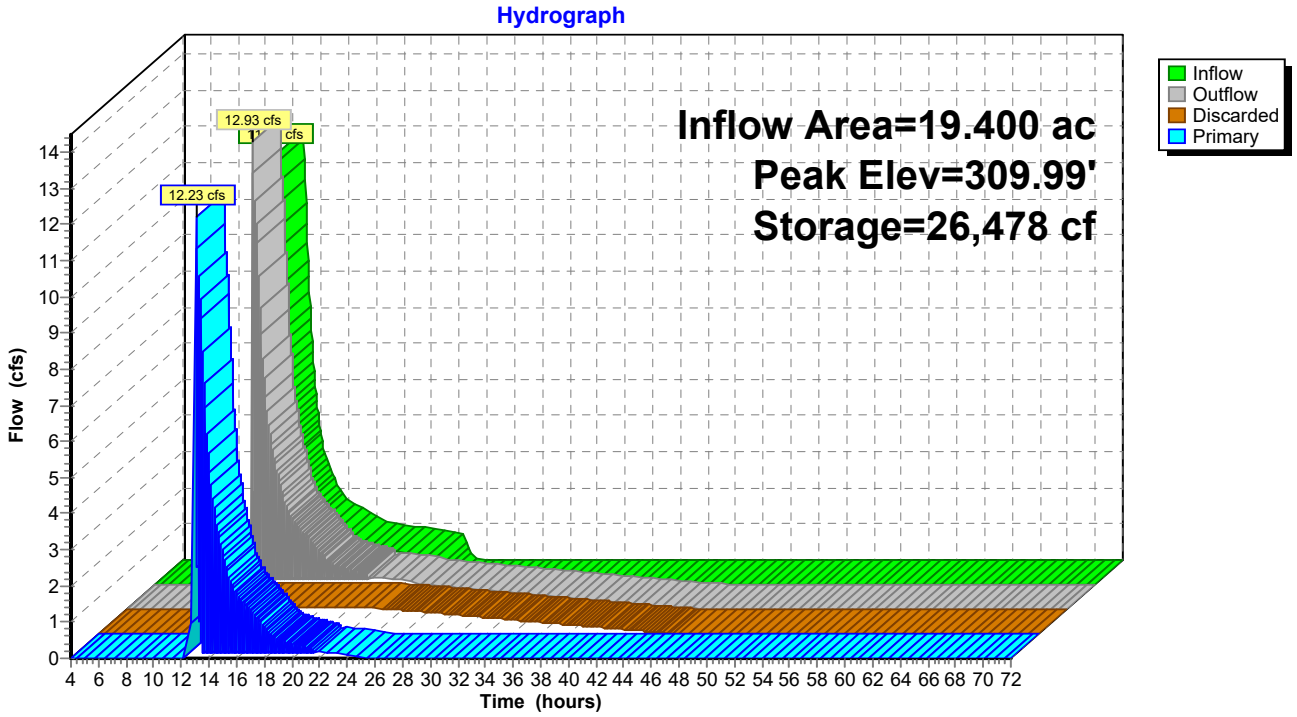
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
307.30	48	0	0
308.00	11,143	3,917	3,917
309.00	28,160	19,652	23,568
309.10	30,032	2,910	26,478

Device	Routing	Invert	Outlet Devices
#1	Discarded	307.30'	**1.020 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	309.05'	**5.0' 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

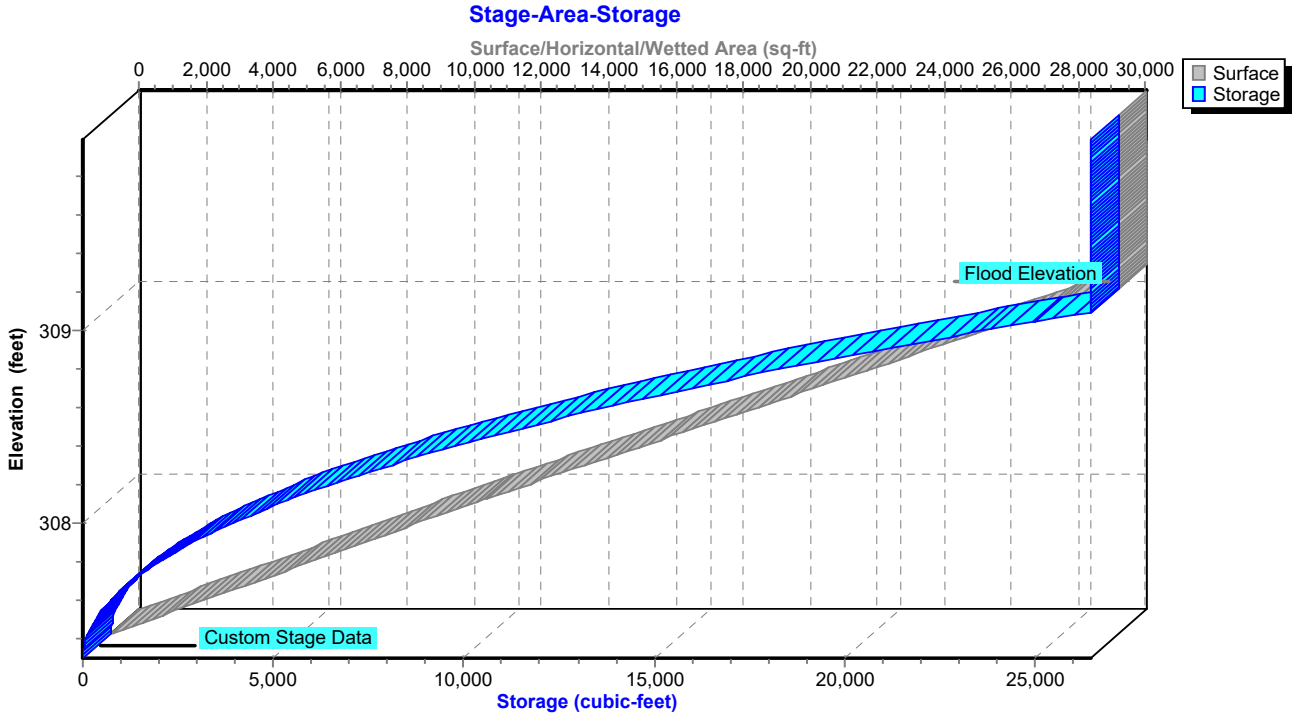
Discarded OutFlow Max=0.71 cfs @ 13.05 hrs HW=309.99' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.71 cfs)

Primary OutFlow Max=11.56 cfs @ 13.05 hrs HW=309.96' TW=0.00' (Dynamic Tailwater)
↑**2=Broad-Crested Rectangular Weir** (Weir Controls 11.56 cfs @ 2.55 fps)

Pond 1E: Existing Depression



Pond 1E: Existing Depression



Summary for Subcatchment E1: Subcatchment to BVW

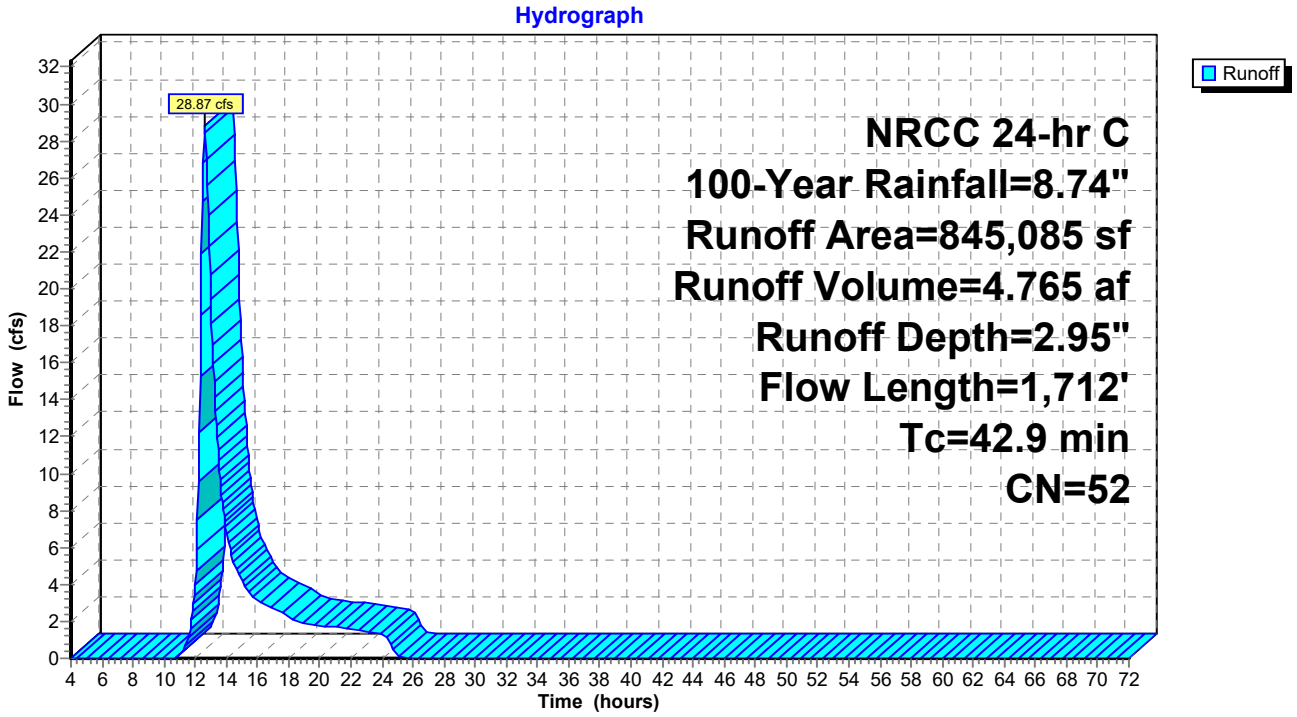
Runoff = 28.87 cfs @ 12.62 hrs, Volume= 4.765 af, Depth= 2.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.74"

Area (sf)	CN	Description
636,164	55	Woods, Good, HSG B
22,971	61	>75% Grass cover, Good, HSG B
178,444	39	>75% Grass cover, Good, HSG A
7,506	30	Woods, Good, HSG A
845,085	52	Weighted Average
845,085		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.2	50	0.0800	0.07		**Sheet Flow, Segment A-B** Woods: Dense underbrush n= 0.800 P2= 3.26"
0.9	78	0.0800	1.41		**Shallow Concentrated Flow, Segment B-C** Woodland Kv= 5.0 fps
12.7	592	0.0240	0.77		**Shallow Concentrated Flow, Segment C-D** Woodland Kv= 5.0 fps
10.0	581	0.0190	0.96		**Shallow Concentrated Flow, Segment D-E** Short Grass Pasture Kv= 7.0 fps
7.1	411	0.0190	0.96		**Shallow Concentrated Flow, Segment E-F** Short Grass Pasture Kv= 7.0 fps
42.9	1,712	Total			

Subcatchment E1: Subcatchment to BVW



Summary for Subcatchment E2: Subcatchment to Blackstone Street

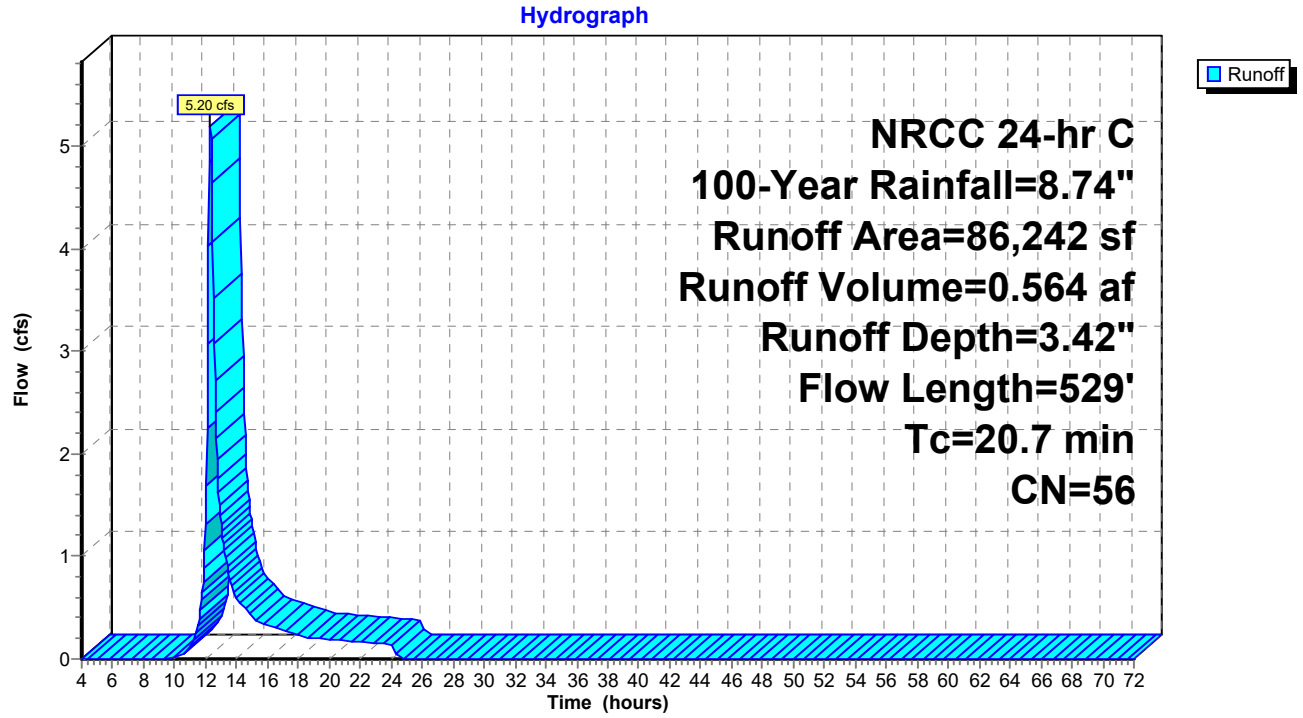
Runoff = 5.20 cfs @ 12.31 hrs, Volume= 0.564 af, Depth= 3.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.74"

Area (sf)	CN	Description
68,935	55	Woods, Good, HSG B
15,889	61	>75% Grass cover, Good, HSG B
934	39	>75% Grass cover, Good, HSG A
484	30	Woods, Good, HSG A
86,242	56	Weighted Average
86,242		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.6	50	0.0610	0.06		**Sheet Flow, Segment A-B** Woods: Dense underbrush n= 0.800 P2= 3.26"
2.8	215	0.0640	1.26		**Shallow Concentrated Flow, Segment B-C** Woodland Kv= 5.0 fps
2.2	103	0.0240	0.77		**Shallow Concentrated Flow, Segment C-D** Woodland Kv= 5.0 fps
2.1	161	0.0340	1.29		**Shallow Concentrated Flow, Segment D-E** Short Grass Pasture Kv= 7.0 fps
20.7	529	Total			

Subcatchment E2: Subcatchment to Blackstone Street

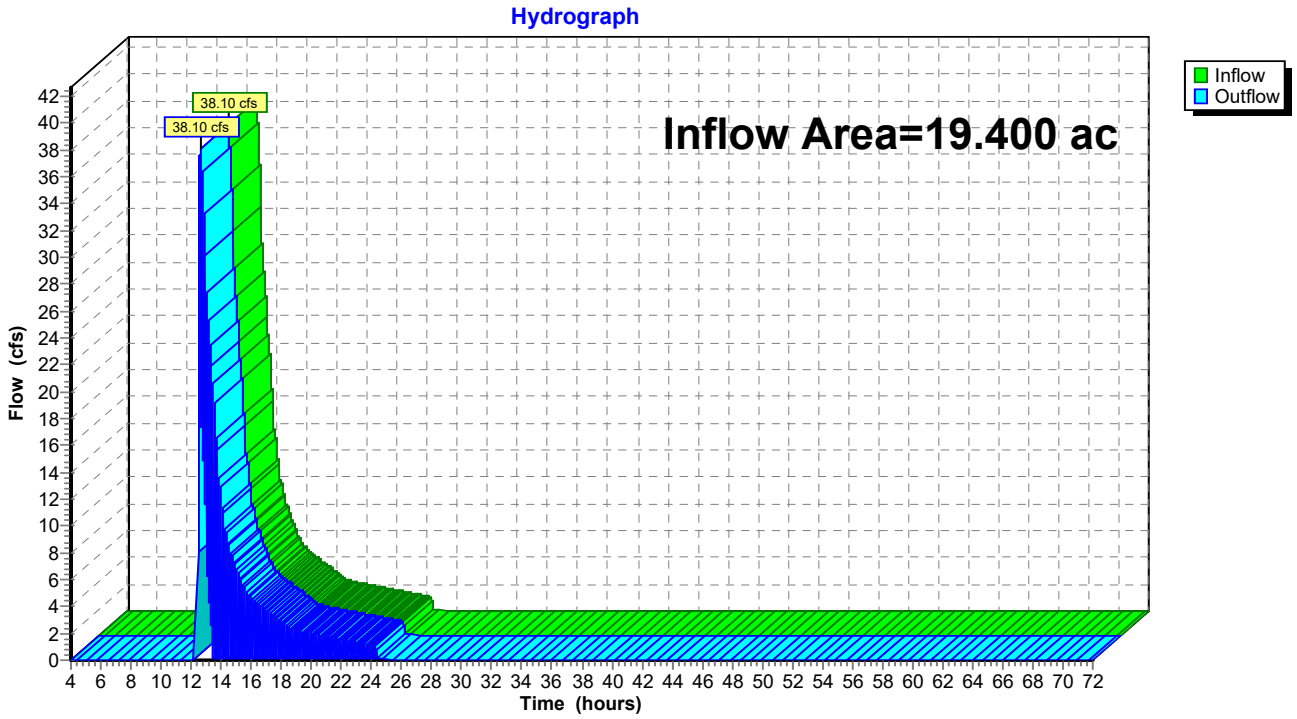


Summary for Reach EX1: Analysis Point - AP1

Inflow Area = 19.400 ac, 0.00% Impervious, Inflow Depth = 2.11" for 100-Year event
Inflow = 38.10 cfs @ 12.65 hrs, Volume= 3.406 af
Outflow = 38.10 cfs @ 12.65 hrs, Volume= 3.406 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs

Reach EX1: Analysis Point - AP1

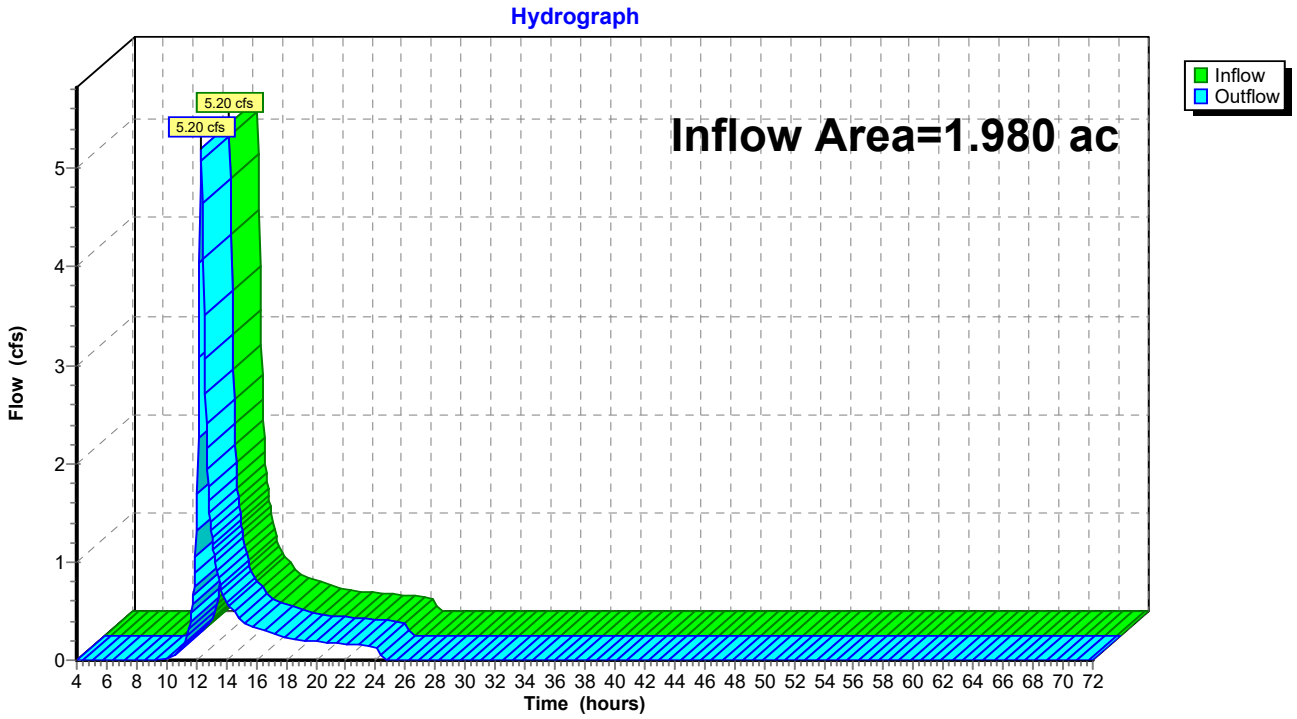


Summary for Reach EX2: Analysis Point - AP2

Inflow Area = 1.980 ac, 0.00% Impervious, Inflow Depth = 3.42" for 100-Year event
Inflow = 5.20 cfs @ 12.31 hrs, Volume= 0.564 af
Outflow = 5.20 cfs @ 12.31 hrs, Volume= 0.564 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs

Reach EX2: Analysis Point - AP2



Summary for Pond 1E: Existing Depression

Inflow Area = 19.400 ac, 0.00% Impervious, Inflow Depth = 2.95" for 100-Year event
Inflow = 28.87 cfs @ 12.62 hrs, Volume= 4.765 af
Outflow = 38.81 cfs @ 12.65 hrs, Volume= 4.765 af, Atten= 0%, Lag= 1.6 min
Discarded = 0.71 cfs @ 12.50 hrs, Volume= 1.359 af
Primary = 38.10 cfs @ 12.65 hrs, Volume= 3.406 af

Routing by Dyn-Stor-Ind method, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 311.07' @ 12.65 hrs Surf.Area= 30,032 sf Storage= 26,478 cf
Flood Elev= 309.20' Surf.Area= 30,032 sf Storage= 26,478 cf

Plug-Flow detention time= 149.0 min calculated for 4.762 af (100% of inflow)
Center-of-Mass det. time= 149.8 min (1,056.4 - 906.6)

Volume	Invert	Avail.Storage	Storage Description
#1	307.30'	26,478 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

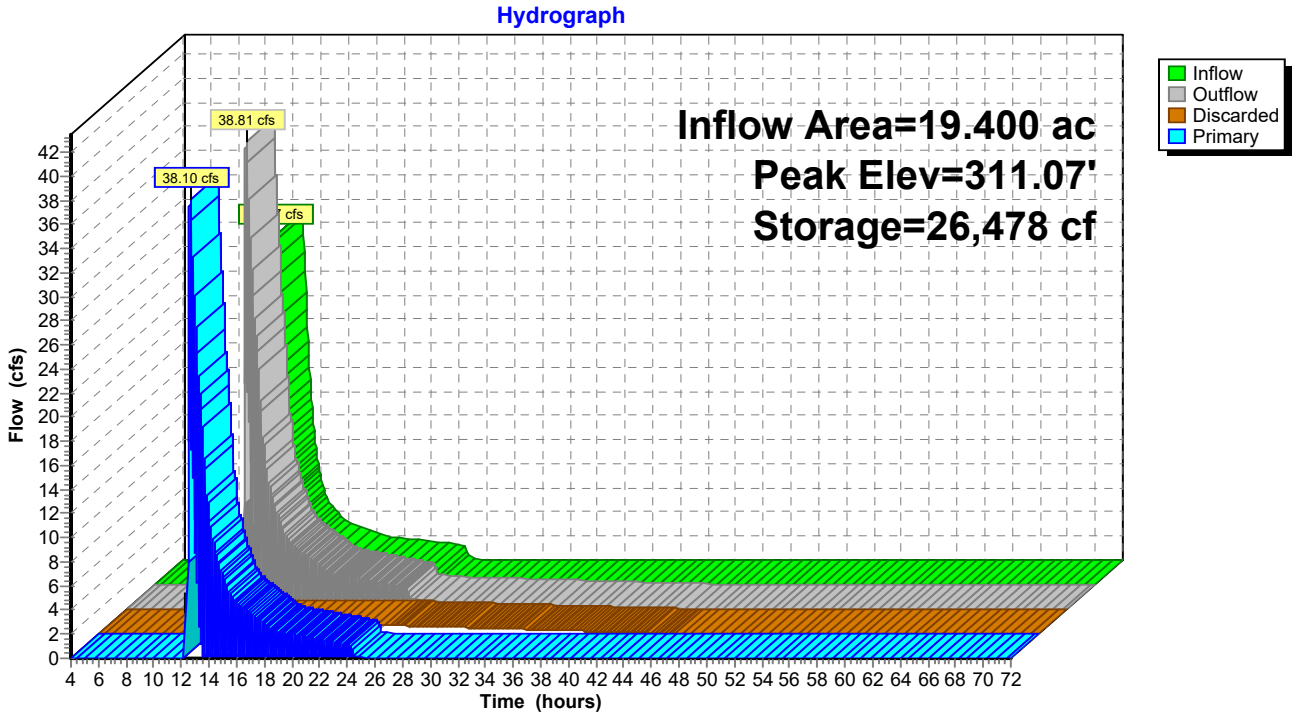
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
307.30	48	0	0
308.00	11,143	3,917	3,917
309.00	28,160	19,652	23,568
309.10	30,032	2,910	26,478

Device	Routing	Invert	Outlet Devices
#1	Discarded	307.30'	**1.020 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	309.05'	**5.0' 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

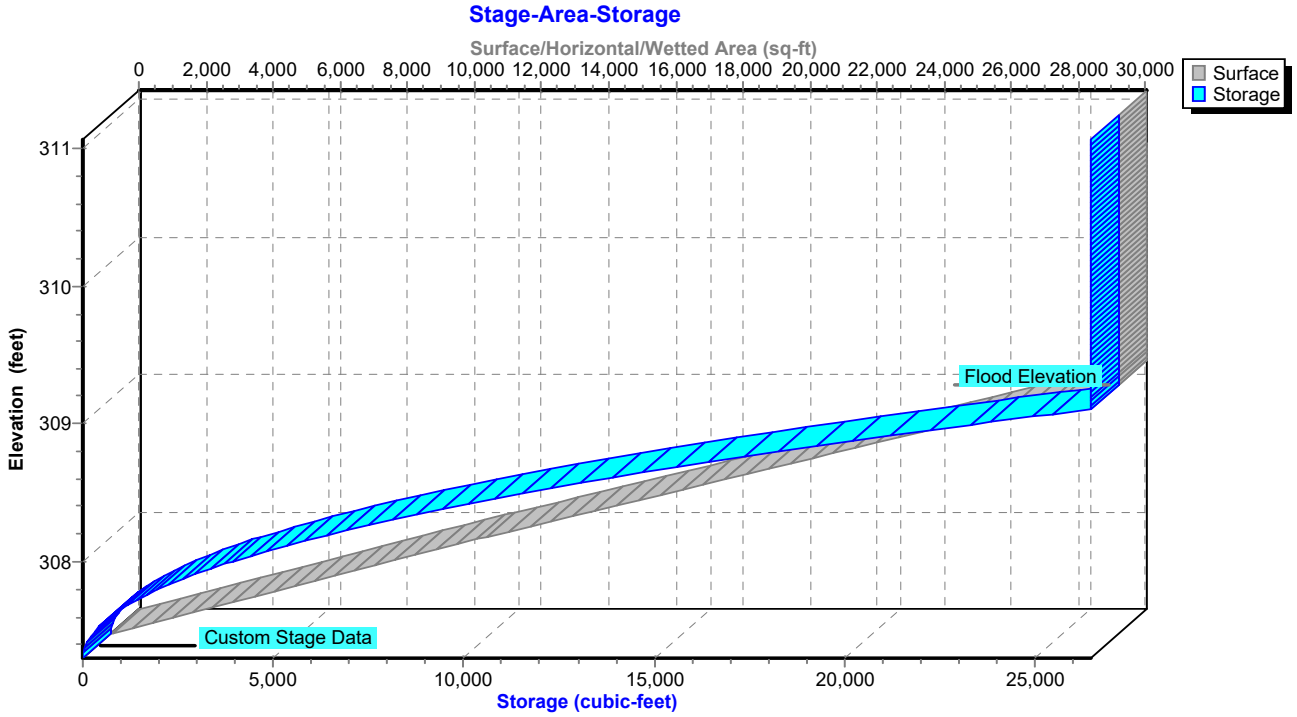
Discarded OutFlow Max=0.71 cfs @ 12.50 hrs HW=310.19' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.71 cfs)

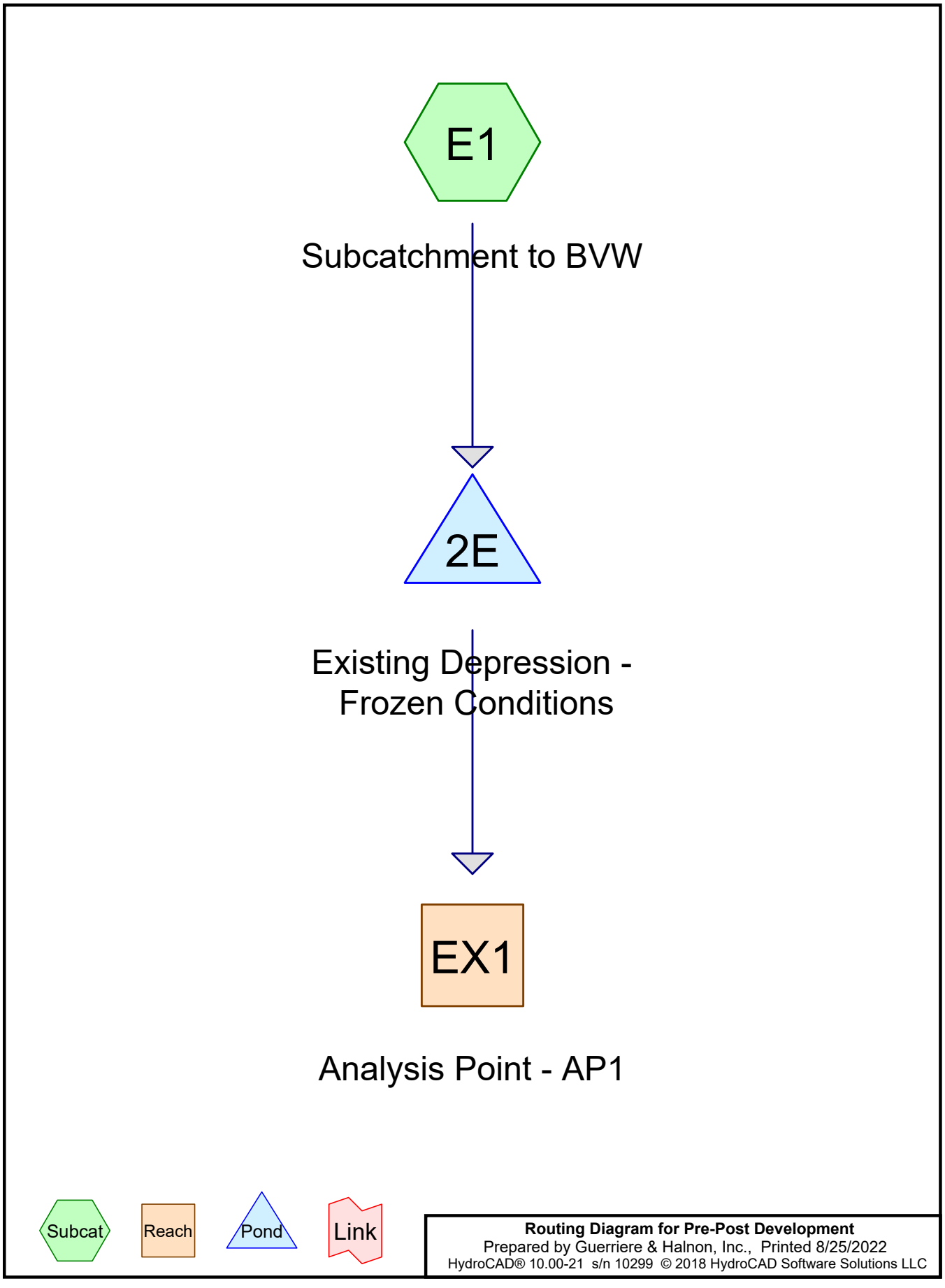
Primary OutFlow Max=37.90 cfs @ 12.65 hrs HW=311.06' TW=0.00' (Dynamic Tailwater)
↑**2=Broad-Crested Rectangular Weir** (Weir Controls 37.90 cfs @ 3.76 fps)

Pond 1E: Existing Depression



Pond 1E: Existing Depression





Routing Diagram for Pre-Post Development
Prepared by Guerriere & Halnon, Inc., Printed 8/25/2022

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
4.097	39	>75% Grass cover, Good, HSG A (E1)
0.527	61	>75% Grass cover, Good, HSG B (E1)
0.172	30	Woods, Good, HSG A (E1)
14.604	55	Woods, Good, HSG B (E1)
19.400	**52**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
4.269	HSG A	E1
15.132	HSG B	E1
0.000	HSG C	
0.000	HSG D	
0.000	Other	
19.400		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
4.097	0.527	0.000	0.000	0.000	4.624	>75% Grass cover, Good	E1
0.172	14.604	0.000	0.000	0.000	14.777	Woods, Good	E1
4.269	**15.132**	**0.000**	**0.000**	**0.000**	**19.400**	**TOTAL AREA**	

Summary for Subcatchment E1: Subcatchment to BVW

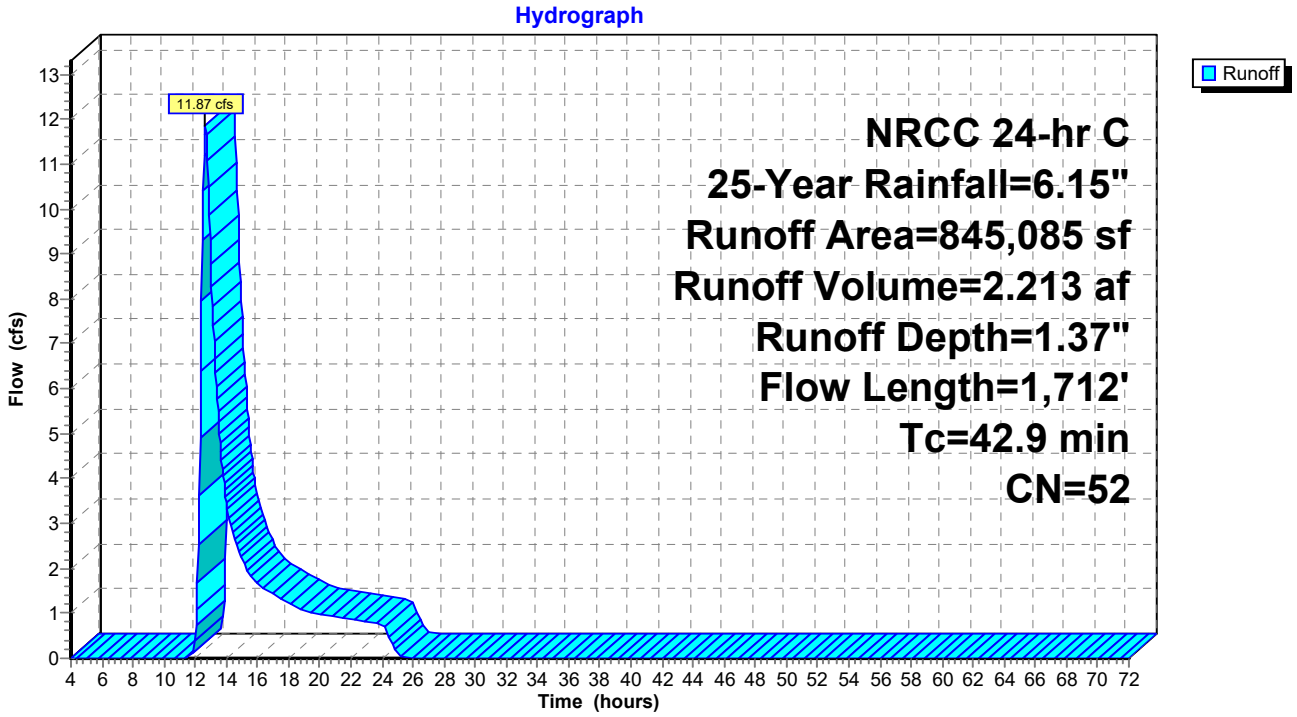
Runoff = 11.87 cfs @ 12.66 hrs, Volume= 2.213 af, Depth= 1.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.15"

Area (sf)	CN	Description
636,164	55	Woods, Good, HSG B
22,971	61	>75% Grass cover, Good, HSG B
178,444	39	>75% Grass cover, Good, HSG A
7,506	30	Woods, Good, HSG A
845,085	52	Weighted Average
845,085		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.2	50	0.0800	0.07		**Sheet Flow, Segment A-B** Woods: Dense underbrush n= 0.800 P2= 3.26"
0.9	78	0.0800	1.41		**Shallow Concentrated Flow, Segment B-C** Woodland Kv= 5.0 fps
12.7	592	0.0240	0.77		**Shallow Concentrated Flow, Segment C-D** Woodland Kv= 5.0 fps
10.0	581	0.0190	0.96		**Shallow Concentrated Flow, Segment D-E** Short Grass Pasture Kv= 7.0 fps
7.1	411	0.0190	0.96		**Shallow Concentrated Flow, Segment E-F** Short Grass Pasture Kv= 7.0 fps
42.9	1,712	Total			

Subcatchment E1: Subcatchment to BVW

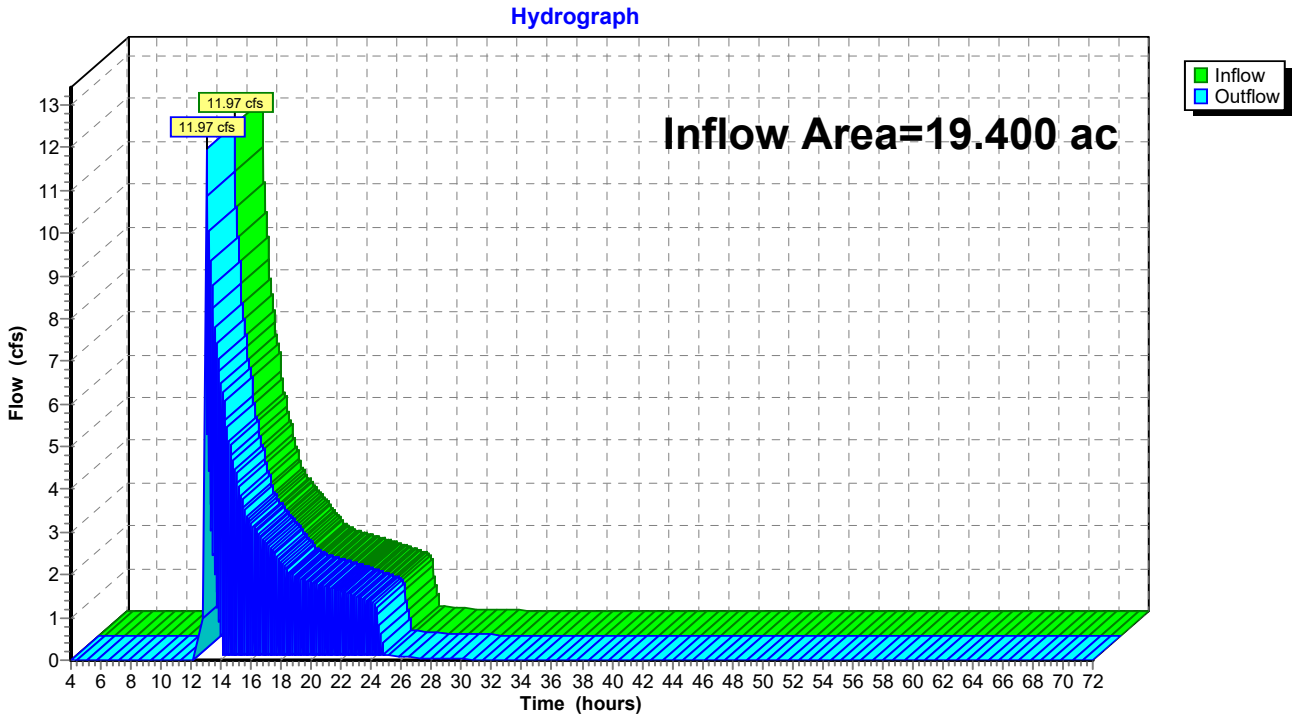


Summary for Reach EX1: Analysis Point - AP1

Inflow Area = 19.400 ac, 0.00% Impervious, Inflow Depth = 1.01" for 25-Year event
Inflow = 11.97 cfs @ 13.01 hrs, Volume= 1.638 af
Outflow = 11.97 cfs @ 13.01 hrs, Volume= 1.638 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs

Reach EX1: Analysis Point - AP1



Summary for Pond 2E: Existing Depression - Frozen Conditions

Inflow Area = 19.400 ac, 0.00% Impervious, Inflow Depth = 1.37" for 25-Year event
Inflow = 11.87 cfs @ 12.66 hrs, Volume= 2.213 af
Outflow = 11.97 cfs @ 13.01 hrs, Volume= 1.638 af, Atten= 0%, Lag= 20.8 min
Primary = 11.97 cfs @ 13.01 hrs, Volume= 1.638 af

Routing by Dyn-Stor-Ind method, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 309.99' @ 13.01 hrs Surf.Area= 30,032 sf Storage= 26,478 cf
Flood Elev= 309.20' Surf.Area= 30,032 sf Storage= 26,478 cf

Plug-Flow detention time= 191.0 min calculated for 1.638 af (74% of inflow)
Center-of-Mass det. time= 83.7 min (1,017.8 - 934.1)

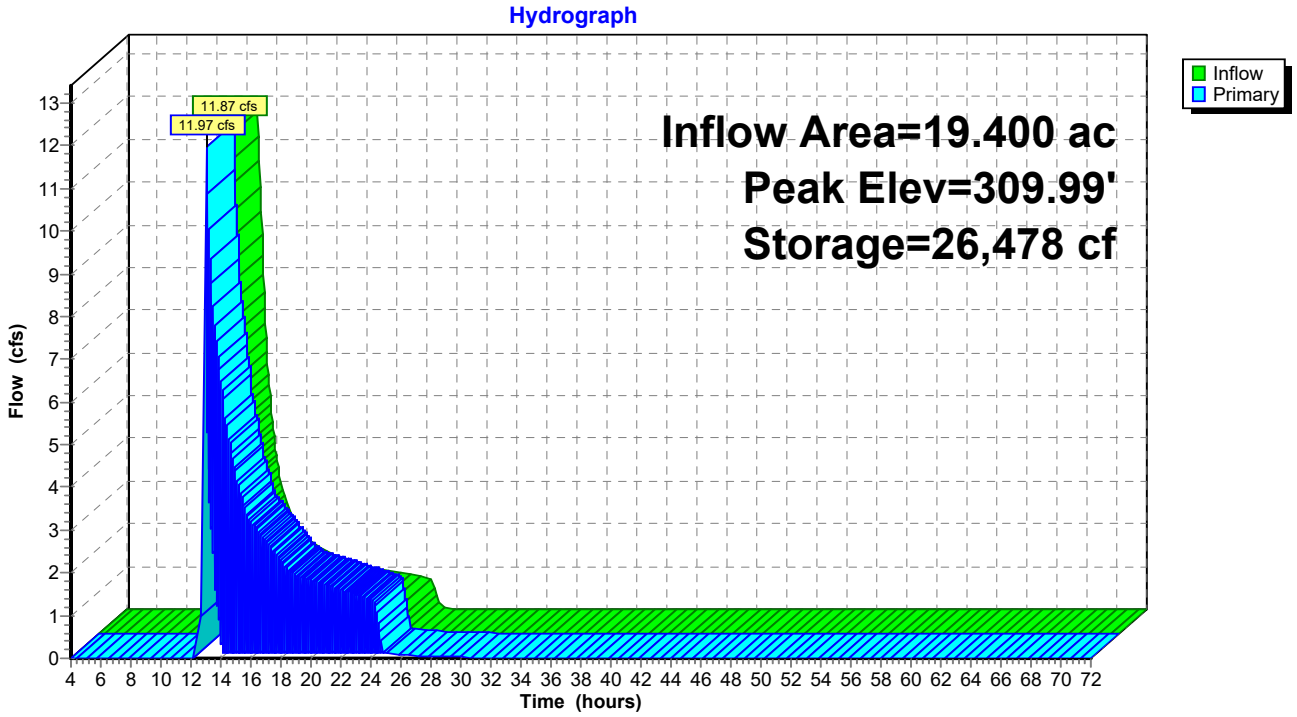
Volume	Invert	Avail.Storage	Storage Description
#1	307.30'	26,478 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
307.30	48	0	0
308.00	11,143	3,917	3,917
309.00	28,160	19,652	23,568
309.10	30,032	2,910	26,478

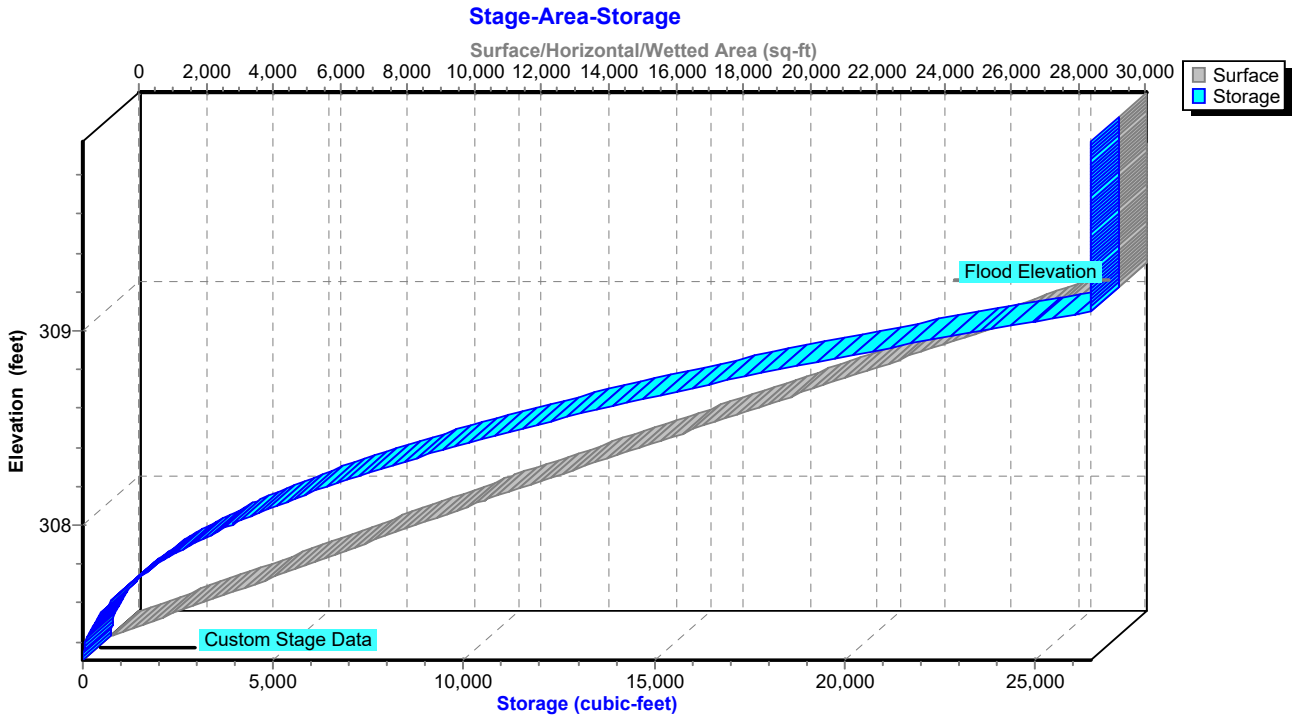
Device	Routing	Invert	Outlet Devices
#1	Primary	309.05'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

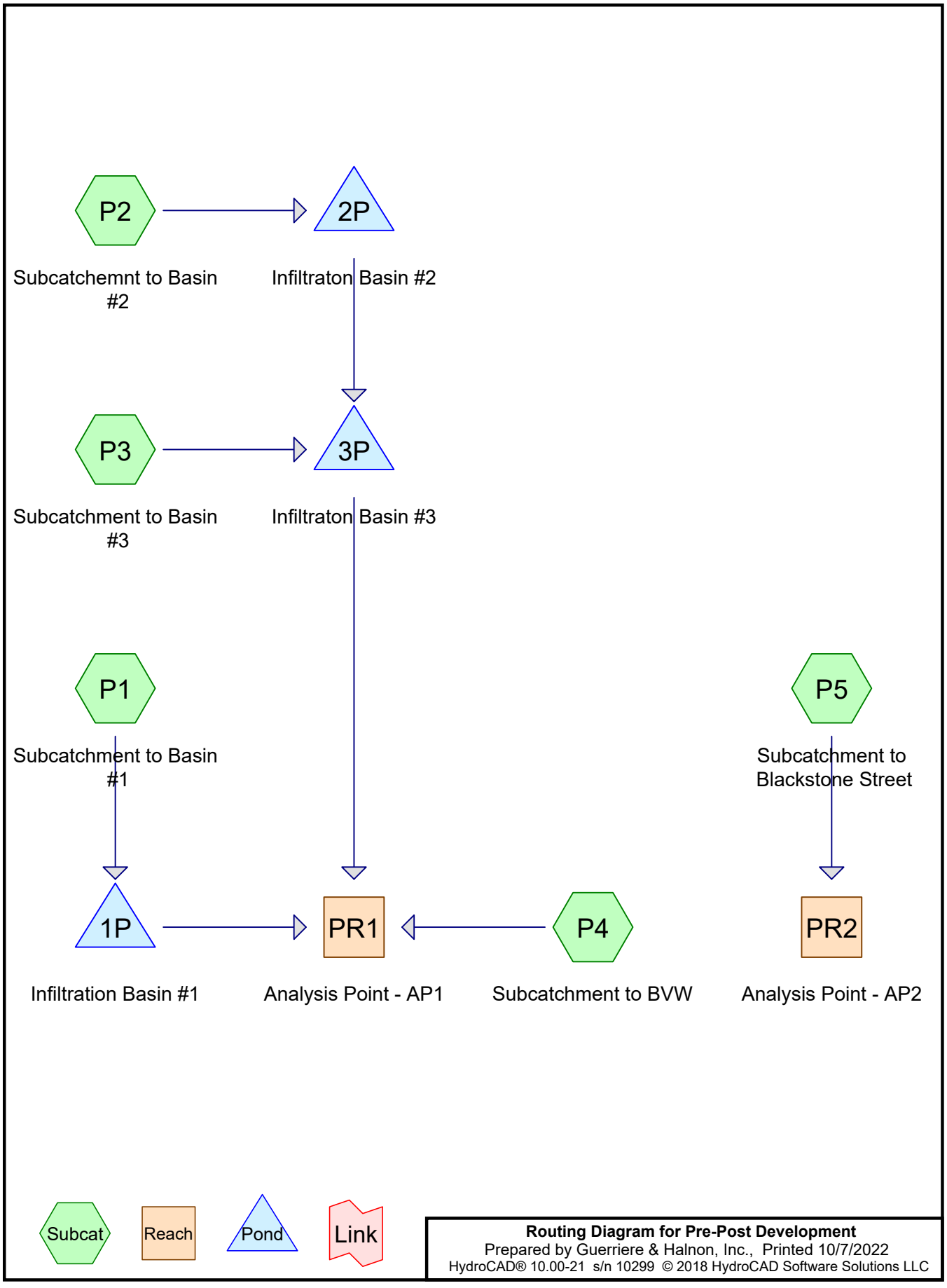
Primary OutFlow Max=10.77 cfs @ 13.01 hrs HW=309.91' TW=0.00' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 10.77 cfs @ 2.49 fps)

Pond 2E: Existing Depression - Frozen Conditions



Pond 2E: Existing Depression - Frozen Conditions





Routing Diagram for Pre-Post Development
Prepared by Guerriere & Halnon, Inc., Printed 10/7/2022

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
3.421	39	>75% Grass cover, Good, HSG A (P1, P2, P3, P4, P5)
1.917	61	>75% Grass cover, Good, HSG B (P1, P2, P5)
0.618	98	Paved roads w/curbs & sewers, HSG A (P1)
0.675	98	Paved roads w/curbs & sewers, HSG B (P1)
0.491	98	Roofs, HSG A (P1)
0.492	98	Roofs, HSG B (P1)
0.012	30	Woods, Good, HSG A (P5)
13.755	55	Woods, Good, HSG B (P2, P5)
21.380	**58**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
4.542	HSG A	P1, P2, P3, P4, P5
16.839	HSG B	P1, P2, P5
0.000	HSG C	
0.000	HSG D	
0.000	Other	
21.380		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
3.421	1.917	0.000	0.000	0.000	5.338	>75% Grass cover, Good	P1, P2, P3, P4, P5
0.618	0.675	0.000	0.000	0.000	1.294	Paved roads w/curbs & sewers	P1
0.491	0.492	0.000	0.000	0.000	0.982	Roofs	P1
0.012	13.755	0.000	0.000	0.000	13.766	Woods, Good	P2, P5
4.542	**16.839**	**0.000**	**0.000**	**0.000**	**21.380**	**TOTAL AREA**	

Summary for Subcatchment P1: Subcatchment to Basin #1

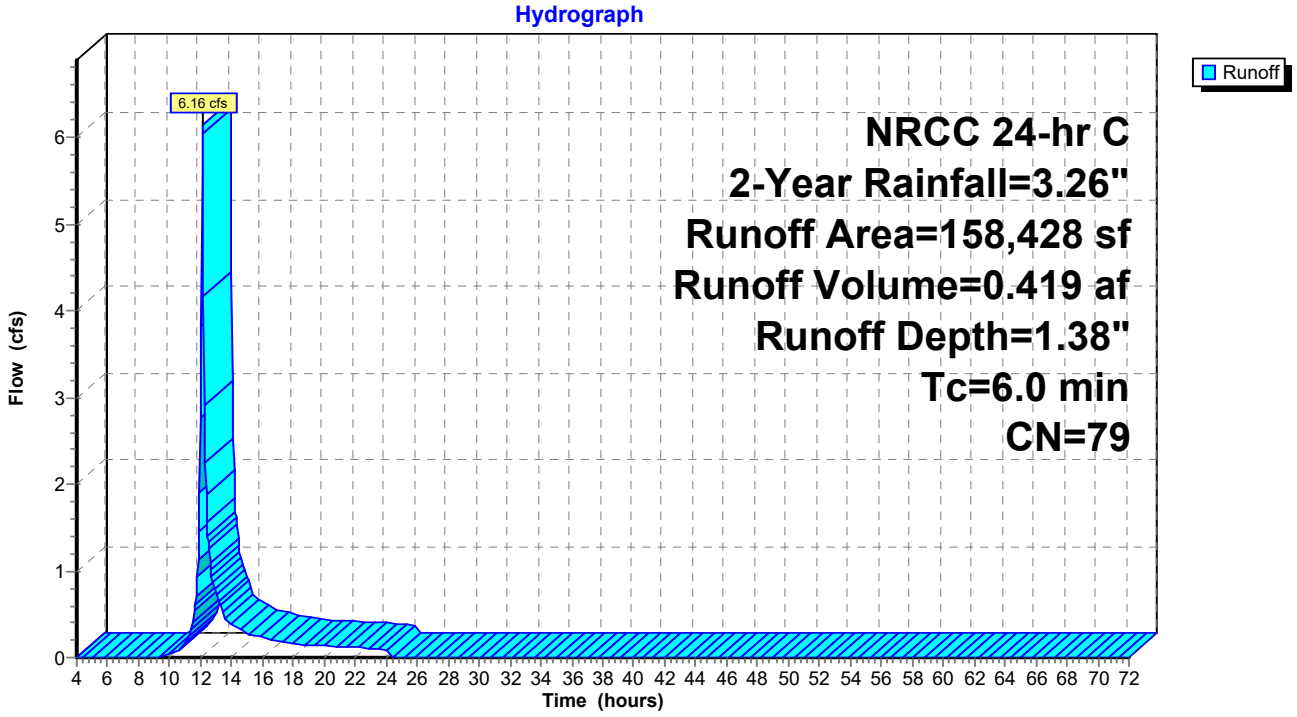
Runoff = 6.16 cfs @ 12.13 hrs, Volume= 0.419 af, Depth= 1.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.26"

Area (sf)	CN	Description
26,935	98	Paved roads w/curbs & sewers, HSG A
29,422	98	Paved roads w/curbs & sewers, HSG B
21,369	98	Roofs, HSG A
21,413	98	Roofs, HSG B
36,739	39	>75% Grass cover, Good, HSG A
22,550	61	>75% Grass cover, Good, HSG B
158,428	79	Weighted Average
59,289		37.42% Pervious Area
99,139		62.58% Impervious Area

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

Subcatchment P1: Subcatchment to Basin #1



Summary for Subcatchment P2: Subcatchemnt to Basin #2

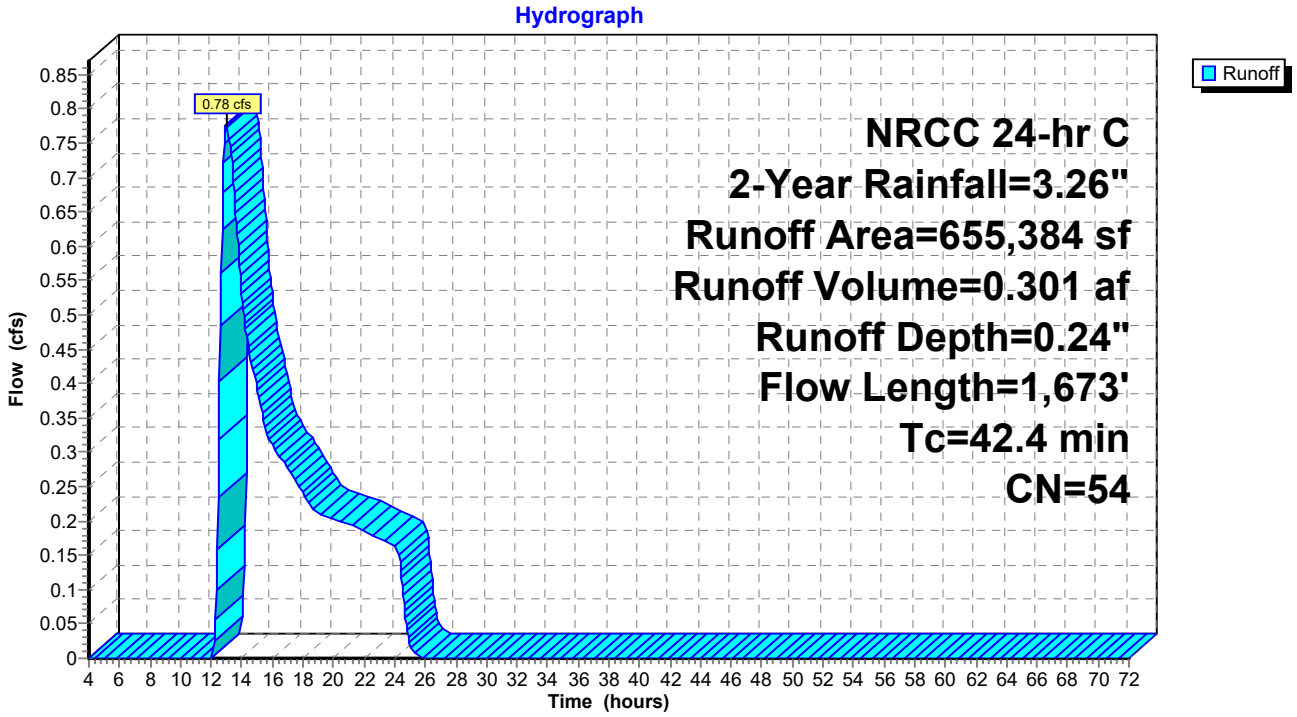
Runoff = 0.78 cfs @ 13.01 hrs, Volume= 0.301 af, Depth= 0.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.26"

Area (sf)	CN	Description
589,181	55	Woods, Good, HSG B
30,779	61	>75% Grass cover, Good, HSG B
35,424	39	>75% Grass cover, Good, HSG A
655,384	54	Weighted Average
655,384		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.2	50	0.0800	0.07		**Sheet Flow, Segment A-B** Woods: Dense underbrush n= 0.800 P2= 3.26"
0.9	78	0.0800	1.41		**Shallow Concentrated Flow, Segment B-C** Woodland Kv= 5.0 fps
12.7	592	0.0240	0.77		**Shallow Concentrated Flow, Segment C-D** Woodland Kv= 5.0 fps
14.1	581	0.0190	0.69		**Shallow Concentrated Flow, Segment D-E** Woodland Kv= 5.0 fps
2.0	60	0.0100	0.50		**Shallow Concentrated Flow, Segment E-F** Woodland Kv= 5.0 fps
0.5	312	0.0230	10.92	34.31	**Pipe Channel, Segment F-G** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Concrete pipe, straight & clean
42.4	1,673	Total			

Subcatchment P2: Subcatchemnt to Basin #2



Summary for Subcatchment P3: Subcatchment to Basin #3

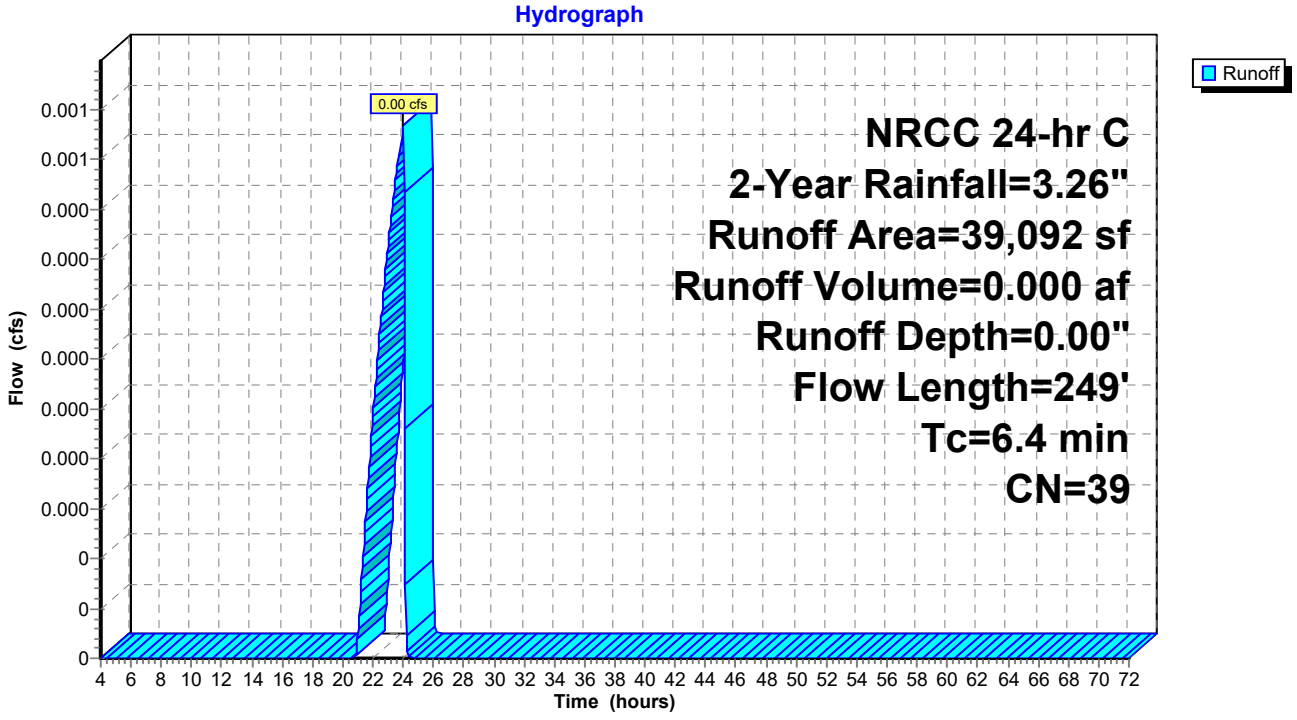
Runoff = 0.00 cfs @ 24.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.26"

Area (sf)	CN	Description
39,092	39	>75% Grass cover, Good, HSG A
39,092		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	50	0.0380	0.19		**Sheet Flow, Segment A-B** Grass: Short n= 0.150 P2= 3.26"
2.0	184	0.0470	1.52		**Shallow Concentrated Flow, Segment B-C** Short Grass Pasture Kv= 7.0 fps
0.1	15	0.3300	4.02		**Shallow Concentrated Flow, Segment C-D** Short Grass Pasture Kv= 7.0 fps
6.4	249	Total			

Subcatchment P3: Subcatchment to Basin #3



Summary for Subcatchment P4: Subcatchment to BVW

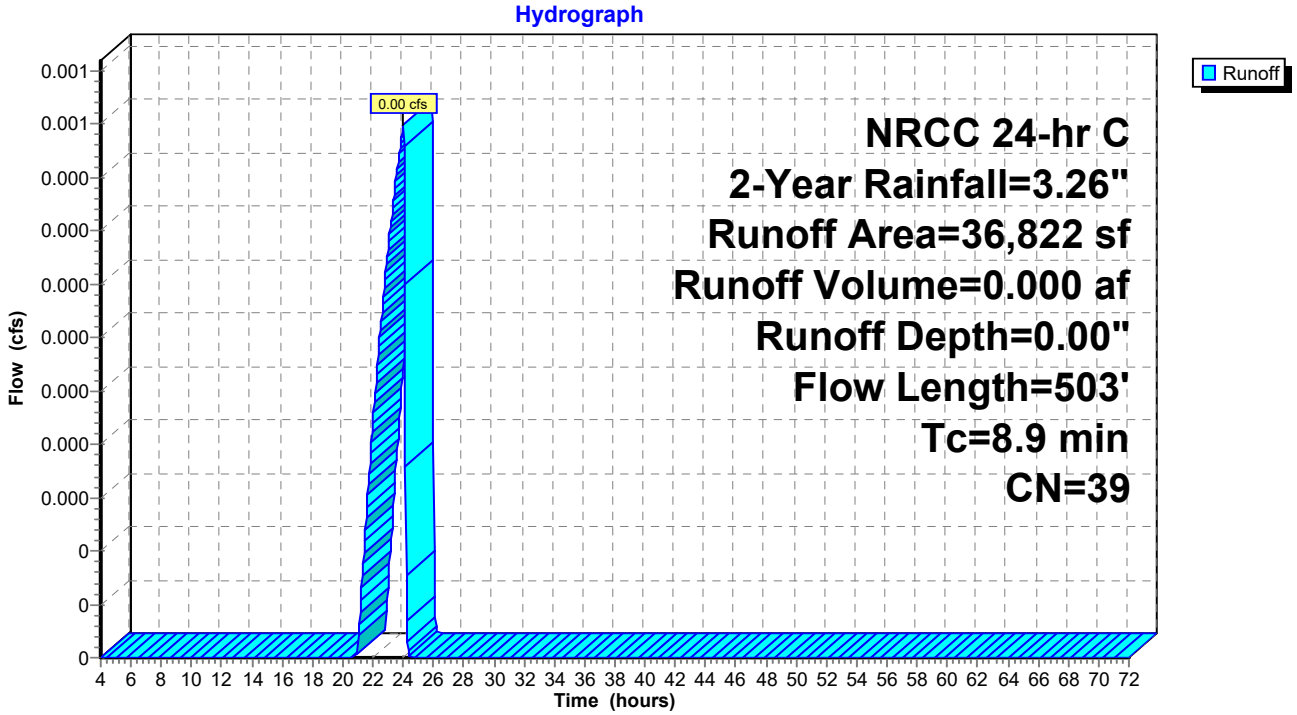
Runoff = 0.00 cfs @ 23.99 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.26"

Area (sf)	CN	Description
36,822	39	>75% Grass cover, Good, HSG A
36,822		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.0	50	0.0950	0.28		**Sheet Flow, Segment A-B** Grass: Short n= 0.150 P2= 3.26"
2.3	153	0.0260	1.13		**Shallow Concentrated Flow, Segment B-C** Short Grass Pasture Kv= 7.0 fps
0.2	47	0.0050	3.79	2.98	**Pipe Channel, RCP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011 Concrete pipe, straight & clean
3.4	253	0.0070	1.25		**Shallow Concentrated Flow, Segment D-E** Grassed Waterway Kv= 15.0 fps
8.9	503	Total			

Subcatchment P4: Subcatchment to BVW



Summary for Subcatchment P5: Subcatchment to Blackstone Street

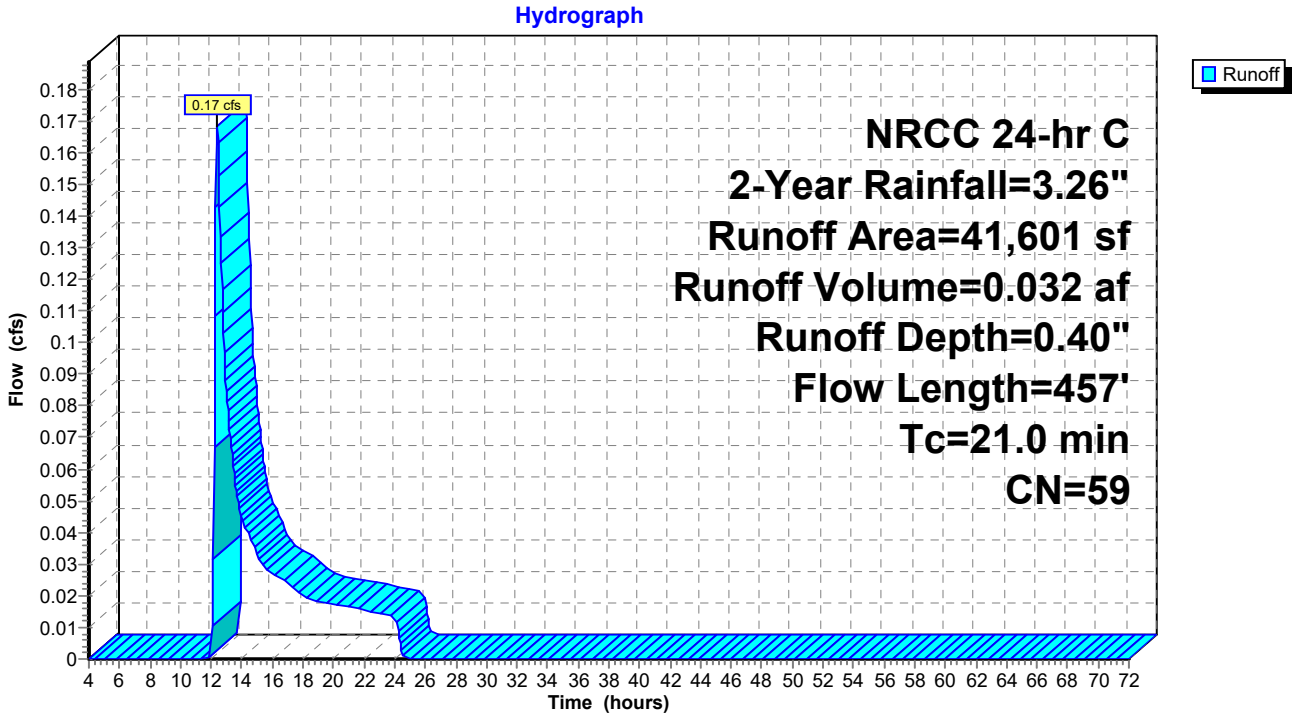
Runoff = 0.17 cfs @ 12.40 hrs, Volume= 0.032 af, Depth= 0.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.26"

Area (sf)	CN	Description
9,968	55	Woods, Good, HSG B
504	30	Woods, Good, HSG A
30,178	61	>75% Grass cover, Good, HSG B
951	39	>75% Grass cover, Good, HSG A
41,601	59	Weighted Average
41,601		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	50	0.0490	0.06		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.26"
1.0	89	0.0890	1.49		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.1	96	0.0470	1.52		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
4.0	222	0.0340	0.92		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
21.0	457	Total			

Subcatchment P5: Subcatchment to Blackstone Street

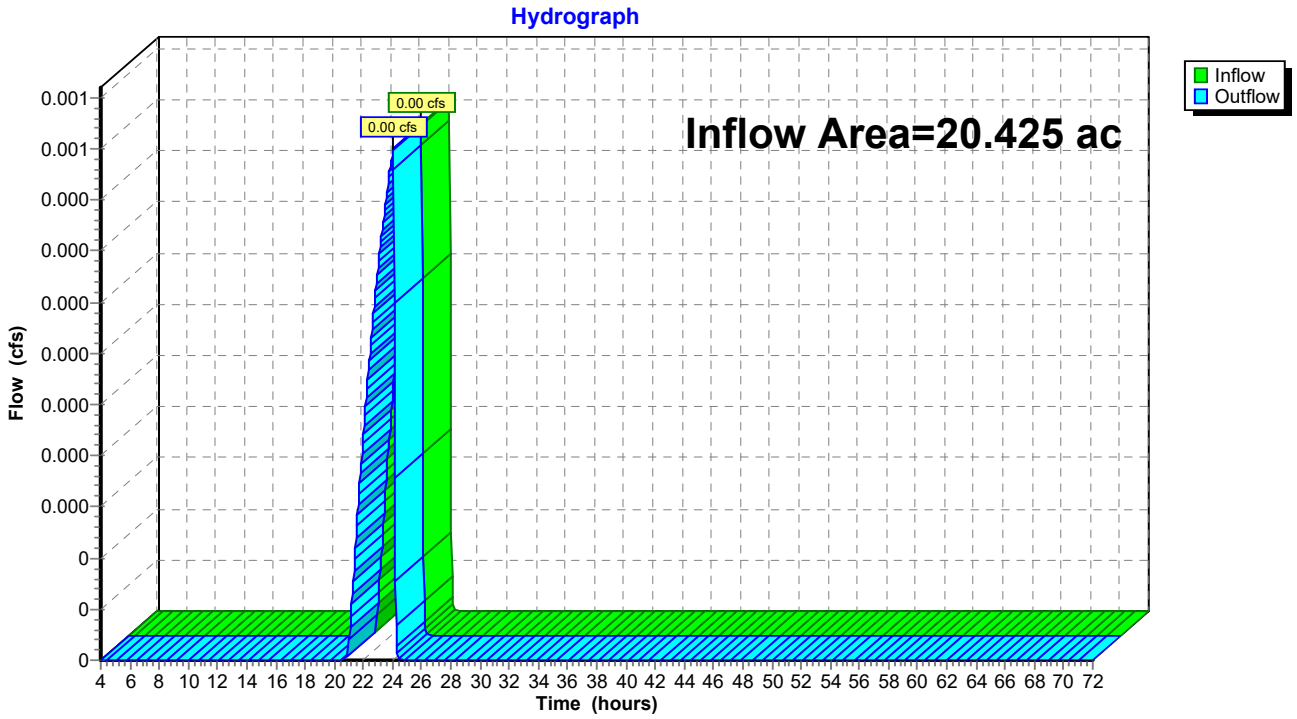


Summary for Reach PR1: Analysis Point - AP1

Inflow Area = 20.425 ac, 11.14% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 23.99 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 23.99 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs

Reach PR1: Analysis Point - AP1

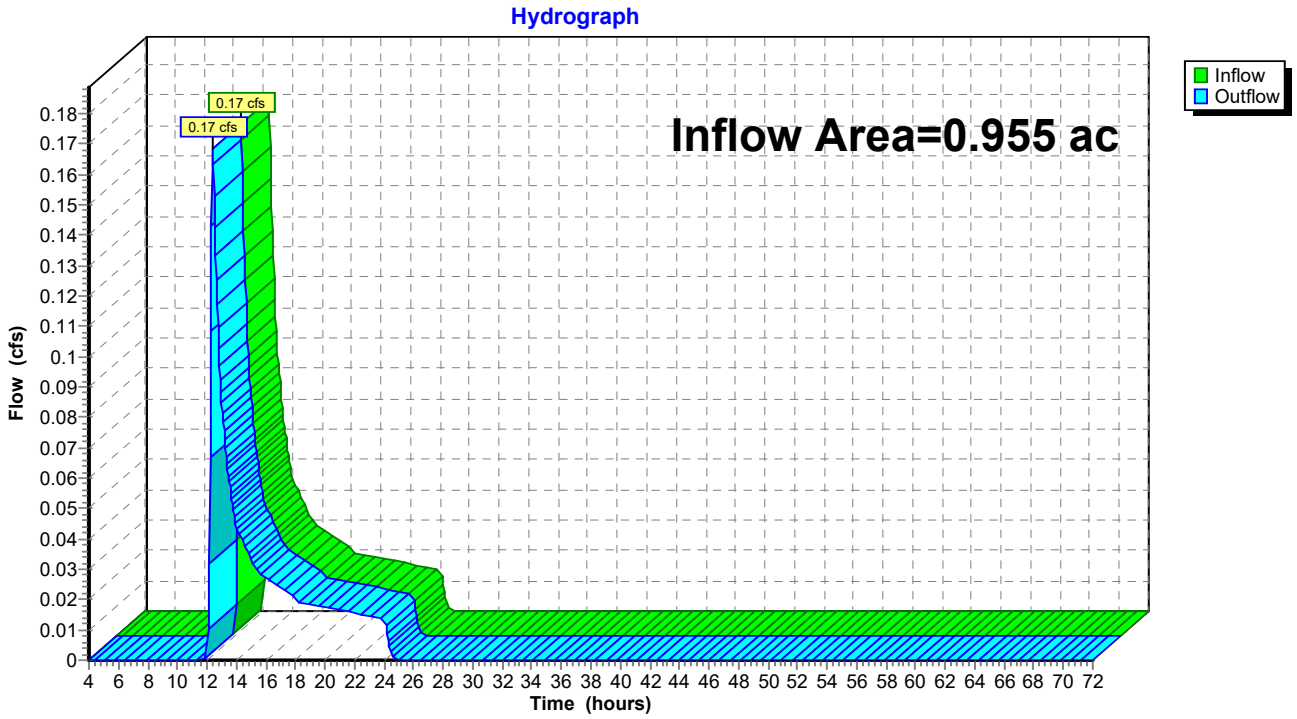


Summary for Reach PR2: Analysis Point - AP2

Inflow Area = 0.955 ac, 0.00% Impervious, Inflow Depth = 0.40" for 2-Year event
Inflow = 0.17 cfs @ 12.40 hrs, Volume= 0.032 af
Outflow = 0.17 cfs @ 12.40 hrs, Volume= 0.032 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs

Reach PR2: Analysis Point - AP2



Summary for Pond 1P: Infiltration Basin #1

Inflow Area = 3.637 ac, 62.58% Impervious, Inflow Depth = 1.38" for 2-Year event
Inflow = 6.16 cfs @ 12.13 hrs, Volume= 0.419 af
Outflow = 1.66 cfs @ 12.39 hrs, Volume= 0.419 af, Atten= 73%, Lag= 15.2 min
Discarded = 1.66 cfs @ 12.39 hrs, Volume= 0.419 af
Primary = 0.00 cfs @ 4.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 306.37' @ 12.39 hrs Surf.Area= 8,656 sf Storage= 3,091 cf
Flood Elev= 310.50' Surf.Area= 13,382 sf Storage= 53,229 cf

Plug-Flow detention time= 9.8 min calculated for 0.419 af (100% of inflow)
Center-of-Mass det. time= 9.8 min (866.1 - 856.4)

Volume	Invert	Avail.Storage	Storage Description
#1	306.00'	55,343 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	306.50'	5,662 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) -Impervious
		61,005 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
306.00	8,252	0	0
308.00	10,461	18,713	18,713
310.00	12,784	23,245	41,958
310.50	13,382	6,542	48,500
311.00	13,990	6,843	55,343

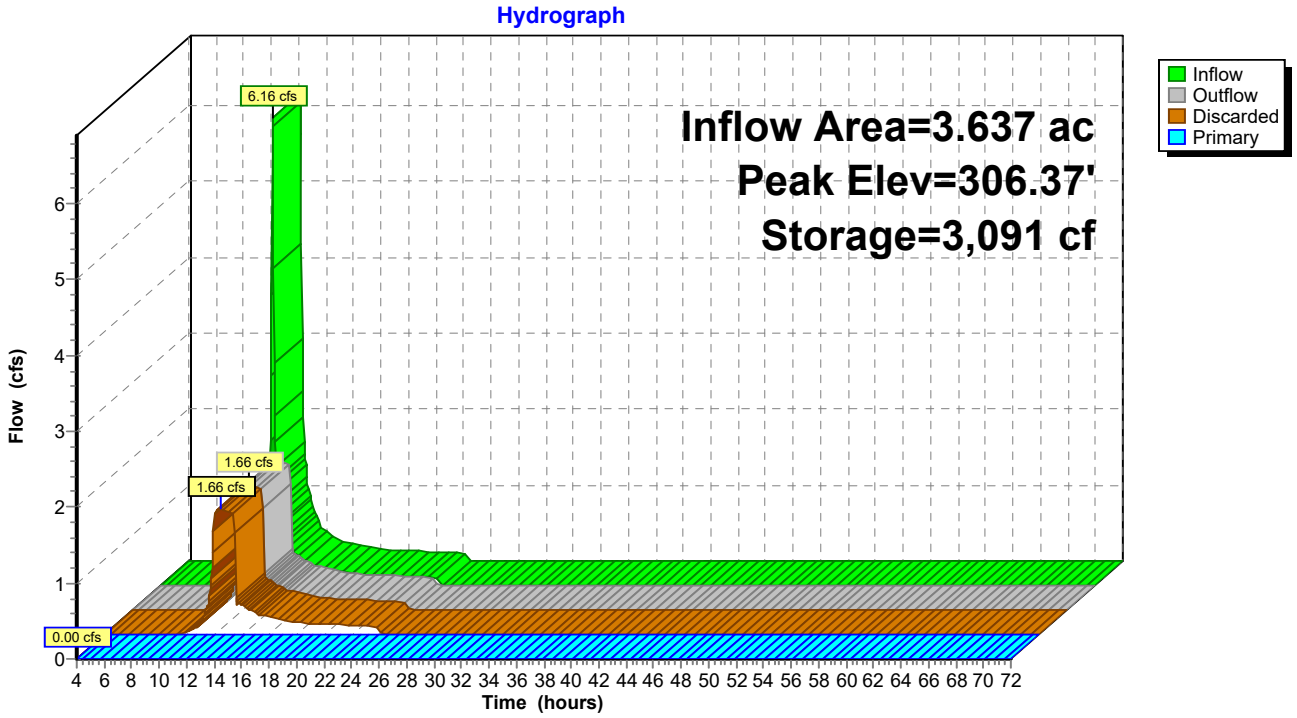
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
306.50	611	0	0
308.00	1,031	1,232	1,232
310.00	1,617	2,648	3,880
310.50	1,781	850	4,729
311.00	1,952	933	5,662

Device	Routing	Invert	Outlet Devices
#1	Primary	305.60'	**12.0" Round Culvert** L= 77.5' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 305.60' / 305.00' S= 0.0077 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Discarded	306.00'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#3	Device 1	308.00'	**2.0" x 2.0" Horiz. Orifice/Grate X 6.00 columns** X 6 rows C= 0.600 in 24.0" x 24.0" Grate (25% open area) Limited to weir flow at low heads
#4	Primary	310.50'	**10.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

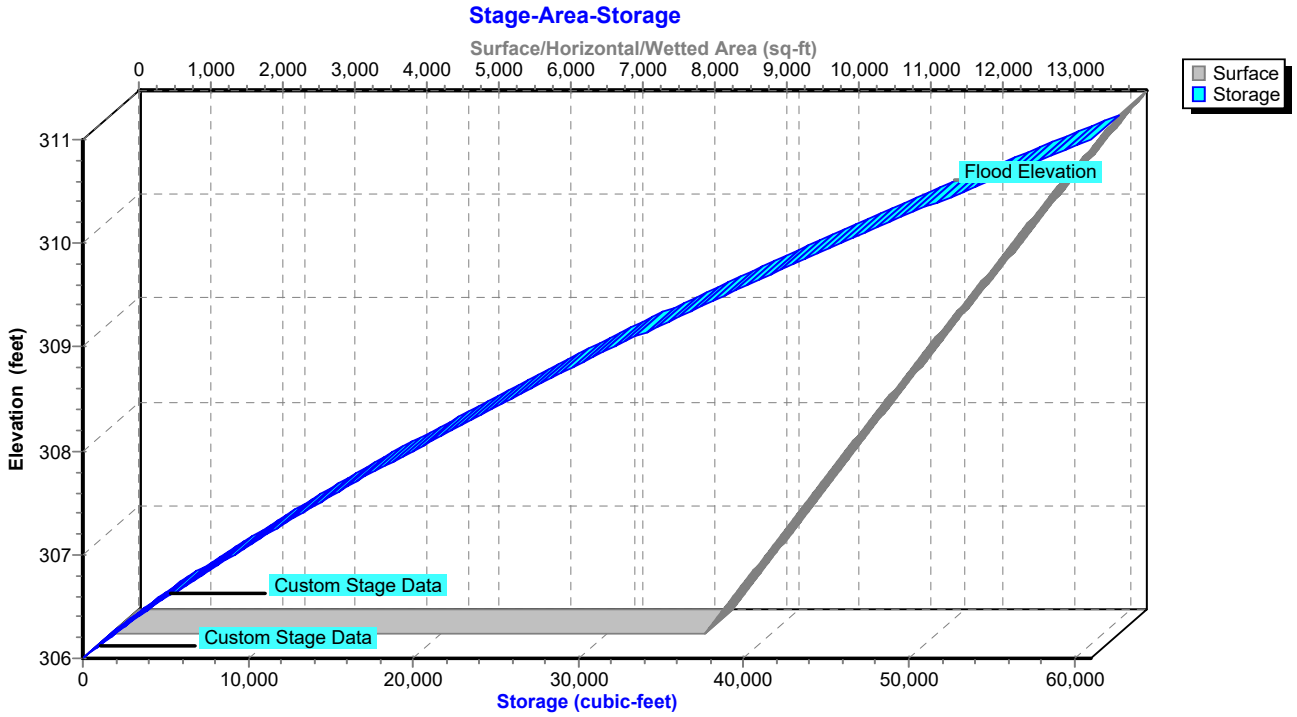
Discarded OutFlow Max=1.66 cfs @ 12.39 hrs HW=306.37' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 1.66 cfs)

Primary OutFlow Max=0.00 cfs @ 4.00 hrs HW=306.00' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 0.00 cfs of 0.66 cfs potential flow)
└**3=Orifice/Grate** (Controls 0.00 cfs)
└**4=Broad-Crested Rectangular Weir**(Controls 0.00 cfs)

Pond 1P: Infiltration Basin #1



Pond 1P: Infiltration Basin #1



Summary for Pond 2P: Infiltraton Basin #2

Inflow Area = 15.046 ac, 0.00% Impervious, Inflow Depth = 0.24" for 2-Year event
Inflow = 0.78 cfs @ 13.01 hrs, Volume= 0.301 af
Outflow = 0.73 cfs @ 13.31 hrs, Volume= 0.301 af, Atten= 6%, Lag= 18.3 min
Discarded = 0.37 cfs @ 13.31 hrs, Volume= 0.258 af
Primary = 0.36 cfs @ 13.31 hrs, Volume= 0.044 af

Routing by Dyn-Stor-Ind method, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 313.51' @ 13.31 hrs Surf.Area= 1,950 sf Storage= 694 cf
Flood Elev= 316.00' Surf.Area= 16,430 sf Storage= 21,448 cf

Plug-Flow detention time= 15.0 min calculated for 0.301 af (100% of inflow)
Center-of-Mass det. time= 15.0 min (1,030.3 - 1,015.2)

Volume	Invert	Avail.Storage	Storage Description
#1	313.00'	21,448 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

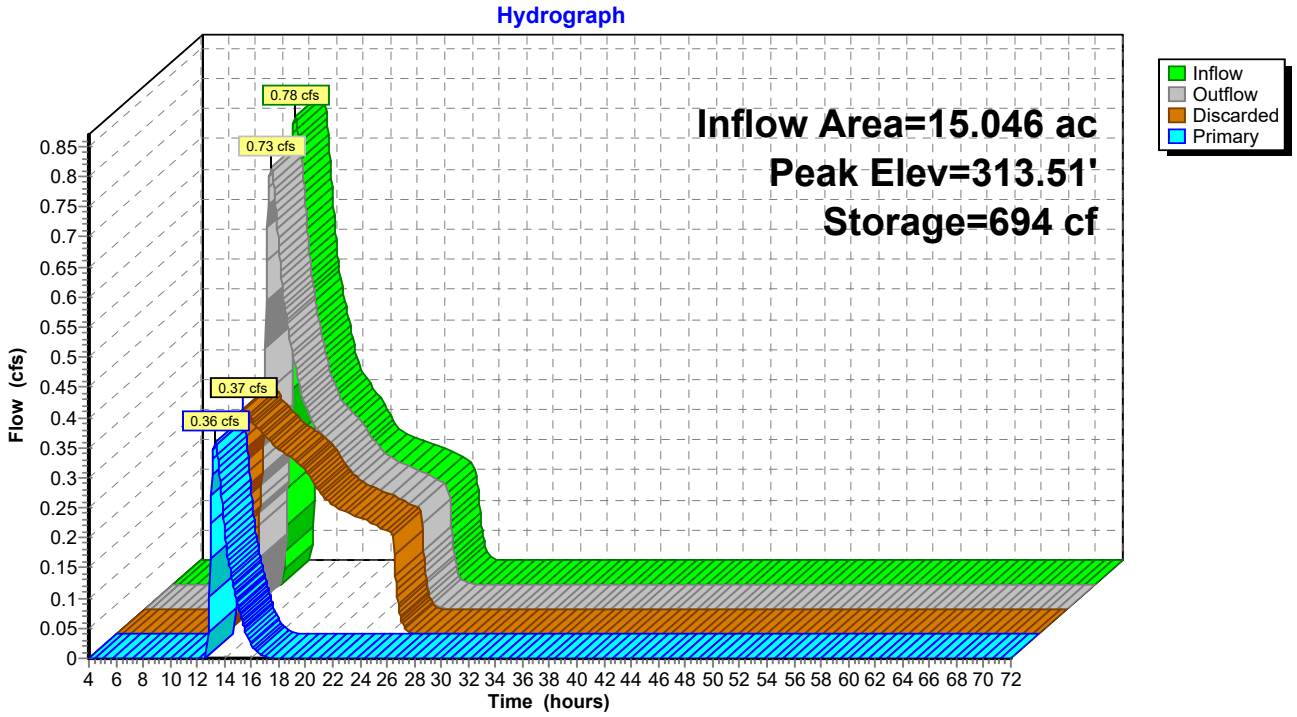
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
313.00	795	0	0
314.00	3,080	1,938	1,938
316.00	16,430	19,510	21,448

Device	Routing	Invert	Outlet Devices
#1	Discarded	313.00'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	313.30'	**24.0" Round Culvert** L= 338.9' RCP, rounded edge headwall, Ke= 0.100 Inlet / Outlet Invert= 313.30' / 305.00' S= 0.0245 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 3.14 sf

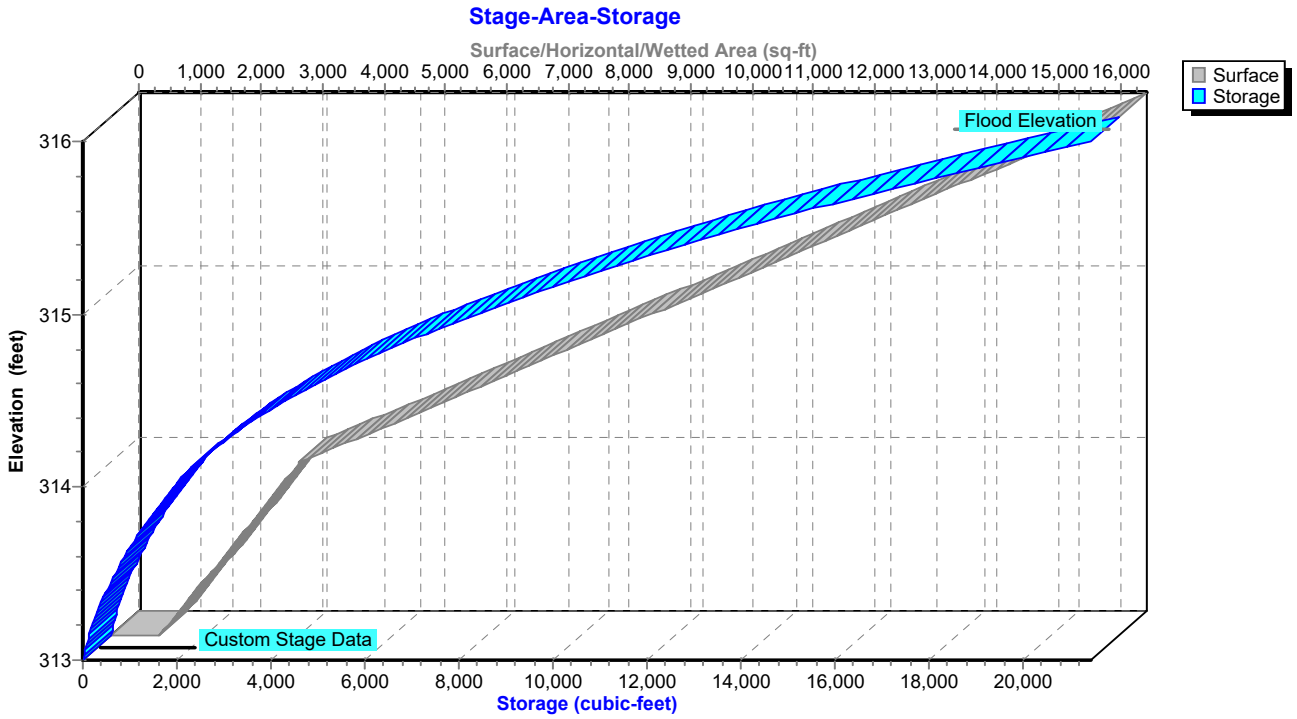
Discarded OutFlow Max=0.37 cfs @ 13.31 hrs HW=313.51' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.37 cfs)

Primary OutFlow Max=0.36 cfs @ 13.31 hrs HW=313.51' TW=305.00' (Dynamic Tailwater)
↑—**2=Culvert** (Inlet Controls 0.36 cfs @ 2.10 fps)

Pond 2P: Infiltraton Basin #2



Pond 2P: Infiltraton Basin #2



Summary for Pond 3P: Infiltraton Basin #3

Inflow Area = 15.943 ac, 0.00% Impervious, Inflow Depth = 0.03" for 2-Year event
Inflow = 0.36 cfs @ 13.31 hrs, Volume= 0.044 af
Outflow = 0.36 cfs @ 13.32 hrs, Volume= 0.044 af, Atten= 0%, Lag= 0.8 min
Discarded = 0.36 cfs @ 13.32 hrs, Volume= 0.044 af
Primary = 0.00 cfs @ 4.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 305.00' @ 13.32 hrs Surf.Area= 4,508 sf Storage= 19 cf
Flood Elev= 310.00' Surf.Area= 9,812 sf Storage= 35,282 cf

Plug-Flow detention time= 0.9 min calculated for 0.044 af (100% of inflow)
Center-of-Mass det. time= 0.9 min (838.8 - 838.0)

Volume	Invert	Avail.Storage	Storage Description
#1	305.00'	35,282 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

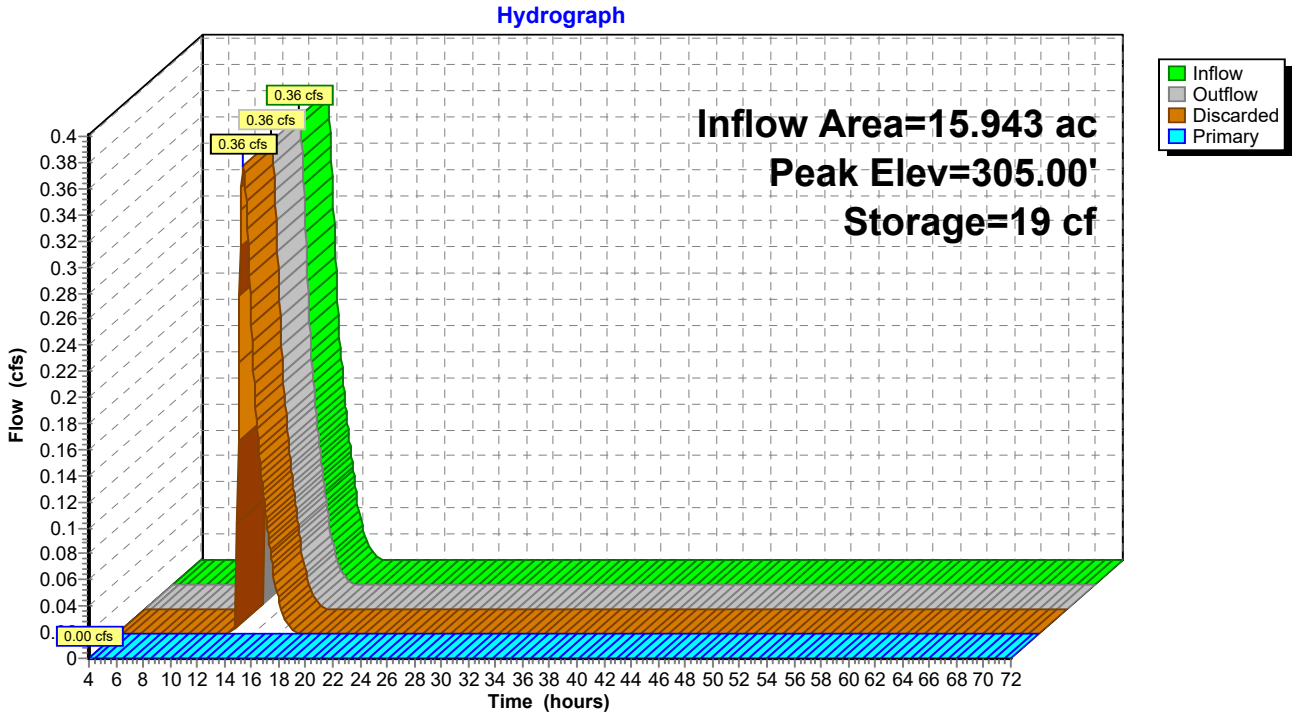
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
305.00	4,504	0	0
306.00	5,453	4,979	4,979
308.00	7,519	12,972	17,951
310.00	9,812	17,331	35,282

Device	Routing	Invert	Outlet Devices
#1	Discarded	305.00'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	309.50'	**30.0' long x 4.0' 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) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

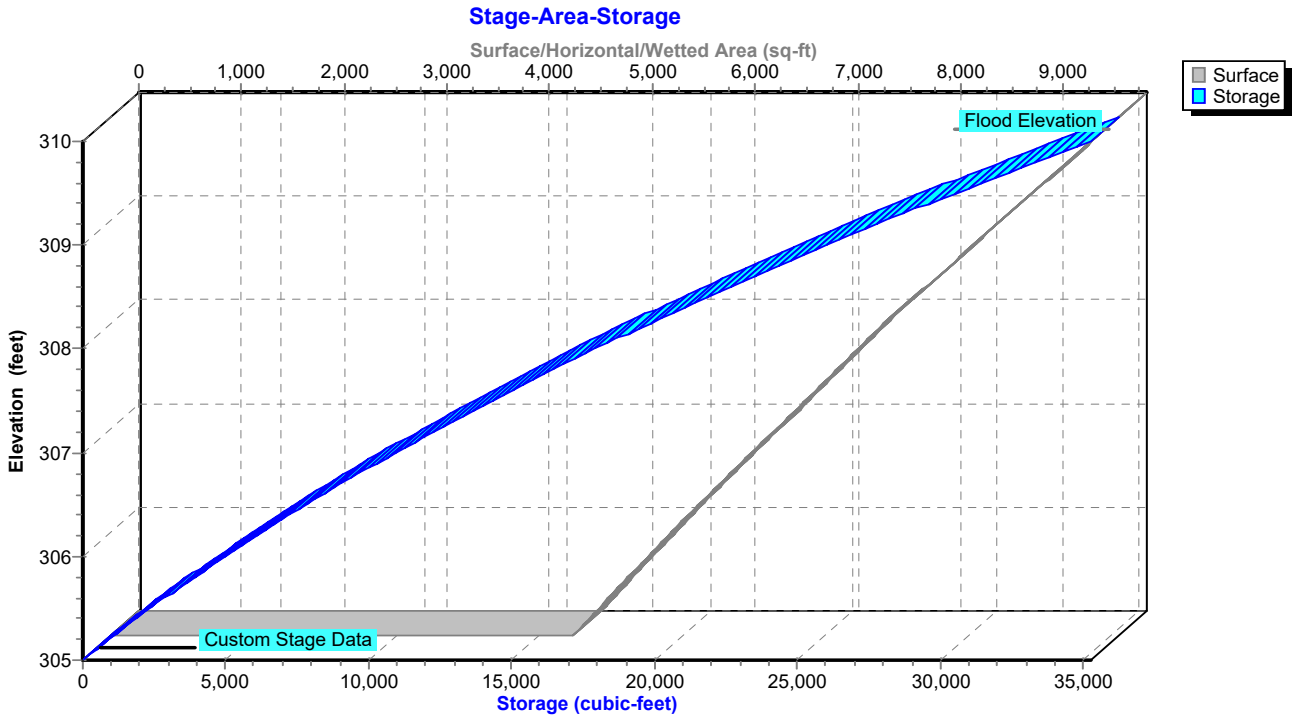
Discarded OutFlow Max=0.36 cfs @ 13.32 hrs HW=305.00' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.36 cfs)

Primary OutFlow Max=0.00 cfs @ 4.00 hrs HW=305.00' TW=0.00' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 3P: Infiltraton Basin #3



Pond 3P: Infiltraton Basin #3



Summary for Subcatchment P1: Subcatchment to Basin #1

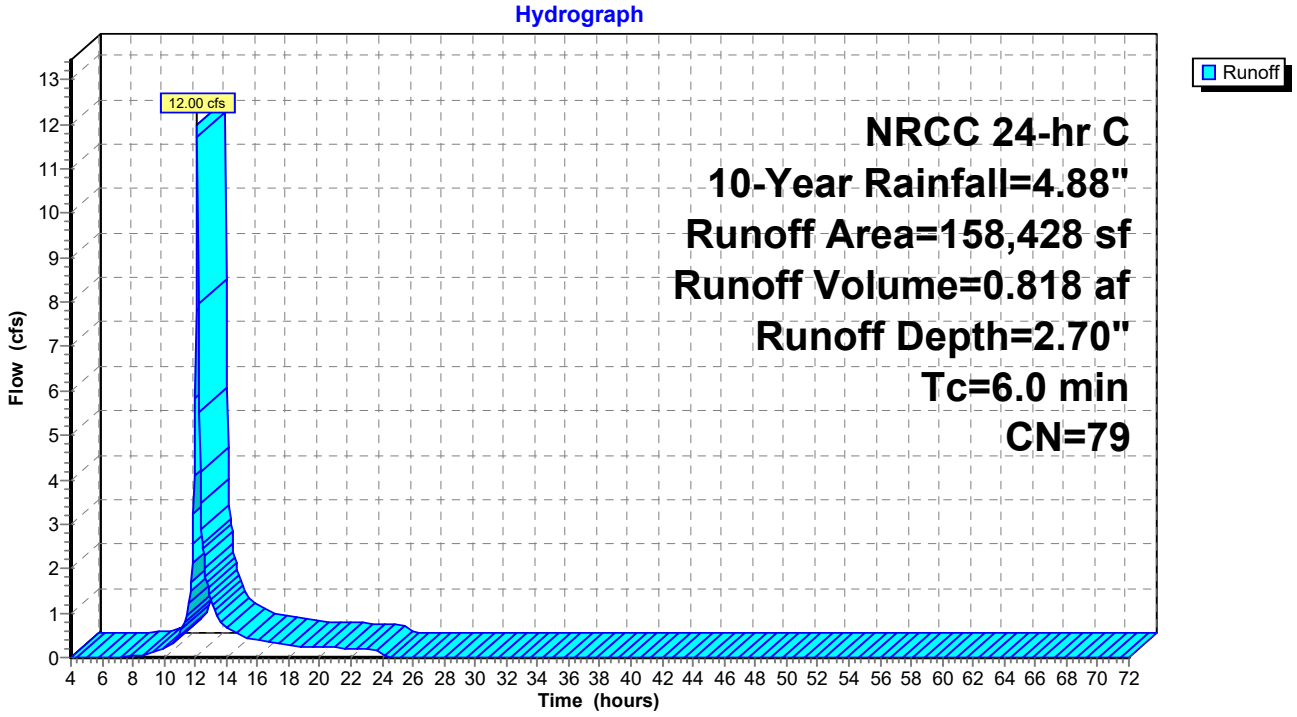
Runoff = 12.00 cfs @ 12.13 hrs, Volume= 0.818 af, Depth= 2.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.88"

Area (sf)	CN	Description
26,935	98	Paved roads w/curbs & sewers, HSG A
29,422	98	Paved roads w/curbs & sewers, HSG B
21,369	98	Roofs, HSG A
21,413	98	Roofs, HSG B
36,739	39	>75% Grass cover, Good, HSG A
22,550	61	>75% Grass cover, Good, HSG B
158,428	79	Weighted Average
59,289		37.42% Pervious Area
99,139		62.58% Impervious Area

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

Subcatchment P1: Subcatchment to Basin #1



Summary for Subcatchment P2: Subcatchemnt to Basin #2

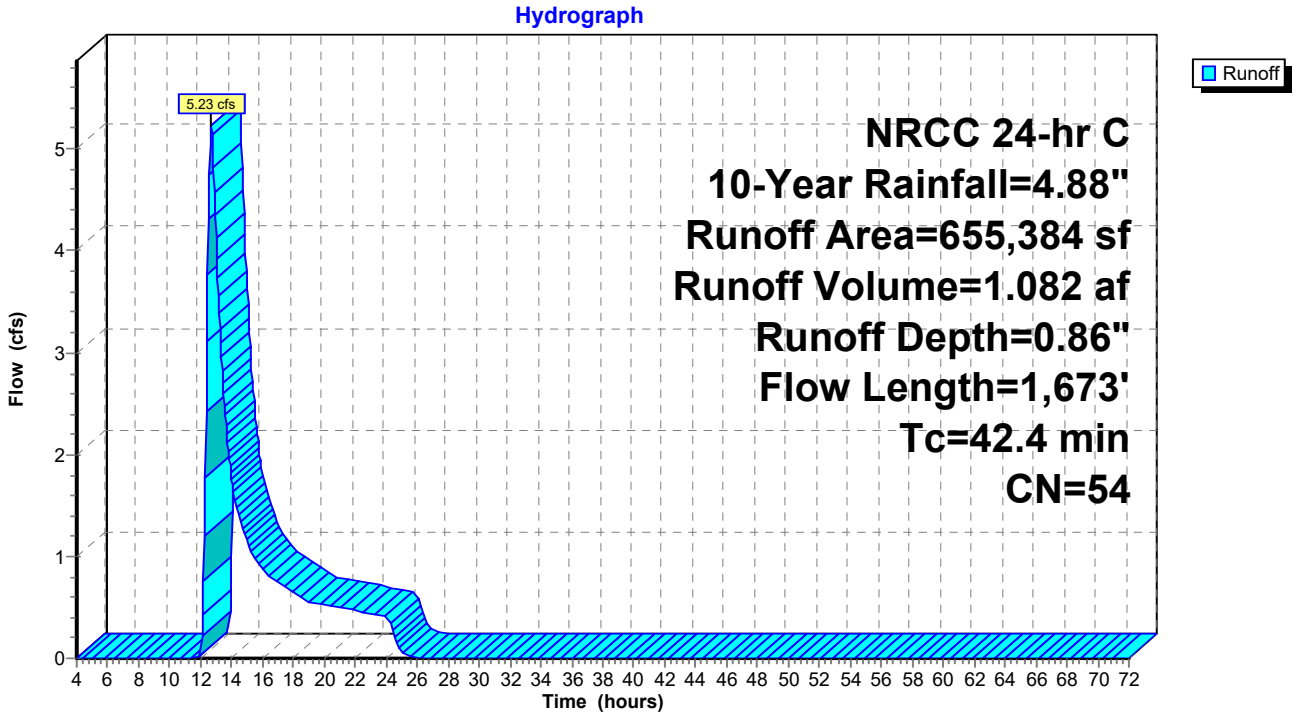
Runoff = 5.23 cfs @ 12.70 hrs, Volume= 1.082 af, Depth= 0.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.88"

Area (sf)	CN	Description
589,181	55	Woods, Good, HSG B
30,779	61	>75% Grass cover, Good, HSG B
35,424	39	>75% Grass cover, Good, HSG A
655,384	54	Weighted Average
655,384		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.2	50	0.0800	0.07		**Sheet Flow, Segment A-B** Woods: Dense underbrush n= 0.800 P2= 3.26"
0.9	78	0.0800	1.41		**Shallow Concentrated Flow, Segment B-C** Woodland Kv= 5.0 fps
12.7	592	0.0240	0.77		**Shallow Concentrated Flow, Segment C-D** Woodland Kv= 5.0 fps
14.1	581	0.0190	0.69		**Shallow Concentrated Flow, Segment D-E** Woodland Kv= 5.0 fps
2.0	60	0.0100	0.50		**Shallow Concentrated Flow, Segment E-F** Woodland Kv= 5.0 fps
0.5	312	0.0230	10.92	34.31	**Pipe Channel, Segment F-G** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Concrete pipe, straight & clean
42.4	1,673	Total			

Subcatchment P2: Subcatchemnt to Basin #2



Summary for Subcatchment P3: Subcatchment to Basin #3

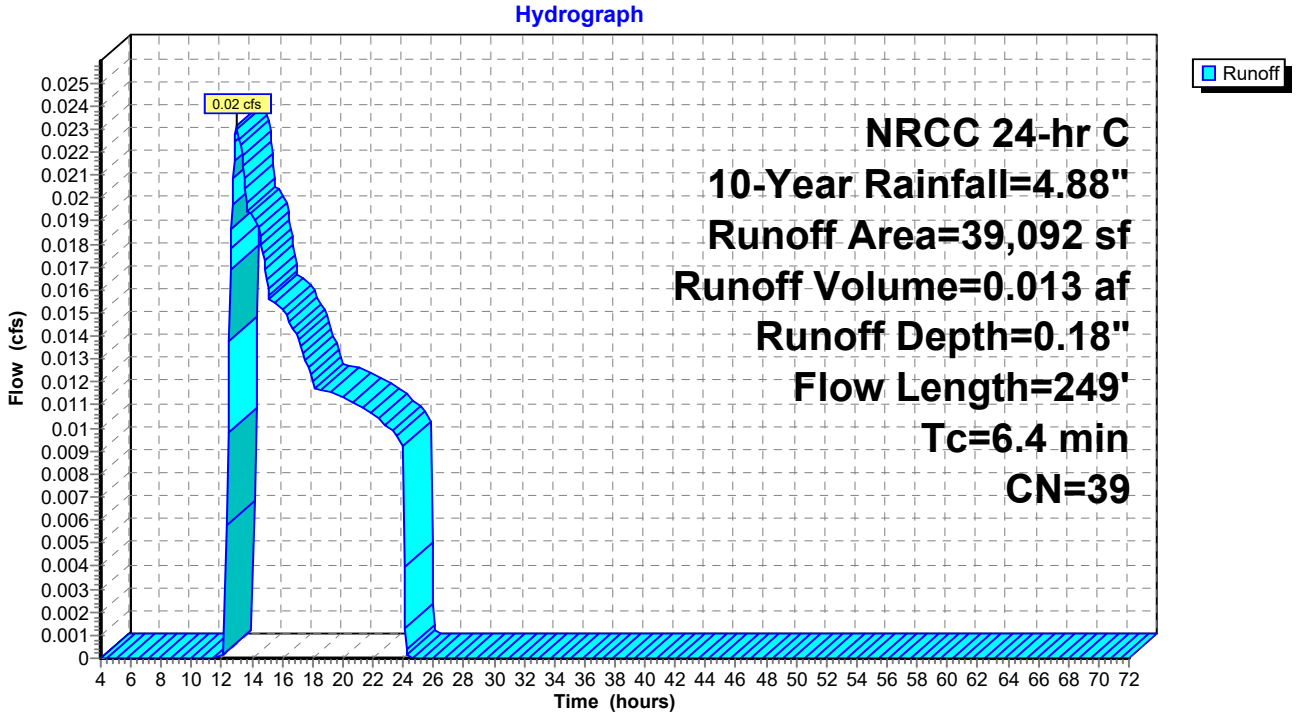
Runoff = 0.02 cfs @ 12.95 hrs, Volume= 0.013 af, Depth= 0.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.88"

Area (sf)	CN	Description
39,092	39	>75% Grass cover, Good, HSG A
39,092		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	50	0.0380	0.19		**Sheet Flow, Segment A-B** Grass: Short n= 0.150 P2= 3.26"
2.0	184	0.0470	1.52		**Shallow Concentrated Flow, Segment B-C** Short Grass Pasture Kv= 7.0 fps
0.1	15	0.3300	4.02		**Shallow Concentrated Flow, Segment C-D** Short Grass Pasture Kv= 7.0 fps
6.4	249	Total			

Subcatchment P3: Subcatchment to Basin #3



Summary for Subcatchment P4: Subcatchment to BVW

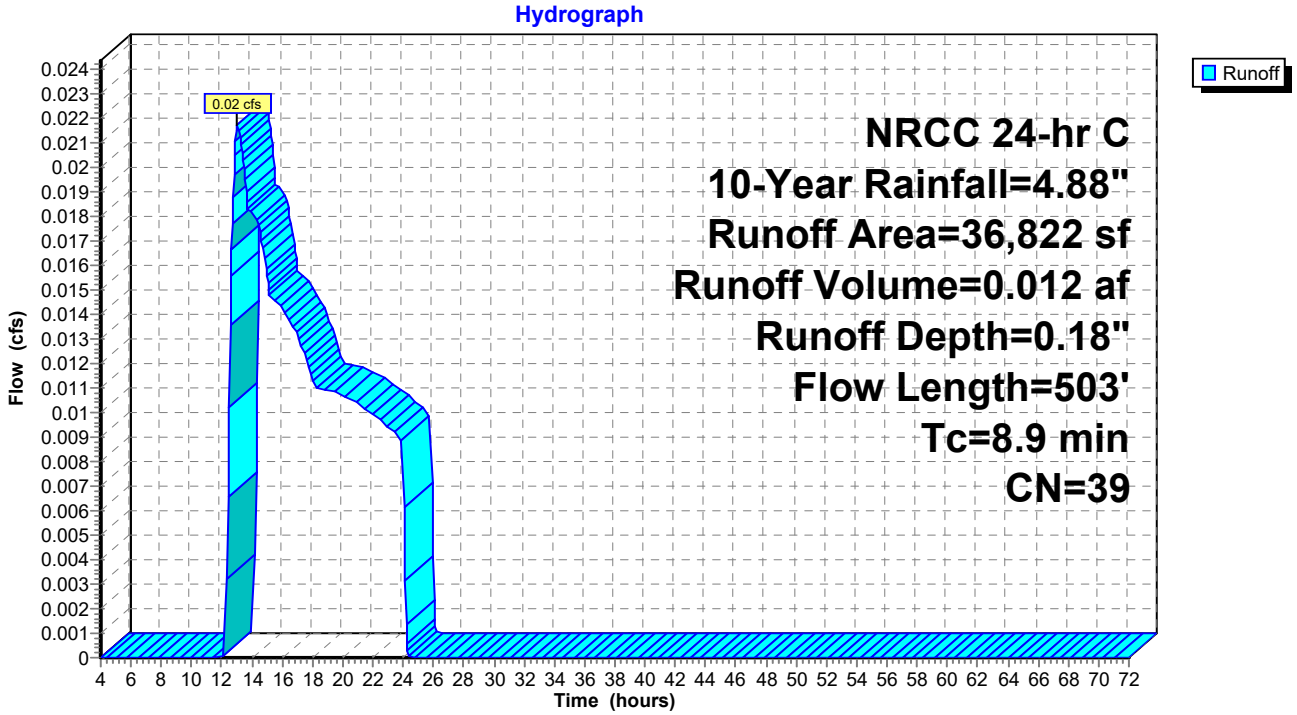
Runoff = 0.02 cfs @ 13.04 hrs, Volume= 0.012 af, Depth= 0.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.88"

Area (sf)	CN	Description
36,822	39	>75% Grass cover, Good, HSG A
36,822		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.0	50	0.0950	0.28		**Sheet Flow, Segment A-B** Grass: Short n= 0.150 P2= 3.26"
2.3	153	0.0260	1.13		**Shallow Concentrated Flow, Segment B-C** Short Grass Pasture Kv= 7.0 fps
0.2	47	0.0050	3.79	2.98	**Pipe Channel, RCP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011 Concrete pipe, straight & clean
3.4	253	0.0070	1.25		**Shallow Concentrated Flow, Segment D-E** Grassed Waterway Kv= 15.0 fps
8.9	503	Total			

Subcatchment P4: Subcatchment to BVW



Summary for Subcatchment P5: Subcatchment to Blackstone Street

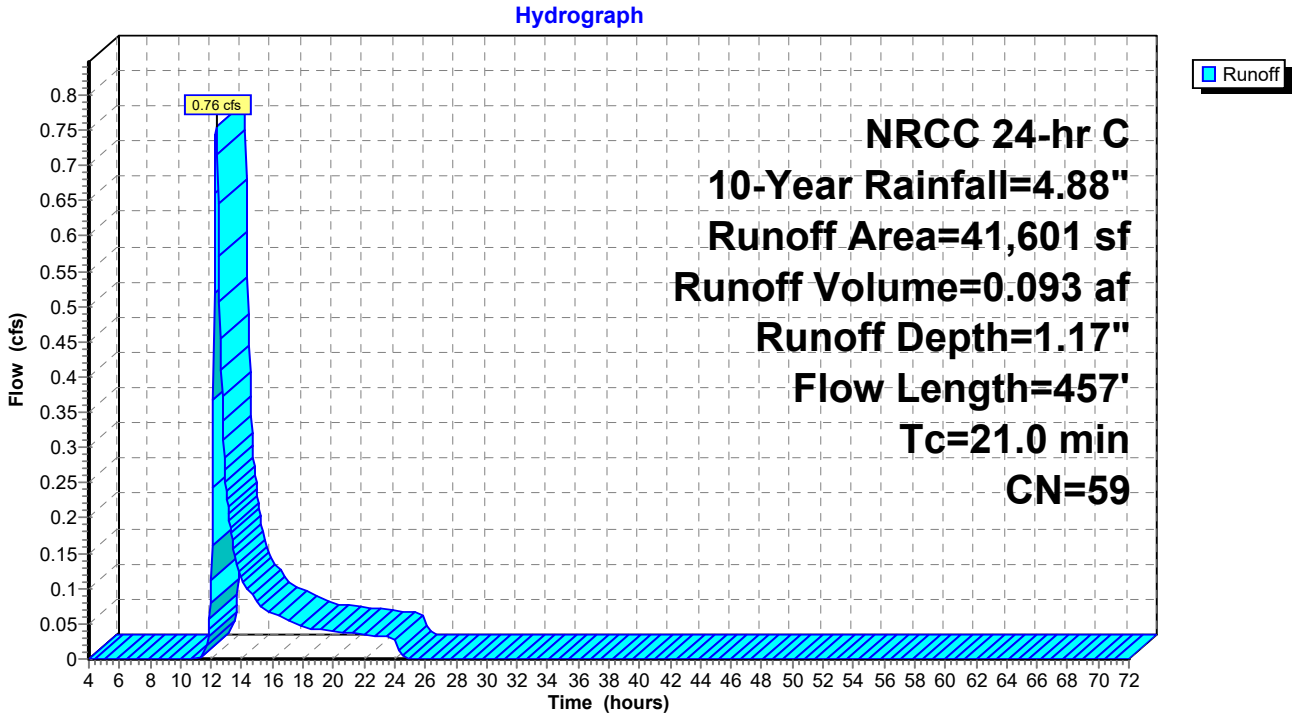
Runoff = 0.76 cfs @ 12.34 hrs, Volume= 0.093 af, Depth= 1.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.88"

Area (sf)	CN	Description
9,968	55	Woods, Good, HSG B
504	30	Woods, Good, HSG A
30,178	61	>75% Grass cover, Good, HSG B
951	39	>75% Grass cover, Good, HSG A
41,601	59	Weighted Average
41,601		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	50	0.0490	0.06		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.26"
1.0	89	0.0890	1.49		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.1	96	0.0470	1.52		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
4.0	222	0.0340	0.92		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
21.0	457	Total			

Subcatchment P5: Subcatchment to Blackstone Street

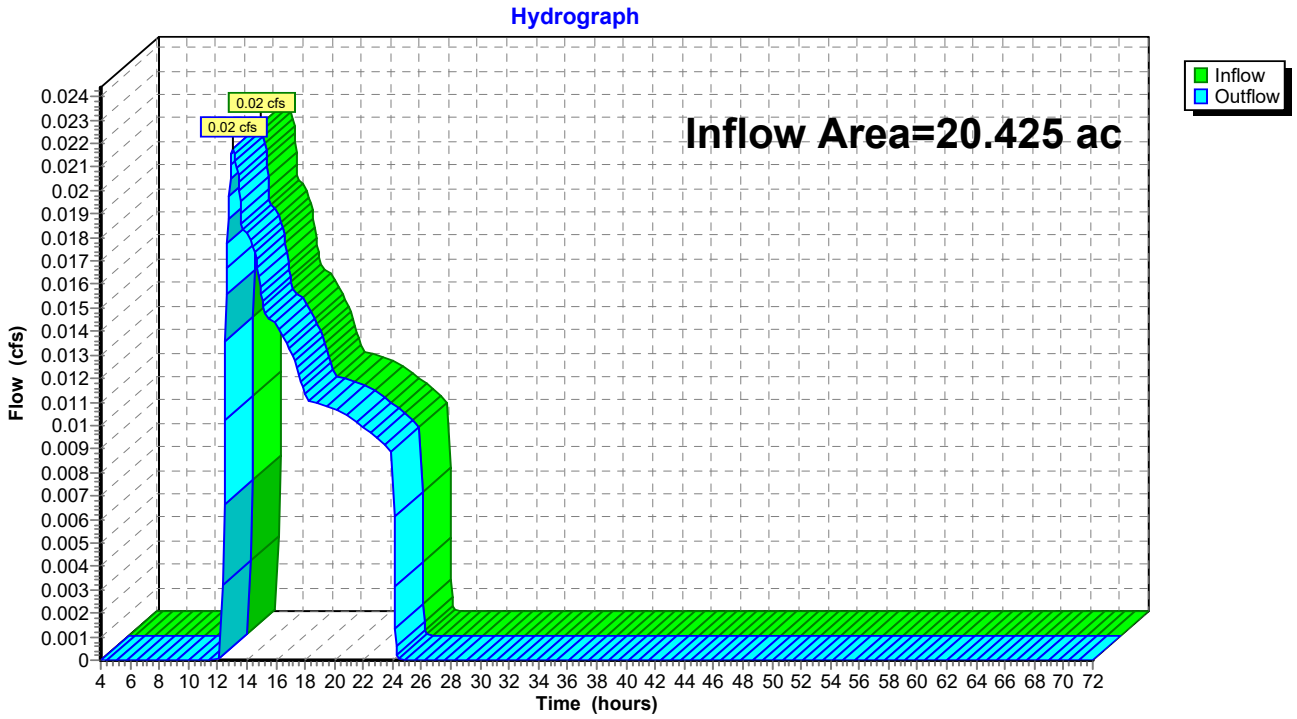


Summary for Reach PR1: Analysis Point - AP1

Inflow Area = 20.425 ac, 11.14% Impervious, Inflow Depth = 0.01" for 10-Year event
Inflow = 0.02 cfs @ 13.04 hrs, Volume= 0.012 af
Outflow = 0.02 cfs @ 13.04 hrs, Volume= 0.012 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs

Reach PR1: Analysis Point - AP1

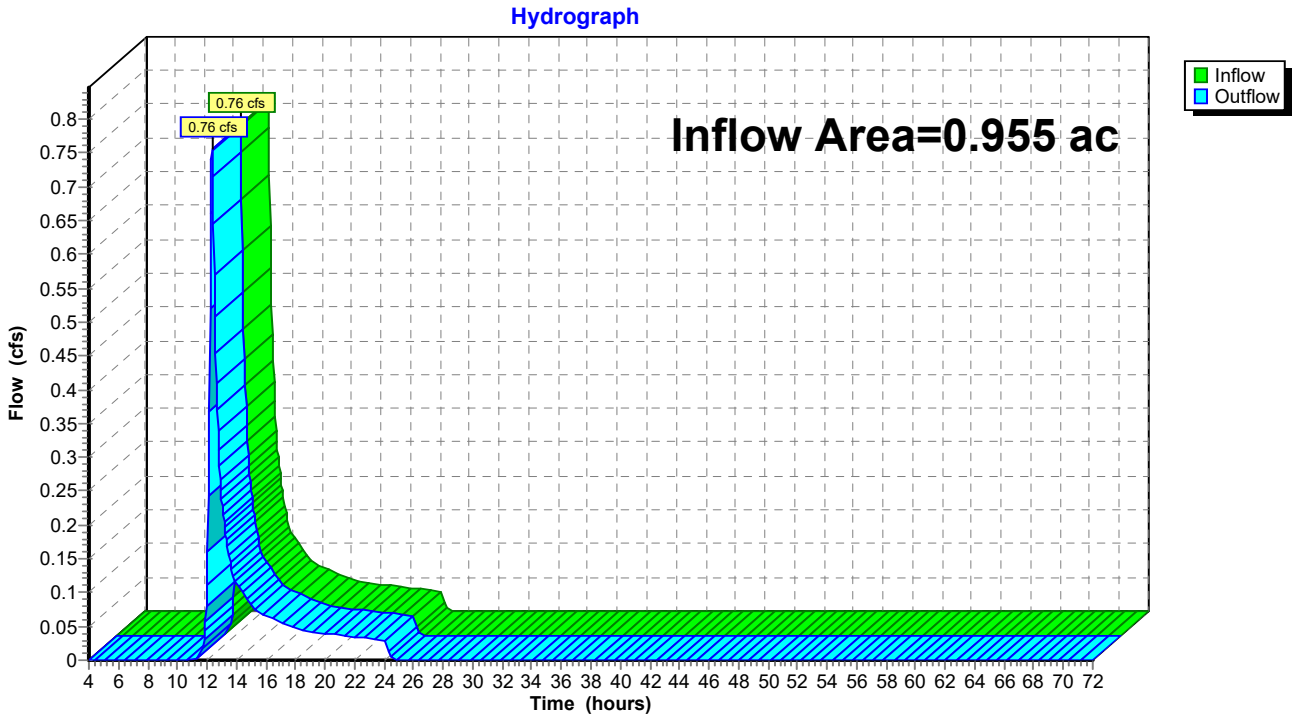


Summary for Reach PR2: Analysis Point - AP2

Inflow Area = 0.955 ac, 0.00% Impervious, Inflow Depth = 1.17" for 10-Year event
Inflow = 0.76 cfs @ 12.34 hrs, Volume= 0.093 af
Outflow = 0.76 cfs @ 12.34 hrs, Volume= 0.093 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs

Reach PR2: Analysis Point - AP2



Summary for Pond 1P: Infiltration Basin #1

Inflow Area = 3.637 ac, 62.58% Impervious, Inflow Depth = 2.70" for 10-Year event
Inflow = 12.00 cfs @ 12.13 hrs, Volume= 0.818 af
Outflow = 1.80 cfs @ 12.67 hrs, Volume= 0.818 af, Atten= 85%, Lag= 32.0 min
Discarded = 1.80 cfs @ 12.67 hrs, Volume= 0.818 af
Primary = 0.00 cfs @ 4.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 307.05' @ 12.67 hrs Surf.Area= 9,408 sf Storage= 9,614 cf
Flood Elev= 310.50' Surf.Area= 13,382 sf Storage= 53,229 cf

Plug-Flow detention time= 36.0 min calculated for 0.817 af (100% of inflow)
Center-of-Mass det. time= 36.0 min (871.1 - 835.0)

Volume	Invert	Avail.Storage	Storage Description
#1	306.00'	55,343 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	306.50'	5,662 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) -Impervious
		61,005 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
306.00	8,252	0	0
308.00	10,461	18,713	18,713
310.00	12,784	23,245	41,958
310.50	13,382	6,542	48,500
311.00	13,990	6,843	55,343

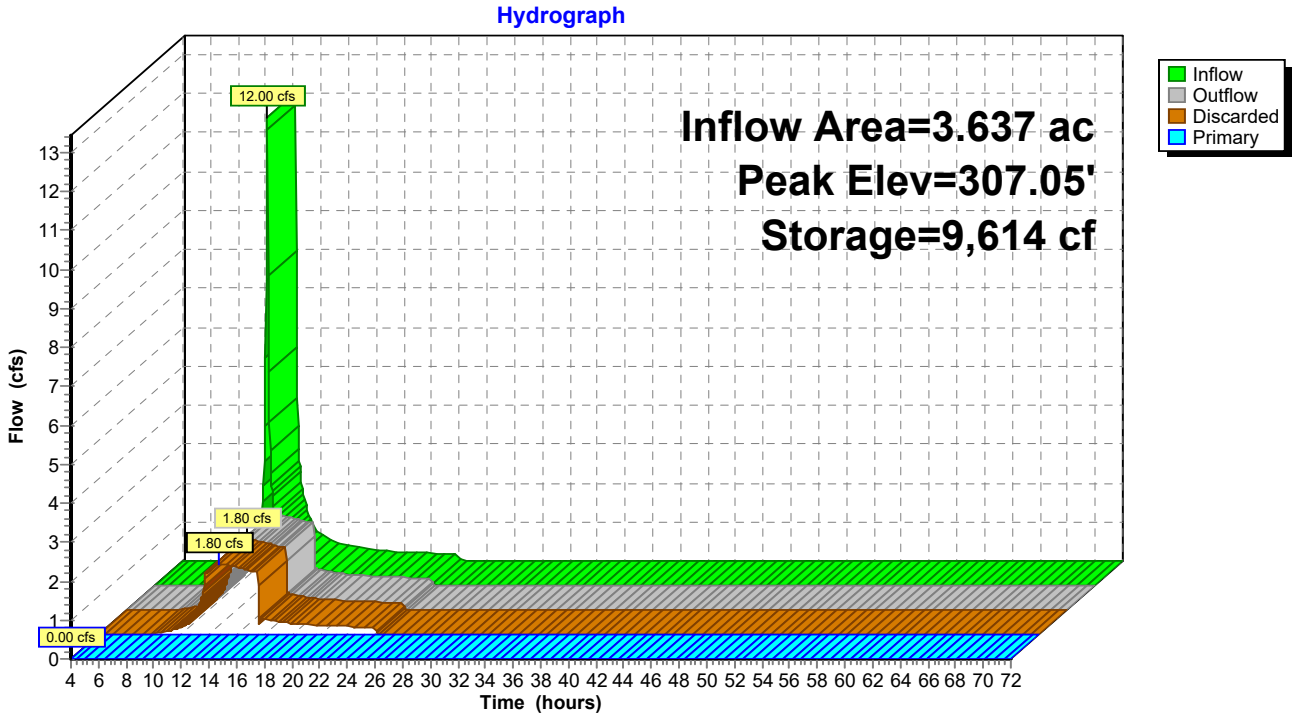
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
306.50	611	0	0
308.00	1,031	1,232	1,232
310.00	1,617	2,648	3,880
310.50	1,781	850	4,729
311.00	1,952	933	5,662

Device	Routing	Invert	Outlet Devices
#1	Primary	305.60'	**12.0" Round Culvert** L= 77.5' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 305.60' / 305.00' S= 0.0077 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Discarded	306.00'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#3	Device 1	308.00'	**2.0" x 2.0" Horiz. Orifice/Grate X 6.00 columns** X 6 rows C= 0.600 in 24.0" x 24.0" Grate (25% open area) Limited to weir flow at low heads
#4	Primary	310.50'	**10.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

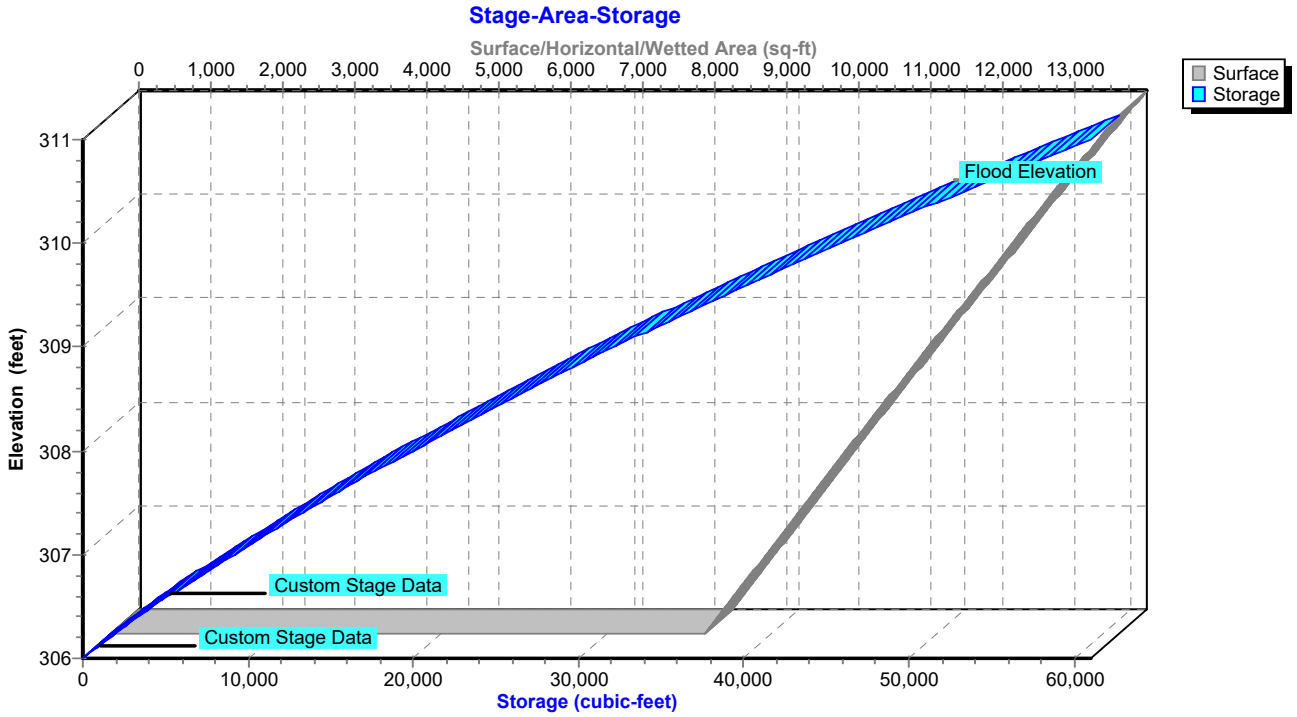
Discarded OutFlow Max=1.80 cfs @ 12.67 hrs HW=307.05' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 1.80 cfs)

Primary OutFlow Max=0.00 cfs @ 4.00 hrs HW=306.00' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 0.00 cfs of 0.66 cfs potential flow)
└**3=Orifice/Grate** (Controls 0.00 cfs)
└**4=Broad-Crested Rectangular Weir**(Controls 0.00 cfs)

Pond 1P: Infiltration Basin #1



Pond 1P: Infiltration Basin #1



Summary for Pond 2P: Infiltraton Basin #2

Inflow Area = 15.046 ac, 0.00% Impervious, Inflow Depth = 0.86" for 10-Year event
Inflow = 5.23 cfs @ 12.70 hrs, Volume= 1.082 af
Outflow = 5.09 cfs @ 12.78 hrs, Volume= 1.082 af, Atten= 3%, Lag= 5.3 min
Discarded = 0.66 cfs @ 12.78 hrs, Volume= 0.412 af
Primary = 4.42 cfs @ 12.78 hrs, Volume= 0.669 af

Routing by Dyn-Stor-Ind method, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 314.06' @ 12.78 hrs Surf.Area= 3,472 sf Storage= 2,130 cf
Flood Elev= 316.00' Surf.Area= 16,430 sf Storage= 21,448 cf

Plug-Flow detention time= 12.5 min calculated for 1.081 af (100% of inflow)
Center-of-Mass det. time= 12.5 min (961.7 - 949.2)

Volume	Invert	Avail.Storage	Storage Description
#1	313.00'	21,448 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

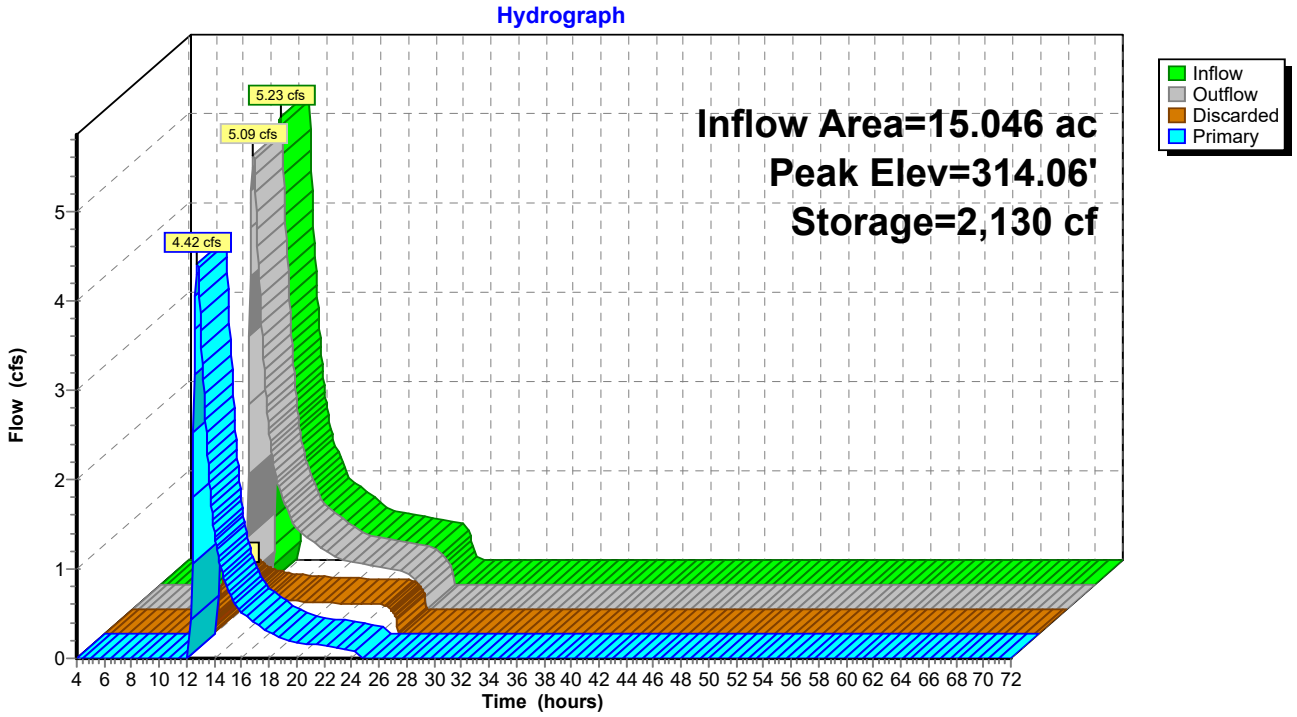
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
313.00	795	0	0
314.00	3,080	1,938	1,938
316.00	16,430	19,510	21,448

Device	Routing	Invert	Outlet Devices
#1	Discarded	313.00'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	313.30'	**24.0" Round Culvert** L= 338.9' RCP, rounded edge headwall, Ke= 0.100 Inlet / Outlet Invert= 313.30' / 305.00' S= 0.0245 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 3.14 sf

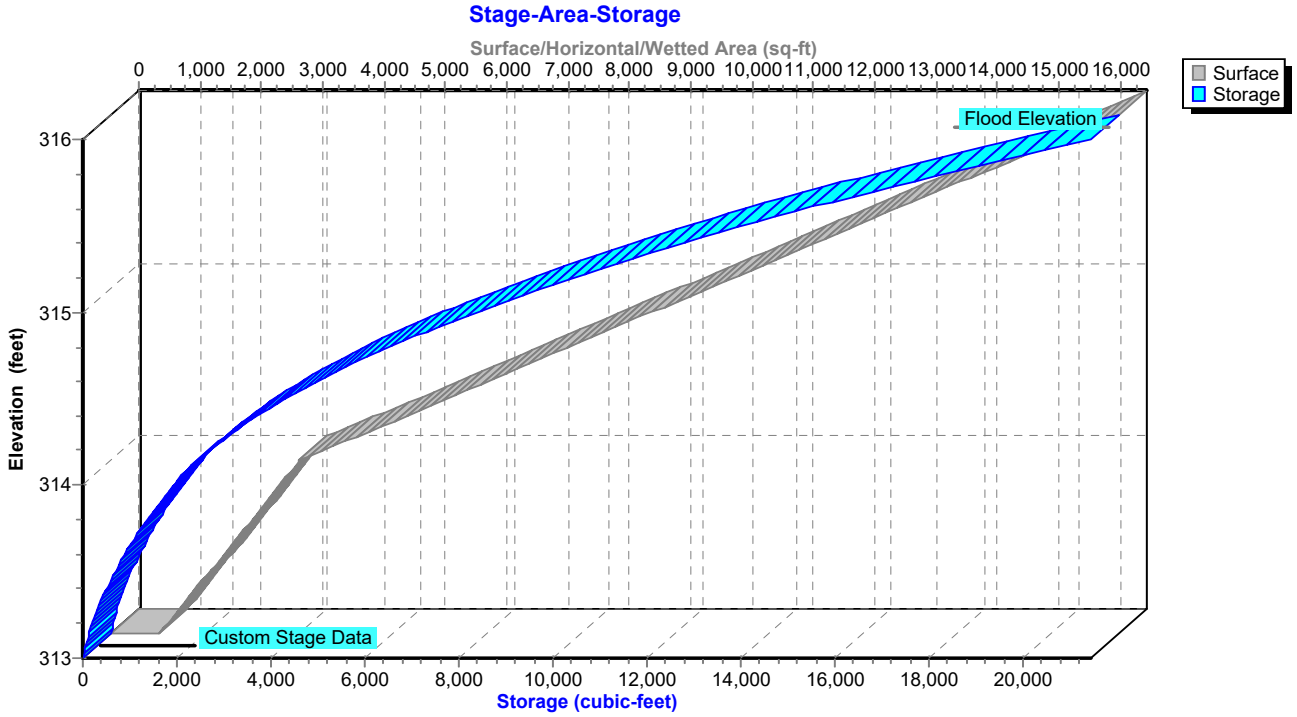
Discarded OutFlow Max=0.66 cfs @ 12.78 hrs HW=314.06' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.66 cfs)

Primary OutFlow Max=4.41 cfs @ 12.78 hrs HW=314.06' TW=305.69' (Dynamic Tailwater)
↑—**2=Culvert** (Inlet Controls 4.41 cfs @ 4.04 fps)

Pond 2P: Infiltraton Basin #2



Pond 2P: Infiltraton Basin #2



Summary for Pond 3P: Infiltraton Basin #3

Inflow Area = 15.943 ac, 0.00% Impervious, Inflow Depth = 0.51" for 10-Year event
Inflow = 4.44 cfs @ 12.78 hrs, Volume= 0.682 af
Outflow = 1.23 cfs @ 14.20 hrs, Volume= 0.682 af, Atten= 72%, Lag= 85.1 min
Discarded = 1.23 cfs @ 14.20 hrs, Volume= 0.682 af
Primary = 0.00 cfs @ 4.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 306.92' @ 14.20 hrs Surf.Area= 6,401 sf Storage= 10,418 cf
Flood Elev= 310.00' Surf.Area= 9,812 sf Storage= 35,282 cf

Plug-Flow detention time= 85.7 min calculated for 0.682 af (100% of inflow)
Center-of-Mass det. time= 85.6 min (974.8 - 889.2)

Volume	Invert	Avail.Storage	Storage Description
#1	305.00'	35,282 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

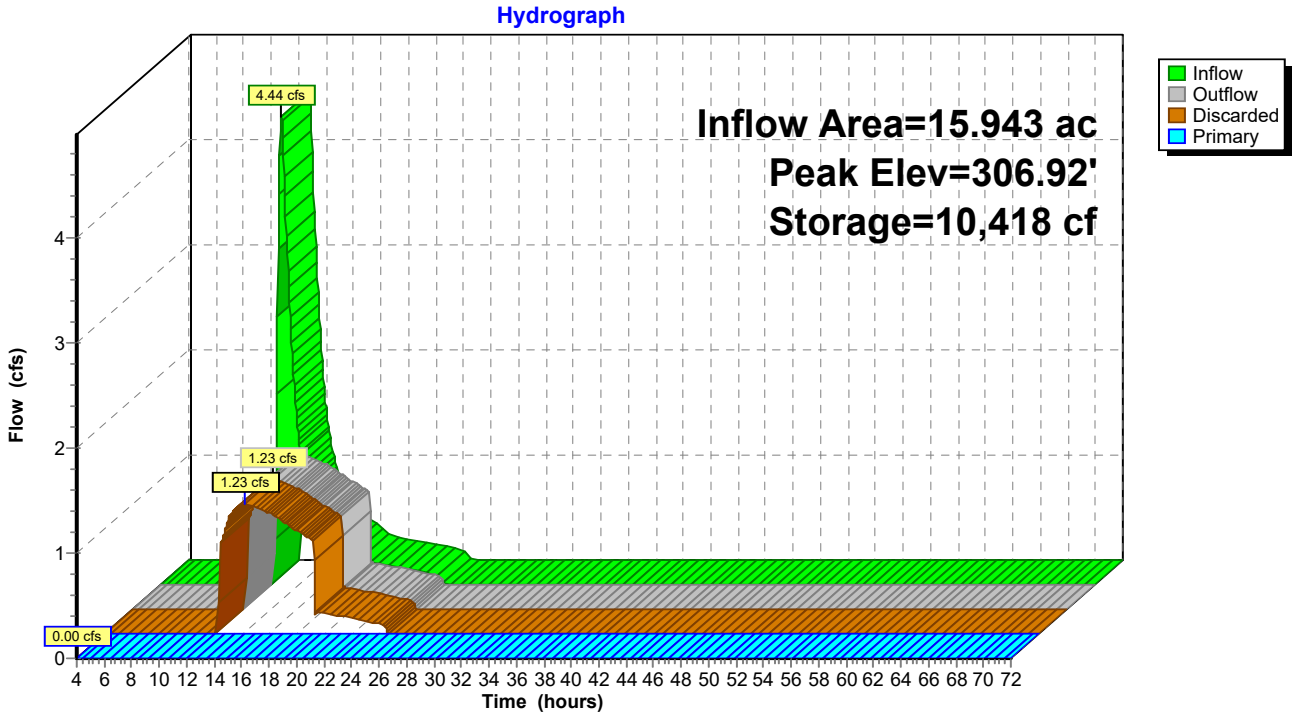
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
305.00	4,504	0	0
306.00	5,453	4,979	4,979
308.00	7,519	12,972	17,951
310.00	9,812	17,331	35,282

Device	Routing	Invert	Outlet Devices
#1	Discarded	305.00'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	309.50'	**30.0' long x 4.0' 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) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

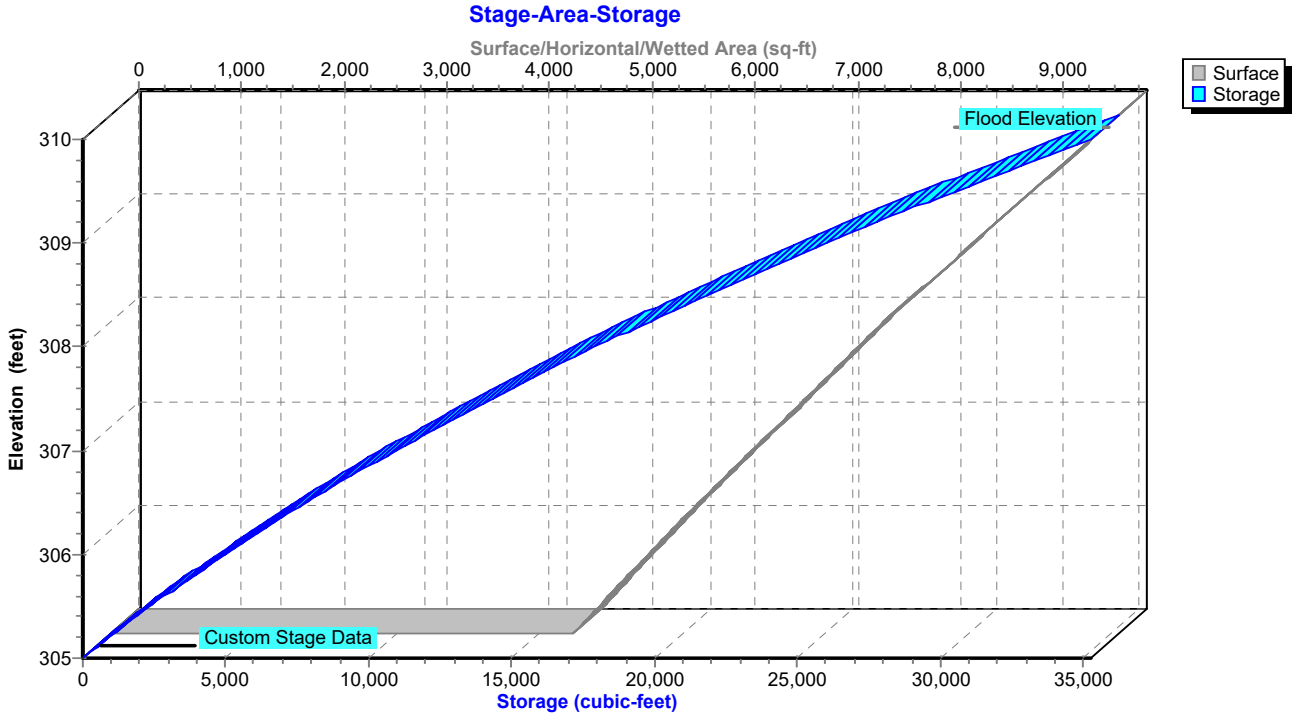
Discarded OutFlow Max=1.23 cfs @ 14.20 hrs HW=306.92' (Free Discharge)
1=Exfiltration (Exfiltration Controls 1.23 cfs)

Primary OutFlow Max=0.00 cfs @ 4.00 hrs HW=305.00' TW=0.00' (Dynamic Tailwater)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 3P: Infiltraton Basin #3



Pond 3P: Infiltraton Basin #3



Summary for Subcatchment P1: Subcatchment to Basin #1

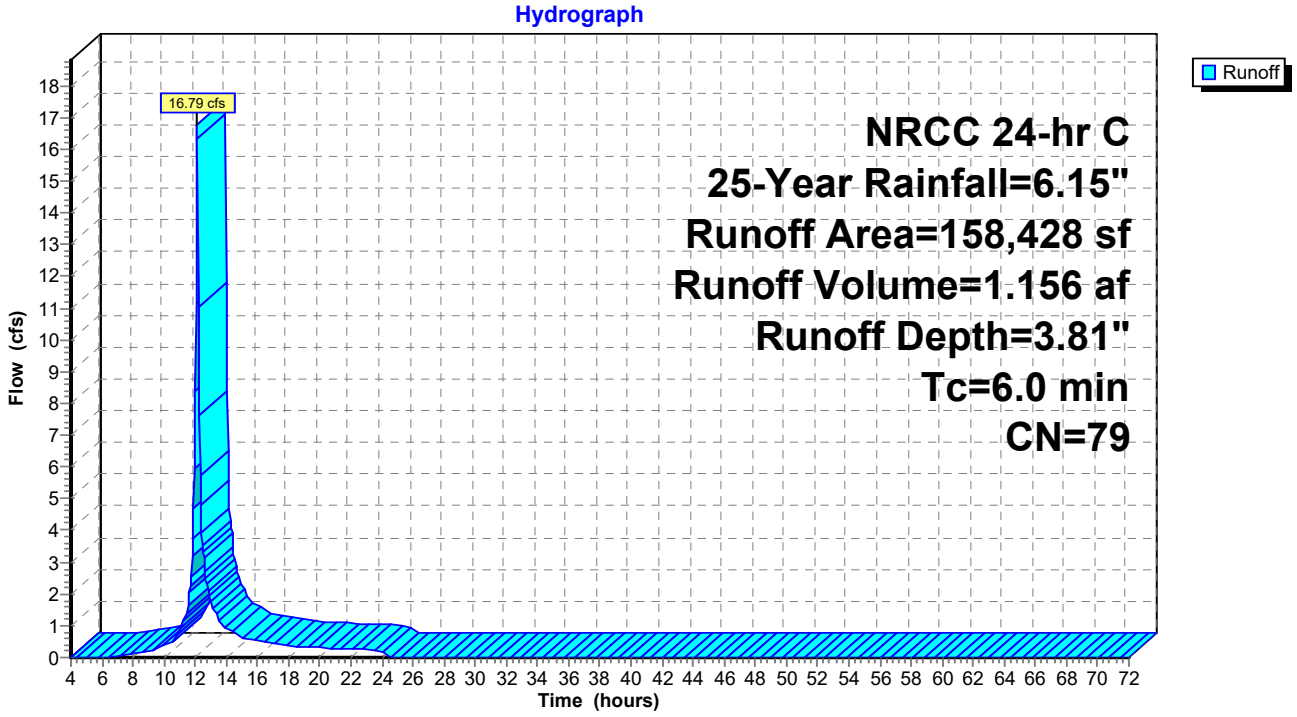
Runoff = 16.79 cfs @ 12.13 hrs, Volume= 1.156 af, Depth= 3.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.15"

Area (sf)	CN	Description
26,935	98	Paved roads w/curbs & sewers, HSG A
29,422	98	Paved roads w/curbs & sewers, HSG B
21,369	98	Roofs, HSG A
21,413	98	Roofs, HSG B
36,739	39	>75% Grass cover, Good, HSG A
22,550	61	>75% Grass cover, Good, HSG B
158,428	79	Weighted Average
59,289		37.42% Pervious Area
99,139		62.58% Impervious Area

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

Subcatchment P1: Subcatchment to Basin #1



Summary for Subcatchment P2: Subcatchemnt to Basin #2

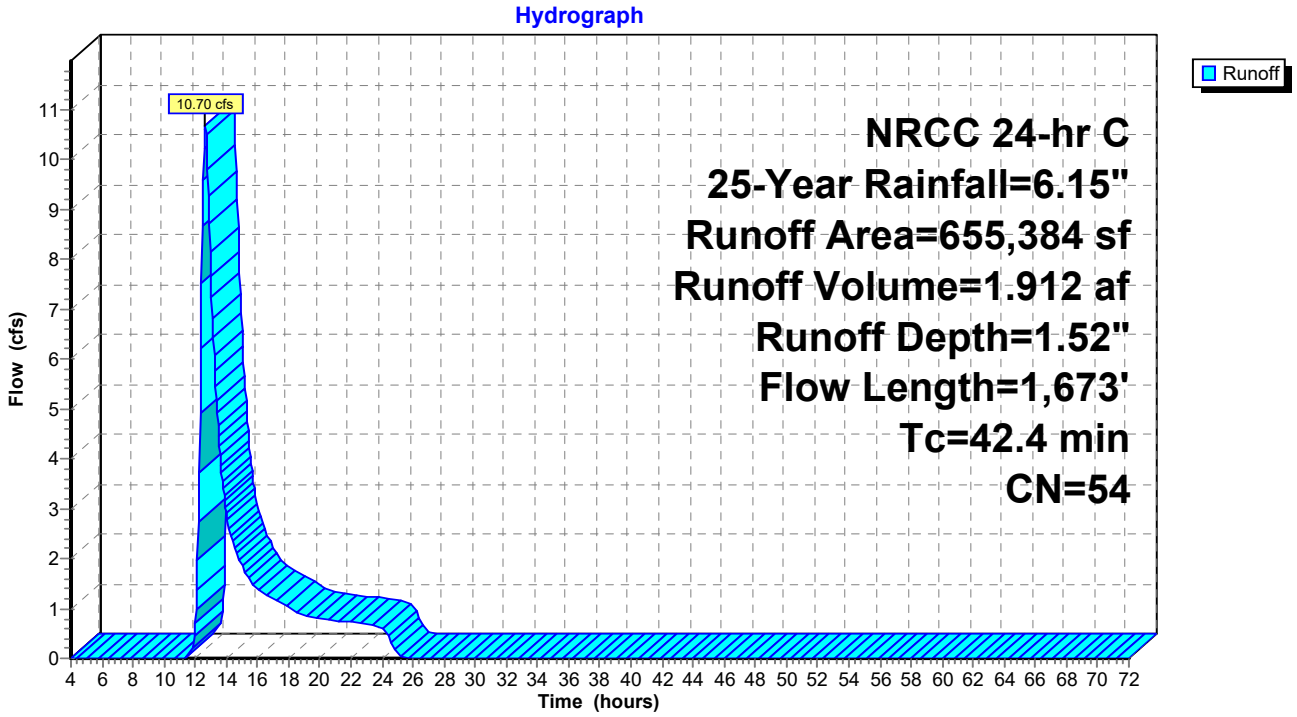
Runoff = 10.70 cfs @ 12.65 hrs, Volume= 1.912 af, Depth= 1.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.15"

Area (sf)	CN	Description
589,181	55	Woods, Good, HSG B
30,779	61	>75% Grass cover, Good, HSG B
35,424	39	>75% Grass cover, Good, HSG A
655,384	54	Weighted Average
655,384		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.2	50	0.0800	0.07		**Sheet Flow, Segment A-B** Woods: Dense underbrush n= 0.800 P2= 3.26"
0.9	78	0.0800	1.41		**Shallow Concentrated Flow, Segment B-C** Woodland Kv= 5.0 fps
12.7	592	0.0240	0.77		**Shallow Concentrated Flow, Segment C-D** Woodland Kv= 5.0 fps
14.1	581	0.0190	0.69		**Shallow Concentrated Flow, Segment D-E** Woodland Kv= 5.0 fps
2.0	60	0.0100	0.50		**Shallow Concentrated Flow, Segment E-F** Woodland Kv= 5.0 fps
0.5	312	0.0230	10.92	34.31	**Pipe Channel, Segment F-G** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Concrete pipe, straight & clean
42.4	1,673	Total			

Subcatchment P2: Subcatchemnt to Basin #2



Summary for Subcatchment P3: Subcatchment to Basin #3

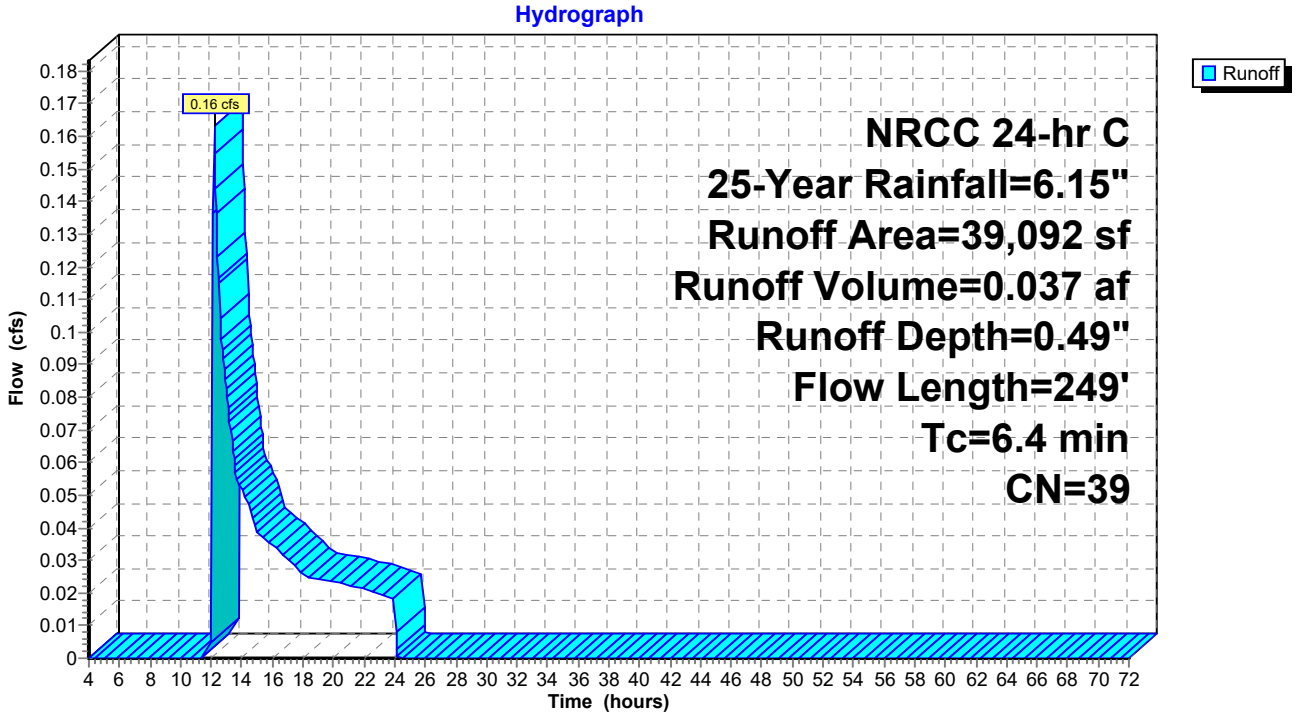
Runoff = 0.16 cfs @ 12.21 hrs, Volume= 0.037 af, Depth= 0.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.15"

Area (sf)	CN	Description
39,092	39	>75% Grass cover, Good, HSG A
39,092		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	50	0.0380	0.19		**Sheet Flow, Segment A-B** Grass: Short n= 0.150 P2= 3.26"
2.0	184	0.0470	1.52		**Shallow Concentrated Flow, Segment B-C** Short Grass Pasture Kv= 7.0 fps
0.1	15	0.3300	4.02		**Shallow Concentrated Flow, Segment C-D** Short Grass Pasture Kv= 7.0 fps
6.4	249	Total			

Subcatchment P3: Subcatchment to Basin #3



Summary for Subcatchment P4: Subcatchment to BVW

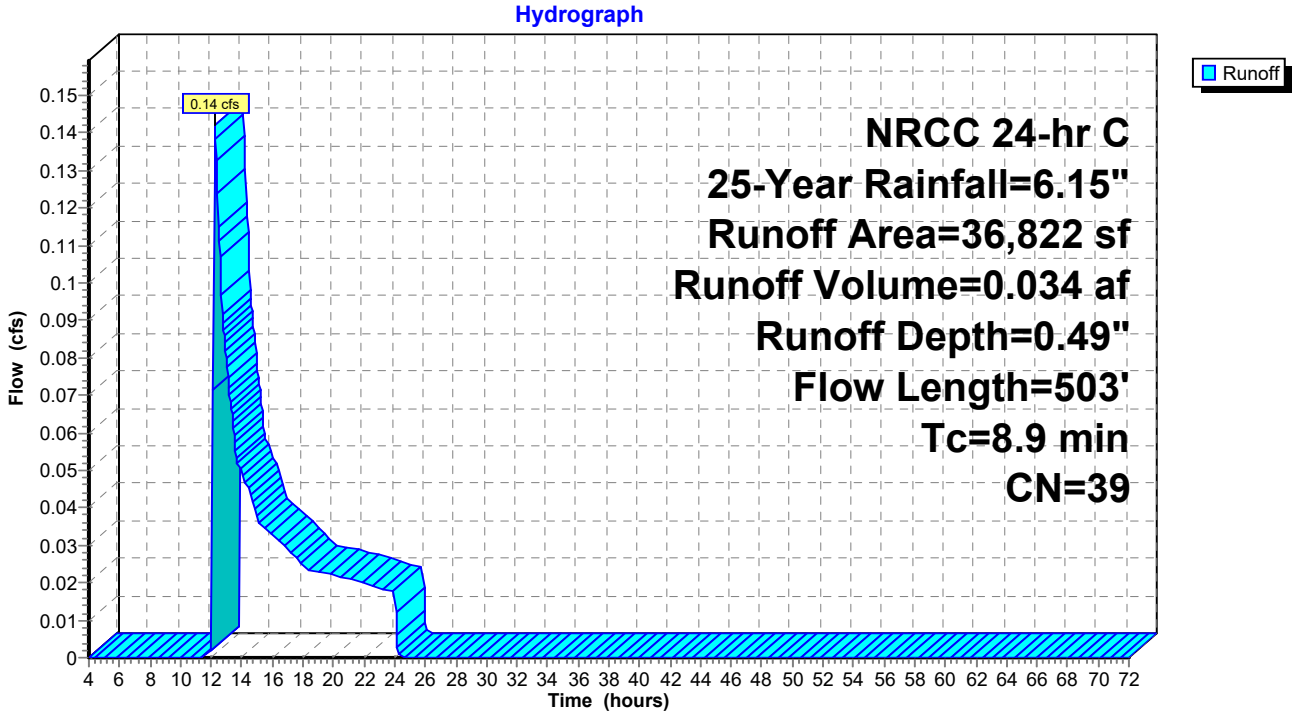
Runoff = 0.14 cfs @ 12.27 hrs, Volume= 0.034 af, Depth= 0.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.15"

Area (sf)	CN	Description
36,822	39	>75% Grass cover, Good, HSG A
36,822		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.0	50	0.0950	0.28		**Sheet Flow, Segment A-B** Grass: Short n= 0.150 P2= 3.26"
2.3	153	0.0260	1.13		**Shallow Concentrated Flow, Segment B-C** Short Grass Pasture Kv= 7.0 fps
0.2	47	0.0050	3.79	2.98	**Pipe Channel, RCP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011 Concrete pipe, straight & clean
3.4	253	0.0070	1.25		**Shallow Concentrated Flow, Segment D-E** Grassed Waterway Kv= 15.0 fps
8.9	503	Total			

Subcatchment P4: Subcatchment to BVW



Summary for Subcatchment P5: Subcatchment to Blackstone Street

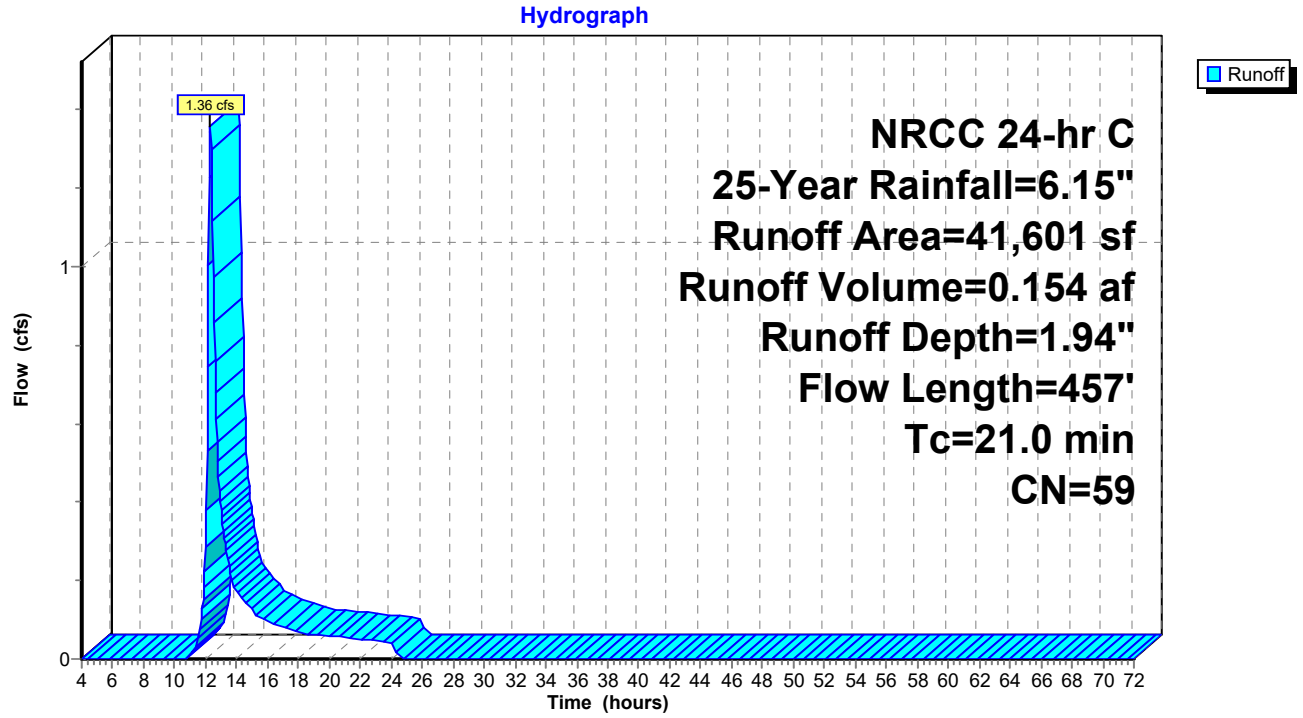
Runoff = 1.36 cfs @ 12.32 hrs, Volume= 0.154 af, Depth= 1.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.15"

Area (sf)	CN	Description
9,968	55	Woods, Good, HSG B
504	30	Woods, Good, HSG A
30,178	61	>75% Grass cover, Good, HSG B
951	39	>75% Grass cover, Good, HSG A
41,601	59	Weighted Average
41,601		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	50	0.0490	0.06		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.26"
1.0	89	0.0890	1.49		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.1	96	0.0470	1.52		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
4.0	222	0.0340	0.92		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
21.0	457	Total			

Subcatchment P5: Subcatchment to Blackstone Street

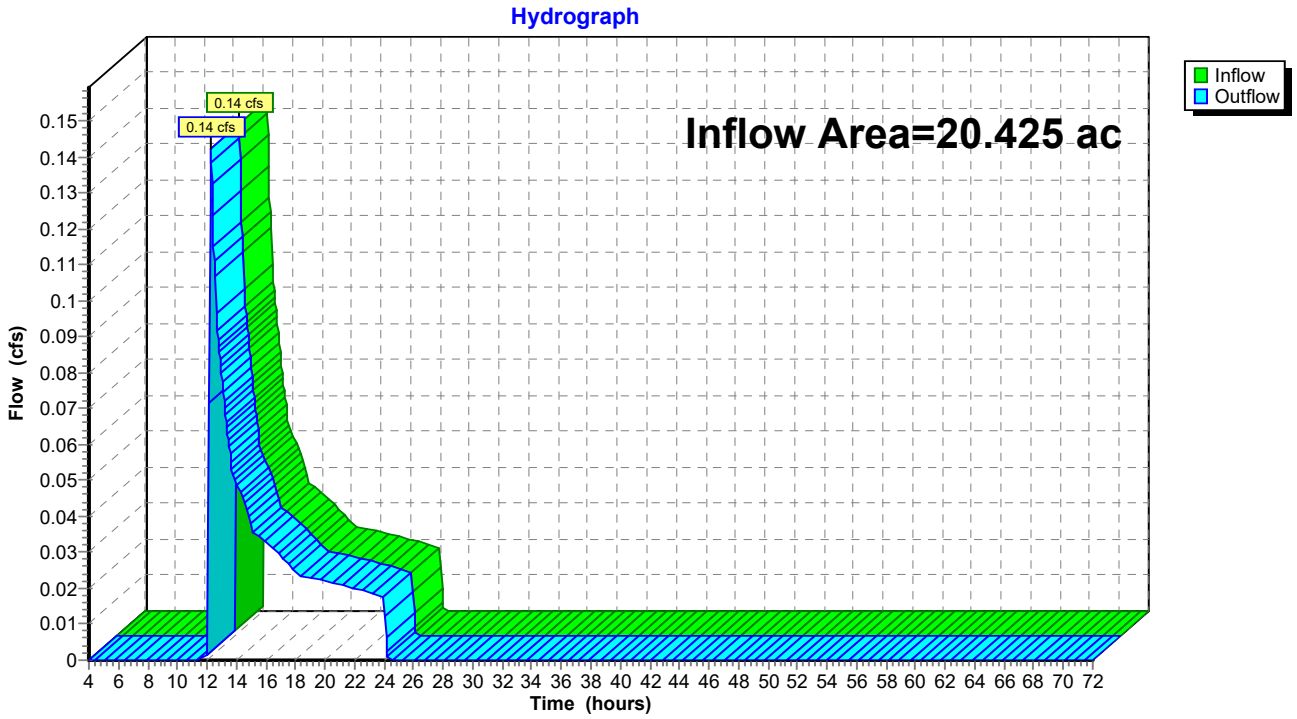


Summary for Reach PR1: Analysis Point - AP1

Inflow Area = 20.425 ac, 11.14% Impervious, Inflow Depth = 0.02" for 25-Year event
Inflow = 0.14 cfs @ 12.27 hrs, Volume= 0.034 af
Outflow = 0.14 cfs @ 12.27 hrs, Volume= 0.034 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs

Reach PR1: Analysis Point - AP1

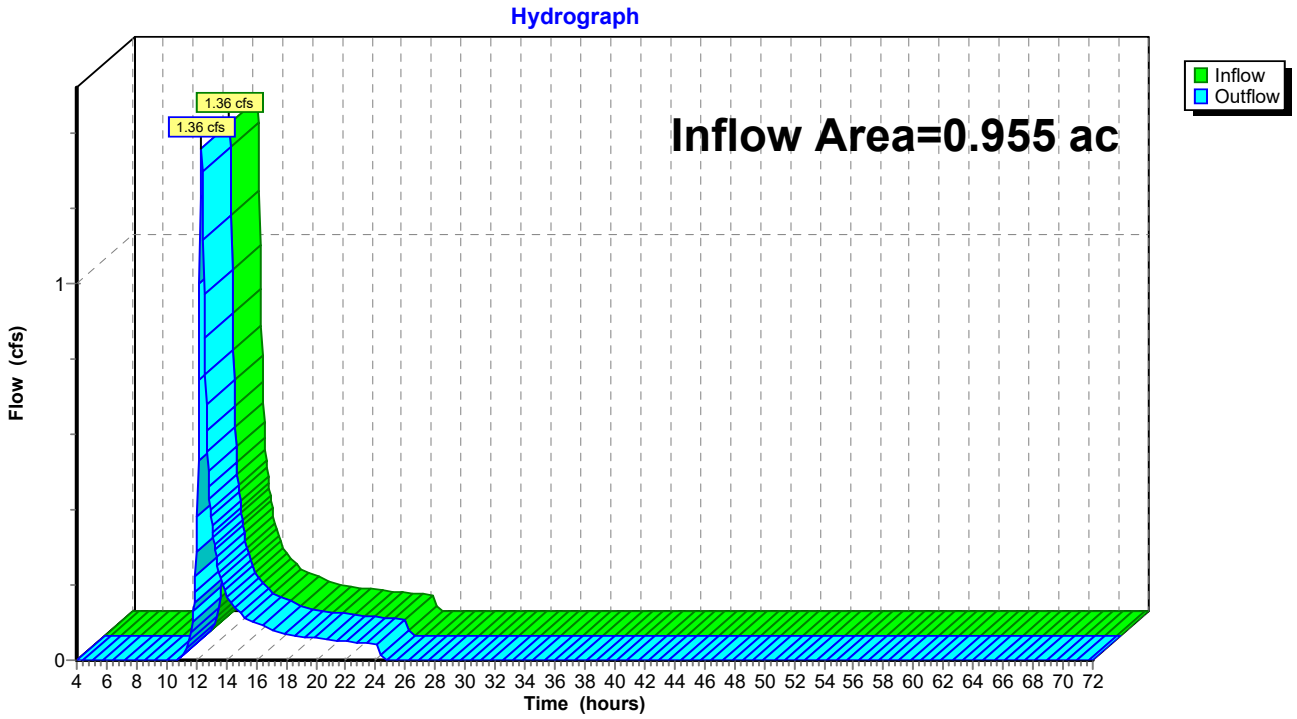


Summary for Reach PR2: Analysis Point - AP2

Inflow Area = 0.955 ac, 0.00% Impervious, Inflow Depth = 1.94" for 25-Year event
Inflow = 1.36 cfs @ 12.32 hrs, Volume= 0.154 af
Outflow = 1.36 cfs @ 12.32 hrs, Volume= 0.154 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs

Reach PR2: Analysis Point - AP2



Summary for Pond 1P: Infiltration Basin #1

Inflow Area = 3.637 ac, 62.58% Impervious, Inflow Depth = 3.81" for 25-Year event
Inflow = 16.79 cfs @ 12.13 hrs, Volume= 1.156 af
Outflow = 1.93 cfs @ 12.93 hrs, Volume= 1.156 af, Atten= 88%, Lag= 47.8 min
Discarded = 1.93 cfs @ 12.93 hrs, Volume= 1.156 af
Primary = 0.00 cfs @ 4.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 307.66' @ 12.93 hrs Surf.Area= 10,090 sf Storage= 16,162 cf
Flood Elev= 310.50' Surf.Area= 13,382 sf Storage= 53,229 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 62.8 min (886.9 - 824.1)

Volume	Invert	Avail.Storage	Storage Description
#1	306.00'	55,343 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	306.50'	5,662 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) -Impervious
		61,005 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
306.00	8,252	0	0
308.00	10,461	18,713	18,713
310.00	12,784	23,245	41,958
310.50	13,382	6,542	48,500
311.00	13,990	6,843	55,343

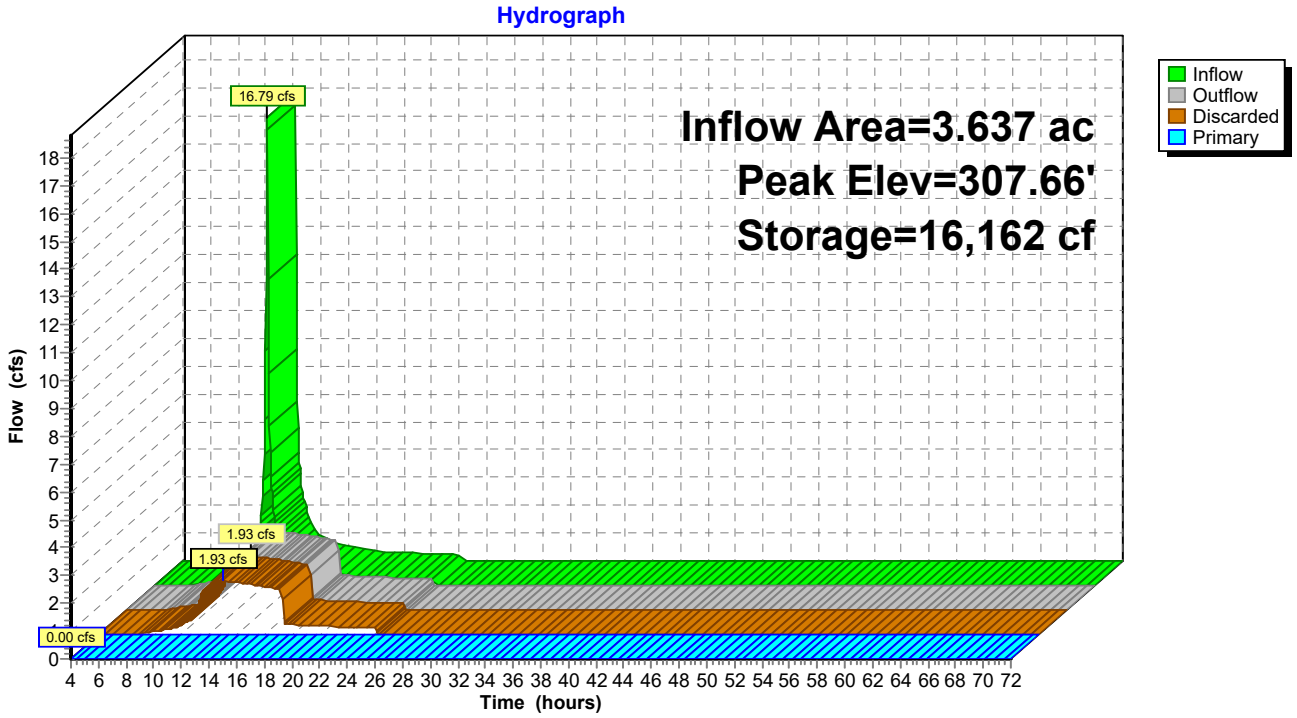
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
306.50	611	0	0
308.00	1,031	1,232	1,232
310.00	1,617	2,648	3,880
310.50	1,781	850	4,729
311.00	1,952	933	5,662

Device	Routing	Invert	Outlet Devices
#1	Primary	305.60'	**12.0" Round Culvert** L= 77.5' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 305.60' / 305.00' S= 0.0077 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Discarded	306.00'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#3	Device 1	308.00'	**2.0" x 2.0" Horiz. Orifice/Grate X 6.00 columns** X 6 rows C= 0.600 in 24.0" x 24.0" Grate (25% open area) Limited to weir flow at low heads
#4	Primary	310.50'	**10.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

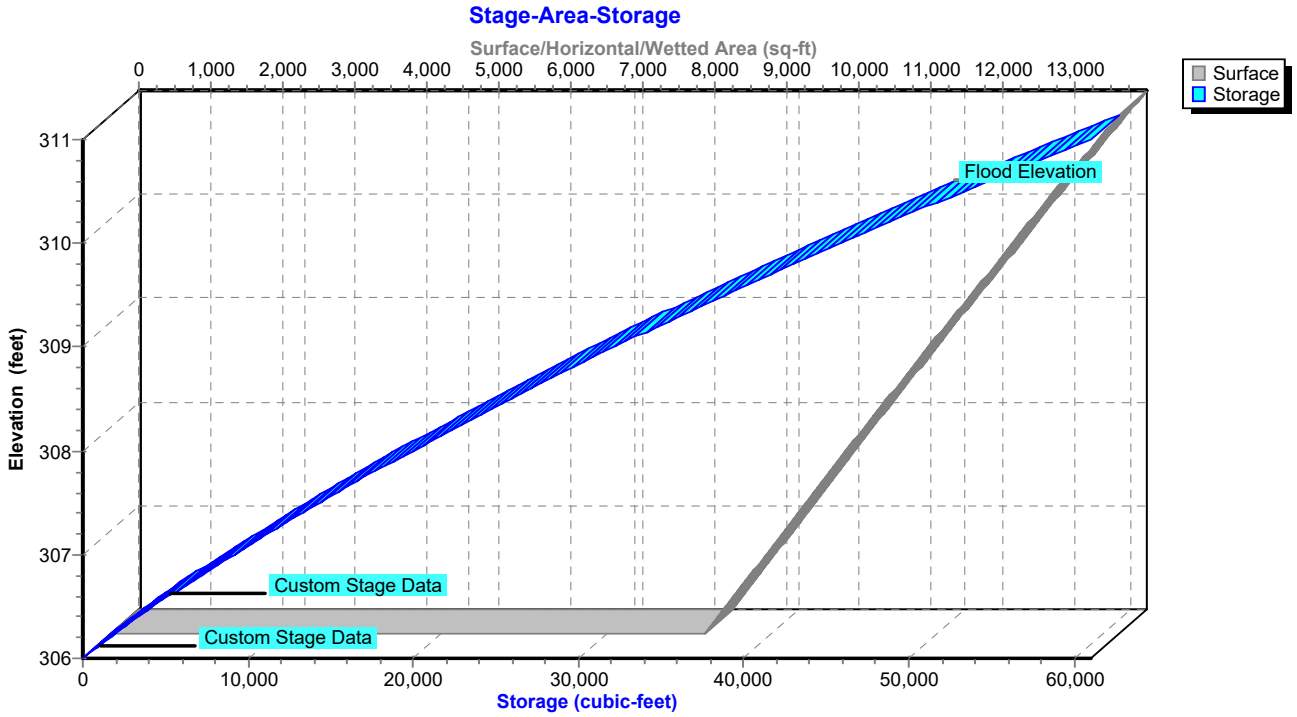
Discarded OutFlow Max=1.93 cfs @ 12.93 hrs HW=307.66' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 1.93 cfs)

Primary OutFlow Max=0.00 cfs @ 4.00 hrs HW=306.00' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 0.00 cfs of 0.66 cfs potential flow)
└**3=Orifice/Grate** (Controls 0.00 cfs)
└**4=Broad-Crested Rectangular Weir**(Controls 0.00 cfs)

Pond 1P: Infiltration Basin #1



Pond 1P: Infiltration Basin #1



Summary for Pond 2P: Infiltraton Basin #2

Inflow Area = 15.046 ac, 0.00% Impervious, Inflow Depth = 1.52" for 25-Year event
Inflow = 10.70 cfs @ 12.65 hrs, Volume= 1.912 af
Outflow = 10.24 cfs @ 12.76 hrs, Volume= 1.912 af, Atten= 4%, Lag= 6.5 min
Discarded = 1.14 cfs @ 12.76 hrs, Volume= 0.498 af
Primary = 9.09 cfs @ 12.76 hrs, Volume= 1.414 af

Routing by Dyn-Stor-Ind method, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 314.43' @ 12.76 hrs Surf.Area= 5,980 sf Storage= 3,906 cf
Flood Elev= 316.00' Surf.Area= 16,430 sf Storage= 21,448 cf

Plug-Flow detention time= 9.9 min calculated for 1.910 af (100% of inflow)
Center-of-Mass det. time= 9.9 min (936.5 - 926.6)

Volume	Invert	Avail.Storage	Storage Description
#1	313.00'	21,448 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

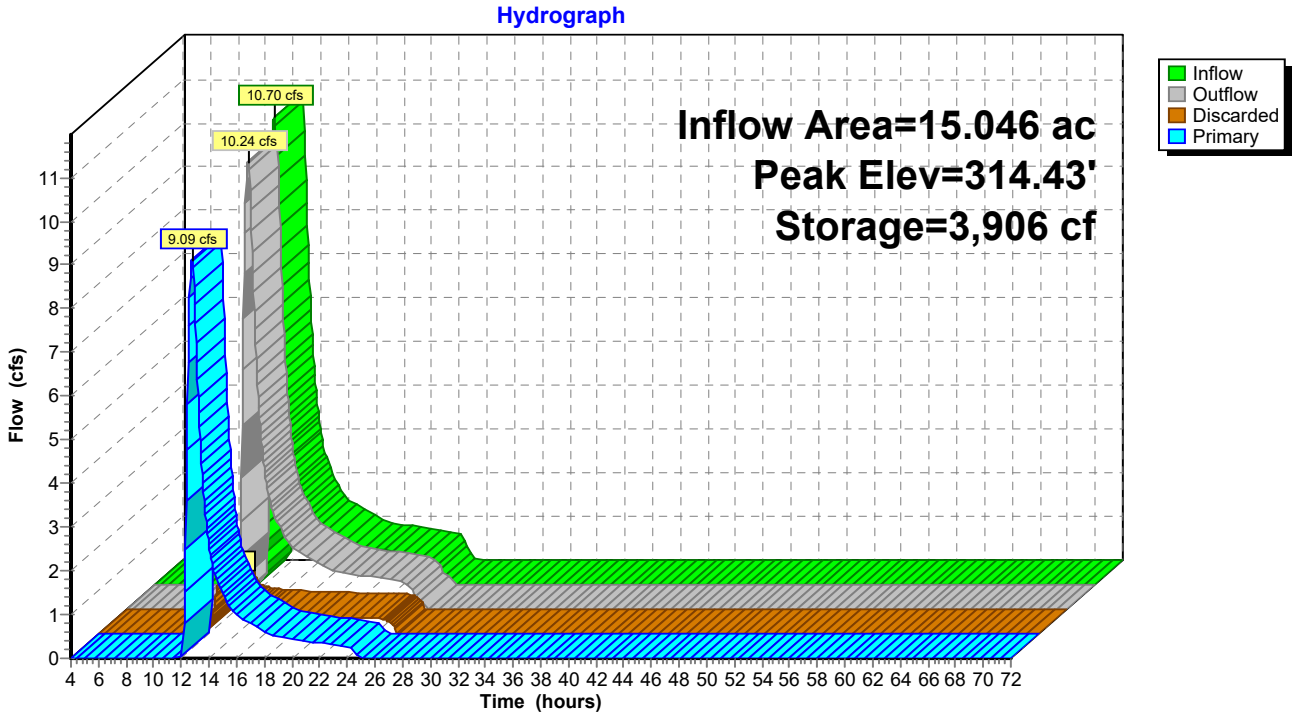
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
313.00	795	0	0
314.00	3,080	1,938	1,938
316.00	16,430	19,510	21,448

Device	Routing	Invert	Outlet Devices
#1	Discarded	313.00'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	313.30'	**24.0" Round Culvert** L= 338.9' RCP, rounded edge headwall, Ke= 0.100 Inlet / Outlet Invert= 313.30' / 305.00' S= 0.0245 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 3.14 sf

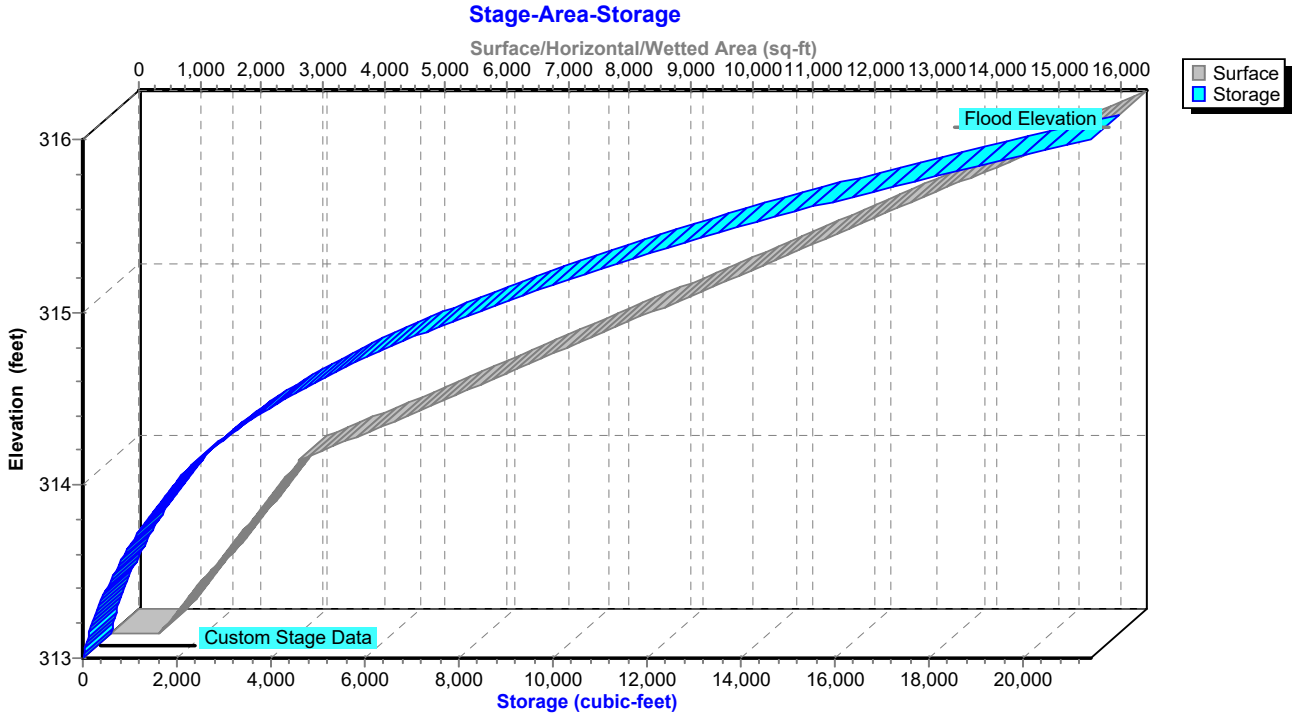
Discarded OutFlow Max=1.14 cfs @ 12.76 hrs HW=314.43' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 1.14 cfs)

Primary OutFlow Max=9.09 cfs @ 12.76 hrs HW=314.43' TW=306.84' (Dynamic Tailwater)
↑—**2=Culvert** (Inlet Controls 9.09 cfs @ 4.94 fps)

Pond 2P: Infiltraton Basin #2



Pond 2P: Infiltraton Basin #2



Summary for Pond 3P: Infiltraton Basin #3

Inflow Area = 15.943 ac, 0.00% Impervious, Inflow Depth = 1.09" for 25-Year event
Inflow = 9.19 cfs @ 12.75 hrs, Volume= 1.451 af
Outflow = 1.71 cfs @ 14.69 hrs, Volume= 1.452 af, Atten= 81%, Lag= 116.2 min
Discarded = 1.71 cfs @ 14.69 hrs, Volume= 1.452 af
Primary = 0.00 cfs @ 4.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 309.24' @ 14.69 hrs Surf.Area= 8,937 sf Storage= 28,129 cf
Flood Elev= 310.00' Surf.Area= 9,812 sf Storage= 35,282 cf

Plug-Flow detention time= 191.4 min calculated for 1.450 af (100% of inflow)
Center-of-Mass det. time= 191.6 min (1,086.3 - 894.8)

Volume	Invert	Avail.Storage	Storage Description
#1	305.00'	35,282 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

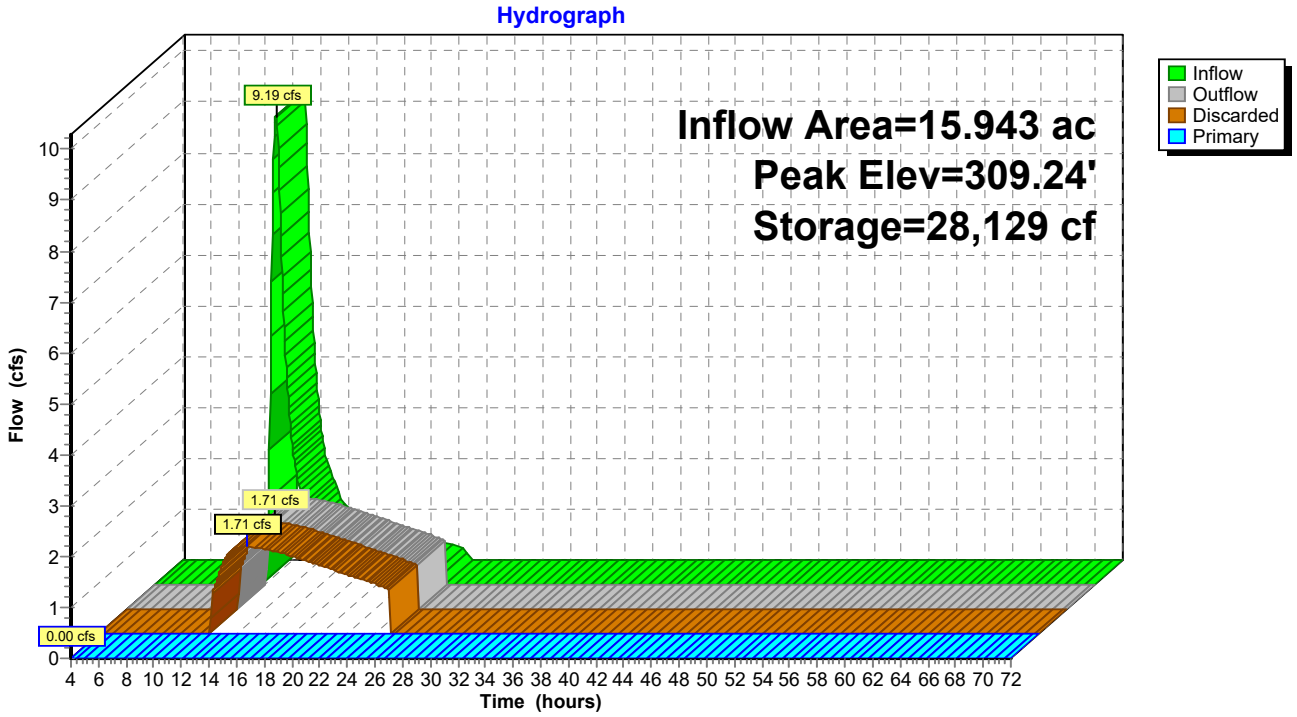
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
305.00	4,504	0	0
306.00	5,453	4,979	4,979
308.00	7,519	12,972	17,951
310.00	9,812	17,331	35,282

Device	Routing	Invert	Outlet Devices
#1	Discarded	305.00'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	309.50'	**30.0' long x 4.0' 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) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

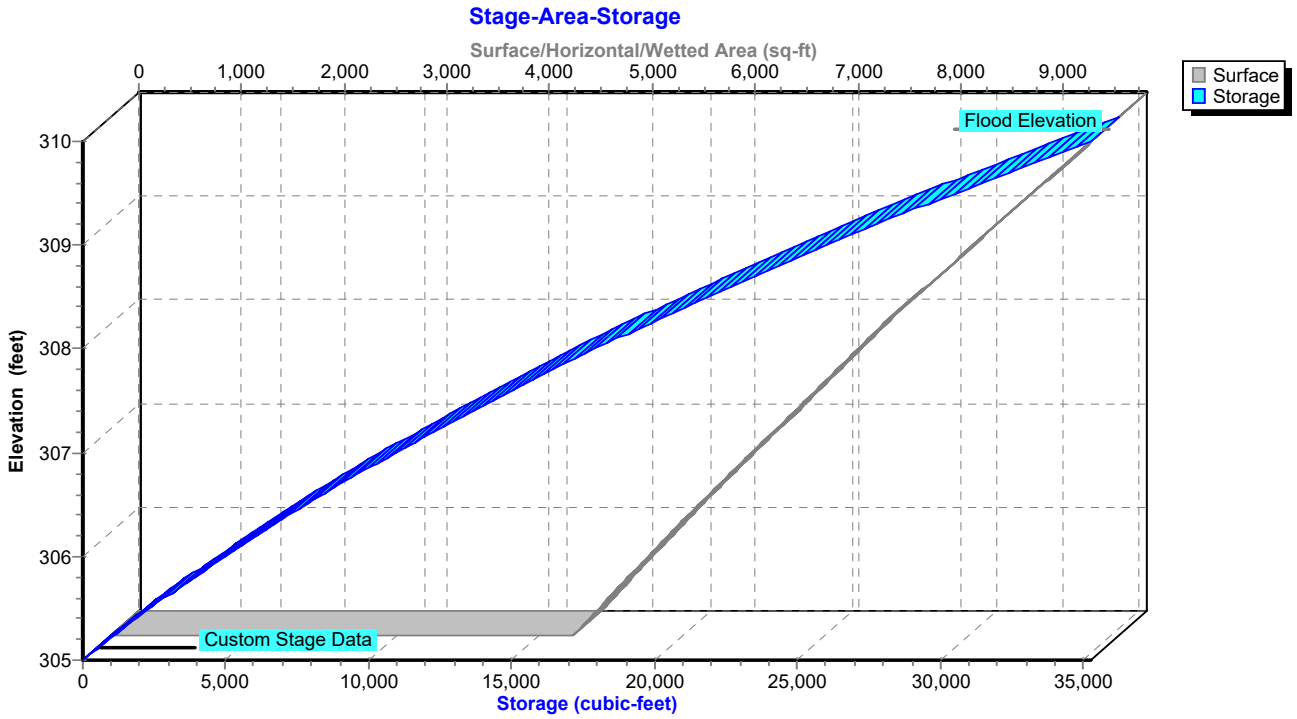
Discarded OutFlow Max=1.71 cfs @ 14.69 hrs HW=309.24' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 1.71 cfs)

Primary OutFlow Max=0.00 cfs @ 4.00 hrs HW=305.00' TW=0.00' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 3P: Infiltraton Basin #3



Pond 3P: Infiltraton Basin #3



Summary for Subcatchment P1: Subcatchment to Basin #1

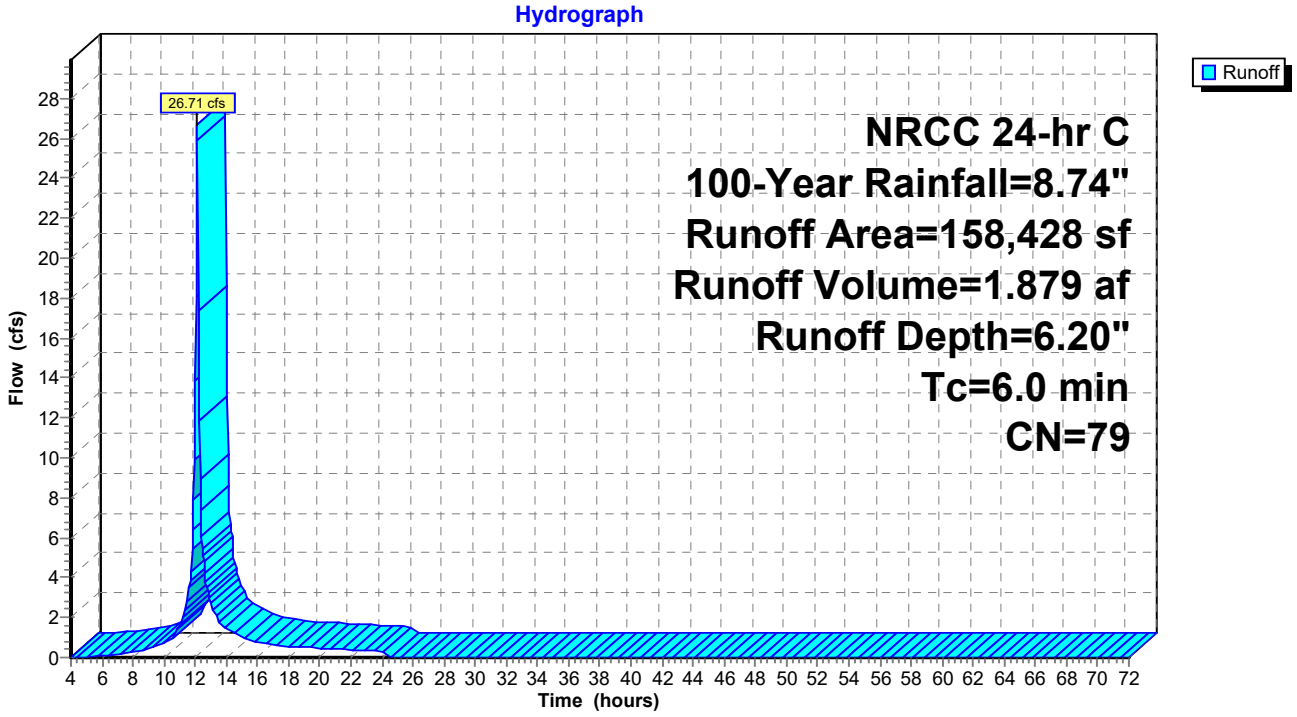
Runoff = 26.71 cfs @ 12.13 hrs, Volume= 1.879 af, Depth= 6.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.74"

Area (sf)	CN	Description
26,935	98	Paved roads w/curbs & sewers, HSG A
29,422	98	Paved roads w/curbs & sewers, HSG B
21,369	98	Roofs, HSG A
21,413	98	Roofs, HSG B
36,739	39	>75% Grass cover, Good, HSG A
22,550	61	>75% Grass cover, Good, HSG B
158,428	79	Weighted Average
59,289		37.42% Pervious Area
99,139		62.58% Impervious Area

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

Subcatchment P1: Subcatchment to Basin #1



Summary for Subcatchment P2: Subcatchemnt to Basin #2

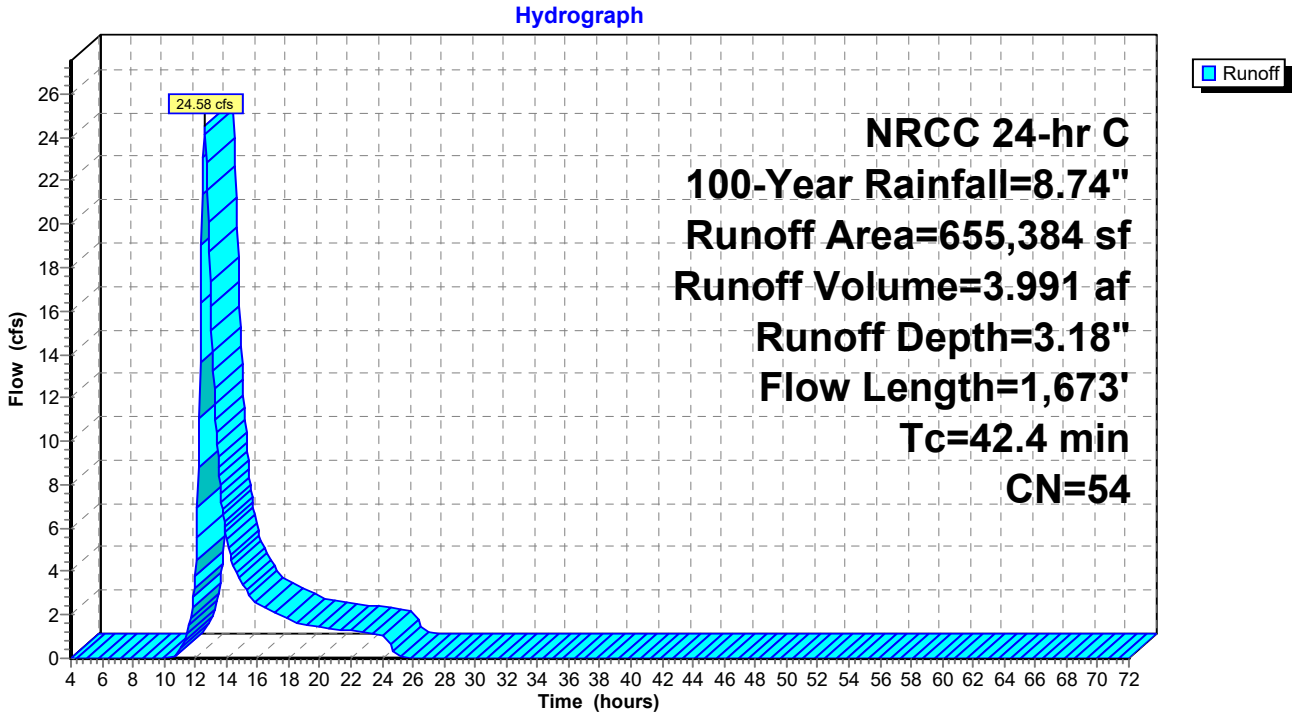
Runoff = 24.58 cfs @ 12.61 hrs, Volume= 3.991 af, Depth= 3.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.74"

Area (sf)	CN	Description
589,181	55	Woods, Good, HSG B
30,779	61	>75% Grass cover, Good, HSG B
35,424	39	>75% Grass cover, Good, HSG A
655,384	54	Weighted Average
655,384		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.2	50	0.0800	0.07		**Sheet Flow, Segment A-B** Woods: Dense underbrush n= 0.800 P2= 3.26"
0.9	78	0.0800	1.41		**Shallow Concentrated Flow, Segment B-C** Woodland Kv= 5.0 fps
12.7	592	0.0240	0.77		**Shallow Concentrated Flow, Segment C-D** Woodland Kv= 5.0 fps
14.1	581	0.0190	0.69		**Shallow Concentrated Flow, Segment D-E** Woodland Kv= 5.0 fps
2.0	60	0.0100	0.50		**Shallow Concentrated Flow, Segment E-F** Woodland Kv= 5.0 fps
0.5	312	0.0230	10.92	34.31	**Pipe Channel, Segment F-G** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Concrete pipe, straight & clean
42.4	1,673	Total			

Subcatchment P2: Subcatchemnt to Basin #2



Summary for Subcatchment P3: Subcatchment to Basin #3

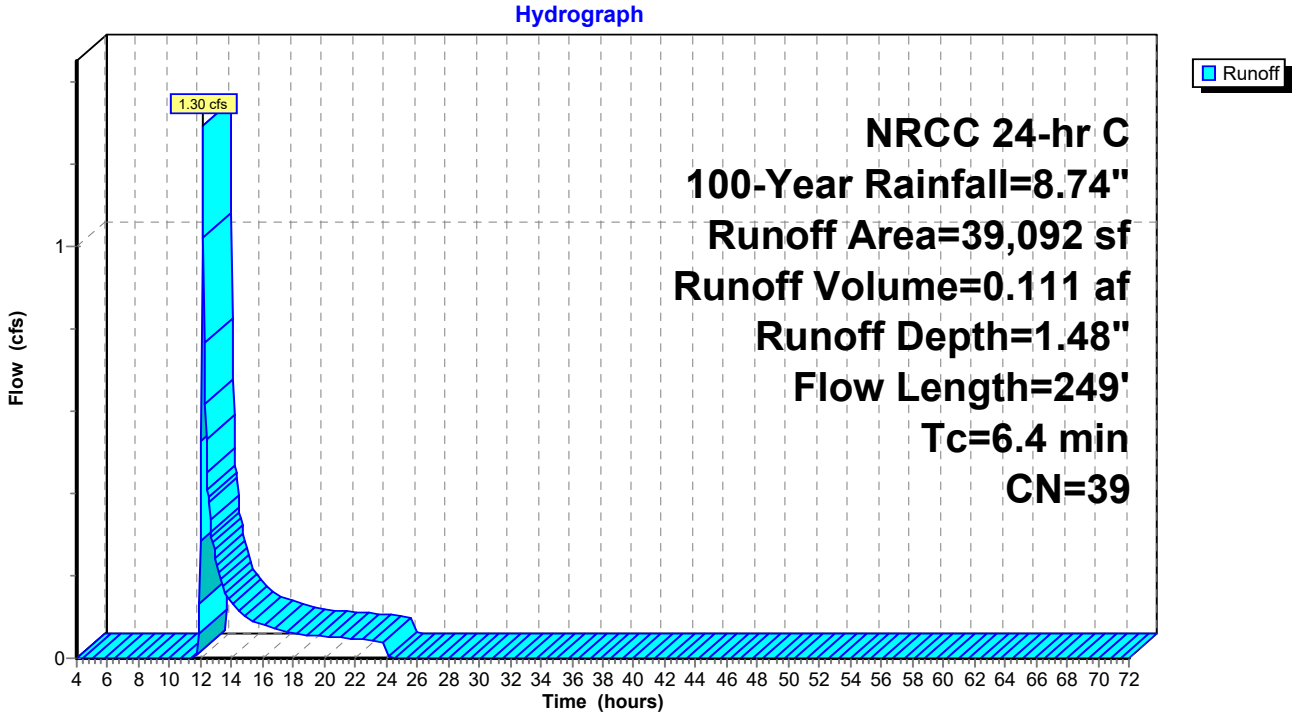
Runoff = 1.30 cfs @ 12.15 hrs, Volume= 0.111 af, Depth= 1.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.74"

Area (sf)	CN	Description
39,092	39	>75% Grass cover, Good, HSG A
39,092		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	50	0.0380	0.19		**Sheet Flow, Segment A-B** Grass: Short n= 0.150 P2= 3.26"
2.0	184	0.0470	1.52		**Shallow Concentrated Flow, Segment B-C** Short Grass Pasture Kv= 7.0 fps
0.1	15	0.3300	4.02		**Shallow Concentrated Flow, Segment C-D** Short Grass Pasture Kv= 7.0 fps
6.4	249	Total			

Subcatchment P3: Subcatchment to Basin #3



Summary for Subcatchment P4: Subcatchment to BVW

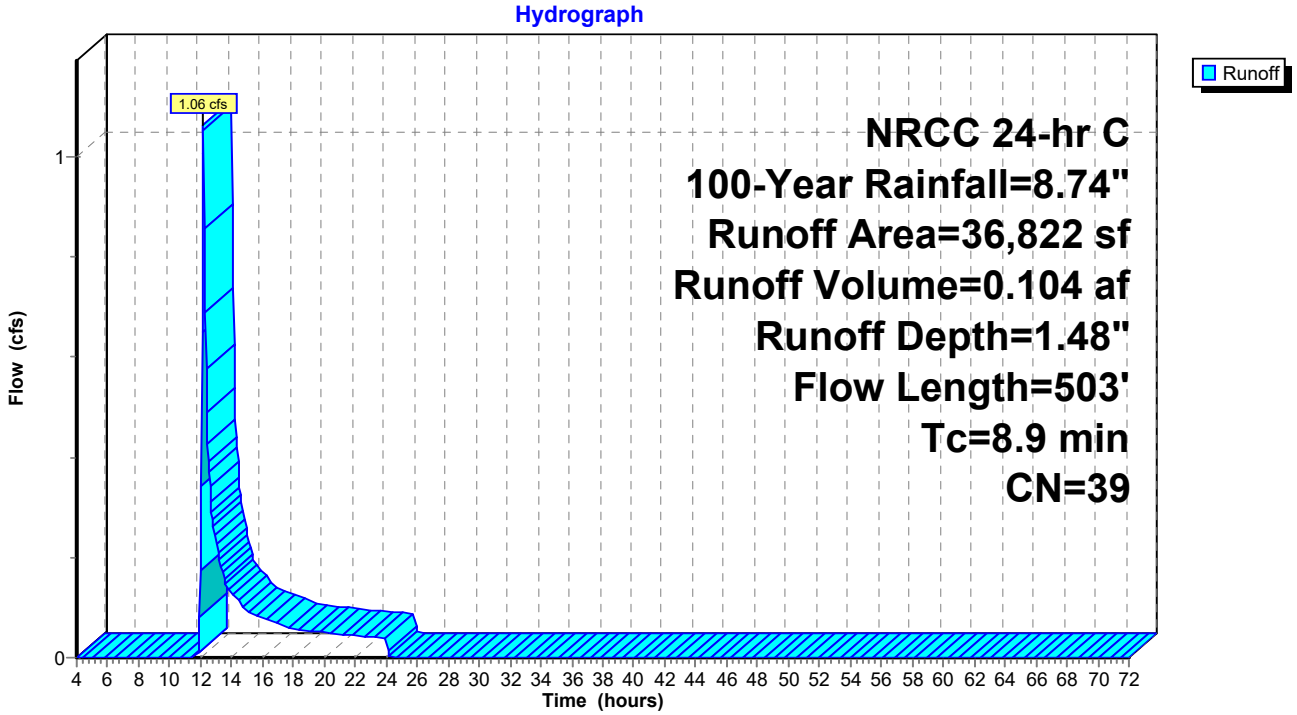
Runoff = 1.06 cfs @ 12.18 hrs, Volume= 0.104 af, Depth= 1.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.74"

Area (sf)	CN	Description
36,822	39	>75% Grass cover, Good, HSG A
36,822		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.0	50	0.0950	0.28		**Sheet Flow, Segment A-B** Grass: Short n= 0.150 P2= 3.26"
2.3	153	0.0260	1.13		**Shallow Concentrated Flow, Segment B-C** Short Grass Pasture Kv= 7.0 fps
0.2	47	0.0050	3.79	2.98	**Pipe Channel, RCP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011 Concrete pipe, straight & clean
3.4	253	0.0070	1.25		**Shallow Concentrated Flow, Segment D-E** Grassed Waterway Kv= 15.0 fps
8.9	503	Total			

Subcatchment P4: Subcatchment to BVW



Summary for Subcatchment P5: Subcatchment to Blackstone Street

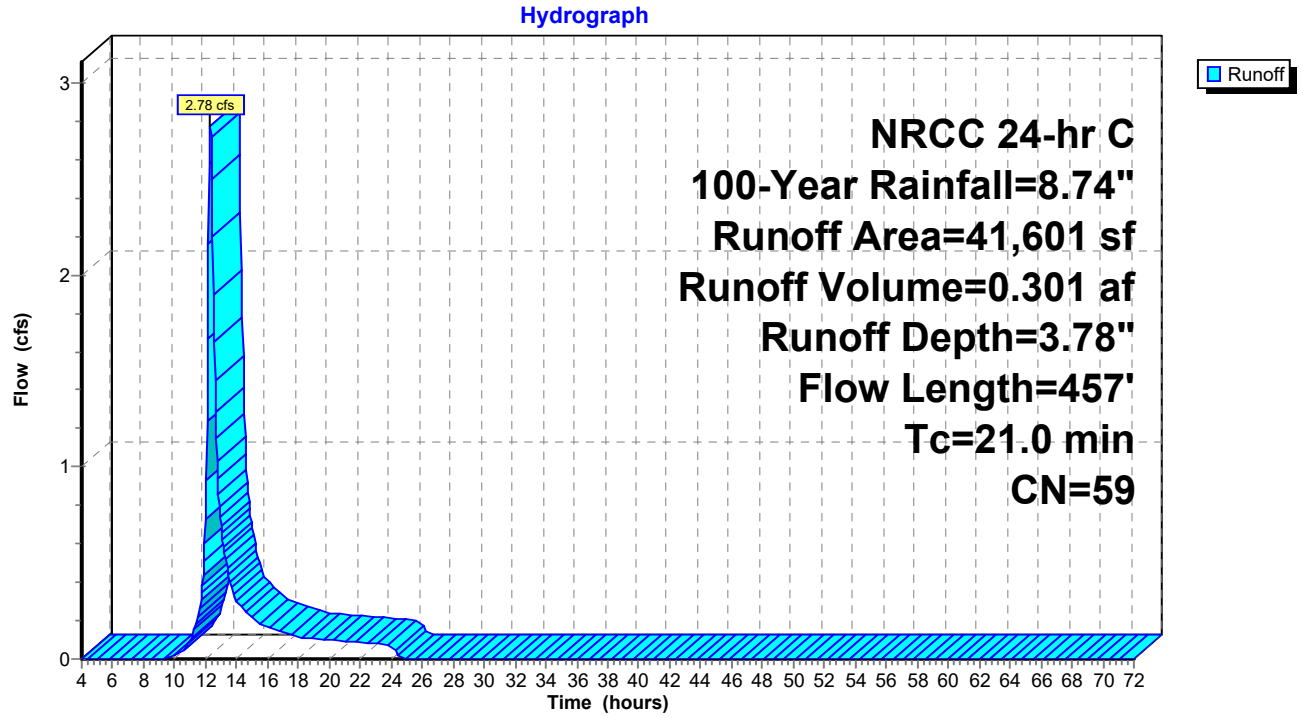
Runoff = 2.78 cfs @ 12.31 hrs, Volume= 0.301 af, Depth= 3.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.74"

Area (sf)	CN	Description
9,968	55	Woods, Good, HSG B
504	30	Woods, Good, HSG A
30,178	61	>75% Grass cover, Good, HSG B
951	39	>75% Grass cover, Good, HSG A
41,601	59	Weighted Average
41,601		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	50	0.0490	0.06		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.26"
1.0	89	0.0890	1.49		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.1	96	0.0470	1.52		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
4.0	222	0.0340	0.92		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
21.0	457	Total			

Subcatchment P5: Subcatchment to Blackstone Street

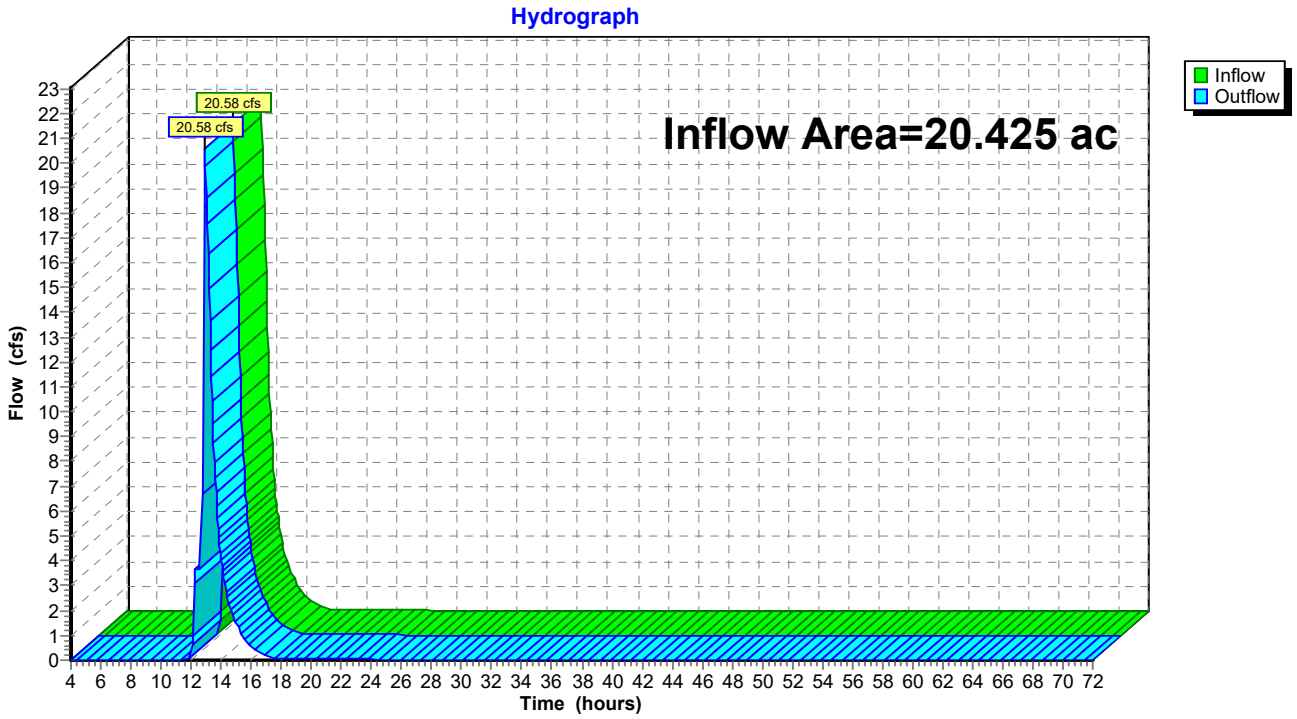


Summary for Reach PR1: Analysis Point - AP1

Inflow Area = 20.425 ac, 11.14% Impervious, Inflow Depth = 0.98" for 100-Year event
Inflow = 20.58 cfs @ 12.92 hrs, Volume= 1.676 af
Outflow = 20.58 cfs @ 12.92 hrs, Volume= 1.676 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs

Reach PR1: Analysis Point - AP1

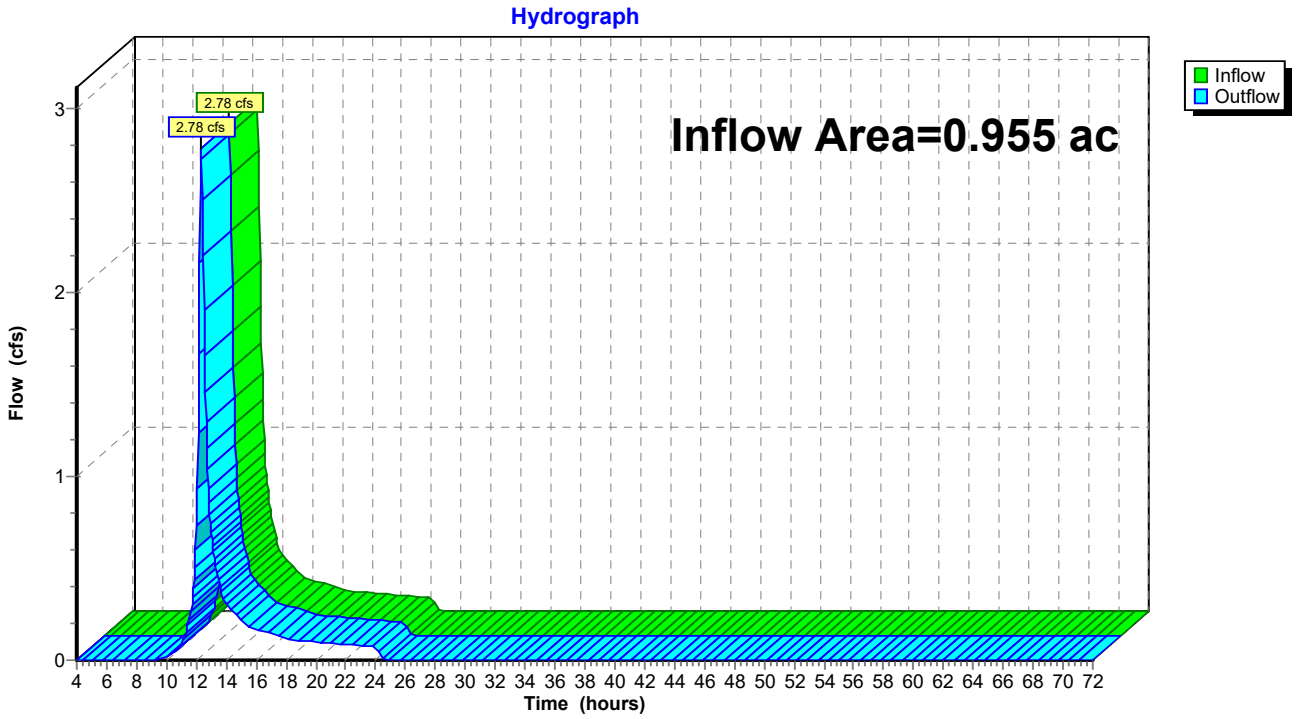


Summary for Reach PR2: Analysis Point - AP2

Inflow Area = 0.955 ac, 0.00% Impervious, Inflow Depth = 3.78" for 100-Year event
Inflow = 2.78 cfs @ 12.31 hrs, Volume= 0.301 af
Outflow = 2.78 cfs @ 12.31 hrs, Volume= 0.301 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs

Reach PR2: Analysis Point - AP2



Summary for Pond 1P: Infiltration Basin #1

Inflow Area = 3.637 ac, 62.58% Impervious, Inflow Depth = 6.20" for 100-Year event
Inflow = 26.71 cfs @ 12.13 hrs, Volume= 1.879 af
Outflow = 5.46 cfs @ 12.46 hrs, Volume= 1.879 af, Atten= 80%, Lag= 19.6 min
Discarded = 2.11 cfs @ 12.46 hrs, Volume= 1.610 af
Primary = 3.35 cfs @ 12.46 hrs, Volume= 0.269 af

Routing by Dyn-Stor-Ind method, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 308.48' @ 12.46 hrs Surf.Area= 11,022 sf Storage= 25,664 cf
Flood Elev= 310.50' Surf.Area= 13,382 sf Storage= 53,229 cf

Plug-Flow detention time= 73.6 min calculated for 1.878 af (100% of inflow)
Center-of-Mass det. time= 73.5 min (882.3 - 808.8)

Volume	Invert	Avail.Storage	Storage Description
#1	306.00'	55,343 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	306.50'	5,662 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) -Impervious
		61,005 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
306.00	8,252	0	0
308.00	10,461	18,713	18,713
310.00	12,784	23,245	41,958
310.50	13,382	6,542	48,500
311.00	13,990	6,843	55,343

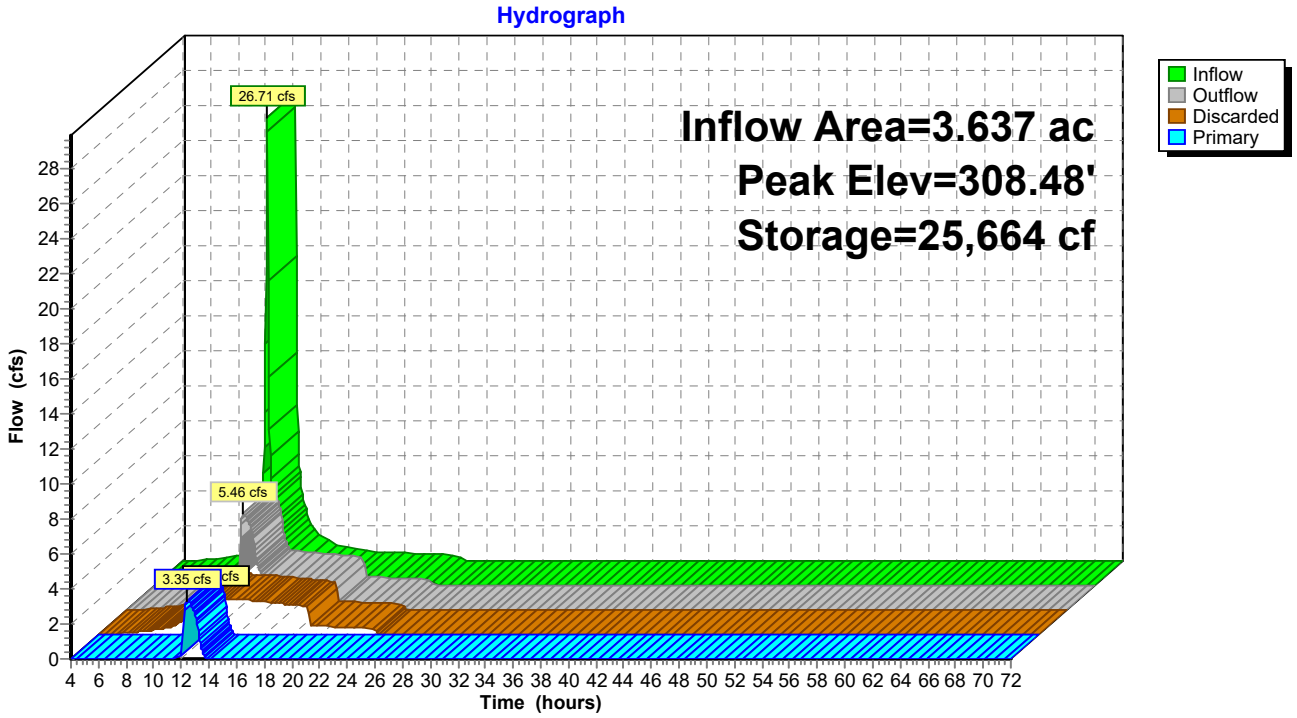
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
306.50	611	0	0
308.00	1,031	1,232	1,232
310.00	1,617	2,648	3,880
310.50	1,781	850	4,729
311.00	1,952	933	5,662

Device	Routing	Invert	Outlet Devices
#1	Primary	305.60'	**12.0" Round Culvert** L= 77.5' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 305.60' / 305.00' S= 0.0077 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Discarded	306.00'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#3	Device 1	308.00'	**2.0" x 2.0" Horiz. Orifice/Grate X 6.00 columns** X 6 rows C= 0.600 in 24.0" x 24.0" Grate (25% open area) Limited to weir flow at low heads
#4	Primary	310.50'	**10.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

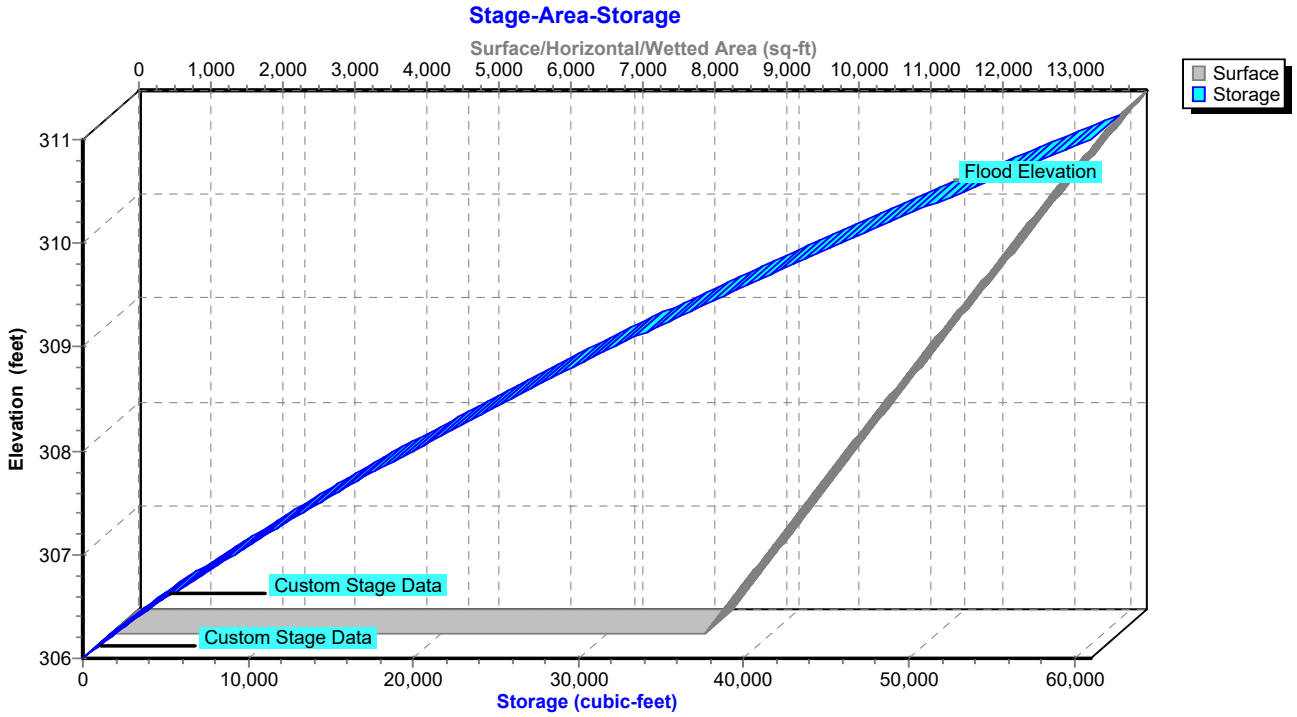
Discarded OutFlow Max=2.11 cfs @ 12.46 hrs HW=308.48' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 2.11 cfs)

Primary OutFlow Max=3.34 cfs @ 12.46 hrs HW=308.48' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 3.34 cfs of 5.79 cfs potential flow)
└**3=Orifice/Grate** (Orifice Controls 3.34 cfs @ 3.34 fps)
└**4=Broad-Crested Rectangular Weir**(Controls 0.00 cfs)

Pond 1P: Infiltration Basin #1



Pond 1P: Infiltration Basin #1



Summary for Pond 2P: Infiltraton Basin #2

Inflow Area = 15.046 ac, 0.00% Impervious, Inflow Depth = 3.18" for 100-Year event
Inflow = 24.58 cfs @ 12.61 hrs, Volume= 3.991 af
Outflow = 22.06 cfs @ 12.78 hrs, Volume= 3.991 af, Atten= 10%, Lag= 10.1 min
Discarded = 2.15 cfs @ 12.78 hrs, Volume= 0.693 af
Primary = 19.91 cfs @ 12.78 hrs, Volume= 3.298 af

Routing by Dyn-Stor-Ind method, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 315.22' @ 12.78 hrs Surf.Area= 11,207 sf Storage= 10,635 cf
Flood Elev= 316.00' Surf.Area= 16,430 sf Storage= 21,448 cf

Plug-Flow detention time= 8.5 min calculated for 3.988 af (100% of inflow)
Center-of-Mass det. time= 8.5 min (909.4 - 900.9)

Volume	Invert	Avail.Storage	Storage Description
#1	313.00'	21,448 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

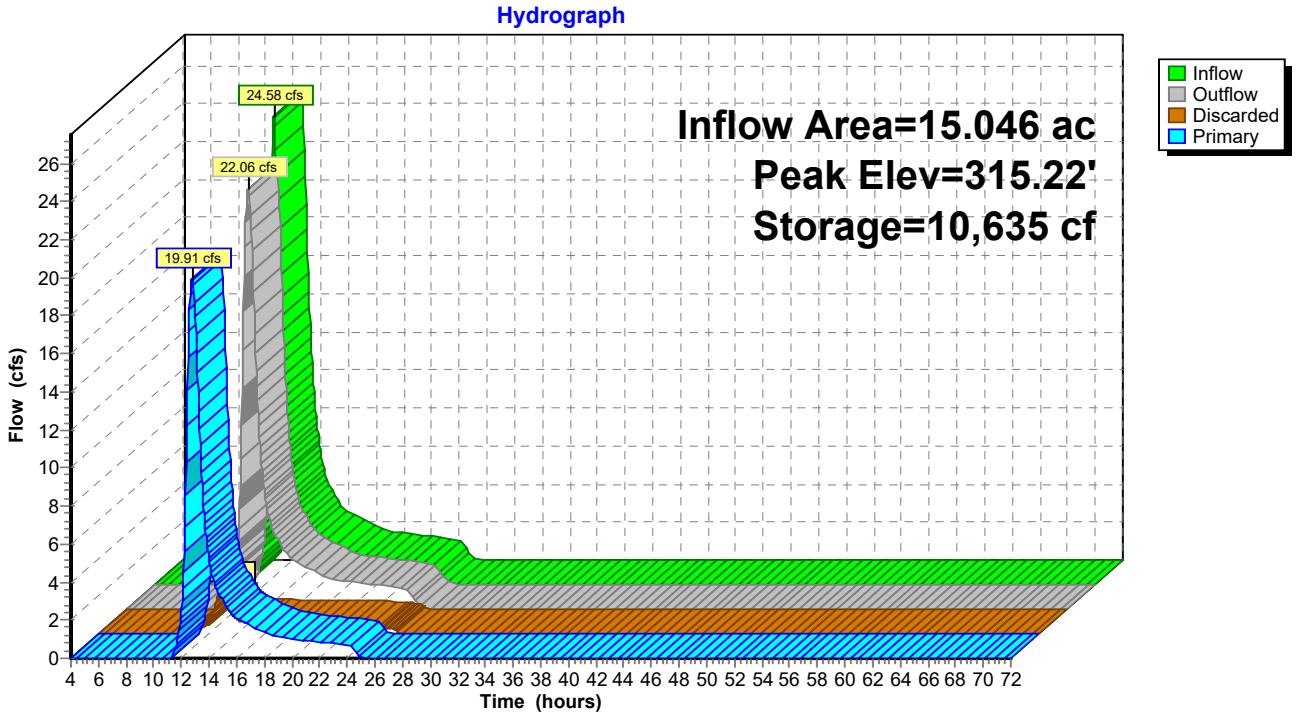
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
313.00	795	0	0
314.00	3,080	1,938	1,938
316.00	16,430	19,510	21,448

Device	Routing	Invert	Outlet Devices
#1	Discarded	313.00'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	313.30'	**24.0" Round Culvert** L= 338.9' RCP, rounded edge headwall, Ke= 0.100 Inlet / Outlet Invert= 313.30' / 305.00' S= 0.0245 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 3.14 sf

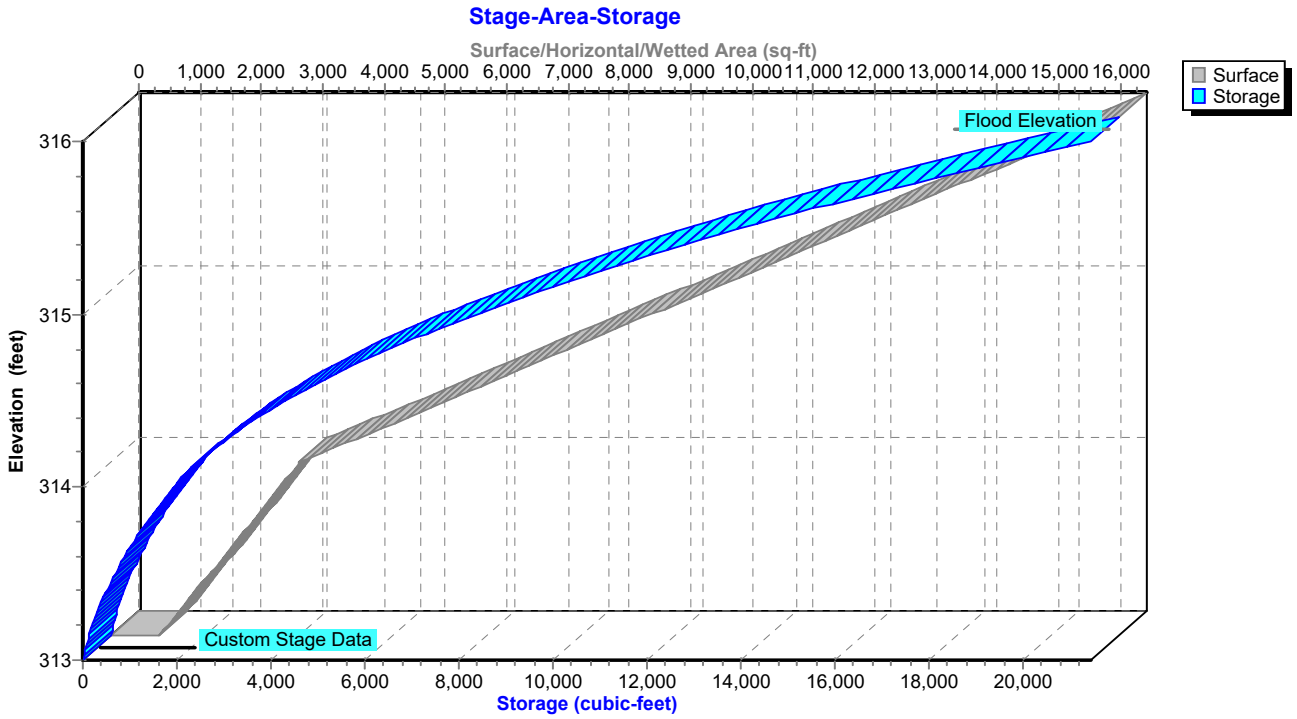
Discarded OutFlow Max=2.14 cfs @ 12.78 hrs HW=315.22' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 2.14 cfs)

Primary OutFlow Max=19.89 cfs @ 12.78 hrs HW=315.22' TW=309.60' (Dynamic Tailwater)
↑—**2=Culvert** (Inlet Controls 19.89 cfs @ 6.43 fps)

Pond 2P: Infiltraton Basin #2



Pond 2P: Infiltraton Basin #2



Summary for Pond 3P: Infiltraton Basin #3

Inflow Area = 15.943 ac, 0.00% Impervious, Inflow Depth = 2.57" for 100-Year event
Inflow = 20.19 cfs @ 12.78 hrs, Volume= 3.409 af
Outflow = 19.53 cfs @ 12.92 hrs, Volume= 3.409 af, Atten= 3%, Lag= 8.8 min
Discarded = 1.85 cfs @ 12.90 hrs, Volume= 2.106 af
Primary = 17.68 cfs @ 12.92 hrs, Volume= 1.303 af

Routing by Dyn-Stor-Ind method, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 309.88' @ 12.90 hrs Surf.Area= 9,669 sf Storage= 34,070 cf
Flood Elev= 310.00' Surf.Area= 9,812 sf Storage= 35,282 cf

Plug-Flow detention time= 143.2 min calculated for 3.406 af (100% of inflow)
Center-of-Mass det. time= 143.3 min (1,032.7 - 889.4)

Volume	Invert	Avail.Storage	Storage Description
#1	305.00'	35,282 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

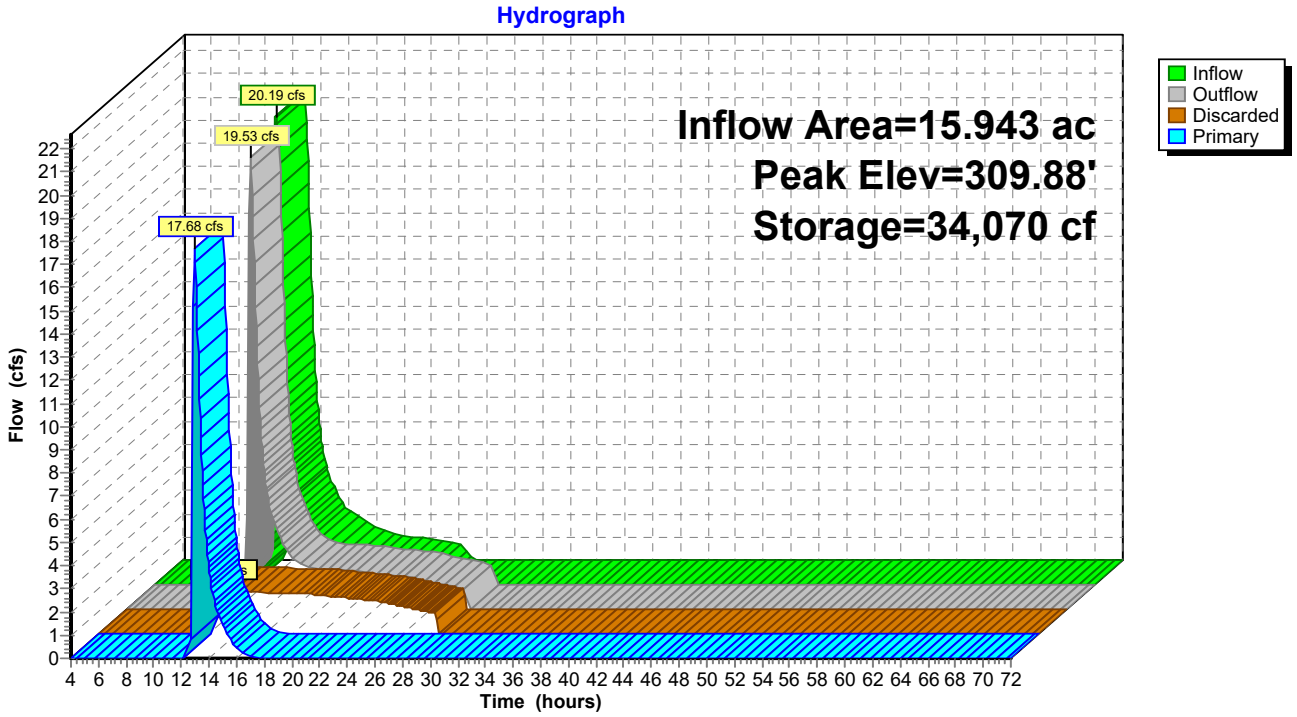
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
305.00	4,504	0	0
306.00	5,453	4,979	4,979
308.00	7,519	12,972	17,951
310.00	9,812	17,331	35,282

Device	Routing	Invert	Outlet Devices
#1	Discarded	305.00'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	309.50'	**30.0' long x 4.0' 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) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

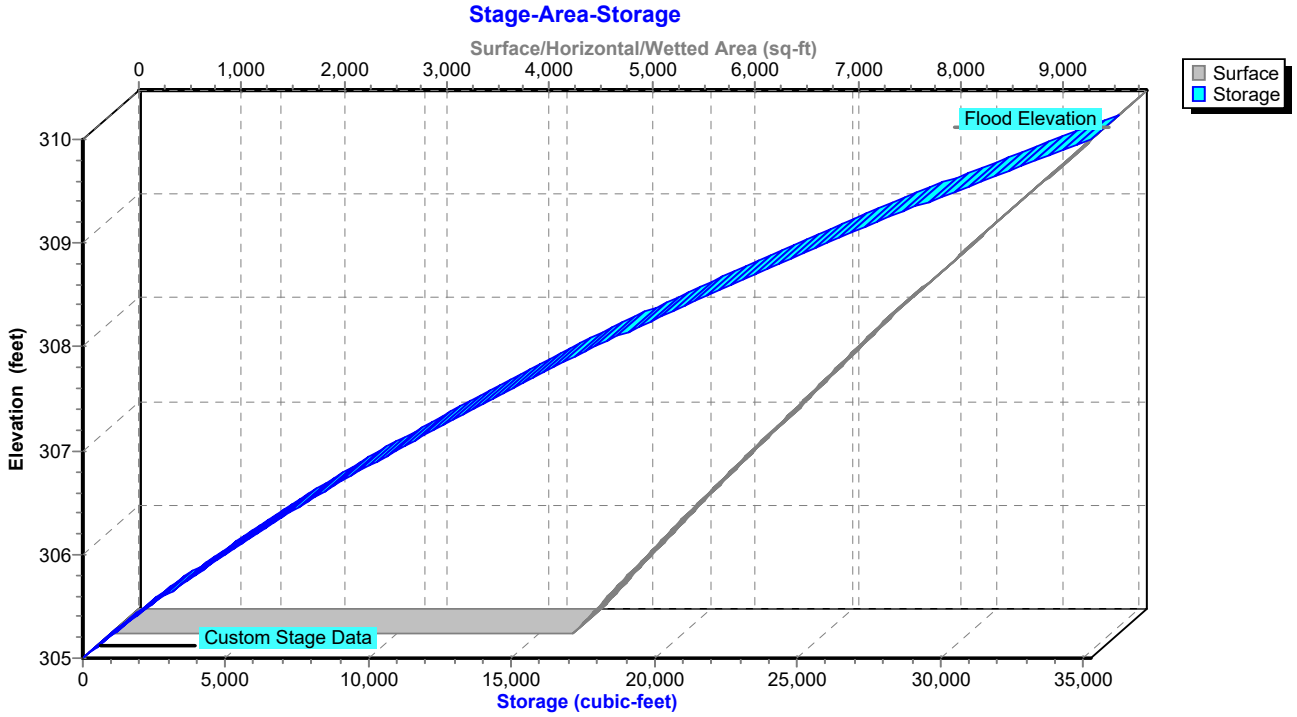
Discarded OutFlow Max=1.85 cfs @ 12.90 hrs HW=309.88' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 1.85 cfs)

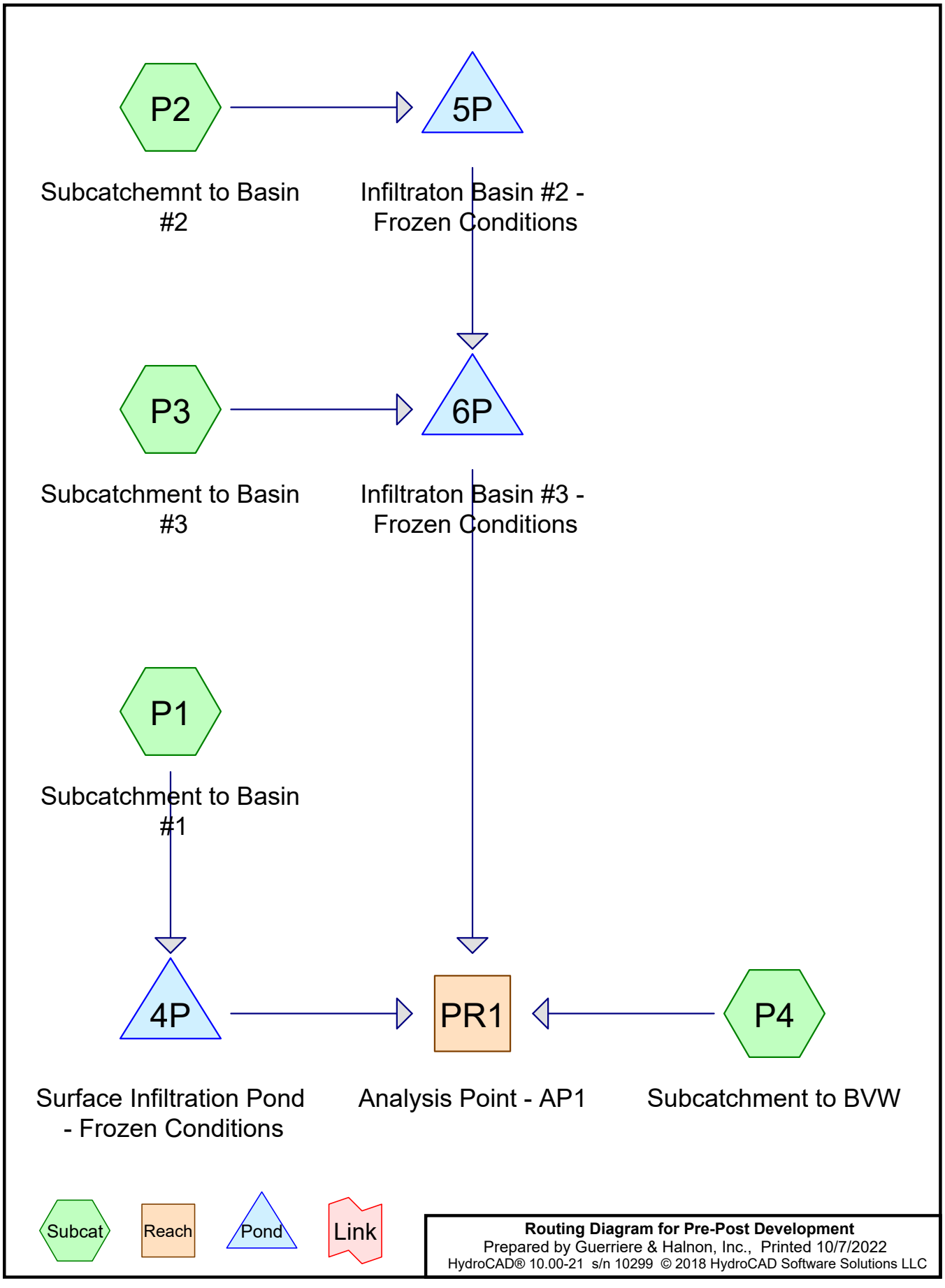
Primary OutFlow Max=17.41 cfs @ 12.92 hrs HW=309.88' TW=0.00' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 17.41 cfs @ 1.54 fps)

Pond 3P: Infiltraton Basin #3



Pond 3P: Infiltraton Basin #3




P2
5P
Subcatchemnt to Basin #2
Infiltraton Basin #2 - Frozen Conditions
P3
6P
Subcatchment to Basin #3
Infiltraton Basin #3 - Frozen Conditions
P1
Subcatchment to Basin #1
4P
PR1
P4
Surface Infiltration Pond - Frozen Conditions
Analysis Point - AP1
Subcatchment to BVW
Subcat
Reach
Pond
Link
Routing Diagram for Pre-Post Development
Prepared by Guerriere & Halnon, Inc., Printed 10/7/2022
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Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
3.399	39	>75% Grass cover, Good, HSG A (P1, P2, P3, P4)
1.224	61	>75% Grass cover, Good, HSG B (P1, P2)
0.618	98	Paved roads w/curbs & sewers, HSG A (P1)
0.675	98	Paved roads w/curbs & sewers, HSG B (P1)
0.491	98	Roofs, HSG A (P1)
0.492	98	Roofs, HSG B (P1)
13.526	55	Woods, Good, HSG B (P2)
20.425	**57**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
4.508	HSG A	P1, P2, P3, P4
15.917	HSG B	P1, P2
0.000	HSG C	
0.000	HSG D	
0.000	Other	
20.425		**TOTAL AREA**

Summary for Subcatchment P1: Subcatchment to Basin #1

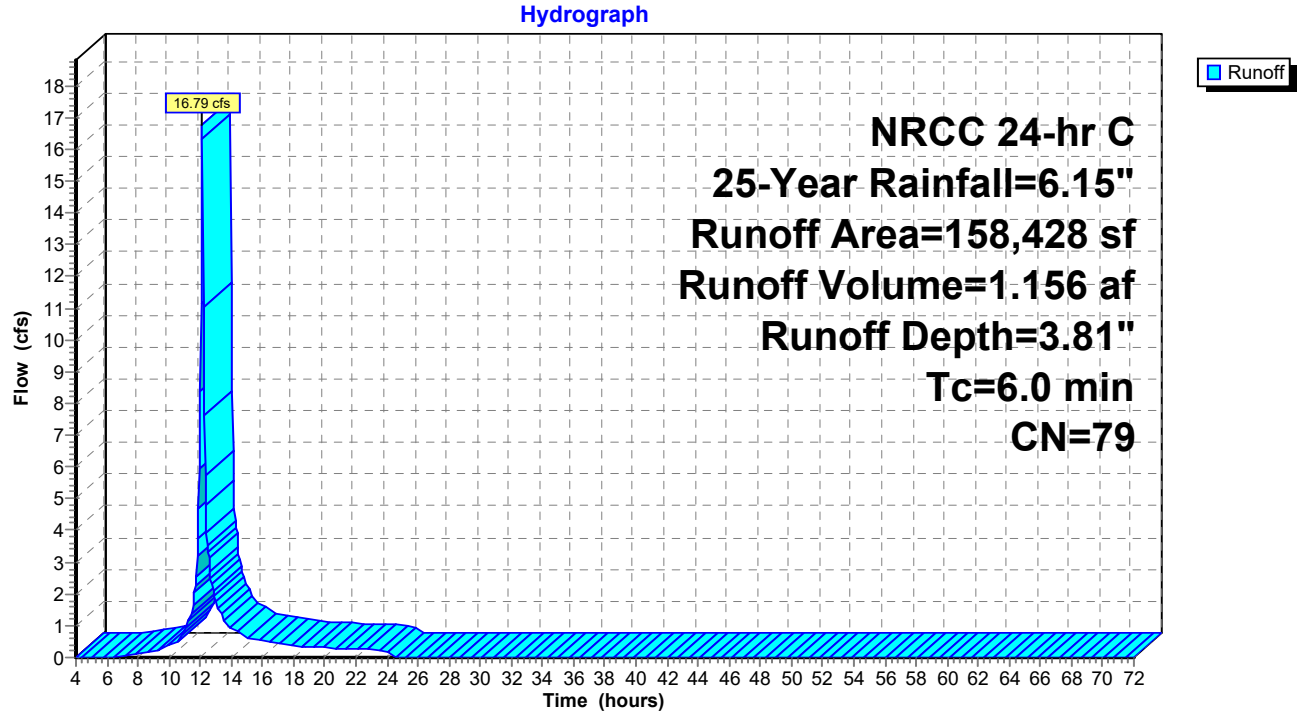
Runoff = 16.79 cfs @ 12.13 hrs, Volume= 1.156 af, Depth= 3.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.15"

Area (sf)	CN	Description
26,935	98	Paved roads w/curbs & sewers, HSG A
29,422	98	Paved roads w/curbs & sewers, HSG B
21,369	98	Roofs, HSG A
21,413	98	Roofs, HSG B
36,739	39	>75% Grass cover, Good, HSG A
22,550	61	>75% Grass cover, Good, HSG B
158,428	79	Weighted Average
59,289		37.42% Pervious Area
99,139		62.58% Impervious Area

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

Subcatchment P1: Subcatchment to Basin #1



Summary for Subcatchment P2: Subcatchemnt to Basin #2

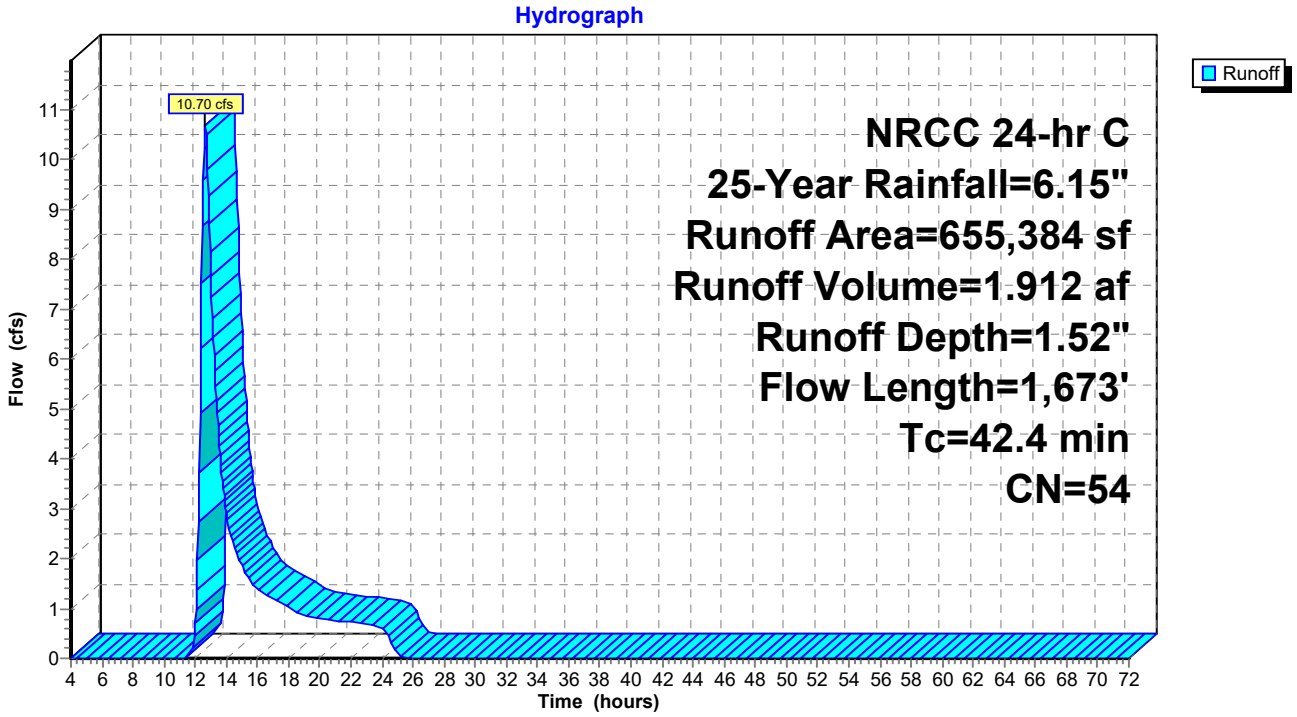
Runoff = 10.70 cfs @ 12.65 hrs, Volume= 1.912 af, Depth= 1.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.15"

Area (sf)	CN	Description
589,181	55	Woods, Good, HSG B
30,779	61	>75% Grass cover, Good, HSG B
35,424	39	>75% Grass cover, Good, HSG A
655,384	54	Weighted Average
655,384		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.2	50	0.0800	0.07		**Sheet Flow, Segment A-B** Woods: Dense underbrush n= 0.800 P2= 3.26"
0.9	78	0.0800	1.41		**Shallow Concentrated Flow, Segment B-C** Woodland Kv= 5.0 fps
12.7	592	0.0240	0.77		**Shallow Concentrated Flow, Segment C-D** Woodland Kv= 5.0 fps
14.1	581	0.0190	0.69		**Shallow Concentrated Flow, Segment D-E** Woodland Kv= 5.0 fps
2.0	60	0.0100	0.50		**Shallow Concentrated Flow, Segment E-F** Woodland Kv= 5.0 fps
0.5	312	0.0230	10.92	34.31	**Pipe Channel, Segment F-G** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Concrete pipe, straight & clean
42.4	1,673	Total			

Subcatchment P2: Subcatchemnt to Basin #2



Summary for Subcatchment P3: Subcatchment to Basin #3

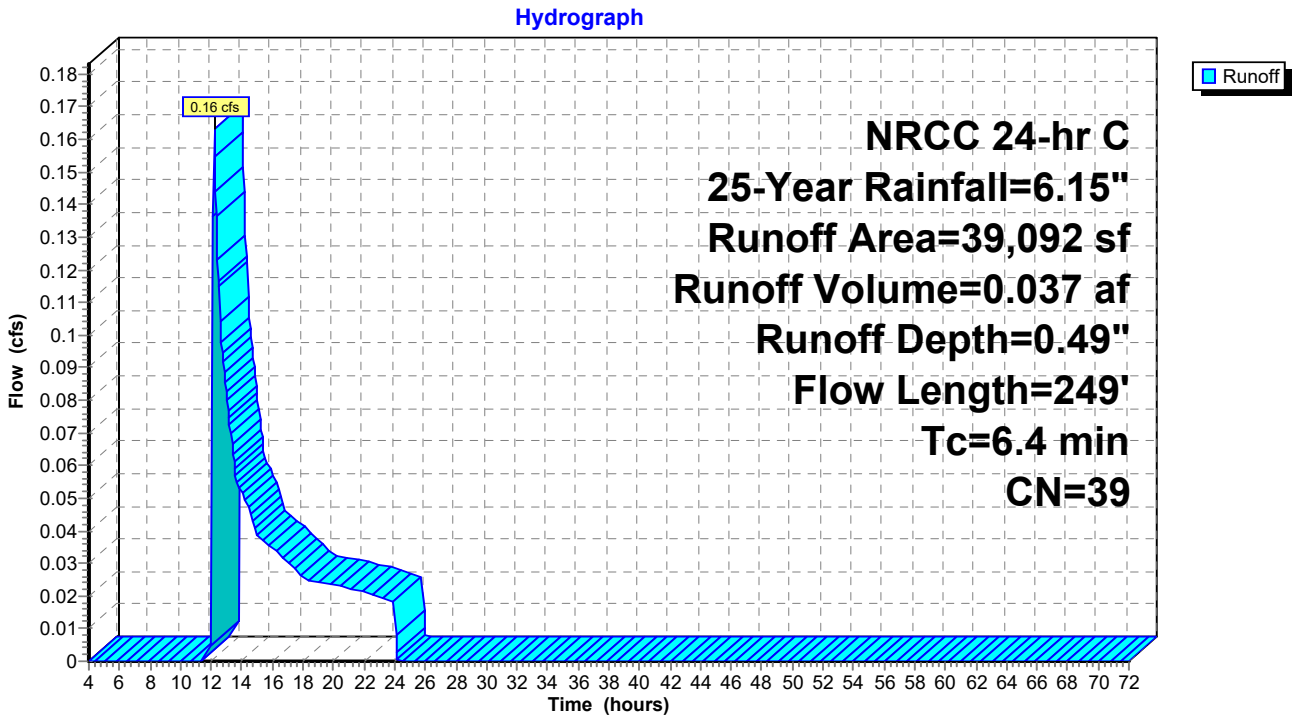
Runoff = 0.16 cfs @ 12.21 hrs, Volume= 0.037 af, Depth= 0.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.15"

Area (sf)	CN	Description
39,092	39	>75% Grass cover, Good, HSG A
39,092		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	50	0.0380	0.19		**Sheet Flow, Segment A-B** Grass: Short n= 0.150 P2= 3.26"
2.0	184	0.0470	1.52		**Shallow Concentrated Flow, Segment B-C** Short Grass Pasture Kv= 7.0 fps
0.1	15	0.3300	4.02		**Shallow Concentrated Flow, Segment C-D** Short Grass Pasture Kv= 7.0 fps
6.4	249	Total			

Subcatchment P3: Subcatchment to Basin #3



Summary for Subcatchment P4: Subcatchment to BVW

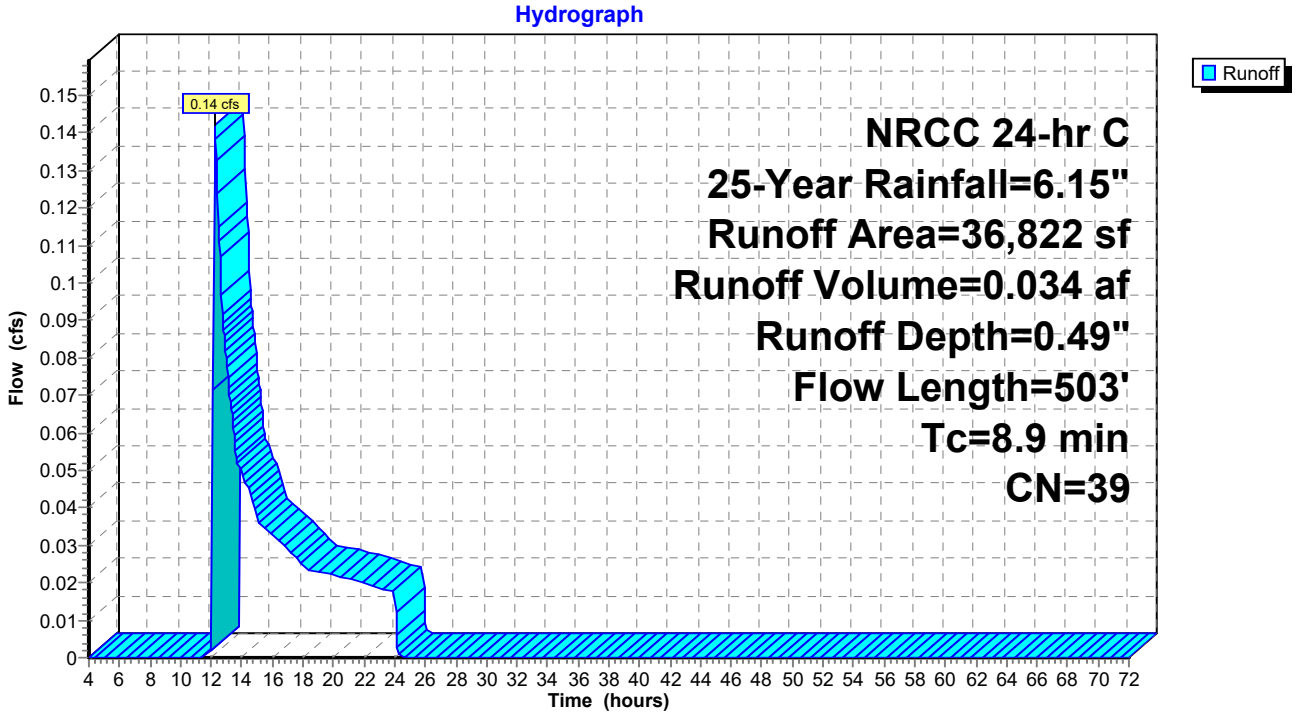
Runoff = 0.14 cfs @ 12.27 hrs, Volume= 0.034 af, Depth= 0.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.15"

Area (sf)	CN	Description
36,822	39	>75% Grass cover, Good, HSG A
36,822		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.0	50	0.0950	0.28		**Sheet Flow, Segment A-B** Grass: Short n= 0.150 P2= 3.26"
2.3	153	0.0260	1.13		**Shallow Concentrated Flow, Segment B-C** Short Grass Pasture Kv= 7.0 fps
0.2	47	0.0050	3.79	2.98	**Pipe Channel, RCP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011 Concrete pipe, straight & clean
3.4	253	0.0070	1.25		**Shallow Concentrated Flow, Segment D-E** Grassed Waterway Kv= 15.0 fps
8.9	503	Total			

Subcatchment P4: Subcatchment to BVW

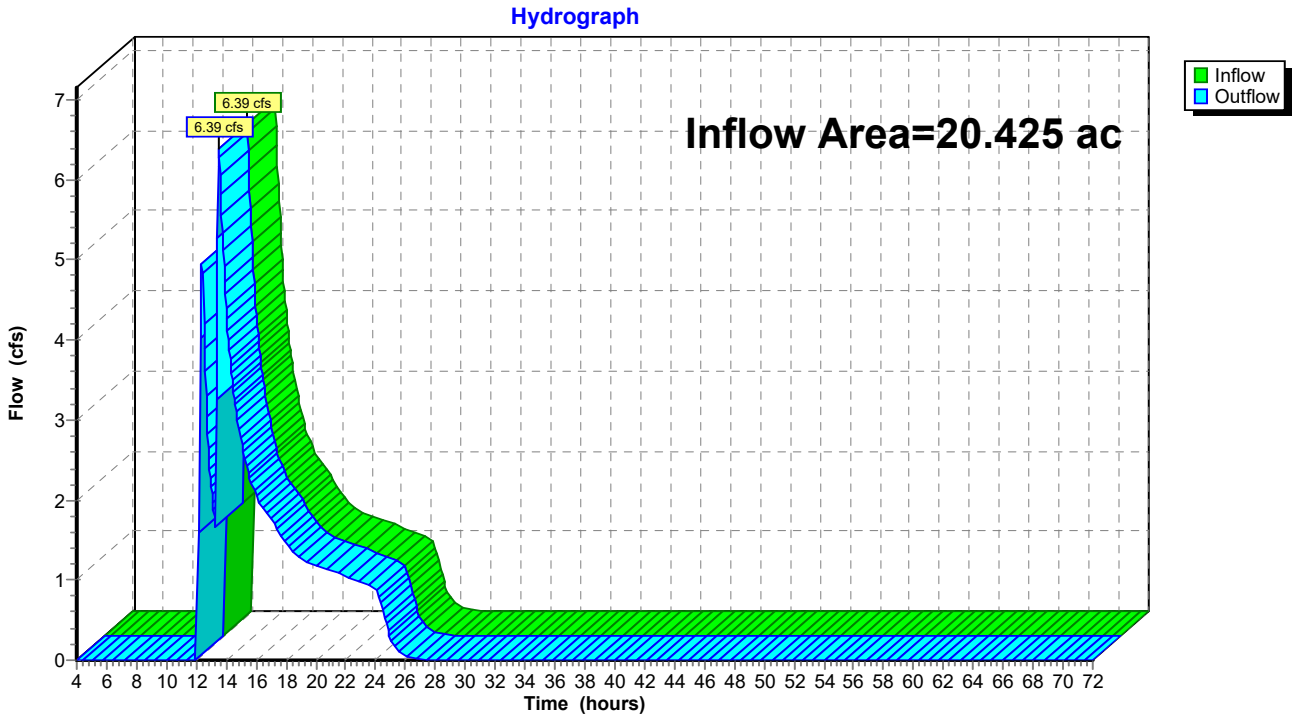


Summary for Reach PR1: Analysis Point - AP1

Inflow Area = 20.425 ac, 11.14% Impervious, Inflow Depth = 1.16" for 25-Year event
Inflow = 6.39 cfs @ 13.51 hrs, Volume= 1.972 af
Outflow = 6.39 cfs @ 13.51 hrs, Volume= 1.972 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs

Reach PR1: Analysis Point - AP1



Summary for Pond 4P: Surface Infiltration Pond - Frozen Conditions

Inflow Area = 3.637 ac, 62.58% Impervious, Inflow Depth = 3.81" for 25-Year event
Inflow = 16.79 cfs @ 12.13 hrs, Volume= 1.156 af
Outflow = 4.87 cfs @ 12.35 hrs, Volume= 0.698 af, Atten= 71%, Lag= 13.1 min
Primary = 4.87 cfs @ 12.35 hrs, Volume= 0.698 af

Routing by Dyn-Stor-Ind method, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 308.26' @ 12.35 hrs Surf.Area= 10,758 sf Storage= 22,929 cf
Flood Elev= 310.50' Surf.Area= 13,382 sf Storage= 53,229 cf

Plug-Flow detention time= 220.3 min calculated for 0.698 af (60% of inflow)
Center-of-Mass det. time= 105.5 min (929.6 - 824.1)

Volume	Invert	Avail.Storage	Storage Description
#1	306.00'	55,343 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	306.50'	5,662 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) -Impervious
		61,005 cf	Total Available Storage

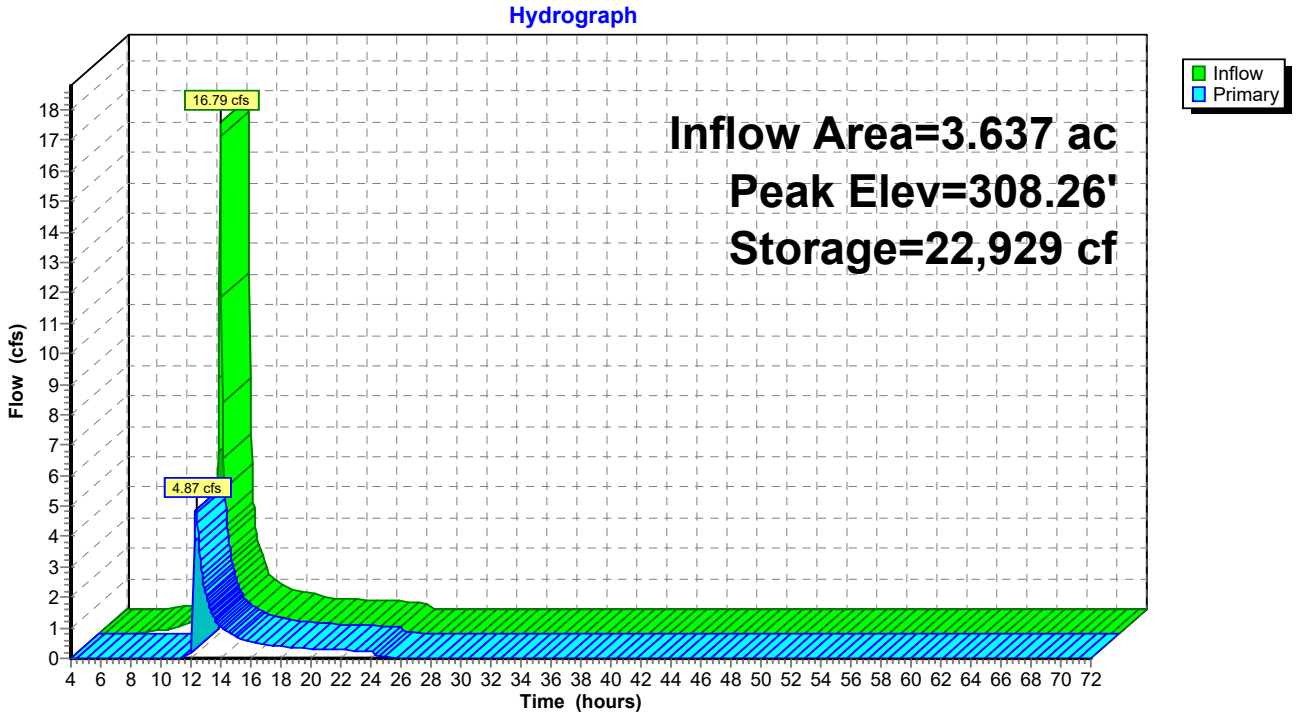
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
306.00	8,252	0	0
308.00	10,461	18,713	18,713
310.00	12,784	23,245	41,958
310.50	13,382	6,542	48,500
311.00	13,990	6,843	55,343

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
306.50	611	0	0
308.00	1,031	1,232	1,232
310.00	1,617	2,648	3,880
310.50	1,781	850	4,729
311.00	1,952	933	5,662

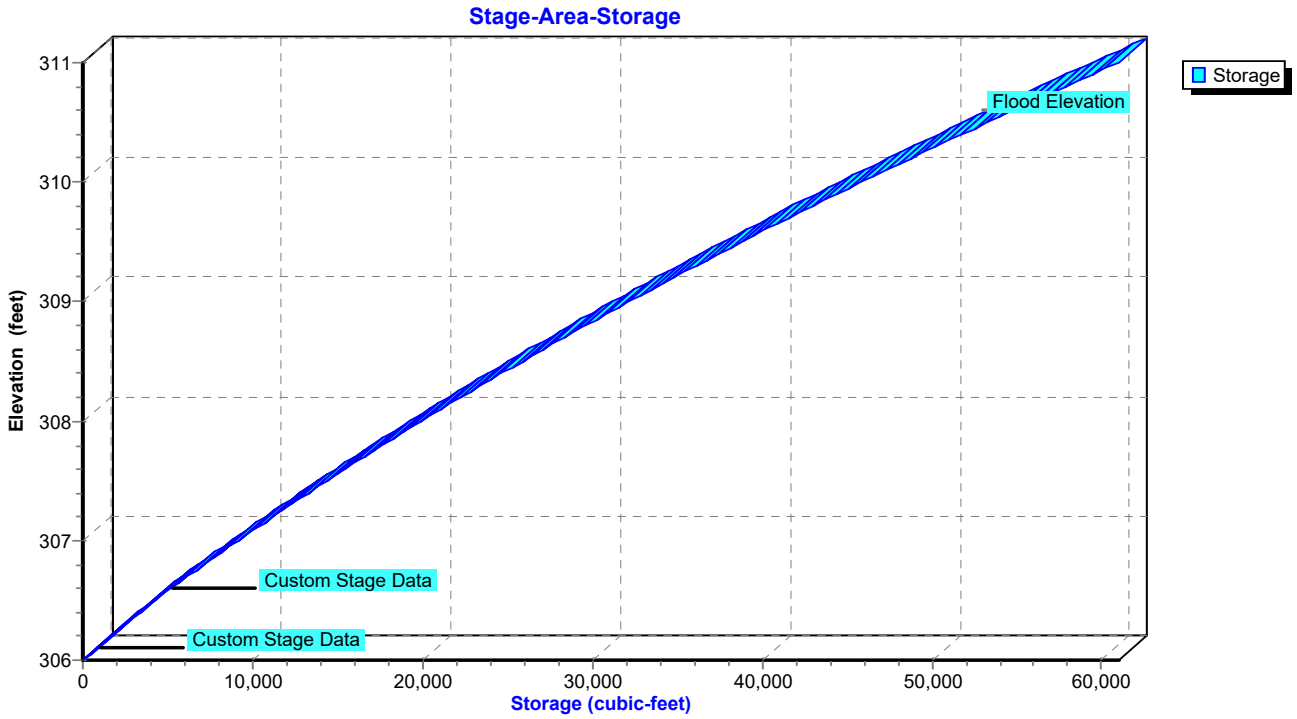
Device	Routing	Invert	Outlet Devices
#1	Primary	305.50'	**12.0" Round Culvert** L= 77.5' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 305.50' / 305.00' S= 0.0065 '/' Cc= 0.900 n= 0.013 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Device 1	308.00'	**2.0" x 2.0" Horiz. Orifice/Grate X 12.00 columns** X 6 rows C= 0.600 in 24.0" x 48.0" Grate (25% open area) Limited to weir flow at low heads
#3	Primary	310.50'	**10.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=4.87 cfs @ 12.35 hrs HW=308.26' TW=0.00' (Dynamic Tailwater)
- **1=Culvert** (Passes 4.87 cfs of 4.97 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 4.87 cfs @ 2.43 fps)
- **3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 4P: Surface Infiltration Pond - Frozen Conditions



Pond 4P: Surface Infiltration Pond - Frozen Conditions



Summary for Pond 5P: Infiltraton Basin #2 - Frozen Conditions

Inflow Area = 15.046 ac, 0.00% Impervious, Inflow Depth = 1.52" for 25-Year event
Inflow = 10.70 cfs @ 12.65 hrs, Volume= 1.912 af
Outflow = 10.12 cfs @ 12.77 hrs, Volume= 1.904 af, Atten= 5%, Lag= 7.3 min
Primary = 10.12 cfs @ 12.77 hrs, Volume= 1.904 af

Routing by Dyn-Stor-Ind method, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 314.51' @ 12.77 hrs Surf.Area= 6,471 sf Storage= 4,363 cf
Flood Elev= 316.00' Surf.Area= 16,430 sf Storage= 21,448 cf

Plug-Flow detention time= 12.9 min calculated for 1.904 af (100% of inflow)
Center-of-Mass det. time= 9.7 min (936.3 - 926.6)

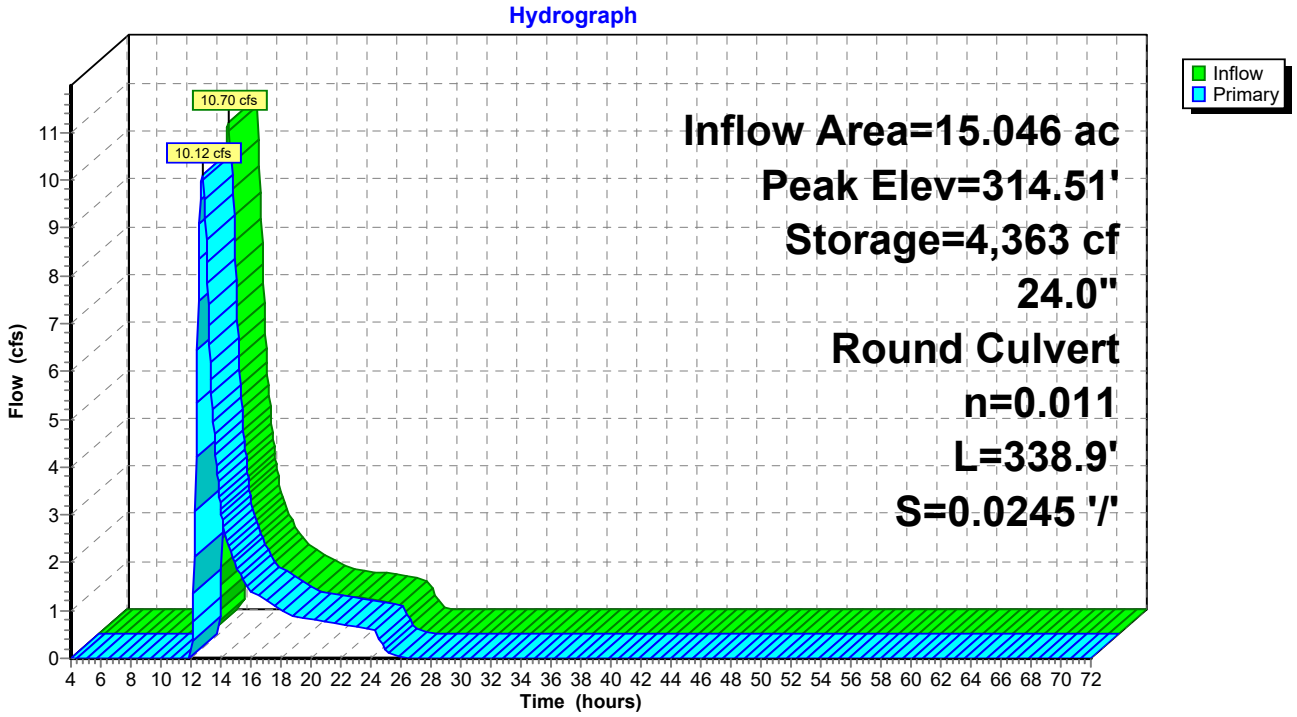
Volume	Invert	Avail.Storage	Storage Description
#1	313.00'	21,448 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
313.00	795	0	0
314.00	3,080	1,938	1,938
316.00	16,430	19,510	21,448

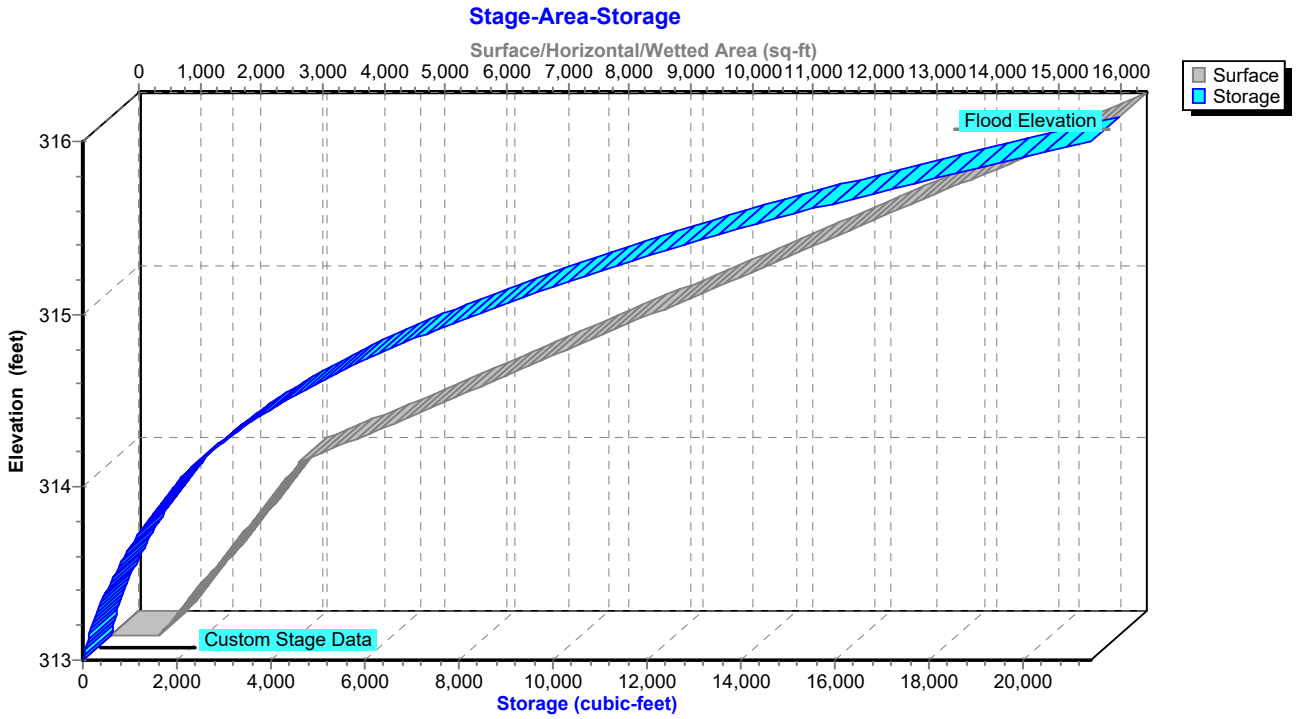
Device	Routing	Invert	Outlet Devices
#1	Primary	313.30'	**24.0" Round Culvert** L= 338.9' RCP, rounded edge headwall, Ke= 0.100 Inlet / Outlet Invert= 313.30' / 305.00' S= 0.0245 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 3.14 sf

Primary OutFlow Max=10.10 cfs @ 12.77 hrs HW=314.51' TW=307.47' (Dynamic Tailwater)
↑**1=Culvert** (Inlet Controls 10.10 cfs @ 5.10 fps)

Pond 5P: Infiltraton Basin #2 - Frozen Conditions



Pond 5P: Infiltraton Basin #2 - Frozen Conditions



Summary for Pond 6P: Infiltraton Basin #3 - Frozen Conditions

Inflow Area = 15.943 ac, 0.00% Impervious, Inflow Depth = 1.46" for 25-Year event
Inflow = 10.22 cfs @ 12.77 hrs, Volume= 1.941 af
Outflow = 4.98 cfs @ 13.52 hrs, Volume= 1.240 af, Atten= 51%, Lag= 45.0 min
Primary = 4.98 cfs @ 13.52 hrs, Volume= 1.240 af

Routing by Dyn-Stor-Ind method, Time Span= 4.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 309.67' @ 13.52 hrs Surf.Area= 9,433 sf Storage= 32,101 cf
Flood Elev= 310.00' Surf.Area= 9,812 sf Storage= 35,282 cf

Plug-Flow detention time= 237.3 min calculated for 1.240 af (64% of inflow)
Center-of-Mass det. time= 103.8 min (1,040.8 - 937.0)

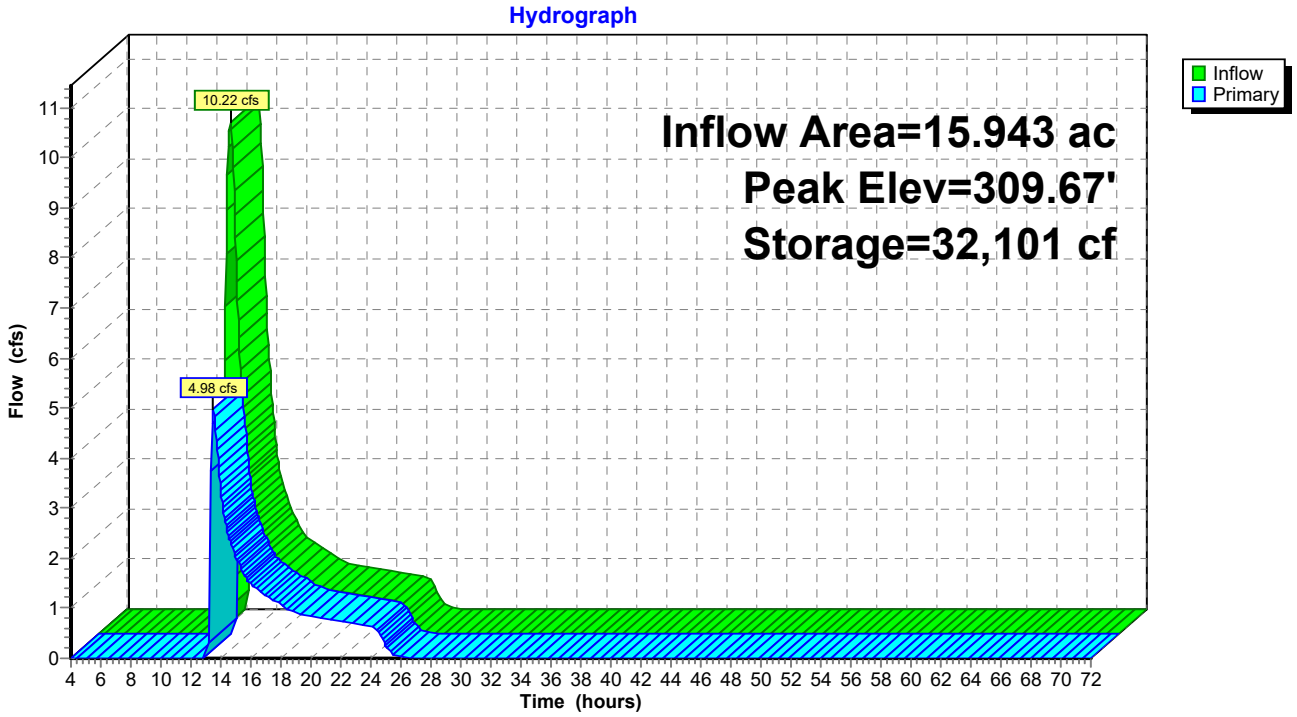
Volume	Invert	Avail.Storage	Storage Description
#1	305.00'	35,282 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
305.00	4,504	0	0
306.00	5,453	4,979	4,979
308.00	7,519	12,972	17,951
310.00	9,812	17,331	35,282

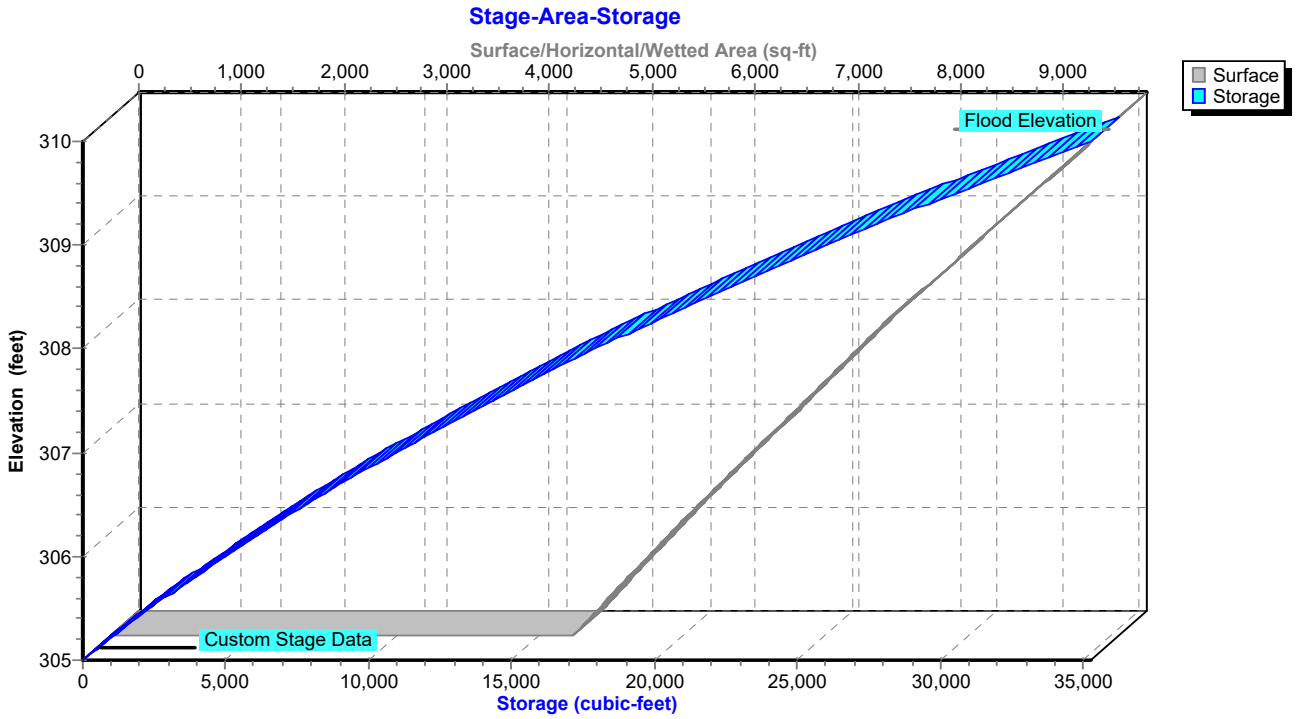
Device	Routing	Invert	Outlet Devices
#1	Primary	309.50'	**30.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=4.95 cfs @ 13.52 hrs HW=309.67' TW=0.00' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 4.95 cfs @ 0.98 fps)

Pond 6P: Infiltraton Basin #3 - Frozen Conditions



Pond 6P: Infiltraton Basin #3 - Frozen Conditions



Stage-Area-Storage Calculations

Appendix 5

Stage-Area-Storage for Pond 1P: Infiltration Basin #1

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
306.00	8,252	0
306.05	8,307	414
306.10	8,362	831
306.15	8,418	1,250
306.20	8,473	1,672
306.25	8,528	2,098
306.30	8,583	2,525
306.35	8,639	2,956
306.40	8,694	3,389
306.45	8,749	3,825
306.50	8,804	4,264
306.55	8,859	4,737
306.60	8,915	5,213
306.65	8,970	5,692
306.70	9,025	6,175
306.75	9,080	6,661
306.80	9,136	7,151
306.85	9,191	7,644
306.90	9,246	8,141
306.95	9,301	8,641
307.00	9,357	9,145
307.05	9,412	9,652
307.10	9,467	10,162
307.15	9,522	10,676
307.20	9,577	11,194
307.25	9,633	11,715
307.30	9,688	12,239
307.35	9,743	12,767
307.40	9,798	13,299
307.45	9,854	13,833
307.50	9,909	14,372
307.55	9,964	14,913
307.60	10,019	15,458
307.65	10,074	16,007
307.70	10,130	16,559
307.75	10,185	17,115
307.80	10,240	17,674
307.85	10,295	18,236
307.90	10,351	18,802
307.95	10,406	19,372
308.00	10,461	19,945
308.05	10,519	20,521
308.10	10,577	21,101
308.15	10,635	21,685
308.20	10,693	22,272
308.25	10,751	22,863
308.30	10,809	23,458
308.35	10,868	24,056
308.40	10,926	24,658
308.45	10,984	25,263
308.50	11,042	25,872
308.55	11,100	26,485
308.60	11,158	27,102
308.65	11,216	27,722
308.70	11,274	28,345
308.75	11,332	28,973
308.80	11,390	29,604
308.85	11,448	30,238
308.90	11,506	30,876
308.95	11,564	31,518
309.00	11,623	32,164
309.05	11,681	32,813
309.10	11,739	33,466
309.15	11,797	34,122
309.20	11,855	34,782
309.25	11,913	35,446
309.30	11,971	36,113
309.35	12,029	36,784
309.40	12,087	37,459
309.45	12,145	38,137
309.50	12,203	38,819
309.55	12,261	39,504
309.60	12,319	40,193
309.65	12,377	40,886
309.70	12,436	41,583
309.75	12,494	42,283
309.80	12,552	42,986
309.85	12,610	43,694
309.90	12,668	44,405
309.95	12,726	45,119
310.00	12,784	45,838
310.05	12,844	46,559
310.10	12,904	47,285
310.15	12,963	48,015
310.20	13,023	48,748
310.25	13,083	49,485
310.30	13,143	50,226
310.35	13,203	50,971
310.40	13,262	51,720
310.45	13,322	52,472
310.50	13,382	53,229
310.55	13,443	53,989
310.60	13,504	54,753
310.65	13,564	55,520
310.70	13,625	56,292
310.75	13,686	57,068
310.80	13,747	57,848
310.85	13,808	58,631
310.90	13,868	59,418
310.95	13,929	60,210
311.00	**13,990**	**61,005**

Volume below lowest invert out

Stage-Area-Storage for Pond 2P: Infiltraton Basin #2

Volume below lowest invert out

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
313.00	795	0
313.05	909	43
313.10	1,024	91
313.15	1,138	145
313.20	1,252	205
313.25	1,366	270
313.30	1,481	341
313.35	1,595	418
313.40	1,709	501
313.45	1,823	589
313.50	1,938	683
313.55	2,052	783
313.60	2,166	888
313.65	2,280	999
313.70	2,394	1,116
313.75	2,509	1,239
313.80	2,623	1,367
313.85	2,737	1,501
313.90	2,851	1,641
313.95	2,966	1,786
314.00	3,080	1,938
314.05	3,414	2,100
314.10	3,748	2,279
314.15	4,081	2,475
314.20	4,415	2,687
314.25	4,749	2,916
314.30	5,083	3,162
314.35	5,416	3,424
314.40	5,750	3,703
314.45	6,084	3,999
314.50	6,418	4,312
314.55	6,751	4,641
314.60	7,085	4,987
314.65	7,419	5,350
314.70	7,752	5,729
314.75	8,086	6,125
314.80	8,420	6,538
314.85	8,754	6,967
314.90	9,087	7,413
314.95	9,421	7,876
315.00	9,755	8,355
315.05	10,089	8,851
315.10	10,423	9,364
315.15	10,756	9,893
315.20	11,090	10,439
315.25	11,424	11,002
315.30	11,758	11,582
315.35	12,091	12,178
315.40	12,425	12,791
315.45	12,759	13,421
315.50	13,093	14,067
315.55	13,426	14,730
315.60	13,760	15,410
315.65	14,094	16,106
315.70	14,427	16,819
315.75	14,761	17,549
315.80	15,095	18,295
315.85	15,429	19,058
315.90	15,762	19,838
315.95	16,096	20,634
316.00	**16,430**	**21,448**

Stage-Area-Storage for Pond 3P: Infiltraton Basin #3

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
305.00	4,504	0
305.05	4,551	226
305.10	4,599	455
305.15	4,646	686
305.20	4,694	920
305.25	4,741	1,156
305.30	4,789	1,394
305.35	4,836	1,635
305.40	4,884	1,878
305.45	4,931	2,123
305.50	4,979	2,371
305.55	5,026	2,621
305.60	5,073	2,873
305.65	5,121	3,128
305.70	5,168	3,385
305.75	5,216	3,645
305.80	5,263	3,907
305.85	5,311	4,171
305.90	5,358	4,438
305.95	5,406	4,707
306.00	5,453	4,979
306.05	5,505	5,252
306.10	5,556	5,529
306.15	5,608	5,808
306.20	5,660	6,090
306.25	5,711	6,374
306.30	5,763	6,661
306.35	5,815	6,950
306.40	5,866	7,242
306.45	5,918	7,537
306.50	5,970	7,834
306.55	6,021	8,134
306.60	6,073	8,436
306.65	6,124	8,741
306.70	6,176	9,049
306.75	6,228	9,359
306.80	6,279	9,671
306.85	6,331	9,987
306.90	6,383	10,305
306.95	6,434	10,625
307.00	6,486	10,948
307.05	6,538	11,274
307.10	6,589	11,602
307.15	6,641	11,933
307.20	6,693	12,266
307.25	6,744	12,602
307.30	6,796	12,940
307.35	6,848	13,281
307.40	6,899	13,625
307.45	6,951	13,971
307.50	7,003	14,320
307.55	7,054	14,672
307.60	7,106	15,026
307.65	7,157	15,382
307.70	7,209	15,741
307.75	7,261	16,103
307.80	7,312	16,467
307.85	7,364	16,834
307.90	7,416	17,204
307.95	7,467	17,576
308.00	7,519	17,951
308.05	7,576	18,328
308.10	7,634	18,708
308.15	7,691	19,091
308.20	7,748	19,477
308.25	7,806	19,866
308.30	7,863	20,258
308.35	7,920	20,652
308.40	7,978	21,050
308.45	8,035	21,450
308.50	8,092	21,853
308.55	8,150	22,259
308.60	8,207	22,668
308.65	8,264	23,080
308.70	8,322	23,495
308.75	8,379	23,912
308.80	8,436	24,333
308.85	8,494	24,756
308.90	8,551	25,182
308.95	8,608	25,611
309.00	8,666	26,043
309.05	8,723	26,477
309.10	8,780	26,915
309.15	8,837	27,355
309.20	8,895	27,799
309.25	8,952	28,245
309.30	9,009	28,694
309.35	9,067	29,146
309.40	9,124	29,601
309.45	9,181	30,058
309.50	9,239	30,519
309.55	9,296	30,982
309.60	9,353	31,448
309.65	9,411	31,918
309.70	9,468	32,389
309.75	9,525	32,864
309.80	9,583	33,342
309.85	9,640	33,823
309.90	9,697	34,306
309.95	9,755	34,792
310.00	**9,812**	**35,282**

Volume below lowest invert out

TSS Removal Worksheet

Appendix 6

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Location: North Street / Blackstone Street, Bellingham MA

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump Hooded Catch Basin	0.25	1.00	0.25	0.75
Infiltration Basin	0.80	0.75	0.60	0.15

Total TSS Removal = 85%

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

Project: F-4410

Prepared By: Kyle Pitz

Date: 17-August-22

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

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

1. From MassDEP Stormwater Handbook Vol. 1

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Location: North Street / Blackstone Street, Bellingham MA

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump Hooded Catch Basin	0.25	1.00	0.25	0.75
Sediment Forebay	0.25	0.75	0.19	0.56

Total TSS Removal = 44%

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

Project: F-4410

Prepared By: Kyle Pitz

Date: 17-August-22

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

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

1. From MassDEP Stormwater Handbook Vol. 1

Long Term Operation and Maintenance Plan

Appendix 7

The following shall serve as the (O&M) Plan required by Standard 9, as well as the Long-Term Pollution Prevention Plan required by Standard 4.

A. Names of Persons or Entity Responsible for Plan Compliance

Applicant: Raven Homes, Inc.
22 Buckhill Road
Northborough, MA 01532
PH: 508-393-4511

B. Stormwater Management System Owner

Owner:
Raven Homes, Inc.
22 Buckhill Road
Northborough, MA 01532
PH: 508-393-4511

C. Good housekeeping practices

1. Maintain site, landscaping and vegetation.
2. Sweep and pick up litter on pavements and grounds.
3. Deliveries shall be monitored by owners or representative to ensure that if any spillage occurs, it shall be contained and cleaned up immediately.
4. Maintain pavement and curbing in good repair.

D. Requirements for routine inspections and maintenance of stormwater BMPs

1. Plans: The stormwater Operation and Maintenance Plan shall consist of all Plans, documents and all local state and federal approvals as required for the subject property.
2. Record Keeping:
   a. Maintain a log of all operation and maintenance activities for at least three years following construction, including inspections, repairs, replacement and disposal (for disposal, the log shall indicate the type of material and the disposal location).
   b. Make this log available to MassDEP and the Conservation Commission upon request; and
   c. Allow MassDEP and the Conservation Commission to inspect each BMP to determine whether the responsible party is implementing the Operation and Maintenance Plan.
3. Descriptions and Designs: The Best Management Practices (BMP) incorporated into the design include the following.
   a. Street Sweeping – Stipulated within the Construction Period Pollution Prevention Plan, the Long-Term Pollution Prevention Plan, and the Operation and Maintenance Plan. As the amount of TSS removal is discretionary, no credit was taken within the calculations for this BMP.
   b. Deep sump catch basins with hoods installed to promote TSS Removal of solids and control floatable pollutants. This BMP has a design rate of 25% TSS Removal.
   c. Infiltration basin and sediment forebay provided to promote the required 80% TSS Removal. Refer to TSS Removal Worksheet in Standard 4 for treatment train.
   d. Safety Fencing: Provide 6-FT high chain link fence with lockable gates around detention basin for public safety.
   e. Spill Containment Kit to contain and clean-up spills that could occur on site.

4. BMP Maintenance: After construction it is the responsibility of the owner to perform maintenance. The cleaning of the components of the stormwater management system shall generally be as follows:
    a. Roadway: The owner shall keep the roadway swept with a mechanical sweeper or hand swept semi-annually at a minimum.
    b. Catch Basins: Shall be cleaned by excavating, pumping or vacuuming four times per year and at the end of foliage and snow removal seasons. The sediment shall be disposed of off-site by the Owner. Inspect quarterly, remove silt when ¼ full.
    c. Infiltration Basin: Preventative maintenance shall be performed at least twice per year. Inspection shall be performed after every major storm for the first three months and twice a year thereafter and when there are discharges through the high outlet orifice. Mowing of the buffer area, and bottom of basin; removal of trash and debris; removal of grass clippings and organic matter to be performed at least twice per year. Pretreatment devices shall be inspected every other month and a least twice a year and after every major storm event.

5. Access Provisions: All of the components of the storm water system shall be accessible by the Owner

E. Spill prevention and response plans
1. Inventory materials to be present on-site during construction.
2. Train employees and subcontractors in prevention and clean up procedures.
3. All materials stored on site will be stored in their appropriate containers under a roof.
4. Follow manufacturers recommendation for disposal of used containers.
5. Store only enough product on site to do the job.
6. On site equipment, fueling and maintenance measures:
    a. Inspect on-site vehicles and equipment daily for leaks.
    b. Conduct all vehicle and equipment maintenance and refueling in one location, away from storm drains.
    c. Perform major repairs and maintenance off site.
    d. Use drip pans, drip cloths or absorbent pads when replacing spent fuels.
    e. Collect spent fuels and remove from site.
7. Clean up spills.
    a. Never hose down “dirty” pavement or impermeable surfaces where fluids have spilled. Use dry clean up methods (sawdust, cat litter and/or rags and absorbent pads).
    b. Sweep up dry materials immediately. Never wash them away or bury them.
    c. Clean up spills on dirt areas by digging up and properly disposing of contaminated soil.
    d. Report significant spills to the Fire Department, Conservation Commission and Board of Health.

F. Provisions for maintenance of lawns, gardens, and other landscaped areas
Use only organic fertilizer. Dispose of clippings outside of the 100-foot buffer zone to the adjacent wetland.

G. Requirements for storage and use of herbicides, and pesticides
The application of herbicides or pesticides will be done by professional certified contractor.

H. Provisions for operation and management of septic system
Site to be serviced by private on-site sewer.

I. Requirements for handling of pet waste

Pet waste should never be dumped or washed into the local storm drain system. Waste shall be picked up immediately and placed in bags and properly disposed of in the garbage to be collected and taken to a landfill.

J. Provisions for washing of vehicles

Washing of vehicles shall be done in an area as to eliminate wash water from being directly discharged to the local storm drain system. Vehicles should be washed in areas where wash water can be held prior to discharging to the sanitary sewer system or in areas where infiltration precludes runoff to storm drains. Avoid using detergents whenever possible.

K. Provisions for solid waste management

1. Waste Management Plan
    a. Recycle materials whenever possible (paper, plaster cardboard, metal cans). Separate containers for material are recommended.
    b. Do not bury waste and debris on site.
    c. Certified haulers will be hired to remove the dumpster container waste as needed. Recycling products will also be removed off site weekly.

L. Snow disposal and plowing plans relative to Wetland Resource Areas

Snow storage is adequate around the site for large storm events. Storage of snow shall not be placed directly near areas adjacent to the proposed infiltration basin.

M. Winter Road Salt and/or Sand Use and Storage restrictions

No sand, salt, or chemicals for de-icing will be stored outside.

N. Street sweeping schedules

Sweeping, the act of cleaning pavement can be done by mechanical sweepers, vacuum sweeper or hand sweeper. The quantity of sand is a direct correlation with the treatment of ice and snow and the types of chemicals and spreaders that are being used on site to manage snow. If a liquid de-icer such as calcium chloride is used as a pretreatment to new events the amount of sand is minimized. Sweeping for this site should be done semi-annually at a minimum. Collecting the particulate before it enters the catch basins is cheaper and more environmentally friendly than in a catch basin mixing with oils and greases in the surface water runoff in catch basins.

O. Provisions for prevention of illicit discharges to the stormwater management system

The discharge into the stormwater system is not being violated, see attachment for illicit discharges compliance.

P. Training the staff or personnel involved with implementing Long-Term Pollution Prevention Plan

The owner shall develop policies and procedures for containing the illicit spilling of oils, soda, beer, paper and litter. These wastes provide a degrading of the water quality. The placement of signs and trash barrels with lids around the site would contribute to a clean water quality site condition.

Q. List of Emergency contacts for implementing Long-Term Pollution Prevention Plan:

Raven Homes, Inc.
22 Buckhill Road
Northborough, MA 01532
PH: 508-393-4511

This shall be the contact until such time as the project is sold.

R. Estimated BMP Maintenance Costs

The following prices are estimates of the costs associated with maintenance of the proposed site BMPs. Costs provided are only estimates and may not reflect actual costs to perform the work. Actual costs may vary depending on company/personnel performing the work. Actual costs may increase over time.

BMP	Estimated Maintenance Cost
Pavement sweeping	$ 400 per year
Catch basin cleaning	$ 200 per catch basin per cleaning
Infiltration Basin	$ 200 per cleaning
Spill Containment Kit	$ 750 purchase price

Construction Period Pollution Prevention Plan

Appendix 8

Construction Period Pollution Prevention Plan and Erosion and Sedimentation Control.
EPA NPDES – Storm Water Pollution Prevention Plan (SWPPP)

A. Names of Persons or Entity Responsible for Plan Compliance

Applicant: Raven Homes, Inc.
22 Buckhill Road
Northborough, MA 01532
PH: 508-393-4511

B. Construction Period Pollution Prevention Measures

1. Inventory materials to be present on-site during construction.
2. Train employees and subcontractors in prevention and clean up procedures.
3. All materials stored on site will be stored in their appropriate containers and if possible, under a roof or covered.
4. Follow manufacturer's recommendation for disposal of used containers.
5. Store only enough product on site to do the job.
6. On site equipment, fueling and maintenance measures:
    a. Inspect on-site vehicles and equipment daily for leaks.
    b. Conduct all vehicle and equipment maintenance and refueling in front of building, away from storm drains.
    c. Perform major repairs and maintenance off site.
    d. Use drip pans, drip cloths or absorbent pads when replacing spent fuels.
    e. Collect spent fuels and remove from site, per Local and State regulations.
    f. Maintain a clean construction entrance where truck traffic is frequent to reduce soil compaction constant sweeping is required and limit tracking of sediment into streets, sweeping street when silt is observed on street.
7. Stockpile materials and maintain Erosion Control around the materials where it can easily be accessed. Maintain easy access to clean up materials to include brooms, mops, rags gloves, goggles, sand, sawdust, plastic and metal trash containers.
8. Clean up spills.
    a. Never hose down "dirty" pavement or impermeable surfaces where fluids have spilled. Use dry clean up methods (sawdust, cat litter and/or rags and absorbent pads).
    b. Sweep up dry materials immediately. Never wash them away or bury them.
    c. Clean up spills on dirt areas by digging up and properly disposing of contaminated soil in a certified container and notify a certified hauler for removal.
    d. Report significant spills to the Fire Department.
9. It is the responsibility of the site superintendent or employees designated by the Applicant to inspect erosion control and repair as needed, also to inspect all on site vehicles for leaks and check all containers on site that may contain hazardous materials daily.

C. Erosion and Sedimentation Control Plan.
See Erosion Control Plan prepared by Guerriere & Halnon, Inc. Dated 12/30/22

D. Site Development Plans.
See Site Plan prepared by Guerriere & Halnon, Inc. Dated 12/30/22

E. Construction Plans
See Site Plan prepared by Guerriere & Halnon, Inc. Dated 12/30/22

1. Construction
    a. Record Order of Conditions - The site superintendent shall be aware of all the Conditions contained within the Order including inspection schedules.
    b. Install DEP File # Sign.
    c. Prior to any work on the site including tree/brush clearing, the approved limit of clearing as well as the location of the proposed erosion control devices (such as silt fence/straw bales, etc.) must be staked on the ground under the direction of a Massachusetts registered Professional Land Surveyor.
    d. Install silt fence/hay bales at locations
    e. Strip off top and subsoil. Stockpile material to be reused away from the wetland, remove excess material from the site. Install and maintain erosion control barrier around stockpile.
    f. Rough grade site, maintaining a temporary low area/sediment trap away from the wetland.
    g. Construct drainage outfalls and stilling basin. Stabilize side slopes with loam, seed and mulch.
    h. Install underground utilities; protect all open drainage structures with erosion/siltation control devices.
    i. Install binder course of bituminous asphalt.
    j. Install wearing course of asphalt, and striping (where required).
    k. Maintain all erosion control devices until site is stabilized and a Certificate of Compliance is issued by the Conservation Commission.
    l. The Contractor shall be responsible to schedule any required inspections of his/her work.

F. Construction Waste Management Plan
    a. Dumpster for trash and bulk waste collection shall be provided separately for construction.
    b. Recycle materials whenever possible (paper, plaster cardboard, metal cans). Separate containers for material are recommended.
    c. Segregate and provide containers for disposal options for waste.
    d. Do not bury waste and debris on site.
    e. Certified haulers will be hired to remove the dumpster container waste as needed. Recycling products will also be removed off site weekly.
    f. The sewer system is only for disposal of human waste, and substances permitted for disposal in the site sewer permit with the Town B.O.H.

G. <u>Operation and Maintenance of Erosion and Sedimentation Controls</u>

The operation and maintenance of sedimentation control shall be the responsibility of the contractor. The inspection and maintenance of the stormwater component shall be performed as noted below. The contractor shall have erosion control in place at all times. The contractor, based on future weather reports, shall prepare and inspect all erosion control devices; cleaning, repairing and upgrading is a priority so that the devices perform as per design. Inspect the site during rain events. Do not stay away from the site. At a minimum there should be inspection to assure the devices are not clogged or plugged, or that devices have not been destroyed or damaged during the rain event. After a storm event inspection is required to clean and repair any damage components. Immediate repair is required.

H. <u>Inspection and Maintenance Schedules</u>
1. Inspection must be conducted at least once every 7 days and within 24 hours of the end of a storm event 0.5 inches or greater.
2. Inspection frequency can be reduced to once a month if:

a. The site is temporarily stabilized.
b. Runoff is unlikely due to winter conditions when site is covered with snow or ice.

3. Inspections must be conducted by qualified personnel, "qualified personnel" means a person knowledgeable in the principles and practice of erosion and sediment controls and who possess the skills to assess the conditions and take measures to maintain and ensure proper operation, also to conclude if the erosion control methods selected are effective.
4. For each inspection, the inspection report must include: (See attached inspection and maintenance log)
   a. The inspection date.
   b. Names, titles of personnel making the inspection.
   c. Weather information for the period since the last inspection.
   d. Weather information at the time of the inspection.
   e. Locations of discharges of sediment from the site, if any.
   f. Locations of BMP's that need to be maintained.
   g. Locations where additional BMP's may be required.
   h. Corrective action required or any changes to the SWPPP that may be necessary.

5. The owner, or their representative, such as the contractor, shall inspect the following in-place work.

Inspection Schedule:

Erosion Control	Weekly
Catch Basins	Weekly
Temporary Sedimentation Traps/Basins	Weekly
Street Sweeping	Weekly

Please Note: Special inspections shall also be made after a significant rainfall event.

Maintenance Schedule

Erosion Control Devices Failure	Immediately
Catch Basins	Sump 1/4 full of sediment
Street Sweeping	14 days minimum and prior to any significant rain event.

Please Note: Special maintenance shall also be made after a significant rainfall event.

I. Inspection and Maintenance Log Form. (Log Form Follows)

Illicit Discharge Statement

Appendix 9

Illicit Discharge Compliance Statement

It is the intent of the Applicant, Raven Homes, Inc, 22 Buckhill Road, Northborough, MA 01532, (508) 326-7937, to control illicit disposal into the storm drainage system. There will be no connection to the storm water system to inadvertently direct other types of liquids, chemicals or solids into the storm drainage system. The Applicant will also promote a clean Green Environment by mitigating spills onto pavements, oils, chemicals, pet waste, debris and litter.

Respectfully Acknowledged,

Raven Homes, Inc.

Drainage Area Plans

Appendix 10

F4457

LOT 2
"CONSERVATION RESTRICTION LAND"
551,608±SF
(12.66±AC)

422B
CANTON FINE SANDY LOAM,
0 TO 8 PERCENT SLOPES,
EXTREMELY STONY
HSG B

254B
MERRIMAC FINE SANDY LOAM,
3 TO 8 PERCENT SLOPES
HSG A

LOT 1
355,994±SF
(8.17±AC)

420B
CANTON FINE SANDY LOAM,
3 TO 8 PERCENT SLOPES
HSG B

BORDERING VEGETATED WETLAND (BVW)

WETLANDS

AP-1

APPROXIMATE LIMIT OF FLOOD ZONE X

EXISTING DEPRESSION

EXISTING DEPRESSION
OUTLET
EL.= 309.05

EX-1

EX-2

AP-2

WOODS

PR. RET. WALL

TP #1 310.5
TP #2 312.7
TP #3 310.3
TP #4 315.4
TP #5 309.7
TP #6 317.6
TP #7 310.2
TP #8 308.8
TP #9 316.9
TP #10 309.0
TP #11 313.0

B L A C K S T O N E S T R E E T
(PUBLIC ~ VARIABLE W

N O R T H S T R E E T
(PUBLIC ~ VARIABLE WIDTH)

OLD TOWN ROAD
(UNIMPROVED)

LEGEND

EX — EXISTING SUBCATCHMENT

AP — ANALYSIS POINT

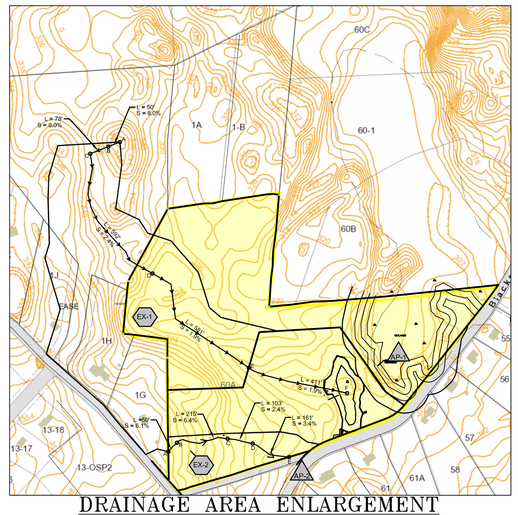
SUBCATCHMENT BOUNDARY

SOIL BOUNDARY

FLOW PATH

TIME OF CONCENTRATION (Tc)

E1 = 42.9 MINUTES
E2 = 20.7 MINUTES



DRAINAGE AREA ENLARGEMENT
N.T.S.

APPROVED DATE:

BELLINGHAM PLANNING BOARD

BEING A MAJORITY

LEGAL NOTES

UTILITIES ARE PLOTTED AS A COMPILATION OF RECORD DOCUMENTS, MARKINGS AND OTHER OBSERVED EVIDENCE TO DEVELOP A VIEW OF THE UNDERGROUND UTILITIES AND SHOULD BE CONSIDERED APPROXIMATE. LACKING EXCAVATION, THE EXACT LOCATION OF UNDERGROUND FEATURES CANNOT BE ACCURATELY, COMPLETELY AND RELIABLY DEPICTED. ADDITIONAL UTILITIES, NOT EVIDENCED BY RECORD DOCUMENTS OR OBSERVED PHYSICAL EVIDENCE, MAY EXIST. CONTRACTORS (IN ACCORDANCE WITH MASS.G.L. CHAPTER 82 SECTION 40 AS AMENDED) MUST CONTACT ALL UTILITY COMPANIES BEFORE EXCAVATING AND DRILLING AND CALL DIGSAFE AT 1(888)DIG-SAFE(7233).

CONSTRUCTION ON THIS LAND IS SUBJECT TO ANY EASEMENTS, RIGHTS-OF-WAY, RESTRICTIONS, RESERVATIONS, OR OTHER LIMITATIONS WHICH MAY BE REVEALED BY AN EXAMINATION OF THE TITLE.

OWNER

RAVEN HOMES, INC.
22 BUCKHILL ROAD
NORTHBOROUGH, MA 01532

DEED BOOK 38607 PAGE 308
PLAN BOOK 697, PLAN 40

A.M. 58 LOTS 1C, 1D & 1E
A.M. 59 LOT 60A

APPLICANT

RAVEN HOMES, INC.
22 BUCKHILL ROAD
NORTHBOROUGH, MA 01532

SITE PLAN
NORTH STREET & BLACKSTONE STREET
BELLINGHAM
MASSACHUSETTS

EXISTING WATERSHED

OCTOBER 7, 2022

DATE	REVISION DESCRIPTION

GRAPHIC SCALE: 1"=40'

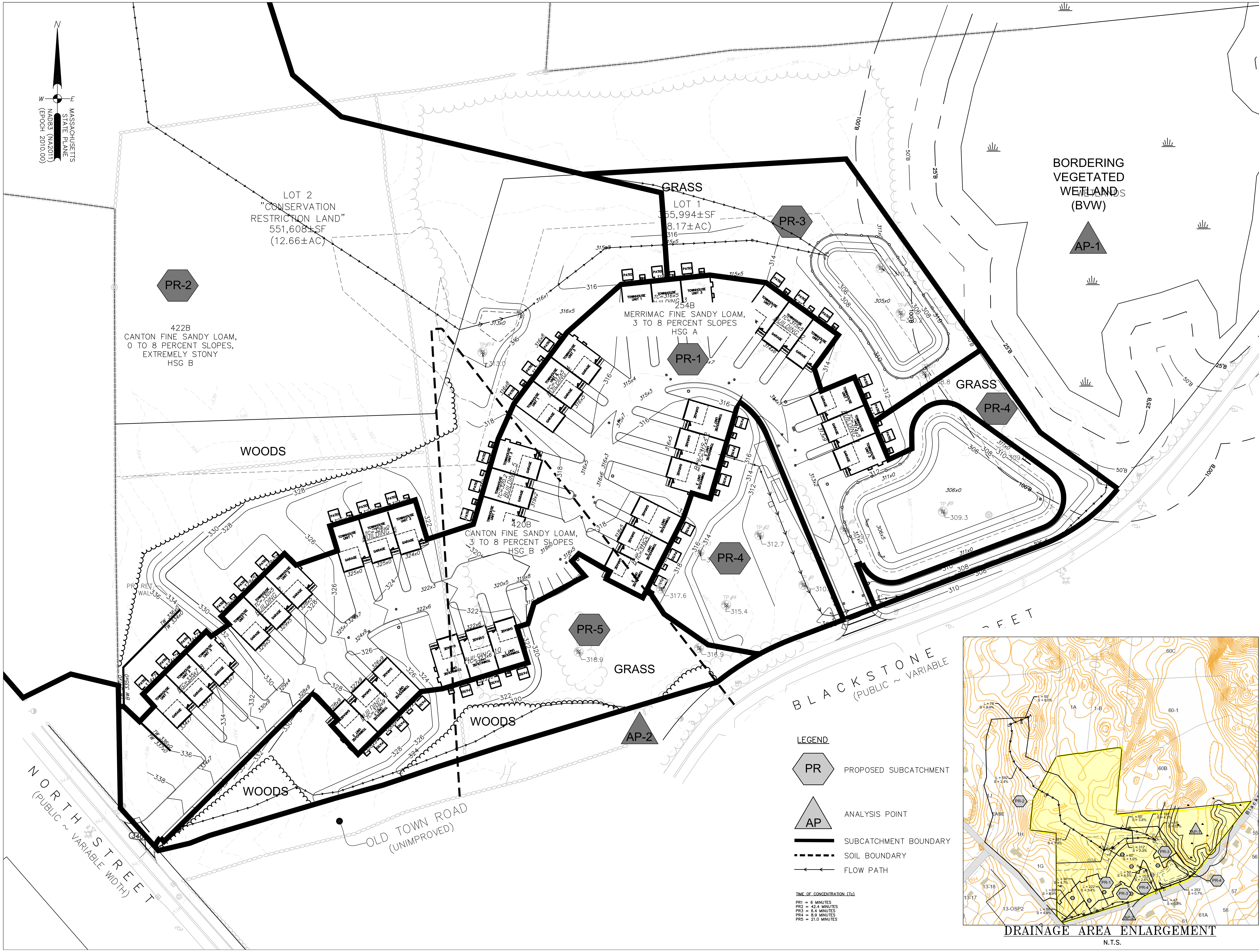
0 10 20 30 40 50 75 100 FEET
0 5 10 15 20 30 METERS

Guerriere & Halnon, Inc.
ENGINEERING & LAND SURVEYING
55 WEST CENTRAL ST. PH. (508) 528-3221
FRANKLIN, MA 02038 FX. (508) 528-7921
www.gandhengineering.com

SHEET 1 OF 2

JOB NO. F4457

G:\C3D\Franklin\F4457\DWG\F4457-CIVIL.dwg, EX. WATERSHED PLAN, 10/26/2022 12:23:33 PM, kpritz, Bluebeam PDF



LEGEND

PR	PROPOSED SUBCATCHMENT
AP	ANALYSIS POINT
	SUBCATCHMENT BOUNDARY
	SOIL BOUNDARY
	FLOW PATH

TIME OF CONCENTRATION (Tc)

PR1 = 6 MINUTES
PR2 = 42.4 MINUTES
PR3 = 6.4 MINUTES
PR4 = 8.9 MINUTES
PR5 = 21.0 MINUTES

DRAINAGE AREA ENLARGEMENT
N.T.S.

F4457

APPROVED DATE:

BELLINGHAM PLANNING BOARD

BEING A MAJORITY

LEGAL NOTES

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A.M. 58 LOTS 1C, 1D & 1E
A.M. 59 LOT 60A

APPLICANT

RAVEN HOMES, INC.
22 BUCKHILL ROAD
NORTHBOROUGH, MA 01532

SITE PLAN NORTH STREET & BLACKSTONE STREET BELLINGHAM MASSACHUSETTS

PROPOSED WATERSHED

OCTOBER 7, 2022

DATE	REVISION DESCRIPTION

GRAPHIC SCALE: 1"=40'

Guerriere & Halnon, Inc.
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SHEET 2 OF 2

JOB NO. F4457

SUPPLEMENTAL ATTACHMENTS

Appendix 11

Land Use Coefficients "C"

Pave	0.90
Gravel	0.80
Wetland	0.72
Grass	0.30
Woods	0.25
Roof	0.90

Drainage Area	Land Use Area Impervious (acres)	Gravel (acres)	Wetland (acres)	Pervious (acres)	Woods (acres)	Roof (acres)	Total (acres)	Weighted "C"
DA-1A	0.233			0.242		0.164	0.639	0.67
DA-1B	0.142			0.008		0.082	0.232	0.88
DA-2A	0.135			0.171		0.113	0.419	0.65
DA-2B	0.164			0.110		0.135	0.409	0.74
DA-3A	0.274			0.217		0.330	0.821	0.74
DA-3B	0.185			0.085		0.111	0.380	0.77
DA-4A	0.086			0.003		0.048	0.136	0.89
DA-4B	0.065						0.065	0.90
DA-5					21.218		21.218	0.25
DA-6				1.270	0.240		1.511	0.29
SUBTOTAL	1.284	0.000	0.000	2.106	21.458	0.982	25.830	
OVERALL TOTALS	1.284			2.106	21.458	0.982	25.830	

Guerriere & Halnon, Inc.
55 West Central Steet
Franklin, MA 01757-0235

Project: North Street & Blackstone Street, Bellingham MA
Job No.: 4457

DESIGN COMPUTATIONS FOR STORM DRAINS

Prepared By: KKP Date: 10/12/2022 Revised
Checked By: Date: Revised

Drainage Area	Upper Structure	Lower Structure	Sum of CA's (sf)	Time of Concentration (Tc) (min)	Rainfall Intensity (I) (in/hr)	Actual Peak Flow Rate (Q) (cfs)	Pipe Diameter (in)	Slope (ft/ft)	Roughness Coefficient (n)	Design Flow Full (Q) (cfs)	Velocity Flow Full (V) (fps)	Actual Velocity (V) (fps)	Length of Pipe (L)* (ft)	Time in pipe (min)	Total Fall (ft)	Invert Elevation Elev. Upper End	Invert Elevation Elev. Lower End	Rim Elev Elev. Upper End	Rim Elev Elev. Lower End	Destination
DA-1	CB-1A	DMH-1	0.43	6.00	5.80	2.49	12	0.029	0.011	7.17	9.12	3.17	34.5	0.06	1.00	321.25	320.25	324.76	323.75	
	CB-1B	DMH-1	0.20	6.00	5.80	1.18	12	0.037	0.011	8.05	10.25	1.51	26.0	0.04	0.95	320.65	319.70	324.69	323.75	
	DMH-1	DMH-2	0.63	6.04	5.80	3.67	12	0.028	0.011	7.01	8.92	4.68	173.3	0.32	4.80	319.60	314.80	323.75	318.90	
	DMH-2	DMH-3	0.63	6.37	5.80	3.67	12	0.023	0.011	6.34	8.08	4.68	61.7	0.13	1.40	314.70	313.30	318.90	317.38	
DA-2	CB-2A	DMH-3	0.27	6.00	5.80	1.59	12	0.012	0.011	4.57	5.81	2.03	17.0	0.05	0.20	313.70	313.50	317.22	317.38	
	CB-2B	DMH-3	0.30	6.00	5.80	1.75	12	0.017	0.011	5.45	6.94	2.23	6.0	0.01	0.10	313.40	313.30	317.43	317.38	
	DMH-3	DMH-4	1.21	6.49	5.80	7.02	15	0.020	0.011	10.84	8.83	5.72	81.9	0.15	1.65	313.20	311.55	317.38	315.86	
	DMH-4	DMH-5	1.21	6.65	5.69	6.89	15	0.012	0.011	8.31	6.77	5.62	63.4	0.16	0.75	311.55	310.80	315.86	315.25	
	DMH-5	DMH-10	1.21	6.80	5.69	6.89	15	0.010	0.011	7.60	6.19	5.62	55.5	0.15	0.55	310.70	310.15	315.25	314.67	
	DMH-10	DMH-6	1.21	6.95	5.69	6.89	15	0.010	0.011	7.60	6.20	5.62	45.4	0.12	0.45	310.05	309.60	314.67	314.15	
	DMH-6	DMH-7	1.21	7.08	5.59	6.77	15	0.010	0.011	7.81	6.36	5.52	52.6	0.14	0.55	309.50	308.95	314.15	313.81	
DA-3	CB-3A	DMH-7	0.61	6.00	5.80	3.53	12	0.010	0.011	4.28	5.45	4.49	19.4	0.06	0.20	310.10	309.90	313.70	313.81	
	CB-3B	DMH-7	0.29	6.00	5.80	1.69	12	0.012	0.011	4.60	5.85	2.15	16.8	0.05	0.20	310.10	309.90	313.70	313.81	
	DMH-7	DMH-8	2.11	7.21	5.59	11.80	18	0.017	0.011	16.00	9.05	6.68	69.3	0.13	1.15	308.70	307.55	313.81	311.67	
	DMH-8	HW #1	2.11	6.06	5.80	12.23	18	0.011	0.011	12.93	7.31	6.92	41.5	0.09	0.45	306.95	306.50	311.67		
DA-4	CB-4A	DMH-9	0.12	6.00	5.80	0.70	12	0.010	0.011	4.16	5.29	0.89	10.3	0.03	0.10	307.30	307.20	310.47	310.81	
	CB-4B	DMH-9	0.06	6.00	5.80	0.34	12	0.007	0.011	3.55	4.52	0.43	14.1	0.05	0.10	307.30	307.20	310.47	310.81	
	DMH-9	HW #7	0.18	6.05	5.80	1.04	12	0.011	0.011	4.38	5.58	1.32	41.5	0.12	0.45	306.95	306.50	311.67		
	OCS	HW #2				3.35	12	0.010	0.013	3.64	4.63	4.27	57.6	0.21	0.60	305.60	305.00			
DA-5	HW #5	DMH-11	5.30	60.00	5.80	30.77	24	0.026	0.011	42.94	13.67	9.79	102.7	0.13	2.65	313.30	310.65		315.00	
	DMH-11	DMH-12	5.30	60.00	5.80	30.77	24	0.023	0.011	40.24	12.81	9.79	139.1	0.18	3.15	310.55	307.40	315.00	315.00	
	DMH-12	HW #6	5.30	60.00	5.80	30.77	24	0.032	0.011	48.11	15.31	9.79	71.0	0.08	2.30	307.30	305.00	315.00		
DA-6	HW #3	HW #4	0.44	6.00	5.80	2.56	12	0.005	0.011	3.07	3.91	3.26	47.1	0.20	0.25	307.75	307.50	317.22	317.38	

INFILTRATION BASIN

Pipe lengths were taken from center of structures

** 100 yr discharge flow rate from HydroCAD

N

W — E

MASSACHUSETTS STATE PLANE NAD83 (NA2011) (EPOCH 2010.00)

LOT 2
"CONSERVATION RESTRICTION LAND"
551,608±SF
(12.66±AC)

GRASS
LOT 1
355,994±SF
(8.17±AC)

BORDERING VEGETATED WETLAND (BVW)

WETLANDS

WOODS

GRASS

WOODS

WOODS

DA-5

FOR OVERALL DRAINAGE AREA (DA-5) SEE ENLARGEMENT BELOW

DA-1A
DA-1B
DA-2A
DA-2B
DA-3A
DA-3B
DA-4A
DA-4B
DA-6

BUILDING 1
BUILDING 2
BUILDING 3
BUILDING 4
BUILDING 5
BUILDING 6
BUILDING 7
BUILDING 8
BUILDING 9
BUILDING 10

TOWNHOUSE UNIT 1
TOWNHOUSE UNIT 2
TOWNHOUSE UNIT 3
GARAGE
PATIO

DMH #1 (PROVIDE F&G)
DMH #2
DMH #3
DMH #4
DMH #5
DMH #6
DMH #7
DMH #8
DMH #9
DMH #10
DMH #11 (PROVIDE F&G)
DMH #12

CBCI #1A (DBL F&G)
CBCI #1B
CBCI #2A
CBCI #2B
CBCI #3A (DBL F&G)
CBCI #3B
CBCI #4A
CBCI #4B

HW #1
HW #2
HW #3
HW #4
HW #5
HW #6
HW #7

INFILTRATION BASIN #1
INFILTRATION BASIN #2 (EXISTING DEPRESSION)
INFILTRATION BASIN #3

SUMMER FOREN

OUTLET CONTROL STRUCTURE

PR. RET. WALL

PR. GAS LINE

NORTH STREET
(PUBLIC ~ VARIABLE WIDTH)

OLD TOWN ROAD
(UNIMPROVED)

BLACKSTONE

LEGEND

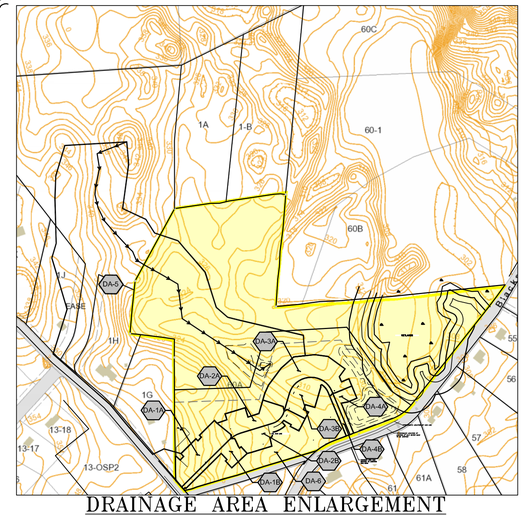
DA — DRAINAGE AREA SUBCATCHMENT

SUBCATCHMENT BOUNDARY

FLOW PATH

TIME OF CONCENTRATION (Tc)

DA-1 TO DA-4 = 6 MINUTES
DA-5 = 60 MINUTES



DRAINAGE AREA ENLARGEMENT
N.T.S.

F4457

APPROVED DATE:

BELLINGHAM PLANNING BOARD

BEING A MAJORITY

LEGAL NOTES

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OWNER

RAVEN HOMES, INC.
22 BUCKHILL ROAD
NORTHBOROUGH, MA 01532

DEED BOOK 38607 PAGE 308
PLAN BOOK 697, PLAN 40

A.M. 58 LOTS 1C, 1D & 1E
A.M. 59 LOT 60A

APPLICANT

RAVEN HOMES, INC.
22 BUCKHILL ROAD
NORTHBOROUGH, MA 01532

SITE PLAN
NORTH STREET & BLACKSTONE STREET
BELLINGHAM
MASSACHUSETTS

DRAINAGE AREA MAP

OCTOBER 7, 2022

DATE	REVISION DESCRIPTION

GRAPHIC SCALE: 1"=40'

0 10 20 30 40 50 75 100 FEET
0 5 10 15 20 30 METERS

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SHEET 1 OF 1

JOB NO. F4457

G:\CSDFranklin\F4457\DWG\F4457-CIVIL.dwg, DRAINAGE AREA MAP, 10/12/2022 11:17:32 AM, kpritz, Blueteam PDF

CONSTRUCTION PHASE INSPECTION FORMS

North Street and Blackstone Street

Bellingham MA

Date _____ Prev. Insp. Date: _____

Inspector: _____ Title: _____

Weather: _____

Weather Since Last Inspection _____

Erosion Control - Inspect Weekly

Comments:
Corrective measures taken and date

On Site Pavement Sweeping - Inspect Weekly

Comments:
Corrective measures taken and date

Catch Basins - Inspect Weekly

Comments:
Corrective measures taken and date

Stormceptor - Inspect Weekly

Comments:
Corrective measures taken and date

Temporary Sediment Traps/Basins - Inspect Weekly

Comments:
Corrective measures taken and date

CONSTRUCTION PHASE INSPECTION FORMS

North Street and Blackstone Street

Bellingham MA

Notify Conservation Commission RE Issues Effecting Resource Areas

Comments:
Corrective measures taken and date

Silt on Public Streets - Inspect Weekly

Comments:
Corrective measures taken and date

Stock Pile Materials - Ring with Haybales - Inspect Weekly

Comments:
Corrective measures taken and date

Any Fuel or Chemical Spill - Inspect Daily

Comments:
Corrective measures taken and date

Post Construction Inspection Report
North Street/Blackstone Street
Bellingham, Massachusetts

INSPECTION DATE:						
Person Inspecting		Weather				Other Personnel Present
		Clear				
Item	**N/A***	**sat.****	**NMR*****	**CAM****	**MCA***	**Comments:**
Pavement Swept						
Catch Basins						
CB #1						
CB #2						
CB #3						
CB #4						
CB #5						
CB #6						
CB #7						
CB #8						
Infiltration Basin						
Sediment Forebay						
Infiltration Basin						
NMR* normal maintenance requested						
N/A* not applicable at the time of inspection						
CAM* corrective action - minor						
SAT* satisfactory conditions as compliant						
MCA* Major corrective action						