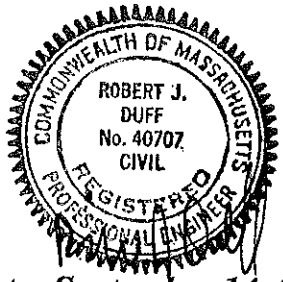
Stormwater Report
Franklin Heights Parcel B
Franklin, MA



Date: September 14, 2022

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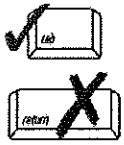
F-4471

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

Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

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

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

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

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

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

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

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

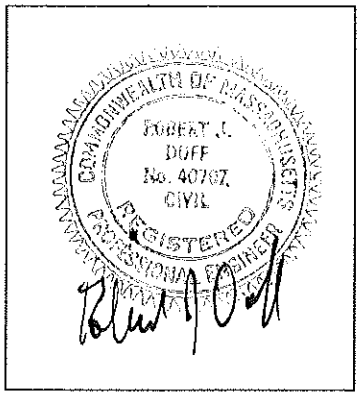
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature



Signature and Date 9-20-2022

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 site consists of approximately 20.3+/- acres of land located off Lincoln Street and is bordered to the east by a residential property, to the west by the previously constructed Franklin Heights Parcel A development, and to the north by residential properties off Daniels Street.. The parcel is located within Zoning District Rural Residential II. The site is largely surrounded by wetlands, which were delineated by Creative Land & Water Engineering, LLC and field located by Guerriere & Halnon, Inc.

Soils on site are identified in five categories – a Paxton Fine Sandy Loam – 305B, 3 to 8% slopes, a Woodbridge Fine Sandy Loam – 310B, 3 to 8% slopes, Swansea Muck – 51, 0 to 1% slopes, a Whitman Fine Sandy Loam – 73A, 0 to 3% slopes, extremely stony, and a Ridgebury Fine Sandy Loam – 71B, 3 to 8% slopes. Soils are based on the Web Soil Survey and site observations - See Appendix 2 / NRCS Soil Report.

The project proponent intends to construct a 60 unit 40-B development consisting of modified bituminous concrete berm, bituminous concrete roadways, bituminous concrete sidewalks and three-foot landscaped area between sidewalks and roadway. The proposed roadways will be a 22' wide paved surface with full access to Lincoln Street. Existing gated access to Daniels Street will be maintained for emergency use only. All units will be serviced by town water and be provided connections to the towns sanitary sewer system. Storm water run-off will be collected by catch basin to manhole drainage systems. Run-off collected within the development will be sent to infiltration basins throughout the development for treatment, detention, and infiltration prior to discharge to the surrounding wetlands.

Pre-development drainage runoff from the entire 20.3± acre site was analyzed as one watershed - See Appendix 10 / Drainage Area Plans.

- EX-1 watershed area includes approximately 20.3 acres. Runoff from this watershed flows generally from the high point in the center of the property toward the wetlands around the perimeter of the site. The perimeter wetlands are identified as the point of analysis (EX AP-1).

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

- PR-1, PR-2, and PR-3 watersheds consist of paved roadways, sidewalks, driveways, roofs, lawns, and wooded areas within the proposed development. Runoff within these watersheds is collected by a series of catch basins conveyed by drainage pipes and manholes to the proposed infiltration basins, ultimately discharging at the adjacent wetlands. Analysis points for these watersheds is identified as AP-1, AP-2, AP-3, and AP-4 respectively. See post development watershed plan in appendices.

- PR-4 watershed includes runoff from grass areas of the developed portions of the site in addition to runoff from undeveloped portions of the site. Runoff generated within

this watershed flows overland to the existing Bordering Vegetative Wetlands identified as AP-1.

Post development stormwater runoff will be collected and conveyed via a standard catch basin and manhole collection system to either proposed infiltration basins for treatment, detention, and infiltration. 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 and Massachusetts Wetlands Protection Act.

Compliance with the 10 Stormwater Standards

Standard 1: No new untreated Discharges

The proposed development has one distinct stormwater discharge location. Runoff to location AP-1 from subcatchments PR-1, PR-2, and PR-3 includes the stormwater runoff from the proposed roadways and driveways which will discharge into proposed infiltration basins. Also, contributing to these locations is the runoff from the developed and undeveloped portion of the site which flow overland to the adjacent properties. All impervious areas are collected in deep sump hooded catch basins and discharged to forebays prior to discharging to infiltration basins, this treatment system provides greater than 80% TSS removal discharge from the basins goes to the adjacent wetlands. Clean roof drainage is designed to be discharged to the proposed infiltration basins on-site. Runoff from subcatchment PR-4 consists of non-impervious areas from developed and undeveloped portions of the site which will be discharged to the existing BVW's located within the development.

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 (3.20, 4.70, 5.50, and 6.70 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 five categories – a Paxton Fine Sandy Loam – 305B, 3 to 8% slopes, Hydrologic Group C, a Woodbridge Fine Sandy Loam – 310B, 3 to 8% slopes, Hydrologic Group C/D, Swansea Muck – 51, 0 to 1% slopes, Hydrologic Group B/D, a Whitman Fine Sandy Loam – 73A, 0 to 3% slopes, extremely stony, Hydrologic Group D, and a Ridgebury Fine Sandy Loam – 71B, 3 to 8% slopes, Hydrologic Group D. 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. Watershed EX-1 was used to model the stormwater being discharged to the surrounding wetlands identified as analysis point EX AP-1. The post development condition was evaluated using four watershed areas, PR-1, PR-2, PR-3, PR-4 and one discharge point for analysis, AP-1.

The post development watersheds PR-1, PR-2, and PR-3 consist of paved roadways and driveways, sidewalks, roofs, and lawn areas. All generated runoff is collected in catch basins and discharges into infiltration basins. Runoff generated in sub catchment area PR-4 flows via surface flow in a way like the predevelopment conditions and discharges to the perimeter wetlands. 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 flow rates and volumes do not exceed the pre-development peak flow rates and volumes.

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. See Tables 1A and 1B for a complete summary.

Table 1A: Peak Rate Attenuation Summary

	2-yr Storm	**10-yr Storm**	**25-yr Storm**	**100-yr Storm**
Flow to Analysis Point (AP-1)				
Pre-Development	24.93 cfs	52.32 cfs	68.08 cfs	92.51 cfs
Post-Development	19.36 cfs	43.50 cfs	55.27 cfs	72.75 cfs

Table 1B: Runoff Volume

	2-yr Storm	**10-yr Storm**	**25-yr Storm**	**100-yr Storm**
Flow to Analysis Point (AP-1)				
Pre-Development	1.85 af	3.74 af	4.84 af	6.58 af
Post-Development	1.72 af	3.53 af	4.57 af	6.33 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 3.5 ft Class V RCP will be used. On-site storm drain 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 watershed 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 soils as Chattfield-Hollis-Rock outcrop complexes, Paxton Fine Sandy Loams, and Woodbridge Fine Sandy Loams. The site is an existing undeveloped residential parcel, and 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	None	0
B - *loam*	0.35	None	0
C - *silty loam*	0.25	96,703.2	2,014.7
D - *clay*	0.10	101,364	844.7
		Required Recharge Volume Total	**2859.4 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 Volumes

	Recharge Volume
Basin 1 @ elev. = 252.50	20,233 cf
Basin 2 @ elev. = 242.00	8,390 cf
Total	28,623 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)
Basins 1, 2,3 and 4	Loamy Sand	2.41 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 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	20,233 cf	2,994 sf	34 hours
Basin 2	8,390 cf	3,222 sf	13 hours

A groundwater mounding analysis is required when the vertical separation from the bottom of the exfiltration system to the seasonal high groundwater is less than four (4) feet. The infiltration facilities proposed for the site is designed to receive flows from all storm events with less than four (4) feet separation to groundwater. As such, a groundwater mounding analysis is required per Mass Stormwater Policy requirements.

MS4 Bylaw Compliance:

Based on the Town of Franklin MS4 stormwater bylaw as specified in § 153-16 (B)(1)(a), new developments require the on-site stormwater management systems to be designed to retain the volume of runoff equivalent to, or greater than, one (1.0) inch multiplied by the total post-construction impervious surface area, and/or remove 90% of the average annual load of Total Suspended Solids (TSS) generated from the total post construction impervious area on site and 60% of the average annual load of Total Phosphorous (TP) generated from the post construction impervious surface area on site..

Standard 7 of the MassDEP Stormwater Management Standards indicates that a project that increases the impervious area shall not be considered a redevelopment. This project has never been previously developed so the 1.0-inch requirement will be used in these calculations.

The total site impervious area, including roofs, is 198,067 square feet. The equivalent 1" of runoff from these surfaces is 16,506 cubic feet. The total storage provided below the lowest inverts out are as follows. See Appendix 5 – Stage -Area-Storage calculations.

Basin 1 @ Elev. 252.50 = 20,233 cf
Basin 2 @ Elev. 242.00 = 8,390 cf

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" due to the rapid recharge rates present on the site. Accordingly, 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, 101,902 sf of roof area 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 96,141 square feet of impervious pavement requires a water quality volume of 8,012 cubic feet. Detailed calculations for the infiltration basins 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 trains. The infiltration basin in conjunction with deep sump hooded catch basins and sediment forebays complete the treatment trains at a minimum of 80 percent and 44 percent TSS removal.

Sediment Forebay Sizing

All the stormwater from the impervious pavement is collected and discharged to the proposed sediment forebays which are sized to treat 0.1" of runoff. Detailed calculations for TSS Removal are are included in Appendix 5 / Stage-Area-Storage Calculations.

Basin Forebays:
0.1"/12" per foot x 96,141 sf = 801.2 cf of storage required

Table 6: Sediment Forebay Sizing

	Impervious Area being Discharged	Required Volume	Provided Volume
Basin 1	31,581 sf	263.2 c.f.	672 c.f.
Basin 2	64,556 sf	538.0 c.f.	803 c.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 subject property does not discharge to a critical area. Due to rapid recharge rates present in the infiltration chambers, the Water Quality Volume is calculated using the required 1.0" rule, and 44% TSS removal is achieved prior to discharge to the infiltration basins. See Standard 4 for computations. The design utilizes stormwater BMPs designated as suitable for critical areas within the Massachusetts Stormwater Handbook. No metal roof is proposed.

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 7 will be followed to prevent discharge of erosion to abutting properties.

Standard 9: Operation and Maintenance Plan

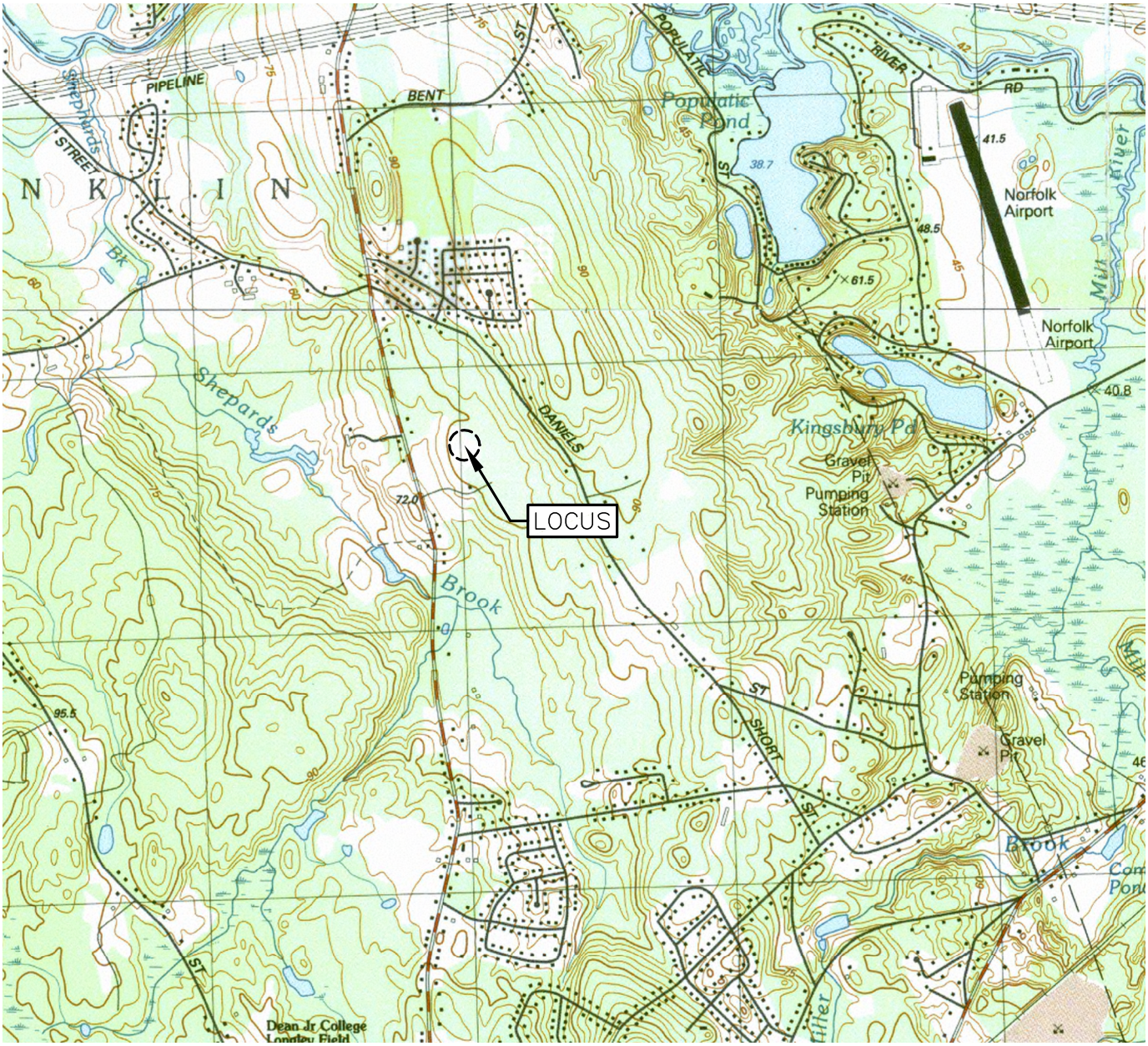
The Operation and Maintenance Plan included in Appendix 8 address the responsibilities of maintaining the stormwater BMPs.

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

FRANKLIN HEIGHTS PARCEL B
Franklin, Massachusetts

Date: July 7, 2022 | *Project No. F-4471*

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

Franklin Heights Parcel B

July 5, 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.

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

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Contents

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group (Franklin Heights Parcel B)

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

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

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

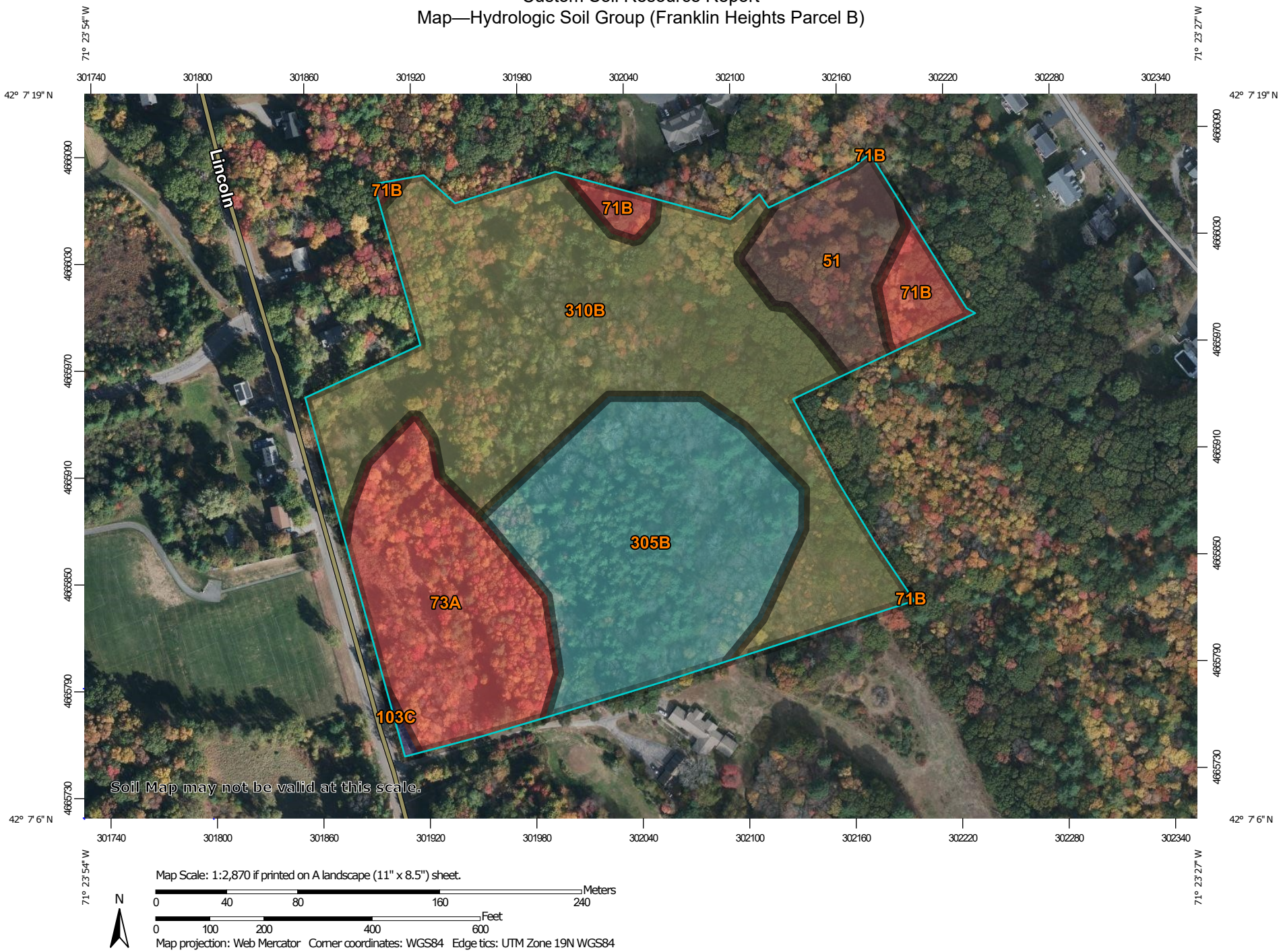
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

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

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

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

Custom Soil Resource Report
Map—Hydrologic Soil Group (Franklin Heights Parcel B)



MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Lines

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Points

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Norfolk and Suffolk Counties, Massachusetts
Survey Area Data: Version 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: Aug 31, 2020—Oct 22, 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.

Table—Hydrologic Soil Group (Franklin Heights Parcel B)

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
51	Swansea muck, 0 to 1 percent slopes	B/D	1.7	8.1%
71B	Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony	D	0.8	4.0%
73A	Whitman fine sandy loam, 0 to 3 percent slopes, extremely stony	D	3.5	17.0%
103C	Charlton-Hollis-Rock outcrop complex, 8 to 15 percent slopes	B	0.0	0.2%
305B	Paxton fine sandy loam, 3 to 8 percent slopes	C	5.2	25.8%
310B	Woodbridge fine sandy loam, 3 to 8 percent slopes	C/D	9.1	44.9%
Totals for Area of Interest			**20.3**	**100.0%**

Rating Options—Hydrologic Soil Group (Franklin Heights Parcel B)

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

Field Soils Evaluation

Appendix 3

TESTING INFORMATION

TESTING DATE: OCTOBER 27, 2005 SOIL EVALUATOR: DONALD R. NEILSEN

240.9 TP 10

LOAM	0"–6"
SANDY LOAM	6"–24"
VERY FINE SAND (REDDISH)	24"–48"

236.9 GW@15"

235.9 TP 11

LOAM	0"–6"
SANDY LOAM	6"–13"
VERY FINE SAND	13"

234.8 SEEPAGE @13"

237.5 TP 12

LOAM	0"–6"
SANDY LOAM	6"–26"
VERY FINE SAND	26"–52"

233.2 GW WEEPING @ 24"

236.3 TP 13

LOAM	0"–6"
SANDY LOAM	6"–24"
VERY FINE SAND	24"–38"

233.1 GW@24"

247.1 TP 14

LOAM	0"–6"
SANDY LOAM	6"–27"
VERY FINE SAND	27"–48"

243.1 GW@27"

253.7 TP 15

LOAM	0"–6"
SANDY LOAM	6"–24"
VERY FINE SAND	24"–48"

249.7 GW@24"

254.4 TP 16

LOAM	0"–6"
SANDY LOAM	6"–24"
VERY FINE SAND	24"–52"

250.1 GW@24"

255.7 TP 17

LOAM	0"–6"
SANDY LOAM	6"–24"
VERY FINE SAND	24"

253.7 GW@13"
REFUSAL@24"

254.8 TP 18

LOAM	0"–6"
SANDY LOAM	6"–24"
VERY FINE SAND	24"

252.8 GW@16"
FRACTURED ROCK

251.0 TP 19

LOAM	0"–6"
SANDY LOAM	6"–24"
VERY FINE SAND	24"–40"

247.7 GW@16"

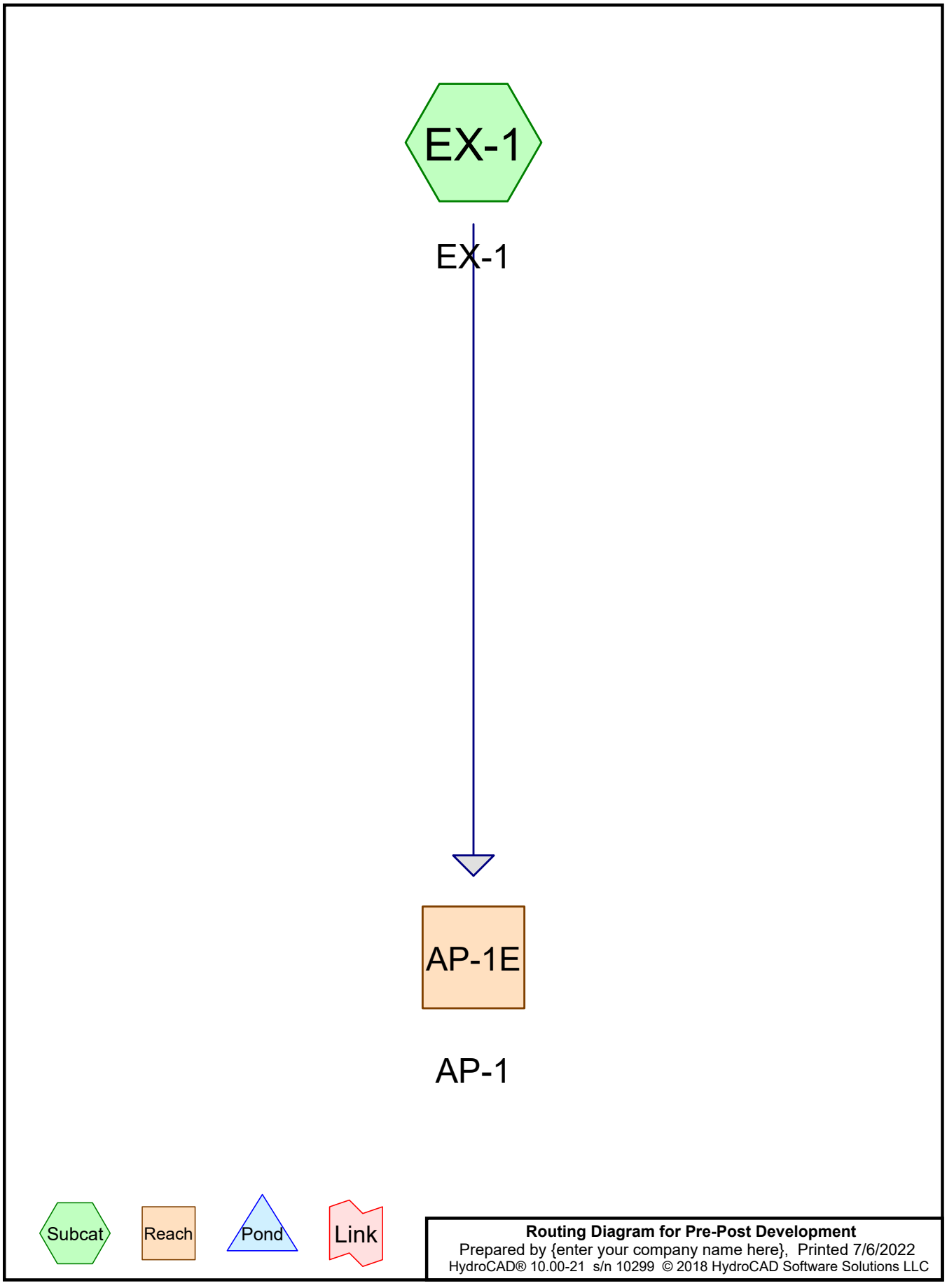
249.3 TP 20

LOAM	0"–6"
SANDY LOAM	6"–18"
VERY FINE SAND	18"–36"

246.3 GW@3'

HydroCAD Calculations

Appendix 4



Routing Diagram for Pre-Post Development
Prepared by {enter your company name here}, Printed 7/6/2022

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.016	65	Brush, Good, HSG C (EX-1)
2.660	73	Brush, Good, HSG D (EX-1)
5.221	70	Woods, Good, HSG C (EX-1)
12.405	77	Woods, Good, HSG D (EX-1)
20.302	**75**	**TOTAL AREA**

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment EX-1: EX-1 Runoff Area=20.302 ac 0.00% Impervious Runoff Depth=1.09"
Tc=6.0 min CN=75 Runoff=24.93 cfs 1.851 af

Reach AP-1E: AP-1 Inflow=24.93 cfs 1.851 af
Outflow=24.93 cfs 1.851 af

Total Runoff Area = 20.302 ac Runoff Volume = 1.851 af Average Runoff Depth = 1.09"
100.00% Pervious = 20.302 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment EX-1: EX-1

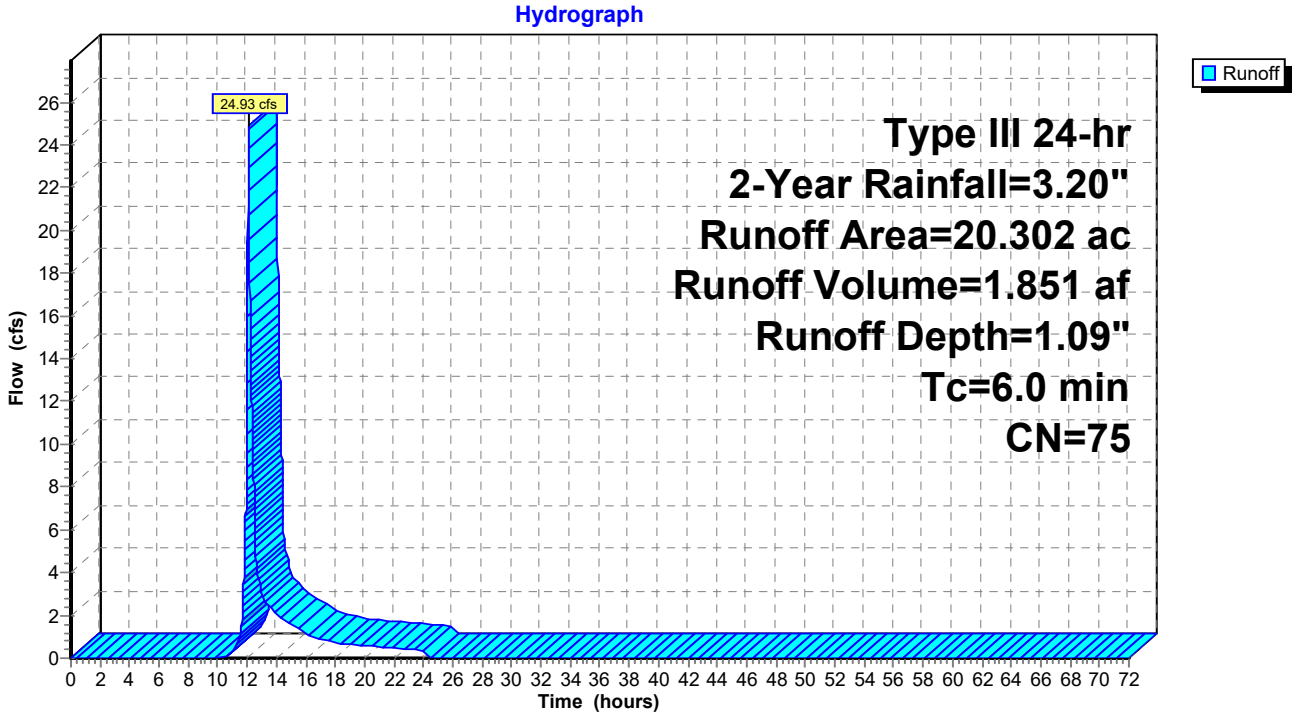
Runoff = 24.93 cfs @ 12.09 hrs, Volume= 1.851 af, Depth= 1.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.20"

Area (ac)	CN	Description
5.221	70	Woods, Good, HSG C
12.405	77	Woods, Good, HSG D
0.016	65	Brush, Good, HSG C
2.660	73	Brush, Good, HSG D
20.302	75	Weighted Average
20.302		100.00% Pervious Area

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

Subcatchment EX-1: EX-1



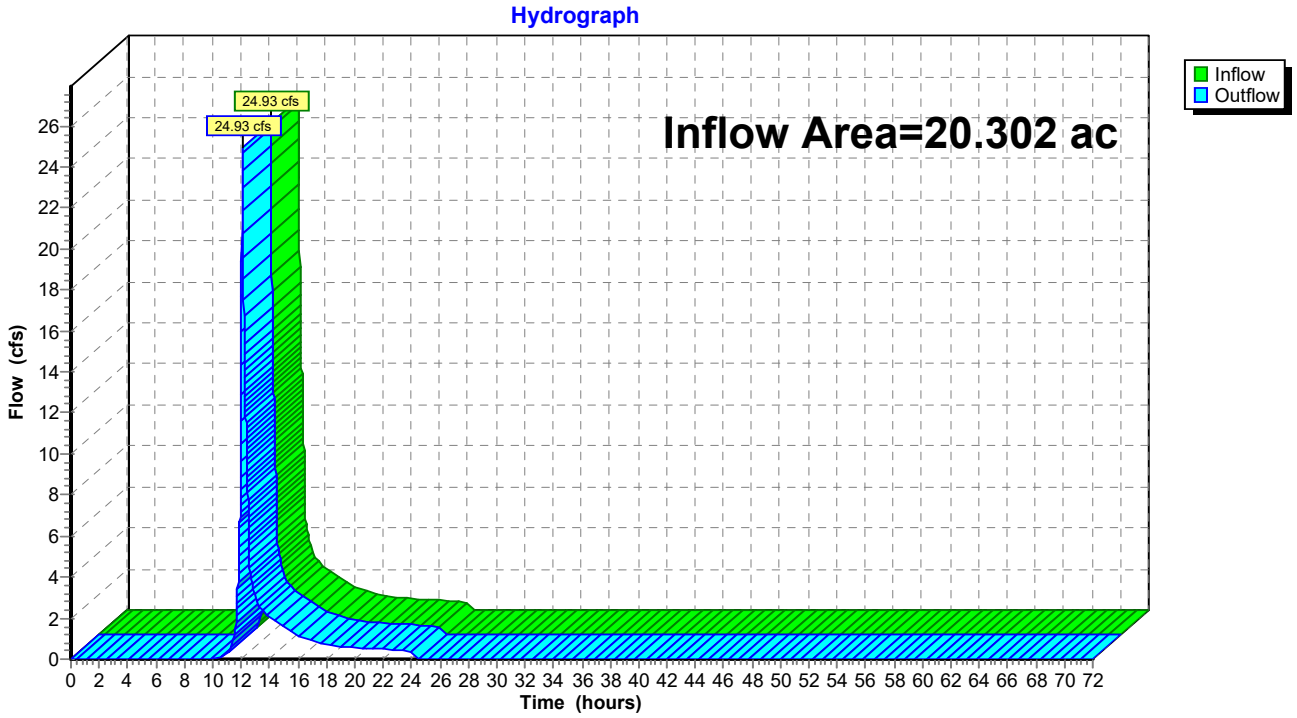
Summary for Reach AP-1E: AP-1

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

Inflow Area = 20.302 ac, 0.00% Impervious, Inflow Depth = 1.09" for 2-Year event
Inflow = 24.93 cfs @ 12.09 hrs, Volume= 1.851 af
Outflow = 24.93 cfs @ 12.09 hrs, Volume= 1.851 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

Reach AP-1E: AP-1



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment EX-1: EX-1 Runoff Area=20.302 ac 0.00% Impervious Runoff Depth=2.21"
Tc=6.0 min CN=75 Runoff=52.32 cfs 3.736 af

Reach AP-1E: AP-1 Inflow=52.32 cfs 3.736 af
Outflow=52.32 cfs 3.736 af

Total Runoff Area = 20.302 ac Runoff Volume = 3.736 af Average Runoff Depth = 2.21"
100.00% Pervious = 20.302 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment EX-1: EX-1

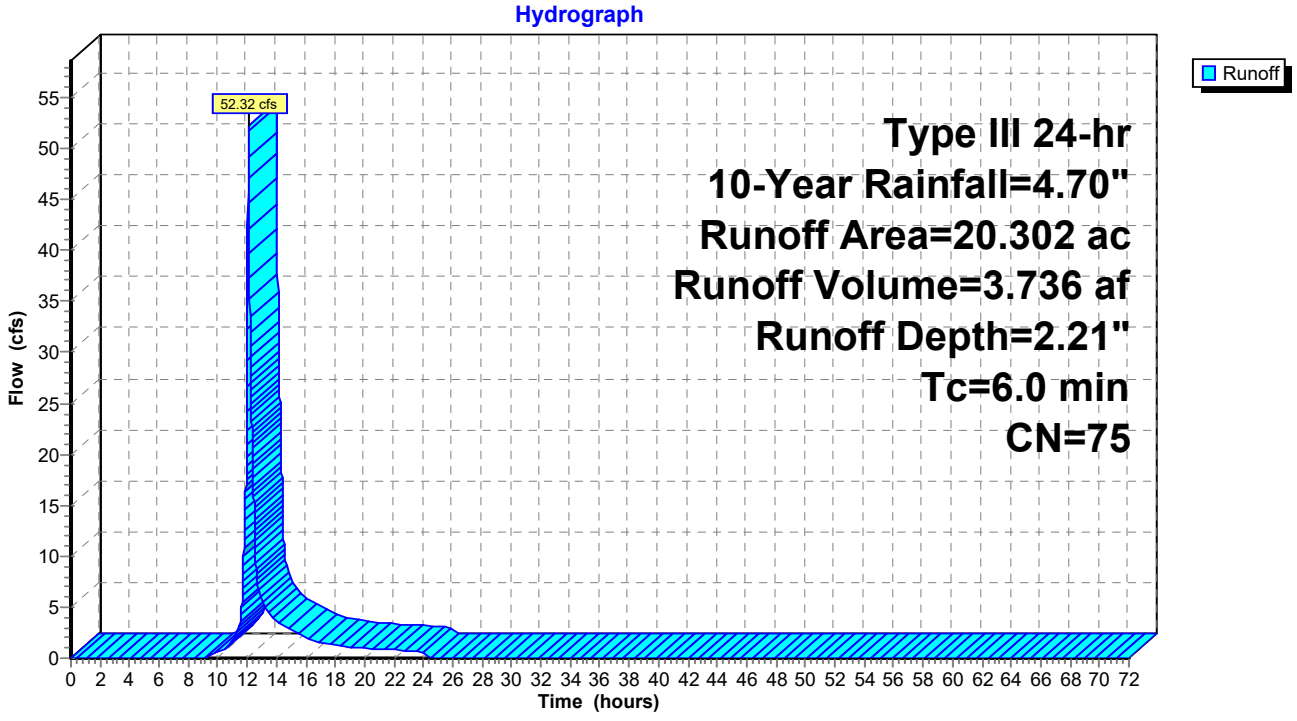
Runoff = 52.32 cfs @ 12.09 hrs, Volume= 3.736 af, Depth= 2.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.70"

Area (ac)	CN	Description
5.221	70	Woods, Good, HSG C
12.405	77	Woods, Good, HSG D
0.016	65	Brush, Good, HSG C
2.660	73	Brush, Good, HSG D
20.302	75	Weighted Average
20.302		100.00% Pervious Area

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

Subcatchment EX-1: EX-1



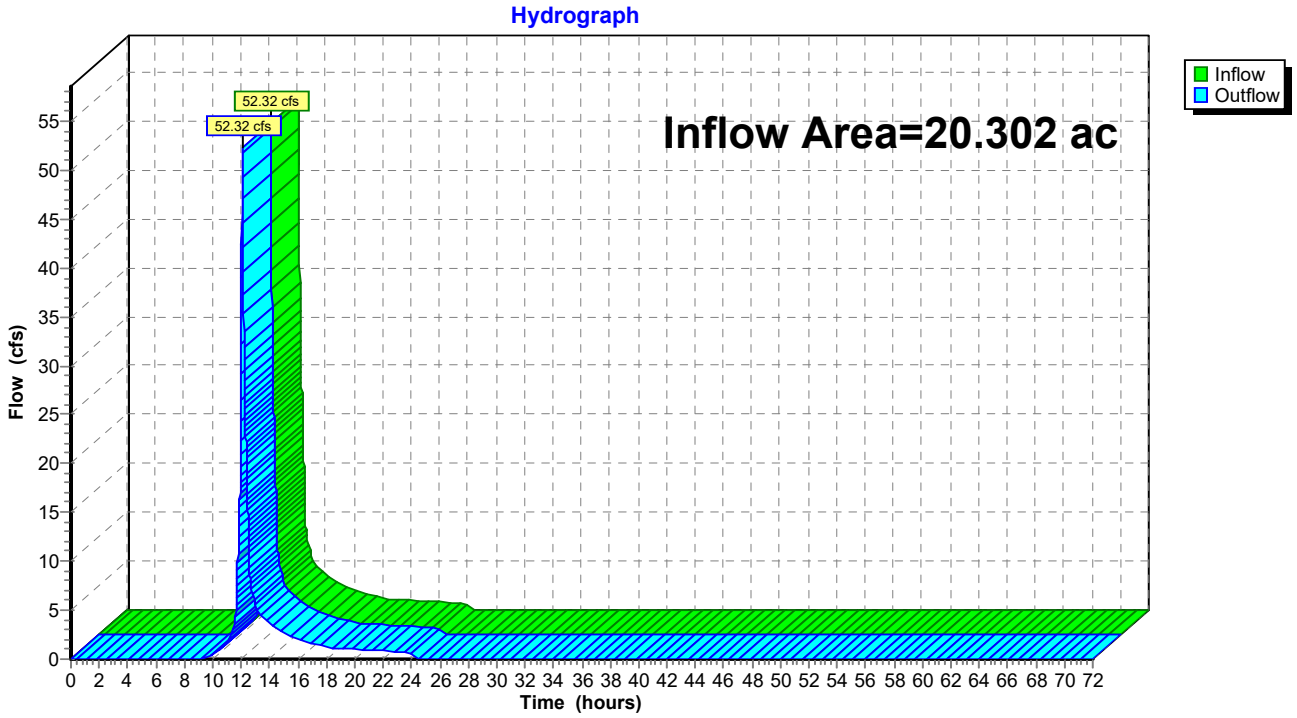
Summary for Reach AP-1E: AP-1

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

Inflow Area = 20.302 ac, 0.00% Impervious, Inflow Depth = 2.21" for 10-Year event
Inflow = 52.32 cfs @ 12.09 hrs, Volume= 3.736 af
Outflow = 52.32 cfs @ 12.09 hrs, Volume= 3.736 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

Reach AP-1E: AP-1



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment EX-1: EX-1 Runoff Area=20.302 ac 0.00% Impervious Runoff Depth=2.86"
Tc=6.0 min CN=75 Runoff=68.08 cfs 4.840 af

Reach AP-1E: AP-1 Inflow=68.08 cfs 4.840 af
Outflow=68.08 cfs 4.840 af

Total Runoff Area = 20.302 ac Runoff Volume = 4.840 af Average Runoff Depth = 2.86"
100.00% Pervious = 20.302 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment EX-1: EX-1

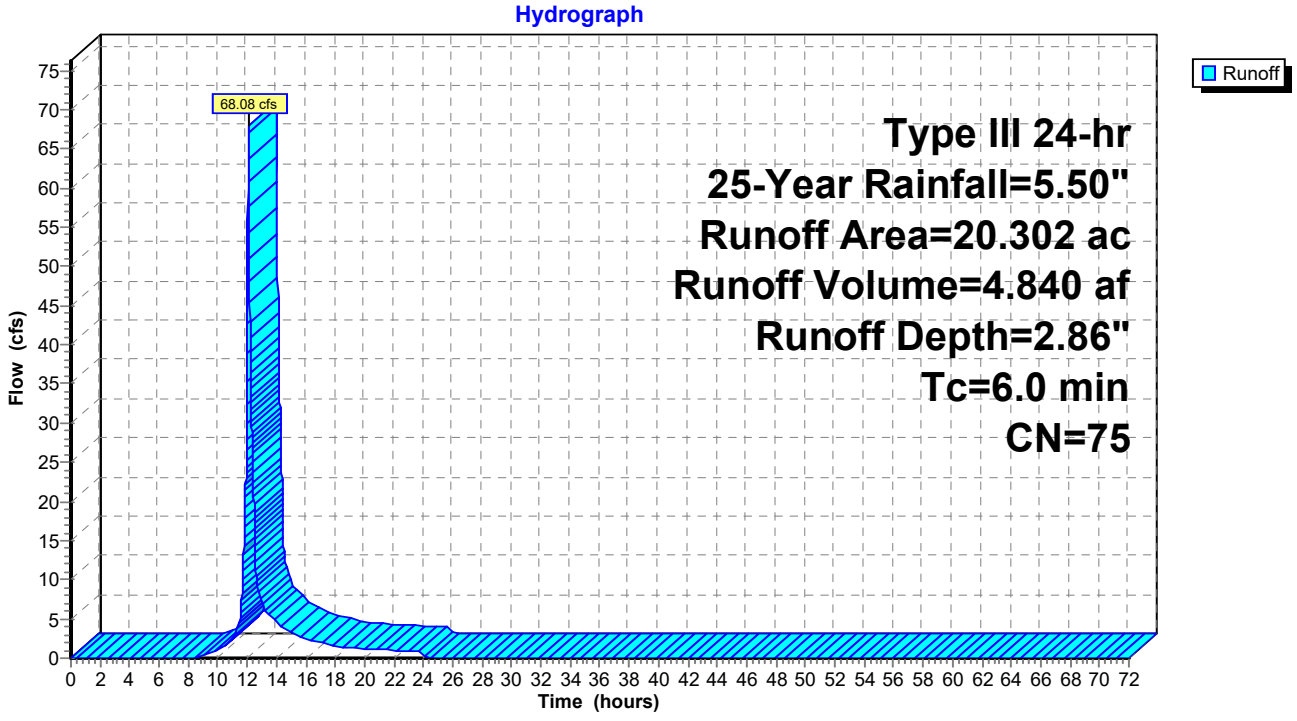
Runoff = 68.08 cfs @ 12.09 hrs, Volume= 4.840 af, Depth= 2.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.50"

Area (ac)	CN	Description
5.221	70	Woods, Good, HSG C
12.405	77	Woods, Good, HSG D
0.016	65	Brush, Good, HSG C
2.660	73	Brush, Good, HSG D
20.302	75	Weighted Average
20.302		100.00% Pervious Area

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

Subcatchment EX-1: EX-1



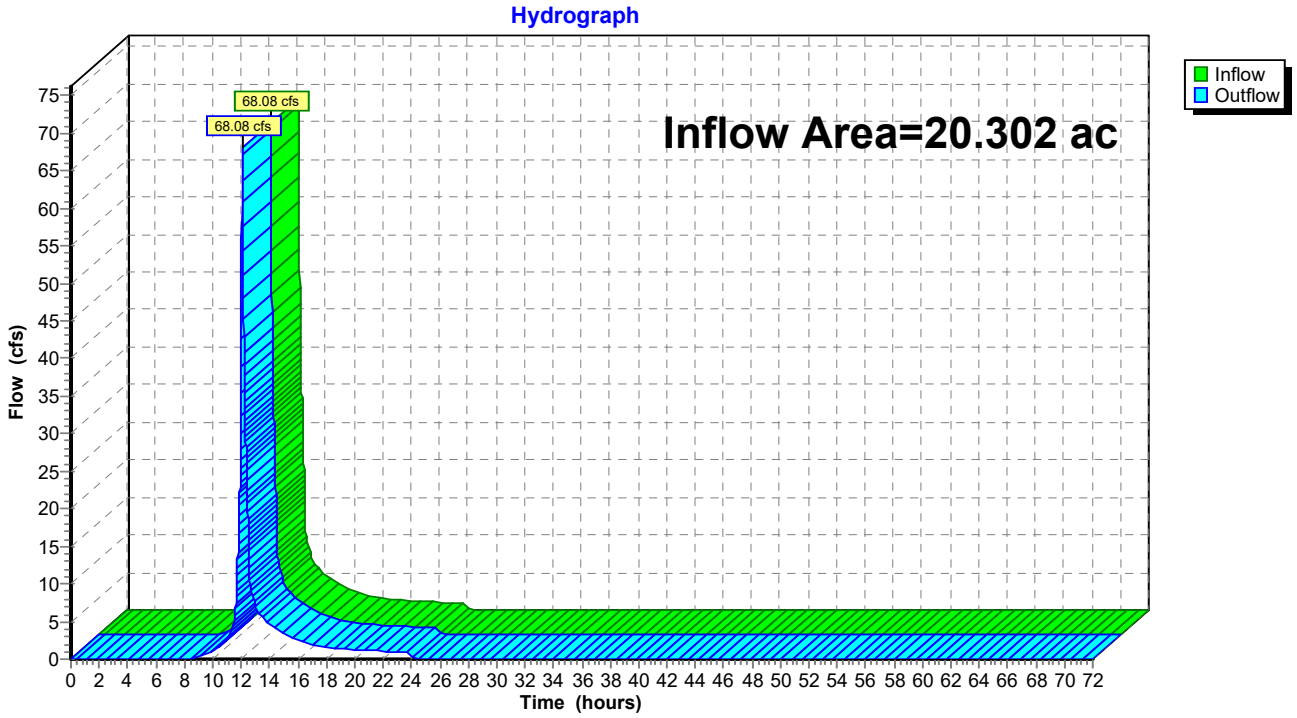
Summary for Reach AP-1E: AP-1

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

Inflow Area = 20.302 ac, 0.00% Impervious, Inflow Depth = 2.86" for 25-Year event
Inflow = 68.08 cfs @ 12.09 hrs, Volume= 4.840 af
Outflow = 68.08 cfs @ 12.09 hrs, Volume= 4.840 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

Reach AP-1E: AP-1



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment EX-1: EX-1 Runoff Area=20.302 ac 0.00% Impervious Runoff Depth=3.89"
Tc=6.0 min CN=75 Runoff=92.51 cfs 6.575 af

Reach AP-1E: AP-1 Inflow=92.51 cfs 6.575 af
Outflow=92.51 cfs 6.575 af

Total Runoff Area = 20.302 ac Runoff Volume = 6.575 af Average Runoff Depth = 3.89"
100.00% Pervious = 20.302 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment EX-1: EX-1

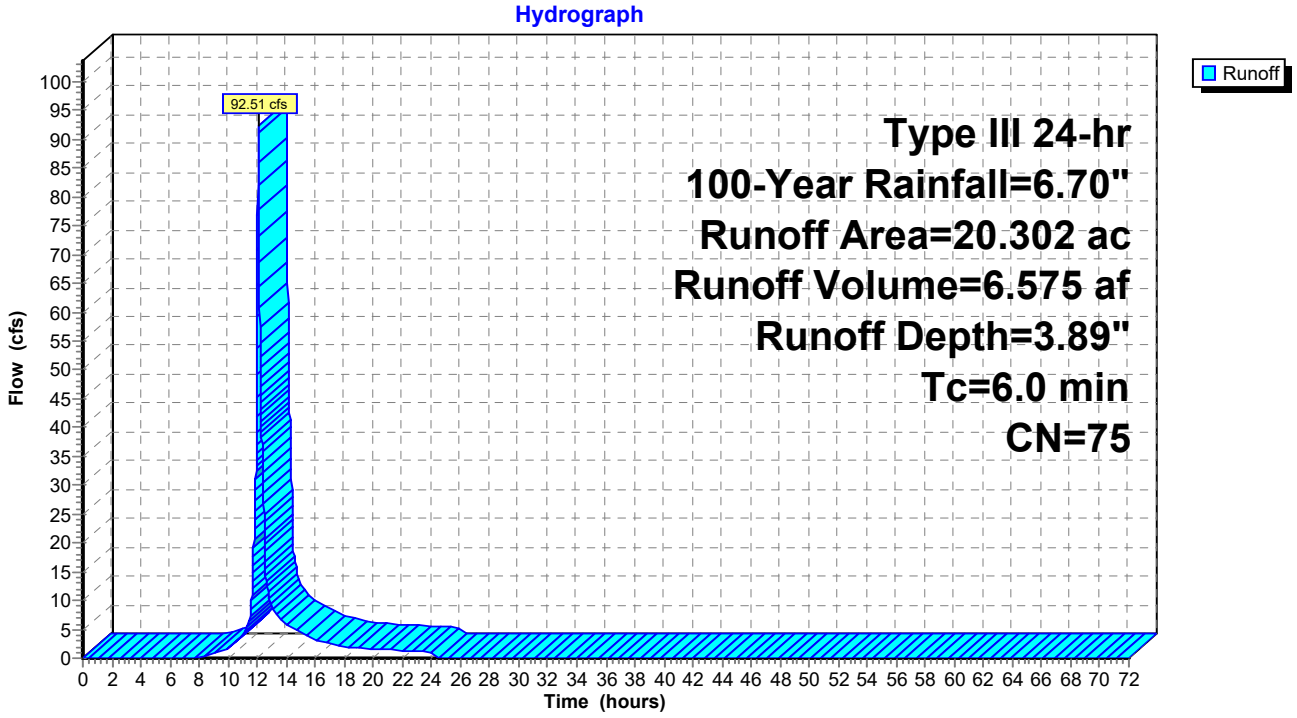
Runoff = 92.51 cfs @ 12.09 hrs, Volume= 6.575 af, Depth= 3.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (ac)	CN	Description
5.221	70	Woods, Good, HSG C
12.405	77	Woods, Good, HSG D
0.016	65	Brush, Good, HSG C
2.660	73	Brush, Good, HSG D
20.302	75	Weighted Average
20.302		100.00% Pervious Area

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

Subcatchment EX-1: EX-1



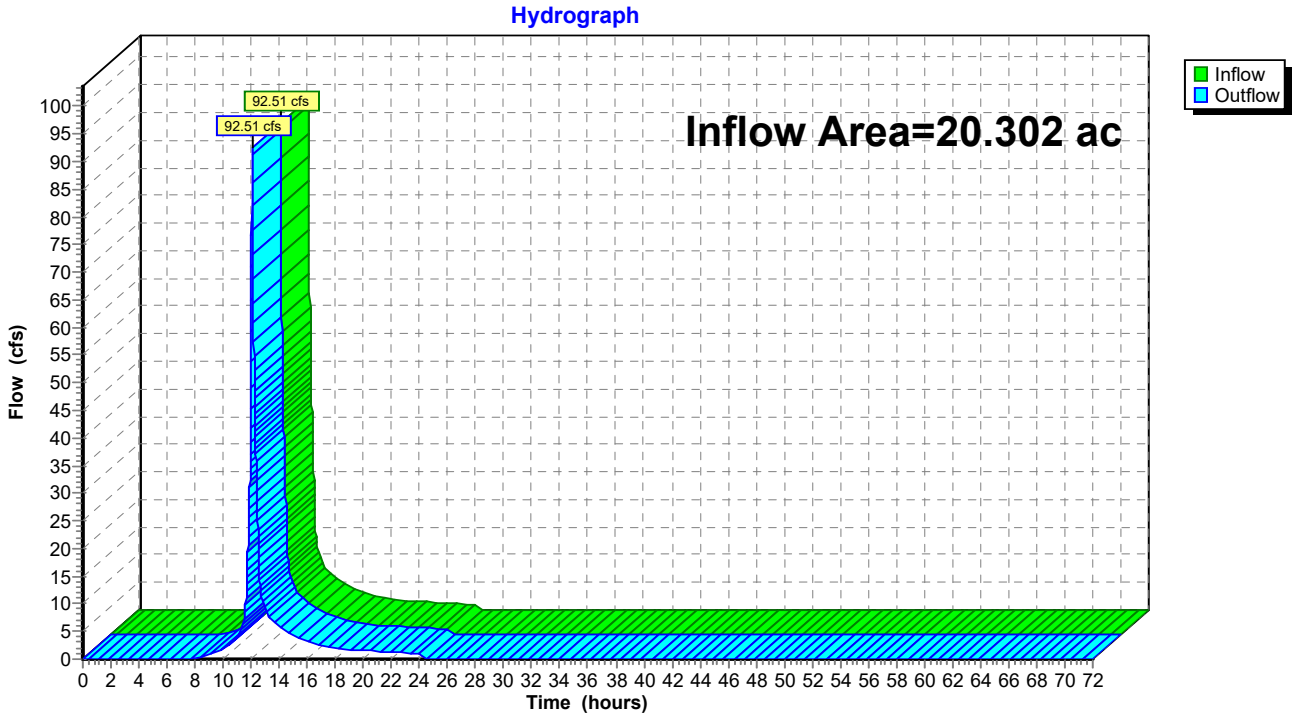
Summary for Reach AP-1E: AP-1

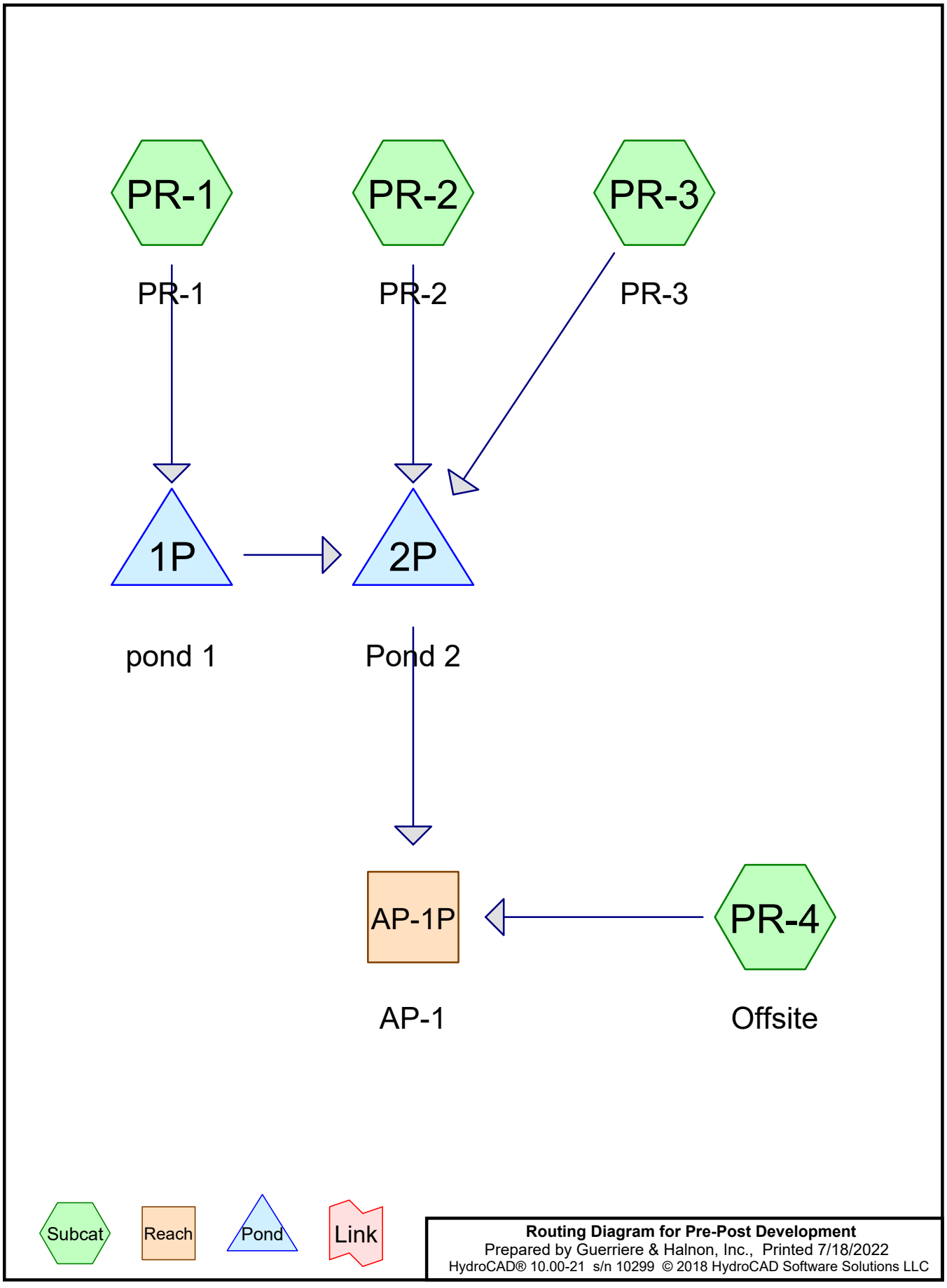
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 20.302 ac, 0.00% Impervious, Inflow Depth = 3.89" for 100-Year event
Inflow = 92.51 cfs @ 12.09 hrs, Volume= 6.575 af
Outflow = 92.51 cfs @ 12.09 hrs, Volume= 6.575 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

Reach AP-1E: AP-1





Routing Diagram for Pre-Post Development
Prepared by Guerriere & Halnon, Inc., Printed 7/18/2022

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
2.370	74	>75% Grass cover, Good, HSG C (PR-1, PR-2, PR-3, PR-4)
3.006	80	>75% Grass cover, Good, HSG D (PR-1, PR-2, PR-3, PR-4)
2.667	73	Brush, Good, HSG D (PR-4)
1.052	98	Paved roads w/curbs & sewers, HSG C (PR-1, PR-2, PR-3)
1.155	98	Paved roads w/curbs & sewers, HSG D (PR-1, PR-2)
1.168	98	Roofs, HSG C (PR-1, PR-2, PR-3)
1.172	98	Roofs, HSG D (PR-1, PR-2, PR-3)
0.637	70	Woods, Good, HSG C (PR-4)
7.194	77	Woods, Good, HSG D (PR-4)
20.421	**81**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
5.226	HSG C	PR-1, PR-2, PR-3, PR-4
15.194	HSG D	PR-1, PR-2, PR-3, PR-4
0.000	Other	
20.421		**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
0.000	0.000	2.370	3.006	0.000	5.376	>75% Grass cover, Good	PR-1, PR-2, PR-3, PR-4
0.000	0.000	0.000	2.667	0.000	2.667	Brush, Good	PR-4
0.000	0.000	1.052	1.155	0.000	2.207	Paved roads w/curbs & sewers	PR-1, PR-2, PR-3
0.000	0.000	1.168	1.172	0.000	2.339	Roofs	PR-1, PR-2, PR-3
0.000	0.000	0.637	7.194	0.000	7.830	Woods, Good	PR-4
0.000	**0.000**	**5.226**	**15.194**	**0.000**	**20.421**	**TOTAL AREA**	

Summary for Subcatchment PR-1: PR-1

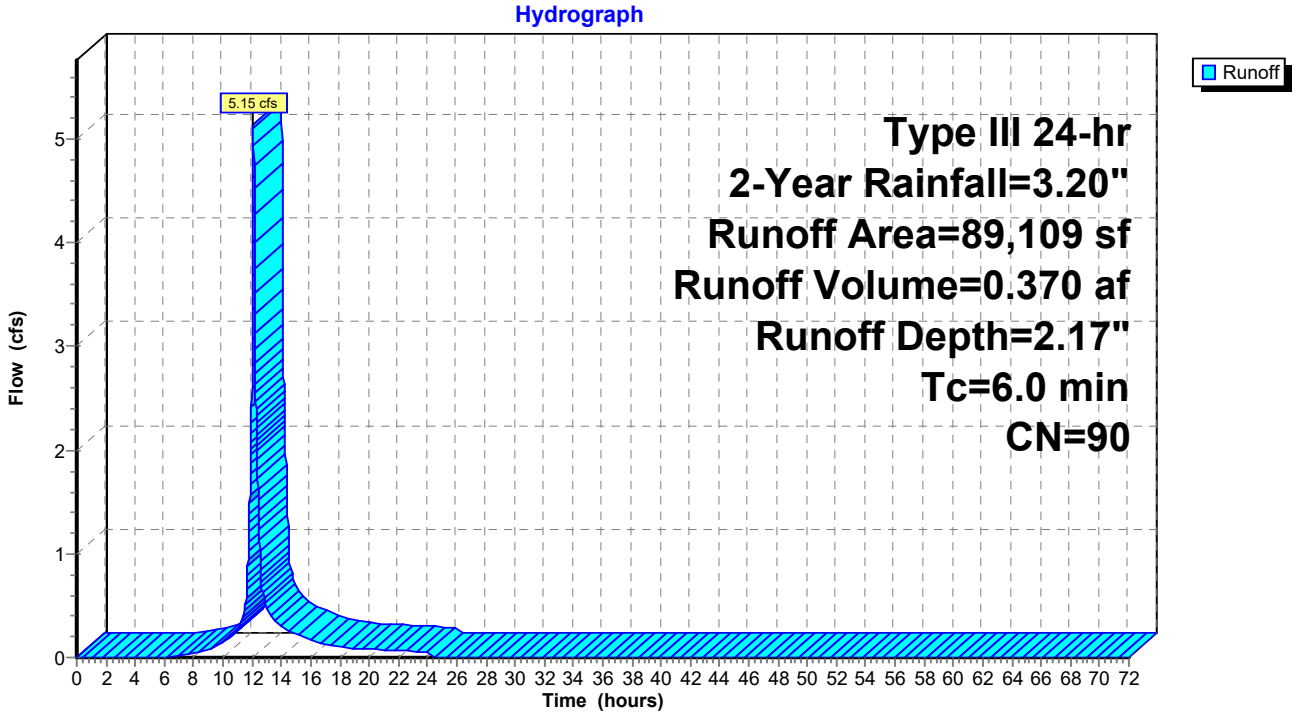
Runoff = 5.15 cfs @ 12.09 hrs, Volume= 0.370 af, Depth= 2.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.20"

Area (sf)	CN	Description
10,416	74	>75% Grass cover, Good, HSG C
26,073	80	>75% Grass cover, Good, HSG D
13,684	98	Paved roads w/curbs & sewers, HSG C
17,897	98	Paved roads w/curbs & sewers, HSG D
2,136	98	Roofs, HSG C
18,903	98	Roofs, HSG D
89,109	90	Weighted Average
36,489		40.95% Pervious Area
52,620		59.05% Impervious Area

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

Subcatchment PR-1: PR-1



Summary for Subcatchment PR-2: PR-2

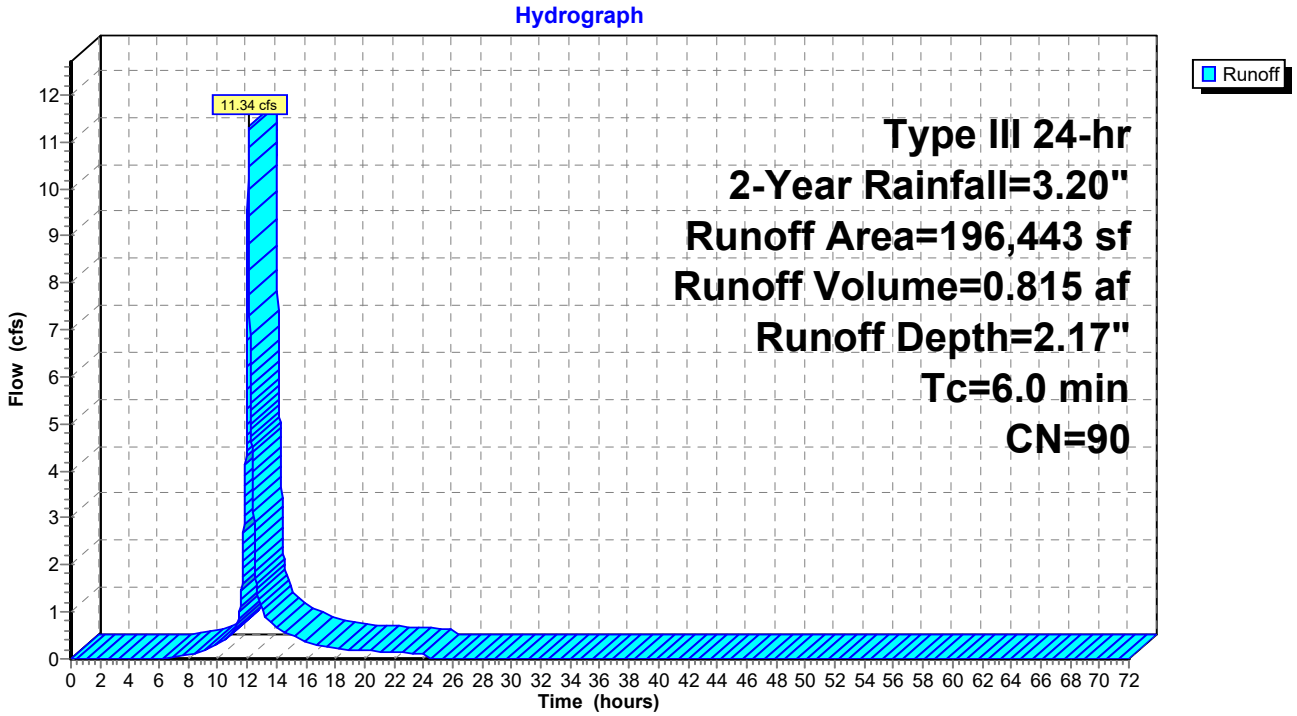
Runoff = 11.34 cfs @ 12.09 hrs, Volume= 0.815 af, Depth= 2.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.20"

Area (sf)	CN	Description
45,318	74	>75% Grass cover, Good, HSG C
30,603	80	>75% Grass cover, Good, HSG D
19,489	98	Paved roads w/curbs & sewers, HSG C
27,247	98	Paved roads w/curbs & sewers, HSG D
5,175	98	Paved roads w/curbs & sewers, HSG D
39,436	98	Roofs, HSG C
29,175	98	Roofs, HSG D
196,443	90	Weighted Average
75,921		38.65% Pervious Area
120,522		61.35% Impervious Area

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

Subcatchment PR-2: PR-2



Summary for Subcatchment PR-3: PR-3

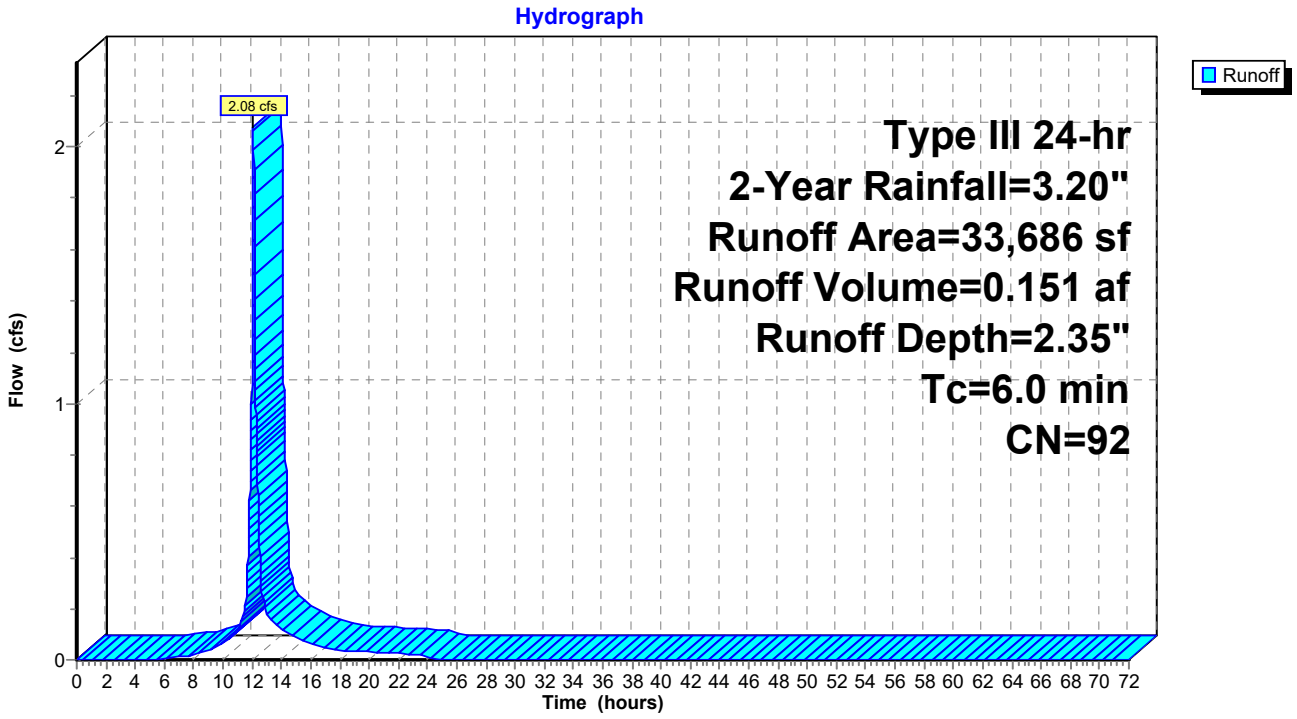
Runoff = 2.08 cfs @ 12.09 hrs, Volume= 0.151 af, Depth= 2.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.20"

Area (sf)	CN	Description
7,184	74	>75% Grass cover, Good, HSG C
1,601	80	>75% Grass cover, Good, HSG D
12,649	98	Paved roads w/curbs & sewers, HSG C
9,293	98	Roofs, HSG C
2,959	98	Roofs, HSG D
33,686	92	Weighted Average
8,785		26.08% Pervious Area
24,901		73.92% Impervious Area

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

Subcatchment PR-3: PR-3



Summary for Subcatchment PR-4: Offsite

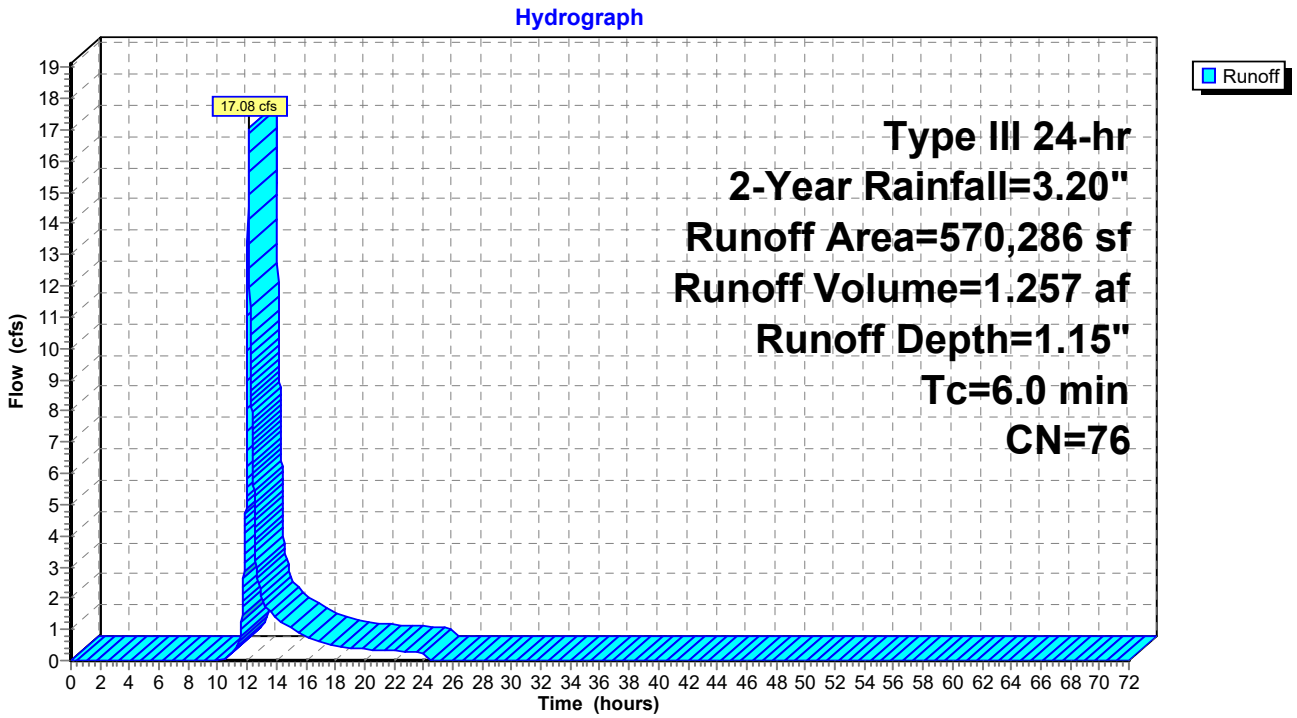
Runoff = 17.08 cfs @ 12.09 hrs, Volume= 1.257 af, Depth= 1.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.20"

Area (sf)	CN	Description
40,322	74	>75% Grass cover, Good, HSG C
72,681	80	>75% Grass cover, Good, HSG D
27,738	70	Woods, Good, HSG C
313,352	77	Woods, Good, HSG D
116,193	73	Brush, Good, HSG D
570,286	76	Weighted Average
570,286		100.00% Pervious Area

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

Subcatchment PR-4: Offsite

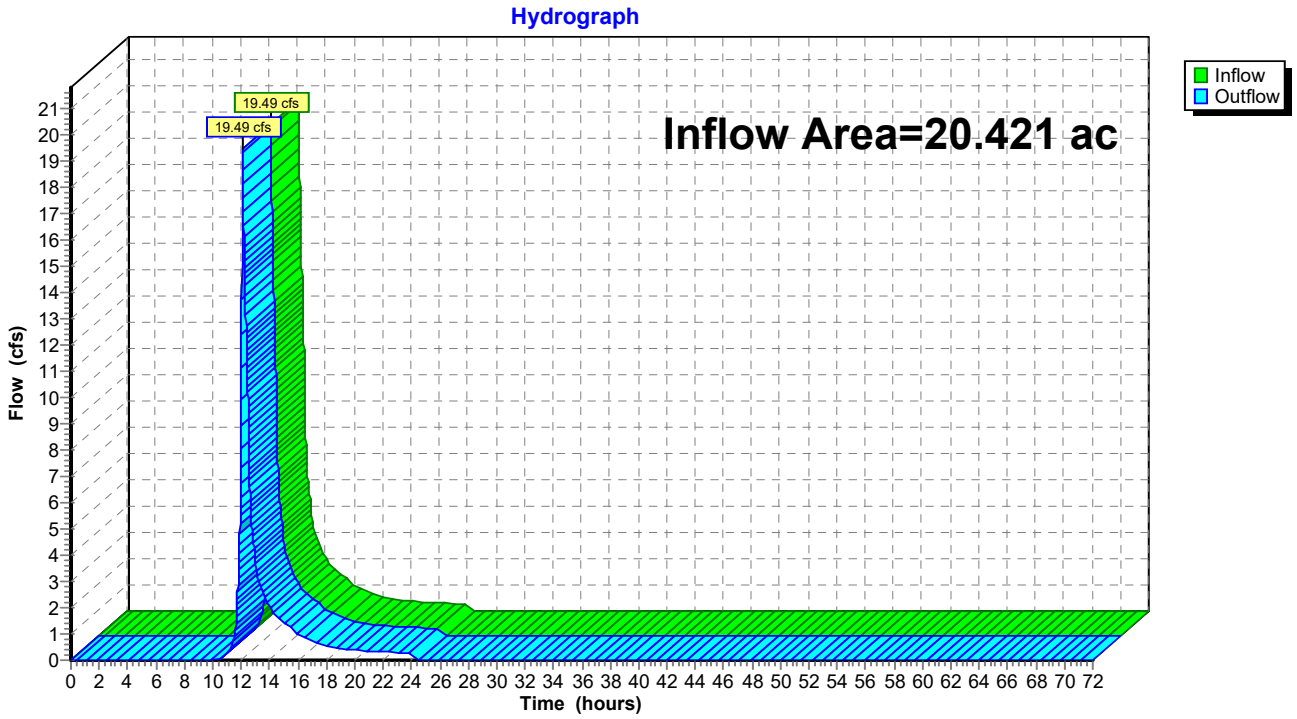


Summary for Reach AP-1P: AP-1

Inflow Area = 20.421 ac, 22.26% Impervious, Inflow Depth = 1.01" for 2-Year event
Inflow = 19.49 cfs @ 12.11 hrs, Volume= 1.727 af
Outflow = 19.49 cfs @ 12.11 hrs, Volume= 1.727 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

Reach AP-1P: AP-1



Summary for Pond 1P: pond 1

Inflow Area = 2.046 ac, 59.05% Impervious, Inflow Depth = 2.17" for 2-Year event
Inflow = 5.15 cfs @ 12.09 hrs, Volume= 0.370 af
Outflow = 0.26 cfs @ 14.53 hrs, Volume= 0.370 af, Atten= 95%, Lag= 146.6 min
Discarded = 0.26 cfs @ 14.53 hrs, Volume= 0.370 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 250.53' @ 14.53 hrs Surf.Area= 4,693 sf Storage= 8,250 cf
Flood Elev= 253.00' Surf.Area= 6,979 sf Storage= 23,924 cf

Plug-Flow detention time= 329.4 min calculated for 0.370 af (100% of inflow)
Center-of-Mass det. time= 329.4 min (1,136.3 - 806.9)

Volume	Invert	Avail.Storage	Storage Description
#1	248.50'	22,156 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	249.00'	1,768 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) -Impervious
		23,924 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
248.50	2,994	0	0
249.00	3,391	1,596	1,596
251.00	5,095	8,486	10,082
253.00	6,979	12,074	22,156

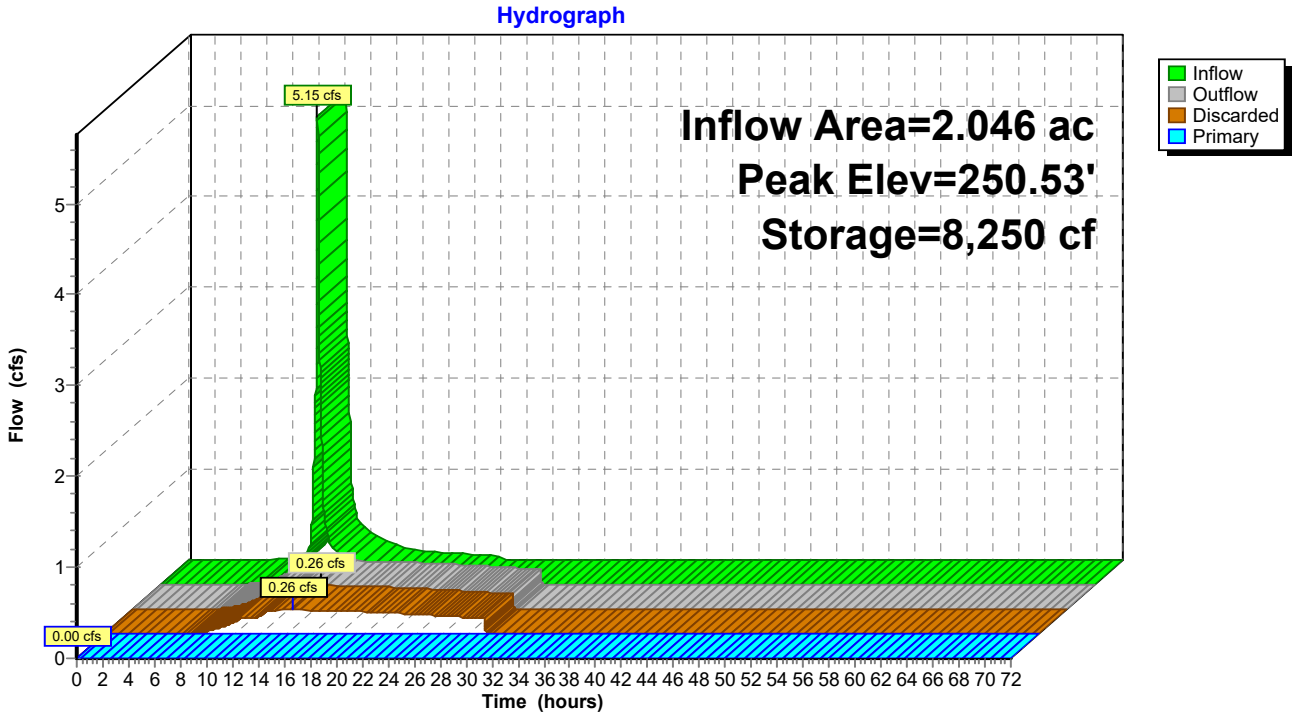
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
249.00	240	0	0
251.00	432	672	672
252.00	545	489	1,161
253.00	669	607	1,768

Device	Routing	Invert	Outlet Devices
#1	Primary	247.00'	**12.0" Round Culvert** L= 60.4' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 247.00' / 245.00' S= 0.0331 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	252.50'	**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
#3	Discarded	248.50'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

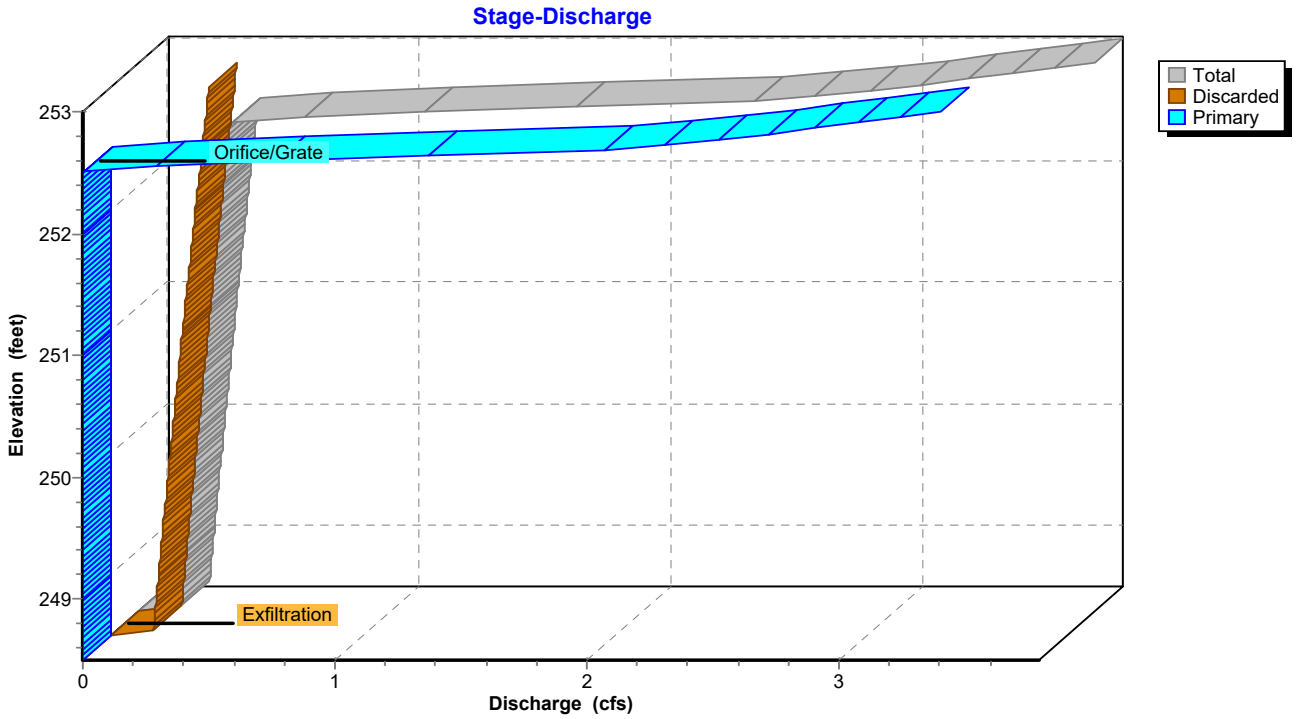
Discarded OutFlow Max=0.26 cfs @ 14.53 hrs HW=250.53' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.26 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=248.50' TW=240.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 0.00 cfs of 3.34 cfs potential flow)
└**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 1P: pond 1



Pond 1P: pond 1



Summary for Pond 2P: Pond 2

Inflow Area = 7.329 ac, 62.04% Impervious, Inflow Depth = 1.58" for 2-Year event
Inflow = 13.42 cfs @ 12.09 hrs, Volume= 0.966 af
Outflow = 5.63 cfs @ 12.30 hrs, Volume= 0.966 af, Atten= 58%, Lag= 12.7 min
Discarded = 0.30 cfs @ 12.30 hrs, Volume= 0.496 af
Primary = 5.33 cfs @ 12.30 hrs, Volume= 0.470 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 243.15' @ 12.30 hrs Surf.Area= 5,390 sf Storage= 14,783 cf
Flood Elev= 245.50' Surf.Area= 7,294 sf Storage= 31,542 cf

Plug-Flow detention time= 215.0 min calculated for 0.966 af (100% of inflow)
Center-of-Mass det. time= 215.0 min (1,020.5 - 805.5)

Volume	Invert	Avail.Storage	Storage Description
#1	240.00'	32,043 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	240.50'	3,767 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) -Impervious
		35,810 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
240.00	3,222	0	0
242.00	4,527	7,749	7,749
244.00	6,025	10,552	18,301
246.00	7,717	13,742	32,043

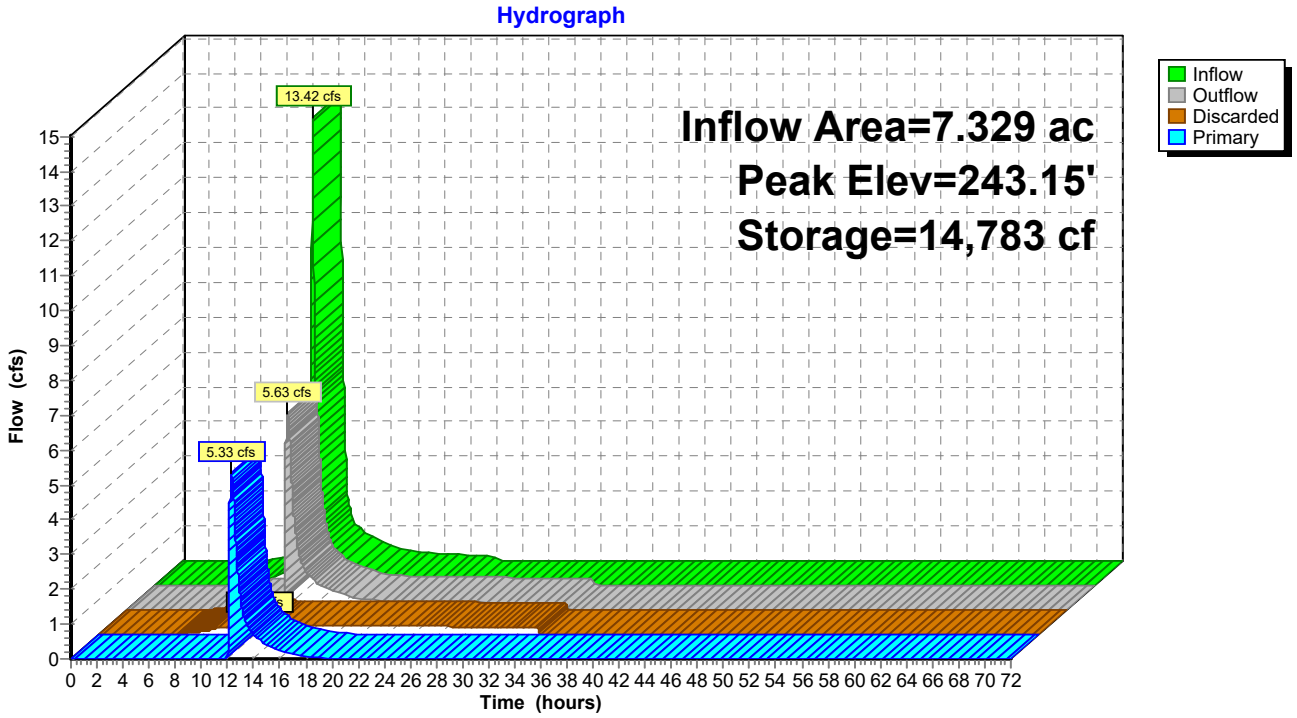
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
240.50	341	0	0
242.00	513	641	641
244.00	774	1,287	1,928
245.00	918	846	2,774
246.00	1,069	994	3,767

Device	Routing	Invert	Outlet Devices
#1	Primary	234.00'	**15.0" Round Culvert** L= 61.6' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 234.00' / 230.00' S= 0.0649 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Device 1	242.00'	**18.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	245.50'	**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
#4	Discarded	240.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.30 cfs @ 12.30 hrs HW=243.15' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.30 cfs)

Primary OutFlow Max=5.33 cfs @ 12.30 hrs HW=243.15' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 5.33 cfs of 15.23 cfs potential flow)
└**2=Orifice/Grate** (Orifice Controls 5.33 cfs @ 3.66 fps)
└**3=Broad-Crested Rectangular Weir**(Controls 0.00 cfs)

Pond 2P: Pond 2



Summary for Subcatchment PR-1: PR-1

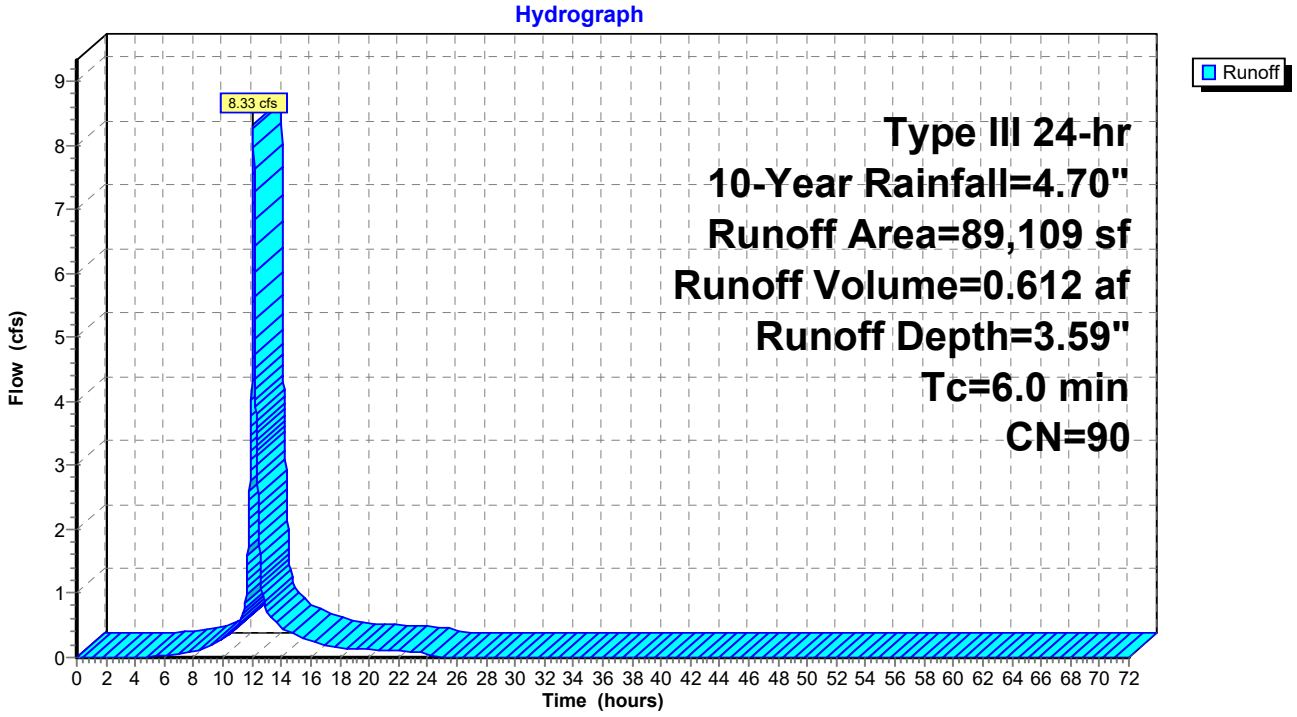
Runoff = 8.33 cfs @ 12.09 hrs, Volume= 0.612 af, Depth= 3.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.70"

Area (sf)	CN	Description
10,416	74	>75% Grass cover, Good, HSG C
26,073	80	>75% Grass cover, Good, HSG D
13,684	98	Paved roads w/curbs & sewers, HSG C
17,897	98	Paved roads w/curbs & sewers, HSG D
2,136	98	Roofs, HSG C
18,903	98	Roofs, HSG D
89,109	90	Weighted Average
36,489		40.95% Pervious Area
52,620		59.05% Impervious Area

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

Subcatchment PR-1: PR-1



Summary for Subcatchment PR-2: PR-2

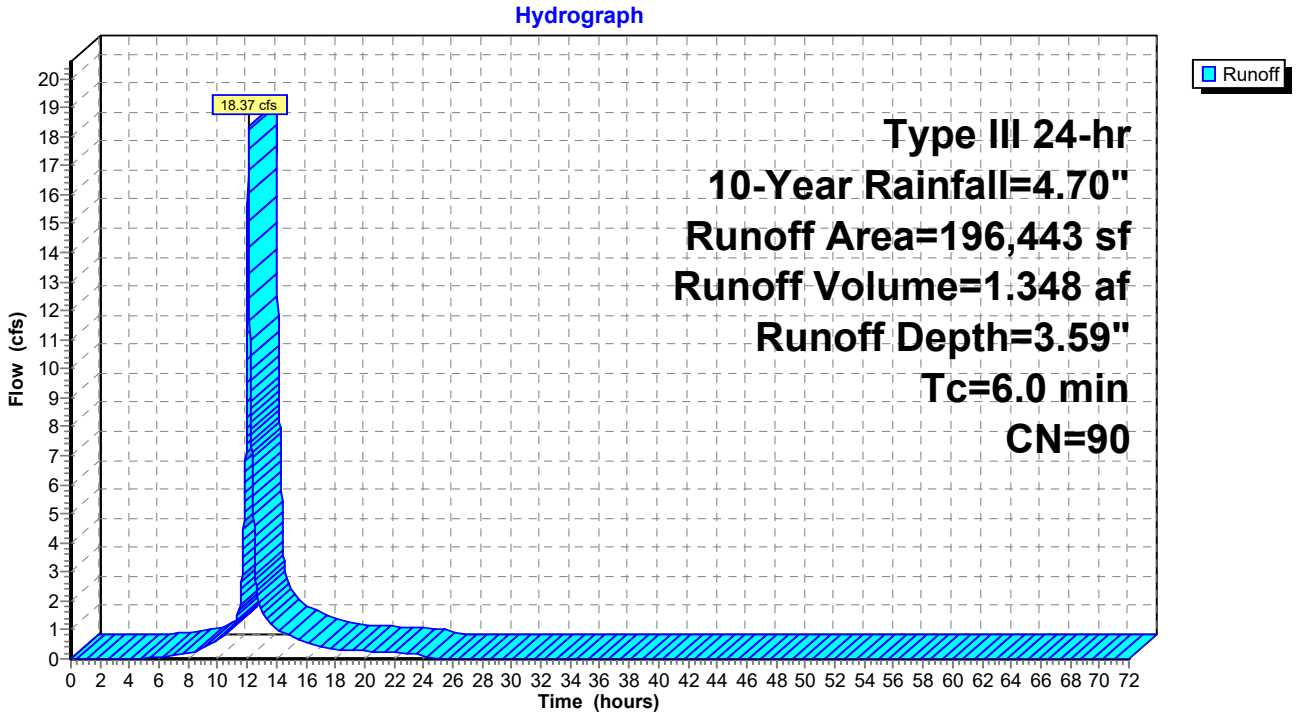
Runoff = 18.37 cfs @ 12.09 hrs, Volume= 1.348 af, Depth= 3.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.70"

Area (sf)	CN	Description
45,318	74	>75% Grass cover, Good, HSG C
30,603	80	>75% Grass cover, Good, HSG D
19,489	98	Paved roads w/curbs & sewers, HSG C
27,247	98	Paved roads w/curbs & sewers, HSG D
5,175	98	Paved roads w/curbs & sewers, HSG D
39,436	98	Roofs, HSG C
29,175	98	Roofs, HSG D
196,443	90	Weighted Average
75,921		38.65% Pervious Area
120,522		61.35% Impervious Area

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

Subcatchment PR-2: PR-2



Summary for Subcatchment PR-3: PR-3

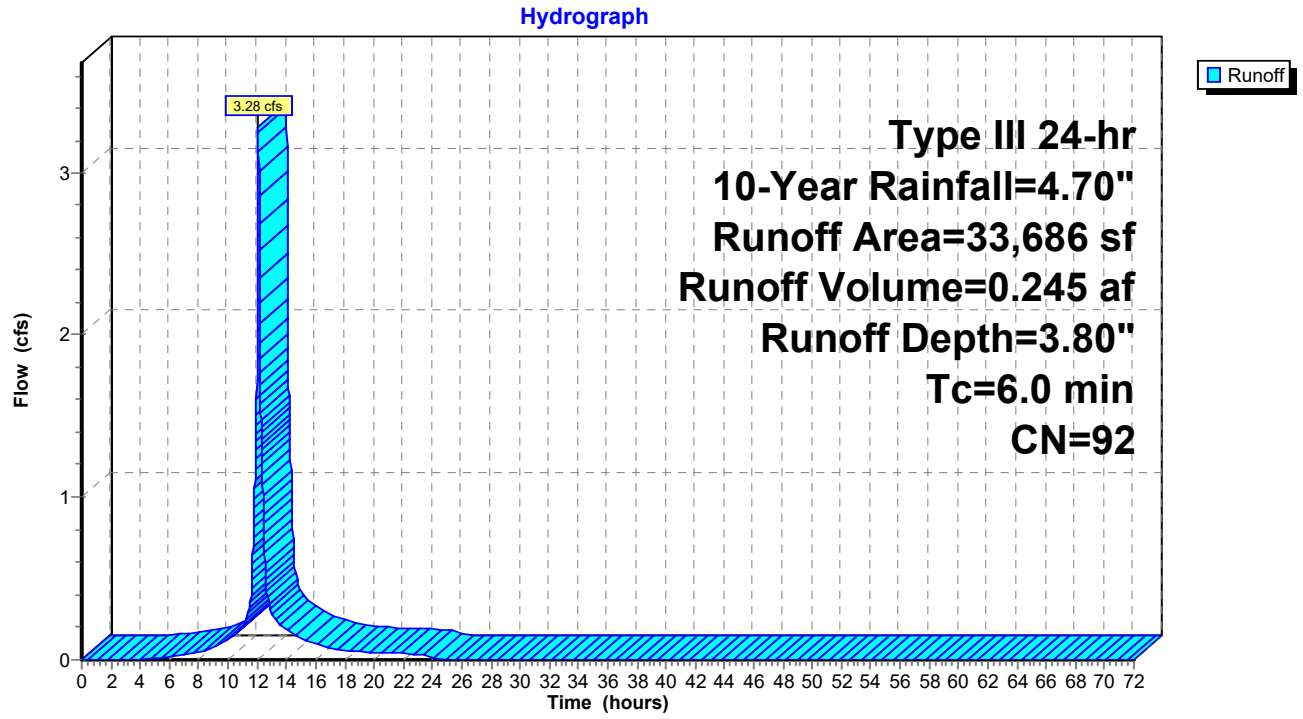
Runoff = 3.28 cfs @ 12.08 hrs, Volume= 0.245 af, Depth= 3.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.70"

Area (sf)	CN	Description
7,184	74	>75% Grass cover, Good, HSG C
1,601	80	>75% Grass cover, Good, HSG D
12,649	98	Paved roads w/curbs & sewers, HSG C
9,293	98	Roofs, HSG C
2,959	98	Roofs, HSG D
33,686	92	Weighted Average
8,785		26.08% Pervious Area
24,901		73.92% Impervious Area

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

Subcatchment PR-3: PR-3



Summary for Subcatchment PR-4: Offsite

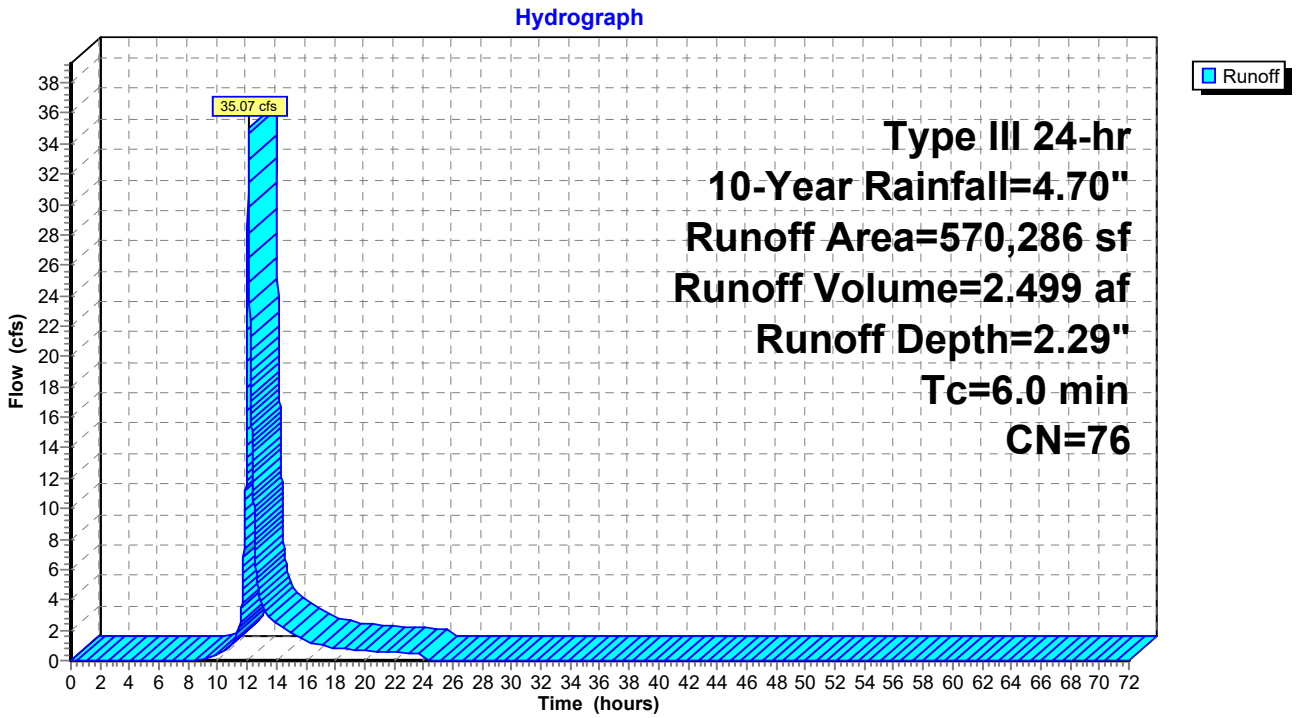
Runoff = 35.07 cfs @ 12.09 hrs, Volume= 2.499 af, Depth= 2.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.70"

Area (sf)	CN	Description
40,322	74	>75% Grass cover, Good, HSG C
72,681	80	>75% Grass cover, Good, HSG D
27,738	70	Woods, Good, HSG C
313,352	77	Woods, Good, HSG D
116,193	73	Brush, Good, HSG D
570,286	76	Weighted Average
570,286		100.00% Pervious Area

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

Subcatchment PR-4: Offsite

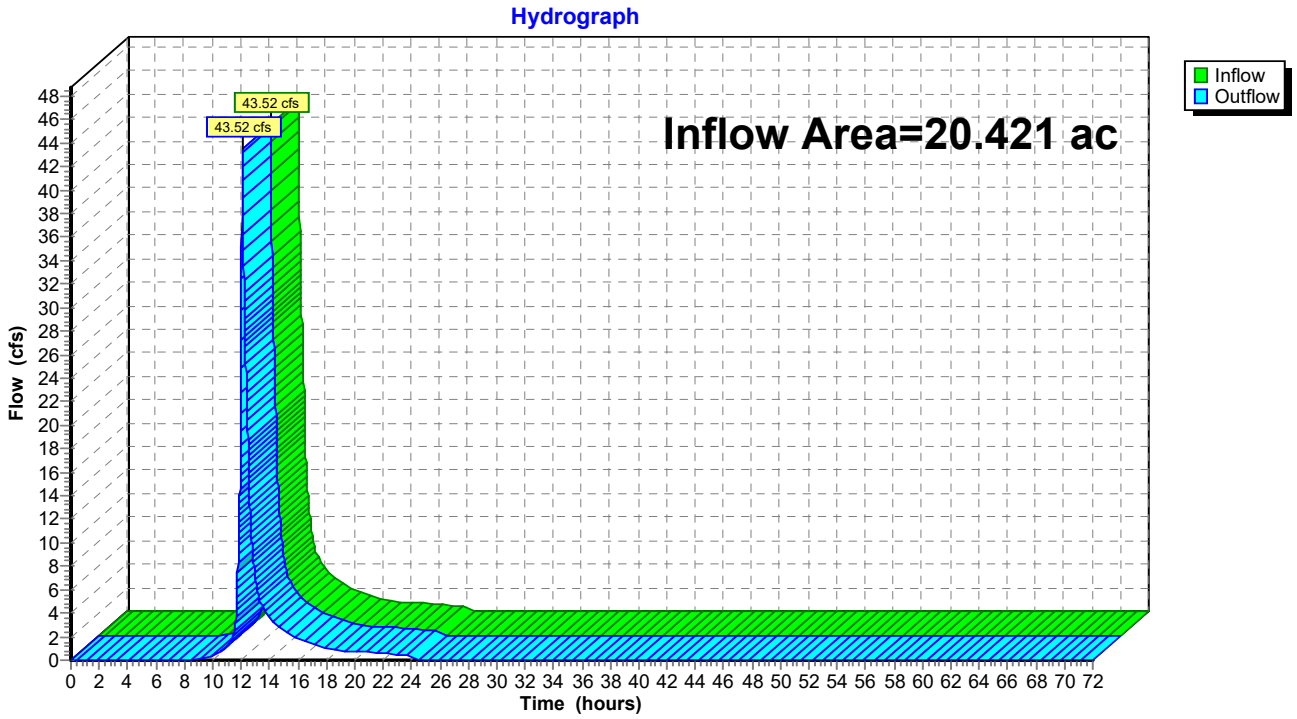


Summary for Reach AP-1P: AP-1

Inflow Area = 20.421 ac, 22.26% Impervious, Inflow Depth = 2.08" for 10-Year event
Inflow = 43.52 cfs @ 12.10 hrs, Volume= 3.532 af
Outflow = 43.52 cfs @ 12.10 hrs, Volume= 3.532 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

Reach AP-1P: AP-1



Summary for Pond 1P: pond 1

Inflow Area = 2.046 ac, 59.05% Impervious, Inflow Depth = 3.59" for 10-Year event
Inflow = 8.33 cfs @ 12.09 hrs, Volume= 0.612 af
Outflow = 0.33 cfs @ 15.28 hrs, Volume= 0.612 af, Atten= 96%, Lag= 191.5 min
Discarded = 0.33 cfs @ 15.28 hrs, Volume= 0.612 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 251.79' @ 15.28 hrs Surf.Area= 5,838 sf Storage= 15,441 cf
Flood Elev= 253.00' Surf.Area= 6,979 sf Storage= 23,924 cf

Plug-Flow detention time= 510.3 min calculated for 0.612 af (100% of inflow)
Center-of-Mass det. time= 510.3 min (1,303.2 - 792.8)

Volume	Invert	Avail.Storage	Storage Description
#1	248.50'	22,156 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	249.00'	1,768 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) -Impervious
		23,924 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
248.50	2,994	0	0
249.00	3,391	1,596	1,596
251.00	5,095	8,486	10,082
253.00	6,979	12,074	22,156

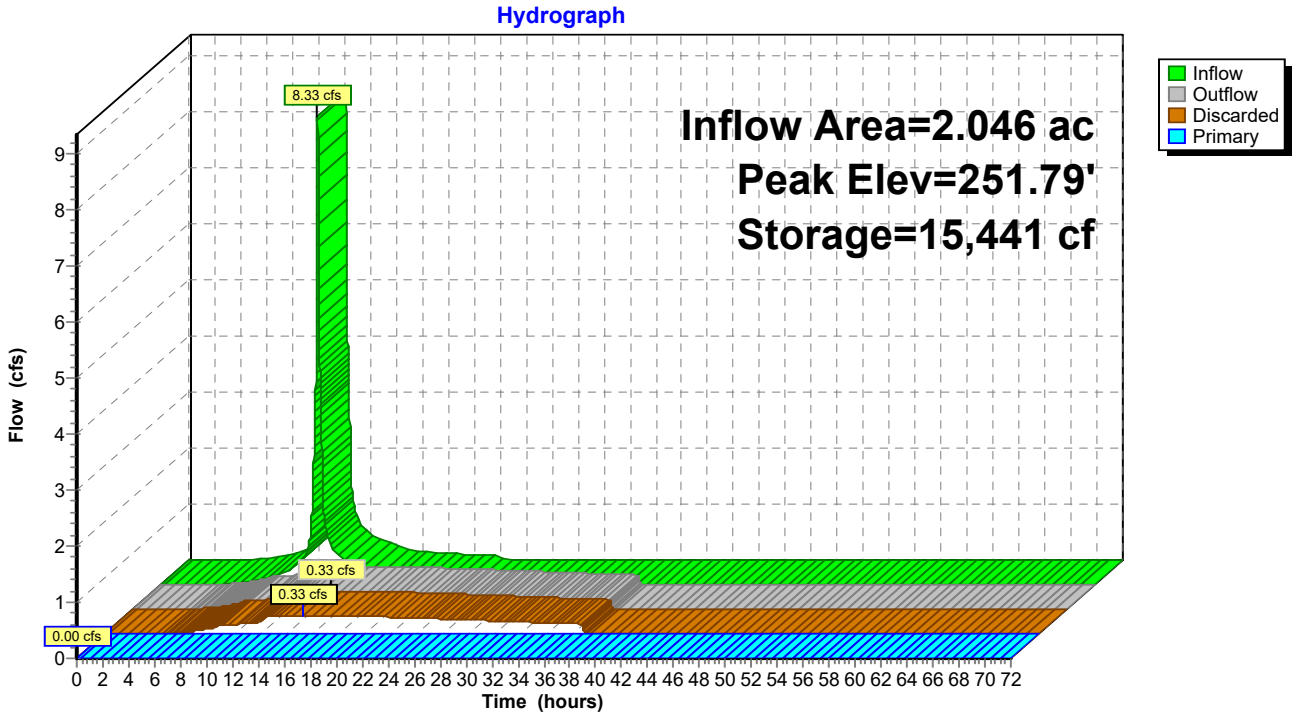
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
249.00	240	0	0
251.00	432	672	672
252.00	545	489	1,161
253.00	669	607	1,768

Device	Routing	Invert	Outlet Devices
#1	Primary	247.00'	**12.0" Round Culvert** L= 60.4' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 247.00' / 245.00' S= 0.0331 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	252.50'	**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
#3	Discarded	248.50'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

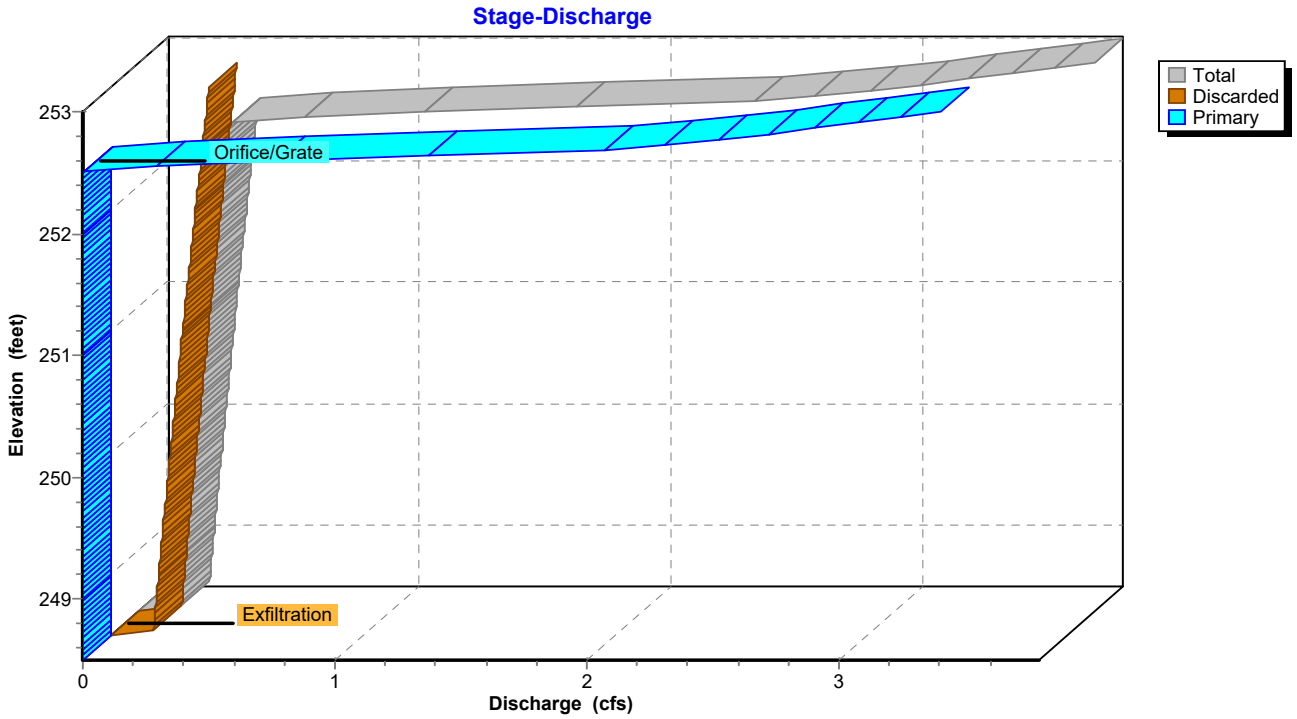
Discarded OutFlow Max=0.33 cfs @ 15.28 hrs HW=251.79' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.33 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=248.50' TW=240.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 0.00 cfs of 3.34 cfs potential flow)
└**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 1P: pond 1



Pond 1P: pond 1



Summary for Pond 2P: Pond 2

Inflow Area = 7.329 ac, 62.04% Impervious, Inflow Depth = 2.61" for 10-Year event
Inflow = 21.65 cfs @ 12.09 hrs, Volume= 1.593 af
Outflow = 10.47 cfs @ 12.24 hrs, Volume= 1.593 af, Atten= 52%, Lag= 9.3 min
Discarded = 0.34 cfs @ 12.24 hrs, Volume= 0.560 af
Primary = 10.13 cfs @ 12.24 hrs, Volume= 1.033 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 244.17' @ 12.24 hrs Surf.Area= 6,167 sf Storage= 21,381 cf
Flood Elev= 245.50' Surf.Area= 7,294 sf Storage= 31,542 cf

Plug-Flow detention time= 156.3 min calculated for 1.593 af (100% of inflow)
Center-of-Mass det. time= 156.4 min (948.0 - 791.6)

Volume	Invert	Avail.Storage	Storage Description
#1	240.00'	32,043 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	240.50'	3,767 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) -Impervious
		35,810 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
240.00	3,222	0	0
242.00	4,527	7,749	7,749
244.00	6,025	10,552	18,301
246.00	7,717	13,742	32,043

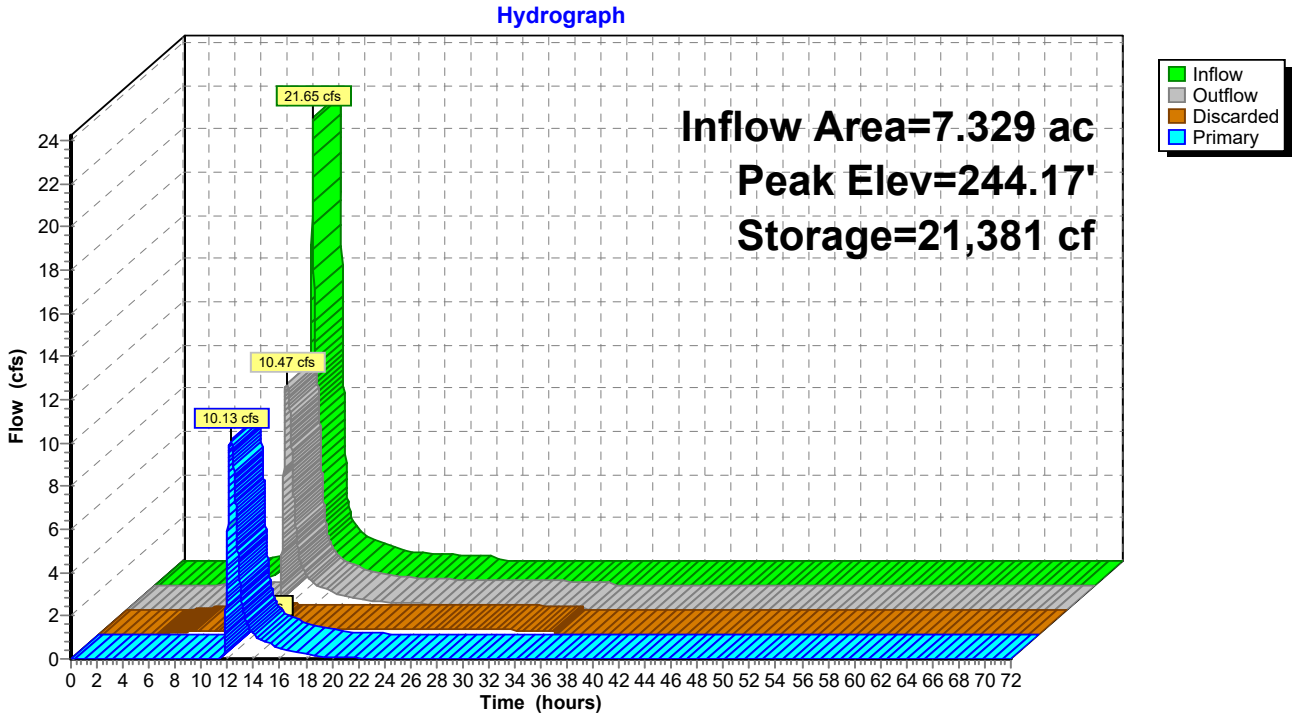
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
240.50	341	0	0
242.00	513	641	641
244.00	774	1,287	1,928
245.00	918	846	2,774
246.00	1,069	994	3,767

Device	Routing	Invert	Outlet Devices
#1	Primary	234.00'	**15.0" Round Culvert** L= 61.6' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 234.00' / 230.00' S= 0.0649 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Device 1	242.00'	**18.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	245.50'	**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
#4	Discarded	240.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.34 cfs @ 12.24 hrs HW=244.17' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.34 cfs)

Primary OutFlow Max=10.13 cfs @ 12.24 hrs HW=244.17' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 10.13 cfs of 16.11 cfs potential flow)
└**2=Orifice/Grate** (Orifice Controls 10.13 cfs @ 5.73 fps)
└**3=Broad-Crested Rectangular Weir**(Controls 0.00 cfs)

Pond 2P: Pond 2



Summary for Subcatchment PR-1: PR-1

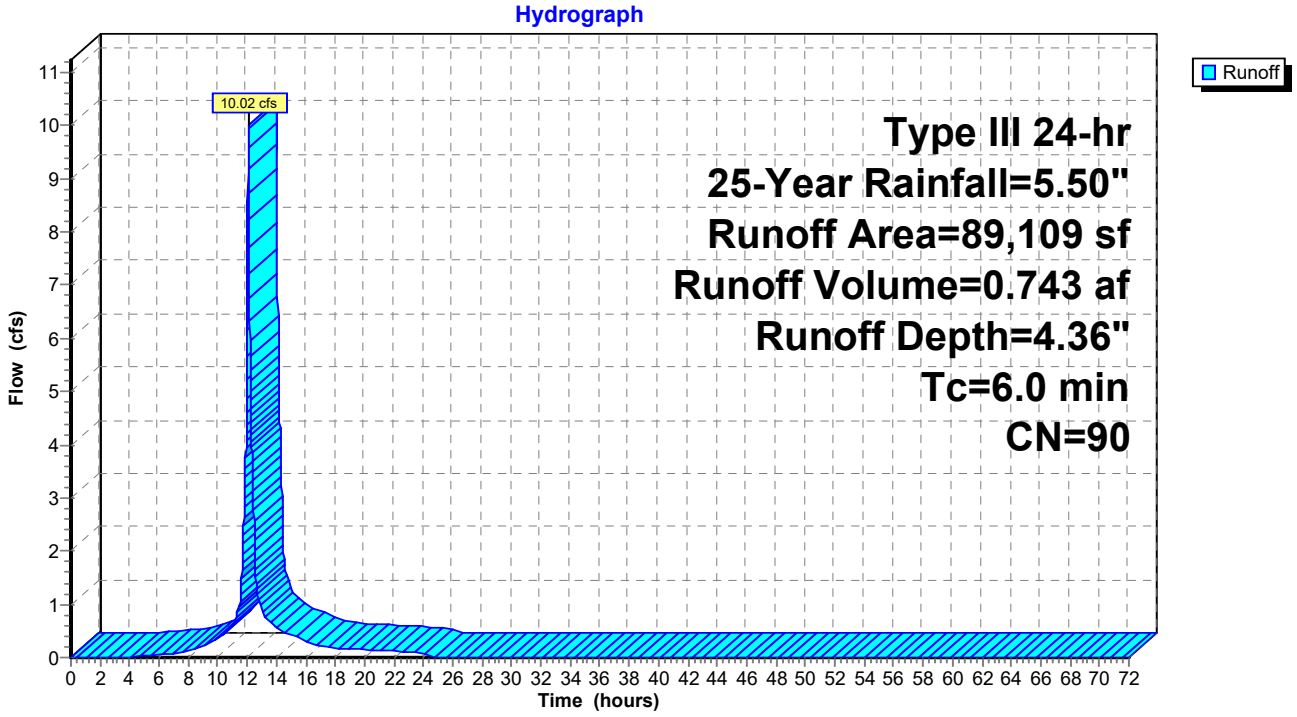
Runoff = 10.02 cfs @ 12.08 hrs, Volume= 0.743 af, Depth= 4.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.50"

Area (sf)	CN	Description
10,416	74	>75% Grass cover, Good, HSG C
26,073	80	>75% Grass cover, Good, HSG D
13,684	98	Paved roads w/curbs & sewers, HSG C
17,897	98	Paved roads w/curbs & sewers, HSG D
2,136	98	Roofs, HSG C
18,903	98	Roofs, HSG D
89,109	90	Weighted Average
36,489		40.95% Pervious Area
52,620		59.05% Impervious Area

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

Subcatchment PR-1: PR-1



Summary for Subcatchment PR-2: PR-2

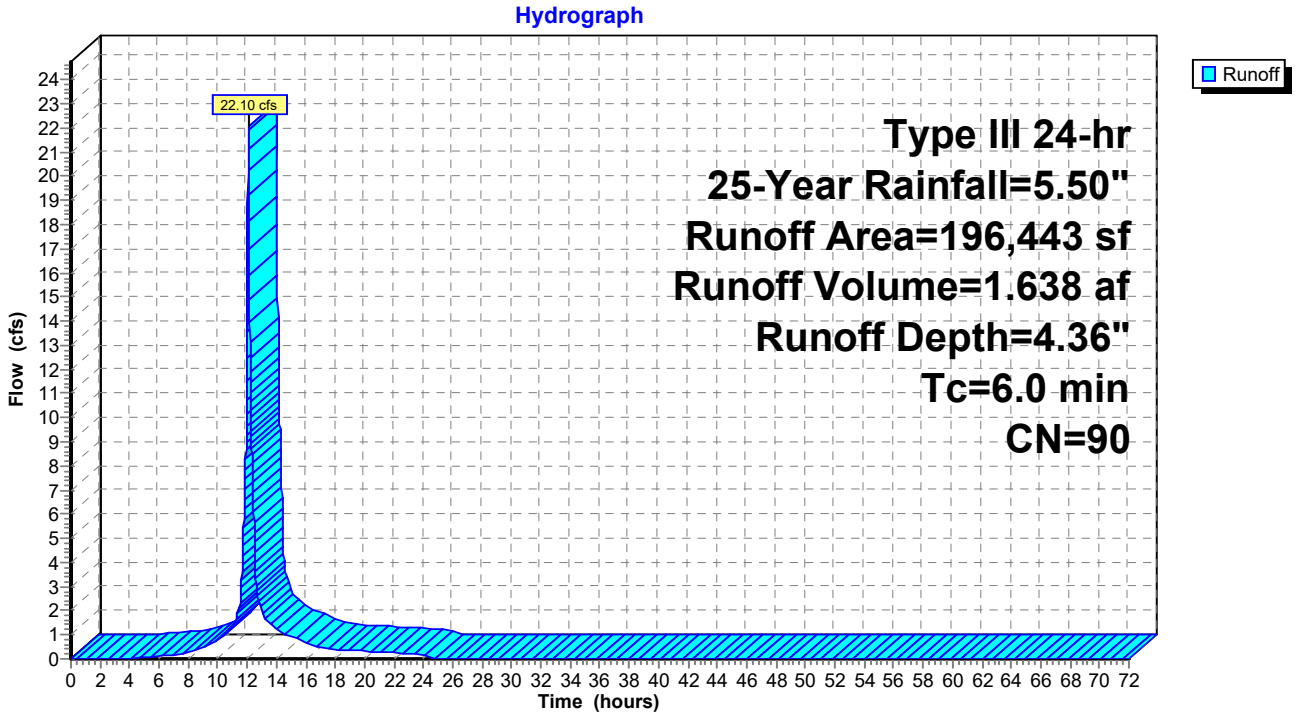
Runoff = 22.10 cfs @ 12.08 hrs, Volume= 1.638 af, Depth= 4.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.50"

Area (sf)	CN	Description
45,318	74	>75% Grass cover, Good, HSG C
30,603	80	>75% Grass cover, Good, HSG D
19,489	98	Paved roads w/curbs & sewers, HSG C
27,247	98	Paved roads w/curbs & sewers, HSG D
5,175	98	Paved roads w/curbs & sewers, HSG D
39,436	98	Roofs, HSG C
29,175	98	Roofs, HSG D
196,443	90	Weighted Average
75,921		38.65% Pervious Area
120,522		61.35% Impervious Area

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

Subcatchment PR-2: PR-2



Summary for Subcatchment PR-3: PR-3

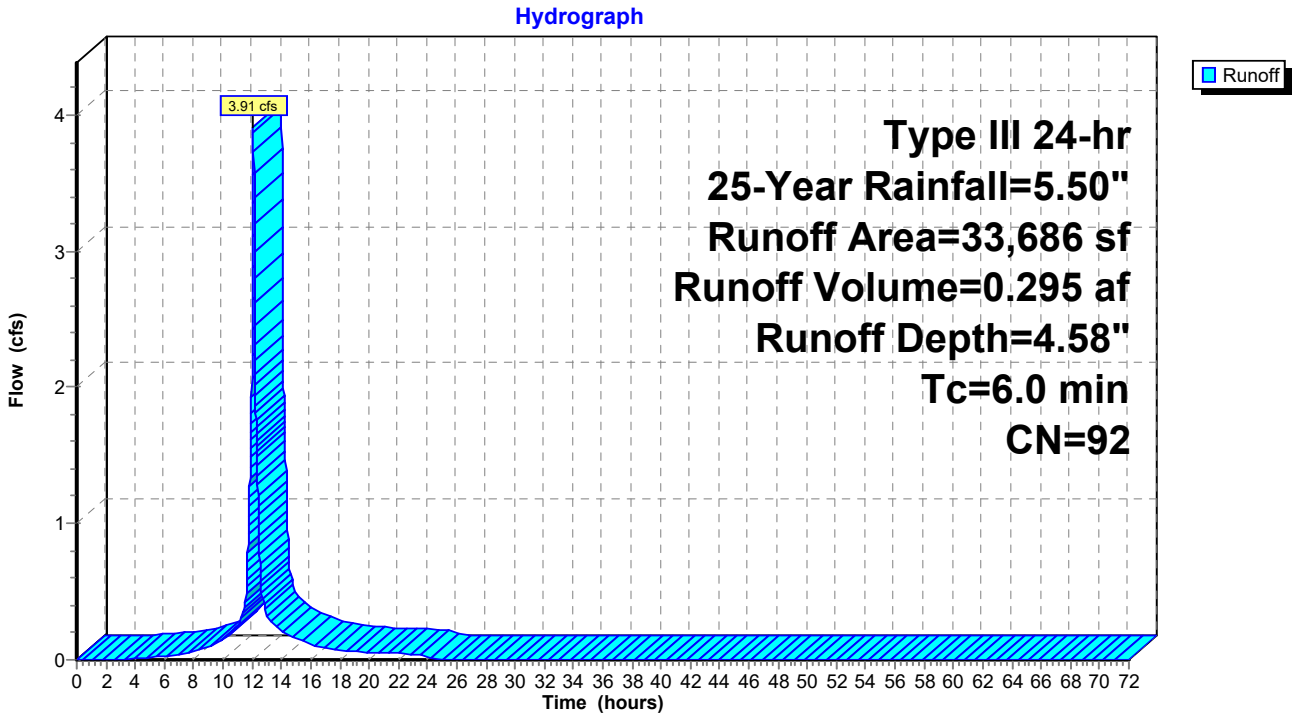
Runoff = 3.91 cfs @ 12.08 hrs, Volume= 0.295 af, Depth= 4.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.50"

Area (sf)	CN	Description
7,184	74	>75% Grass cover, Good, HSG C
1,601	80	>75% Grass cover, Good, HSG D
12,649	98	Paved roads w/curbs & sewers, HSG C
9,293	98	Roofs, HSG C
2,959	98	Roofs, HSG D
33,686	92	Weighted Average
8,785		26.08% Pervious Area
24,901		73.92% Impervious Area

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

Subcatchment PR-3: PR-3



Summary for Subcatchment PR-4: Offsite

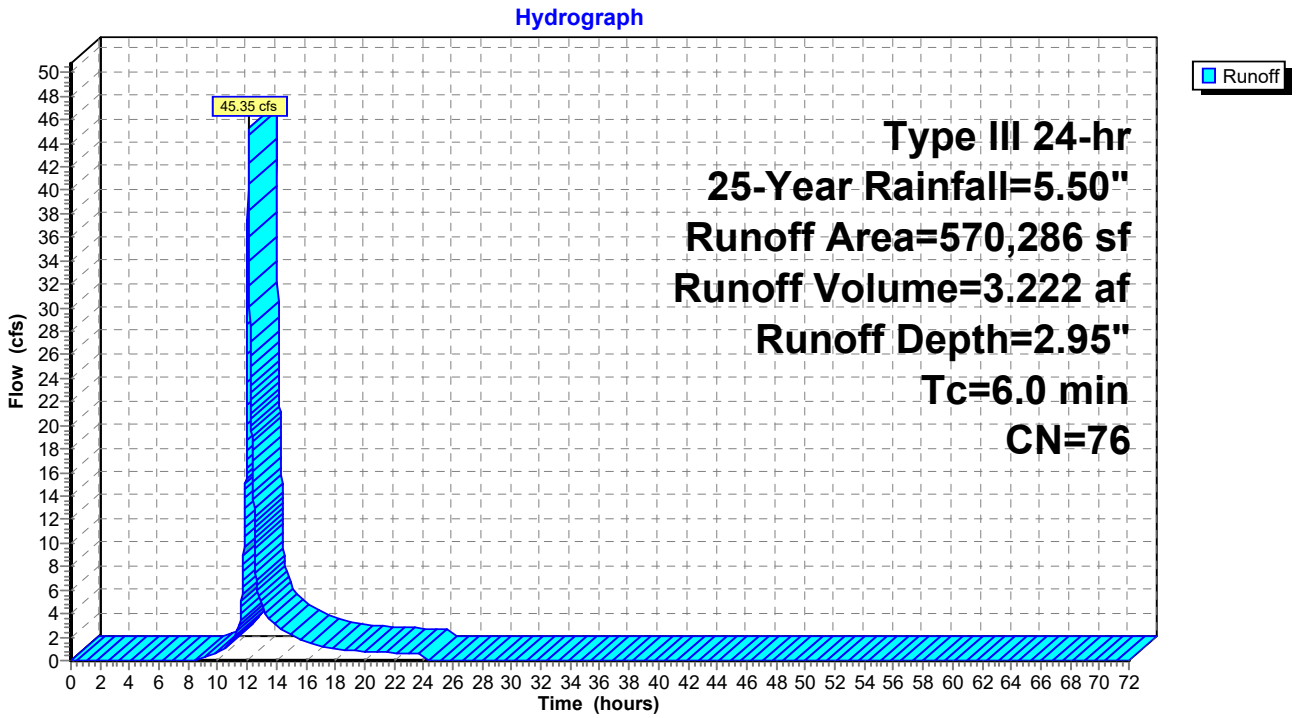
Runoff = 45.35 cfs @ 12.09 hrs, Volume= 3.222 af, Depth= 2.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.50"

Area (sf)	CN	Description
40,322	74	>75% Grass cover, Good, HSG C
72,681	80	>75% Grass cover, Good, HSG D
27,738	70	Woods, Good, HSG C
313,352	77	Woods, Good, HSG D
116,193	73	Brush, Good, HSG D
570,286	76	Weighted Average
570,286		100.00% Pervious Area

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

Subcatchment PR-4: Offsite

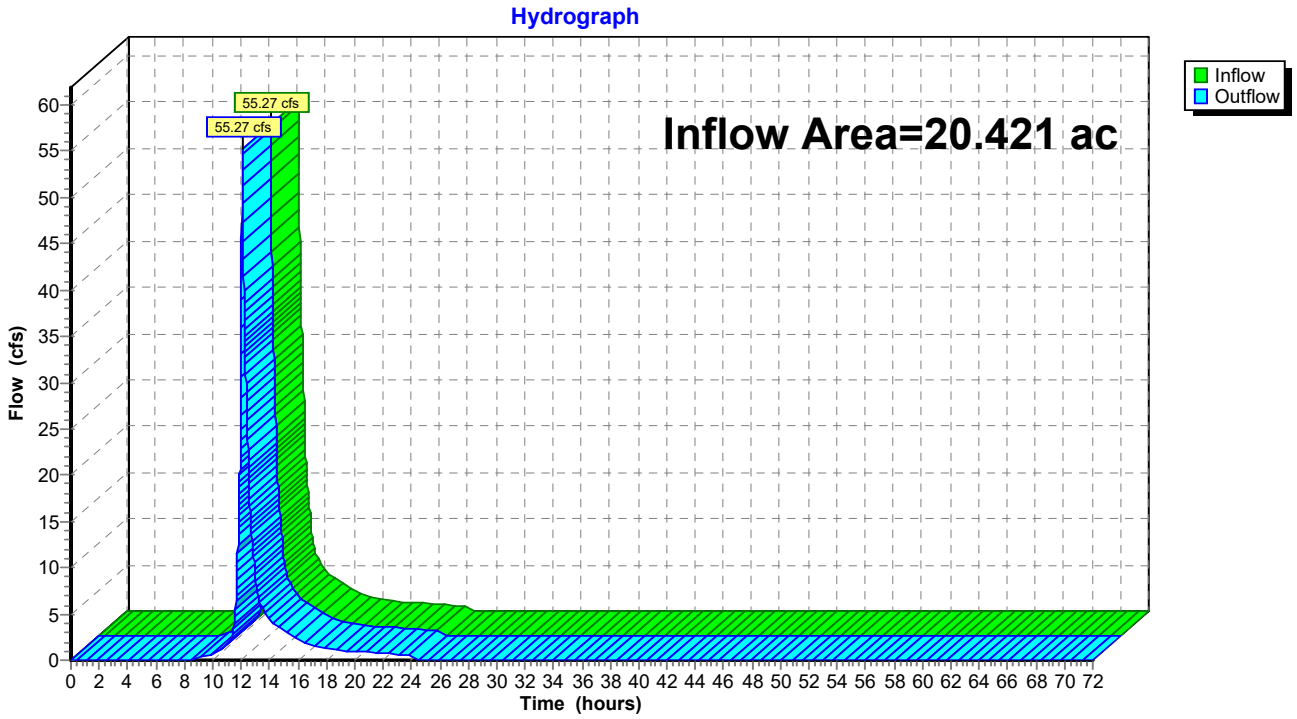


Summary for Reach AP-1P: AP-1

Inflow Area = 20.421 ac, 22.26% Impervious, Inflow Depth = 2.69" for 25-Year event
Inflow = 55.27 cfs @ 12.09 hrs, Volume= 4.573 af
Outflow = 55.27 cfs @ 12.09 hrs, Volume= 4.573 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

Reach AP-1P: AP-1



Summary for Pond 1P: pond 1

Inflow Area = 2.046 ac, 59.05% Impervious, Inflow Depth = 4.36" for 25-Year event
Inflow = 10.02 cfs @ 12.08 hrs, Volume= 0.743 af
Outflow = 0.36 cfs @ 15.50 hrs, Volume= 0.743 af, Atten= 96%, Lag= 205.0 min
Discarded = 0.36 cfs @ 15.50 hrs, Volume= 0.743 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 252.40' @ 15.50 hrs Surf.Area= 6,415 sf Storage= 19,533 cf
Flood Elev= 253.00' Surf.Area= 6,979 sf Storage= 23,924 cf

Plug-Flow detention time= 593.1 min calculated for 0.743 af (100% of inflow)
Center-of-Mass det. time= 593.1 min (1,380.7 - 787.5)

Volume	Invert	Avail.Storage	Storage Description
#1	248.50'	22,156 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	249.00'	1,768 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) -Impervious
		23,924 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
248.50	2,994	0	0
249.00	3,391	1,596	1,596
251.00	5,095	8,486	10,082
253.00	6,979	12,074	22,156

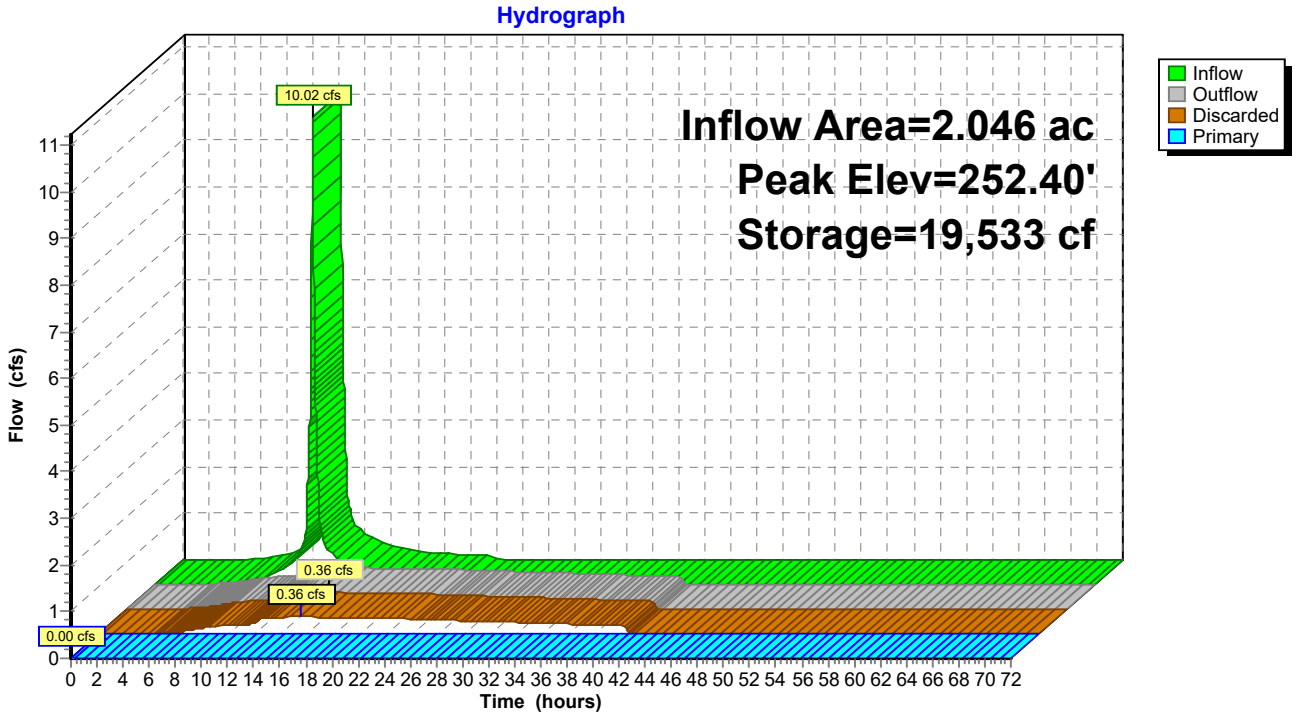
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
249.00	240	0	0
251.00	432	672	672
252.00	545	489	1,161
253.00	669	607	1,768

Device	Routing	Invert	Outlet Devices
#1	Primary	247.00'	**12.0" Round Culvert** L= 60.4' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 247.00' / 245.00' S= 0.0331 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	252.50'	**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
#3	Discarded	248.50'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

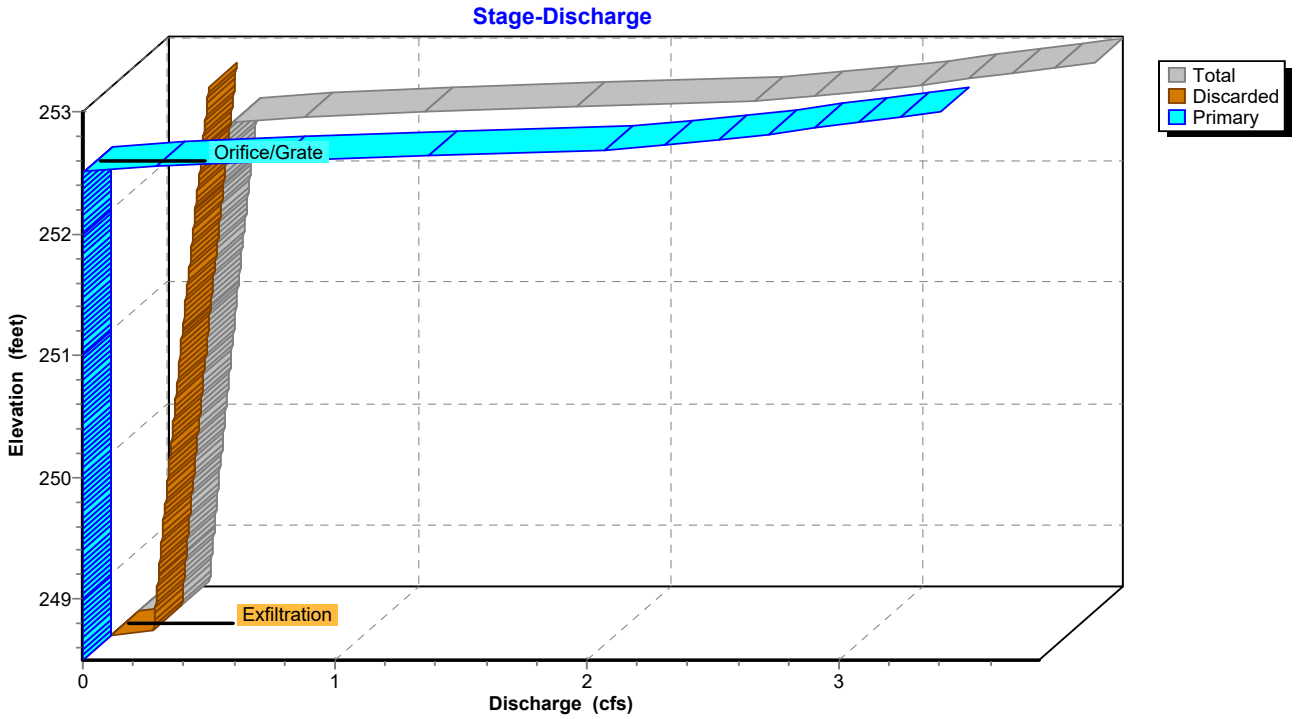
Discarded OutFlow Max=0.36 cfs @ 15.50 hrs HW=252.40' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.36 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=248.50' TW=240.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 0.00 cfs of 3.34 cfs potential flow)
└**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 1P: pond 1



Pond 1P: pond 1



Summary for Pond 2P: Pond 2

Inflow Area = 7.329 ac, 62.04% Impervious, Inflow Depth = 3.17" for 25-Year event
Inflow = 26.01 cfs @ 12.08 hrs, Volume= 1.934 af
Outflow = 12.07 cfs @ 12.25 hrs, Volume= 1.934 af, Atten= 54%, Lag= 10.0 min
Discarded = 0.37 cfs @ 12.25 hrs, Volume= 0.582 af
Primary = 11.70 cfs @ 12.25 hrs, Volume= 1.351 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 244.64' @ 12.25 hrs Surf.Area= 6,567 sf Storage= 24,791 cf
Flood Elev= 245.50' Surf.Area= 7,294 sf Storage= 31,542 cf

Plug-Flow detention time= 138.0 min calculated for 1.934 af (100% of inflow)
Center-of-Mass det. time= 138.0 min (924.4 - 786.3)

Volume	Invert	Avail.Storage	Storage Description
#1	240.00'	32,043 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	240.50'	3,767 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) -Impervious
		35,810 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
240.00	3,222	0	0
242.00	4,527	7,749	7,749
244.00	6,025	10,552	18,301
246.00	7,717	13,742	32,043

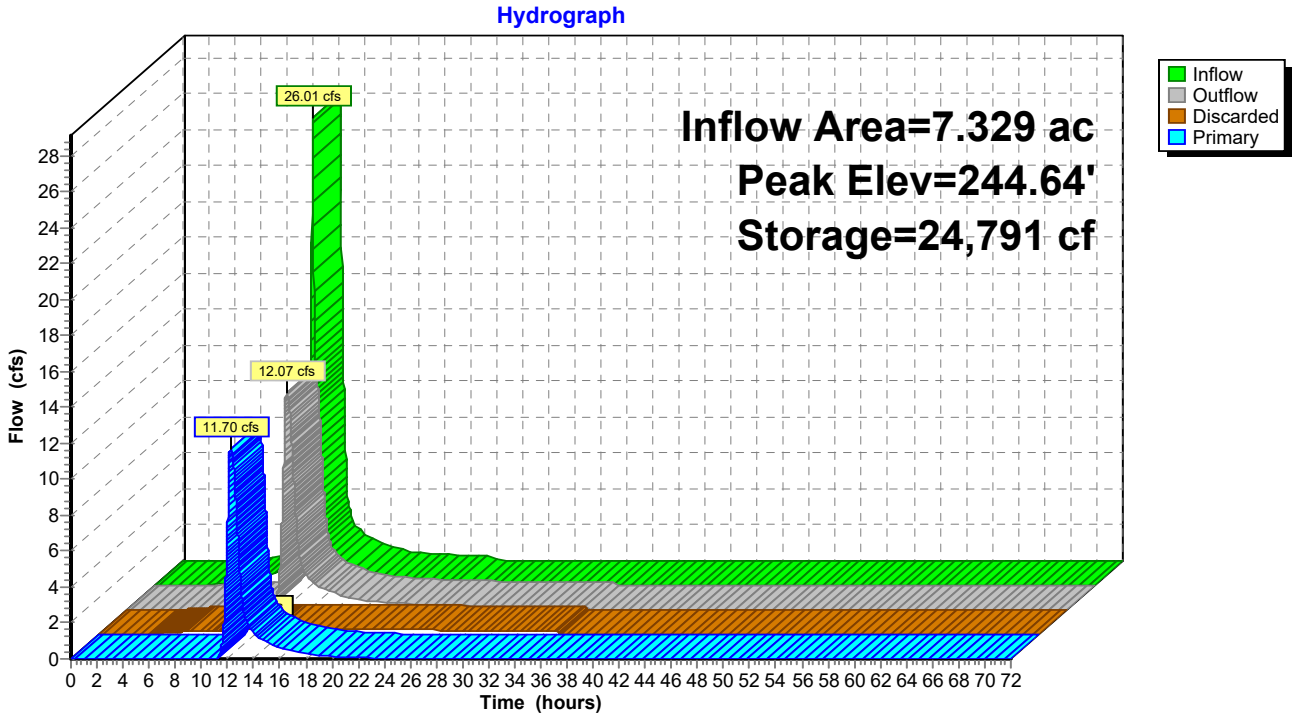
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
240.50	341	0	0
242.00	513	641	641
244.00	774	1,287	1,928
245.00	918	846	2,774
246.00	1,069	994	3,767

Device	Routing	Invert	Outlet Devices
#1	Primary	234.00'	**15.0" Round Culvert** L= 61.6' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 234.00' / 230.00' S= 0.0649 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Device 1	242.00'	**18.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	245.50'	**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
#4	Discarded	240.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.37 cfs @ 12.25 hrs HW=244.64' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.37 cfs)

Primary OutFlow Max=11.70 cfs @ 12.25 hrs HW=244.64' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 11.70 cfs of 16.50 cfs potential flow)
└**2=Orifice/Grate** (Orifice Controls 11.70 cfs @ 6.62 fps)
└**3=Broad-Crested Rectangular Weir**(Controls 0.00 cfs)

Pond 2P: Pond 2



Summary for Subcatchment PR-1: PR-1

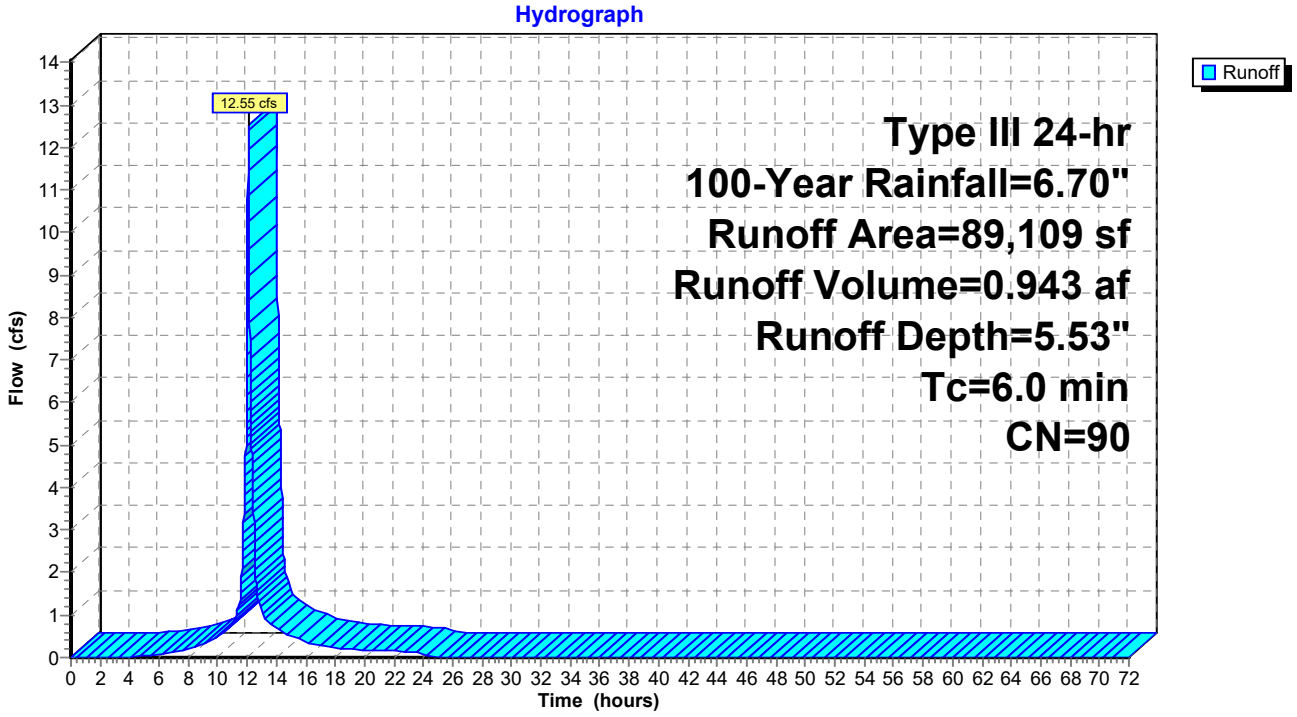
Runoff = 12.55 cfs @ 12.08 hrs, Volume= 0.943 af, Depth= 5.53"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
10,416	74	>75% Grass cover, Good, HSG C
26,073	80	>75% Grass cover, Good, HSG D
13,684	98	Paved roads w/curbs & sewers, HSG C
17,897	98	Paved roads w/curbs & sewers, HSG D
2,136	98	Roofs, HSG C
18,903	98	Roofs, HSG D
89,109	90	Weighted Average
36,489		40.95% Pervious Area
52,620		59.05% Impervious Area

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

Subcatchment PR-1: PR-1



Summary for Subcatchment PR-2: PR-2

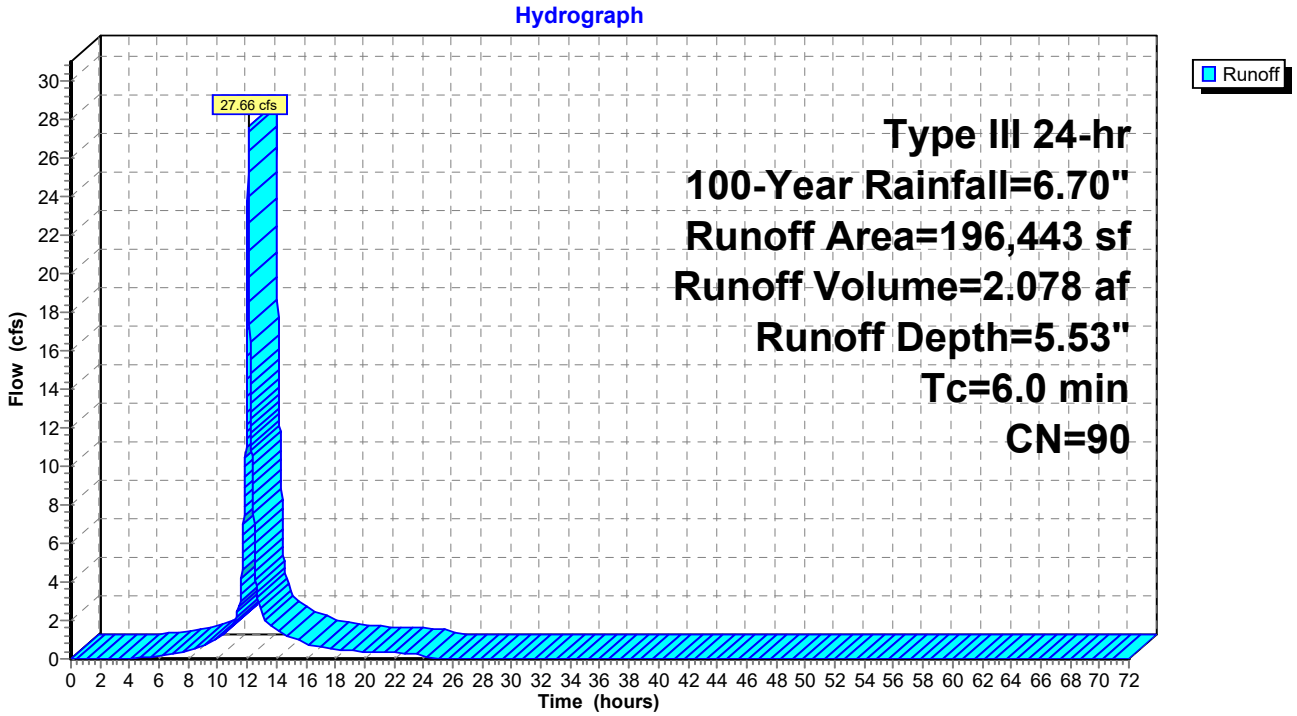
Runoff = 27.66 cfs @ 12.08 hrs, Volume= 2.078 af, Depth= 5.53"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
45,318	74	>75% Grass cover, Good, HSG C
30,603	80	>75% Grass cover, Good, HSG D
19,489	98	Paved roads w/curbs & sewers, HSG C
27,247	98	Paved roads w/curbs & sewers, HSG D
5,175	98	Paved roads w/curbs & sewers, HSG D
39,436	98	Roofs, HSG C
29,175	98	Roofs, HSG D
196,443	90	Weighted Average
75,921		38.65% Pervious Area
120,522		61.35% Impervious Area

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

Subcatchment PR-2: PR-2



Summary for Subcatchment PR-3: PR-3

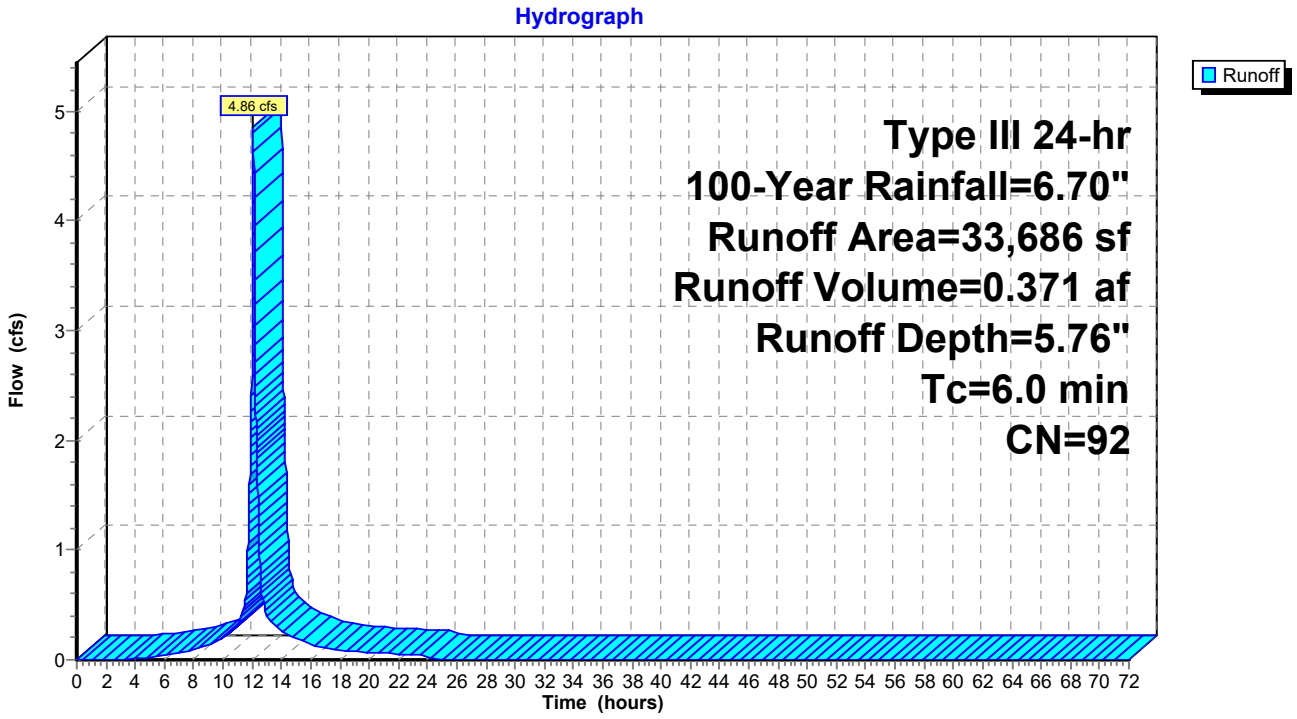
Runoff = 4.86 cfs @ 12.08 hrs, Volume= 0.371 af, Depth= 5.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
7,184	74	>75% Grass cover, Good, HSG C
1,601	80	>75% Grass cover, Good, HSG D
12,649	98	Paved roads w/curbs & sewers, HSG C
9,293	98	Roofs, HSG C
2,959	98	Roofs, HSG D
33,686	92	Weighted Average
8,785		26.08% Pervious Area
24,901		73.92% Impervious Area

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

Subcatchment PR-3: PR-3



Summary for Subcatchment PR-4: Offsite

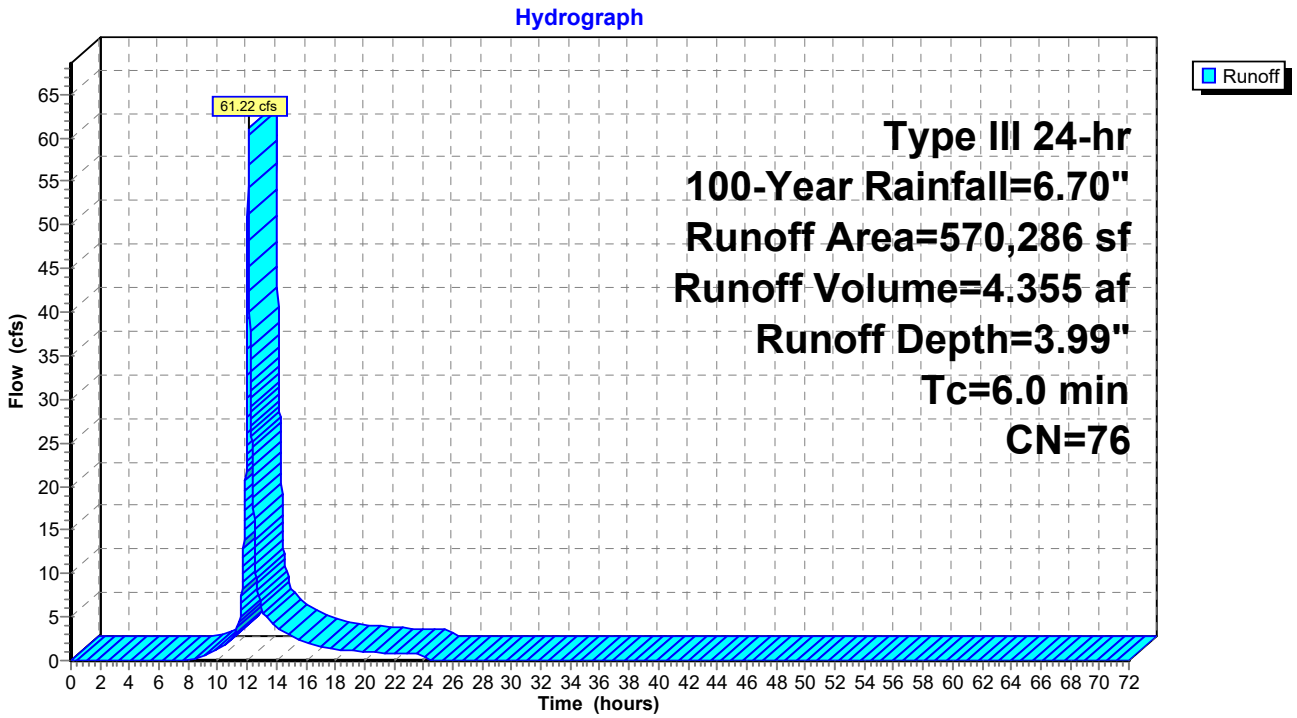
Runoff = 61.22 cfs @ 12.09 hrs, Volume= 4.355 af, Depth= 3.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
40,322	74	>75% Grass cover, Good, HSG C
72,681	80	>75% Grass cover, Good, HSG D
27,738	70	Woods, Good, HSG C
313,352	77	Woods, Good, HSG D
116,193	73	Brush, Good, HSG D
570,286	76	Weighted Average
570,286		100.00% Pervious Area

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

Subcatchment PR-4: Offsite

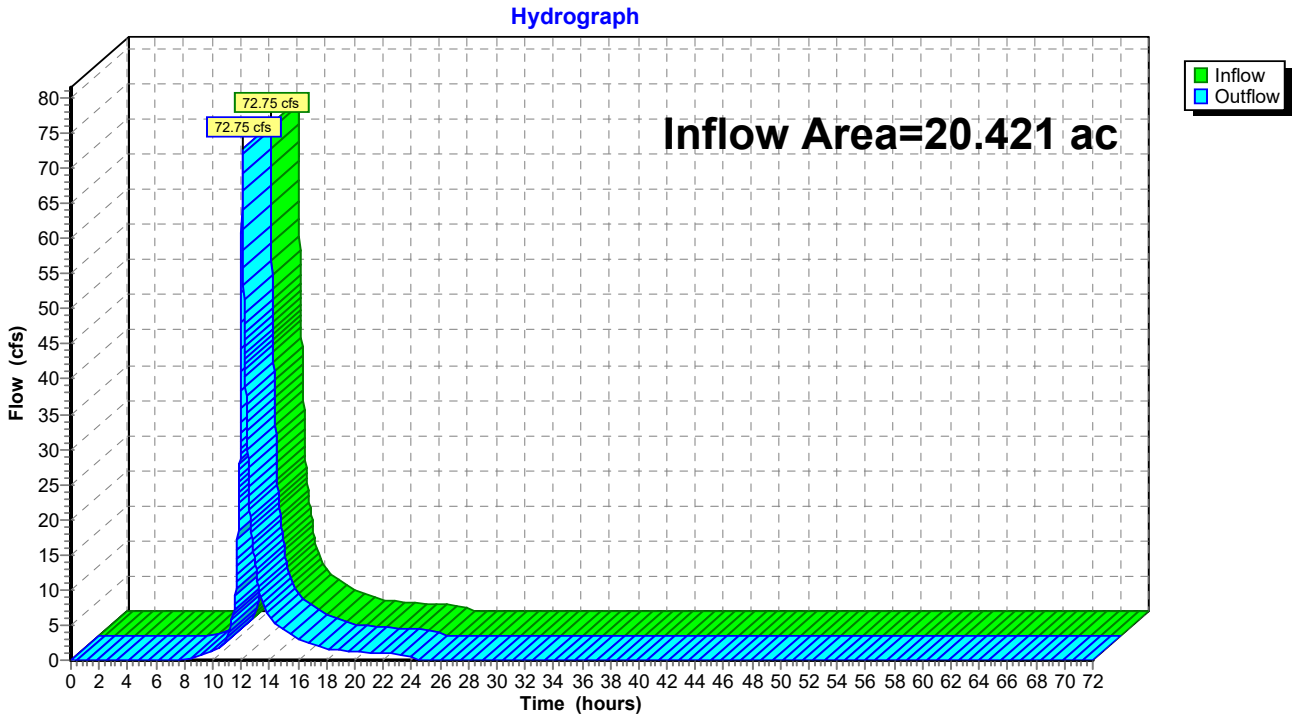


Summary for Reach AP-1P: AP-1

Inflow Area = 20.421 ac, 22.26% Impervious, Inflow Depth = 3.72" for 100-Year event
Inflow = 72.75 cfs @ 12.09 hrs, Volume= 6.329 af
Outflow = 72.75 cfs @ 12.09 hrs, Volume= 6.329 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

Reach AP-1P: AP-1



Summary for Pond 1P: pond 1

Inflow Area = 2.046 ac, 59.05% Impervious, Inflow Depth = 5.53" for 100-Year event
Inflow = 12.55 cfs @ 12.08 hrs, Volume= 0.943 af
Outflow = 1.81 cfs @ 12.58 hrs, Volume= 0.943 af, Atten= 86%, Lag= 30.0 min
Discarded = 0.37 cfs @ 12.58 hrs, Volume= 0.807 af
Primary = 1.44 cfs @ 12.58 hrs, Volume= 0.136 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 252.64' @ 12.58 hrs Surf.Area= 6,644 sf Storage= 21,273 cf
Flood Elev= 253.00' Surf.Area= 6,979 sf Storage= 23,924 cf

Plug-Flow detention time= 530.0 min calculated for 0.942 af (100% of inflow)
Center-of-Mass det. time= 530.0 min (1,311.3 - 781.2)

Volume	Invert	Avail.Storage	Storage Description
#1	248.50'	22,156 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	249.00'	1,768 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) -Impervious
		23,924 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
248.50	2,994	0	0
249.00	3,391	1,596	1,596
251.00	5,095	8,486	10,082
253.00	6,979	12,074	22,156

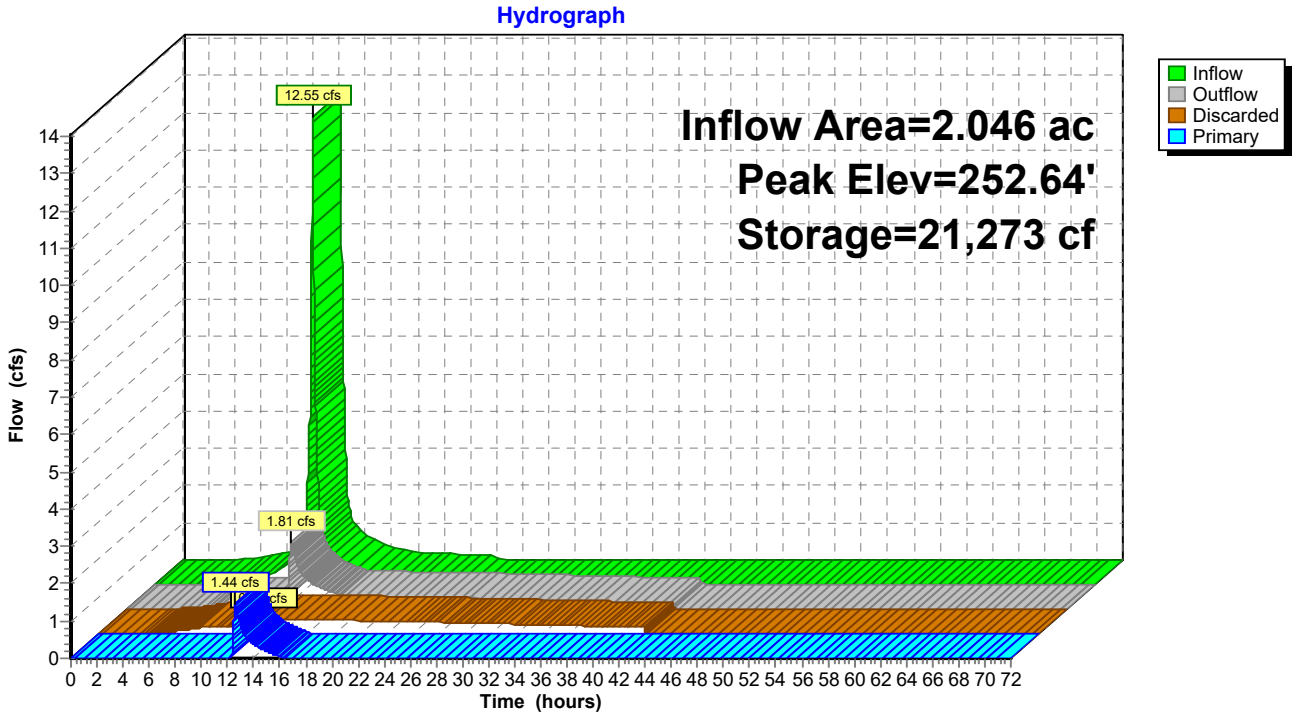
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
249.00	240	0	0
251.00	432	672	672
252.00	545	489	1,161
253.00	669	607	1,768

Device	Routing	Invert	Outlet Devices
#1	Primary	247.00'	**12.0" Round Culvert** L= 60.4' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 247.00' / 245.00' S= 0.0331 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	252.50'	**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
#3	Discarded	248.50'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

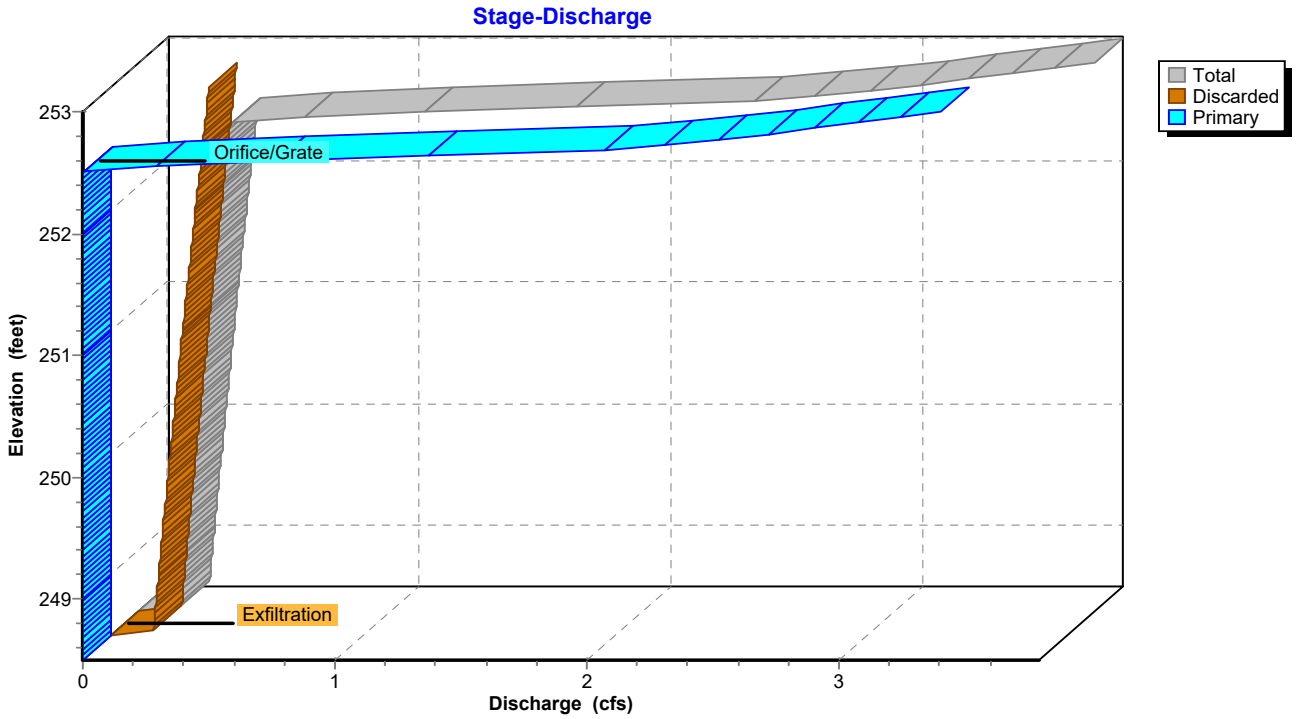
Discarded OutFlow Max=0.37 cfs @ 12.58 hrs HW=252.64' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.37 cfs)

Primary OutFlow Max=1.44 cfs @ 12.58 hrs HW=252.64' TW=244.76' (Dynamic Tailwater)
└**1=Culvert** (Passes 1.44 cfs of 7.57 cfs potential flow)
└**2=Orifice/Grate** (Weir Controls 1.44 cfs @ 1.24 fps)

Pond 1P: pond 1



Pond 1P: pond 1



Summary for Pond 2P: Pond 2

Inflow Area = 7.329 ac, 62.04% Impervious, Inflow Depth = 4.23" for 100-Year event
Inflow = 32.52 cfs @ 12.08 hrs, Volume= 2.585 af
Outflow = 13.99 cfs @ 12.27 hrs, Volume= 2.585 af, Atten= 57%, Lag= 11.4 min
Discarded = 0.40 cfs @ 12.27 hrs, Volume= 0.611 af
Primary = 13.59 cfs @ 12.27 hrs, Volume= 1.974 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 245.30' @ 12.27 hrs Surf.Area= 7,125 sf Storage= 29,906 cf
Flood Elev= 245.50' Surf.Area= 7,294 sf Storage= 31,542 cf

Plug-Flow detention time= 113.8 min calculated for 2.585 af (100% of inflow)
Center-of-Mass det. time= 113.8 min (895.5 - 781.6)

Volume	Invert	Avail.Storage	Storage Description
#1	240.00'	32,043 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	240.50'	3,767 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) -Impervious
		35,810 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
240.00	3,222	0	0
242.00	4,527	7,749	7,749
244.00	6,025	10,552	18,301
246.00	7,717	13,742	32,043

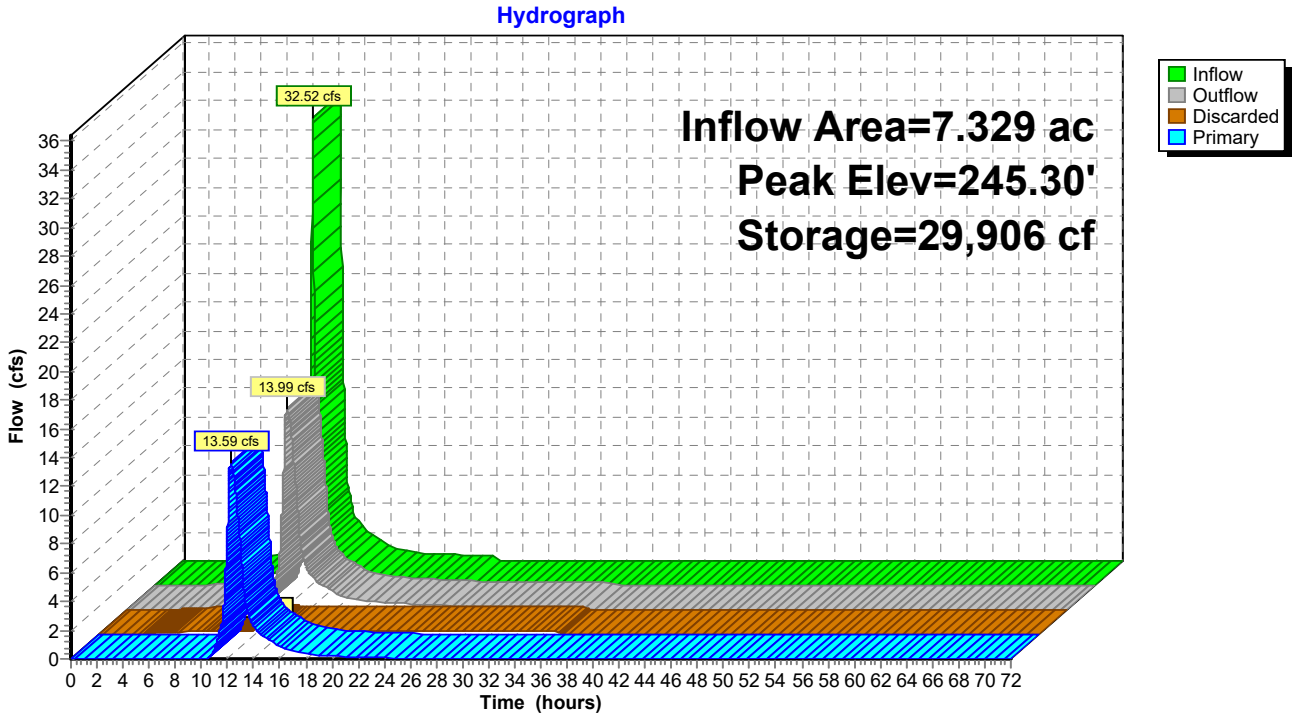
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
240.50	341	0	0
242.00	513	641	641
244.00	774	1,287	1,928
245.00	918	846	2,774
246.00	1,069	994	3,767

Device	Routing	Invert	Outlet Devices
#1	Primary	234.00'	**15.0" Round Culvert** L= 61.6' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 234.00' / 230.00' S= 0.0649 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Device 1	242.00'	**18.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	245.50'	**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
#4	Discarded	240.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.40 cfs @ 12.27 hrs HW=245.30' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.40 cfs)

Primary OutFlow Max=13.59 cfs @ 12.27 hrs HW=245.30' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 13.59 cfs of 17.03 cfs potential flow)
└**2=Orifice/Grate** (Orifice Controls 13.59 cfs @ 7.69 fps)
└**3=Broad-Crested Rectangular Weir**(Controls 0.00 cfs)

Pond 2P: Pond 2



Stage-Area-Storage Calculations

Appendix 5

Stage-Area-Storage for Pond 1P: pond 1

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
248.50	2,994	0
248.55	3,034	151
248.60	3,073	303
248.65	3,113	458
248.70	3,153	615
248.75	3,193	773
248.80	3,232	934
248.85	3,272	1,097
248.90	3,312	1,261
248.95	3,351	1,428
249.00	3,391	1,596
249.05	3,434	1,779
249.10	3,476	1,964
249.15	3,519	2,152
249.20	3,561	2,341
249.25	3,604	2,534
249.30	3,647	2,728
249.35	3,689	2,925
249.40	3,732	3,124
249.45	3,774	3,326
249.50	3,817	3,530
249.55	3,860	3,737
249.60	3,902	3,945
249.65	3,945	4,157
249.70	3,987	4,370
249.75	4,030	4,586
249.80	4,073	4,804
249.85	4,115	5,025
249.90	4,158	5,248
249.95	4,200	5,473
250.00	4,243	5,701
250.05	4,286	5,931
250.10	4,328	6,164
250.15	4,371	6,399
250.20	4,413	6,636
250.25	4,456	6,876
250.30	4,499	7,118
250.35	4,541	7,362
250.40	4,584	7,609
250.45	4,626	7,858
250.50	4,669	8,109
250.55	4,712	8,363
250.60	4,754	8,619
250.65	4,797	8,878
250.70	4,839	9,139
250.75	4,882	9,402
250.80	4,925	9,668
250.85	4,967	9,936
250.90	5,010	10,206
250.95	5,052	10,479
251.00	5,095	10,754
251.05	5,142	11,032
251.10	5,189	11,312
251.15	5,236	11,595
251.20	5,283	11,881
251.25	5,331	12,169
251.30	5,378	12,460
251.35	5,425	12,753
251.40	5,472	13,049
251.45	5,519	13,348
251.50	5,566	13,650
251.55	5,613	13,954
251.60	5,660	14,260
251.65	5,707	14,570
251.70	5,754	14,882
251.75	5,802	15,196
251.80	5,849	15,513
251.85	5,896	15,833
251.90	5,943	16,156
251.95	5,990	16,481
252.00	6,037	16,809
252.05	6,084	17,139
252.10	6,131	17,472
252.15	6,178	17,808
252.20	6,225	18,146
252.25	6,273	18,488
252.30	6,320	18,831
252.35	6,367	19,178
252.40	6,414	19,527
252.45	6,461	19,879
252.50	6,508	20,233
252.55	6,555	20,590
252.60	6,602	20,950
252.65	6,649	21,312
252.70	6,696	21,677
252.75	6,744	22,045
252.80	6,791	22,415
252.85	6,838	22,789
252.90	6,885	23,164
252.95	6,932	23,543
253.00	**6,979**	**23,924**

Volume below lowest invert out

Stage-Area-Storage for Pond 2P: Pond 2

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
240.00	3,222	0
240.10	3,287	325
240.20	3,352	657
240.30	3,418	996
240.40	3,483	1,341
240.50	3,548	1,693
240.60	3,613	2,085
240.70	3,679	2,486
240.80	3,744	2,894
240.90	3,809	3,310
241.00	3,875	3,733
241.10	3,940	4,164
241.20	4,005	4,603
241.30	4,070	5,049
241.40	4,136	5,504
241.50	4,201	5,965
241.60	4,266	6,435
241.70	4,331	6,912
241.80	4,397	7,397
241.90	4,462	7,889
242.00	4,527	8,390
242.10	4,602	8,898
242.20	4,677	9,415
242.30	4,752	9,941
242.40	4,827	10,476
242.50	4,902	11,019
242.60	4,976	11,572
242.70	5,051	12,133
242.80	5,126	12,703
242.90	5,201	13,282
243.00	5,276	13,869
243.10	5,351	14,466
243.20	5,426	15,071
243.30	5,501	15,685
243.40	5,576	16,307
243.50	5,651	16,939
243.60	5,725	17,579
243.70	5,800	18,228
243.80	5,875	18,886
243.90	5,950	19,553
244.00	6,025	20,229
244.10	6,110	20,913
244.20	6,194	21,608
244.30	6,279	22,313
244.40	6,363	23,027
244.50	6,448	23,752
244.60	6,533	24,486
244.70	6,617	25,230
244.80	6,702	25,985
244.90	6,786	26,749
245.00	6,871	27,523
245.10	6,956	28,306
245.20	7,040	29,100
245.30	7,125	29,904
245.40	7,209	30,718
245.50	7,294	31,542
245.60	7,379	32,375
245.70	7,463	33,219
245.80	7,548	34,073
245.90	7,632	34,936
246.00	**7,717**	**35,810**

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: Franklin Heights Parcel B, Franklin MA - Basin #1

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

Pretreatment

Total TSS Removal = 44%

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

Project: F-4471

Prepared By: Michael Hassett

Date: 7/7/2022

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

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

1. From MassDEP Stormwater Handbook Vol. 1

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: Franklin Heights Parcel B, Franklin MA - Basin #1

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-4471

Prepared By: Michael Hassett

Date: 7/7/2022

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

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

1. From MassDEP Stormwater Handbook Vol. 1

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: Franklin Heights Parcel B, Franklin MA - Basin #2

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

Pretreatment

Total TSS Removal = 44%

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

Project: F-4471

Prepared By: Michael Hassett

Date: 7/7/2022

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

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

1. From MassDEP Stormwater Handbook Vol. 1

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: Franklin Heights Parcel B, Franklin MA - Basin #2

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-4471

Prepared By: Michael Hassett

Date: 7/7/2022

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

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

1. From MassDEP Stormwater Handbook Vol. 1

Construction Period Pollution Prevention Plan

Appendix 7

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: Oliver Crossing Realty Trust c/o Bruce Wheeler
148 Park Street
North Reading, MA 01864
PH: 617-538-2472

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 Site Plan prepared by Guerriere & Halnon, Inc. Dated 09/14/2022

D. Site Development Plans.
See Site Plan prepared by Guerriere & Halnon, Inc. Dated 09/14/2022

E. Plans

1. Construction Sequencing Plan – Actual sequence of construction activities to be determined by the site contractor.

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)

Long Term Operation and Maintenance Plan

Appendix 8

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: Oliver Crossing Realty Trust c/o Bruce Wheeler
148 Park Street
North Reading, MA 01864
PH: 617-538-2472

B. 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.

C. 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 basins and sediment forebays provided to promote the required 80% TSS Removal. Refer to TSS Removal Worksheet in Standard 4 for treatment train.
   d. Safety Fencing: Provide 5-FT high chain link fence with lockable gates around detention basins 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. Sediment Forebay/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

D. 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.

E. 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.

F. Requirements for storage and use of herbicides, and pesticides

The application of herbicides or pesticides will be done by professional certified contractor.

G. Provisions for operation and management of septic system

Site to be serviced by public sewer.

H. 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.

I. 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.

J. 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.

K. 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.

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

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

M. 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.

N. 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.

O. 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.

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

Oliver Crossing Realty Trust c/o Bruce Wheeler
148 Park Street
North Reading, MA 01864
PH: 617-538-2472

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

Q. 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 Basins	$ 200 per cleaning
Spill Containment Kit	$ 750 purchase price

Illicit Discharge Statement

Appendix 9

Illicit Discharge Compliance Statement

It is the intent of the Applicant, Oliver Crossing Realty Trust, c/o Bruce Wheeler, 148 Park Street, North Reading, MA 01864 to prevent illicit discharges to the stormwater management system, including wastewater discharges and discharges of stormwater contaminated by contact with process wastes, raw materials, toxic pollutants, hazardous substances, oil, or grease. 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 Owner will also promote a clean Green Environment by mitigating spills onto pavements; oils, soda, chemicals, pet waste, debris and litter.

Respectfully Acknowledged,

Drainage Area Plans

Appendix 10

TIME OF CONCENTRATION (Tc)

EX1 = 6.0 MINUTES

LEGEND

SOIL BOUNDARY

DRAINAGE AREA

G:\CIVDP\Franklin\F4471\DWG\F4471-CIVIL rev1.dwg, 9/21/2022 8:12:00 AM

F4471

APPROVED DATE:

TOWN_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(S)

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PO BOX 600269
120 ADAMS STREET
NEWTON, MA 02460

JOHN A. FARINA
ANTHONY J. MEDAGLIA, JR.
STEPHEN M. COLLINS
BRYON R. COLLINS
DAVID C. COLLINS
SEAN C. COLLINS
C/O KATHRYN G. COLLINS, ESQ.
HORNUNG & SCIMONE PC
5 COMMONWEALTH ROAD, 4TH FLOOR
NATICK, MA 01760

APPLICANT

OLIVER CROSSING REALTY TRUST
148 PARK STREET
NORTH READING MA, 01864

LOCUS REFERENCES

PLAN BK. 553 PLAN PG. 1 OF 2006
A.M. 219 LOT 178.2

FRANKLIN HEIGHTS
PARCEL B
40B DEVELOPMENT PLAN
FRANKLIN MASSACHUSETTS

EXISTING WATERSHED

SEPTEMBER 14, 2022

DATE	REVISION DESCRIPTION

GRAPHIC SCALE: 1"=60'

0 50 75 100 150 200 FEET
0 5 10 15 20 30 40 50 60 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. F4471

F4471

APPROVED DATE:

TOWN_PLANNING_BOARD

BEING A MAJORITY

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APPLICANT

OLIVER CROSSING REALTY TRUST
148 PARK STREET
NORTH READING MA, 01864

LOCUS REFERENCES

PLAN BK. 553 PLAN PG. 1 OF 2006
A.M. 219 LOT 178.2

FRANKLIN HEIGHTS
PARCEL B
40B DEVELOPMENT PLAN
FRANKLIN MASSACHUSETTS

PROPOSED WATERSHED

SEPTEMBER 14, 2022

DATE	REVISION DESCRIPTION

GRAPHIC SCALE: 1"=60'

0 50 75 100 150 200 FEET
0 5 10 15 20 30 40 50 60 METERS

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SHEET 2 OF 2 | JOB NO. F4471

TIME OF CONCENTRATION (Tc)

PR = 6.0 MINUTES

LEGEND

SOIL BOUNDARY
DRAINAGE AREA

PARCEL B
AREA=804,349 ± SQ.FT.
20.302 ±AC.

PR-1 PR-2 PR-3 PR-4 AP-1

71B RIDGEBURY FINE SANDY LOAM, 3 TO 8 PERCENT SLOPES, EXTREMELY STONY

51 SWANSEA MUCK, 0 TO 1 PERCENT SLOPES

310B WOODBRIDGE FINE SANDY LOAM, 3 TO 8 PERCENT SLOPES

305B PAXTON FINE SANDY LOAM, 3 TO 8 PERCENT SLOPES

73A WHITMAN FINE SANDY LOAM, 0 TO 3 PERCENT SLOPES, EXTREMELY STONY

MASS STATE PLANE NAD83

LINCOLN STREET
(PUBLIC~60' WIDE)
COUNTY LAYOUT OF OCT. 29, 1946

20' WIDE WAY

20' WIDE DRAIN EASEMENT

SEE ORAD RECORDED AT THE NORFOLK COUNTY REGISTRY OF DEEDS, BOOK 7224, PG 356.

LOT 6A

N/F FORD

N/F ESTHIMER

BUILDING #1
BUILDING #2
BUILDING #3
BUILDING #6
BUILDING #7
BUILDING #8
EX. BUILDING #4
EX. BUILDING #5

LEANNE WAY
SILVINE DRIVE
TROOPER PAUL HAMEL WAY

PR. HYDRANT

G:\C3D\Franklin\F4471\DWG\F4471-CIVIL rev1.dwg, 9/21/2022 8:12:01 AM

SUPPLEMENTAL ATTACHMENTS

Appendix 11

F4471

APPROVED DATE:

TOWN_PLANNING_BOARD

BEING A MAJORITY

LEGAL NOTES

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NATICK, MA 01760

APPLICANT

OLIVER CROSSING REALTY TRUST
148 PARK STREET
NORTH READING MA, 01864

LOCUS REFERENCES

PLAN BK. 553 PLAN PG. 1 OF 2006
A.M. 219 LOT 178.2

FRANKLIN HEIGHTS
PARCEL B
40B DEVELOPMENT PLAN
FRANKLIN MASSACHUSETTS

DRAINAGE AREA MAP

SEPTEMBER 14, 2022

DATE	REVISION DESCRIPTION

GRAPHIC SCALE: 1"=60'

0 50 75 100 150 200 FEET
0 5 10 15 20 30 40 50 60 METERS

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SHEET 1 OF 1

JOB NO. F4471

LEGEND

SOIL BOUNDARY

DRAINAGE AREA

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	0.541			0.415		0.483	1.439	0.73
DA-1B	0.199			0.153		0.000	0.351	0.64
DA-2A	0.099			0.030		0.163	0.293	0.84
DA-2B	0.046			0.021		0.000	0.067	0.71
DA-3A	0.114			0.024		0.000	0.138	0.80
DA-3B	0.081			0.000		0.000	0.081	0.90
DA-4A	0.324			0.127		0.425	0.876	0.81
DA-4B	0.225			0.738		0.472	1.434	0.59
DA-5A	0.132			0.402		0.231	0.765	0.58
DA-5B	0.213			0.184		0.361	0.758	0.75
DA-6A	0.044			0.000		0.000	0.044	0.90
DA-6B	0.163			0.113		0.213	0.490	0.76
SUBTOTAL	2.181	0.000	0.000	2.207	0.000	0.483	6.737	
OVERALL TOTALS	2.181			2.207		0.483	6.737	

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

Project: Franklin Heights, Franklin MA
Job No.: 4280

DESIGN COMPUTATIONS FOR STORM DRAINS

Prepared By: KKP Date: 7/06/2022 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-2A	DMH-2	1.05	6.00	5.50	5.75	15	0.006	0.011	6.05	4.93	4.69	31.9	0.11	0.20	250.35	250.15	253.20	253.35	
	CB-2B	DMH-2	0.22	6.00	5.50	1.24	12	0.005	0.011	3.12	3.97	1.57	27.3	0.11	0.15	250.30	250.15	253.20	253.35	
	DMH-2	DMH-7	1.27	6.11	5.50	6.99	18	0.005	0.011	9.16	5.19	3.96	55.1	0.18	0.30	250.05	249.75	253.35	254.05	
	DMH-7	DMH-8	1.27	6.29	5.50	6.99	18	0.005	0.011	8.77	4.96	3.96	80.1	0.27	0.40	249.65	249.25	254.05	253.35	INFILTRATION BASIN #1
	DMH-8	FES #1	1.27	6.56	5.50	6.99	18	0.006	0.011	9.91	5.61	3.96	23.5	0.07	0.15	249.15	249.00	253.35		
	OCS #1	HW #1				0.11	12	0.033	0.011	7.66	9.76	0.14	60.4	0.10	2.00	247.00	245.00			
DA-2	CB-3A	DMH-3	0.25	6.00	5.50	1.35	12	0.012	0.011	4.60	5.86	1.72	16.8	0.05	0.20	245.80	245.60	251.36	251.34	
	CB-3B	DMH-3	0.05	6.00	5.50	0.26	12	0.010	0.011	4.14	5.28	0.33	5.2	0.02	0.05	246.65	246.60	251.36	251.34	
	DMH-3	DMH-9	0.29	6.05	5.50	1.61	12	0.011	0.011	4.37	5.56	2.05	32.5	0.10	0.35	245.50	245.15	251.34	251.03	
DA-3	CB-1A	DMH-1	0.11	6.00	5.50	0.61	12	0.013	0.011	4.82	6.14	0.77	26.7	0.07	0.35	246.75	246.40	251.26	251.53	
	CB-1B	DMH-1	0.07	6.00	5.50	0.40	12	0.011	0.011	4.45	5.66	0.51	31.4	0.09	0.35	246.75	246.40	251.26	251.53	
	DMH-1	DMH-9	0.18	6.09	5.50	1.01	12	0.010	0.011	4.28	5.45	1.28	111.1	0.34	1.15	246.30	245.15	251.53	251.03	
	DMH-9	DMH-10	0.48	6.43	5.50	2.62	12	0.010	0.011	4.25	5.42	3.33	98.0	0.30	1.00	245.05	244.05	251.03	249.56	
	DMH-10	DMH-4	0.48	6.73	5.50	2.73	12	0.010	0.011	4.24	5.40	3.47	69.1	0.21	0.70	243.95	243.25	249.56	249.23	
DA-4	CB-4A	DMH-4	0.71	6.95	5.50	3.91	12	0.011	0.011	4.41	5.61	4.98	13.7	0.04	0.15	244.30	244.15	249.03	249.23	
	CB-4B	DMH-4	0.85	6.99	5.50	4.67	15	0.010	0.011	7.80	6.36	3.80	14.4	0.04	0.15	244.30	244.15	249.03	249.23	
	DMH-4	DMH-16	0.85	7.03	5.50	4.67	15	0.011	0.011	8.01	6.52	3.80	31.8	0.08	0.35	243.15	242.80	249.23	249.33	
	DMH-16	DMH-15	0.85	7.11	5.50	4.67	15	0.011	0.011	7.87	6.41	3.80	51.7	0.13	0.55	242.70	242.15	249.33	250.17	
																				INFILTRATION BASIN #2
DA-6	CB-6A	DMH-6	0.04	6.00	5.50	0.22	12	0.011	0.011	4.38	5.58	0.28	23.1	0.07	0.25	252.10	251.85	256.39	256.03	

Post Construction Inspection Report
Curtis Hill Estates
Charlton, Massachusetts

INSPECTION DATE:						
Person Inspecting		Weather				Other Personnel Present
		Clear				
Item	**N/A***	**sat.****	**NMR*****	**CAM****	**MCA***	**Comments:**
Pavement Swept						
Catch Basins						
CB #1A						
CB #1B						
CB #2A						
CB #2B						
CB #3A						
CB #3B						
CB #4A						
CB #4B						
CB #5A						
CB #5B						
CB #6A						
CB #6B						
Infiltration Basin						
Sediment Forebay #1						
Infiltration Basin #1						
Sediment Forebay #2						
Infiltration Basin #2						