DRAINAGE ANALYSIS

Prepared for New England Realty Trust
Proposed Car Wash

33 Mazzeo Drive
Randolph, Massachusetts 02368

January 27, 2022

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

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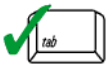
A. Introduction

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



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

The Stormwater Report must include:

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

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

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

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

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

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

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature

1/27/2022

Signature and Date

Checklist

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

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

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

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

Standard 1: No New Untreated Discharges

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

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

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

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

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

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

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

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

☐ Static ☒ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

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

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

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

Standard 10: Prohibition of Illicit Discharges

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

☒ An Illicit Discharge Compliance Statement is attached;

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

1. INTRODUCTION

MBL Land Development and Permitting Corporation (MBL) has prepared this Drainage Analysis for the proposed development of the project site located at 33 Mazzeo Drive, Randolph, Massachusetts. The purpose of the analysis is to quantitatively understand the impacts of the proposed site development on the existing hydrologic conditions and to mitigate these impacts through the implementation of a proposed stormwater management system that utilizes best management practices (BMPs) and is supported by an Operations & Maintenance Plan as well as a Long-Term Pollution Prevention Plan.

2. SITE DESCRIPTION

2.1 EXISTING CONDITIONS

The project is located at 33 Mazzeo Drive in Randolph, Massachusetts on the north side of the street between Thomas Patten Drive and West Street. This property is referenced as Block B, Lot 18..12A on Assessors Map 57 and contains a total area of 0.825 acres. The existing site is comprised of a single-family house on the north side of the property and a 1-story garage on the south side of the property with broken pavement and concrete areas.

The site does not lie within a flood area, as shown on the F.E.M.A. Flood insurance rate map (F.I.R.M.) for Norfolk county, Massachusetts, Map Number 25021C0216E, Community Number 250251, Panel 0216, having an effective date of July 17, 2012.

The site is not located within a NHESP Priority Habitat of Rare Species or an Estimated Habitat of Rare Wildlife according to the Massachusetts Natural Heritage Atlas, 14th Edition effective August 2017. This site is located within a Public Watershed Supply Outstanding Resource Water Critical Area.

2.2 PROPOSED CONDITIONS

The proposed site development consists of the construction of a 6,000 S.F. car wash building with associated site access, parking, utilities, and a stormwater management system.

2.3 SOILS

The Soil Conservation Survey for Norfolk County indicates that the entirety of the site is located within Soil Map Unit 422B – Canton Fine Sandy Loam, 0-8% slopes, extremely stony. This soil type has a Hydrologic Soil Group of B.

2.4 SITE TOPOGRAPHY

The site topography ranges from elevation 100 at the high point on the north side of the site to elevation 91 at the south side of the site. The site slopes are generally between 1-15%.

3. DRAINAGE CALCULATIONS

To mitigate the quality and quantity of stormwater runoff discharging from the site, the stormwater management system has been designed to collect, treat and control flows leaving the site.

The proposed stormwater management system will consist of a series of deep sump hooded catch basins, drain manholes, and water quality units that will convey stormwater runoff to the two subsurface recharge chamber systems located within the site parking lot.

The stormwater management system has been designed to reduce peak flows from the existing conditions to the proposed conditions for all storm events. From an environmentally sensitive perspective, the aforementioned measures result in a low impact design that promotes on-site groundwater recharge while preserving the natural hydrologic conditions.

A detailed hydrologic and hydraulic analysis of the stormwater management system was completed to evaluate its performance and document compliance with the Massachusetts Stormwater Standards for a redevelopment project. MBL has prepared the following drainage system calculations for the proposed site development. These calculations are broken into two main sections; Hydrologic and Hydraulic Analysis.

3.1 HYDROLOGIC ANALYSIS

The Soil Conservation Service (SCS) Unit Hydrograph methodology was utilized to develop a hydrologic model of the site. MBL utilized HydroCAD Version 10.0 software, developed by HydroCAD Software Solutions, LLC to analyze the site hydrology. The program calculates peak rates of runoff and runoff volume based on selected rainfall events. Contributing watershed areas were identified and soils, surface cover, watershed slope, and flow paths were evaluated to develop the necessary HydroCAD model input parameters. A minimum Time of Concentration (Tc) of six (6) minutes was used in the calculations.

Drainage calculations were performed for the Existing and Proposed Conditions for the 24-hour 2, 10, 25 and 100-year Type III storm events. The total rainfall for each of the storm events was based upon data from the NOAA Atlas 14. The total rainfall values used in the hydrologic modeling are shown in the following table:

Table 1: Table Design Rainfall Data

2-year, 24-hour storm	10-year, 24-hour storm	25-year, 24-hour storm	100-year, 24-hour storm
3.22 inches	4.86 inches	6.15 inches	8.80 inches

3.1.1 Design Points

To compare the difference between the existing and proposed peak flow rates, the existing and proposed watershed areas were delineated. The design point for the watershed weas determined by flow paths from the hydraulically most distance point of the watershed. These

parameters were utilized to calculate the times of concentration which were modeled. The same Design Point was analyzed for both the existing and proposed conditions. For this project, four design points were identified, which are as follows:

- Mazzeo Drive
- Offsite North
- Offsite East
- Offsite West

3.1.2 Existing Hydrology

The existing site was analyzed using 4 watershed areas discharging to the design points above. The existing watershed areas are shown on the attached Figure 7 titled, “Existing Conditions Drainage Map”. The hydrographs for the watershed areas were generated to develop the peak discharge rates for the 24-hour, 2, 10, 25, and 100-year storm events for the existing site conditions.

3.1.3 Proposed Hydrology

The proposed site was analyzed using 13 watershed areas discharging to the design points above. The proposed watershed areas are shown on the attached Figure 8 entitled “Proposed Conditions Drainage Map”. The hydrographs for the watershed areas were generated and routed through the proposed BMPs to develop the peak discharge rates for the 24-hour 2, 10, 25 and 100-year storm events for the proposed site conditions.

3.1.4 Peak Discharge Rates

Table 2 below summarizes the existing and proposed peak discharge rates for each Design Point. As depicted in the table, the proposed peak rate of discharge does not increase over existing rate for all storm events analyzed.

Table 2: Pre- and Post-Development Peak Discharge Rates								
Storm Frequency	Existing Peak Runoff (cfs)	Proposed Peak Runoff (cfs)	Existing Peak Runoff (cfs)	Proposed Peak Runoff (cfs)	Existing Peak Runoff (cfs)	Proposed Peak Runoff (cfs)	Existing Peak Runoff (cfs)	Proposed Peak Runoff (cfs)
	Mazzeo Drive	Mazzeo Drive	Offsite North	Offsite North	Offsite East	Offsite East	Offsite West	Offsite West
2	0.10	0.07	0.00	0.00	0.00	0.00	0.02	0.01
10	0.33	0.16	0.04	0.01	0.04	0.01	0.24	0.08
25	0.54	0.24	0.08	0.02	0.09	0.03	0.57	0.16
100	1.04	0.41	0.18	0.05	0.23	0.08	1.47	0.36

3.2 HYDRAULIC ANALYSIS

The stormwater closed (underground piping) drainage system discharging to the BMPs were designed to convey the 25-year storm event. Pipe capacity and peak discharge rates for the closed drainage system were calculated using a Manning's Formula.

The closed drainage system, as designed, is capable of conveying the design flow as calculated. The closed drainage system analysis for the proposed system is depicted in Appendix B.

4. BEST MANAGEMENT PRACTICES

The Massachusetts Stormwater Standards requires 80% removal rate over an average annual basis, for Total Suspended Solids (TSS) contained in stormwater runoff. The water quality volume or "first flush" is defined as the volume obtained by multiplying one-half inch (½") or one inch (1") times the impervious surface area of the contributing drainage area. Water quality volume calculations are provided in Appendix D. When this volume is incorporated into properly designed BMPs an 80% reduction of average annual TSS loading will result. The following Best Management Practices will be employed for the project.

4.1 DEEP SUMP HODDED CATCH BASINS

Deep sump hooded catch basins are proposed for pretreatment. 25% TSS pretreatment credit has been taken for the deep sump hooded catch basins.

4.2 WATER QUALITY UNITS

Stormceptor Water Quality Units are proposed for TSS removal. Please see Appendix D for the manufacturer's TSS removal calculations for the proposed water quality units.

4.3 SUBSURFACE RECHARGE CHAMBERS

Cultec 180HD Subsurface Recharge Chambers and Cultec 330XLHD Subsurface Recharge Chambers are proposed to recharge runoff. Recharge chambers have a TSS removal rate of 80%.

5. STORMWATER MANAGEMENT STANDARDS COMPLIANCE

The proposed best management practices (BMPs) selection and their placement within the treatment train of the stormwater management system has been strategically planned and designed as prescribed by the Massachusetts Stormwater Management Handbook. The following addresses how the project complies with Standards 1-10 as set forth in the Massachusetts Stormwater Handbook:

Standard 1

No new stormwater conveyances (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.

There are no new untreated discharges to or that will cause erosion in wetlands or waters of the Commonwealth. 95.5% of stormwater runoff from impervious surfaces is designed to be collected, conveyed and treated prior to recharging on-site. The proposed 1,085 s.f. of impervious area discharging directly offsite to the Mazzeo Drive study point is lower than the 2,800 s.f. of existing impervious area discharging offsite to this same study point.

Standard 2

Stormwater management systems shall be designed so that the post-development peak discharge rates do not exceed pre-development peak discharge rates.

The stormwater management system has been designed so that the proposed peak discharge rates are less than the existing peak discharge rates for the 2-year, 10-year, 25-year and 100-year 24-hour storm events (see Table 2 of this report). Supporting documentation such as HydroCAD computer model output, required computations, and tables are located in Appendix A.

Standard 3

Loss of annual recharge to groundwater shall be eliminated or minimized with environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance.

The proposed stormwater management system has been designed to collect stormwater runoff and recharge it back into the ground on-site. The soils on-site are conducive to recharge. Supporting documentation such as Required Recharge Volume Calculations can be found in Appendix C.

Standard 4

Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS).

The required removal of 80% TSS has been achieved by a series of BMP's including deep sump hooded catch basins, water quality units, and subsurface recharge chambers. Computations and documentation are provided in Appendix D.

Standard 5

For land uses with higher potential loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable.

The site is not a land use with higher potential pollutant load, per the regulations.

Standard 6

Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply and stormwater discharges near or to any other critical area require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas, as provided in the Massachusetts Stormwater Handbook.

The site is located within a Public Water Supply Outstanding Resource Water Critical Area. A 1" runoff depth has been utilized to account for this in the Water Quality Volume calculations provided in Appendix D.

Standard 7

A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural stormwater best management practice requirements of Standards 4, 5, and 6. Existing Stormwater discharges shall comply with Standard 1 only to the maximum extent practicable.

The project is not considered a redevelopment project per the regulations.

Standard 8

A plan to control construction-related impacts, including erosion, sedimentation, and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented.

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan is located in Appendix E.

Standard 9

A Long-Term Operation and Maintenance (O&M) Plan shall be developed and implemented to ensure that stormwater management systems function as designed.

A Long-Term Operation and Maintenance Plan (O&M Plan) for the site stormwater management facilities can be found in Appendix G and a Long-Term Pollution Prevention Plan (LPPP) is located in Appendix F.

Standard 10

All illicit discharges to the stormwater management system are prohibited.

An Illicit Discharge Compliance Statement has been provided in Appendix H.

6. CONCLUSION

The proposed project will not increase the peak rate of runoff for all modeled storm events for this site over existing conditions. This has been accomplished by implementing BMPs that will enhance the quality of stormwater runoff including deep sump hooded catch basins, water quality units, drain manholes, and subsurface recharge chambers. The proposed stormwater management system has been designed to the meet all 10 of the Massachusetts Stormwater Management System Standards and the Town of Randolph Stormwater Rules & Regulations.

Figure 1: Aerial Map

NOTE: INFORMATION ON THIS PLAN OBTAINED FROM MASSGIS USGS COLOR ORTHO IMAGERY 2019.

MBL
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AERIAL MAP

33 MAZZEO DRIVE

MAP 57 LOT BLOCK B LOT 18..12A

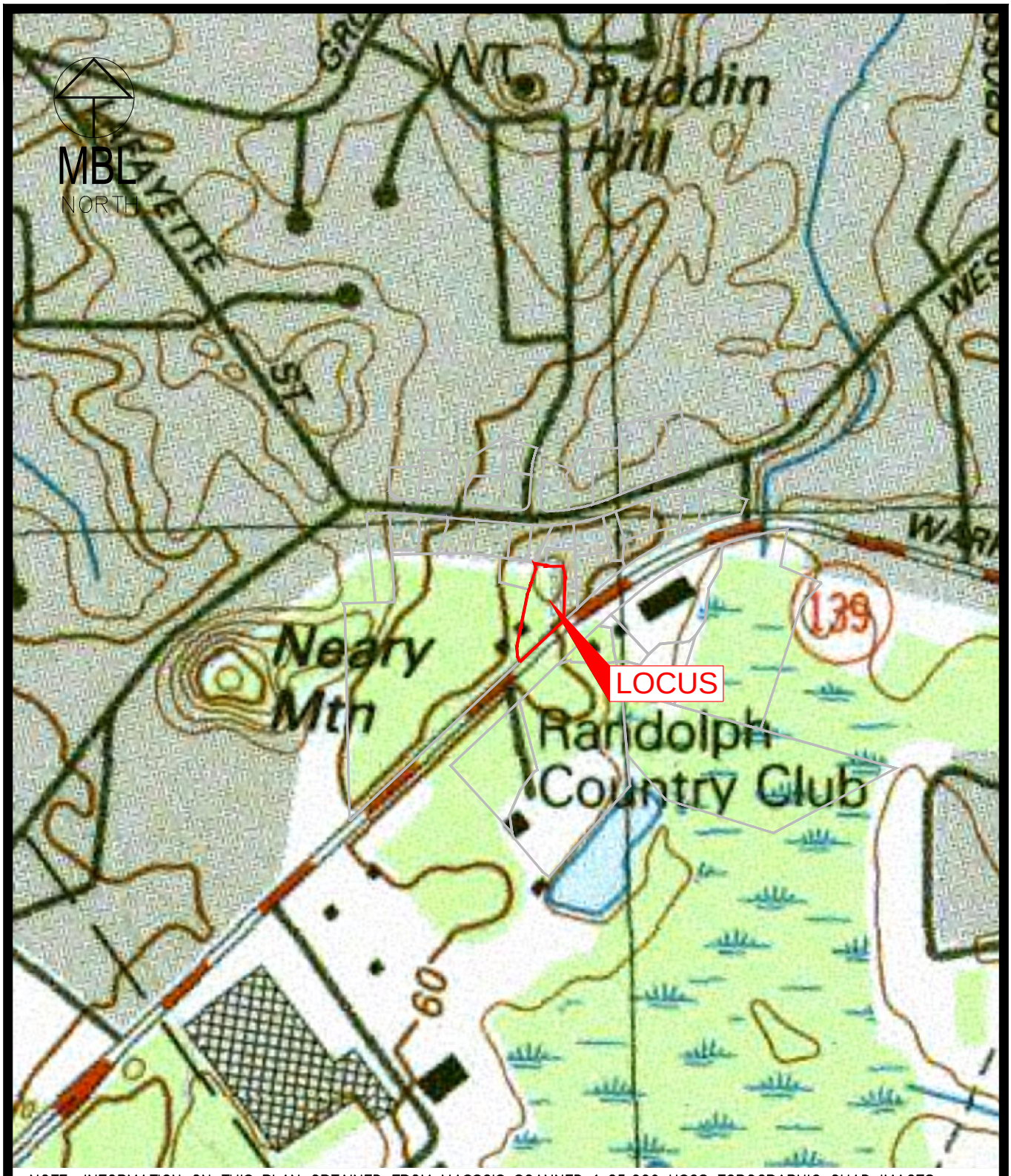
RANDOLPH MASSACHUSETTS

PROJ. No:	2021-054
DATE:	01/05/2022
SCALE:	1"=500'

FIGURE 1

X:\2021\2021-054\ADMIN\REPORTS\NOI\FIGURES\2021-054 FIGURES.DWG

Figure 2: USGS Topographic Map



NOTE: INFORMATION ON THIS PLAN OBTAINED FROM MASSGIS SCANNED 1:25,000 USGS TOPOGRAPHIC QUAD IMAGES, JUNE 2001.

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P.508.297.2746
EMAIL:info@MBLLandDevelopment.com
WEB: www.MBLLand Development.com

USGS TOPOGRAPHIC MAP

33 MAZZEO DRIVE

MAP 57 LOT BLOCK B LOT 18..12A

RANDOLPH MASSACHUSETTS

PROJ. No:	2021-054
DATE:	01/05/2022
SCALE:	1"=500'

FIGURE 2

X:\2021\2021-054\ADMIN\REPORTS\NOI\FIGURES\2021-054 FIGURES.DWG

Figure 3: Flood Insurance Rate Map

ZONE X, AREAS BETWEEN THE LIMITS OF THE 100–YEAR AND 500–YEAR FLOODS

ZONE AE, AREAS OF THE 100–YEAR, BASE FLOOD ELEVATION DETERMINED

FLOODWAY AREAS IN ZONE AE

NOTE: FLOOD BOUNDARY INFORMATION SHOWN OBTAINED FROM FEMA FIRM MAP FOR COMMUNITY PANEL NO. 25021C0216E HAVING AN EFFECTIVE DATE OF JULY 17, 2012.

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FLOOD MAP

33 MAZZEO DRIVE

MAP 57 LOT BLOCK B LOT 18..12A

RANDOLPH MASSACHUSETTS

PROJ. No:	2021-054
DATE:	01/05/2022
SCALE:	1"=500'

FIGURE 3

X:\2021\2021-054\ADMIN\REPORTS\NOI\FIGURES\2021-054 FIGURES.DWG

Figure 4: Natural Heritage Map

ESTIMATED HABITATS OF RARE WILDLIFE

PRIORITY HABITATS OF RARE SPECIES

CERTIFIED VERNAL POOL

NOTE: INFORMATION ON THIS PLAN OBTAINED FROM THE 14TH EDITION OF THE MASSACHUSETTS NATURAL HERITAGE ATLAS DATED AUGUST 1, 2017.

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NATURAL HERITAGE

33 MAZZEO DRIVE

MAP 57 LOT BLOCK B LOT 18..12A

RANDOLPH MASSACHUSETTS

PROJ. No:	2021-054
DATE:	01/05/2022
SCALE:	1"=500'

FIGURE 4

X:\2021\2021-054\ADMIN\REPORTS\NOI\FIGURES\2021-054 FIGURES.DWG

Figure 5: Critical Areas

AREAS OF CRITICAL ENVIRONMENTAL CONCERN

WELLHEAD PROTECTION AREAS

OUTSTANDING RESOURCE WATERS

NOTE: INFORMATION ON THIS PLAN OBTAINED FROM MASS GIS DATABASE ACEC, IPWA, ZONE II AND OUTSTANDING RESOURCE WATERS DATA LAYER. THE LOCUS IS NOT LOCATED WITHIN A CRITICAL AREA.

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CRITICAL AREAS

33 MAZZEO DRIVE

MAP 57 LOT BLOCK B LOT 18..12A

RANDOLPH MASSACHUSETTS

PROJ. No:	2021-054
DATE:	01/05/2022
SCALE:	1"=500'

FIGURE 5

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Figure 6: Soils Map

NOTE: INFORMATION ON THIS PLAN OBTAINED FROM MASS GIS NRCS SSURGO–CERTIFIED SOILS DATA LAYER.

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SOILS MAP

33 MAZZEO DRIVE

MAP 57 LOT BLOCK B LOT 18..12A

RANDOLPH MASSACHUSETTS

PROJ. No:	2021-054
DATE:	01/05/2022
SCALE:	1"=100'

FIGURE 6

X:\2021\2021-054\ADMIN\REPORTS\NOI\FIGURES\2021-054 FIGURES.DWG

Figure 7: Existing Conditions Drainage Map

MBL NORTH
LCC# 30037A

EX-3 : TO OFFSITE NORTH
TOTAL AREA=2,120 S.F.
BRUSH/WEEDS/GRASS MIX=1,849 S.F.
GRAVEL=27 S.F.
IMPERVIOUS=244 S.F.

STUDY POINT:
OFFSITE NORTH

EX-2 : TO OFFSITE EAST
TOTAL AREA=3,128 S.F.
BRUSH/WEEDS/GRASS MIX=2,922 S.F.
IMPERVIOUS=206 S.F.

STUDY POINT:
OFFSITE EAST

STUDY POINT:
OFFSITE WEST

EX-4 : TO OFFSITE WEST
TOTAL AREA=21,676 S.F.
BRUSH/WEEDS/GRASS MIX=20,564 S.F.
GRAVEL=83 S.F.
IMPERVIOUS=1,029 S.F.

EX-1 : TO MAZZEO DRIVE
TOTAL AREA=9,021 S.F.
BRUSH/WEEDS/GRASS MIX=6,221 S.F.
IMPERVIOUS=2,800 S.F.

STUDY POINT:
MAZZEO DRIVE

1-STORY WOOD #308
1-STORY WOOD
SHED
1-STORY COV GARAGE
STONE WALL
PCC
SGE
MAZZEO (S.H.L.O. #4152) DRIVE

LEGEND

- WATERSHED BOUNDARY
- DRAINAGE FLOWPATH
- IMPERVIOUS
- GRAVEL
- BRUSH/GRASS/WEEDS MIX

NOTE: WHERE NO FLOWPATH IS SHOWN, A TIME OF CONCENTRATION OF 6 MINUTES WAS USED.

811 DigSafe MA.ME.NH.RI.VT

No.	DATE	DESCRIPTION	BY
REVISIONS			

PROJ. MANAGER: TLD
CHIEF DESIGNER: DT
REVIEWED BY: DATE

SEAL

SEAL

PREPARED FOR
NEW ENGLAND REALTY TRUST
611 HIGH STREET, NO.190
DEDHAM MASSACHUSETTS

SCALE:
HORZ.: 1"=20'
VERT.:
DATUM:
HORZ.:
VERT.:
20 10 0 20
GRAPHIC SCALE

MBL
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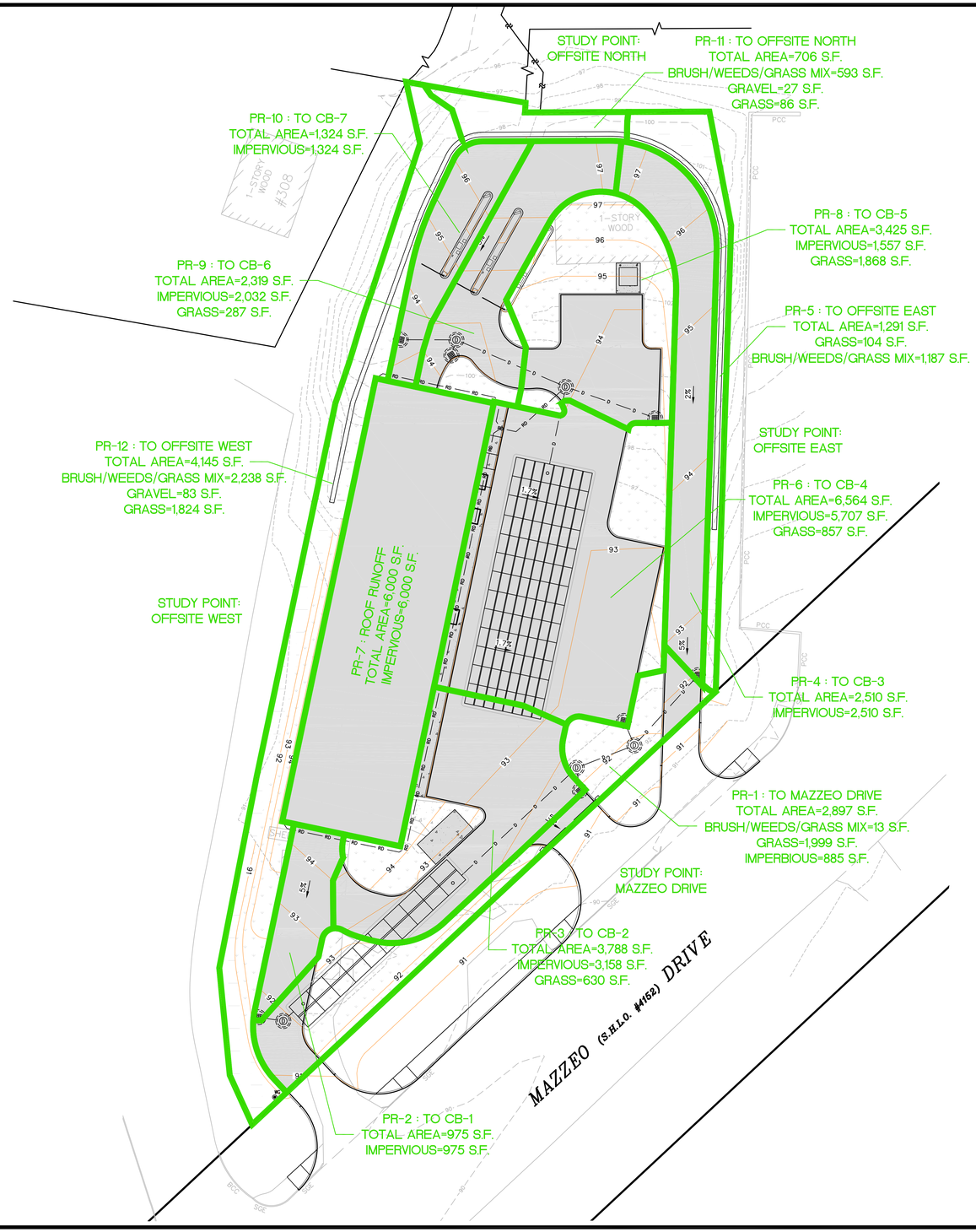
SITE PLANS
EXISTING CONDITIONS DRAINAGE MAP
33 MAZZEO DRIVE
ASSESSORS MAP 57 BLOCK B LOT 18..12A
RANDOLPH MASSACHUSETTS

PROJ. No.: 2021-054
DATE: JANUARY 27, 2022

FIGURE 7

Figure 8: Proposed Conditions Drainage Map

MBL NORTH
LCC# 30037A



LEGEND

- WATERSHED BOUNDARY
- DRAINAGE FLOWPATH
- IMPERVIOUS
- GRAVEL
- GRASS
- BRUSH/GRASS/WEEDS MIX

NOTE: WHERE NO FLOWPATH IS SHOWN, A TIME OF CONCENTRATION OF 6 MINUTES WAS USED.

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No.	DATE	DESCRIPTION	BY
REVISIONS			

PROJ. MANAGER: TLD
CHIEF DESIGNER: DT
REVIEWED BY: DATE

SEAL

SEAL

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NEW ENGLAND REALTY TRUST
611 HIGH STREET, NO.190
DEDHAM MASSACHUSETTS

SCALE:
HORZ.: 1"=20'
VERT.:
DATUM:
HORZ.:
VERT.:
20 10 0 20
GRAPHIC SCALE

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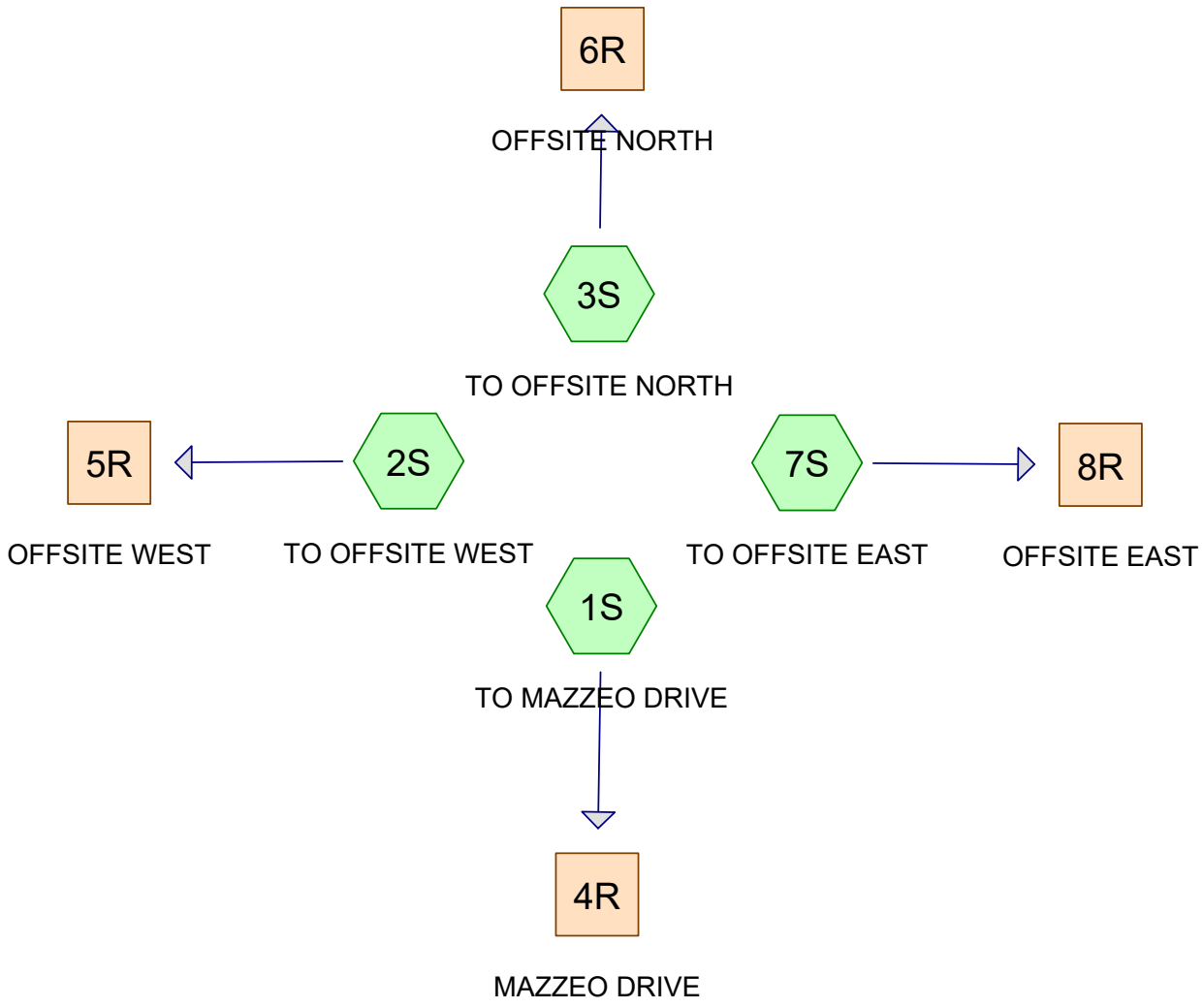
SITE PLANS
PROPOSED CONDITIONS DRAINAGE MAP
33 MAZZEO DRIVE
ASSESSORS MAP 57 BLOCK B LOT 18..12A
RANDOLPH MASSACHUSETTS

PROJ. No.: 2021-054
DATE: JANUARY 27, 2022

FIGURE 8

APPENDIX A: HYDROLOGIC ANALYSIS

Pre-Development HydroCAD Analysis



Subcat Reach Pond Link

Routing Diagram for 2021-054 - EX

Prepared by {enter your company name here}, Printed 1/11/2022

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.724	48	Brush, Good, HSG B (1S, 2S, 3S, 7S)
0.003	96	Gravel surface, HSG B (2S, 3S)
0.098	98	Impervious (1S, 2S, 3S, 7S)
0.825	**54**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.727	HSG B	1S, 2S, 3S, 7S
0.000	HSG C	
0.000	HSG D	
0.098	Other	1S, 2S, 3S, 7S
0.825		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.724	0.000	0.000	0.000	0.724	Brush, Good	1S, 2S, 3S, 7S
0.000	0.003	0.000	0.000	0.000	0.003	Gravel surface	2S, 3S
0.000	0.000	0.000	0.000	0.098	0.098	Impervious	1S, 2S, 3S, 7S
0.000	**0.727**	**0.000**	**0.000**	**0.098**	**0.825**	**TOTAL AREA**	

Time span=1.00-24.00 hrs, dt=0.05 hrs, 461 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: TO MAZZEO DRIVE Runoff Area=9,021 sf 31.04% Impervious Runoff Depth>0.57"
Flow Length=160' Tc=6.5 min CN=64 Runoff=0.10 cfs 0.010 af

Subcatchment 2S: TO OFFSITE WEST Runoff Area=21,676 sf 4.75% Impervious Runoff Depth>0.15"
Flow Length=197' Tc=7.8 min CN=51 Runoff=0.02 cfs 0.006 af

Subcatchment 3S: TO OFFSITE NORTH Runoff Area=2,120 sf 11.51% Impervious Runoff Depth>0.23"
Tc=6.0 min CN=54 Runoff=0.00 cfs 0.001 af

Subcatchment 7S: TO OFFSITE EAST Runoff Area=3,128 sf 6.59% Impervious Runoff Depth>0.15"
Tc=6.0 min CN=51 Runoff=0.00 cfs 0.001 af

Reach 4R: MAZZEO DRIVE Inflow=0.10 cfs 0.010 af
Outflow=0.10 cfs 0.010 af

Reach 5R: OFFSITE WEST Inflow=0.02 cfs 0.006 af
Outflow=0.02 cfs 0.006 af

Reach 6R: OFFSITE NORTH Inflow=0.00 cfs 0.001 af
Outflow=0.00 cfs 0.001 af

Reach 8R: OFFSITE EAST Inflow=0.00 cfs 0.001 af
Outflow=0.00 cfs 0.001 af

Total Runoff Area = 0.825 ac Runoff Volume = 0.018 af Average Runoff Depth = 0.26"
88.10% Pervious = 0.727 ac 11.90% Impervious = 0.098 ac

Summary for Subcatchment 1S: TO MAZZEO DRIVE

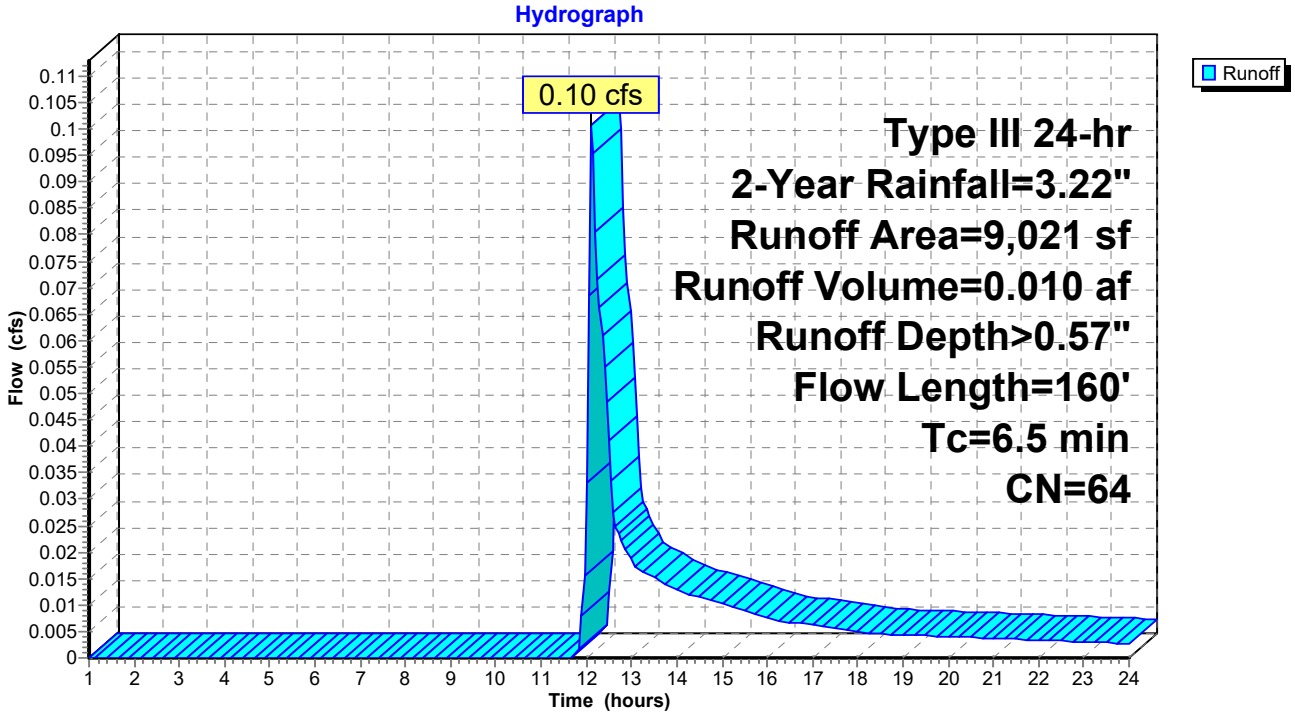
Runoff = 0.10 cfs @ 12.12 hrs, Volume= 0.010 af, Depth> 0.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.22"

	Area (sf)	CN	Description
	6,221	48	Brush, Good, HSG B
*	2,800	98	Impervious
	9,021	64	Weighted Average
	6,221		68.96% Pervious Area
	2,800		31.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	50	0.0640	0.16		**Sheet Flow, ab** Grass: Dense n= 0.240 P2= 3.22"
1.4	110	0.0664	1.29		**Shallow Concentrated Flow, bc** Woodland Kv= 5.0 fps
6.5	160	Total			

Subcatchment 1S: TO MAZZEO DRIVE



Summary for Subcatchment 2S: TO OFFSITE WEST

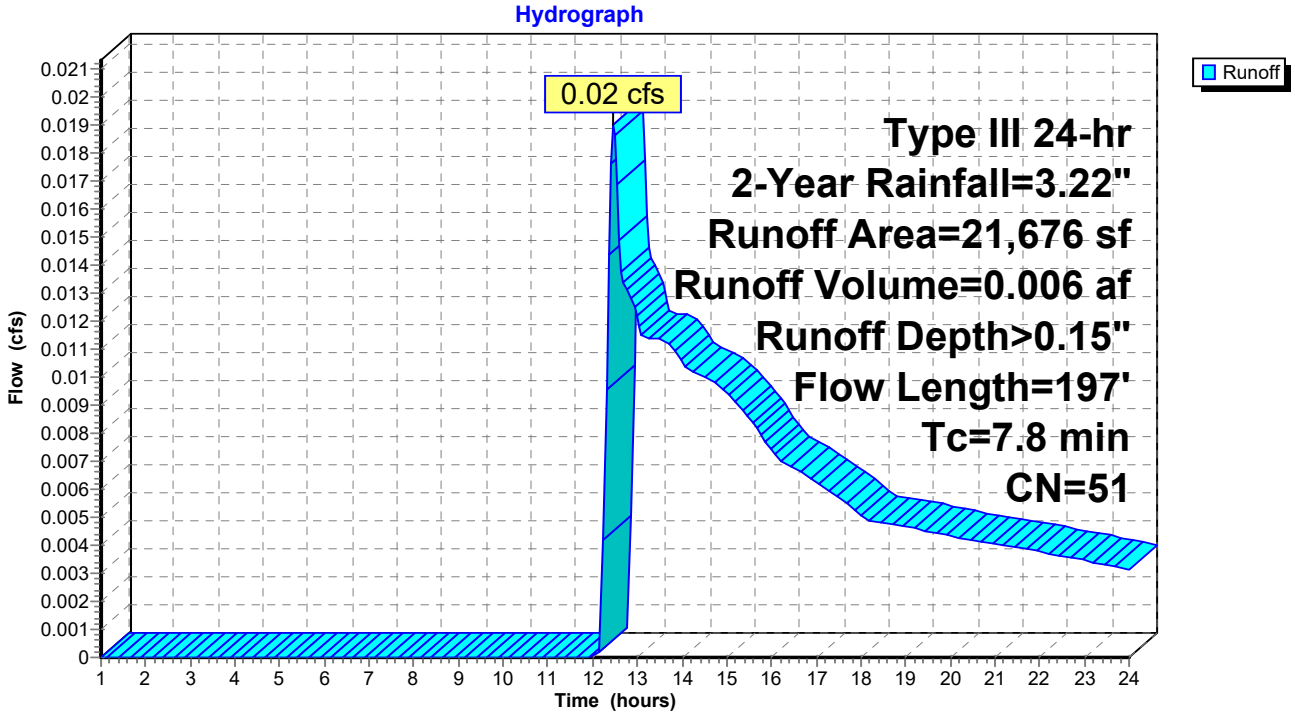
Runoff = 0.02 cfs @ 12.46 hrs, Volume= 0.006 af, Depth> 0.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.22"

	Area (sf)	CN	Description
	83	96	Gravel surface, HSG B
	20,564	48	Brush, Good, HSG B
*	1,029	98	Impervious
	21,676	51	Weighted Average
	20,647		95.25% Pervious Area
	1,029		4.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	50	0.0480	0.14		**Sheet Flow, ab** Grass: Dense n= 0.240 P2= 3.22"
2.0	147	0.0598	1.22		**Shallow Concentrated Flow, bc** Woodland Kv= 5.0 fps
7.8	197	Total			

Subcatchment 2S: TO OFFSITE WEST



Summary for Subcatchment 3S: TO OFFSITE NORTH

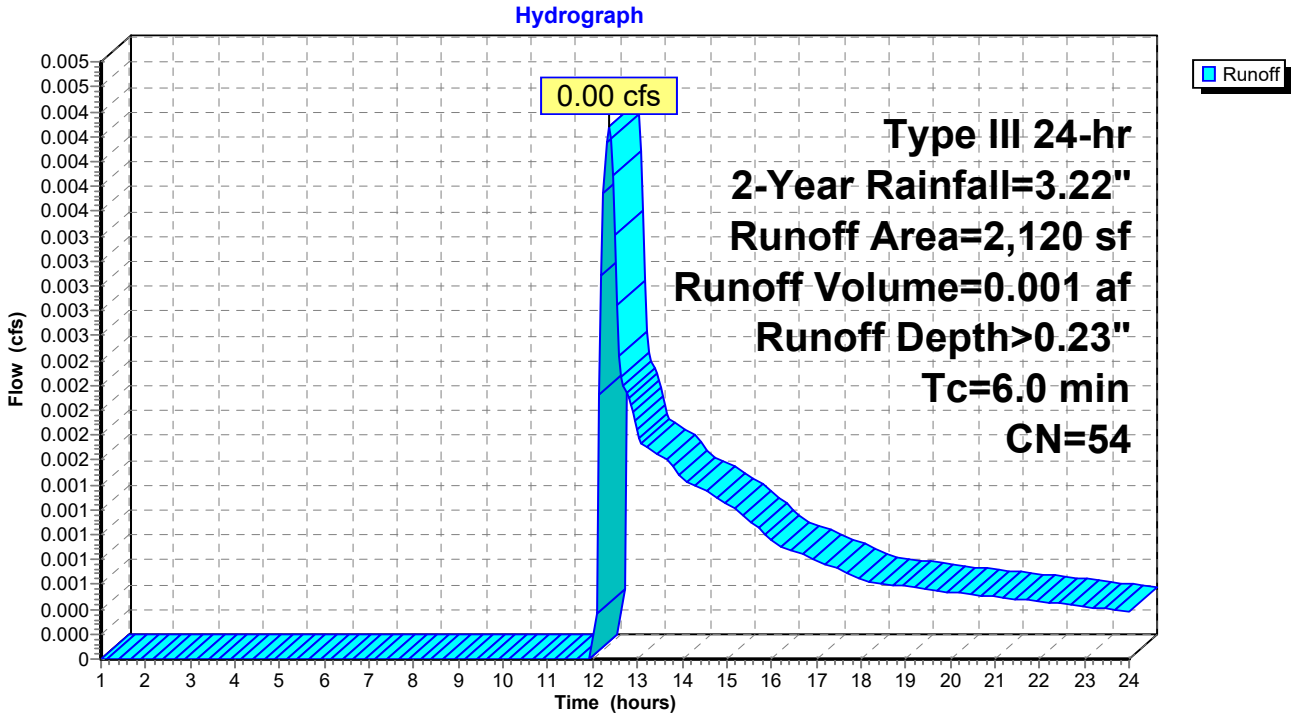
Runoff = 0.00 cfs @ 12.35 hrs, Volume= 0.001 af, Depth> 0.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.22"

	Area (sf)	CN	Description
	27	96	Gravel surface, HSG B
	1,849	48	Brush, Good, HSG B
*	244	98	Impervious
	2,120	54	Weighted Average
	1,876		88.49% Pervious Area
	244		11.51% Impervious Area

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

Subcatchment 3S: TO OFFSITE NORTH



Summary for Subcatchment 7S: TO OFFSITE EAST

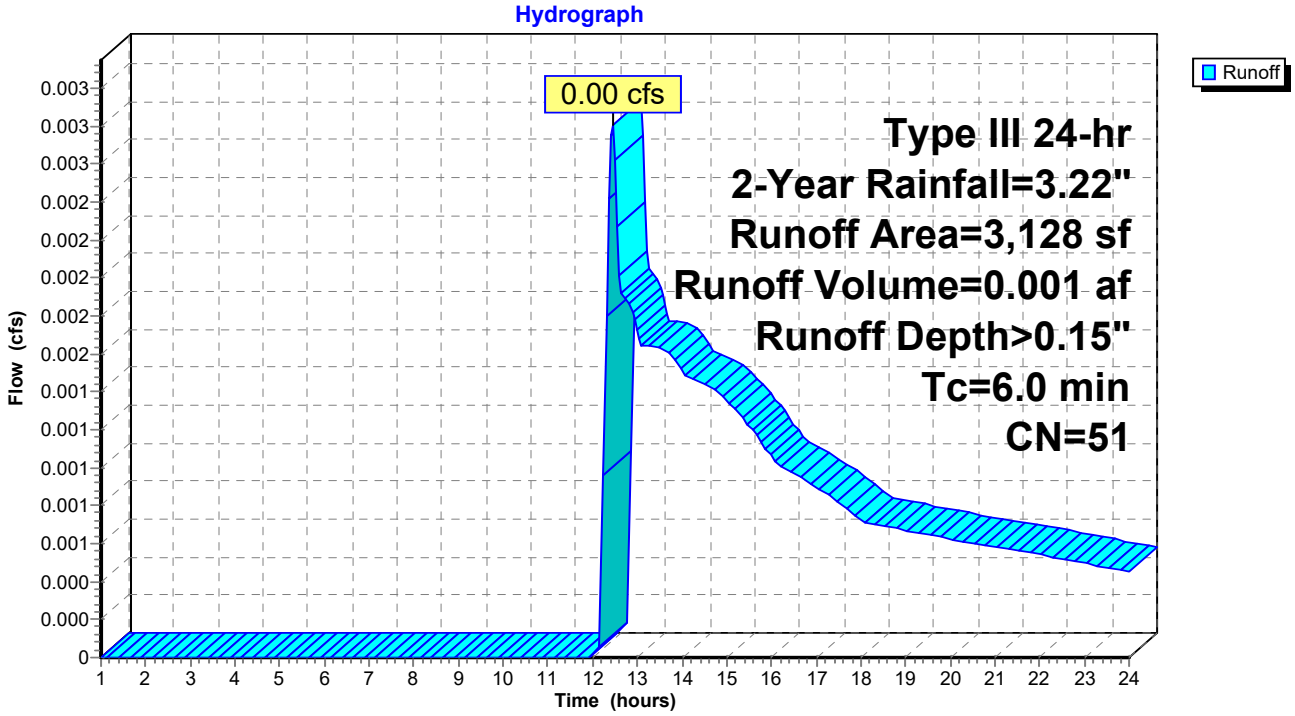
Runoff = 0.00 cfs @ 12.44 hrs, Volume= 0.001 af, Depth> 0.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.22"

	Area (sf)	CN	Description
	2,922	48	Brush, Good, HSG B
*	206	98	Impervious
	3,128	51	Weighted Average
	2,922		93.41% Pervious Area
	206		6.59% Impervious Area

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

Subcatchment 7S: TO OFFSITE EAST

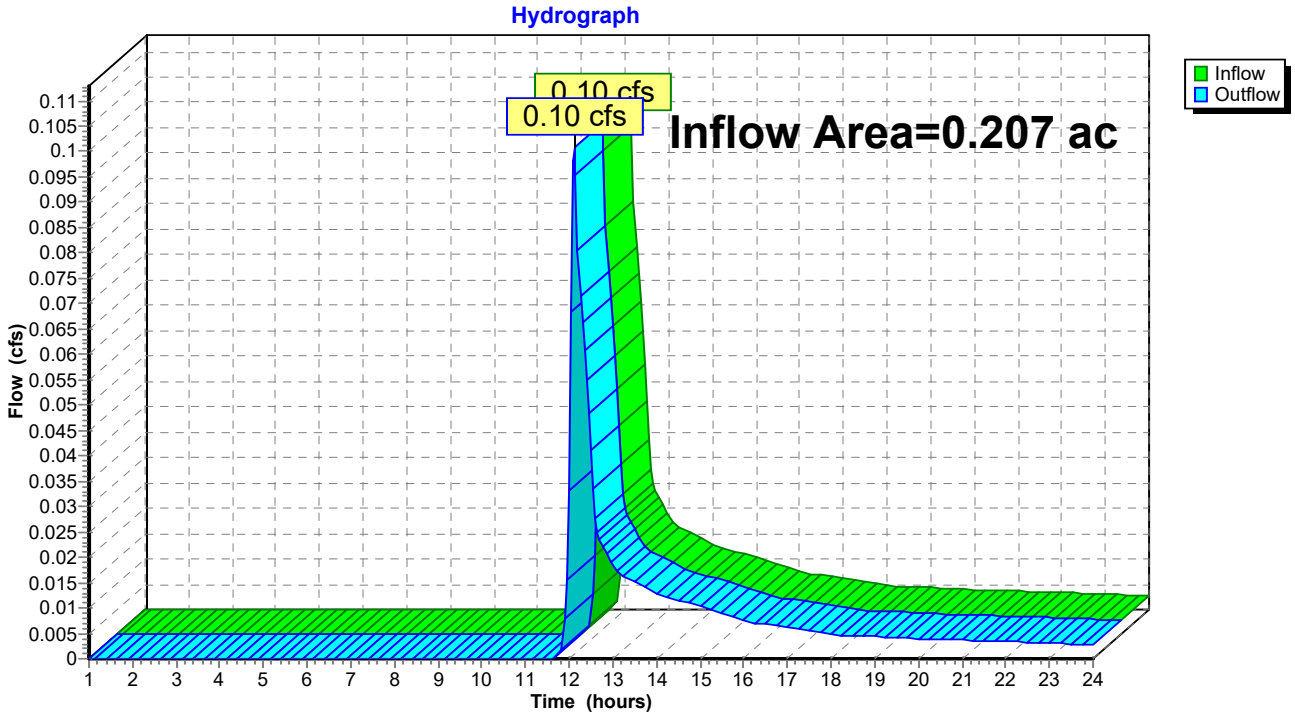


Summary for Reach 4R: MAZZEO DRIVE

Inflow Area = 0.207 ac, 31.04% Impervious, Inflow Depth > 0.57" for 2-Year event
Inflow = 0.10 cfs @ 12.12 hrs, Volume= 0.010 af
Outflow = 0.10 cfs @ 12.12 hrs, Volume= 0.010 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs

Reach 4R: MAZZEO DRIVE

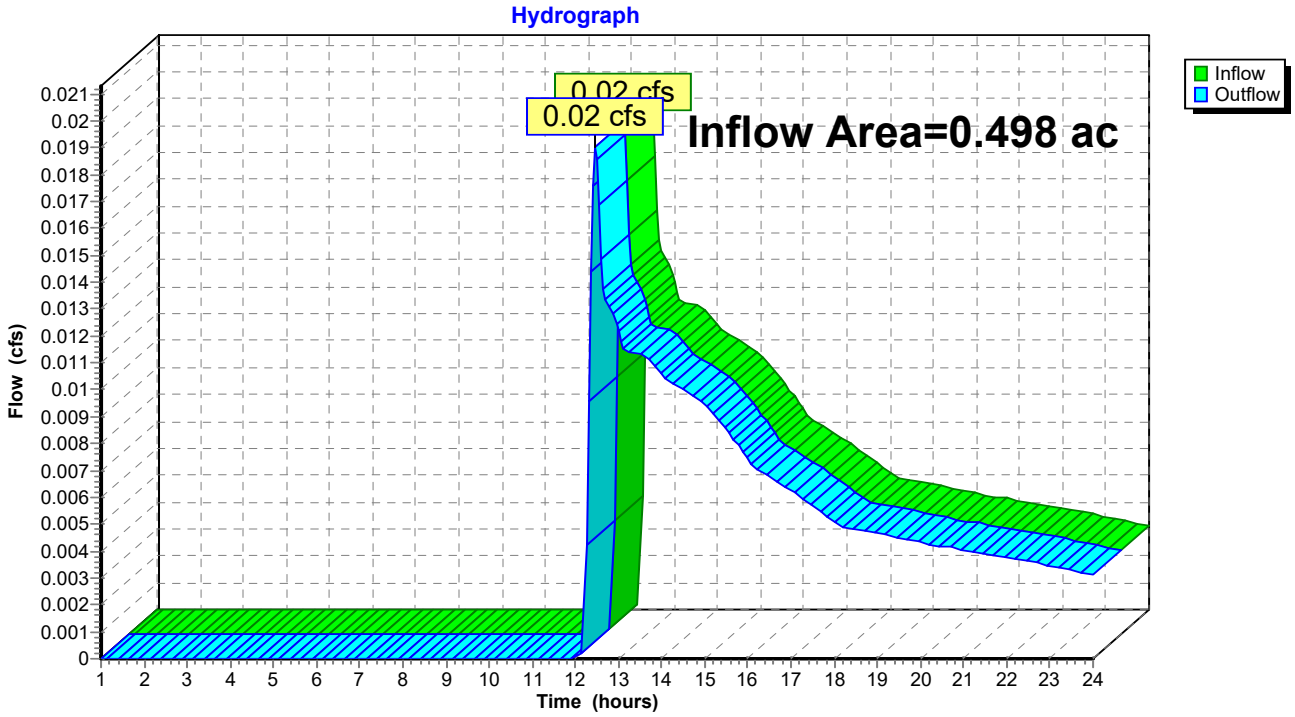


Summary for Reach 5R: OFFSITE WEST

Inflow Area = 0.498 ac, 4.75% Impervious, Inflow Depth > 0.15" for 2-Year event
Inflow = 0.02 cfs @ 12.46 hrs, Volume= 0.006 af
Outflow = 0.02 cfs @ 12.46 hrs, Volume= 0.006 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs

Reach 5R: OFFSITE WEST

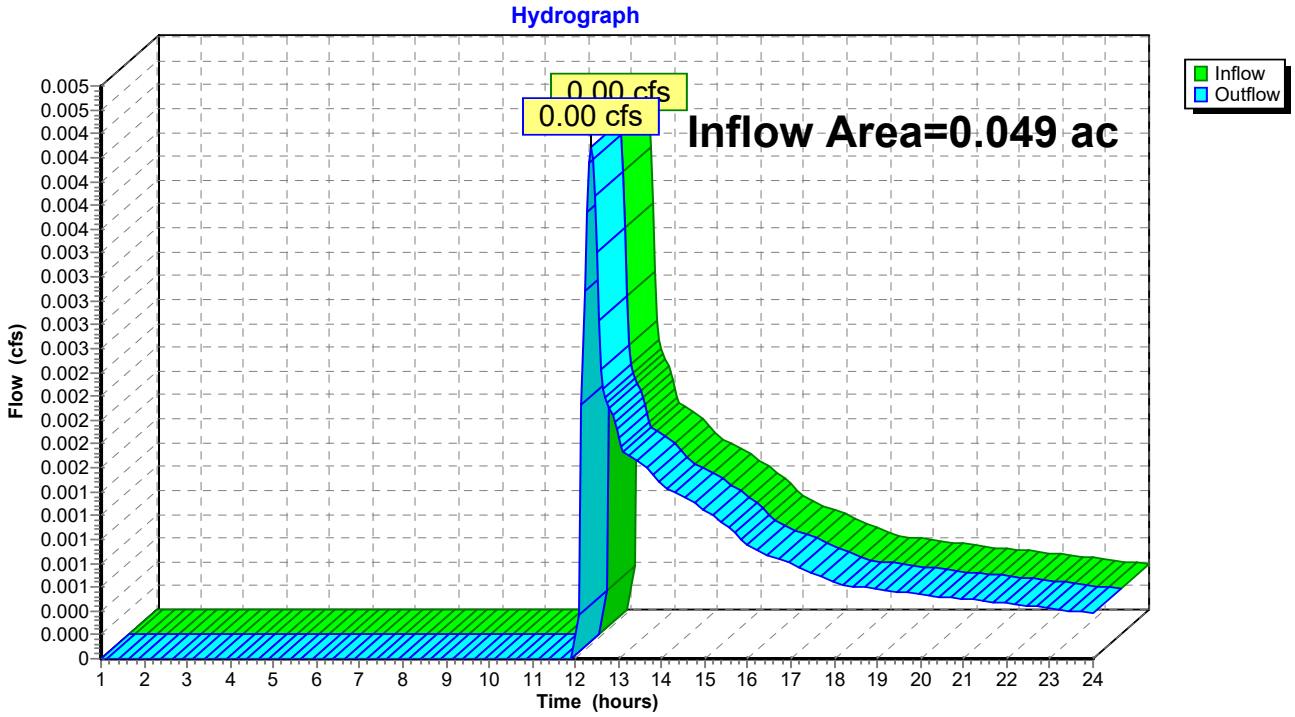


Summary for Reach 6R: OFFSITE NORTH

Inflow Area = 0.049 ac, 11.51% Impervious, Inflow Depth > 0.23" for 2-Year event
Inflow = 0.00 cfs @ 12.35 hrs, Volume= 0.001 af
Outflow = 0.00 cfs @ 12.35 hrs, Volume= 0.001 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs

Reach 6R: OFFSITE NORTH

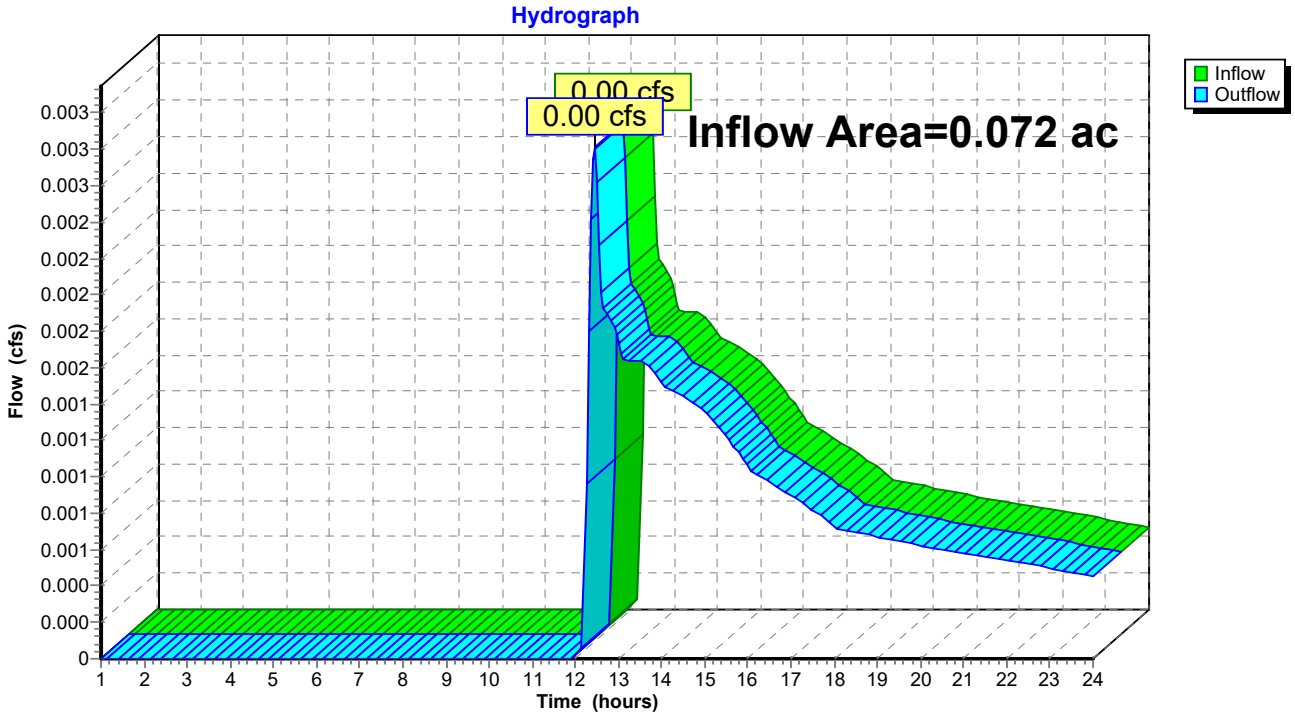


Summary for Reach 8R: OFFSITE EAST

Inflow Area = 0.072 ac, 6.59% Impervious, Inflow Depth > 0.15" for 2-Year event
Inflow = 0.00 cfs @ 12.44 hrs, Volume= 0.001 af
Outflow = 0.00 cfs @ 12.44 hrs, Volume= 0.001 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs

Reach 8R: OFFSITE EAST



Time span=1.00-24.00 hrs, dt=0.05 hrs, 461 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: TO MAZZEO DRIVE Runoff Area=9,021 sf 31.04% Impervious Runoff Depth>1.49"
Flow Length=160' Tc=6.5 min CN=64 Runoff=0.33 cfs 0.026 af

Subcatchment 2S: TO OFFSITE WEST Runoff Area=21,676 sf 4.75% Impervious Runoff Depth>0.69"
Flow Length=197' Tc=7.8 min CN=51 Runoff=0.24 cfs 0.028 af

Subcatchment 3S: TO OFFSITE NORTH Runoff Area=2,120 sf 11.51% Impervious Runoff Depth>0.85"
Tc=6.0 min CN=54 Runoff=0.04 cfs 0.003 af

Subcatchment 7S: TO OFFSITE EAST Runoff Area=3,128 sf 6.59% Impervious Runoff Depth>0.69"
Tc=6.0 min CN=51 Runoff=0.04 cfs 0.004 af

Reach 4R: MAZZEO DRIVE Inflow=0.33 cfs 0.026 af
Outflow=0.33 cfs 0.026 af

Reach 5R: OFFSITE WEST Inflow=0.24 cfs 0.028 af
Outflow=0.24 cfs 0.028 af

Reach 6R: OFFSITE NORTH Inflow=0.04 cfs 0.003 af
Outflow=0.04 cfs 0.003 af

Reach 8R: OFFSITE EAST Inflow=0.04 cfs 0.004 af
Outflow=0.04 cfs 0.004 af

Total Runoff Area = 0.825 ac Runoff Volume = 0.062 af Average Runoff Depth = 0.90"
88.10% Pervious = 0.727 ac 11.90% Impervious = 0.098 ac

Summary for Subcatchment 1S: TO MAZZEO DRIVE

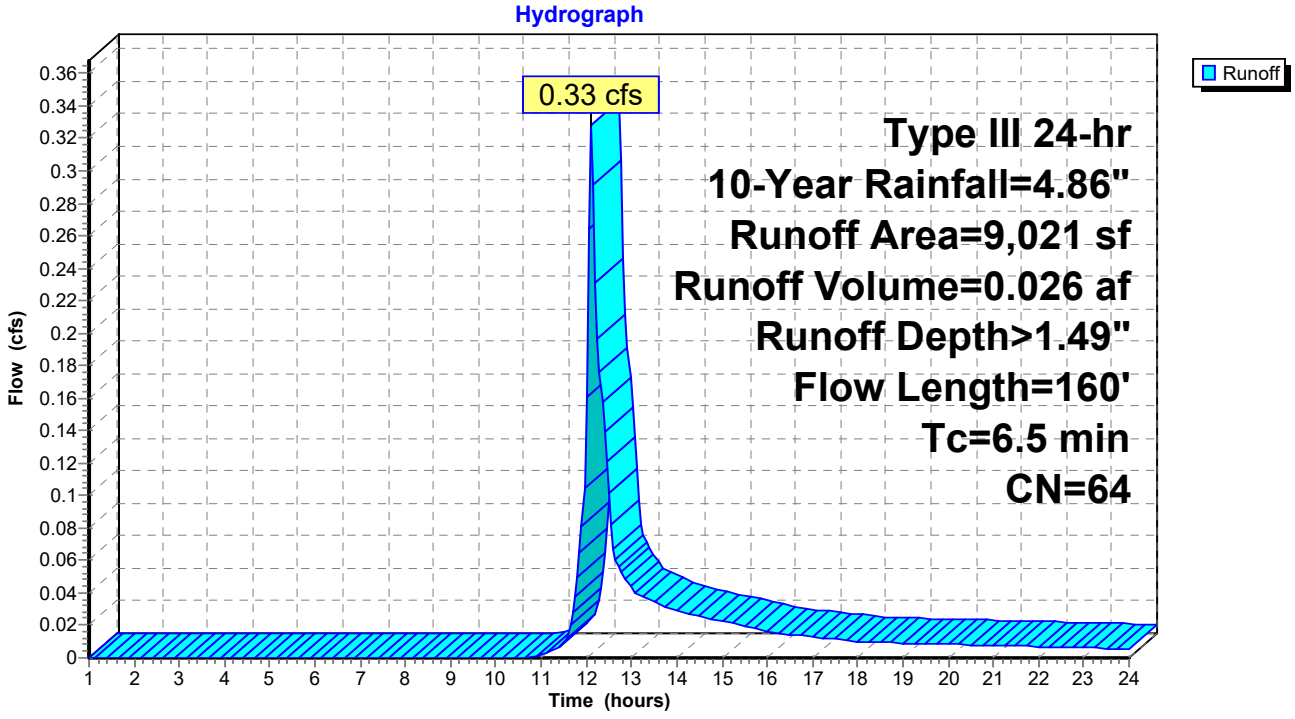
Runoff = 0.33 cfs @ 12.11 hrs, Volume= 0.026 af, Depth> 1.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.86"

	Area (sf)	CN	Description
	6,221	48	Brush, Good, HSG B
*	2,800	98	Impervious
	9,021	64	Weighted Average
	6,221		68.96% Pervious Area
	2,800		31.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	50	0.0640	0.16		**Sheet Flow, ab** Grass: Dense n= 0.240 P2= 3.22"
1.4	110	0.0664	1.29		**Shallow Concentrated Flow, bc** Woodland Kv= 5.0 fps
6.5	160	Total			

Subcatchment 1S: TO MAZZEO DRIVE



Summary for Subcatchment 2S: TO OFFSITE WEST

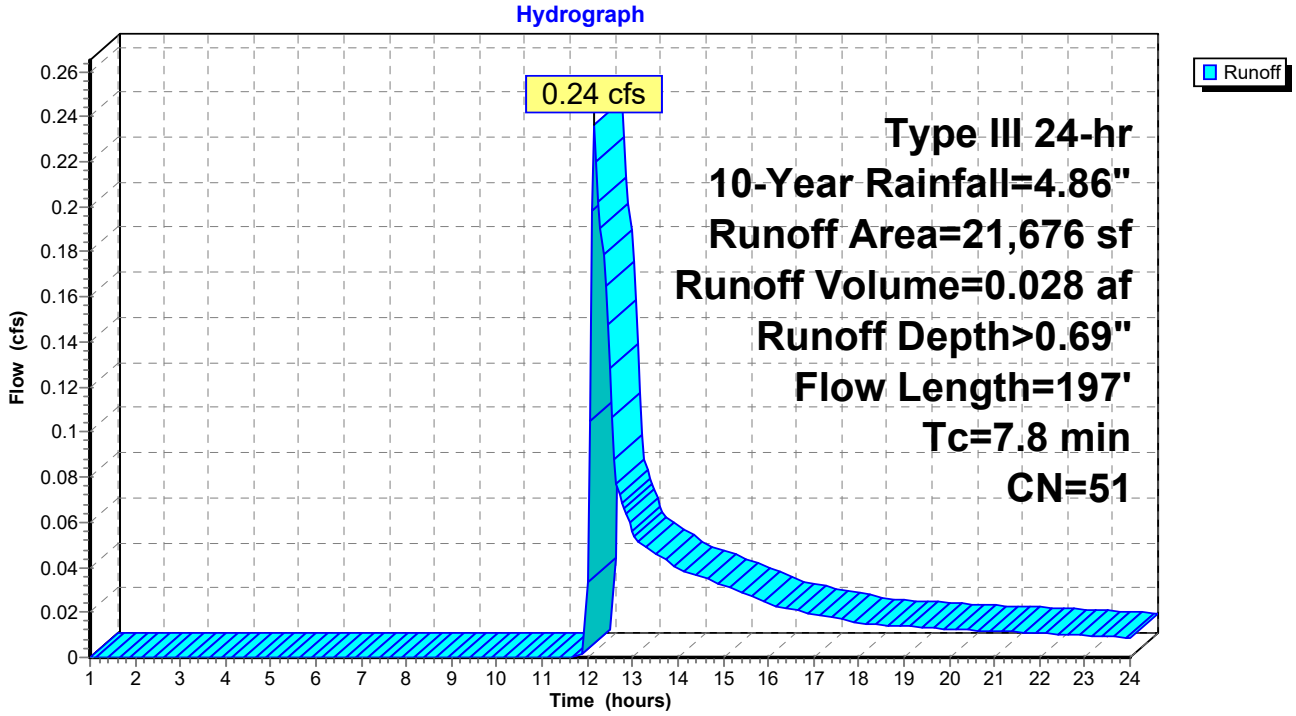
Runoff = 0.24 cfs @ 12.16 hrs, Volume= 0.028 af, Depth> 0.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.86"

	Area (sf)	CN	Description
	83	96	Gravel surface, HSG B
	20,564	48	Brush, Good, HSG B
*	1,029	98	Impervious
	21,676	51	Weighted Average
	20,647		95.25% Pervious Area
	1,029		4.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	50	0.0480	0.14		**Sheet Flow, ab** Grass: Dense n= 0.240 P2= 3.22"
2.0	147	0.0598	1.22		**Shallow Concentrated Flow, bc** Woodland Kv= 5.0 fps
7.8	197	Total			

Subcatchment 2S: TO OFFSITE WEST



Summary for Subcatchment 3S: TO OFFSITE NORTH

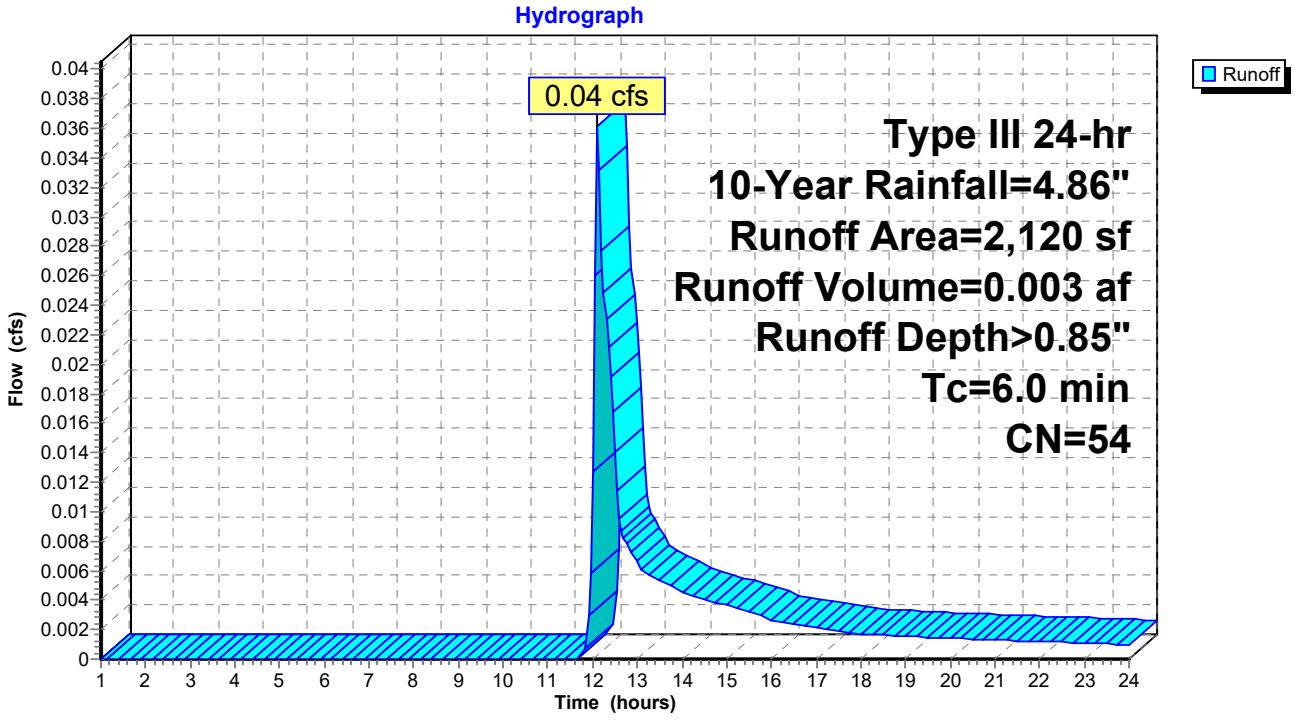
Runoff = 0.04 cfs @ 12.11 hrs, Volume= 0.003 af, Depth> 0.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.86"

	Area (sf)	CN	Description
	27	96	Gravel surface, HSG B
	1,849	48	Brush, Good, HSG B
*	244	98	Impervious
	2,120	54	Weighted Average
	1,876		88.49% Pervious Area
	244		11.51% Impervious Area

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

Subcatchment 3S: TO OFFSITE NORTH



Summary for Subcatchment 7S: TO OFFSITE EAST

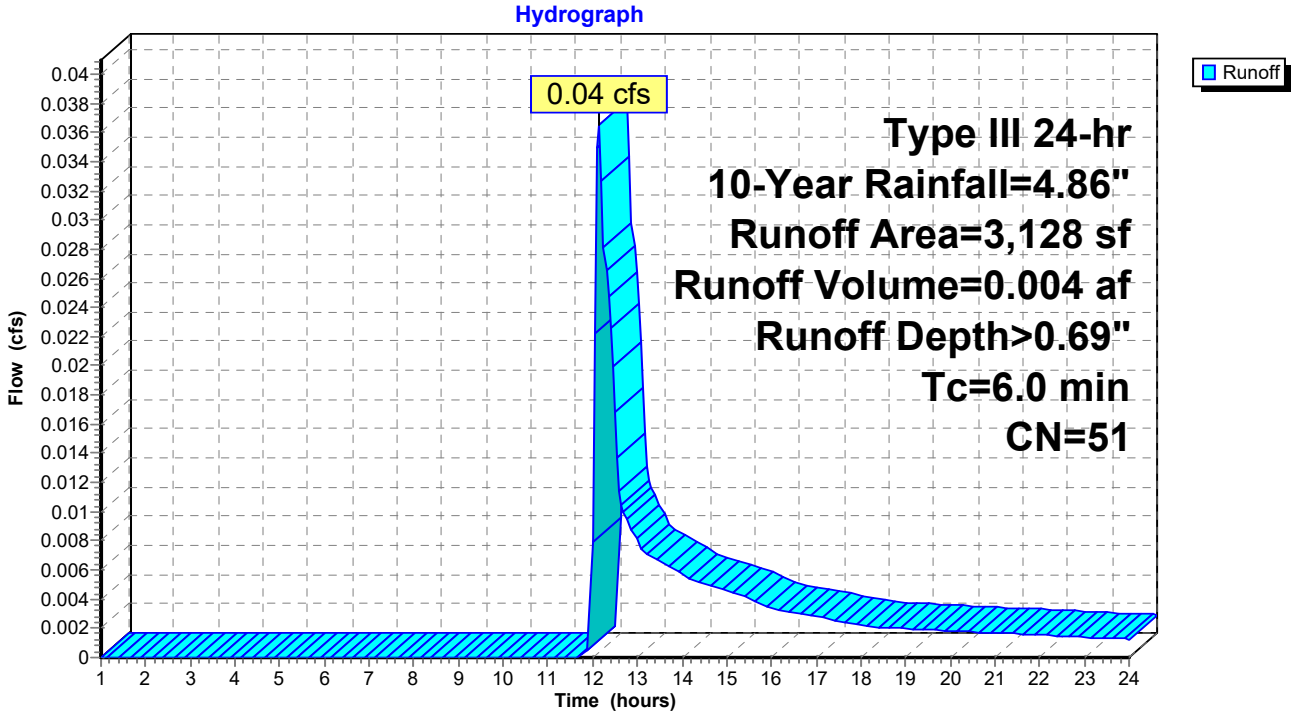
Runoff = 0.04 cfs @ 12.12 hrs, Volume= 0.004 af, Depth> 0.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.86"

	Area (sf)	CN	Description
	2,922	48	Brush, Good, HSG B
*	206	98	Impervious
	3,128	51	Weighted Average
	2,922		93.41% Pervious Area
	206		6.59% Impervious Area

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

Subcatchment 7S: TO OFFSITE EAST

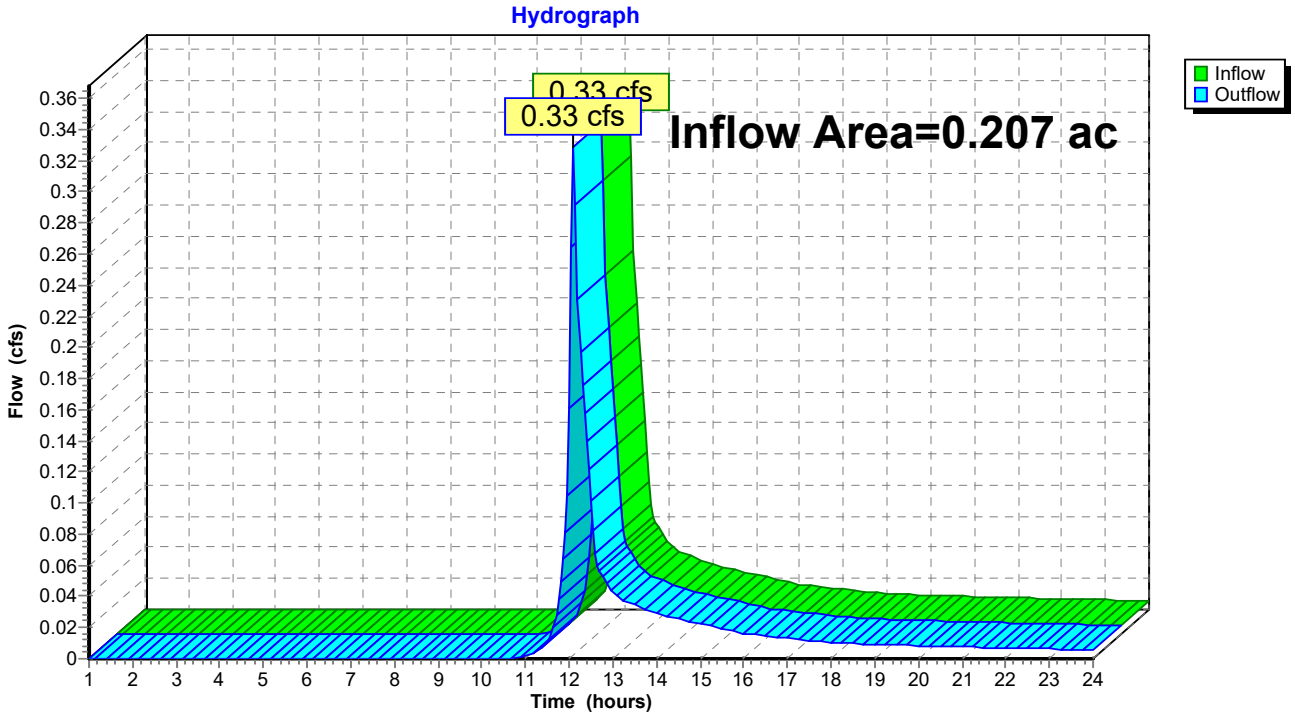


Summary for Reach 4R: MAZZEO DRIVE

Inflow Area = 0.207 ac, 31.04% Impervious, Inflow Depth > 1.49" for 10-Year event
Inflow = 0.33 cfs @ 12.11 hrs, Volume= 0.026 af
Outflow = 0.33 cfs @ 12.11 hrs, Volume= 0.026 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs

Reach 4R: MAZZEO DRIVE

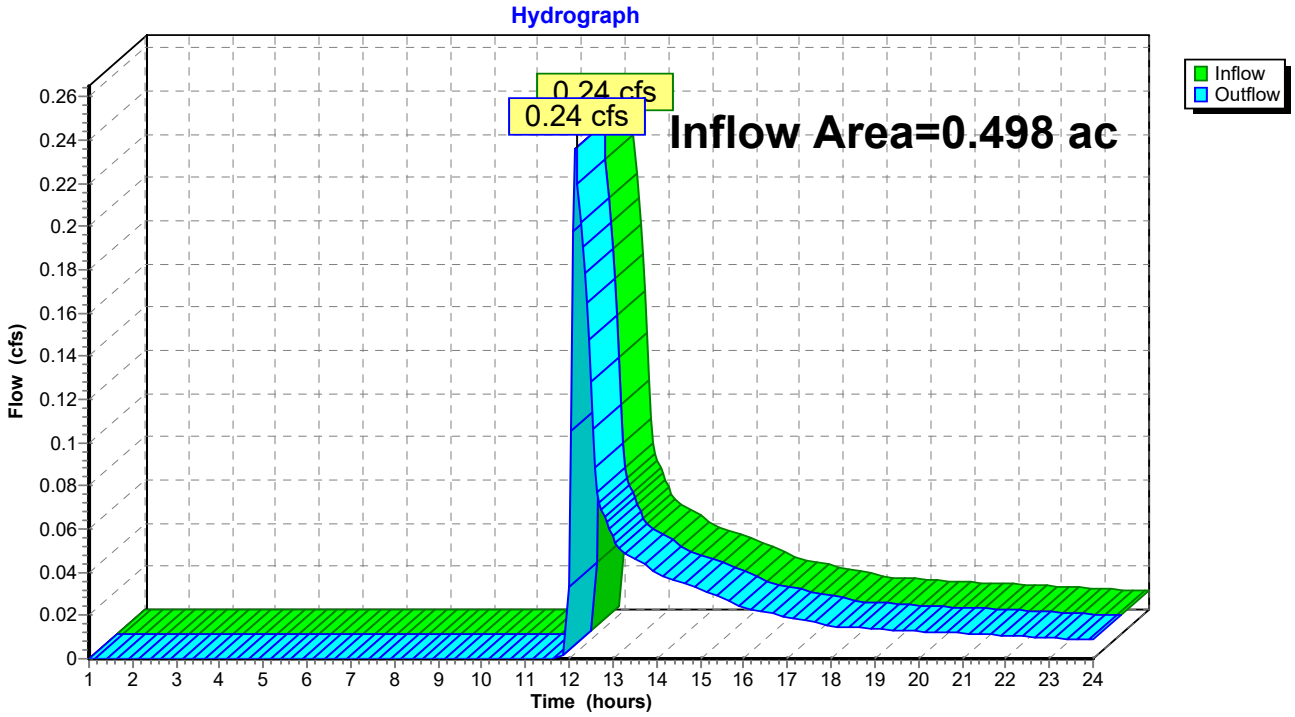


Summary for Reach 5R: OFFSITE WEST

Inflow Area = 0.498 ac, 4.75% Impervious, Inflow Depth > 0.69" for 10-Year event
Inflow = 0.24 cfs @ 12.16 hrs, Volume= 0.028 af
Outflow = 0.24 cfs @ 12.16 hrs, Volume= 0.028 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs

Reach 5R: OFFSITE WEST

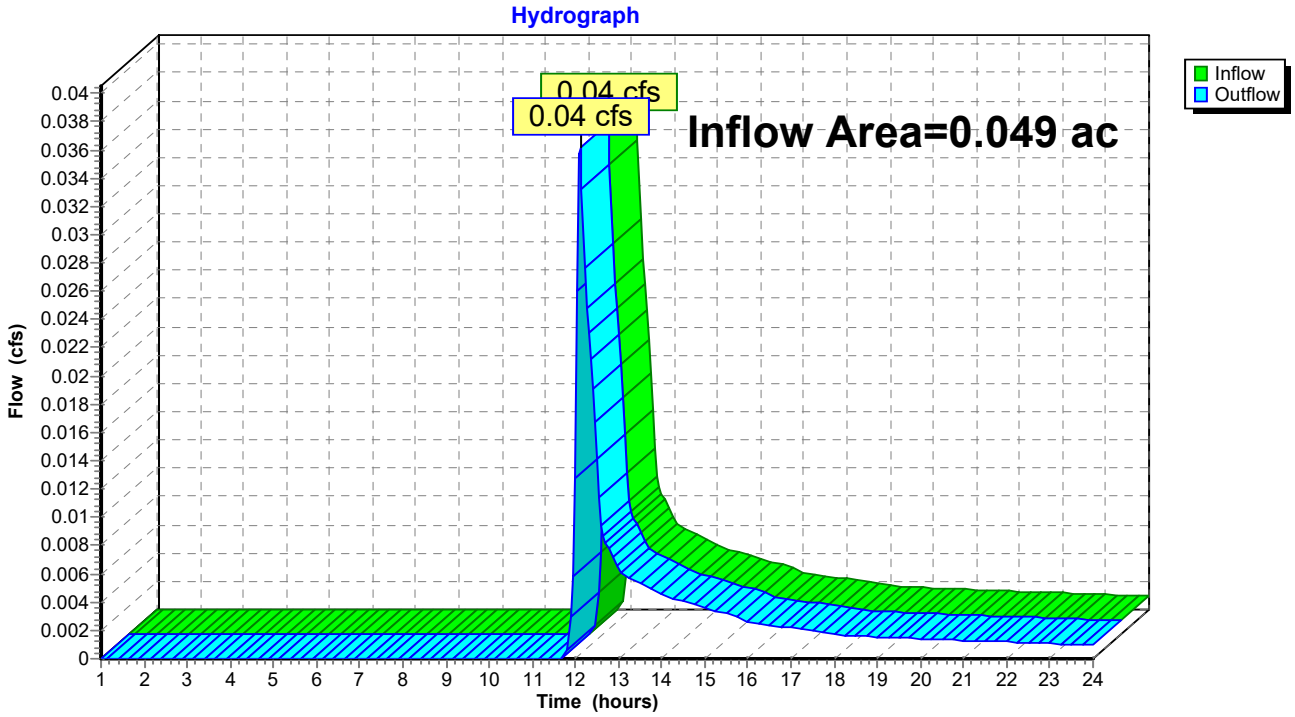


Summary for Reach 6R: OFFSITE NORTH

Inflow Area = 0.049 ac, 11.51% Impervious, Inflow Depth > 0.85" for 10-Year event
Inflow = 0.04 cfs @ 12.11 hrs, Volume= 0.003 af
Outflow = 0.04 cfs @ 12.11 hrs, Volume= 0.003 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs

Reach 6R: OFFSITE NORTH

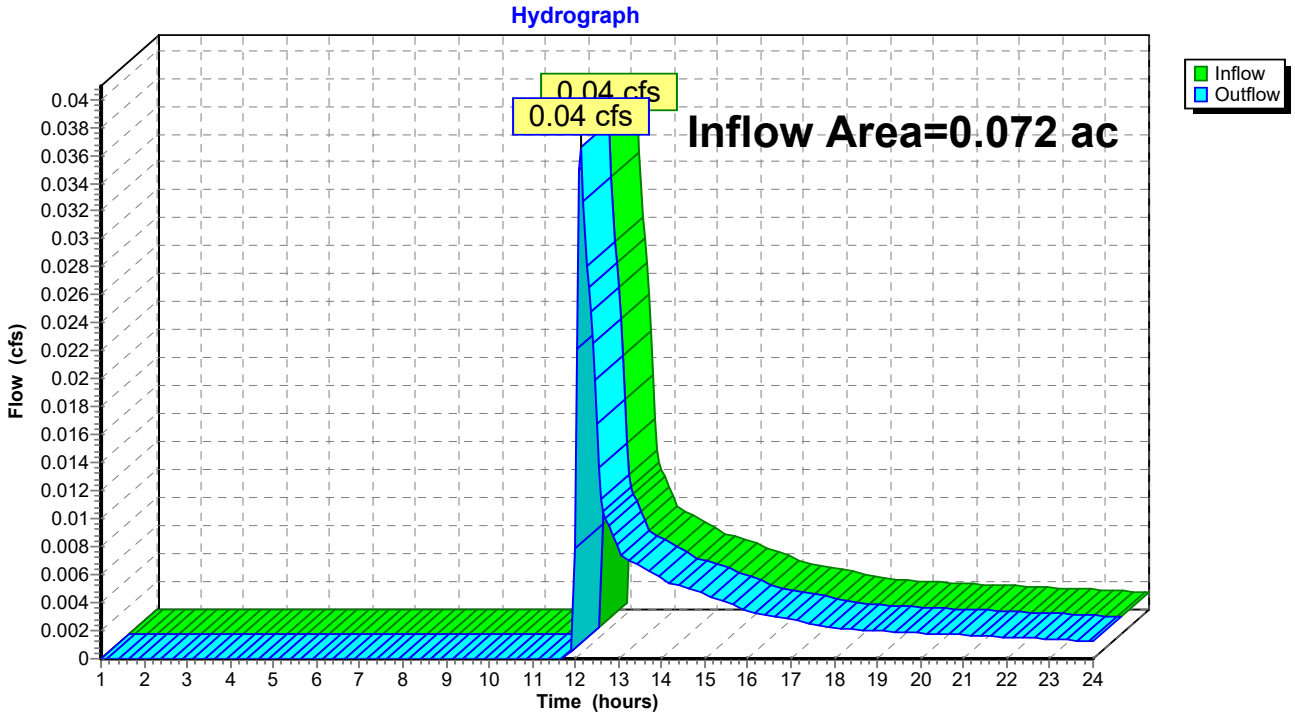


Summary for Reach 8R: OFFSITE EAST

Inflow Area = 0.072 ac, 6.59% Impervious, Inflow Depth > 0.69" for 10-Year event
Inflow = 0.04 cfs @ 12.12 hrs, Volume= 0.004 af
Outflow = 0.04 cfs @ 12.12 hrs, Volume= 0.004 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs

Reach 8R: OFFSITE EAST



Time span=1.00-24.00 hrs, dt=0.05 hrs, 461 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: TO MAZZEO DRIVE Runoff Area=9,021 sf 31.04% Impervious Runoff Depth>2.37"
Flow Length=160' Tc=6.5 min CN=64 Runoff=0.54 cfs 0.041 af

Subcatchment 2S: TO OFFSITE WEST Runoff Area=21,676 sf 4.75% Impervious Runoff Depth>1.29"
Flow Length=197' Tc=7.8 min CN=51 Runoff=0.57 cfs 0.053 af

Subcatchment 3S: TO OFFSITE NORTH Runoff Area=2,120 sf 11.51% Impervious Runoff Depth>1.52"
Tc=6.0 min CN=54 Runoff=0.08 cfs 0.006 af

Subcatchment 7S: TO OFFSITE EAST Runoff Area=3,128 sf 6.59% Impervious Runoff Depth>1.29"
Tc=6.0 min CN=51 Runoff=0.09 cfs 0.008 af

Reach 4R: MAZZEO DRIVE Inflow=0.54 cfs 0.041 af
Outflow=0.54 cfs 0.041 af

Reach 5R: OFFSITE WEST Inflow=0.57 cfs 0.053 af
Outflow=0.57 cfs 0.053 af

Reach 6R: OFFSITE NORTH Inflow=0.08 cfs 0.006 af
Outflow=0.08 cfs 0.006 af

Reach 8R: OFFSITE EAST Inflow=0.09 cfs 0.008 af
Outflow=0.09 cfs 0.008 af

Total Runoff Area = 0.825 ac Runoff Volume = 0.108 af Average Runoff Depth = 1.57"
88.10% Pervious = 0.727 ac 11.90% Impervious = 0.098 ac

Summary for Subcatchment 1S: TO MAZZEO DRIVE

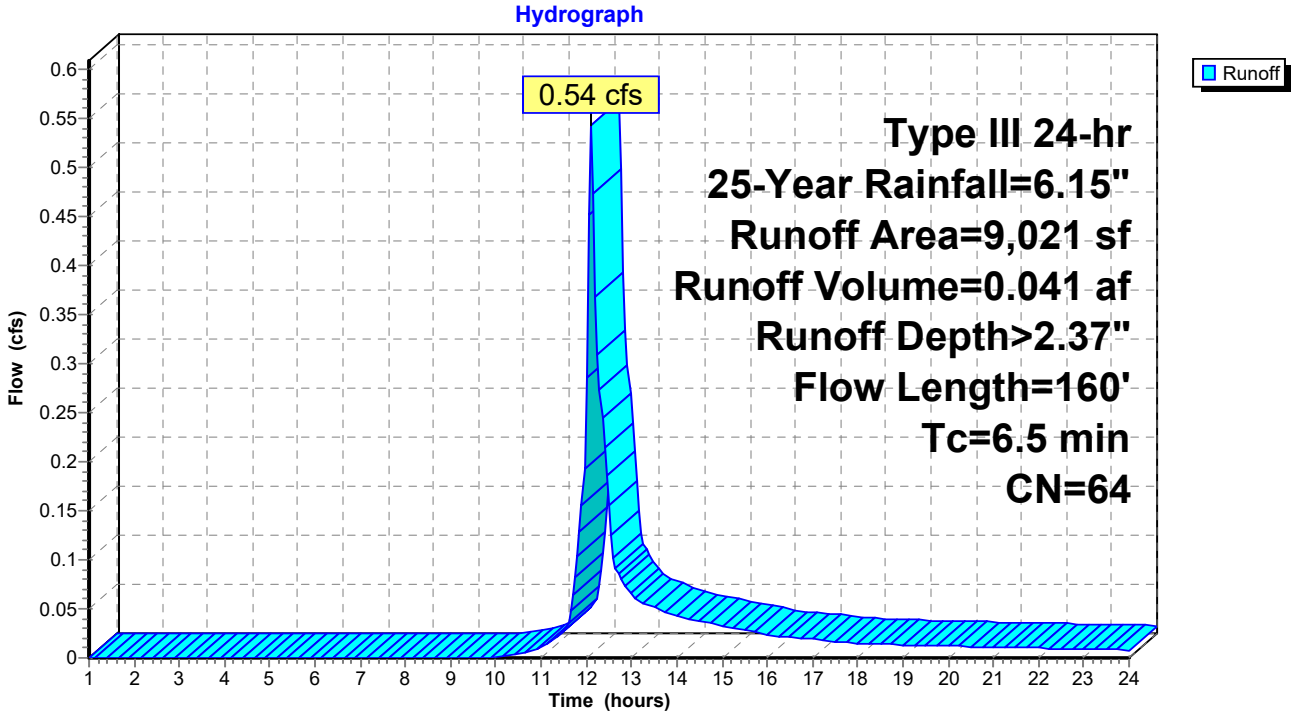
Runoff = 0.54 cfs @ 12.10 hrs, Volume= 0.041 af, Depth> 2.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.15"

	Area (sf)	CN	Description
	6,221	48	Brush, Good, HSG B
*	2,800	98	Impervious
	9,021	64	Weighted Average
	6,221		68.96% Pervious Area
	2,800		31.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	50	0.0640	0.16		**Sheet Flow, ab** Grass: Dense n= 0.240 P2= 3.22"
1.4	110	0.0664	1.29		**Shallow Concentrated Flow, bc** Woodland Kv= 5.0 fps
6.5	160	Total			

Subcatchment 1S: TO MAZZEO DRIVE



Summary for Subcatchment 2S: TO OFFSITE WEST

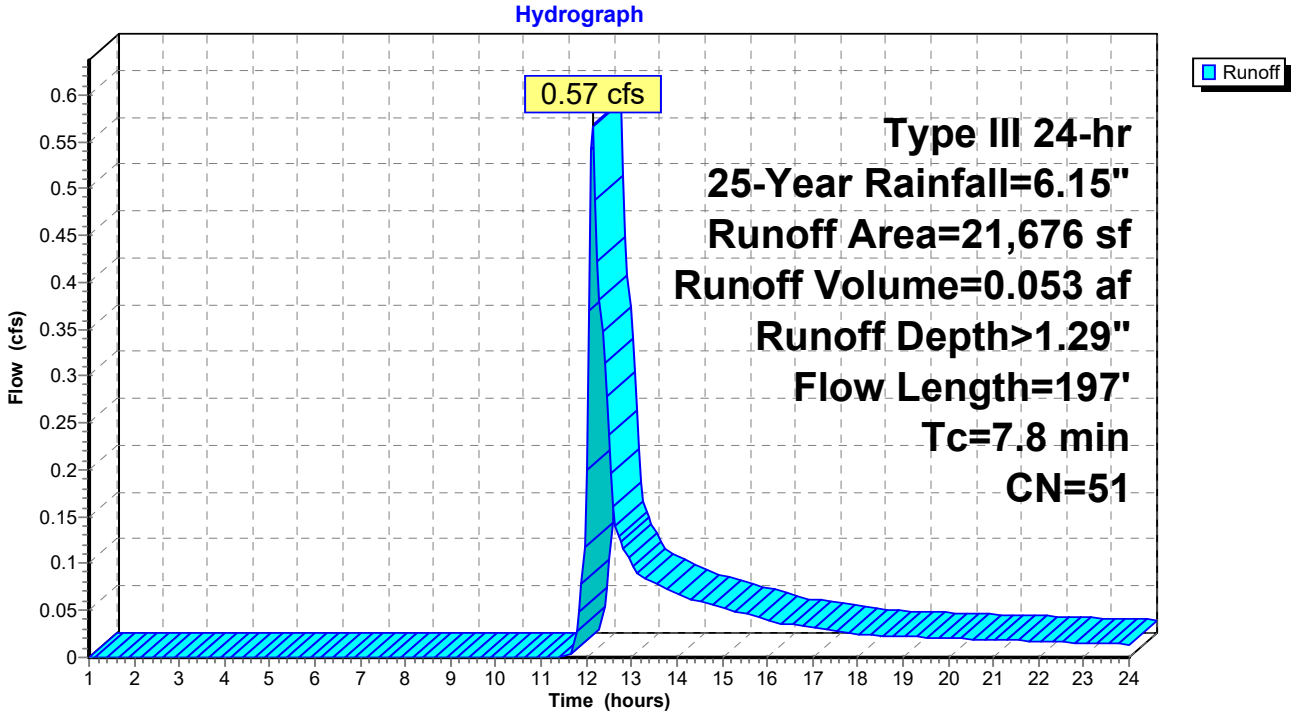
Runoff = 0.57 cfs @ 12.14 hrs, Volume= 0.053 af, Depth> 1.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.15"

	Area (sf)	CN	Description
	83	96	Gravel surface, HSG B
	20,564	48	Brush, Good, HSG B
*	1,029	98	Impervious
	21,676	51	Weighted Average
	20,647		95.25% Pervious Area
	1,029		4.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	50	0.0480	0.14		**Sheet Flow, ab** Grass: Dense n= 0.240 P2= 3.22"
2.0	147	0.0598	1.22		**Shallow Concentrated Flow, bc** Woodland Kv= 5.0 fps
7.8	197	Total			

Subcatchment 2S: TO OFFSITE WEST



Summary for Subcatchment 3S: TO OFFSITE NORTH

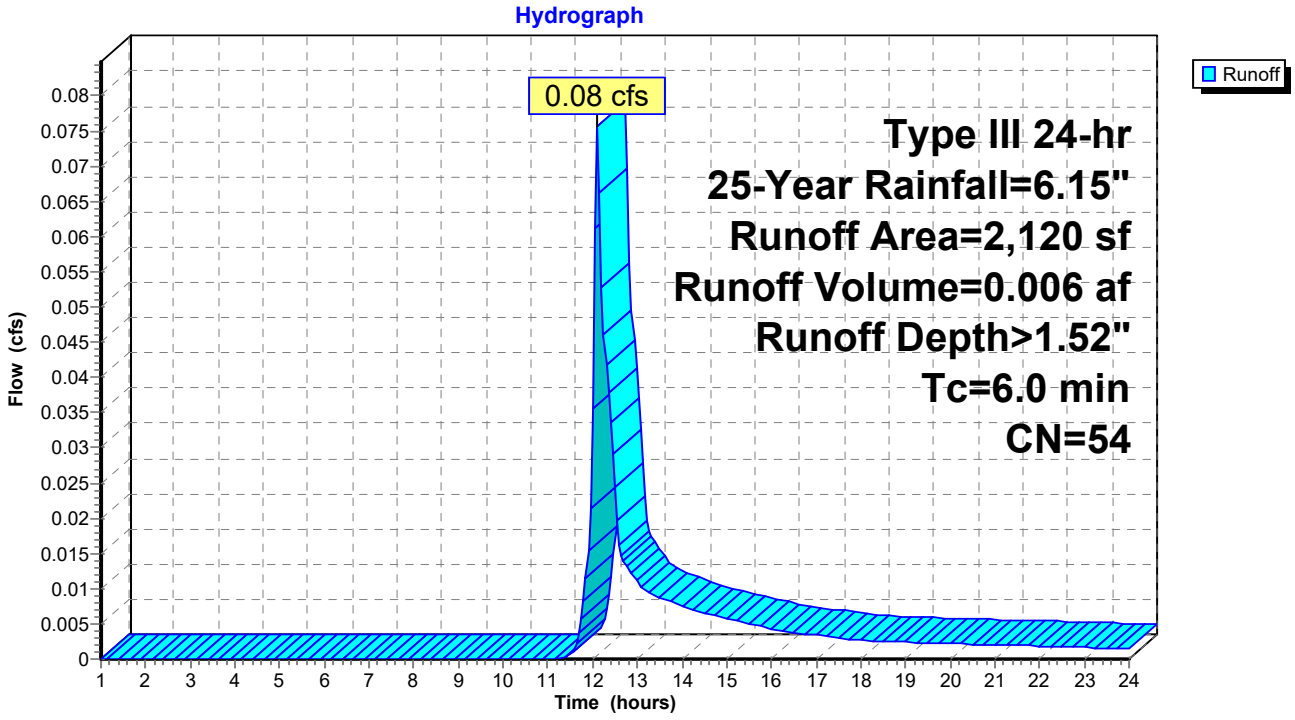
Runoff = 0.08 cfs @ 12.11 hrs, Volume= 0.006 af, Depth> 1.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.15"

	Area (sf)	CN	Description
	27	96	Gravel surface, HSG B
	1,849	48	Brush, Good, HSG B
*	244	98	Impervious
	2,120	54	Weighted Average
	1,876		88.49% Pervious Area
	244		11.51% Impervious Area

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

Subcatchment 3S: TO OFFSITE NORTH



Summary for Subcatchment 7S: TO OFFSITE EAST

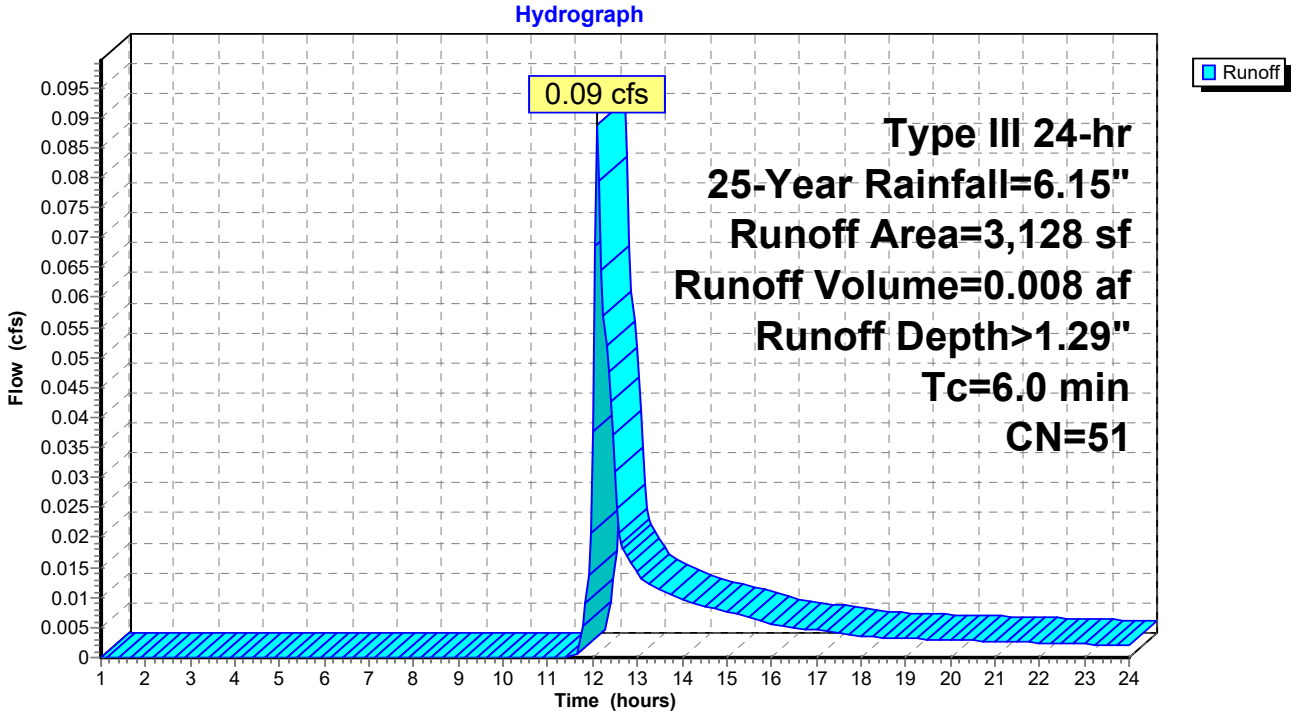
Runoff = 0.09 cfs @ 12.11 hrs, Volume= 0.008 af, Depth> 1.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.15"

	Area (sf)	CN	Description
	2,922	48	Brush, Good, HSG B
*	206	98	Impervious
	3,128	51	Weighted Average
	2,922		93.41% Pervious Area
	206		6.59% Impervious Area

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

Subcatchment 7S: TO OFFSITE EAST

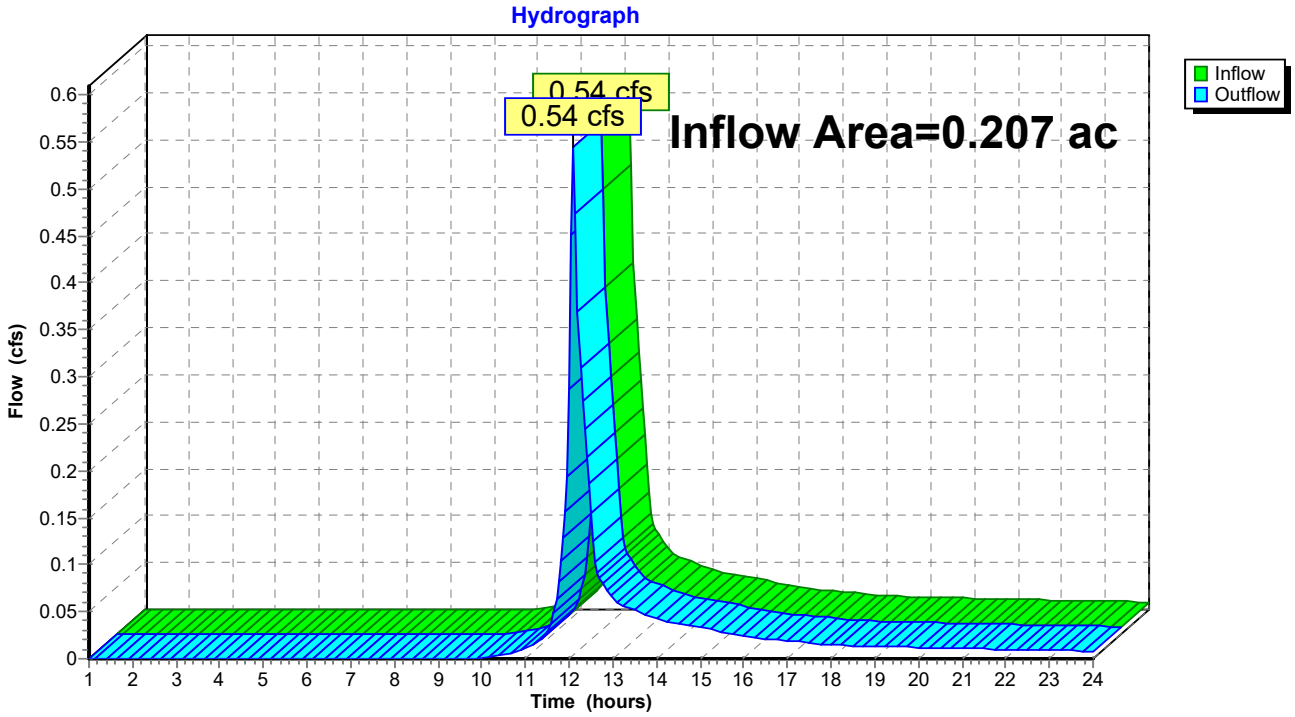


Summary for Reach 4R: MAZZEO DRIVE

Inflow Area = 0.207 ac, 31.04% Impervious, Inflow Depth > 2.37" for 25-Year event
Inflow = 0.54 cfs @ 12.10 hrs, Volume= 0.041 af
Outflow = 0.54 cfs @ 12.10 hrs, Volume= 0.041 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs

Reach 4R: MAZZEO DRIVE

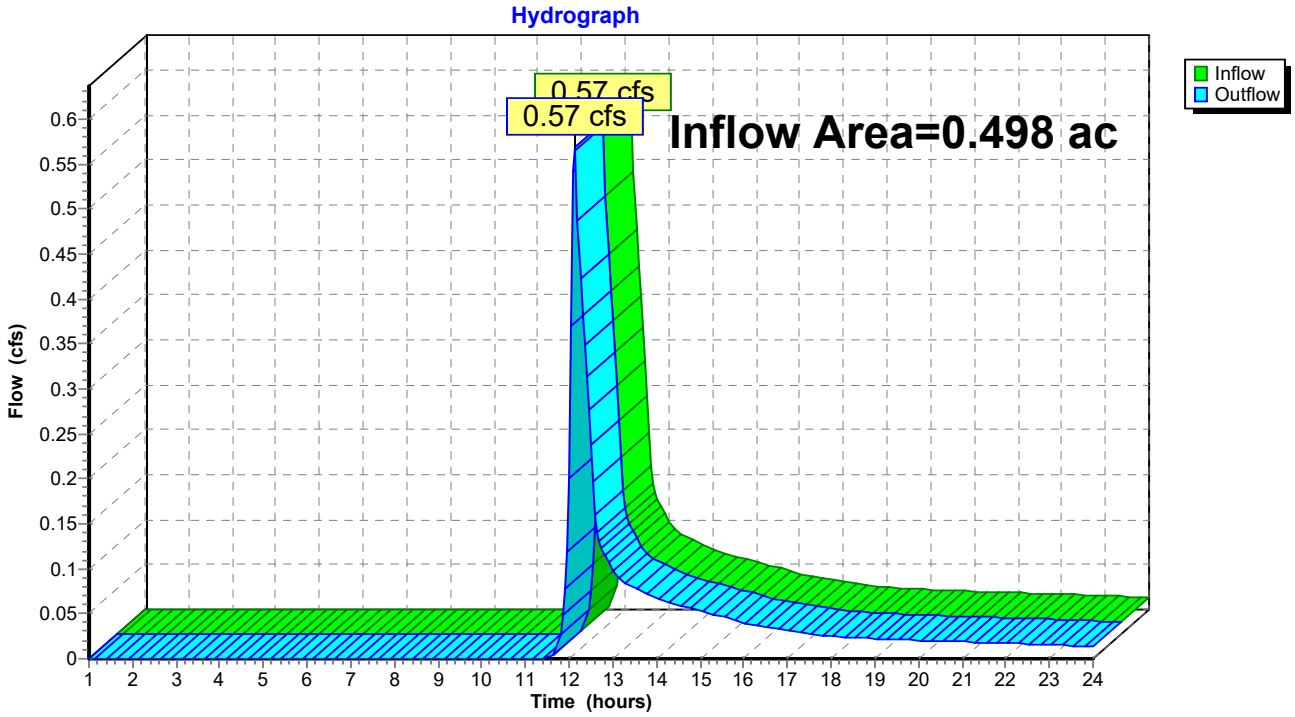


Summary for Reach 5R: OFFSITE WEST

Inflow Area = 0.498 ac, 4.75% Impervious, Inflow Depth > 1.29" for 25-Year event
Inflow = 0.57 cfs @ 12.14 hrs, Volume= 0.053 af
Outflow = 0.57 cfs @ 12.14 hrs, Volume= 0.053 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs

Reach 5R: OFFSITE WEST

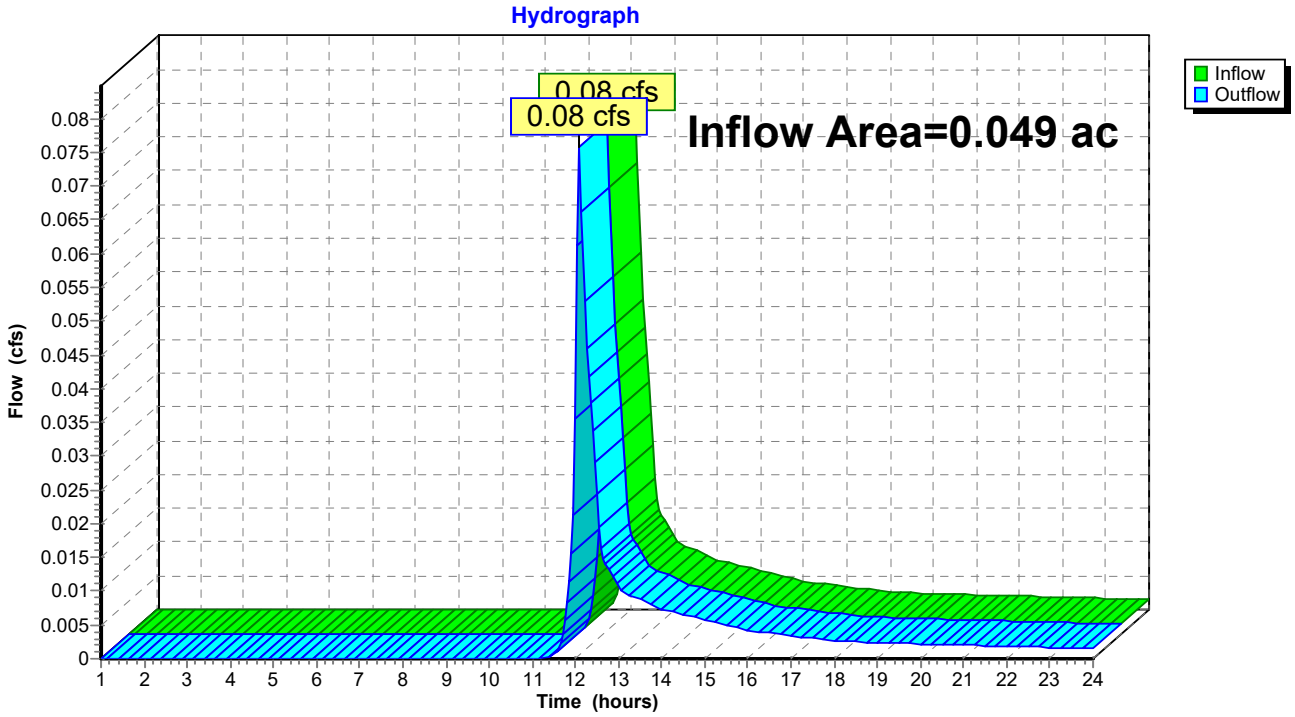


Summary for Reach 6R: OFFSITE NORTH

Inflow Area = 0.049 ac, 11.51% Impervious, Inflow Depth > 1.52" for 25-Year event
Inflow = 0.08 cfs @ 12.11 hrs, Volume= 0.006 af
Outflow = 0.08 cfs @ 12.11 hrs, Volume= 0.006 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs

Reach 6R: OFFSITE NORTH

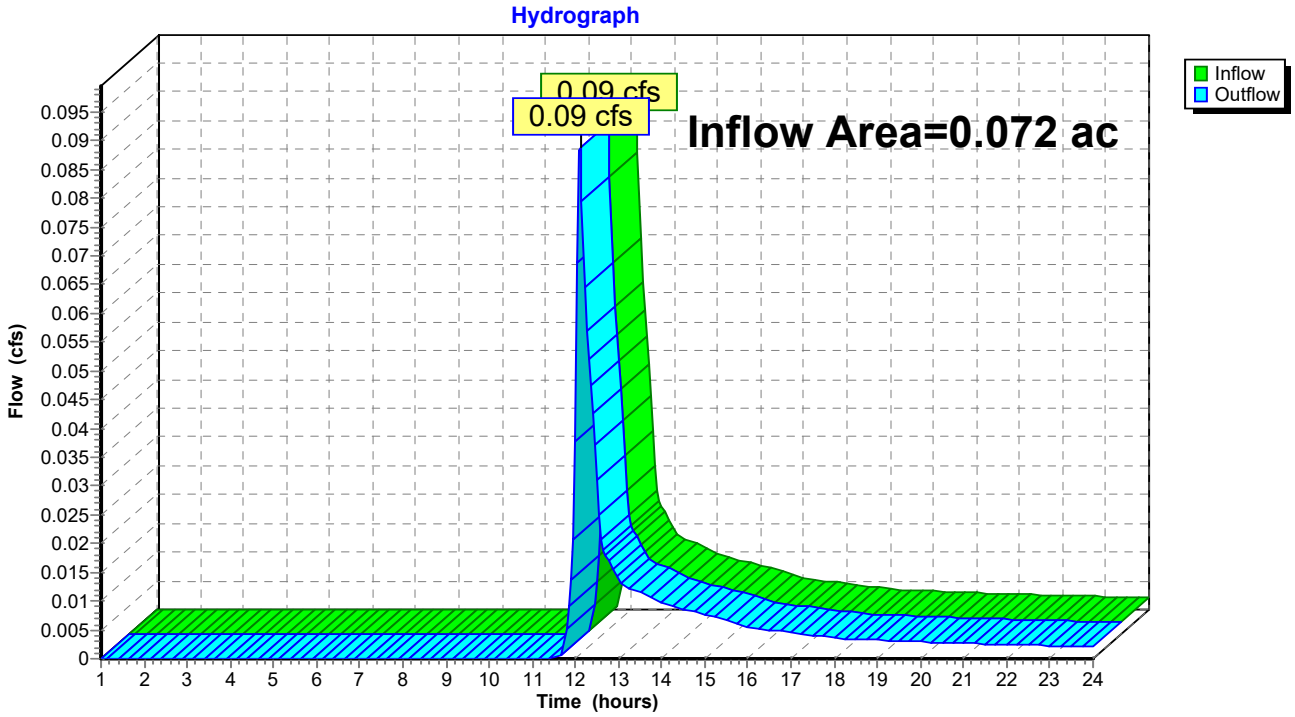


Summary for Reach 8R: OFFSITE EAST

Inflow Area = 0.072 ac, 6.59% Impervious, Inflow Depth > 1.29" for 25-Year event
Inflow = 0.09 cfs @ 12.11 hrs, Volume= 0.008 af
Outflow = 0.09 cfs @ 12.11 hrs, Volume= 0.008 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs

Reach 8R: OFFSITE EAST



Time span=1.00-24.00 hrs, dt=0.05 hrs, 461 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: TO MAZZEO DRIVE Runoff Area=9,021 sf 31.04% Impervious Runoff Depth>4.42"
Flow Length=160' Tc=6.5 min CN=64 Runoff=1.04 cfs 0.076 af

Subcatchment 2S: TO OFFSITE WEST Runoff Area=21,676 sf 4.75% Impervious Runoff Depth>2.87"
Flow Length=197' Tc=7.8 min CN=51 Runoff=1.47 cfs 0.119 af

Subcatchment 3S: TO OFFSITE NORTH Runoff Area=2,120 sf 11.51% Impervious Runoff Depth>3.22"
Tc=6.0 min CN=54 Runoff=0.18 cfs 0.013 af

Subcatchment 7S: TO OFFSITE EAST Runoff Area=3,128 sf 6.59% Impervious Runoff Depth>2.87"
Tc=6.0 min CN=51 Runoff=0.23 cfs 0.017 af

Reach 4R: MAZZEO DRIVE Inflow=1.04 cfs 0.076 af
Outflow=1.04 cfs 0.076 af

Reach 5R: OFFSITE WEST Inflow=1.47 cfs 0.119 af
Outflow=1.47 cfs 0.119 af

Reach 6R: OFFSITE NORTH Inflow=0.18 cfs 0.013 af
Outflow=0.18 cfs 0.013 af

Reach 8R: OFFSITE EAST Inflow=0.23 cfs 0.017 af
Outflow=0.23 cfs 0.017 af

Total Runoff Area = 0.825 ac Runoff Volume = 0.225 af Average Runoff Depth = 3.28"
88.10% Pervious = 0.727 ac 11.90% Impervious = 0.098 ac

Summary for Subcatchment 1S: TO MAZZEO DRIVE

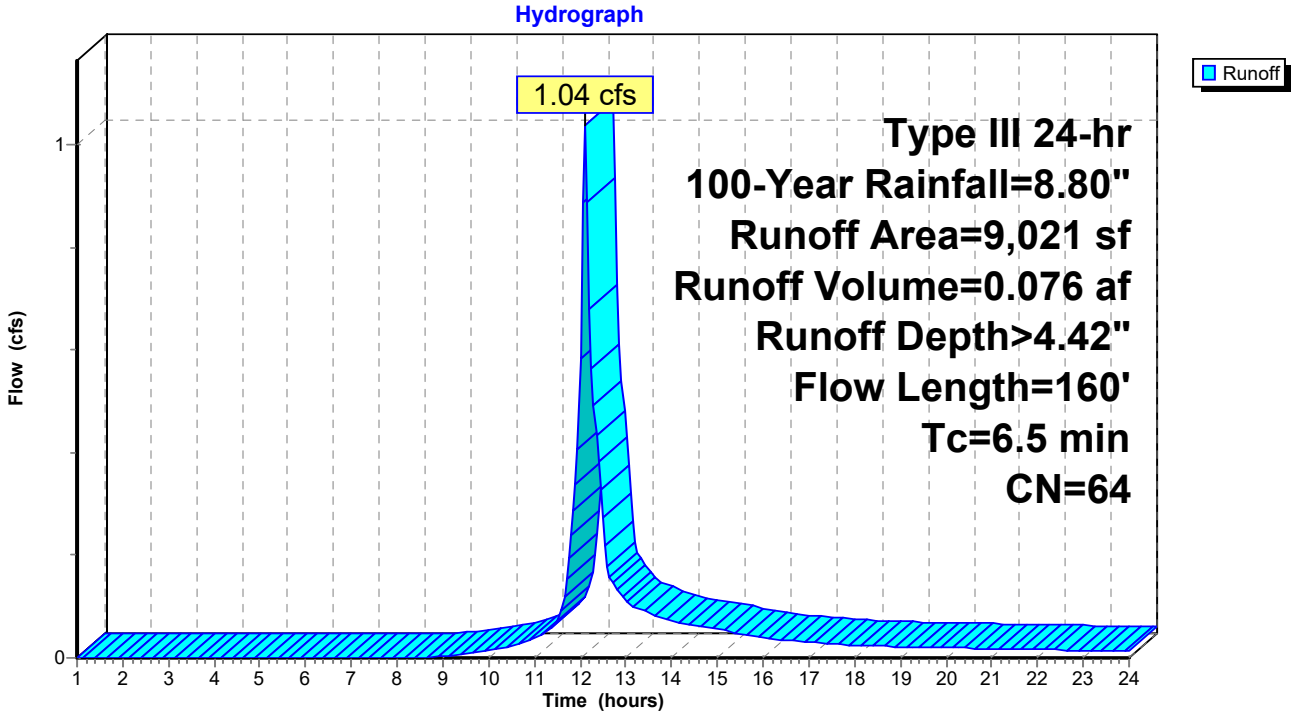
Runoff = 1.04 cfs @ 12.10 hrs, Volume= 0.076 af, Depth> 4.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.80"

	Area (sf)	CN	Description
	6,221	48	Brush, Good, HSG B
*	2,800	98	Impervious
	9,021	64	Weighted Average
	6,221		68.96% Pervious Area
	2,800		31.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	50	0.0640	0.16		**Sheet Flow, ab** Grass: Dense n= 0.240 P2= 3.22"
1.4	110	0.0664	1.29		**Shallow Concentrated Flow, bc** Woodland Kv= 5.0 fps
6.5	160	Total			

Subcatchment 1S: TO MAZZEO DRIVE



Summary for Subcatchment 2S: TO OFFSITE WEST

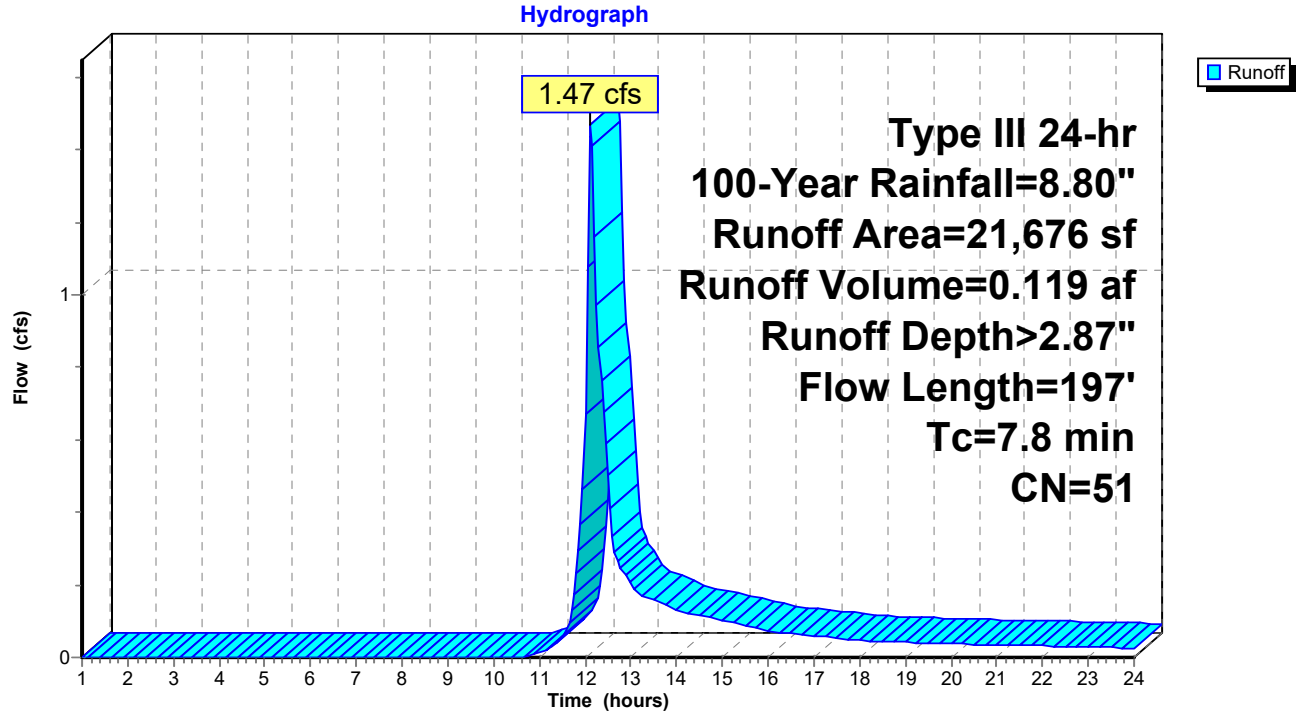
Runoff = 1.47 cfs @ 12.12 hrs, Volume= 0.119 af, Depth> 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.80"

	Area (sf)	CN	Description
	83	96	Gravel surface, HSG B
	20,564	48	Brush, Good, HSG B
*	1,029	98	Impervious
	21,676	51	Weighted Average
	20,647		95.25% Pervious Area
	1,029		4.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	50	0.0480	0.14		**Sheet Flow, ab** Grass: Dense n= 0.240 P2= 3.22"
2.0	147	0.0598	1.22		**Shallow Concentrated Flow, bc** Woodland Kv= 5.0 fps
7.8	197	Total			

Subcatchment 2S: TO OFFSITE WEST



Summary for Subcatchment 3S: TO OFFSITE NORTH

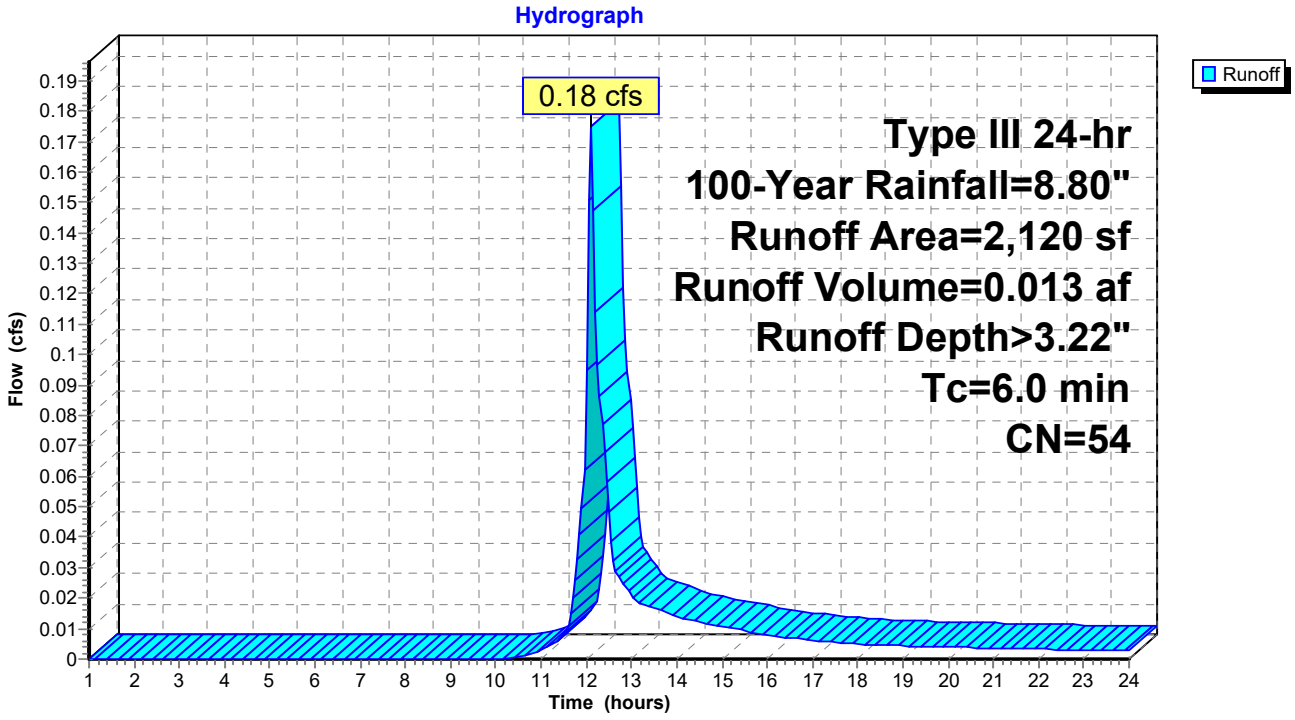
Runoff = 0.18 cfs @ 12.10 hrs, Volume= 0.013 af, Depth> 3.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.80"

	Area (sf)	CN	Description
	27	96	Gravel surface, HSG B
	1,849	48	Brush, Good, HSG B
*	244	98	Impervious
	2,120	54	Weighted Average
	1,876		88.49% Pervious Area
	244		11.51% Impervious Area

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

Subcatchment 3S: TO OFFSITE NORTH



Summary for Subcatchment 7S: TO OFFSITE EAST

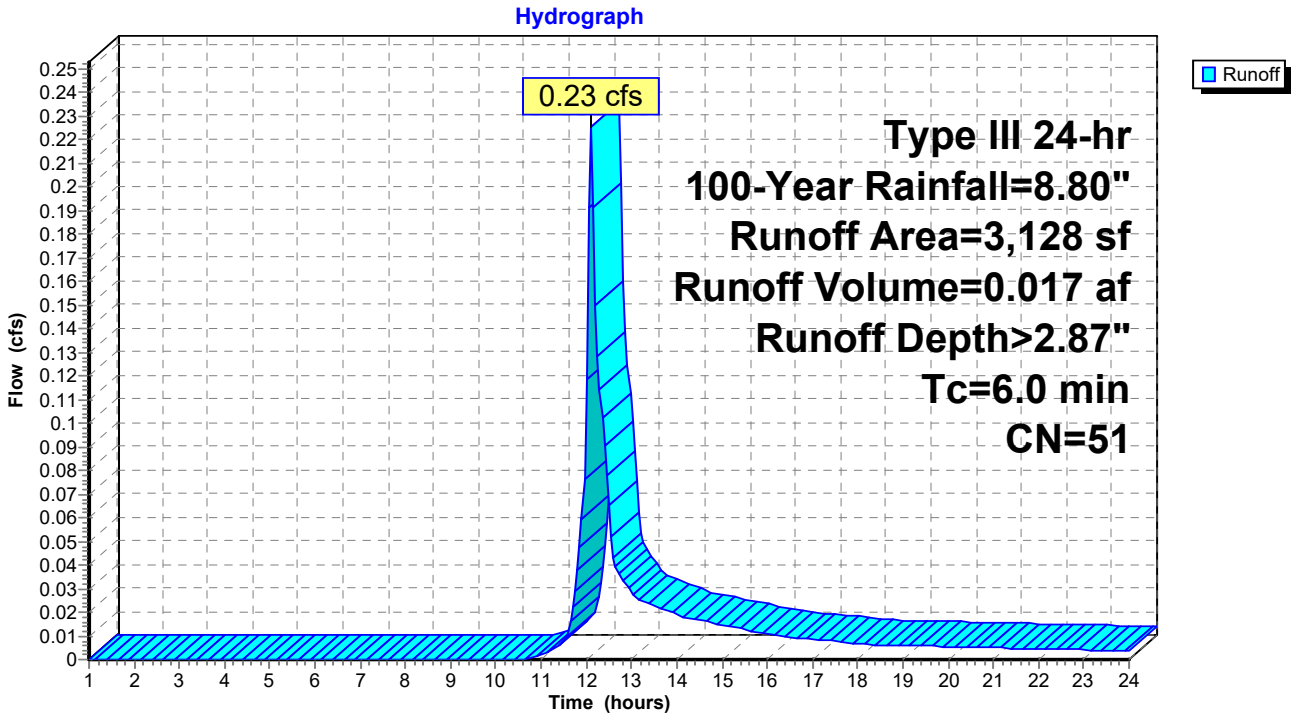
Runoff = 0.23 cfs @ 12.10 hrs, Volume= 0.017 af, Depth> 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.80"

	Area (sf)	CN	Description
	2,922	48	Brush, Good, HSG B
*	206	98	Impervious
	3,128	51	Weighted Average
	2,922		93.41% Pervious Area
	206		6.59% Impervious Area

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

Subcatchment 7S: TO OFFSITE EAST

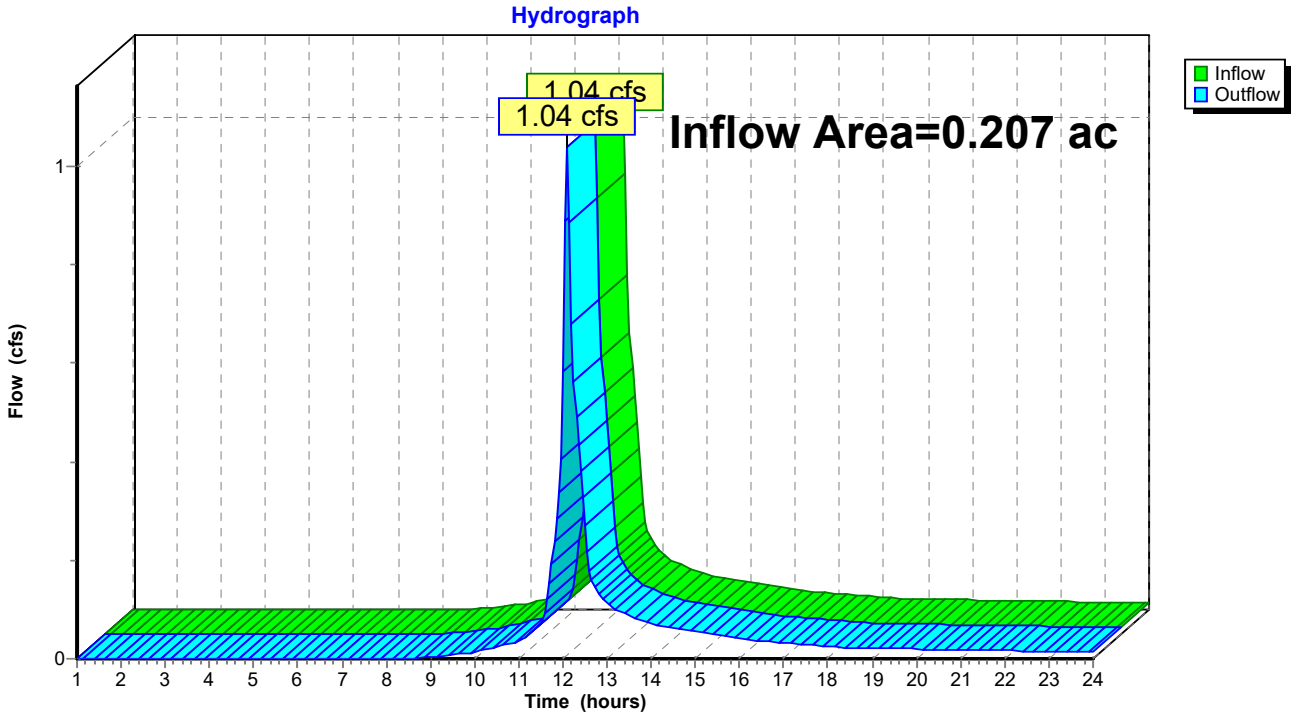


Summary for Reach 4R: MAZZEO DRIVE

Inflow Area = 0.207 ac, 31.04% Impervious, Inflow Depth > 4.42" for 100-Year event
Inflow = 1.04 cfs @ 12.10 hrs, Volume= 0.076 af
Outflow = 1.04 cfs @ 12.10 hrs, Volume= 0.076 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs

Reach 4R: MAZZEO DRIVE

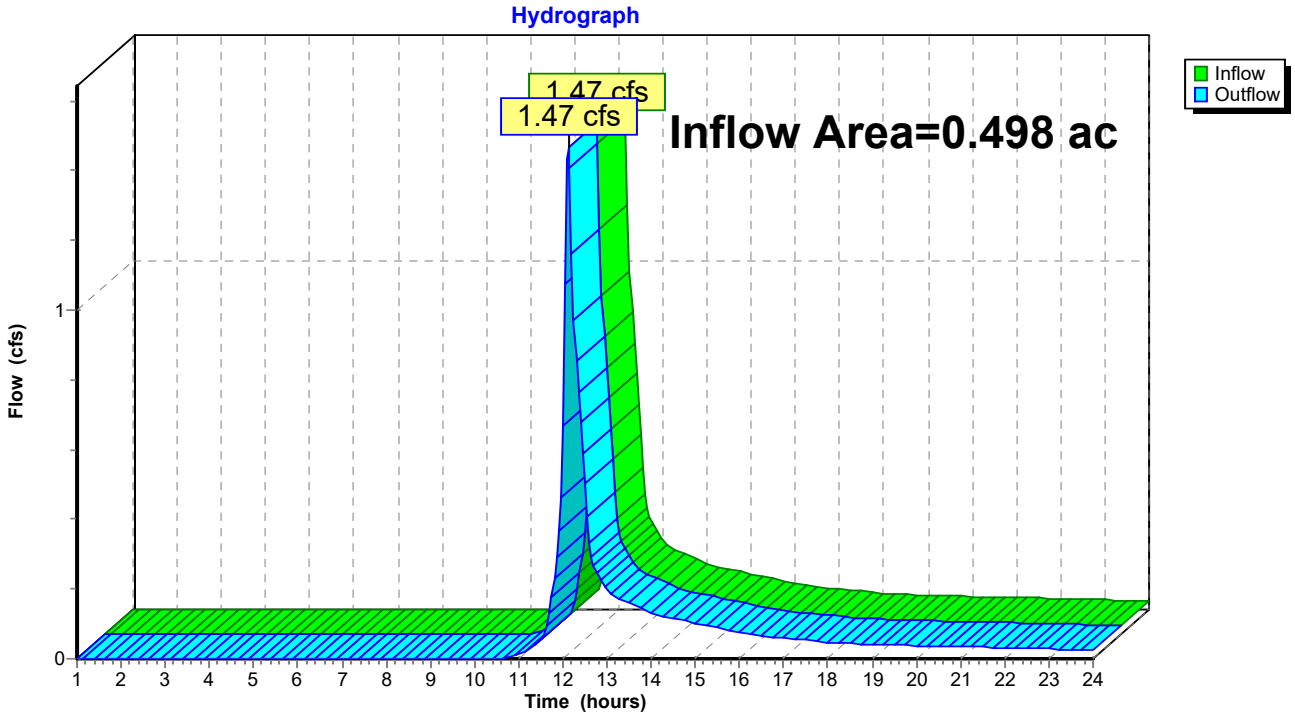


Summary for Reach 5R: OFFSITE WEST

Inflow Area = 0.498 ac, 4.75% Impervious, Inflow Depth > 2.87" for 100-Year event
Inflow = 1.47 cfs @ 12.12 hrs, Volume= 0.119 af
Outflow = 1.47 cfs @ 12.12 hrs, Volume= 0.119 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs

Reach 5R: OFFSITE WEST

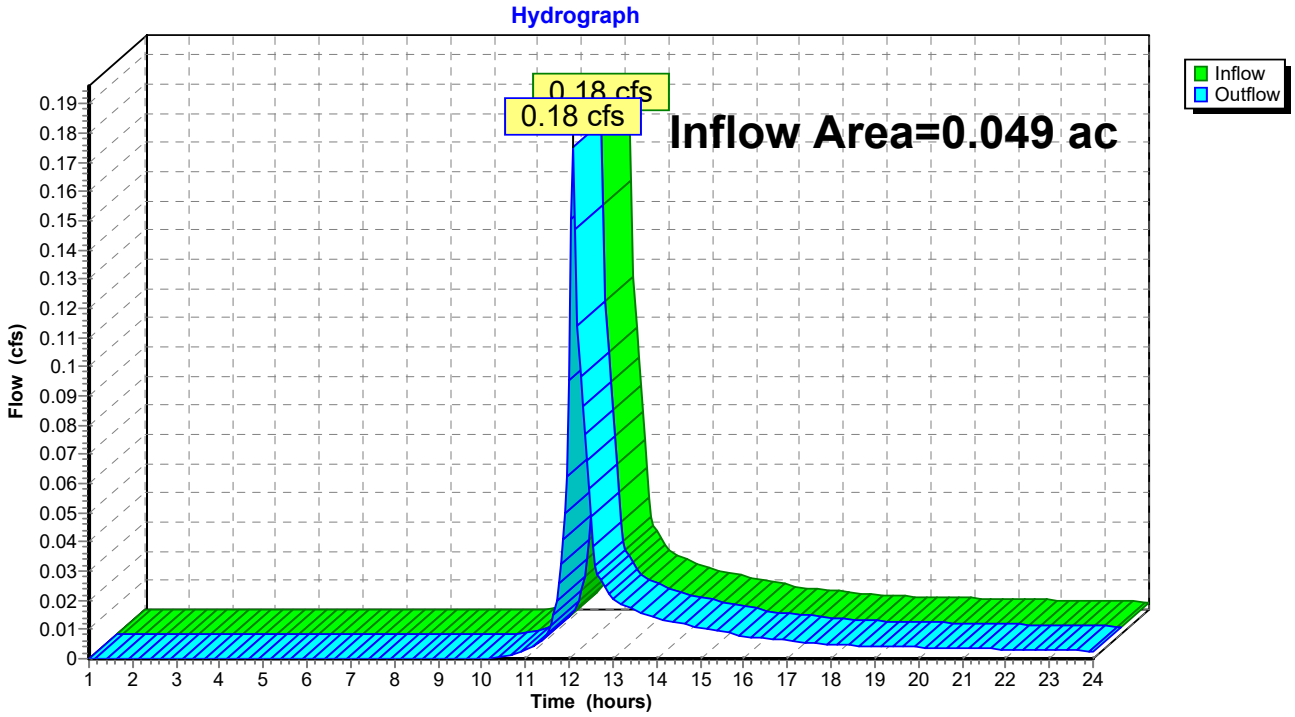


Summary for Reach 6R: OFFSITE NORTH

Inflow Area = 0.049 ac, 11.51% Impervious, Inflow Depth > 3.22" for 100-Year event
Inflow = 0.18 cfs @ 12.10 hrs, Volume= 0.013 af
Outflow = 0.18 cfs @ 12.10 hrs, Volume= 0.013 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs

Reach 6R: OFFSITE NORTH

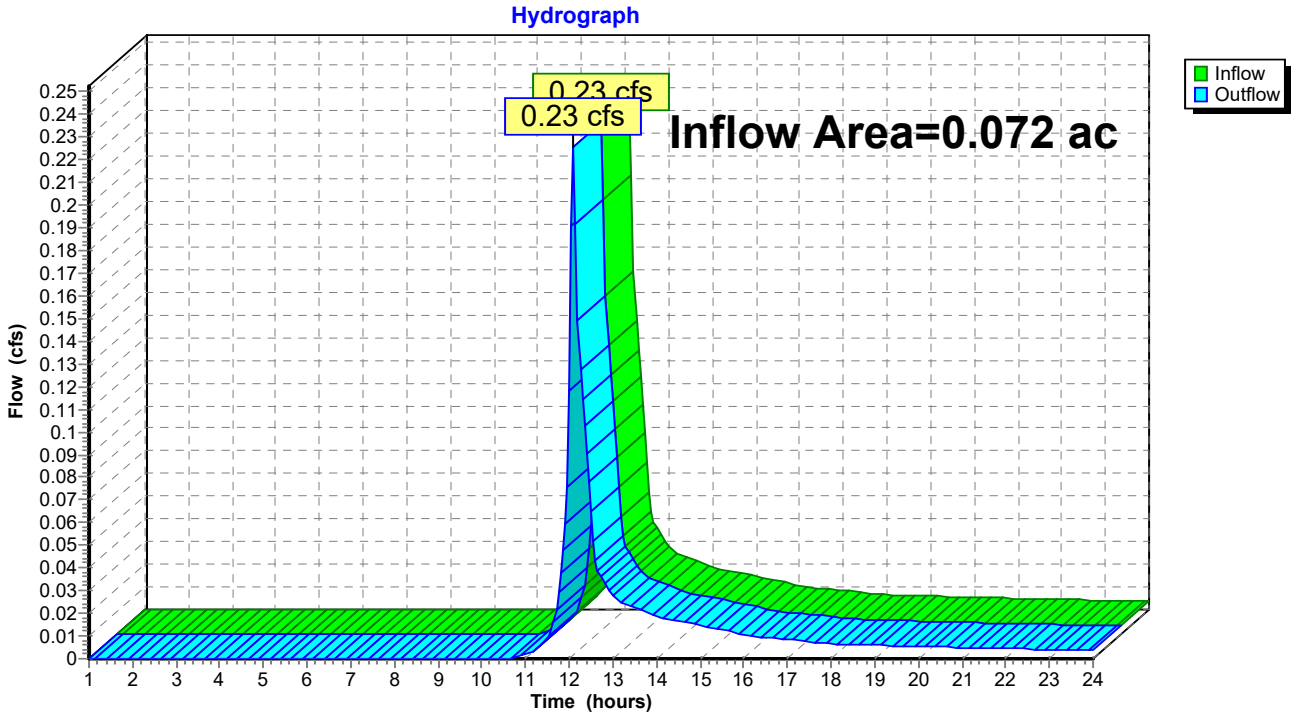


Summary for Reach 8R: OFFSITE EAST

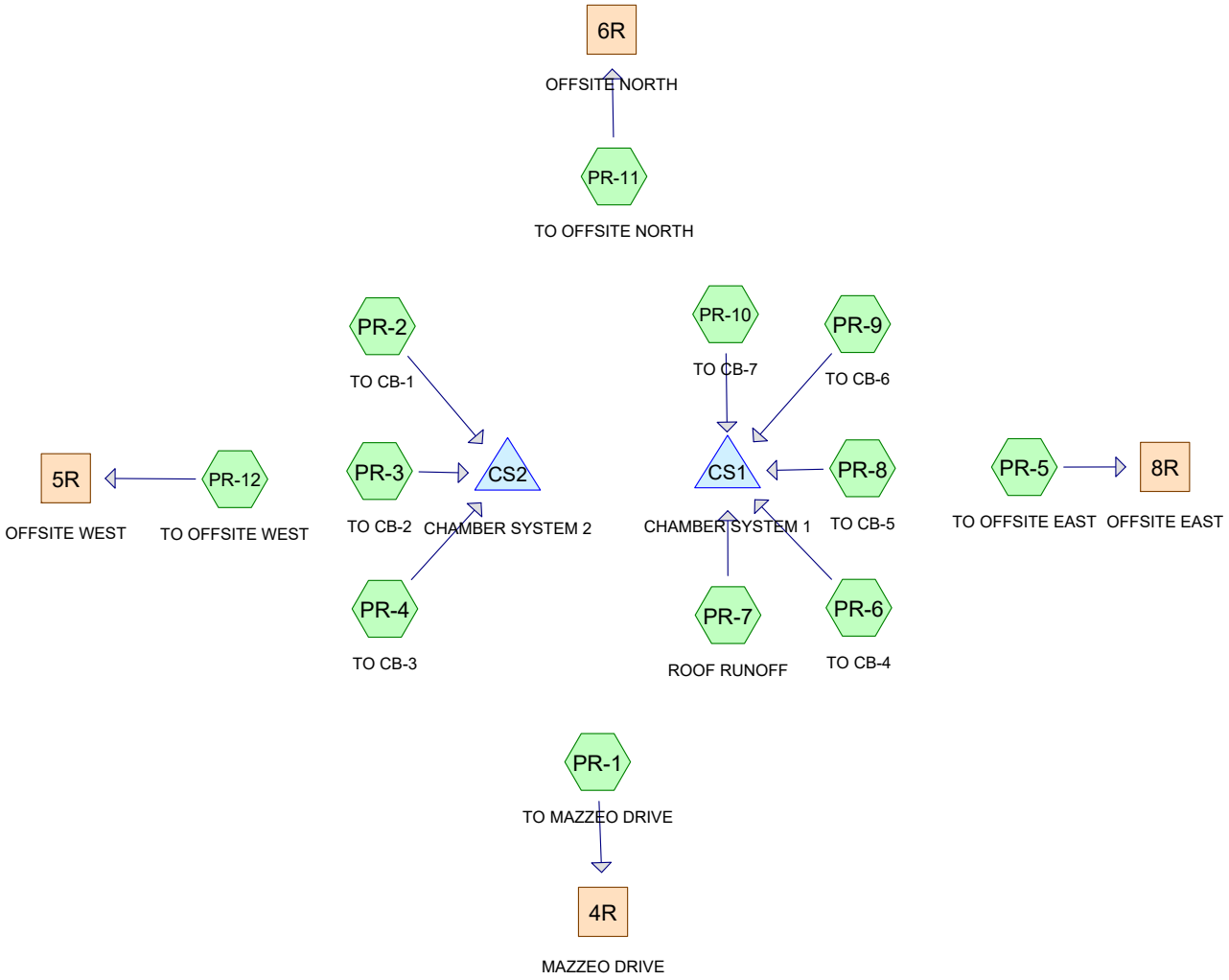
Inflow Area = 0.072 ac, 6.59% Impervious, Inflow Depth > 2.87" for 100-Year event
Inflow = 0.23 cfs @ 12.10 hrs, Volume= 0.017 af
Outflow = 0.23 cfs @ 12.10 hrs, Volume= 0.017 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs

Reach 8R: OFFSITE EAST



Post-Development HydroCAD Analysis



Subcat Reach Pond Link

Routing Diagram for 2021-054 - PR

Prepared by {enter your company name here}, Printed 1/27/2022

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
7,655	61	>75% Grass cover, Good, HSG B (PR-1, PR-11, PR-12, PR-3, PR-5, PR-6, PR-8, PR-9)
4,031	48	Brush, Good, HSG B (PR-1, PR-11, PR-12, PR-5)
110	96	Gravel surface, HSG B (PR-11, PR-12)
24,148	98	Impervious (PR-1, PR-10, PR-2, PR-3, PR-4, PR-6, PR-7, PR-8, PR-9)
35,944	**85**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
11,796	HSG B	PR-1, PR-11, PR-12, PR-3, PR-5, PR-6, PR-8, PR-9
0	HSG C	
0	HSG D	
24,148	Other	PR-1, PR-10, PR-2, PR-3, PR-4, PR-6, PR-7, PR-8, PR-9
35,944		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Sub Num
0	7,655	0	0	0	7,655	>75% Grass cover, Good	
0	4,031	0	0	0	4,031	Brush, Good	
0	110	0	0	0	110	Gravel surface	
0	0	0	0	24,148	24,148	Impervious	
0	**11,796**	**0**	**0**	**24,148**	**35,944**	**TOTAL AREA**	

Time span=1.00-24.00 hrs, dt=0.05 hrs, 461 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PR-1: TO MAZZEO DRIVE Runoff Area=2,897 sf 30.55% Impervious Runoff Depth>0.94"
Tc=6.0 min CN=72 Runoff=0.07 cfs 227 cf

Subcatchment PR-10: TO CB-7 Runoff Area=1,324 sf 100.00% Impervious Runoff Depth>2.99"
Tc=6.0 min CN=98 Runoff=0.09 cfs 329 cf

Subcatchment PR-11: TO OFFSITE NORTH Runoff Area=706 sf 0.00% Impervious Runoff Depth>0.15"
Tc=6.0 min CN=51 Runoff=0.00 cfs 9 cf

Subcatchment PR-12: TO OFFSITE WEST Runoff Area=4,145 sf 0.00% Impervious Runoff Depth>0.26"
Tc=6.0 min CN=55 Runoff=0.01 cfs 89 cf

Subcatchment PR-2: TO CB-1 Runoff Area=975 sf 100.00% Impervious Runoff Depth>2.99"
Tc=6.0 min CN=98 Runoff=0.07 cfs 243 cf

Subcatchment PR-3: TO CB-2 Runoff Area=3,788 sf 83.37% Impervious Runoff Depth>2.37"
Tc=6.0 min CN=92 Runoff=0.23 cfs 747 cf

Subcatchment PR-4: TO CB-3 Runoff Area=2,510 sf 100.00% Impervious Runoff Depth>2.99"
Tc=6.0 min CN=98 Runoff=0.18 cfs 624 cf

Subcatchment PR-5: TO OFFSITE EAST Runoff Area=1,291 sf 0.00% Impervious Runoff Depth>0.11"
Tc=6.0 min CN=49 Runoff=0.00 cfs 12 cf

Subcatchment PR-6: TO CB-4 Runoff Area=6,564 sf 86.94% Impervious Runoff Depth>2.46"
Tc=6.0 min CN=93 Runoff=0.41 cfs 1,347 cf

Subcatchment PR-7: ROOF RUNOFF Runoff Area=6,000 sf 100.00% Impervious Runoff Depth>2.99"
Tc=6.0 min CN=98 Runoff=0.42 cfs 1,493 cf

Subcatchment PR-8: TO CB-5 Runoff Area=3,425 sf 45.46% Impervious Runoff Depth>1.29"
Tc=6.0 min CN=78 Runoff=0.11 cfs 367 cf

Subcatchment PR-9: TO CB-6 Runoff Area=2,319 sf 87.62% Impervious Runoff Depth>2.46"
Tc=6.0 min CN=93 Runoff=0.15 cfs 476 cf

Reach 4R: MAZZEO DRIVE Inflow=0.07 cfs 227 cf
Outflow=0.07 cfs 227 cf

Reach 5R: OFFSITE WEST Inflow=0.01 cfs 89 cf
Outflow=0.01 cfs 89 cf

Reach 6R: OFFSITE NORTH Inflow=0.00 cfs 9 cf
Outflow=0.00 cfs 9 cf

Reach 8R: OFFSITE EAST Inflow=0.00 cfs 12 cf
Outflow=0.00 cfs 12 cf

Pond CS1: CHAMBER SYSTEM 1 Peak Elev=90.28' Storage=478 cf Inflow=1.18 cfs 4,013 cf
Outflow=0.47 cfs 4,012 cf

Pond CS2: CHAMBER SYSTEM 2 Peak Elev=89.09' Storage=223 cf Inflow=0.47 cfs 1,615 cf
Outflow=0.18 cfs 1,614 cf

Total Runoff Area = 35,944 sf Runoff Volume = 5,964 cf Average Runoff Depth = 1.99"
32.82% Pervious = 11,796 sf 67.18% Impervious = 24,148 sf

Summary for Subcatchment PR-1: TO MAZZEO DRIVE

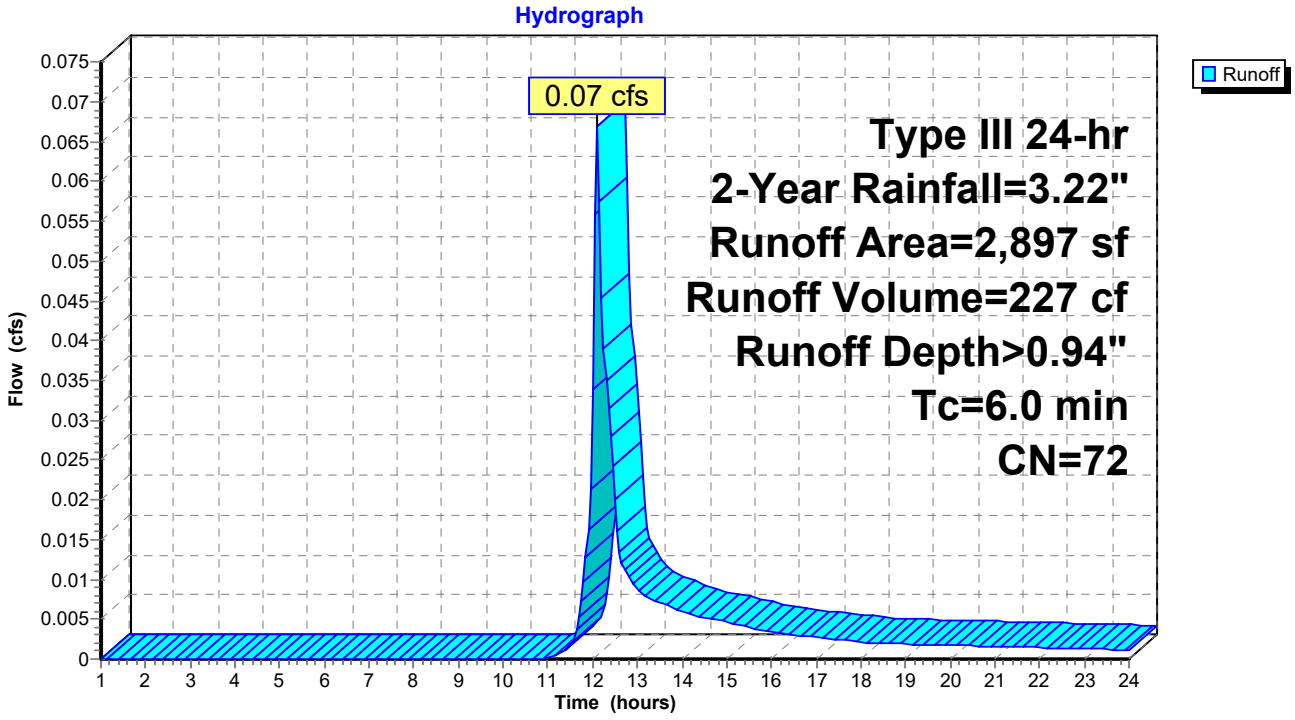
Runoff = 0.07 cfs @ 12.10 hrs, Volume= 227 cf, Depth> 0.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.22"

	Area (sf)	CN	Description
	13	48	Brush, Good, HSG B
	1,999	61	>75% Grass cover, Good, HSG B
*	885	98	Impervious
	2,897	72	Weighted Average
	2,012		69.45% Pervious Area
	885		30.55% Impervious Area

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

Subcatchment PR-1: TO MAZZEO DRIVE



Summary for Subcatchment PR-10: TO CB-7

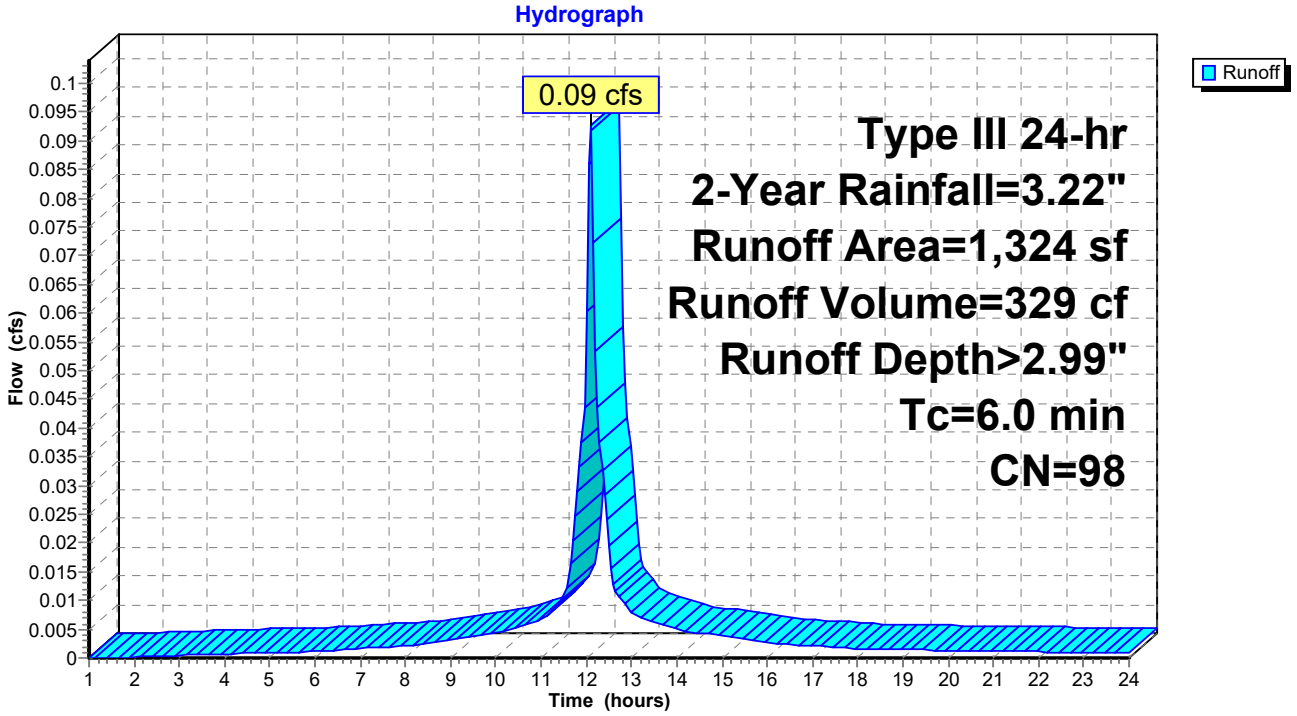
Runoff = 0.09 cfs @ 12.09 hrs, Volume= 329 cf, Depth> 2.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.22"

	Area (sf)	CN	Description
*	1,324	98	Impervious
	1,324		100.00% Impervious Area

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

Subcatchment PR-10: TO CB-7



Summary for Subcatchment PR-11: TO OFFSITE NORTH

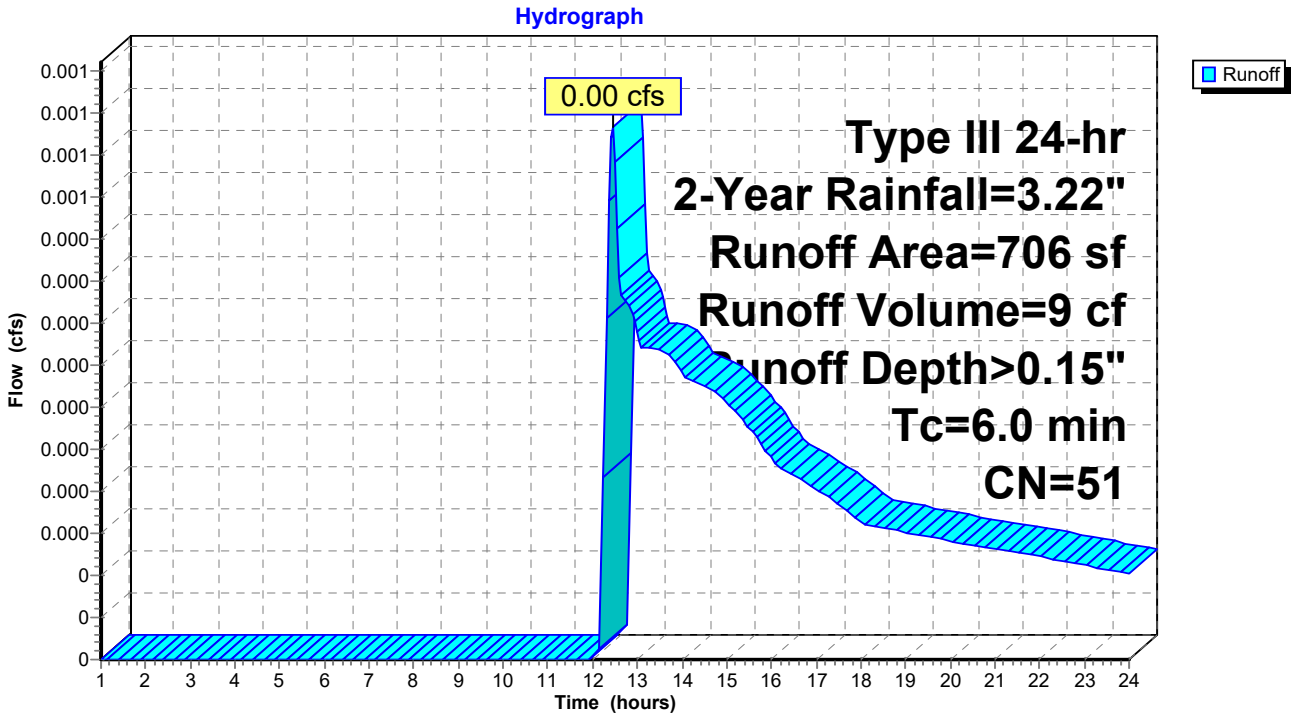
Runoff = 0.00 cfs @ 12.44 hrs, Volume= 9 cf, Depth> 0.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.22"

Area (sf)	CN	Description
27	96	Gravel surface, HSG B
593	48	Brush, Good, HSG B
86	61	>75% Grass cover, Good, HSG B
706	51	Weighted Average
706		100.00% Pervious Area

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

Subcatchment PR-11: TO OFFSITE NORTH



Summary for Subcatchment PR-12: TO OFFSITE WEST

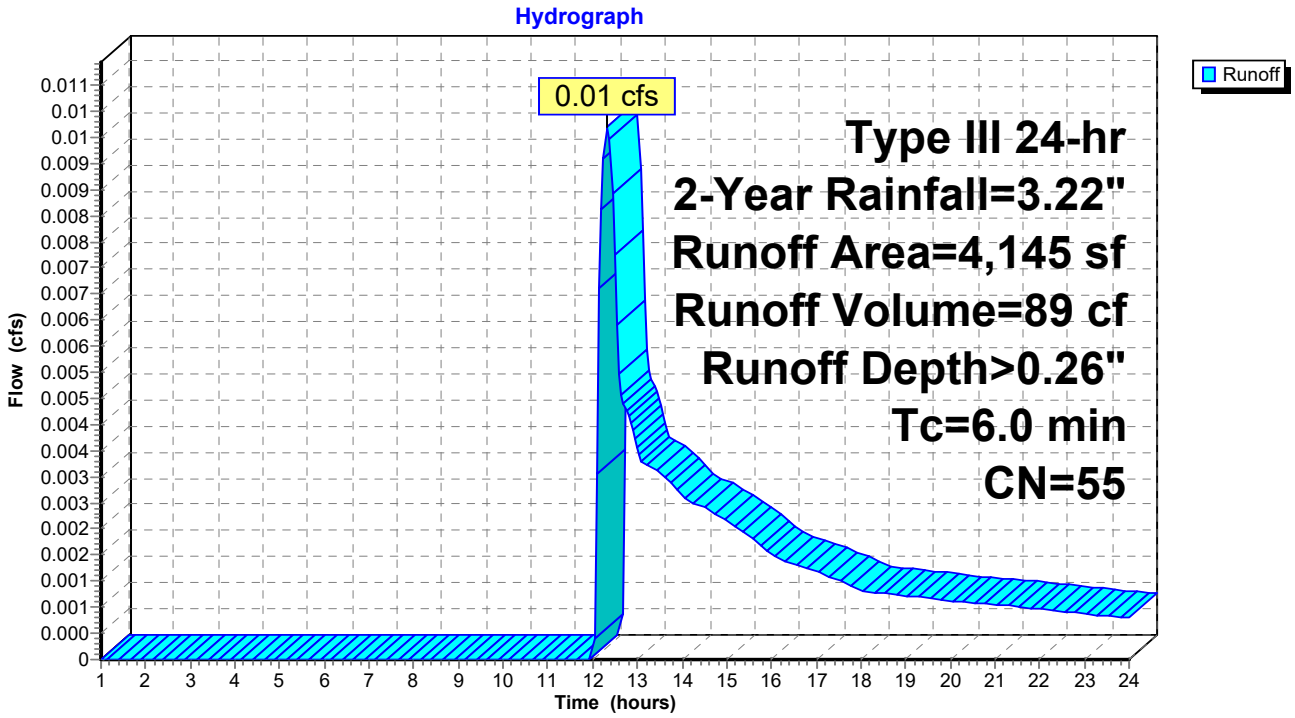
Runoff = 0.01 cfs @ 12.33 hrs, Volume= 89 cf, Depth> 0.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.22"

Area (sf)	CN	Description
83	96	Gravel surface, HSG B
2,238	48	Brush, Good, HSG B
1,824	61	>75% Grass cover, Good, HSG B
4,145	55	Weighted Average
4,145		100.00% Pervious Area

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

Subcatchment PR-12: TO OFFSITE WEST



Summary for Subcatchment PR-2: TO CB-1

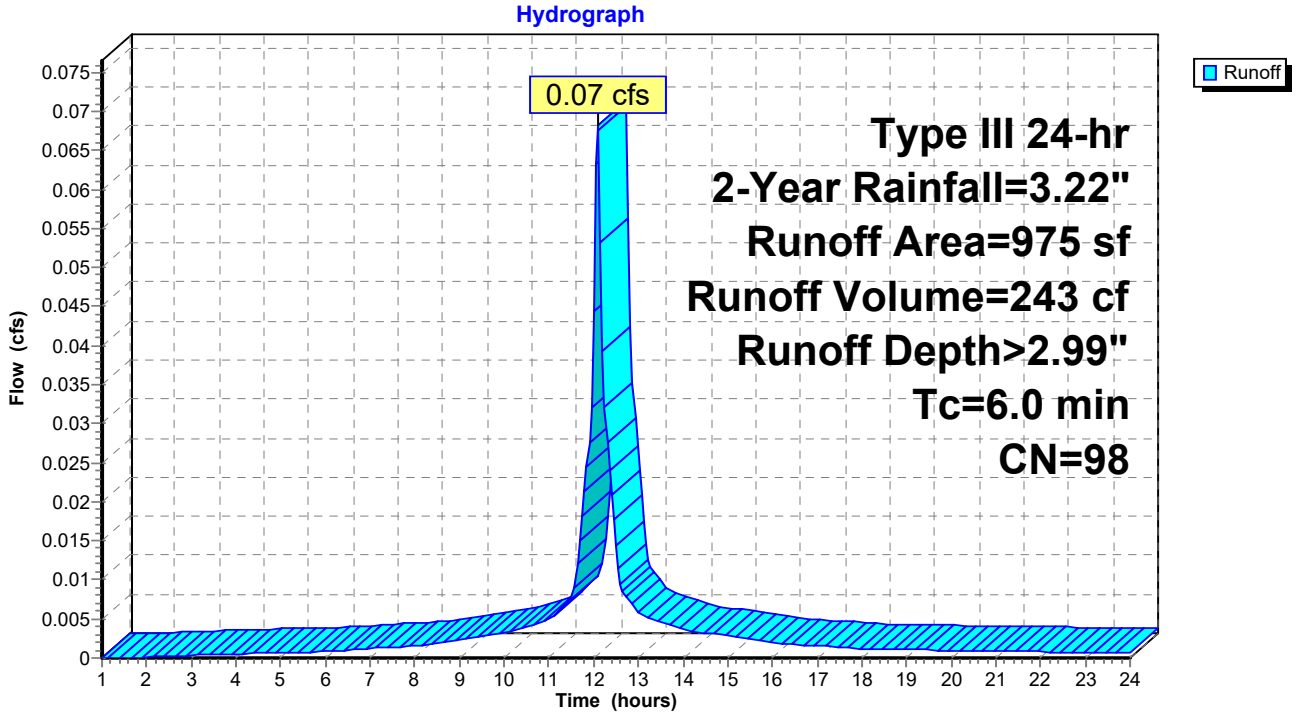
Runoff = 0.07 cfs @ 12.09 hrs, Volume= 243 cf, Depth> 2.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.22"

	Area (sf)	CN	Description
*	975	98	Impervious
	975		100.00% Impervious Area

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

Subcatchment PR-2: TO CB-1



Summary for Subcatchment PR-3: TO CB-2

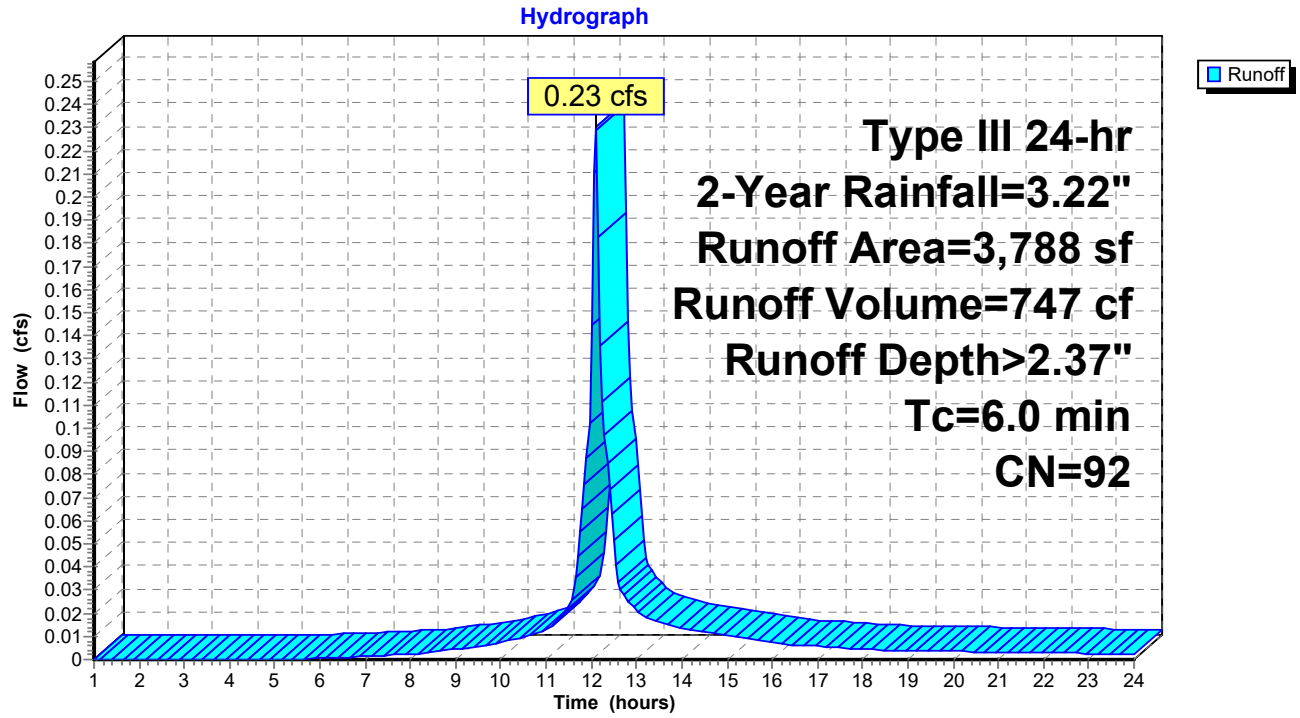
Runoff = 0.23 cfs @ 12.09 hrs, Volume= 747 cf, Depth> 2.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.22"

	Area (sf)	CN	Description
*	3,158	98	Impervious
	630	61	>75% Grass cover, Good, HSG B
	3,788	92	Weighted Average
	630		16.63% Pervious Area
	3,158		83.37% Impervious Area

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

Subcatchment PR-3: TO CB-2



Summary for Subcatchment PR-4: TO CB-3

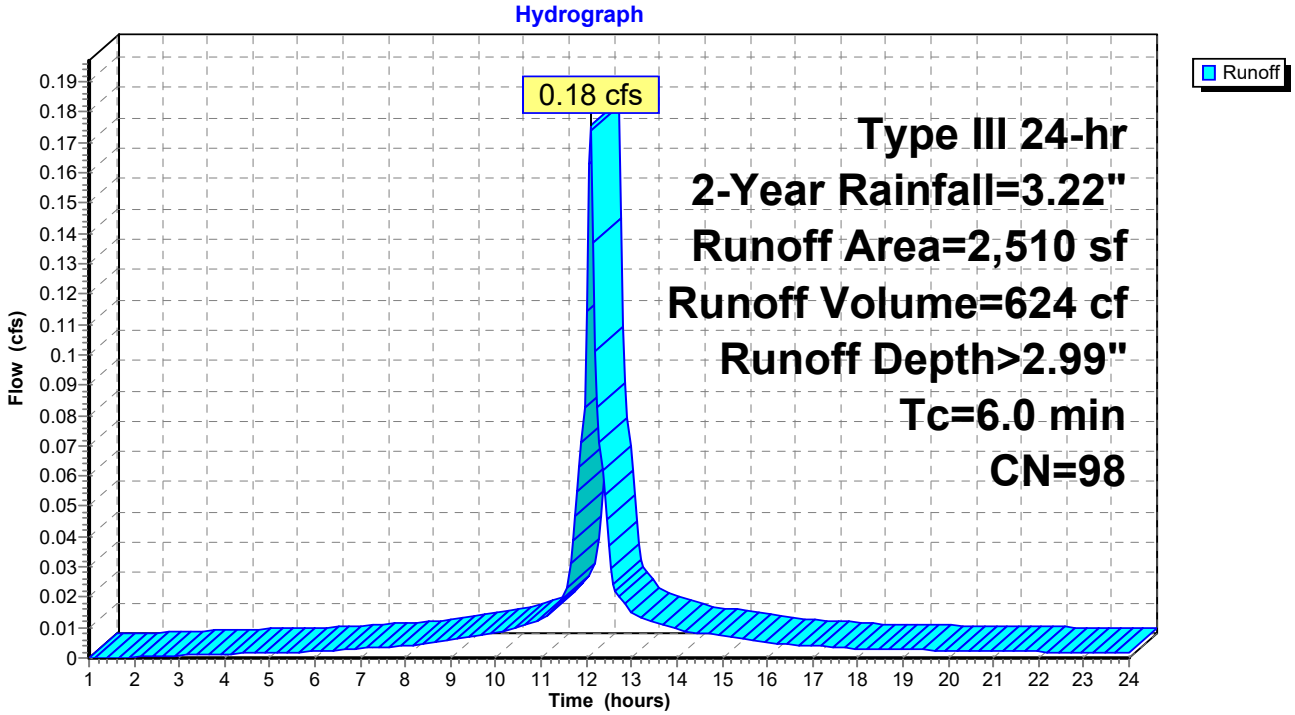
Runoff = 0.18 cfs @ 12.09 hrs, Volume= 624 cf, Depth> 2.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.22"

	Area (sf)	CN	Description
*	2,510	98	Impervious
	2,510		100.00% Impervious Area

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

Subcatchment PR-4: TO CB-3



Summary for Subcatchment PR-5: TO OFFSITE EAST

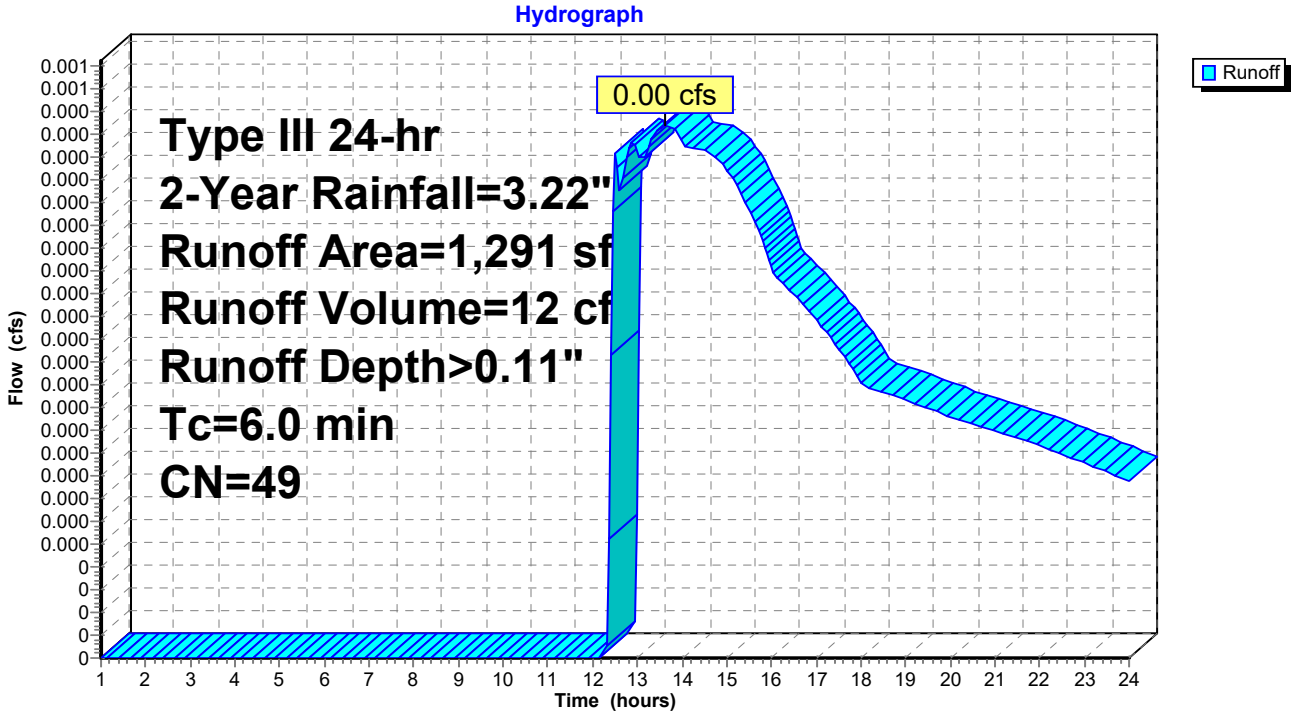
Runoff = 0.00 cfs @ 13.64 hrs, Volume= 12 cf, Depth> 0.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.22"

Area (sf)	CN	Description
1,187	48	Brush, Good, HSG B
104	61	>75% Grass cover, Good, HSG B
1,291	49	Weighted Average
1,291		100.00% Pervious Area

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

Subcatchment PR-5: TO OFFSITE EAST



Summary for Subcatchment PR-6: TO CB-4

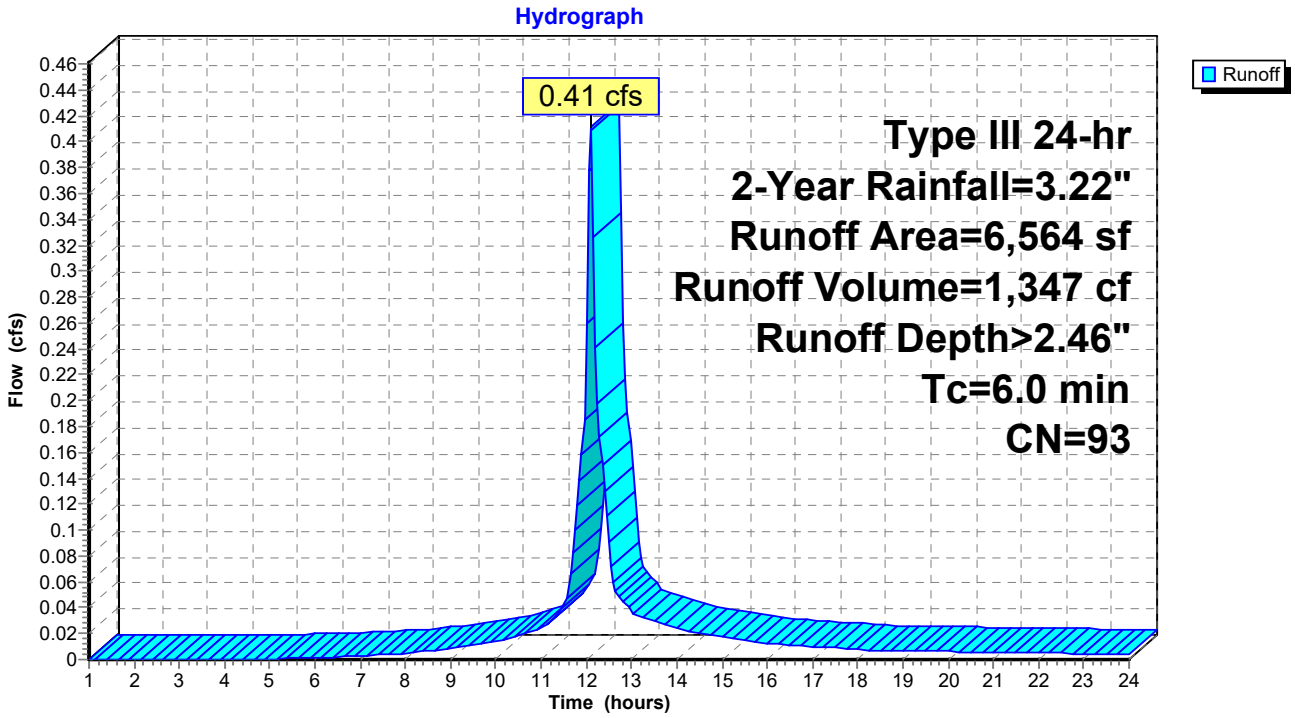
Runoff = 0.41 cfs @ 12.09 hrs, Volume= 1,347 cf, Depth> 2.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.22"

	Area (sf)	CN	Description
*	5,707	98	Impervious
	857	61	>75% Grass cover, Good, HSG B
	6,564	93	Weighted Average
	857		13.06% Pervious Area
	5,707		86.94% Impervious Area

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

Subcatchment PR-6: TO CB-4



Summary for Subcatchment PR-7: ROOF RUNOFF

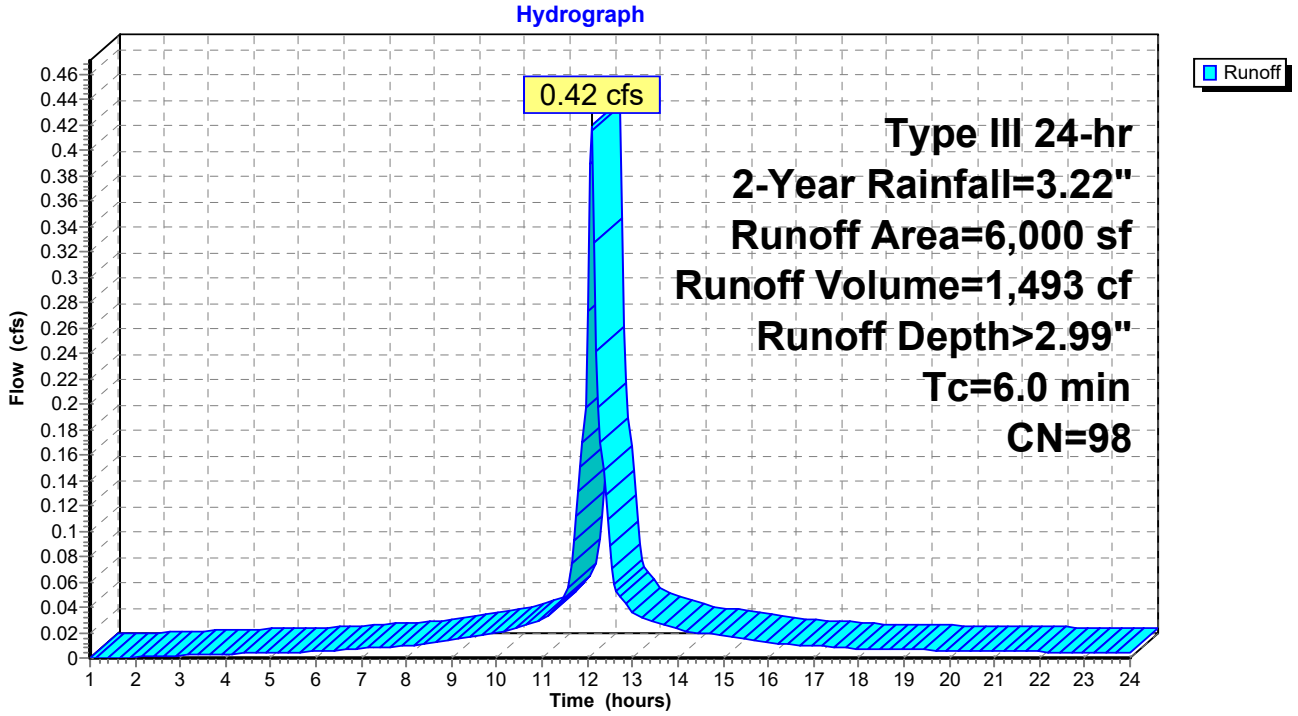
Runoff = 0.42 cfs @ 12.09 hrs, Volume= 1,493 cf, Depth> 2.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.22"

	Area (sf)	CN	Description
*	6,000	98	Impervious
	6,000		100.00% Impervious Area

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

Subcatchment PR-7: ROOF RUNOFF



Summary for Subcatchment PR-8: TO CB-5

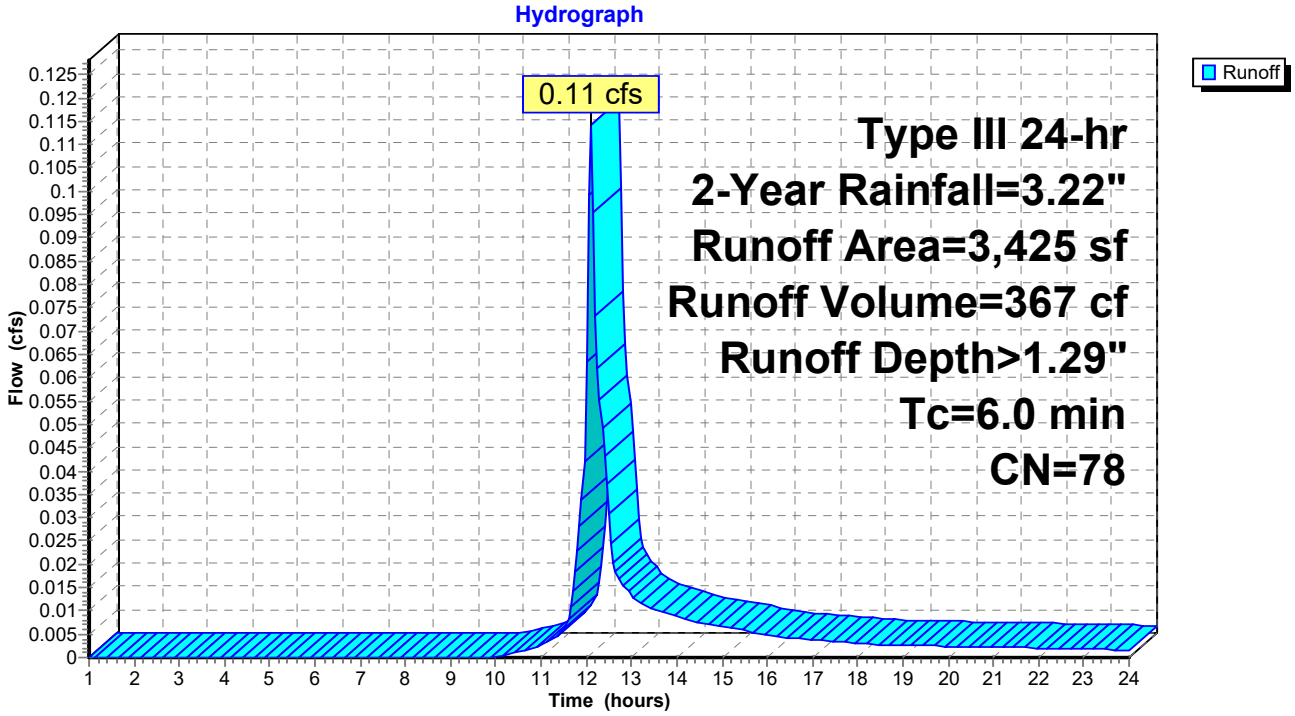
Runoff = 0.11 cfs @ 12.10 hrs, Volume= 367 cf, Depth> 1.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.22"

	Area (sf)	CN	Description
*	1,557	98	Impervious
	1,868	61	>75% Grass cover, Good, HSG B
	3,425	78	Weighted Average
	1,868		54.54% Pervious Area
	1,557		45.46% Impervious Area

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

Subcatchment PR-8: TO CB-5



Summary for Subcatchment PR-9: TO CB-6

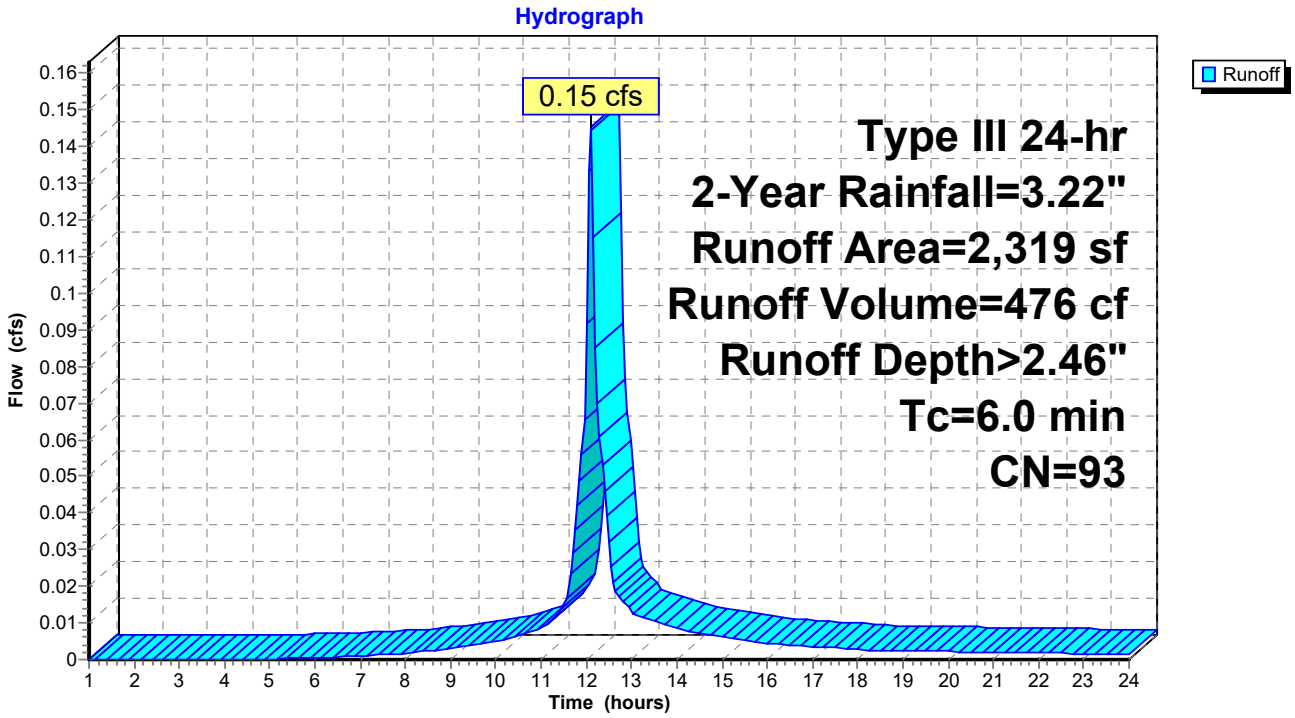
Runoff = 0.15 cfs @ 12.09 hrs, Volume= 476 cf, Depth> 2.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.22"

	Area (sf)	CN	Description
*	2,032	98	Impervious
	287	61	>75% Grass cover, Good, HSG B
	2,319	93	Weighted Average
	287		12.38% Pervious Area
	2,032		87.62% Impervious Area

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

Subcatchment PR-9: TO CB-6

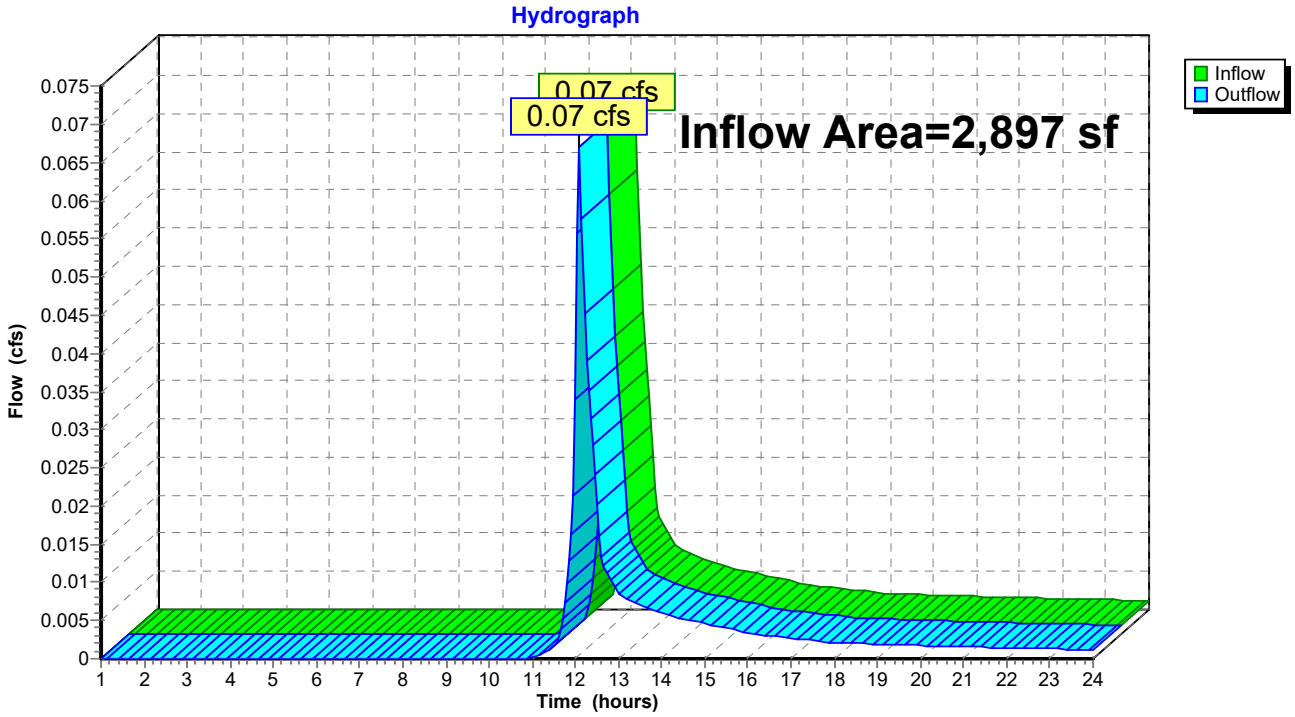


Summary for Reach 4R: MAZZEO DRIVE

Inflow Area = 2,897 sf, 30.55% Impervious, Inflow Depth > 0.94" for 2-Year event
Inflow = 0.07 cfs @ 12.10 hrs, Volume= 227 cf
Outflow = 0.07 cfs @ 12.10 hrs, Volume= 227 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs

Reach 4R: MAZZEO DRIVE

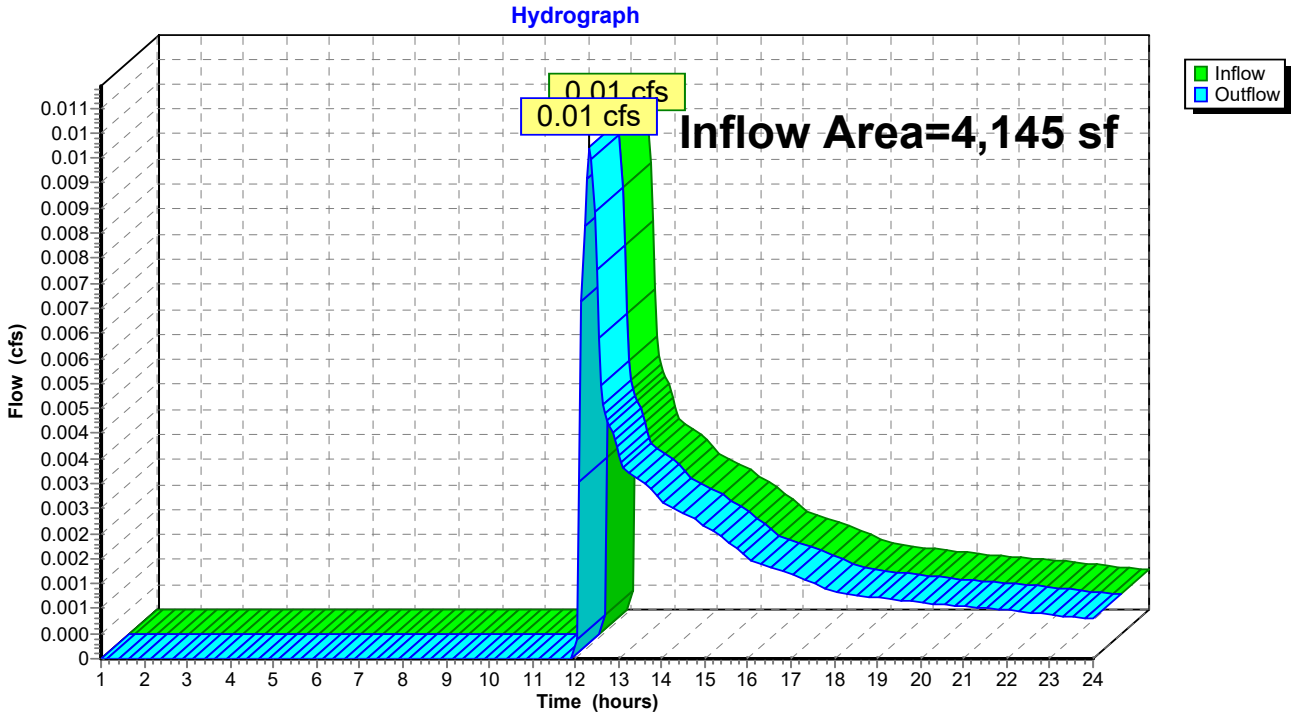


Summary for Reach 5R: OFFSITE WEST

Inflow Area = 4,145 sf, 0.00% Impervious, Inflow Depth > 0.26" for 2-Year event
Inflow = 0.01 cfs @ 12.33 hrs, Volume= 89 cf
Outflow = 0.01 cfs @ 12.33 hrs, Volume= 89 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs

Reach 5R: OFFSITE WEST

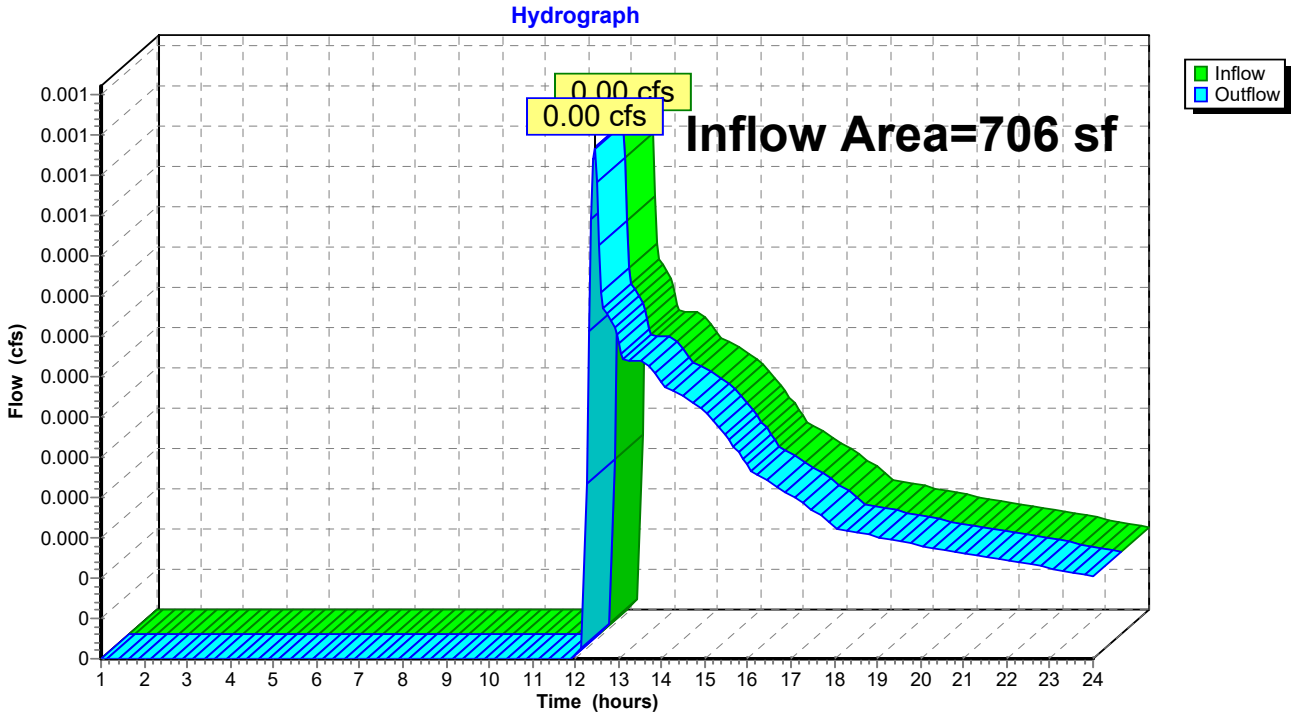


Summary for Reach 6R: OFFSITE NORTH

Inflow Area = 706 sf, 0.00% Impervious, Inflow Depth > 0.15" for 2-Year event
Inflow = 0.00 cfs @ 12.44 hrs, Volume= 9 cf
Outflow = 0.00 cfs @ 12.44 hrs, Volume= 9 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs

Reach 6R: OFFSITE NORTH

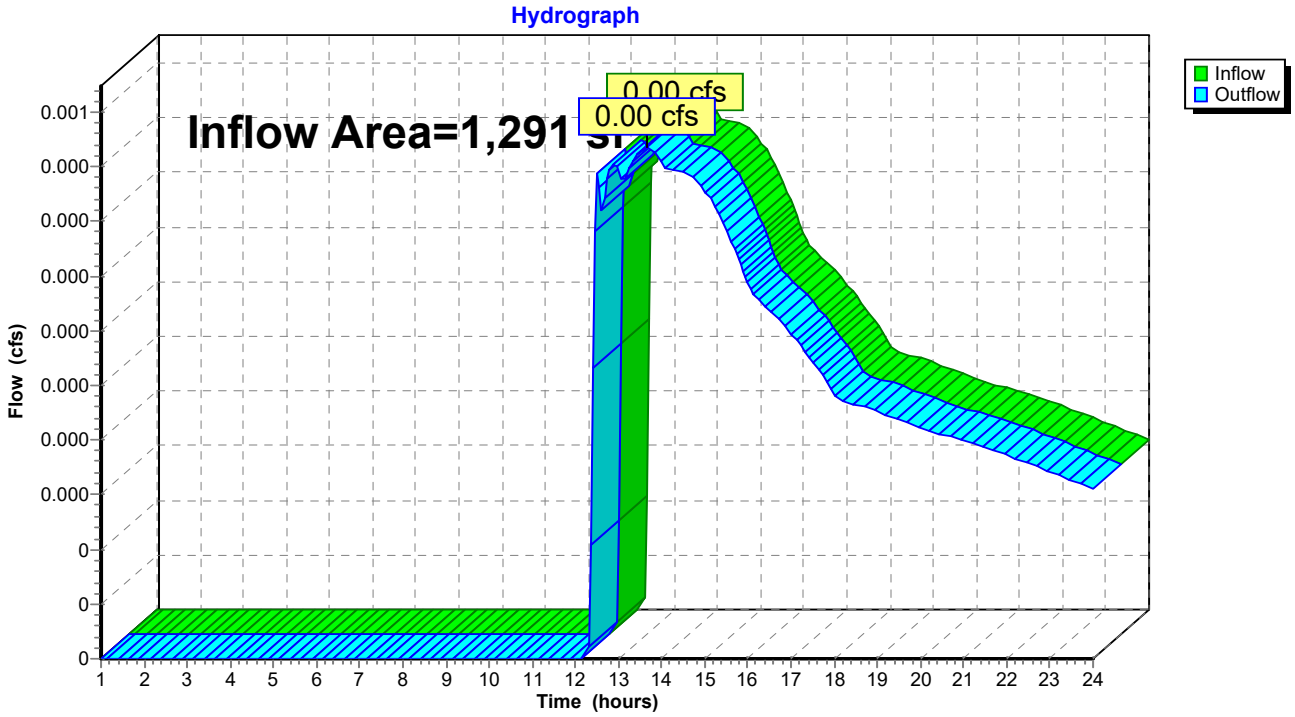


Summary for Reach 8R: OFFSITE EAST

Inflow Area = 1,291 sf, 0.00% Impervious, Inflow Depth > 0.11" for 2-Year event
Inflow = 0.00 cfs @ 13.64 hrs, Volume= 12 cf
Outflow = 0.00 cfs @ 13.64 hrs, Volume= 12 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs

Reach 8R: OFFSITE EAST



Summary for Pond CS1: CHAMBER SYSTEM 1

Inflow Area = 19,632 sf, 84.66% Impervious, Inflow Depth > 2.45" for 2-Year event
Inflow = 1.18 cfs @ 12.09 hrs, Volume= 4,013 cf
Outflow = 0.47 cfs @ 12.32 hrs, Volume= 4,012 cf, Atten= 60%, Lag= 13.9 min
Discarded = 0.47 cfs @ 12.32 hrs, Volume= 4,012 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 90.28' @ 12.32 hrs Surf.Area= 2,367 sf Storage= 478 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 4.5 min (785.3 - 780.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	89.78'	1,647 cf	**27.75'W x 85.29'L x 2.71'H Field A** 6,410 cf Overall - 2,292 cf Embedded = 4,118 cf x 40.0% Voids
#2A	90.28'	2,292 cf	**Cultec R-180** x 104 Inside #1 Effective Size= 33.6"W x 20.0"H => 3.44 sf x 6.33'L = 21.8 cf Overall Size= 36.0"W x 20.5"H x 7.33'L with 1.00' Overlap Row Length Adjustment= +1.00' x 3.44 sf x 8 rows
		3,939 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	89.78'	**8.270 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.47 cfs @ 12.32 hrs HW=90.28' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.47 cfs)

Pond CS1: CHAMBER SYSTEM 1 - Chamber Wizard Field A

Chamber Model = Cultec R-180 (Cultec Recharger® 180HD)
Effective Size= 33.6"W x 20.0"H => 3.44 sf x 6.33'L = 21.8 cf
Overall Size= 36.0"W x 20.5"H x 7.33'L with 1.00' Overlap
Row Length Adjustment= +1.00' x 3.44 sf x 8 rows

36.0" Wide + 3.0" Spacing = 39.0" C-C Row Spacing

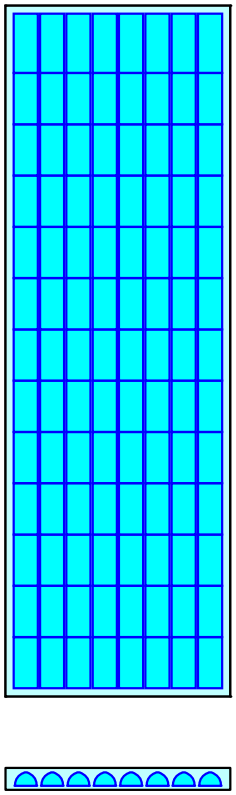
13 Chambers/Row x 6.33' Long +1.00' Row Adjustment = 83.29' Row Length +12.0" End Stone x 2 = 85.29' Base Length
8 Rows x 36.0" Wide + 3.0" Spacing x 7 + 12.0" Side Stone x 2 = 27.75' Base Width
6.0" Base + 20.5" Chamber Height + 6.0" Cover = 2.71' Field Height

104 Chambers x 21.8 cf +1.00' Row Adjustment x 3.44 sf x 8 Rows = 2,291.8 cf Chamber Storage

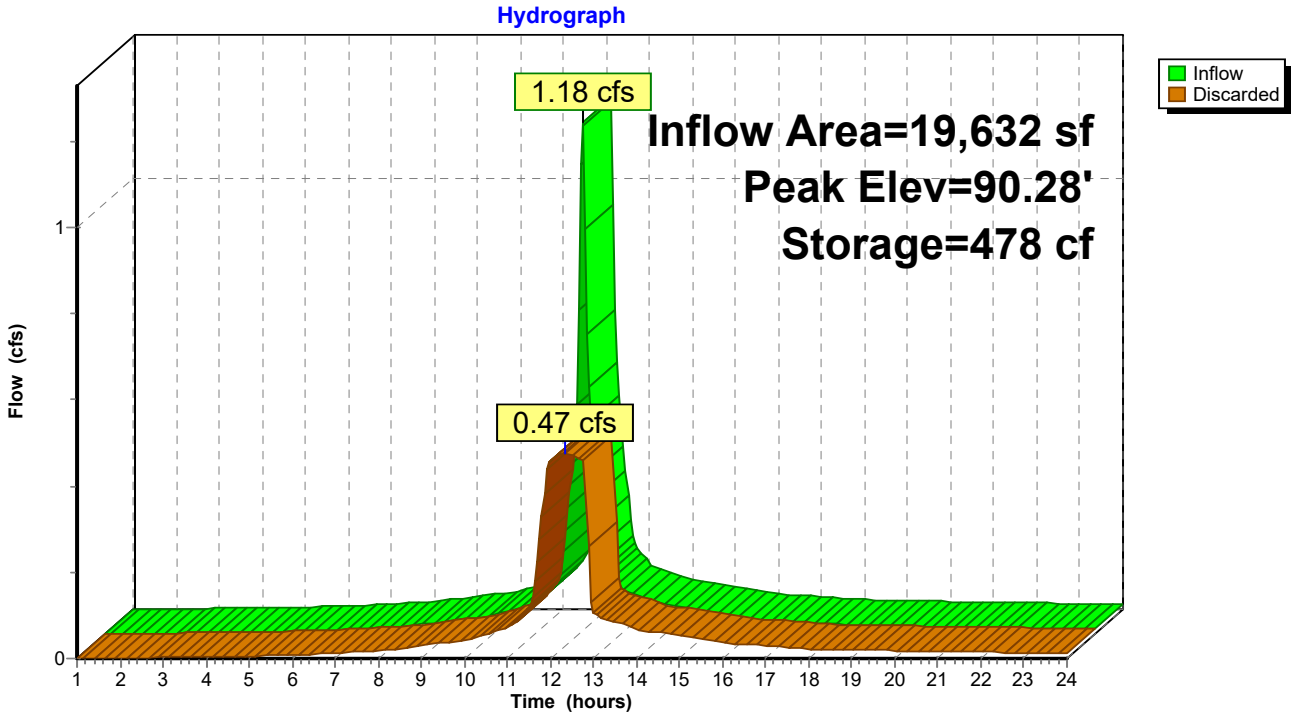
6,410.1 cf Field - 2,291.8 cf Chambers = 4,118.3 cf Stone x 40.0% Voids = 1,647.3 cf Stone Storage

Chamber Storage + Stone Storage = 3,939.1 cf = 0.090 af
Overall Storage Efficiency = 61.5%
Overall System Size = 85.29' x 27.75' x 2.71'

104 Chambers
237.4 cy Field
152.5 cy Stone



Pond CS1: CHAMBER SYSTEM 1



Summary for Pond CS2: CHAMBER SYSTEM 2

Inflow Area = 7,273 sf, 91.34% Impervious, Inflow Depth > 2.66" for 2-Year event
Inflow = 0.47 cfs @ 12.09 hrs, Volume= 1,615 cf
Outflow = 0.18 cfs @ 12.34 hrs, Volume= 1,614 cf, Atten= 63%, Lag= 15.2 min
Discarded = 0.18 cfs @ 12.34 hrs, Volume= 1,614 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 89.09' @ 12.34 hrs Surf.Area= 821 sf Storage= 223 cf

Plug-Flow detention time= 6.1 min calculated for 1,614 cf (100% of inflow)
Center-of-Mass det. time= 6.0 min (780.9 - 774.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	88.50'	737 cf	**11.17'W x 73.50'L x 3.54'H Field A** 2,907 cf Overall - 1,065 cf Embedded = 1,841 cf x 40.0% Voids
#2A	89.00'	1,065 cf	**Cultec R-330XLHD** x 20 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 2 rows
		1,802 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	88.50'	**8.270 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.18 cfs @ 12.34 hrs HW=89.09' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.18 cfs)

Pond CS2: CHAMBER SYSTEM 2 - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)
Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
Row Length Adjustment= +1.50' x 7.45 sf x 2 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

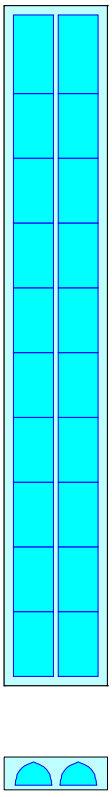
10 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 71.50' Row Length +12.0" End Stone x 2 = 73.50' Base Length
2 Rows x 52.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 11.17' Base Width
6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

20 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 2 Rows = 1,065.5 cf Chamber Storage

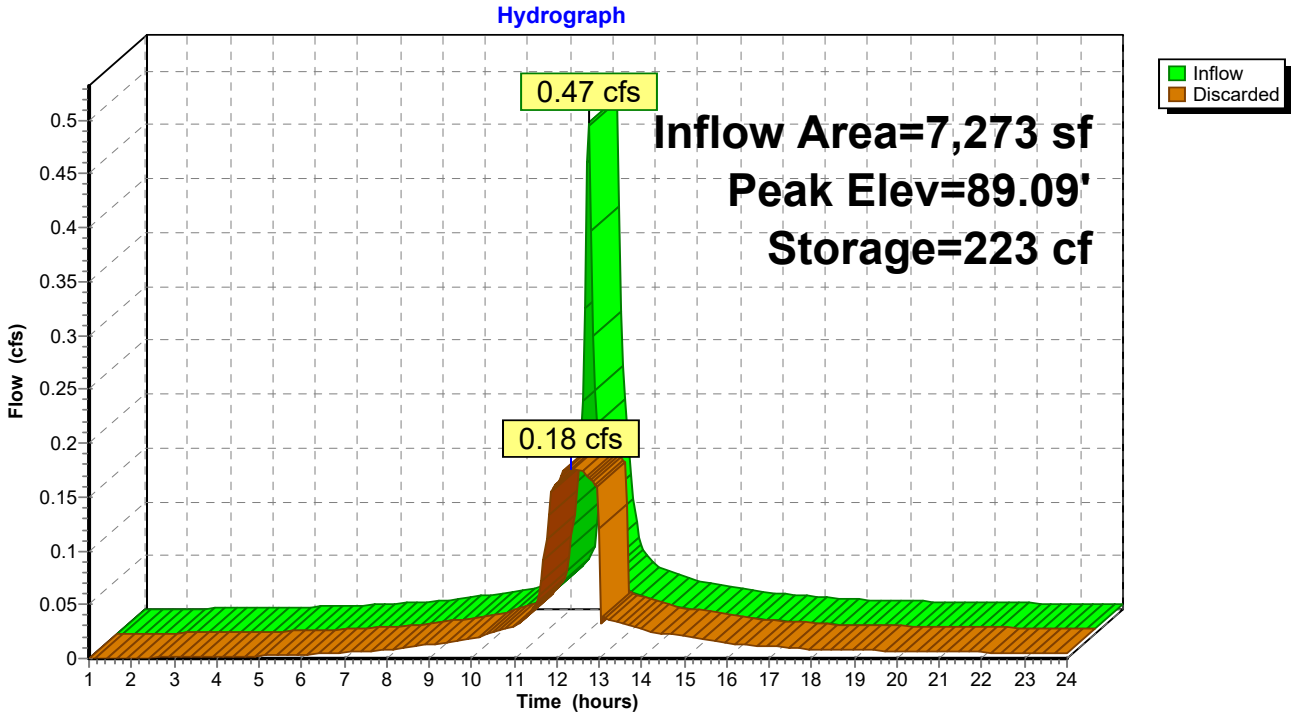
2,906.8 cf Field - 1,065.5 cf Chambers = 1,841.3 cf Stone x 40.0% Voids = 736.5 cf Stone Storage

Chamber Storage + Stone Storage = 1,802.0 cf = 0.041 af
Overall Storage Efficiency = 62.0%
Overall System Size = 73.50' x 11.17' x 3.54'

20 Chambers
107.7 cy Field
68.2 cy Stone



Pond CS2: CHAMBER SYSTEM 2



Time span=1.00-24.00 hrs, dt=0.05 hrs, 461 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PR-1: TO MAZZEO DRIVE Runoff Area=2,897 sf 30.55% Impervious Runoff Depth>2.09"
Tc=6.0 min CN=72 Runoff=0.16 cfs 504 cf

Subcatchment PR-10: TO CB-7 Runoff Area=1,324 sf 100.00% Impervious Runoff Depth>4.62"
Tc=6.0 min CN=98 Runoff=0.14 cfs 510 cf

Subcatchment PR-11: TO OFFSITE NORTH Runoff Area=706 sf 0.00% Impervious Runoff Depth>0.69"
Tc=6.0 min CN=51 Runoff=0.01 cfs 40 cf

Subcatchment PR-12: TO OFFSITE WEST Runoff Area=4,145 sf 0.00% Impervious Runoff Depth>0.91"
Tc=6.0 min CN=55 Runoff=0.08 cfs 314 cf

Subcatchment PR-2: TO CB-1 Runoff Area=975 sf 100.00% Impervious Runoff Depth>4.62"
Tc=6.0 min CN=98 Runoff=0.10 cfs 375 cf

Subcatchment PR-3: TO CB-2 Runoff Area=3,788 sf 83.37% Impervious Runoff Depth>3.95"
Tc=6.0 min CN=92 Runoff=0.37 cfs 1,247 cf

Subcatchment PR-4: TO CB-3 Runoff Area=2,510 sf 100.00% Impervious Runoff Depth>4.62"
Tc=6.0 min CN=98 Runoff=0.27 cfs 966 cf

Subcatchment PR-5: TO OFFSITE EAST Runoff Area=1,291 sf 0.00% Impervious Runoff Depth>0.58"
Tc=6.0 min CN=49 Runoff=0.01 cfs 63 cf

Subcatchment PR-6: TO CB-4 Runoff Area=6,564 sf 86.94% Impervious Runoff Depth>4.06"
Tc=6.0 min CN=93 Runoff=0.66 cfs 2,220 cf

Subcatchment PR-7: ROOF RUNOFF Runoff Area=6,000 sf 100.00% Impervious Runoff Depth>4.62"
Tc=6.0 min CN=98 Runoff=0.64 cfs 2,310 cf

Subcatchment PR-8: TO CB-5 Runoff Area=3,425 sf 45.46% Impervious Runoff Depth>2.59"
Tc=6.0 min CN=78 Runoff=0.23 cfs 739 cf

Subcatchment PR-9: TO CB-6 Runoff Area=2,319 sf 87.62% Impervious Runoff Depth>4.06"
Tc=6.0 min CN=93 Runoff=0.23 cfs 784 cf

Reach 4R: MAZZEO DRIVE Inflow=0.16 cfs 504 cf
Outflow=0.16 cfs 504 cf

Reach 5R: OFFSITE WEST Inflow=0.08 cfs 314 cf
Outflow=0.08 cfs 314 cf

Reach 6R: OFFSITE NORTH Inflow=0.01 cfs 40 cf
Outflow=0.01 cfs 40 cf

Reach 8R: OFFSITE EAST Inflow=0.01 cfs 63 cf
Outflow=0.01 cfs 63 cf

Pond CS1: CHAMBER SYSTEM 1 Peak Elev=90.69' Storage=1,311 cf Inflow=1.91 cfs 6,563 cf
Outflow=0.49 cfs 6,562 cf

Pond CS2: CHAMBER SYSTEM 2 Peak Elev=89.57' Storage=540 cf Inflow=0.75 cfs 2,589 cf
Outflow=0.19 cfs 2,588 cf

Total Runoff Area = 35,944 sf Runoff Volume = 10,074 cf Average Runoff Depth = 3.36"
32.82% Pervious = 11,796 sf 67.18% Impervious = 24,148 sf

Summary for Subcatchment PR-1: TO MAZZEO DRIVE

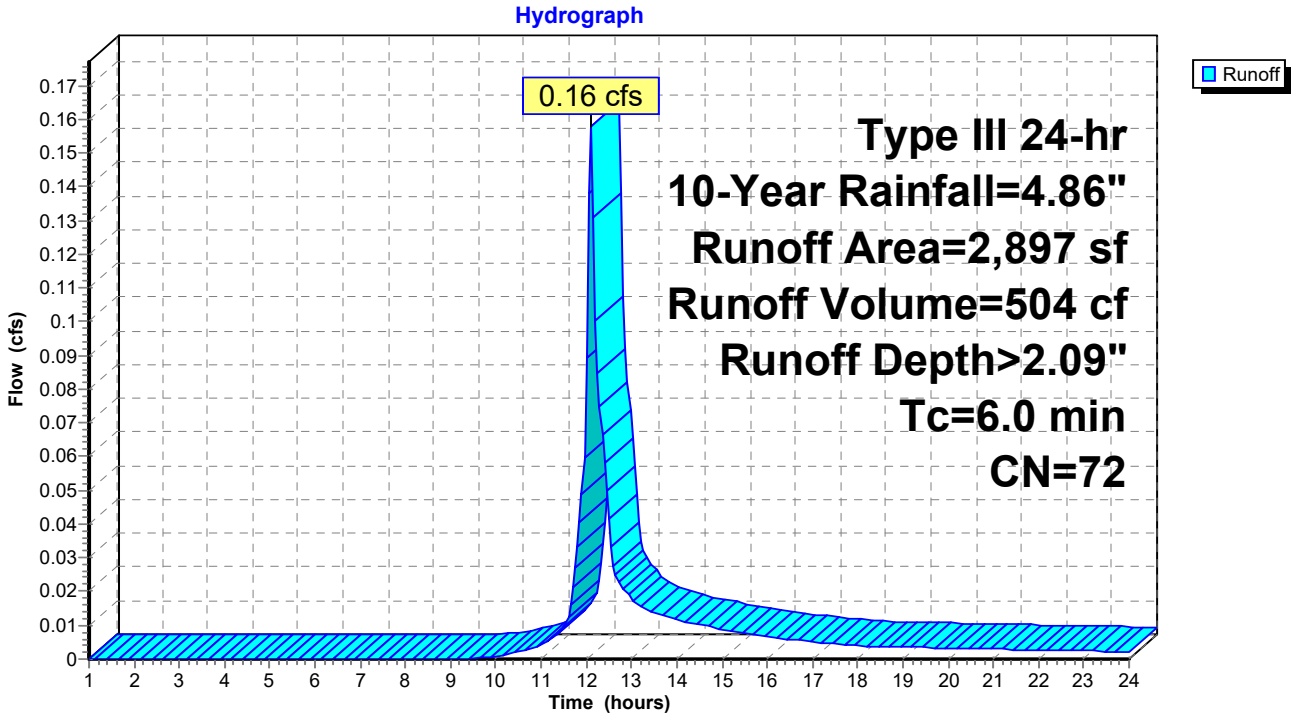
Runoff = 0.16 cfs @ 12.10 hrs, Volume= 504 cf, Depth> 2.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.86"

	Area (sf)	CN	Description
	13	48	Brush, Good, HSG B
	1,999	61	>75% Grass cover, Good, HSG B
*	885	98	Impervious
	2,897	72	Weighted Average
	2,012		69.45% Pervious Area
	885		30.55% Impervious Area

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

Subcatchment PR-1: TO MAZZEO DRIVE



Summary for Subcatchment PR-10: TO CB-7

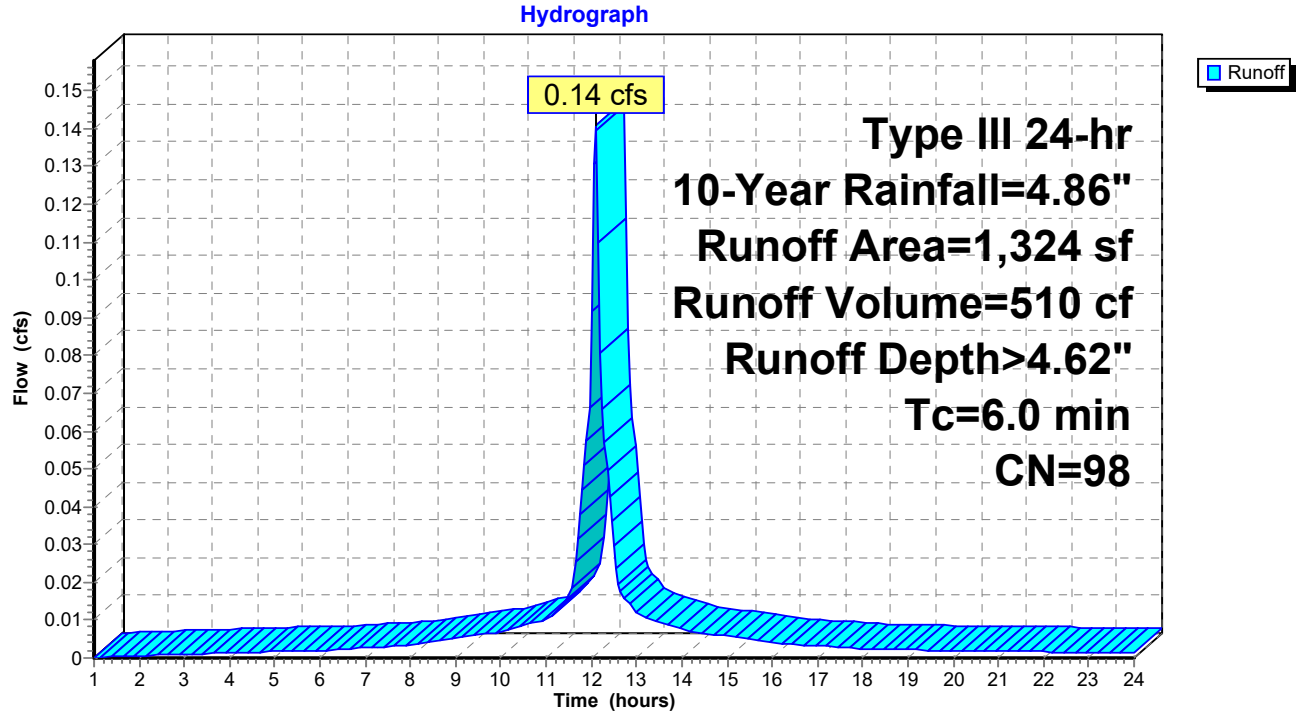
Runoff = 0.14 cfs @ 12.09 hrs, Volume= 510 cf, Depth> 4.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.86"

	Area (sf)	CN	Description
*	1,324	98	Impervious
	1,324		100.00% Impervious Area

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

Subcatchment PR-10: TO CB-7



Summary for Subcatchment PR-11: TO OFFSITE NORTH

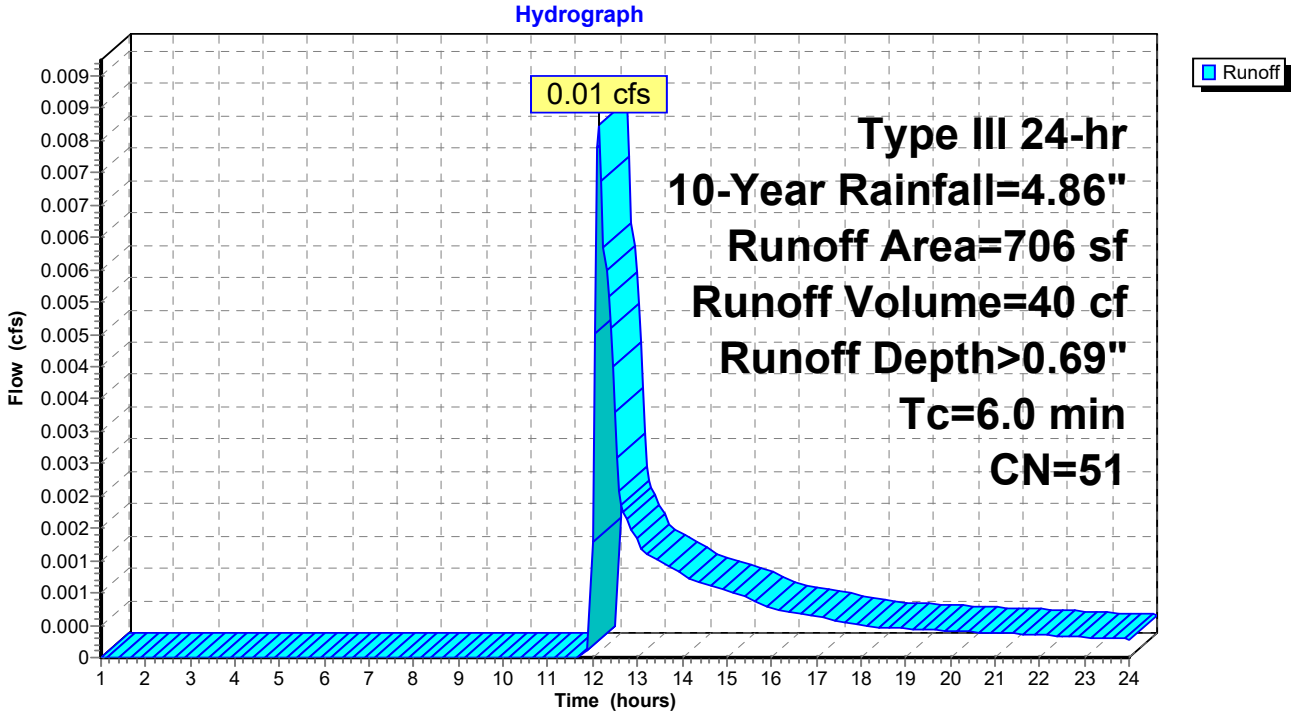
Runoff = 0.01 cfs @ 12.12 hrs, Volume= 40 cf, Depth> 0.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.86"

Area (sf)	CN	Description
27	96	Gravel surface, HSG B
593	48	Brush, Good, HSG B
86	61	>75% Grass cover, Good, HSG B
706	51	Weighted Average
706		100.00% Pervious Area

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

Subcatchment PR-11: TO OFFSITE NORTH



Summary for Subcatchment PR-12: TO OFFSITE WEST

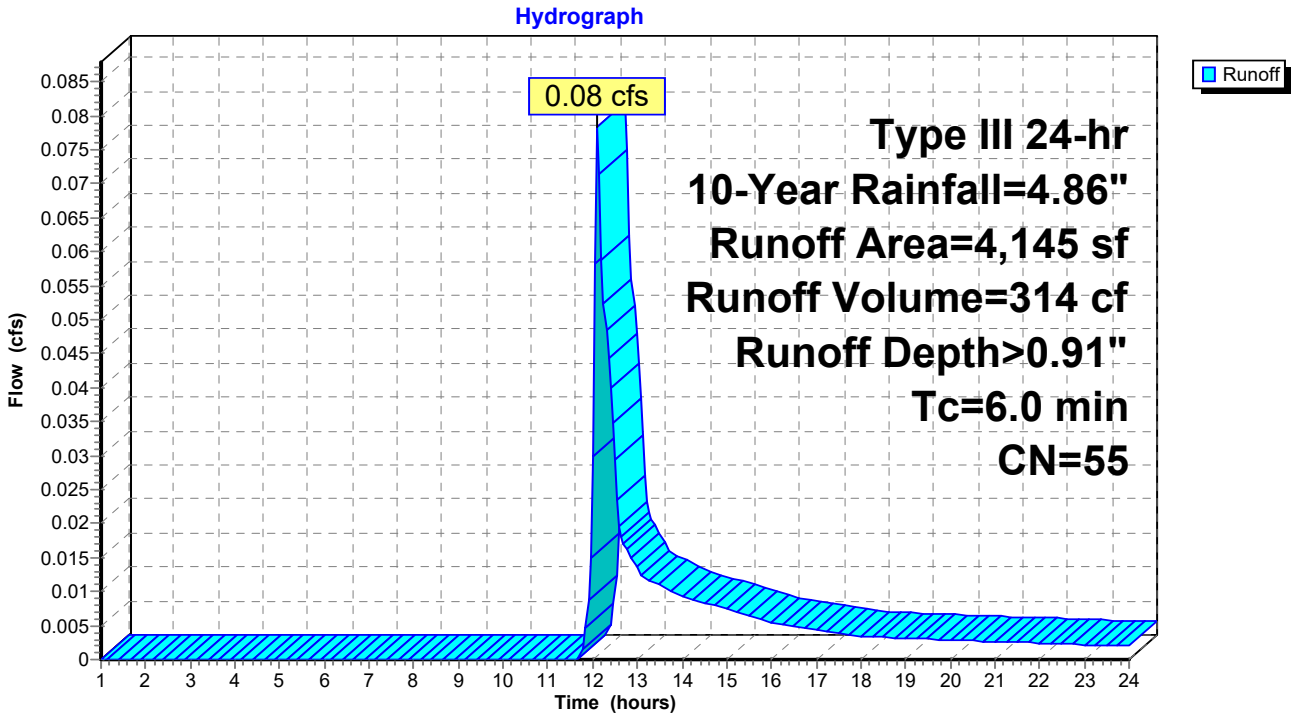
Runoff = 0.08 cfs @ 12.11 hrs, Volume= 314 cf, Depth> 0.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.86"

Area (sf)	CN	Description
83	96	Gravel surface, HSG B
2,238	48	Brush, Good, HSG B
1,824	61	>75% Grass cover, Good, HSG B
4,145	55	Weighted Average
4,145		100.00% Pervious Area

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

Subcatchment PR-12: TO OFFSITE WEST



Summary for Subcatchment PR-2: TO CB-1

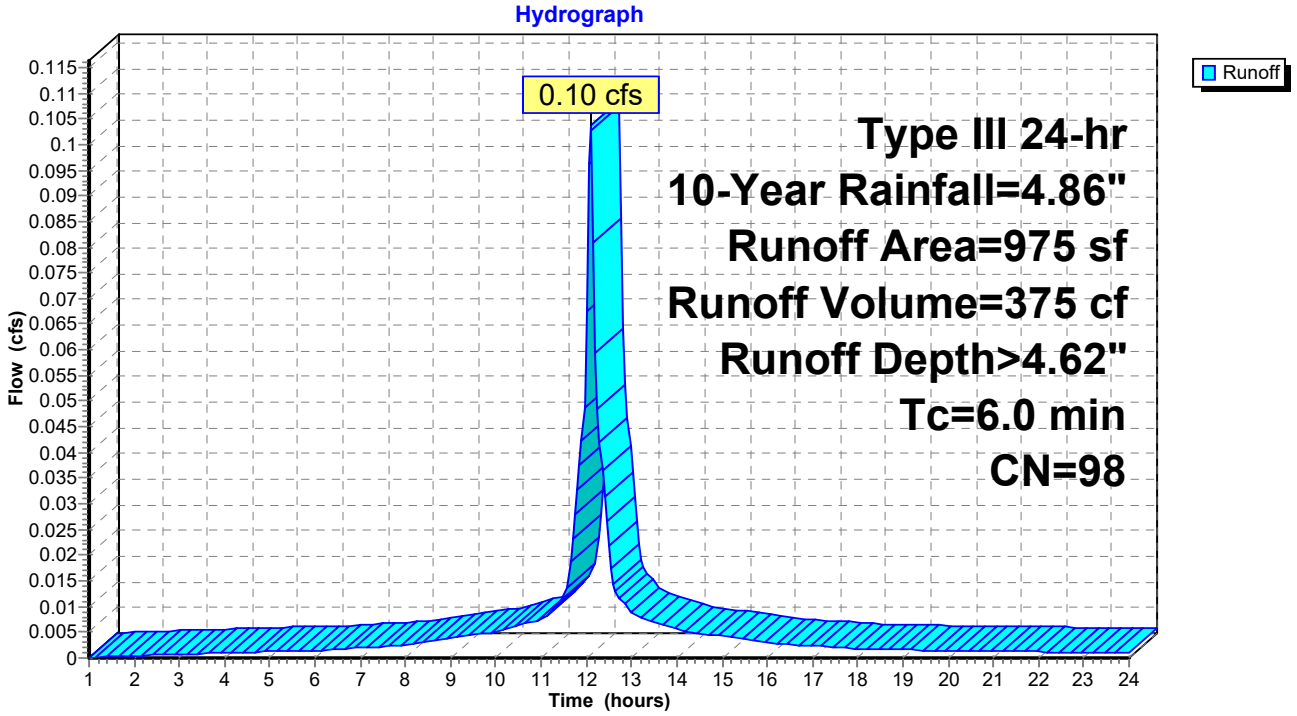
Runoff = 0.10 cfs @ 12.09 hrs, Volume= 375 cf, Depth> 4.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.86"

	Area (sf)	CN	Description
*	975	98	Impervious
	975		100.00% Impervious Area

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

Subcatchment PR-2: TO CB-1



Summary for Subcatchment PR-3: TO CB-2

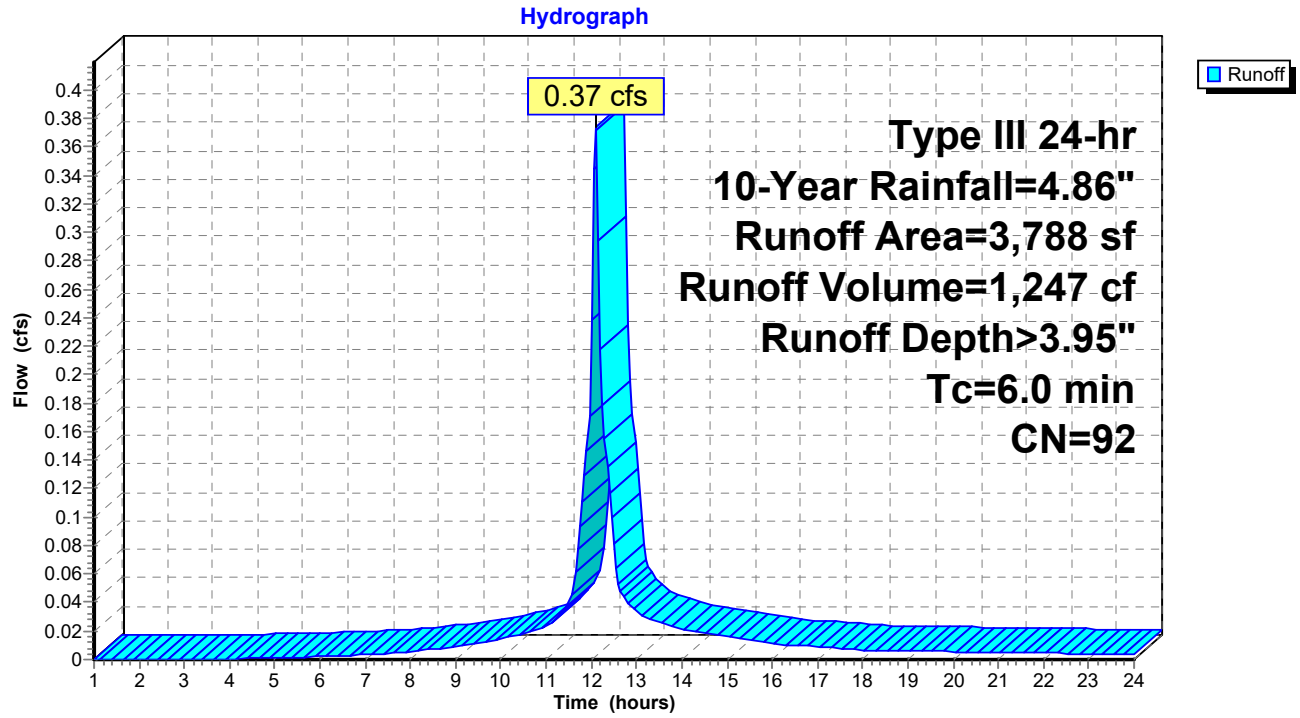
Runoff = 0.37 cfs @ 12.09 hrs, Volume= 1,247 cf, Depth> 3.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.86"

	Area (sf)	CN	Description
*	3,158	98	Impervious
	630	61	>75% Grass cover, Good, HSG B
	3,788	92	Weighted Average
	630		16.63% Pervious Area
	3,158		83.37% Impervious Area

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

Subcatchment PR-3: TO CB-2



Summary for Subcatchment PR-4: TO CB-3

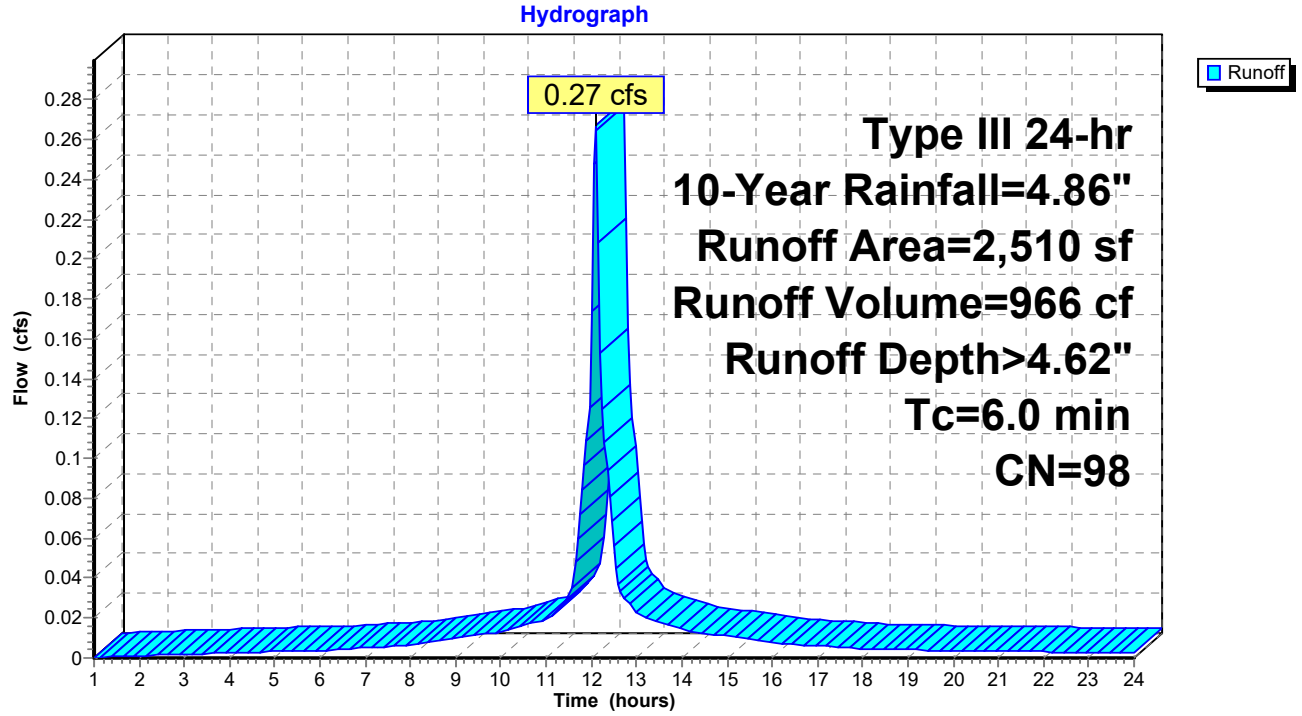
Runoff = 0.27 cfs @ 12.09 hrs, Volume= 966 cf, Depth> 4.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.86"

	Area (sf)	CN	Description
*	2,510	98	Impervious
	2,510		100.00% Impervious Area

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

Subcatchment PR-4: TO CB-3



Summary for Subcatchment PR-5: TO OFFSITE EAST

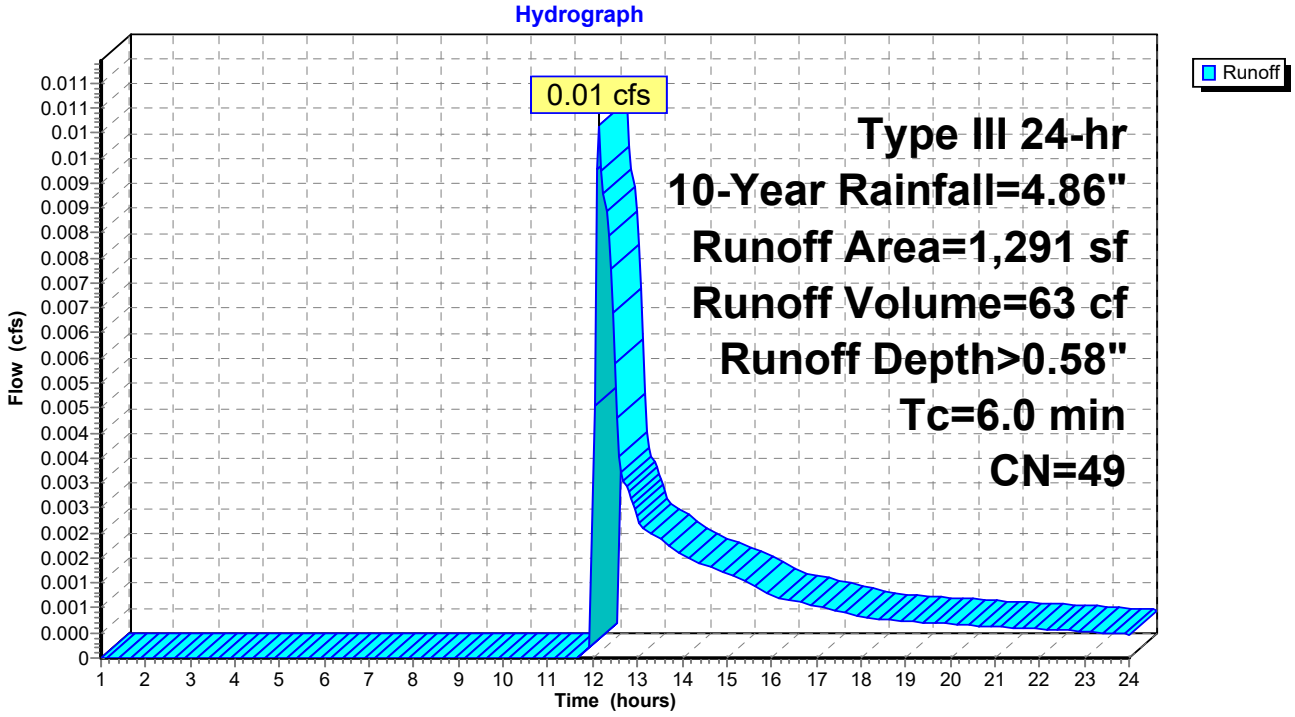
Runoff = 0.01 cfs @ 12.15 hrs, Volume= 63 cf, Depth> 0.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.86"

Area (sf)	CN	Description
1,187	48	Brush, Good, HSG B
104	61	>75% Grass cover, Good, HSG B
1,291	49	Weighted Average
1,291		100.00% Pervious Area

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

Subcatchment PR-5: TO OFFSITE EAST



Summary for Subcatchment PR-6: TO CB-4

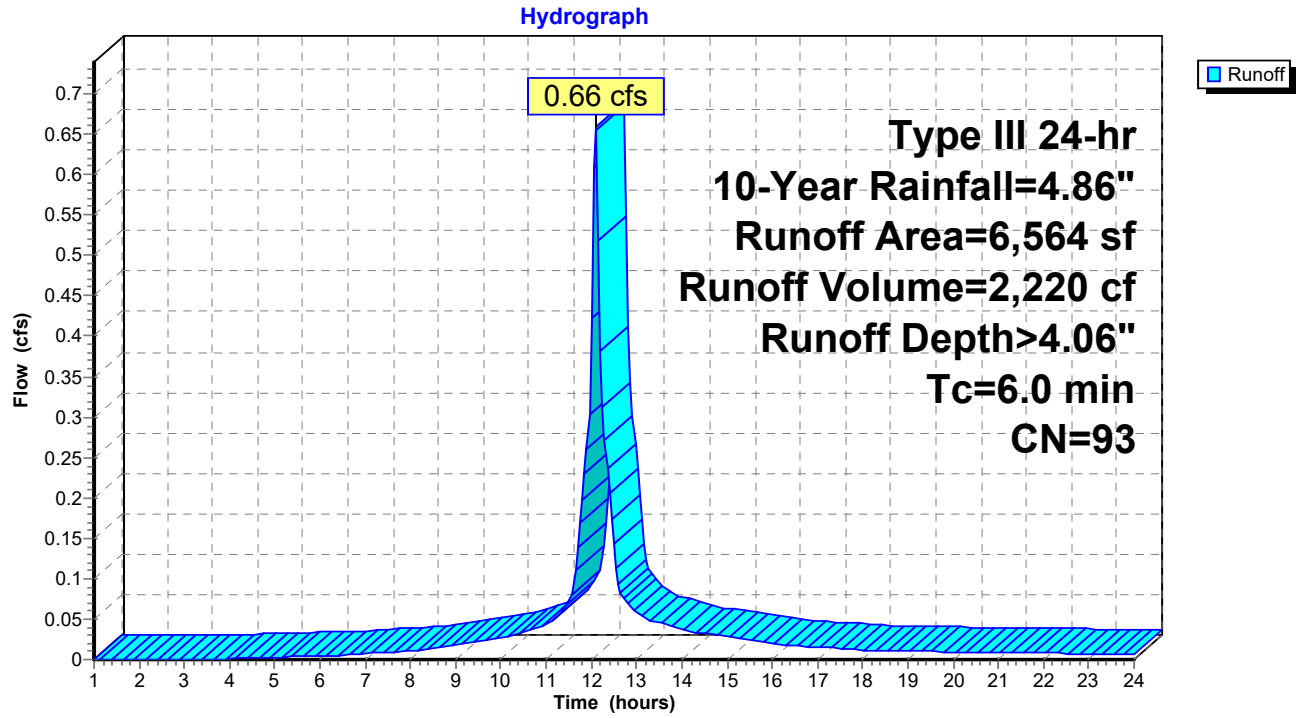
Runoff = 0.66 cfs @ 12.09 hrs, Volume= 2,220 cf, Depth> 4.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.86"

	Area (sf)	CN	Description
*	5,707	98	Impervious
	857	61	>75% Grass cover, Good, HSG B
	6,564	93	Weighted Average
	857		13.06% Pervious Area
	5,707		86.94% Impervious Area

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

Subcatchment PR-6: TO CB-4



Summary for Subcatchment PR-7: ROOF RUNOFF

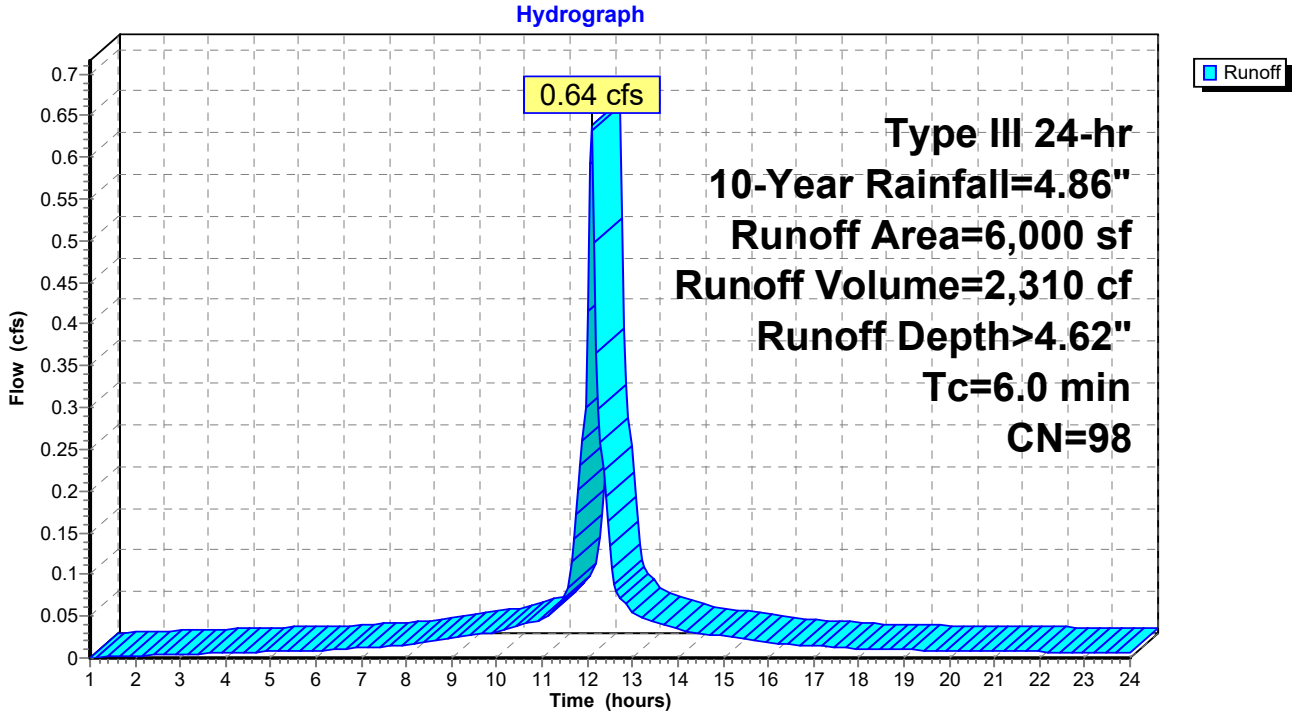
Runoff = 0.64 cfs @ 12.09 hrs, Volume= 2,310 cf, Depth> 4.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.86"

	Area (sf)	CN	Description
*	6,000	98	Impervious
	6,000		100.00% Impervious Area

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

Subcatchment PR-7: ROOF RUNOFF



Summary for Subcatchment PR-8: TO CB-5

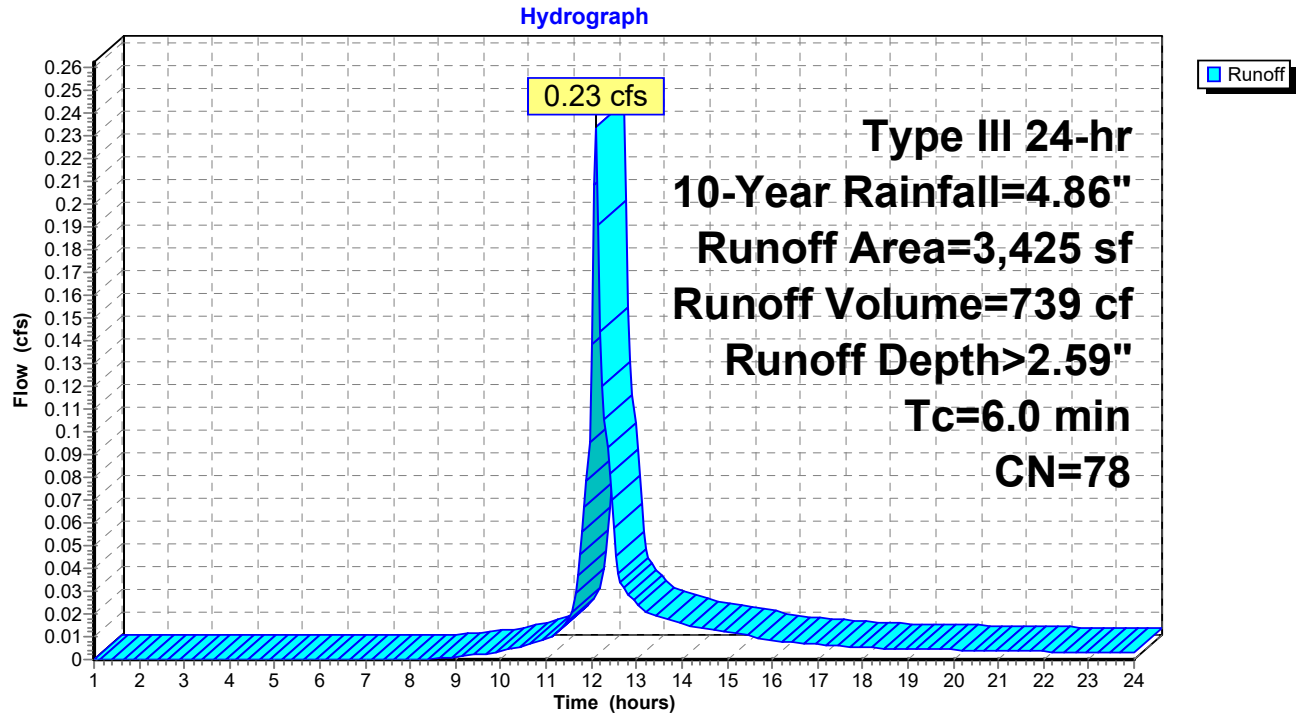
Runoff = 0.23 cfs @ 12.09 hrs, Volume= 739 cf, Depth> 2.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.86"

	Area (sf)	CN	Description
*	1,557	98	Impervious
	1,868	61	>75% Grass cover, Good, HSG B
	3,425	78	Weighted Average
	1,868		54.54% Pervious Area
	1,557		45.46% Impervious Area

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

Subcatchment PR-8: TO CB-5



Summary for Subcatchment PR-9: TO CB-6

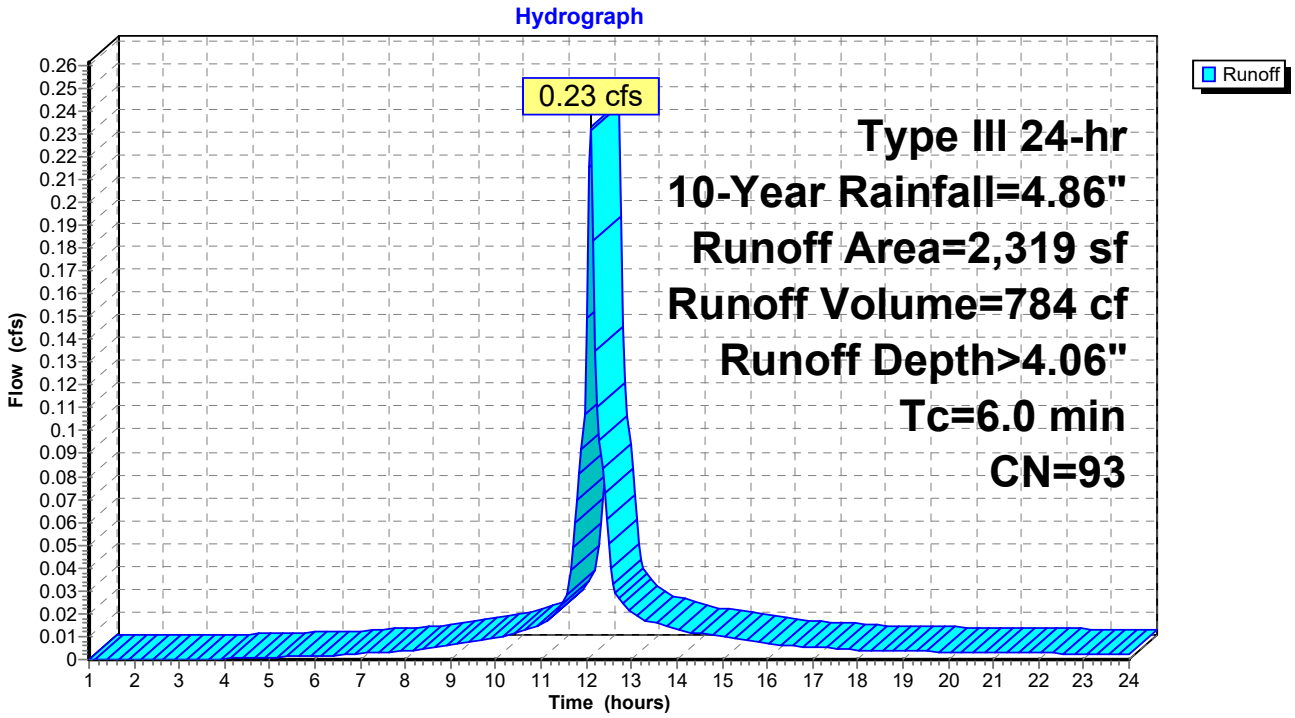
Runoff = 0.23 cfs @ 12.09 hrs, Volume= 784 cf, Depth> 4.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.86"

	Area (sf)	CN	Description
*	2,032	98	Impervious
	287	61	>75% Grass cover, Good, HSG B
	2,319	93	Weighted Average
	287		12.38% Pervious Area
	2,032		87.62% Impervious Area

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

Subcatchment PR-9: TO CB-6

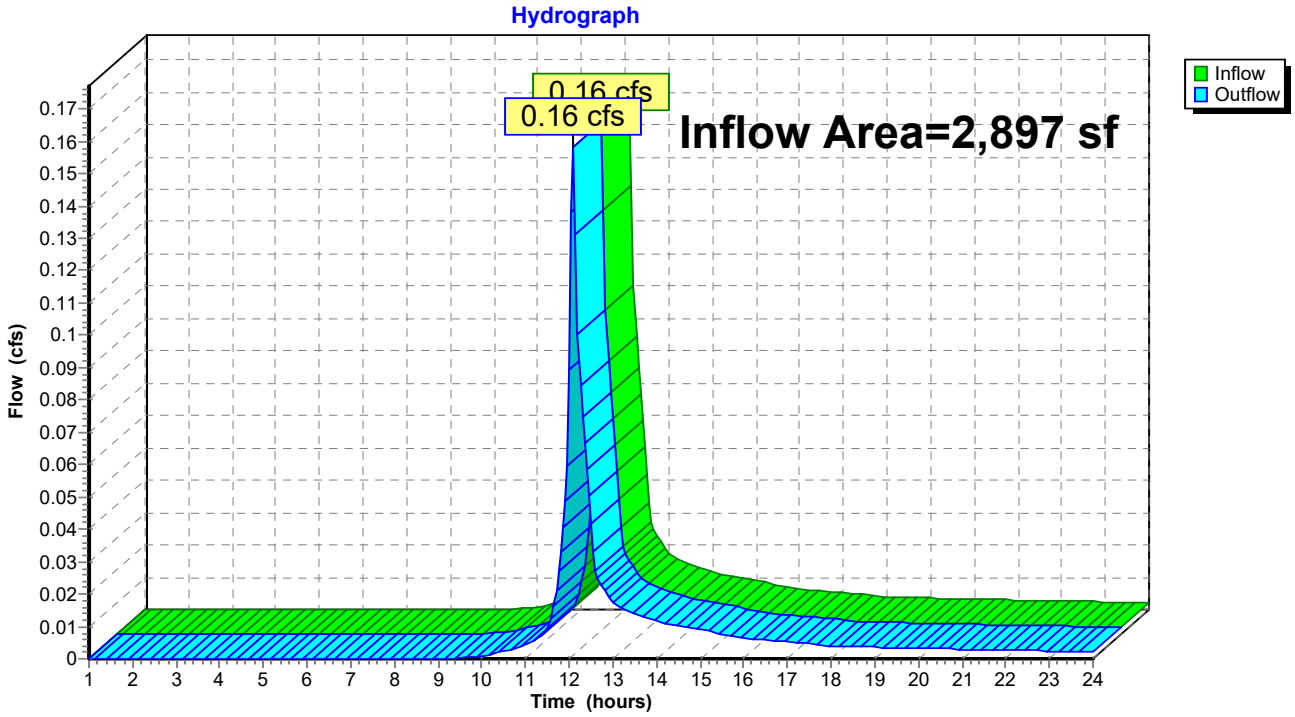


Summary for Reach 4R: MAZZEO DRIVE

Inflow Area = 2,897 sf, 30.55% Impervious, Inflow Depth > 2.09" for 10-Year event
Inflow = 0.16 cfs @ 12.10 hrs, Volume= 504 cf
Outflow = 0.16 cfs @ 12.10 hrs, Volume= 504 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs

Reach 4R: MAZZEO DRIVE

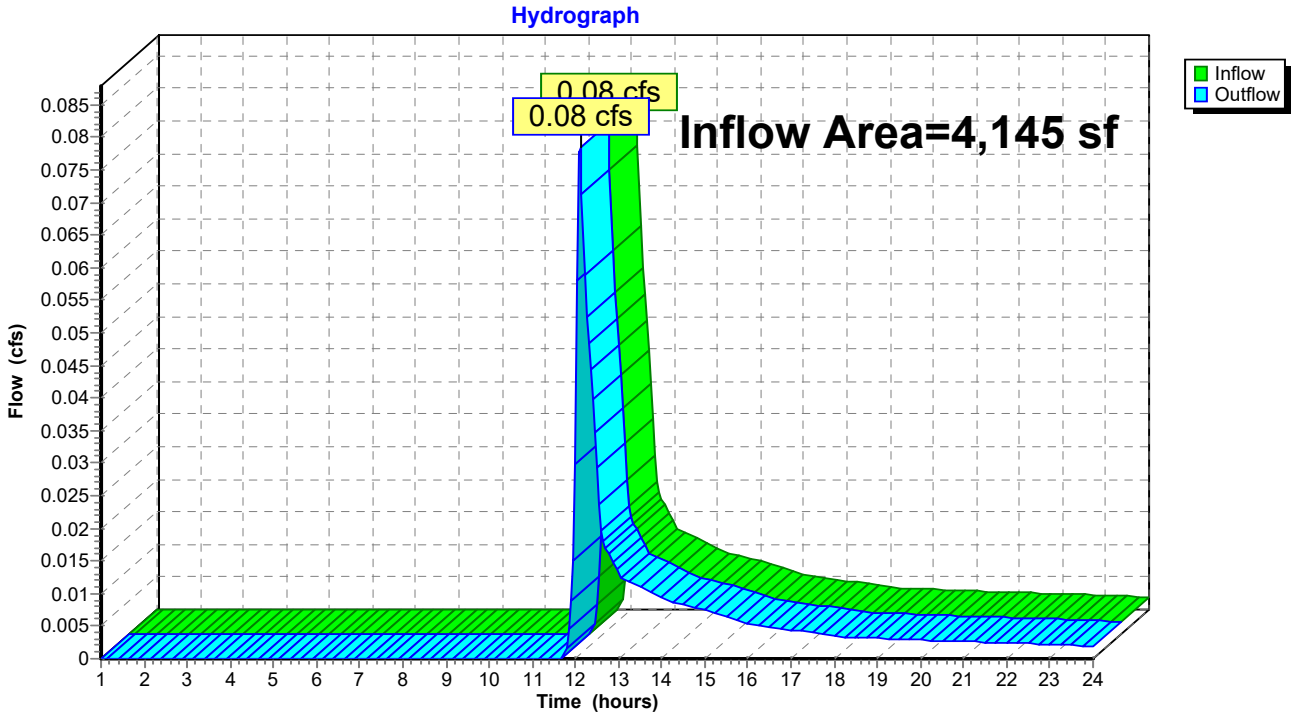


Summary for Reach 5R: OFFSITE WEST

Inflow Area = 4,145 sf, 0.00% Impervious, Inflow Depth > 0.91" for 10-Year event
Inflow = 0.08 cfs @ 12.11 hrs, Volume= 314 cf
Outflow = 0.08 cfs @ 12.11 hrs, Volume= 314 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs

Reach 5R: OFFSITE WEST

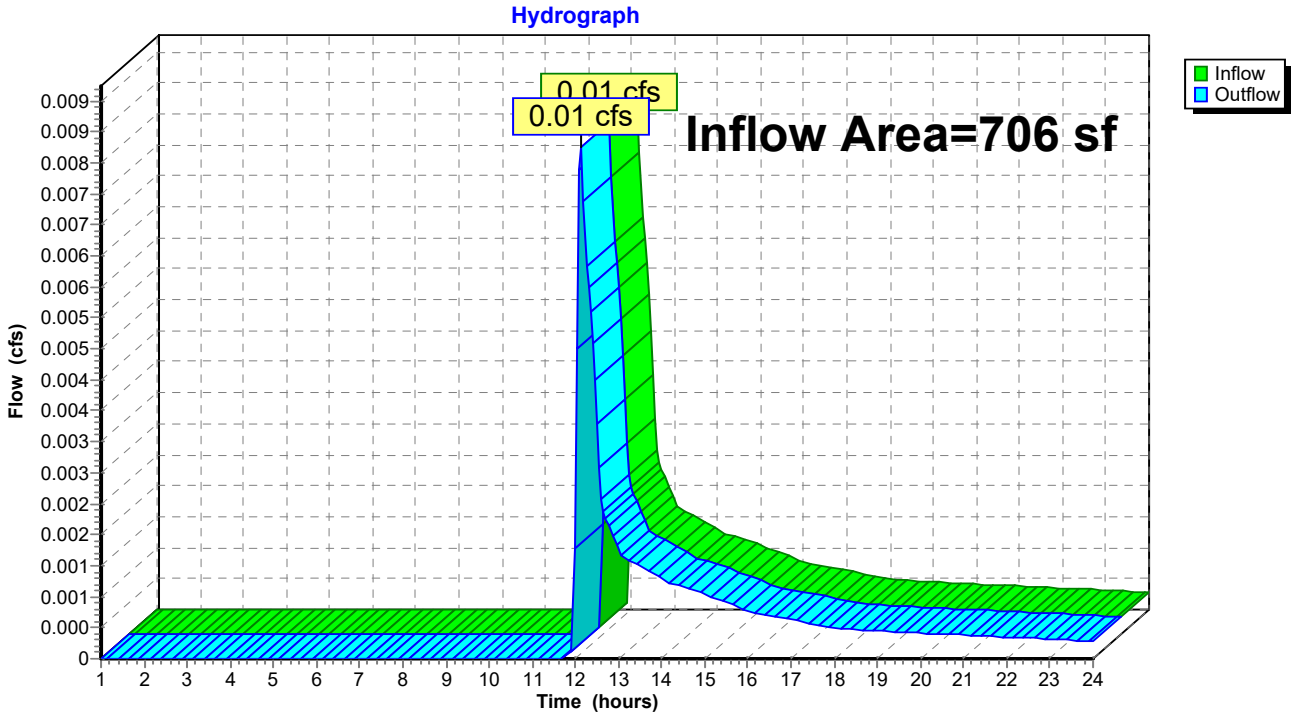


Summary for Reach 6R: OFFSITE NORTH

Inflow Area = 706 sf, 0.00% Impervious, Inflow Depth > 0.69" for 10-Year event
Inflow = 0.01 cfs @ 12.12 hrs, Volume= 40 cf
Outflow = 0.01 cfs @ 12.12 hrs, Volume= 40 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs

Reach 6R: OFFSITE NORTH

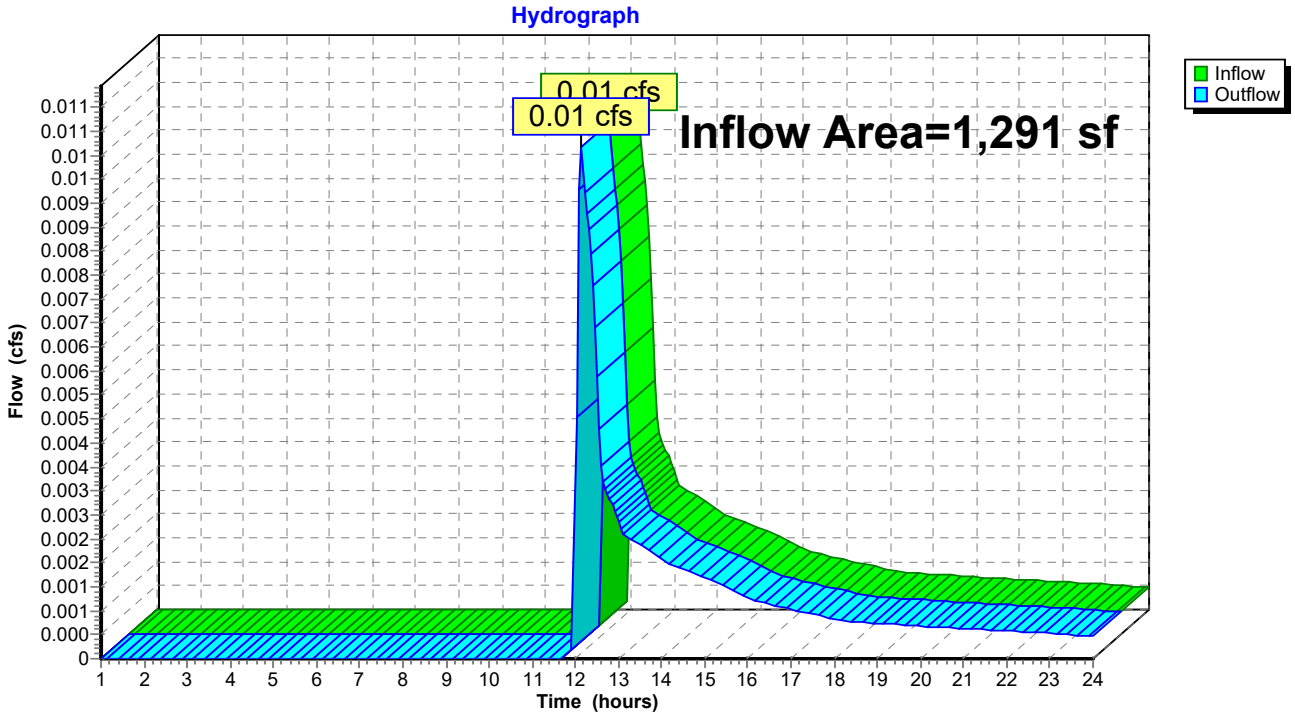


Summary for Reach 8R: OFFSITE EAST

Inflow Area = 1,291 sf, 0.00% Impervious, Inflow Depth > 0.58" for 10-Year event
Inflow = 0.01 cfs @ 12.15 hrs, Volume= 63 cf
Outflow = 0.01 cfs @ 12.15 hrs, Volume= 63 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs

Reach 8R: OFFSITE EAST



Summary for Pond CS1: CHAMBER SYSTEM 1

Inflow Area = 19,632 sf, 84.66% Impervious, Inflow Depth > 4.01" for 10-Year event
Inflow = 1.91 cfs @ 12.09 hrs, Volume= 6,563 cf
Outflow = 0.49 cfs @ 12.46 hrs, Volume= 6,562 cf, Atten= 74%, Lag= 22.2 min
Discarded = 0.49 cfs @ 12.46 hrs, Volume= 6,562 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 90.69' @ 12.46 hrs Surf.Area= 2,367 sf Storage= 1,311 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 13.1 min (784.2 - 771.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	89.78'	1,647 cf	**27.75'W x 85.29'L x 2.71'H Field A** 6,410 cf Overall - 2,292 cf Embedded = 4,118 cf x 40.0% Voids
#2A	90.28'	2,292 cf	**Cultec R-180** x 104 Inside #1 Effective Size= 33.6"W x 20.0"H => 3.44 sf x 6.33'L = 21.8 cf Overall Size= 36.0"W x 20.5"H x 7.33'L with 1.00' Overlap Row Length Adjustment= +1.00' x 3.44 sf x 8 rows
		3,939 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	89.78'	**8.270 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.49 cfs @ 12.46 hrs HW=90.69' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.49 cfs)

Pond CS1: CHAMBER SYSTEM 1 - Chamber Wizard Field A

Chamber Model = Cultec R-180 (Cultec Recharger® 180HD)
Effective Size= 33.6"W x 20.0"H => 3.44 sf x 6.33'L = 21.8 cf
Overall Size= 36.0"W x 20.5"H x 7.33'L with 1.00' Overlap
Row Length Adjustment= +1.00' x 3.44 sf x 8 rows

36.0" Wide + 3.0" Spacing = 39.0" C-C Row Spacing

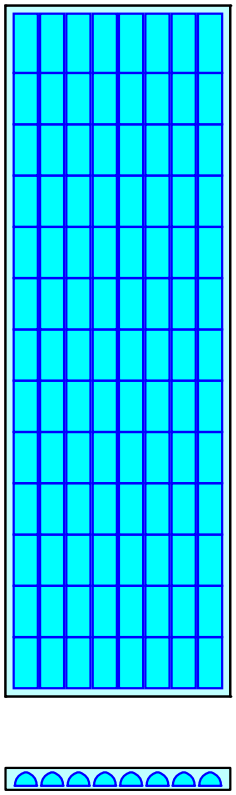
13 Chambers/Row x 6.33' Long +1.00' Row Adjustment = 83.29' Row Length +12.0" End Stone x 2 = 85.29' Base Length
8 Rows x 36.0" Wide + 3.0" Spacing x 7 + 12.0" Side Stone x 2 = 27.75' Base Width
6.0" Base + 20.5" Chamber Height + 6.0" Cover = 2.71' Field Height

104 Chambers x 21.8 cf +1.00' Row Adjustment x 3.44 sf x 8 Rows = 2,291.8 cf Chamber Storage

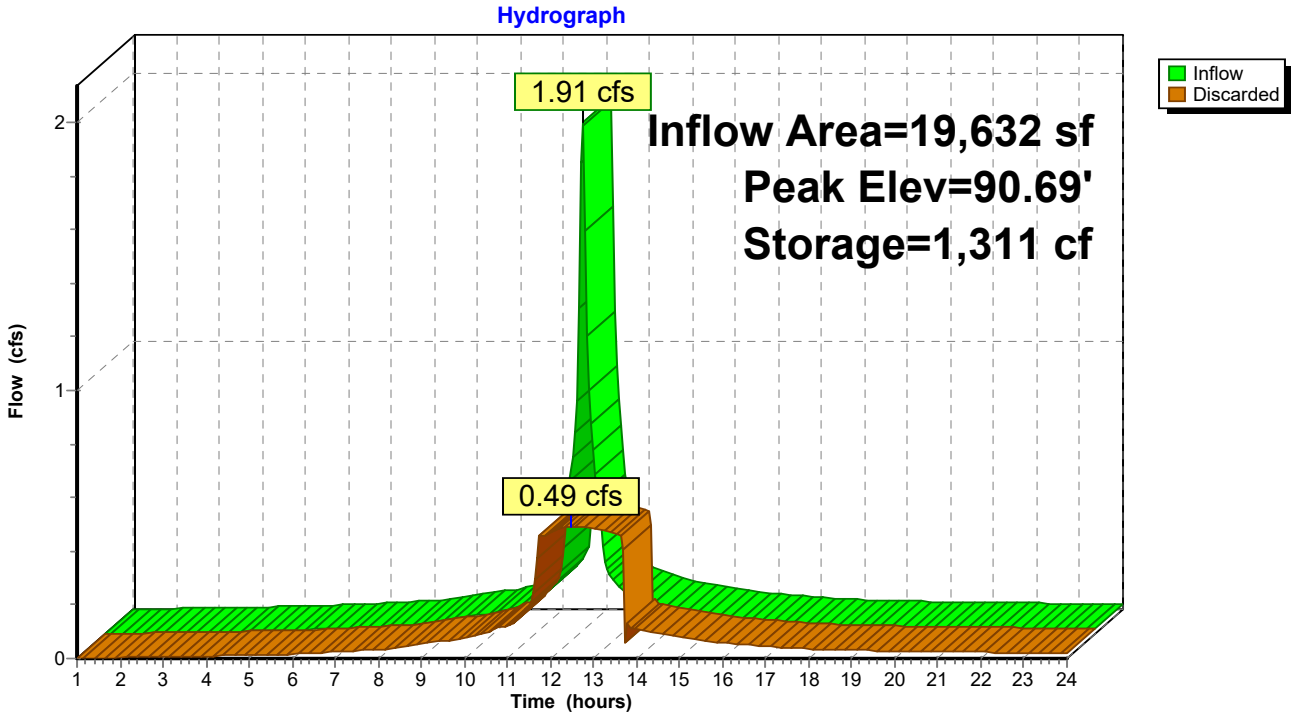
6,410.1 cf Field - 2,291.8 cf Chambers = 4,118.3 cf Stone x 40.0% Voids = 1,647.3 cf Stone Storage

Chamber Storage + Stone Storage = 3,939.1 cf = 0.090 af
Overall Storage Efficiency = 61.5%
Overall System Size = 85.29' x 27.75' x 2.71'

104 Chambers
237.4 cy Field
152.5 cy Stone



Pond CS1: CHAMBER SYSTEM 1



Summary for Pond CS2: CHAMBER SYSTEM 2

Inflow Area = 7,273 sf, 91.34% Impervious, Inflow Depth > 4.27" for 10-Year event
Inflow = 0.75 cfs @ 12.09 hrs, Volume= 2,589 cf
Outflow = 0.19 cfs @ 12.45 hrs, Volume= 2,588 cf, Atten= 74%, Lag= 22.0 min
Discarded = 0.19 cfs @ 12.45 hrs, Volume= 2,588 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 89.57' @ 12.45 hrs Surf.Area= 821 sf Storage= 540 cf

Plug-Flow detention time= 14.8 min calculated for 2,583 cf (100% of inflow)
Center-of-Mass det. time= 14.6 min (779.6 - 765.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	88.50'	737 cf	**11.17'W x 73.50'L x 3.54'H Field A** 2,907 cf Overall - 1,065 cf Embedded = 1,841 cf x 40.0% Voids
#2A	89.00'	1,065 cf	**Cultec R-330XLHD** x 20 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 2 rows
		1,802 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	88.50'	**8.270 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.19 cfs @ 12.45 hrs HW=89.57' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.19 cfs)

Pond CS2: CHAMBER SYSTEM 2 - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)
Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
Row Length Adjustment= +1.50' x 7.45 sf x 2 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

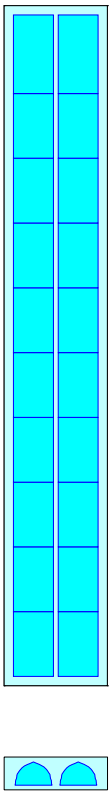
10 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 71.50' Row Length +12.0" End Stone x 2 = 73.50' Base Length
2 Rows x 52.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 11.17' Base Width
6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

20 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 2 Rows = 1,065.5 cf Chamber Storage

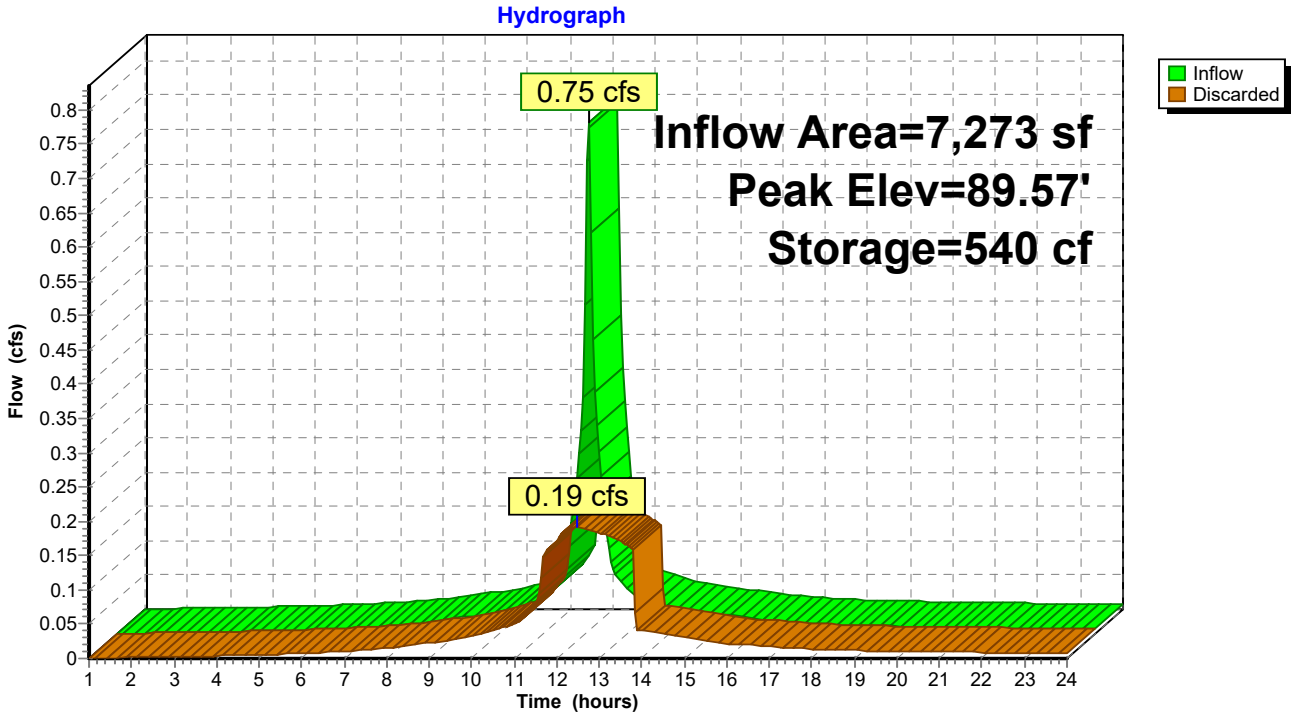
2,906.8 cf Field - 1,065.5 cf Chambers = 1,841.3 cf Stone x 40.0% Voids = 736.5 cf Stone Storage

Chamber Storage + Stone Storage = 1,802.0 cf = 0.041 af
Overall Storage Efficiency = 62.0%
Overall System Size = 73.50' x 11.17' x 3.54'

20 Chambers
107.7 cy Field
68.2 cy Stone



Pond CS2: CHAMBER SYSTEM 2



Time span=1.00-24.00 hrs, dt=0.05 hrs, 461 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PR-1: TO MAZZEO DRIVE Runoff Area=2,897 sf 30.55% Impervious Runoff Depth>3.11"
Tc=6.0 min CN=72 Runoff=0.24 cfs 752 cf

Subcatchment PR-10: TO CB-7 Runoff Area=1,324 sf 100.00% Impervious Runoff Depth>5.91"
Tc=6.0 min CN=98 Runoff=0.18 cfs 652 cf

Subcatchment PR-11: TO OFFSITE NORTH Runoff Area=706 sf 0.00% Impervious Runoff Depth>1.29"
Tc=6.0 min CN=51 Runoff=0.02 cfs 76 cf

Subcatchment PR-12: TO OFFSITE WEST Runoff Area=4,145 sf 0.00% Impervious Runoff Depth>1.60"
Tc=6.0 min CN=55 Runoff=0.16 cfs 554 cf

Subcatchment PR-2: TO CB-1 Runoff Area=975 sf 100.00% Impervious Runoff Depth>5.91"
Tc=6.0 min CN=98 Runoff=0.13 cfs 480 cf

Subcatchment PR-3: TO CB-2 Runoff Area=3,788 sf 83.37% Impervious Runoff Depth>5.21"
Tc=6.0 min CN=92 Runoff=0.49 cfs 1,646 cf

Subcatchment PR-4: TO CB-3 Runoff Area=2,510 sf 100.00% Impervious Runoff Depth>5.91"
Tc=6.0 min CN=98 Runoff=0.34 cfs 1,236 cf

Subcatchment PR-5: TO OFFSITE EAST Runoff Area=1,291 sf 0.00% Impervious Runoff Depth>1.14"
Tc=6.0 min CN=49 Runoff=0.03 cfs 123 cf

Subcatchment PR-6: TO CB-4 Runoff Area=6,564 sf 86.94% Impervious Runoff Depth>5.33"
Tc=6.0 min CN=93 Runoff=0.85 cfs 2,914 cf

Subcatchment PR-7: ROOF RUNOFF Runoff Area=6,000 sf 100.00% Impervious Runoff Depth>5.91"
Tc=6.0 min CN=98 Runoff=0.81 cfs 2,954 cf

Subcatchment PR-8: TO CB-5 Runoff Area=3,425 sf 45.46% Impervious Runoff Depth>3.71"
Tc=6.0 min CN=78 Runoff=0.33 cfs 1,058 cf

Subcatchment PR-9: TO CB-6 Runoff Area=2,319 sf 87.62% Impervious Runoff Depth>5.33"
Tc=6.0 min CN=93 Runoff=0.30 cfs 1,029 cf

Reach 4R: MAZZEO DRIVE Inflow=0.24 cfs 752 cf
Outflow=0.24 cfs 752 cf

Reach 5R: OFFSITE WEST Inflow=0.16 cfs 554 cf
Outflow=0.16 cfs 554 cf

Reach 6R: OFFSITE NORTH Inflow=0.02 cfs 76 cf
Outflow=0.02 cfs 76 cf

Reach 8R: OFFSITE EAST Inflow=0.03 cfs 123 cf
Outflow=0.03 cfs 123 cf

Pond CS1: CHAMBER SYSTEM 1 Peak Elev=91.09' Storage=2,075 cf Inflow=2.48 cfs 8,607 cf
Outflow=0.51 cfs 8,606 cf

Pond CS2: CHAMBER SYSTEM 2 Peak Elev=89.99' Storage=815 cf Inflow=0.96 cfs 3,361 cf
Outflow=0.21 cfs 3,361 cf

Total Runoff Area = 35,944 sf Runoff Volume = 13,473 cf Average Runoff Depth = 4.50"
32.82% Pervious = 11,796 sf 67.18% Impervious = 24,148 sf

Summary for Subcatchment PR-1: TO MAZZEO DRIVE

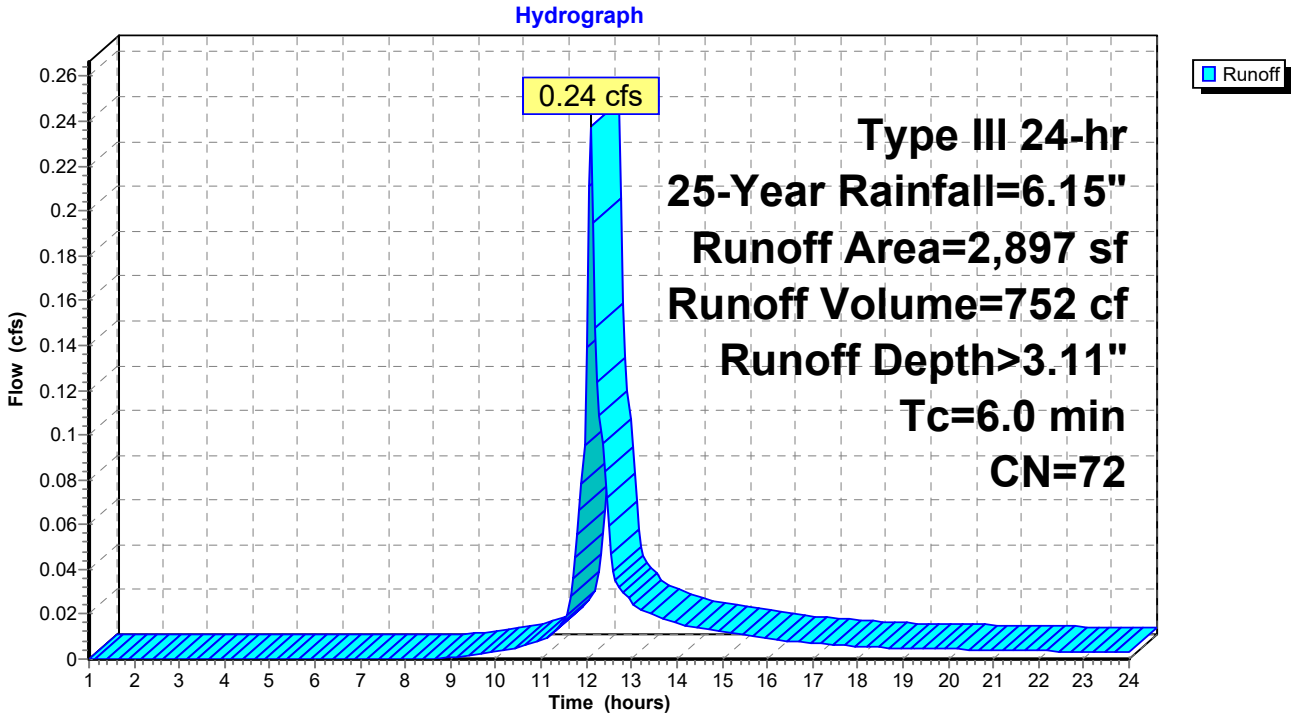
Runoff = 0.24 cfs @ 12.09 hrs, Volume= 752 cf, Depth> 3.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.15"

	Area (sf)	CN	Description
	13	48	Brush, Good, HSG B
	1,999	61	>75% Grass cover, Good, HSG B
*	885	98	Impervious
	2,897	72	Weighted Average
	2,012		69.45% Pervious Area
	885		30.55% Impervious Area

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

Subcatchment PR-1: TO MAZZEO DRIVE



Summary for Subcatchment PR-10: TO CB-7

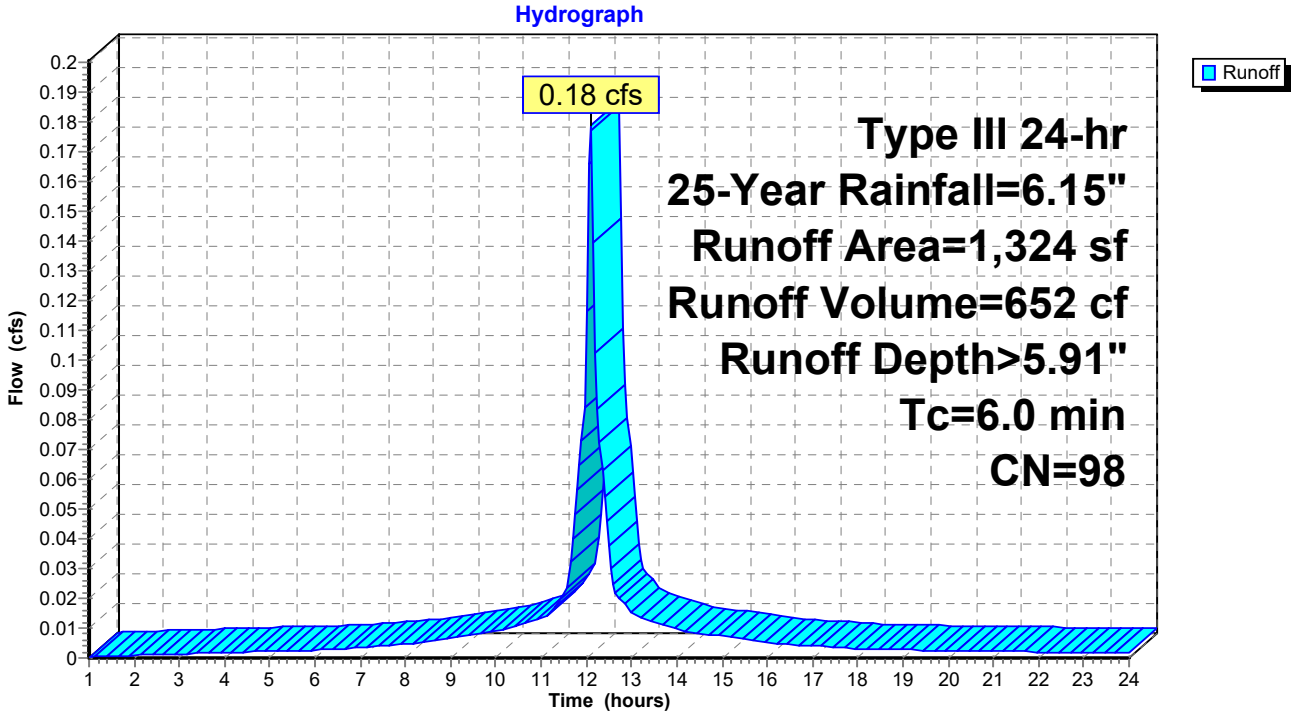
Runoff = 0.18 cfs @ 12.09 hrs, Volume= 652 cf, Depth> 5.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.15"

	Area (sf)	CN	Description
*	1,324	98	Impervious
	1,324		100.00% Impervious Area

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

Subcatchment PR-10: TO CB-7



Summary for Subcatchment PR-11: TO OFFSITE NORTH

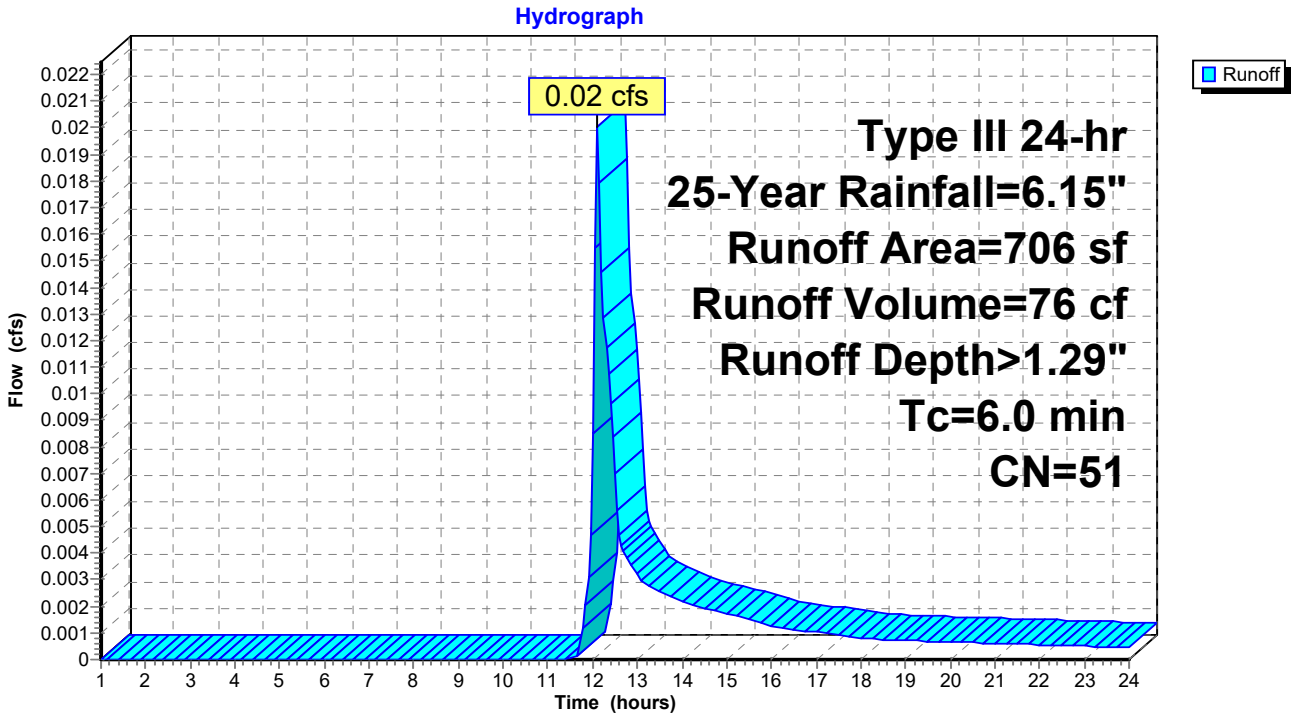
Runoff = 0.02 cfs @ 12.11 hrs, Volume= 76 cf, Depth> 1.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.15"

Area (sf)	CN	Description
27	96	Gravel surface, HSG B
593	48	Brush, Good, HSG B
86	61	>75% Grass cover, Good, HSG B
706	51	Weighted Average
706		100.00% Pervious Area

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

Subcatchment PR-11: TO OFFSITE NORTH



Summary for Subcatchment PR-12: TO OFFSITE WEST

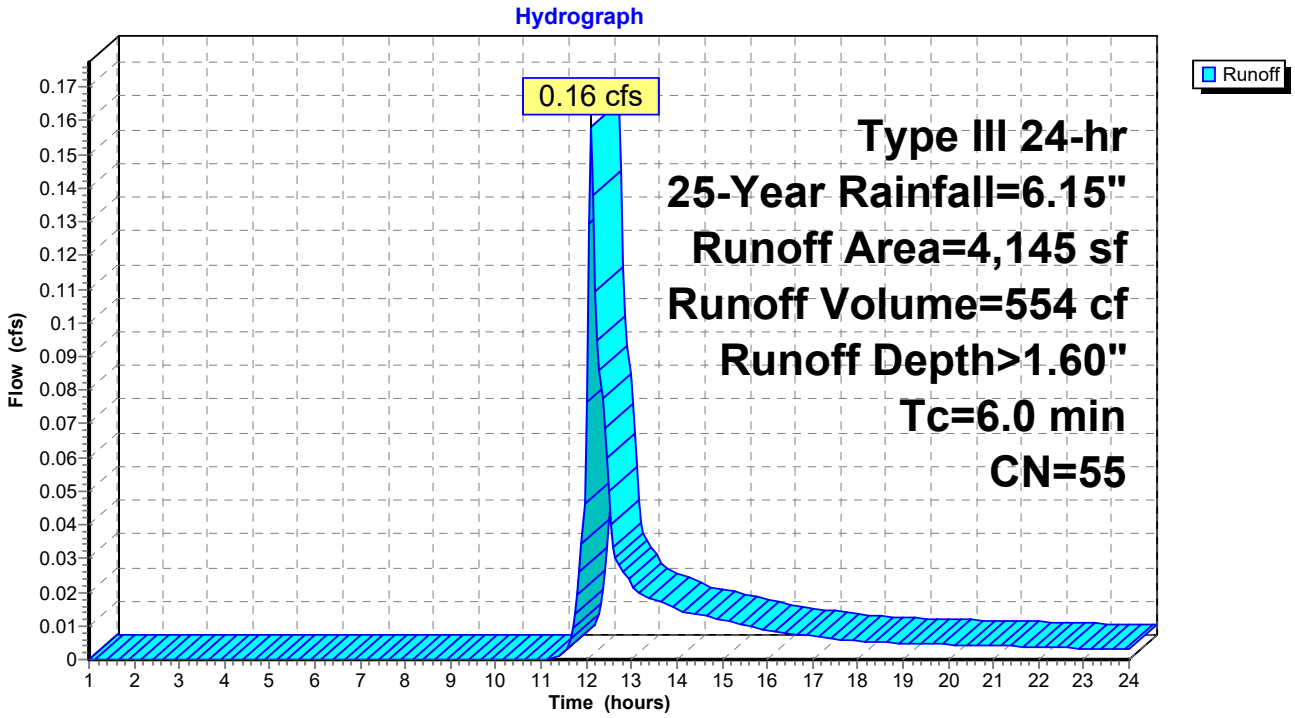
Runoff = 0.16 cfs @ 12.10 hrs, Volume= 554 cf, Depth> 1.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.15"

Area (sf)	CN	Description
83	96	Gravel surface, HSG B
2,238	48	Brush, Good, HSG B
1,824	61	>75% Grass cover, Good, HSG B
4,145	55	Weighted Average
4,145		100.00% Pervious Area

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

Subcatchment PR-12: TO OFFSITE WEST



Summary for Subcatchment PR-2: TO CB-1

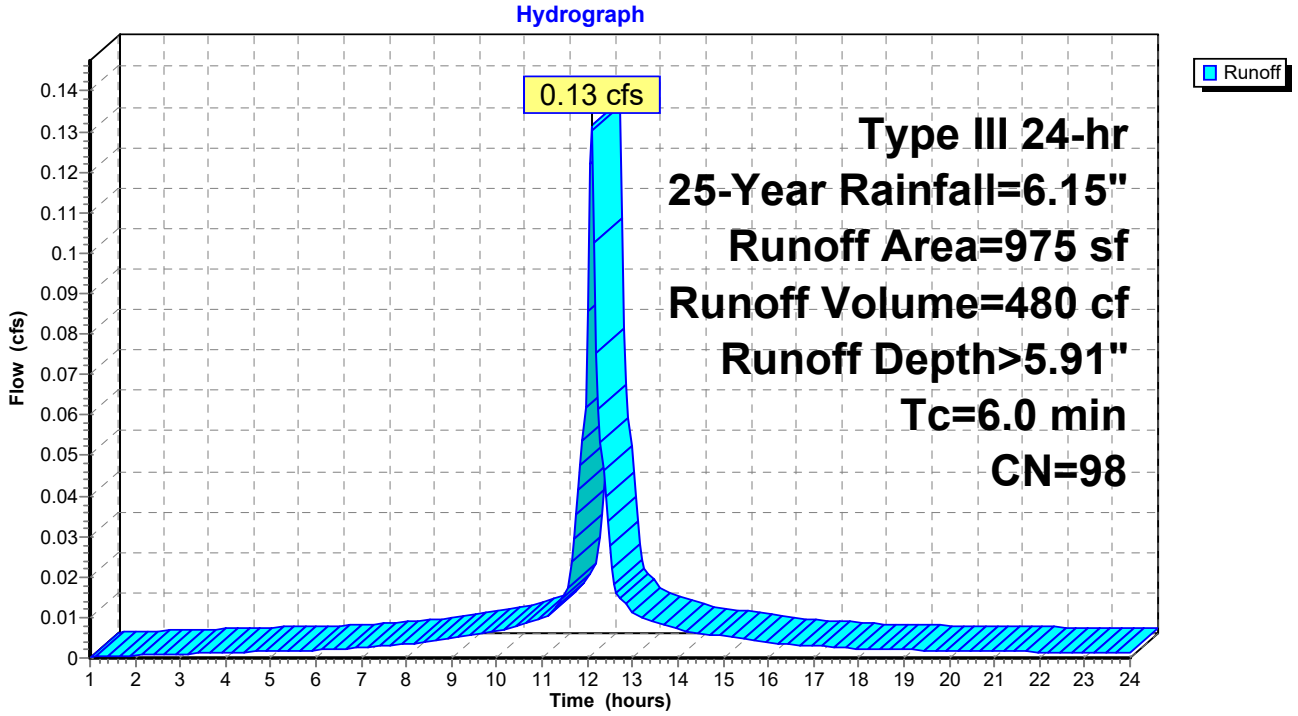
Runoff = 0.13 cfs @ 12.09 hrs, Volume= 480 cf, Depth> 5.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.15"

	Area (sf)	CN	Description
*	975	98	Impervious
	975		100.00% Impervious Area

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

Subcatchment PR-2: TO CB-1



Summary for Subcatchment PR-3: TO CB-2

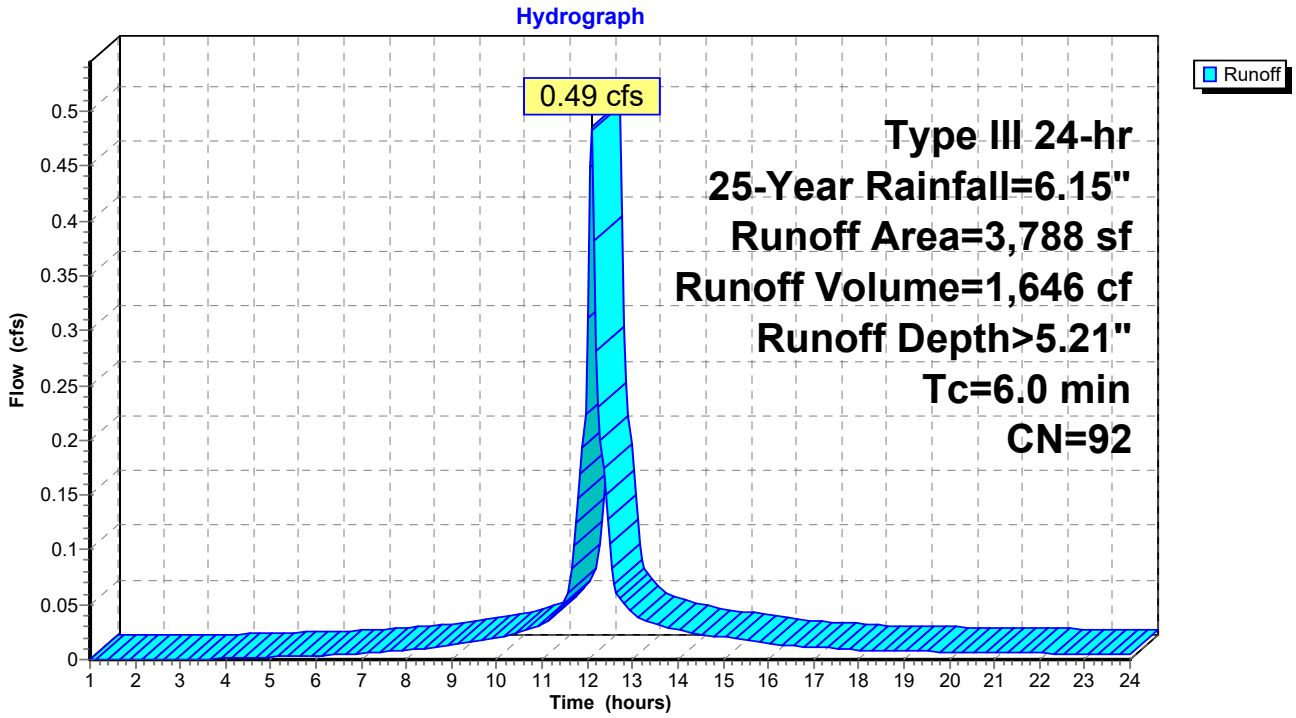
Runoff = 0.49 cfs @ 12.09 hrs, Volume= 1,646 cf, Depth> 5.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.15"

	Area (sf)	CN	Description
*	3,158	98	Impervious
	630	61	>75% Grass cover, Good, HSG B
	3,788	92	Weighted Average
	630		16.63% Pervious Area
	3,158		83.37% Impervious Area

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

Subcatchment PR-3: TO CB-2



Summary for Subcatchment PR-4: TO CB-3

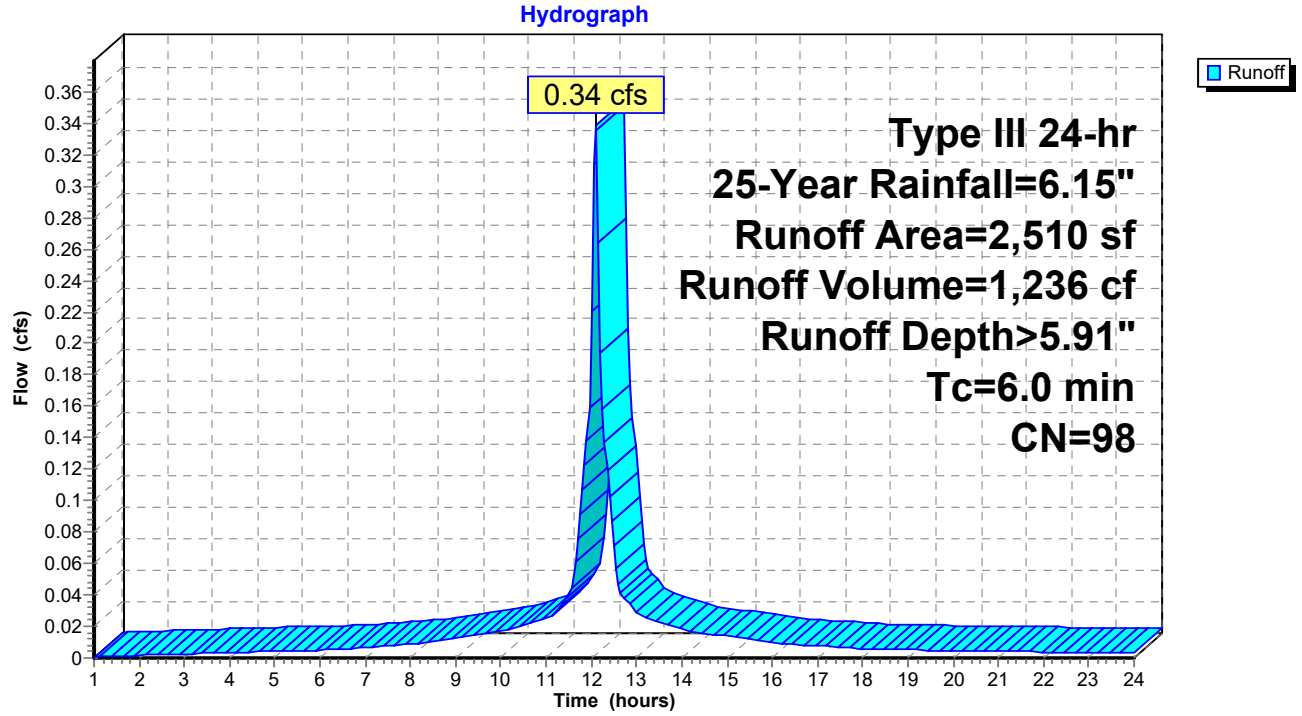
Runoff = 0.34 cfs @ 12.09 hrs, Volume= 1,236 cf, Depth> 5.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.15"

	Area (sf)	CN	Description
*	2,510	98	Impervious
	2,510		100.00% Impervious Area

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

Subcatchment PR-4: TO CB-3



Summary for Subcatchment PR-5: TO OFFSITE EAST

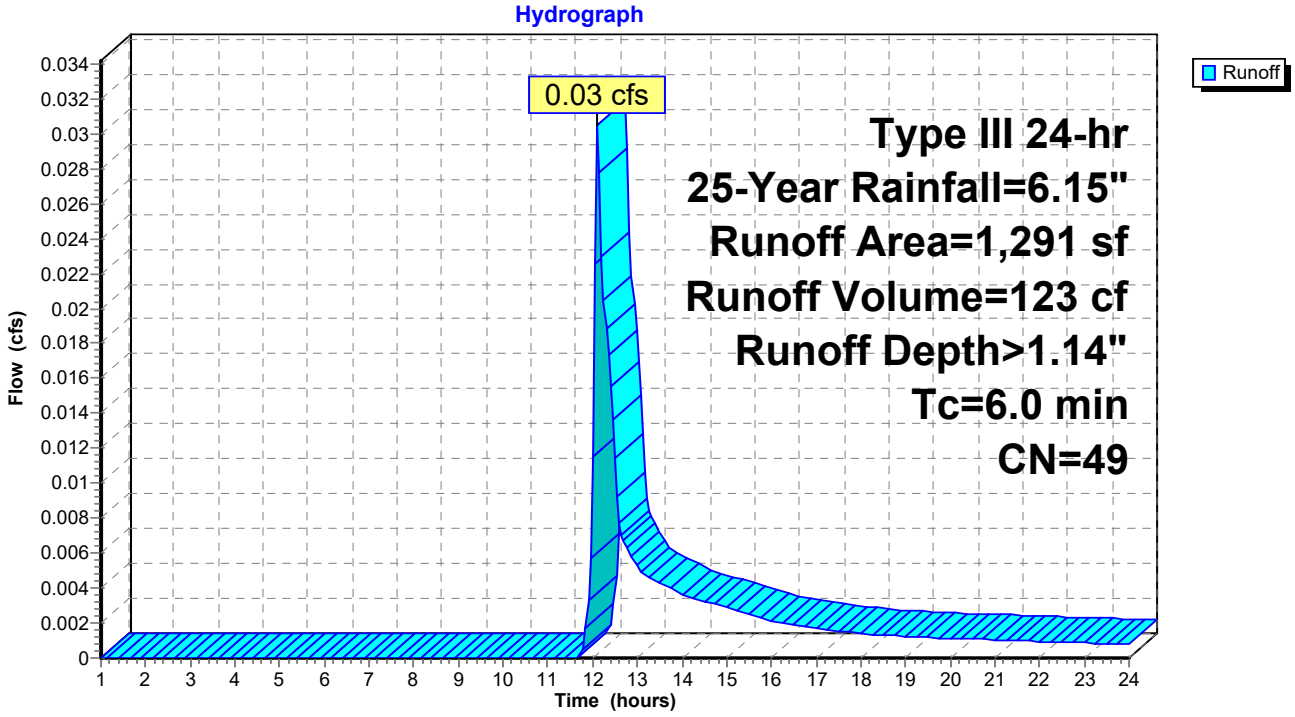
Runoff = 0.03 cfs @ 12.11 hrs, Volume= 123 cf, Depth> 1.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.15"

Area (sf)	CN	Description
1,187	48	Brush, Good, HSG B
104	61	>75% Grass cover, Good, HSG B
1,291	49	Weighted Average
1,291		100.00% Pervious Area

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

Subcatchment PR-5: TO OFFSITE EAST



Summary for Subcatchment PR-6: TO CB-4

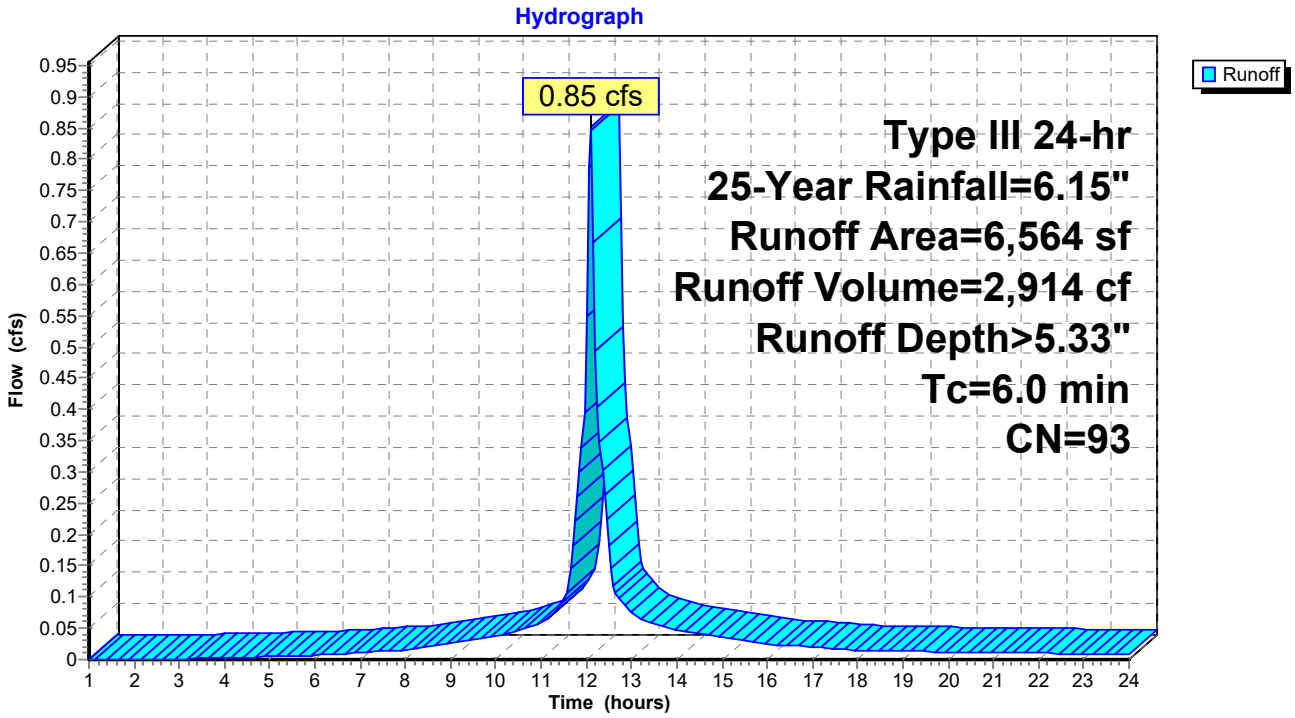
Runoff = 0.85 cfs @ 12.09 hrs, Volume= 2,914 cf, Depth> 5.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.15"

	Area (sf)	CN	Description
*	5,707	98	Impervious
	857	61	>75% Grass cover, Good, HSG B
	6,564	93	Weighted Average
	857		13.06% Pervious Area
	5,707		86.94% Impervious Area

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

Subcatchment PR-6: TO CB-4



Summary for Subcatchment PR-7: ROOF RUNOFF

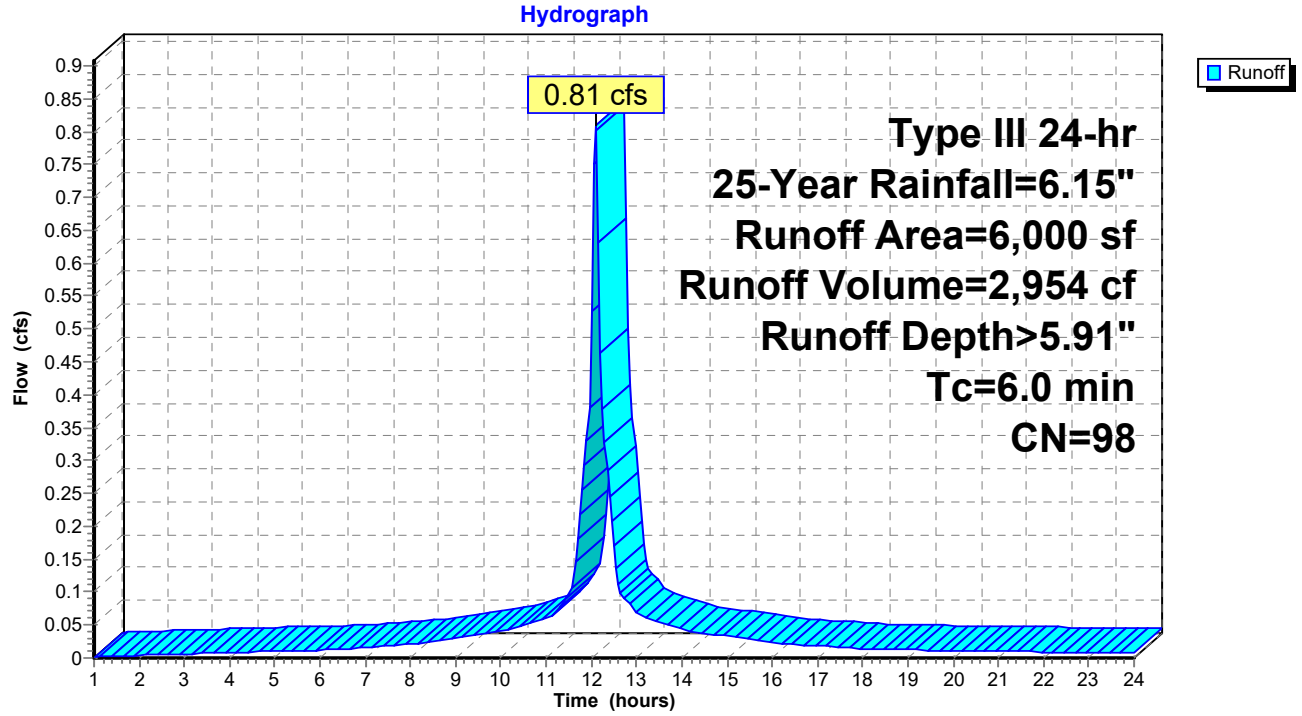
Runoff = 0.81 cfs @ 12.09 hrs, Volume= 2,954 cf, Depth> 5.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.15"

	Area (sf)	CN	Description
*	6,000	98	Impervious
	6,000		100.00% Impervious Area

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

Subcatchment PR-7: ROOF RUNOFF



Summary for Subcatchment PR-8: TO CB-5

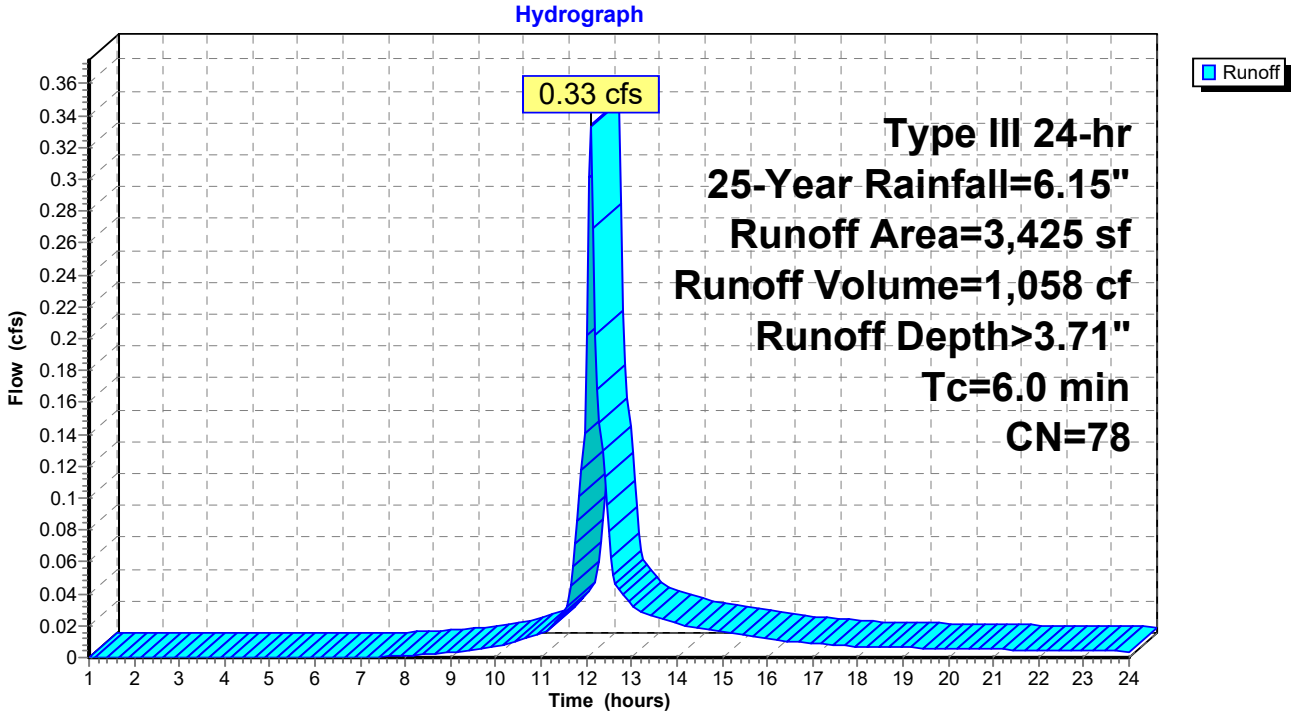
Runoff = 0.33 cfs @ 12.09 hrs, Volume= 1,058 cf, Depth> 3.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.15"

	Area (sf)	CN	Description
*	1,557	98	Impervious
	1,868	61	>75% Grass cover, Good, HSG B
	3,425	78	Weighted Average
	1,868		54.54% Pervious Area
	1,557		45.46% Impervious Area

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

Subcatchment PR-8: TO CB-5



Summary for Subcatchment PR-9: TO CB-6

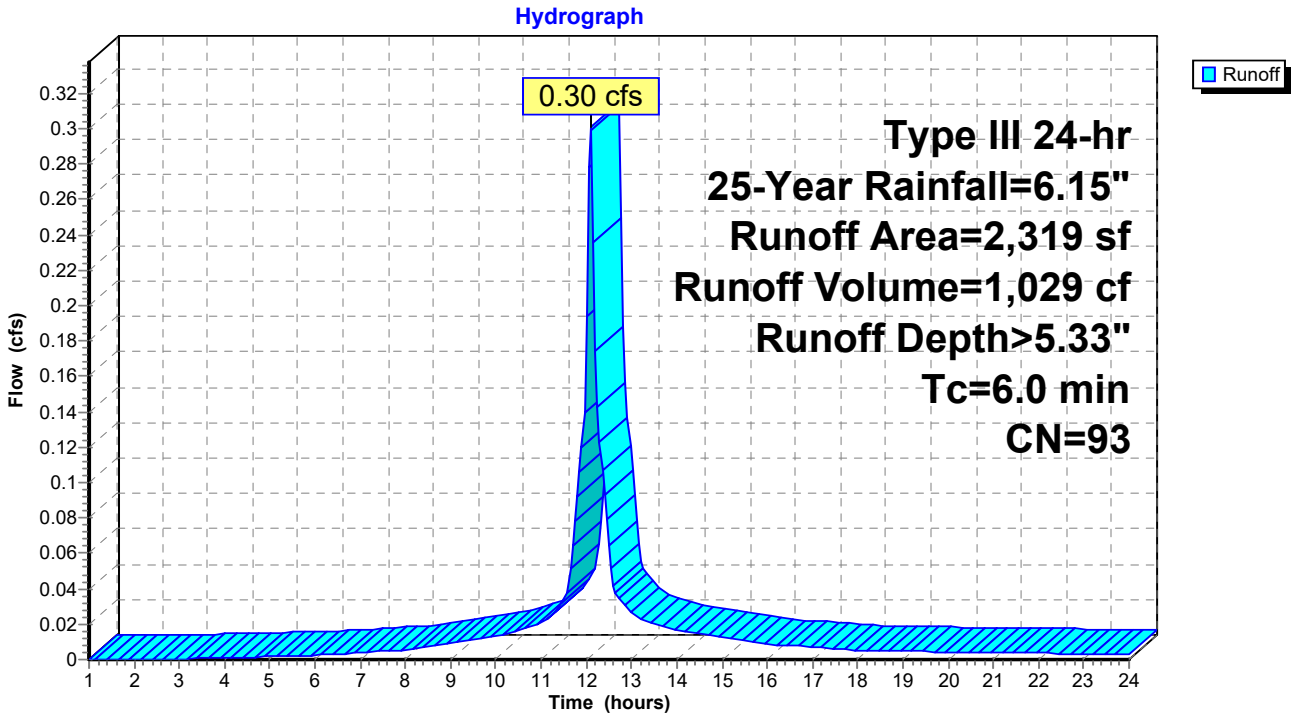
Runoff = 0.30 cfs @ 12.09 hrs, Volume= 1,029 cf, Depth> 5.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.15"

	Area (sf)	CN	Description
*	2,032	98	Impervious
	287	61	>75% Grass cover, Good, HSG B
	2,319	93	Weighted Average
	287		12.38% Pervious Area
	2,032		87.62% Impervious Area

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

Subcatchment PR-9: TO CB-6

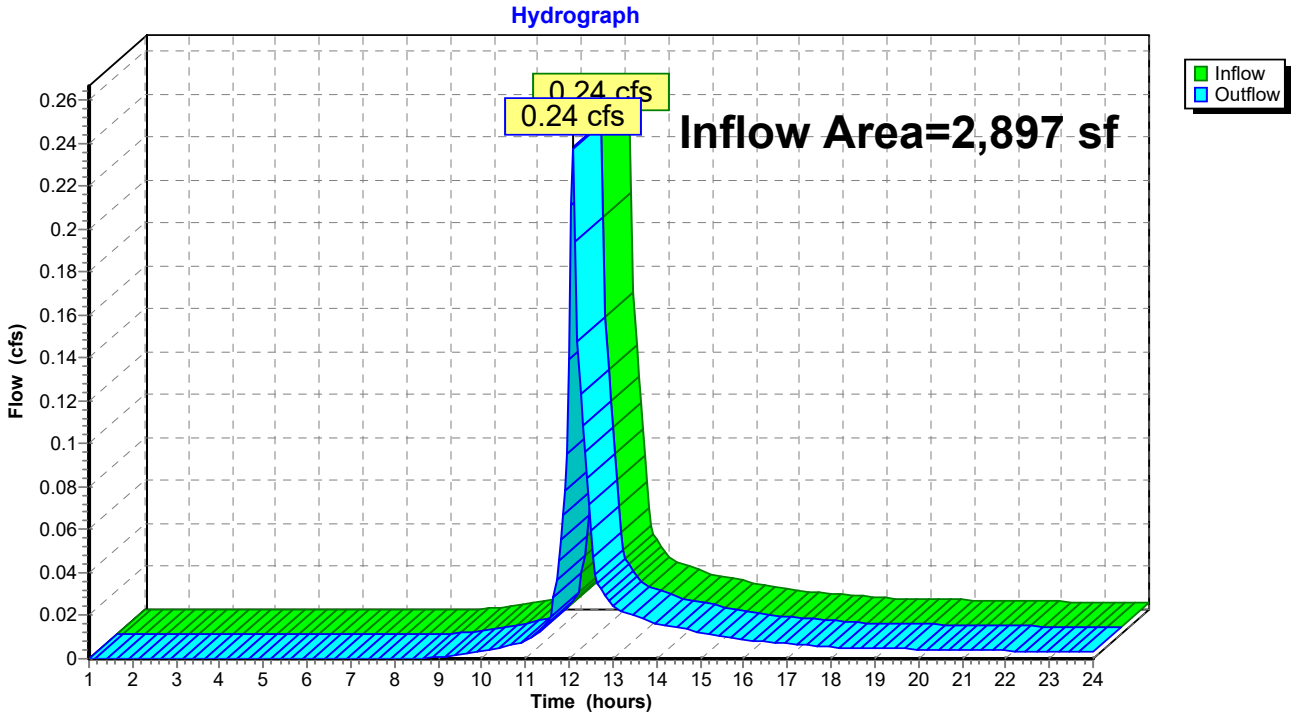


Summary for Reach 4R: MAZZEO DRIVE

Inflow Area = 2,897 sf, 30.55% Impervious, Inflow Depth > 3.11" for 25-Year event
Inflow = 0.24 cfs @ 12.09 hrs, Volume= 752 cf
Outflow = 0.24 cfs @ 12.09 hrs, Volume= 752 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs

Reach 4R: MAZZEO DRIVE

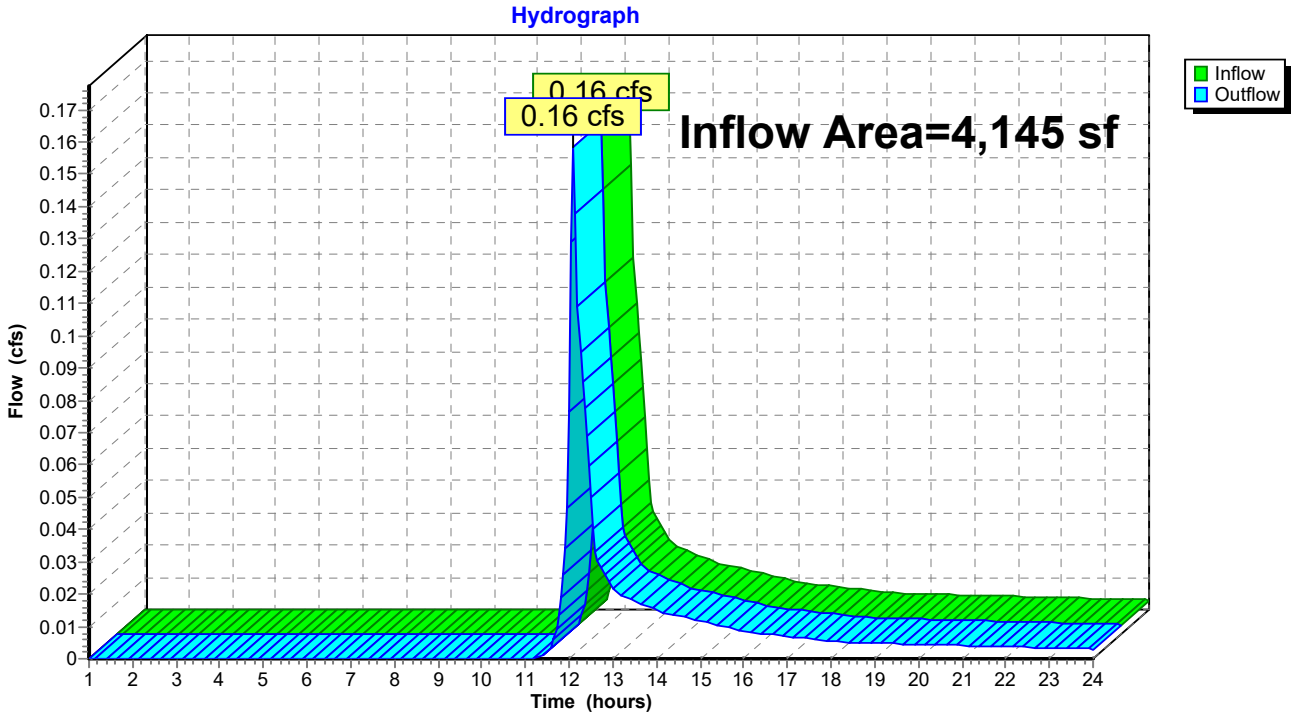


Summary for Reach 5R: OFFSITE WEST

Inflow Area = 4,145 sf, 0.00% Impervious, Inflow Depth > 1.60" for 25-Year event
Inflow = 0.16 cfs @ 12.10 hrs, Volume= 554 cf
Outflow = 0.16 cfs @ 12.10 hrs, Volume= 554 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs

Reach 5R: OFFSITE WEST

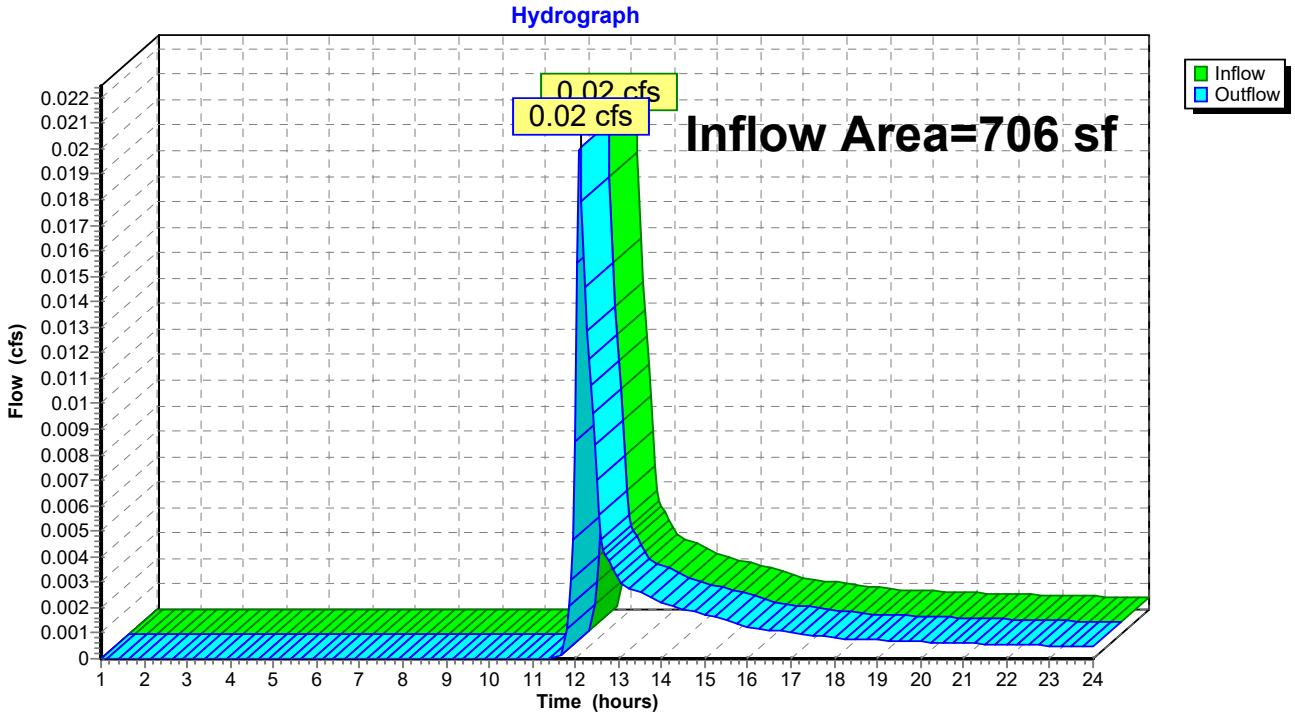


Summary for Reach 6R: OFFSITE NORTH

Inflow Area = 706 sf, 0.00% Impervious, Inflow Depth > 1.29" for 25-Year event
Inflow = 0.02 cfs @ 12.11 hrs, Volume= 76 cf
Outflow = 0.02 cfs @ 12.11 hrs, Volume= 76 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs

Reach 6R: OFFSITE NORTH

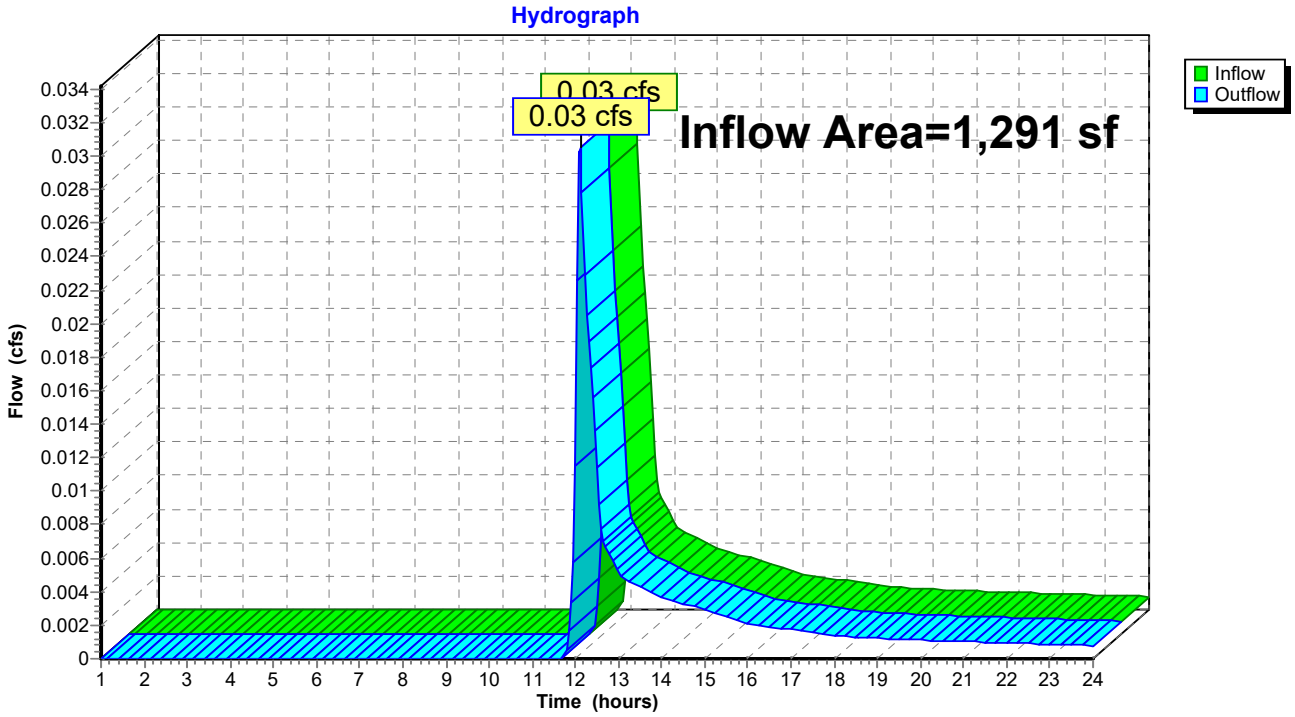


Summary for Reach 8R: OFFSITE EAST

Inflow Area = 1,291 sf, 0.00% Impervious, Inflow Depth > 1.14" for 25-Year event
Inflow = 0.03 cfs @ 12.11 hrs, Volume= 123 cf
Outflow = 0.03 cfs @ 12.11 hrs, Volume= 123 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs

Reach 8R: OFFSITE EAST



Summary for Pond CS1: CHAMBER SYSTEM 1

Inflow Area = 19,632 sf, 84.66% Impervious, Inflow Depth > 5.26" for 25-Year event
Inflow = 2.48 cfs @ 12.09 hrs, Volume= 8,607 cf
Outflow = 0.51 cfs @ 12.51 hrs, Volume= 8,606 cf, Atten= 79%, Lag= 25.5 min
Discarded = 0.51 cfs @ 12.51 hrs, Volume= 8,606 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 91.09' @ 12.51 hrs Surf.Area= 2,367 sf Storage= 2,075 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 21.9 min (787.9 - 766.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	89.78'	1,647 cf	**27.75'W x 85.29'L x 2.71'H Field A** 6,410 cf Overall - 2,292 cf Embedded = 4,118 cf x 40.0% Voids
#2A	90.28'	2,292 cf	**Cultec R-180** x 104 Inside #1 Effective Size= 33.6"W x 20.0"H => 3.44 sf x 6.33'L = 21.8 cf Overall Size= 36.0"W x 20.5"H x 7.33'L with 1.00' Overlap Row Length Adjustment= +1.00' x 3.44 sf x 8 rows
		3,939 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	89.78'	**8.270 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.51 cfs @ 12.51 hrs HW=91.09' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.51 cfs)

Pond CS1: CHAMBER SYSTEM 1 - Chamber Wizard Field A

Chamber Model = Cultec R-180 (Cultec Recharger®180HD)
Effective Size= 33.6"W x 20.0"H => 3.44 sf x 6.33'L = 21.8 cf
Overall Size= 36.0"W x 20.5"H x 7.33'L with 1.00' Overlap
Row Length Adjustment= +1.00' x 3.44 sf x 8 rows

36.0" Wide + 3.0" Spacing = 39.0" C-C Row Spacing

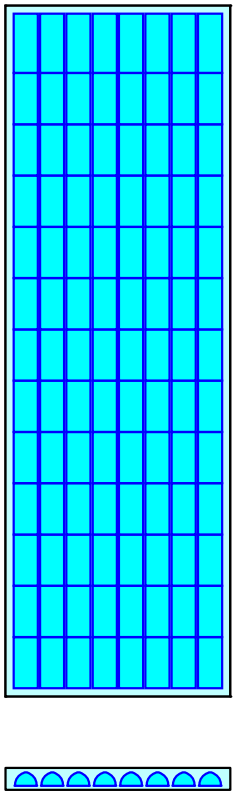
13 Chambers/Row x 6.33' Long +1.00' Row Adjustment = 83.29' Row Length +12.0" End Stone x 2 = 85.29' Base Length
8 Rows x 36.0" Wide + 3.0" Spacing x 7 + 12.0" Side Stone x 2 = 27.75' Base Width
6.0" Base + 20.5" Chamber Height + 6.0" Cover = 2.71' Field Height

104 Chambers x 21.8 cf +1.00' Row Adjustment x 3.44 sf x 8 Rows = 2,291.8 cf Chamber Storage

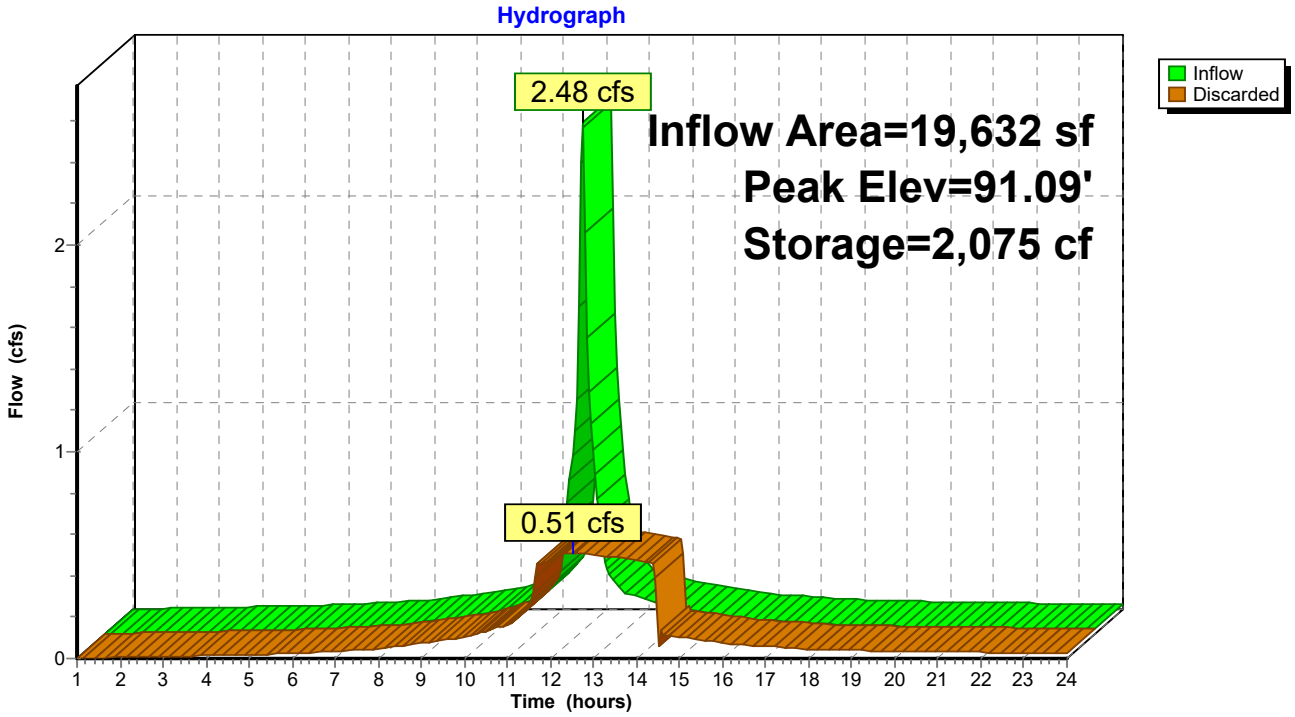
6,410.1 cf Field - 2,291.8 cf Chambers = 4,118.3 cf Stone x 40.0% Voids = 1,647.3 cf Stone Storage

Chamber Storage + Stone Storage = 3,939.1 cf = 0.090 af
Overall Storage Efficiency = 61.5%
Overall System Size = 85.29' x 27.75' x 2.71'

104 Chambers
237.4 cy Field
152.5 cy Stone



Pond CS1: CHAMBER SYSTEM 1



Summary for Pond CS2: CHAMBER SYSTEM 2

Inflow Area = 7,273 sf, 91.34% Impervious, Inflow Depth > 5.55" for 25-Year event
Inflow = 0.96 cfs @ 12.09 hrs, Volume= 3,361 cf
Outflow = 0.21 cfs @ 12.50 hrs, Volume= 3,361 cf, Atten= 79%, Lag= 24.7 min
Discarded = 0.21 cfs @ 12.50 hrs, Volume= 3,361 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 89.99' @ 12.50 hrs Surf.Area= 821 sf Storage= 815 cf

Plug-Flow detention time= 22.3 min calculated for 3,353 cf (100% of inflow)
Center-of-Mass det. time= 22.1 min (782.0 - 759.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	88.50'	737 cf	**11.17'W x 73.50'L x 3.54'H Field A** 2,907 cf Overall - 1,065 cf Embedded = 1,841 cf x 40.0% Voids
#2A	89.00'	1,065 cf	**Cultec R-330XLHD** x 20 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 2 rows
		1,802 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	88.50'	**8.270 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.21 cfs @ 12.50 hrs HW=89.99' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.21 cfs)

Pond CS2: CHAMBER SYSTEM 2 - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)
Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
Row Length Adjustment= +1.50' x 7.45 sf x 2 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

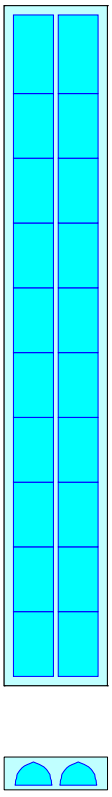
10 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 71.50' Row Length +12.0" End Stone x 2 = 73.50' Base Length
2 Rows x 52.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 11.17' Base Width
6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

20 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 2 Rows = 1,065.5 cf Chamber Storage

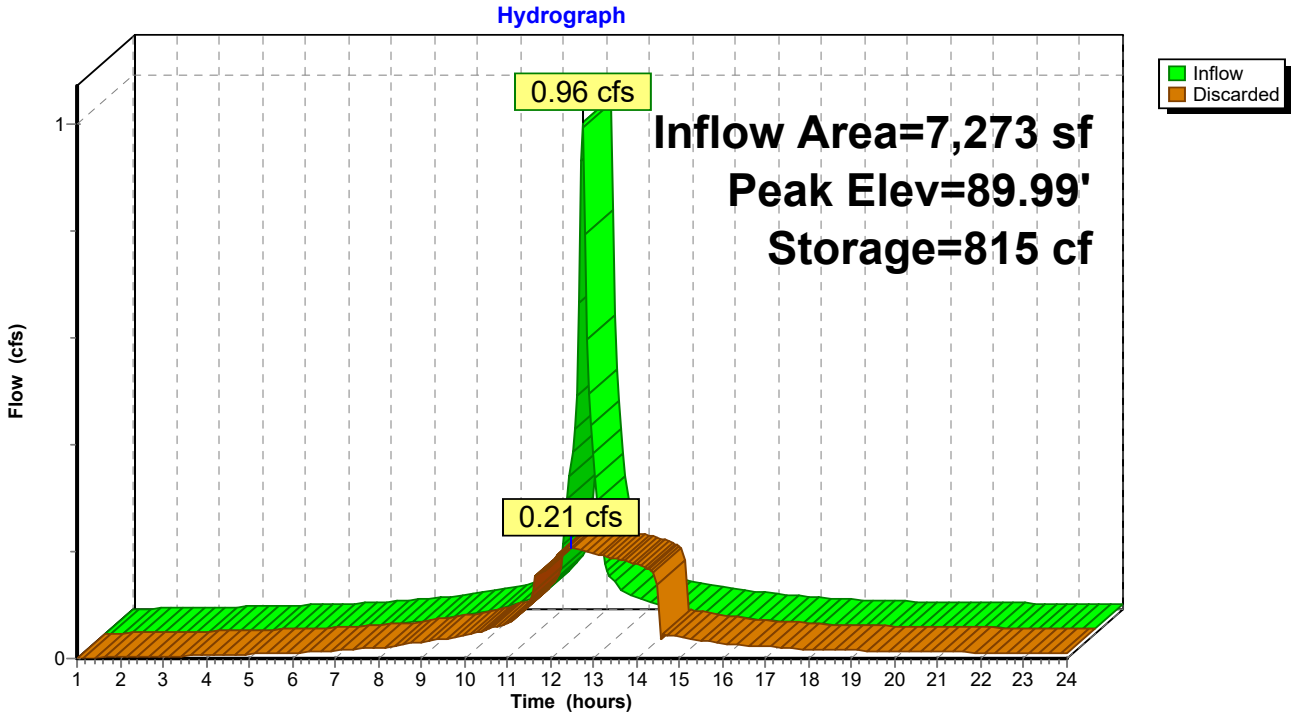
2,906.8 cf Field - 1,065.5 cf Chambers = 1,841.3 cf Stone x 40.0% Voids = 736.5 cf Stone Storage

Chamber Storage + Stone Storage = 1,802.0 cf = 0.041 af
Overall Storage Efficiency = 62.0%
Overall System Size = 73.50' x 11.17' x 3.54'

20 Chambers
107.7 cy Field
68.2 cy Stone



Pond CS2: CHAMBER SYSTEM 2



Time span=1.00-24.00 hrs, dt=0.05 hrs, 461 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PR-1: TO MAZZEO DRIVE Runoff Area=2,897 sf 30.55% Impervious Runoff Depth>5.40"
Tc=6.0 min CN=72 Runoff=0.41 cfs 1,303 cf

Subcatchment PR-10: TO CB-7 Runoff Area=1,324 sf 100.00% Impervious Runoff Depth>8.55"
Tc=6.0 min CN=98 Runoff=0.26 cfs 943 cf

Subcatchment PR-11: TO OFFSITE NORTH Runoff Area=706 sf 0.00% Impervious Runoff Depth>2.87"
Tc=6.0 min CN=51 Runoff=0.05 cfs 169 cf

Subcatchment PR-12: TO OFFSITE WEST Runoff Area=4,145 sf 0.00% Impervious Runoff Depth>3.34"
Tc=6.0 min CN=55 Runoff=0.36 cfs 1,154 cf

Subcatchment PR-2: TO CB-1 Runoff Area=975 sf 100.00% Impervious Runoff Depth>8.55"
Tc=6.0 min CN=98 Runoff=0.19 cfs 695 cf

Subcatchment PR-3: TO CB-2 Runoff Area=3,788 sf 83.37% Impervious Runoff Depth>7.83"
Tc=6.0 min CN=92 Runoff=0.71 cfs 2,472 cf

Subcatchment PR-4: TO CB-3 Runoff Area=2,510 sf 100.00% Impervious Runoff Depth>8.55"
Tc=6.0 min CN=98 Runoff=0.49 cfs 1,788 cf

Subcatchment PR-5: TO OFFSITE EAST Runoff Area=1,291 sf 0.00% Impervious Runoff Depth>2.63"
Tc=6.0 min CN=49 Runoff=0.08 cfs 283 cf

Subcatchment PR-6: TO CB-4 Runoff Area=6,564 sf 86.94% Impervious Runoff Depth>7.95"
Tc=6.0 min CN=93 Runoff=1.25 cfs 4,350 cf

Subcatchment PR-7: ROOF RUNOFF Runoff Area=6,000 sf 100.00% Impervious Runoff Depth>8.55"
Tc=6.0 min CN=98 Runoff=1.16 cfs 4,274 cf

Subcatchment PR-8: TO CB-5 Runoff Area=3,425 sf 45.46% Impervious Runoff Depth>6.13"
Tc=6.0 min CN=78 Runoff=0.55 cfs 1,750 cf

Subcatchment PR-9: TO CB-6 Runoff Area=2,319 sf 87.62% Impervious Runoff Depth>7.95"
Tc=6.0 min CN=93 Runoff=0.44 cfs 1,537 cf

Reach 4R: MAZZEO DRIVE Inflow=0.41 cfs 1,303 cf
Outflow=0.41 cfs 1,303 cf

Reach 5R: OFFSITE WEST Inflow=0.36 cfs 1,154 cf
Outflow=0.36 cfs 1,154 cf

Reach 6R: OFFSITE NORTH Inflow=0.05 cfs 169 cf
Outflow=0.05 cfs 169 cf

Reach 8R: OFFSITE EAST Inflow=0.08 cfs 283 cf
Outflow=0.08 cfs 283 cf

Pond CS1: CHAMBER SYSTEM 1 Peak Elev=92.27' Storage=3,730 cf Inflow=3.65 cfs 12,854 cf
Outflow=0.56 cfs 12,852 cf

Pond CS2: CHAMBER SYSTEM 2 Peak Elev=90.99' Storage=1,403 cf Inflow=1.39 cfs 4,955 cf
Outflow=0.24 cfs 4,954 cf

Total Runoff Area = 35,944 sf Runoff Volume = 20,718 cf Average Runoff Depth = 6.92"
32.82% Pervious = 11,796 sf 67.18% Impervious = 24,148 sf

Summary for Subcatchment PR-1: TO MAZZEO DRIVE

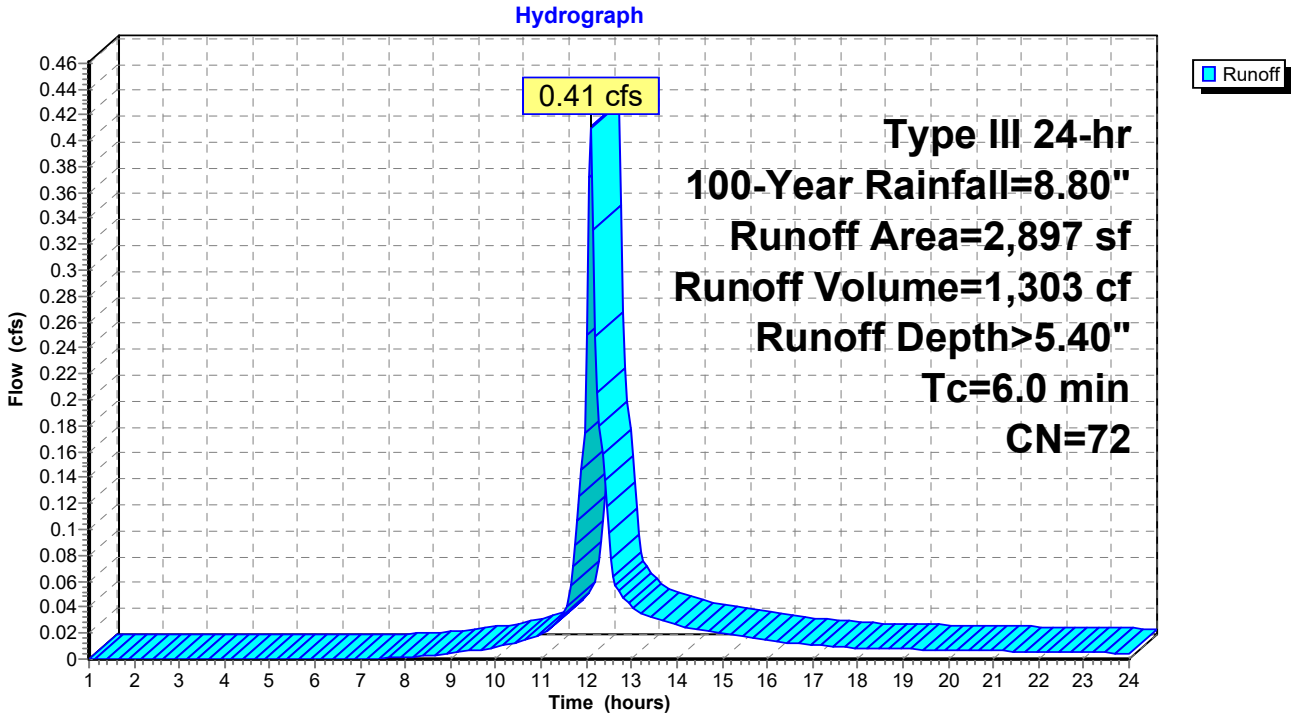
Runoff = 0.41 cfs @ 12.09 hrs, Volume= 1,303 cf, Depth> 5.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.80"

	Area (sf)	CN	Description
	13	48	Brush, Good, HSG B
	1,999	61	>75% Grass cover, Good, HSG B
*	885	98	Impervious
	2,897	72	Weighted Average
	2,012		69.45% Pervious Area
	885		30.55% Impervious Area

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

Subcatchment PR-1: TO MAZZEO DRIVE



Summary for Subcatchment PR-10: TO CB-7

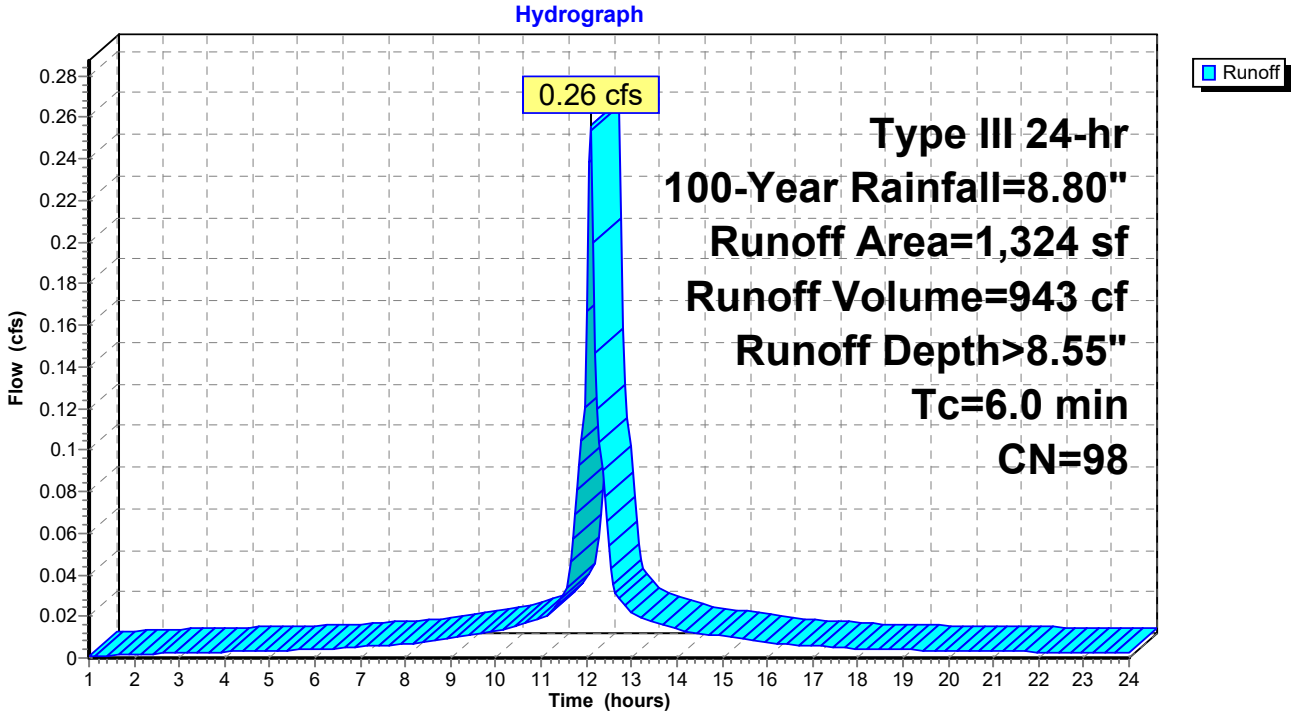
Runoff = 0.26 cfs @ 12.09 hrs, Volume= 943 cf, Depth> 8.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.80"

	Area (sf)	CN	Description
*	1,324	98	Impervious
	1,324		100.00% Impervious Area

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

Subcatchment PR-10: TO CB-7



Summary for Subcatchment PR-11: TO OFFSITE NORTH

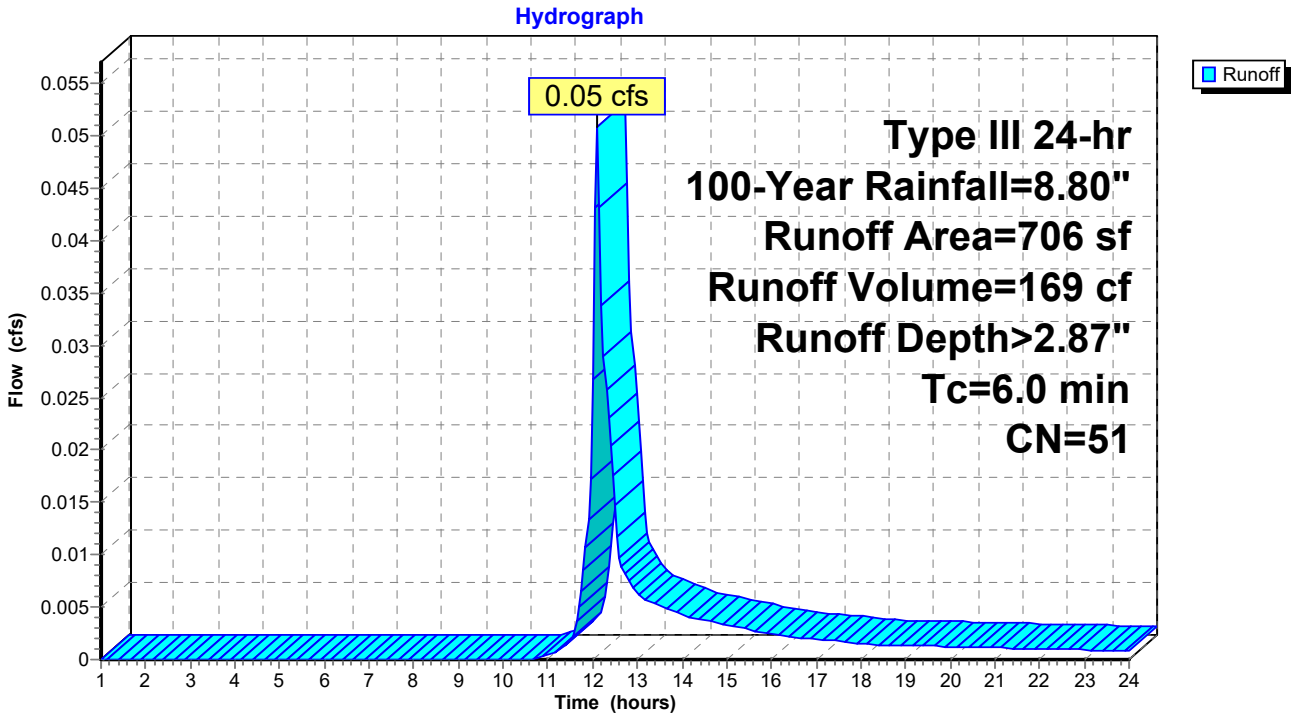
Runoff = 0.05 cfs @ 12.10 hrs, Volume= 169 cf, Depth> 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.80"

Area (sf)	CN	Description
27	96	Gravel surface, HSG B
593	48	Brush, Good, HSG B
86	61	>75% Grass cover, Good, HSG B
706	51	Weighted Average
706		100.00% Pervious Area

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

Subcatchment PR-11: TO OFFSITE NORTH



Summary for Subcatchment PR-12: TO OFFSITE WEST

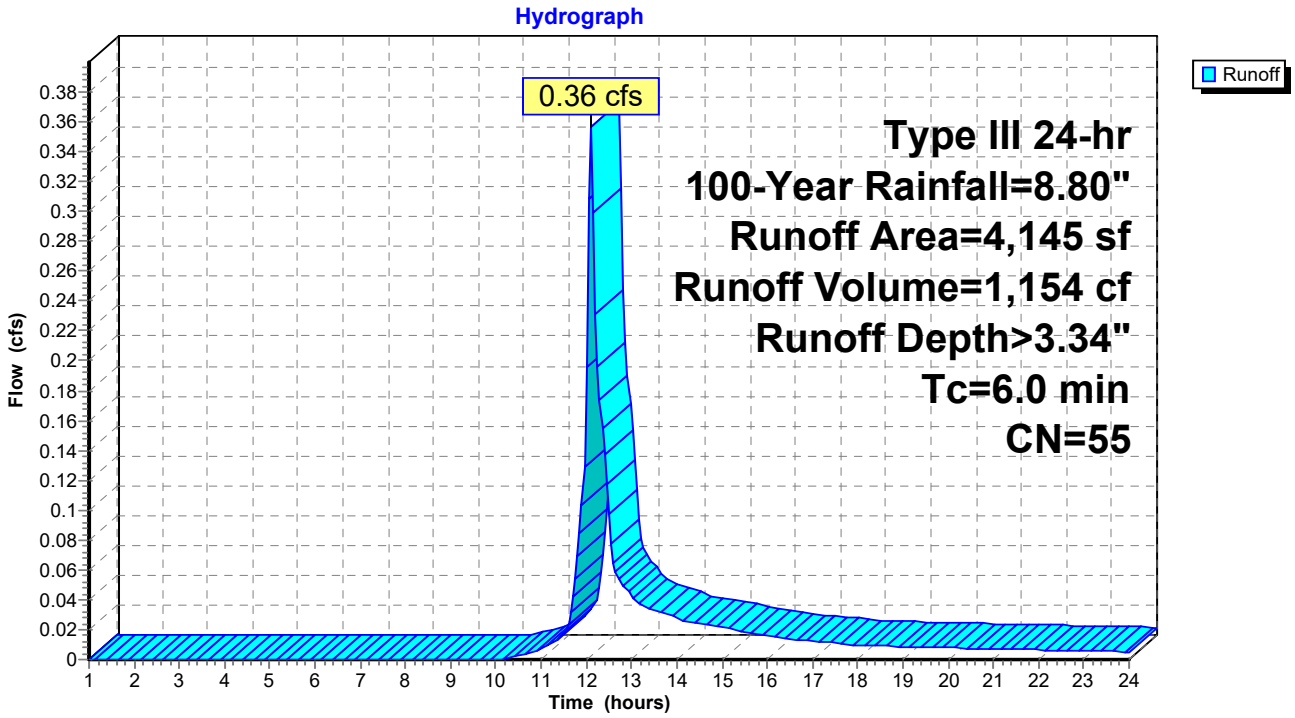
Runoff = 0.36 cfs @ 12.10 hrs, Volume= 1,154 cf, Depth> 3.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.80"

Area (sf)	CN	Description
83	96	Gravel surface, HSG B
2,238	48	Brush, Good, HSG B
1,824	61	>75% Grass cover, Good, HSG B
4,145	55	Weighted Average
4,145		100.00% Pervious Area

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

Subcatchment PR-12: TO OFFSITE WEST



Summary for Subcatchment PR-2: TO CB-1

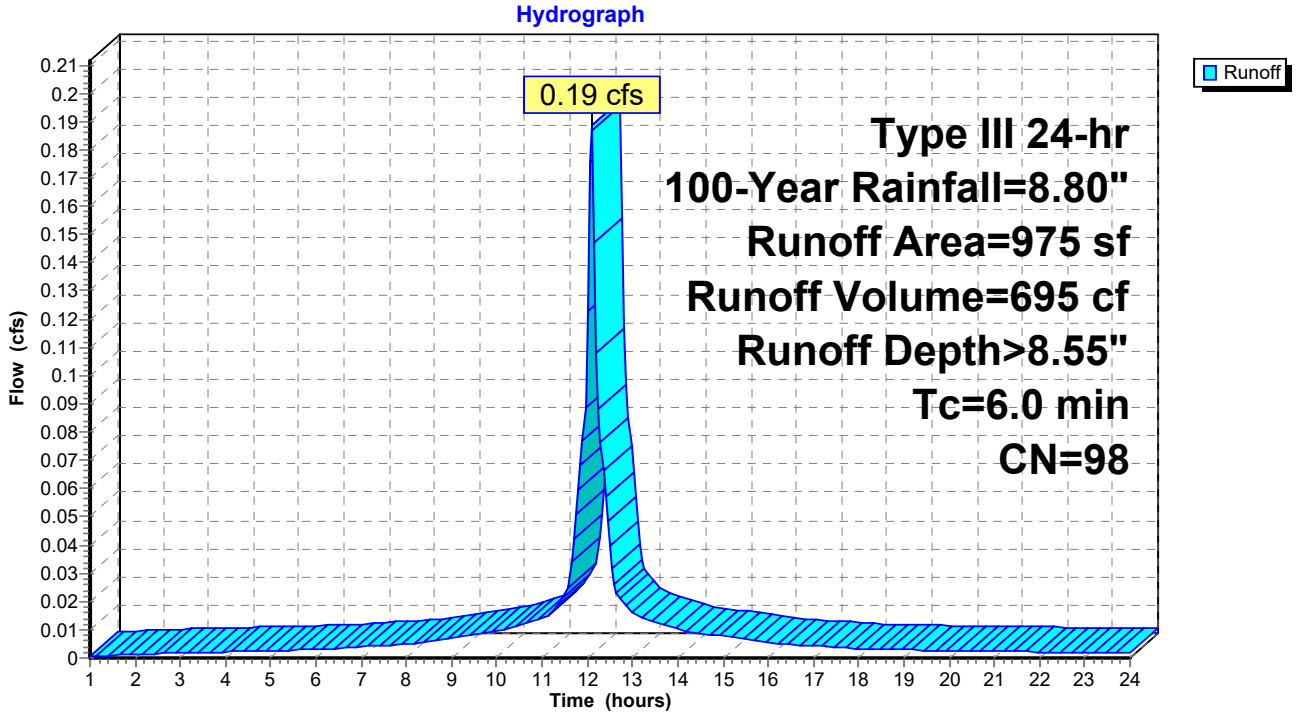
Runoff = 0.19 cfs @ 12.09 hrs, Volume= 695 cf, Depth> 8.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.80"

	Area (sf)	CN	Description
*	975	98	Impervious
	975		100.00% Impervious Area

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

Subcatchment PR-2: TO CB-1



Summary for Subcatchment PR-3: TO CB-2

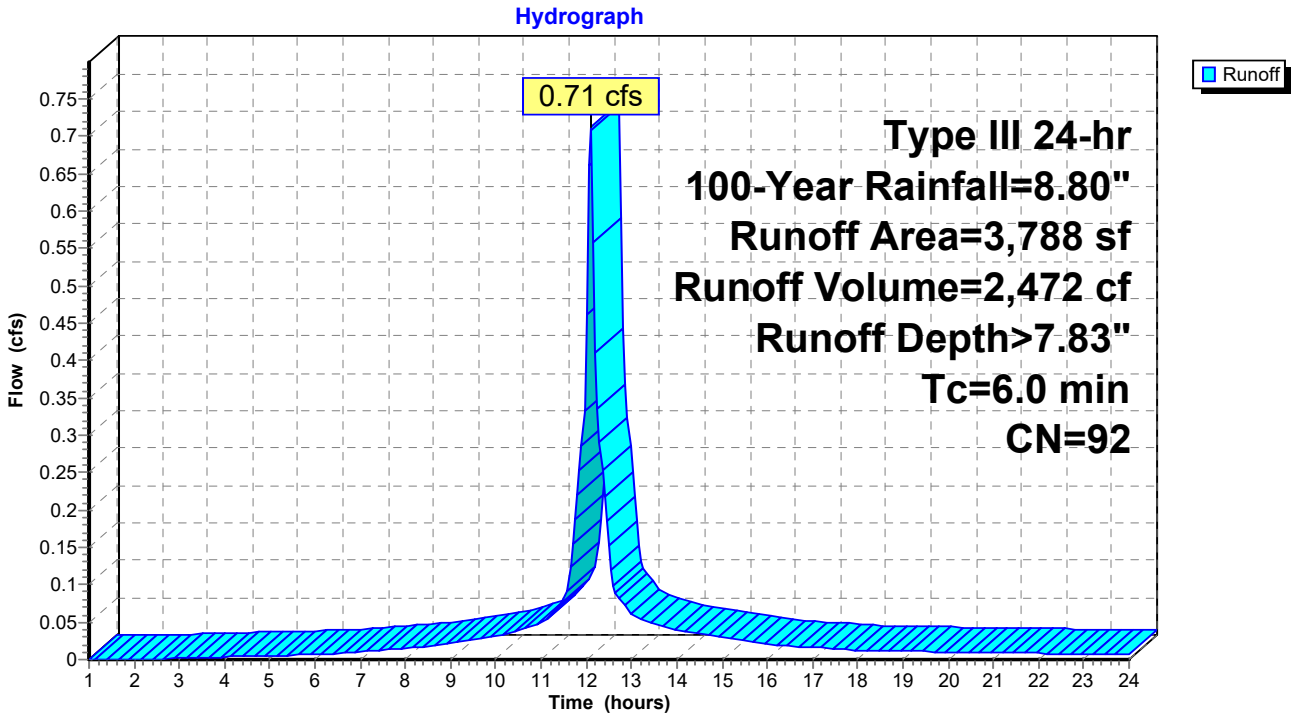
Runoff = 0.71 cfs @ 12.09 hrs, Volume= 2,472 cf, Depth> 7.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.80"

	Area (sf)	CN	Description
*	3,158	98	Impervious
	630	61	>75% Grass cover, Good, HSG B
	3,788	92	Weighted Average
	630		16.63% Pervious Area
	3,158		83.37% Impervious Area

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

Subcatchment PR-3: TO CB-2



Summary for Subcatchment PR-4: TO CB-3

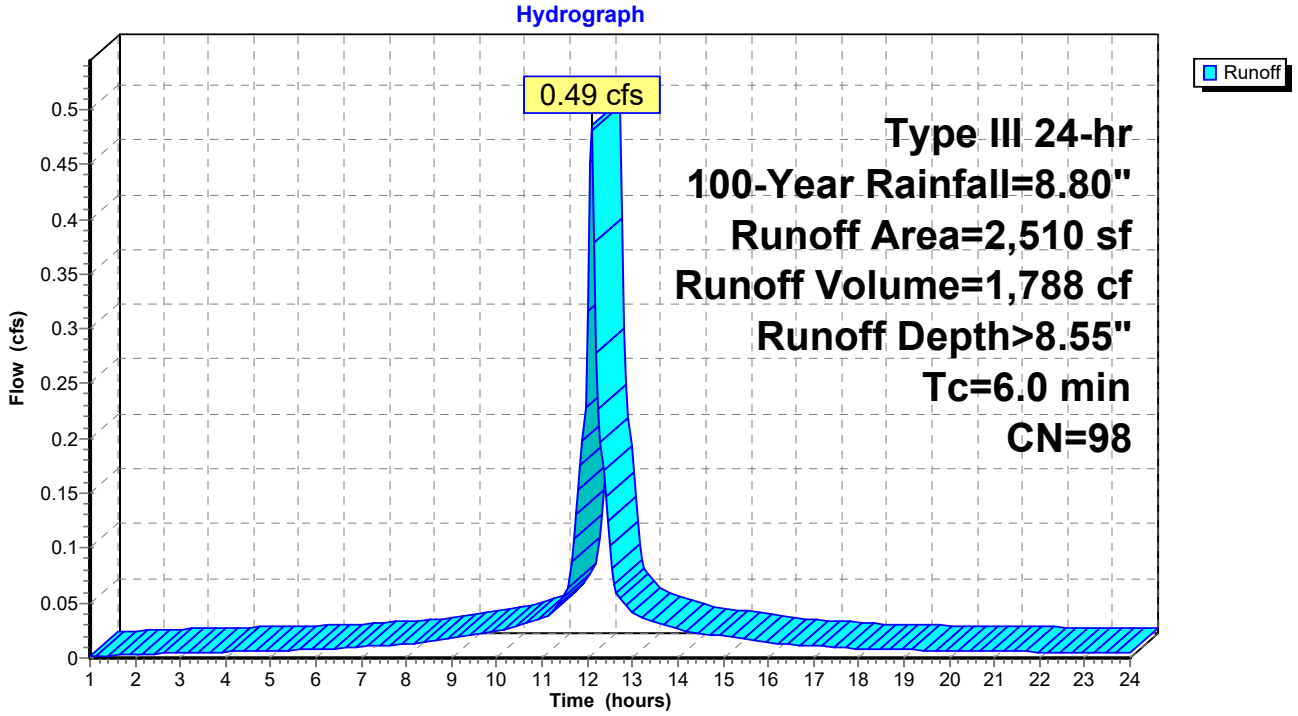
Runoff = 0.49 cfs @ 12.09 hrs, Volume= 1,788 cf, Depth> 8.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.80"

	Area (sf)	CN	Description
*	2,510	98	Impervious
	2,510		100.00% Impervious Area

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

Subcatchment PR-4: TO CB-3



Summary for Subcatchment PR-5: TO OFFSITE EAST

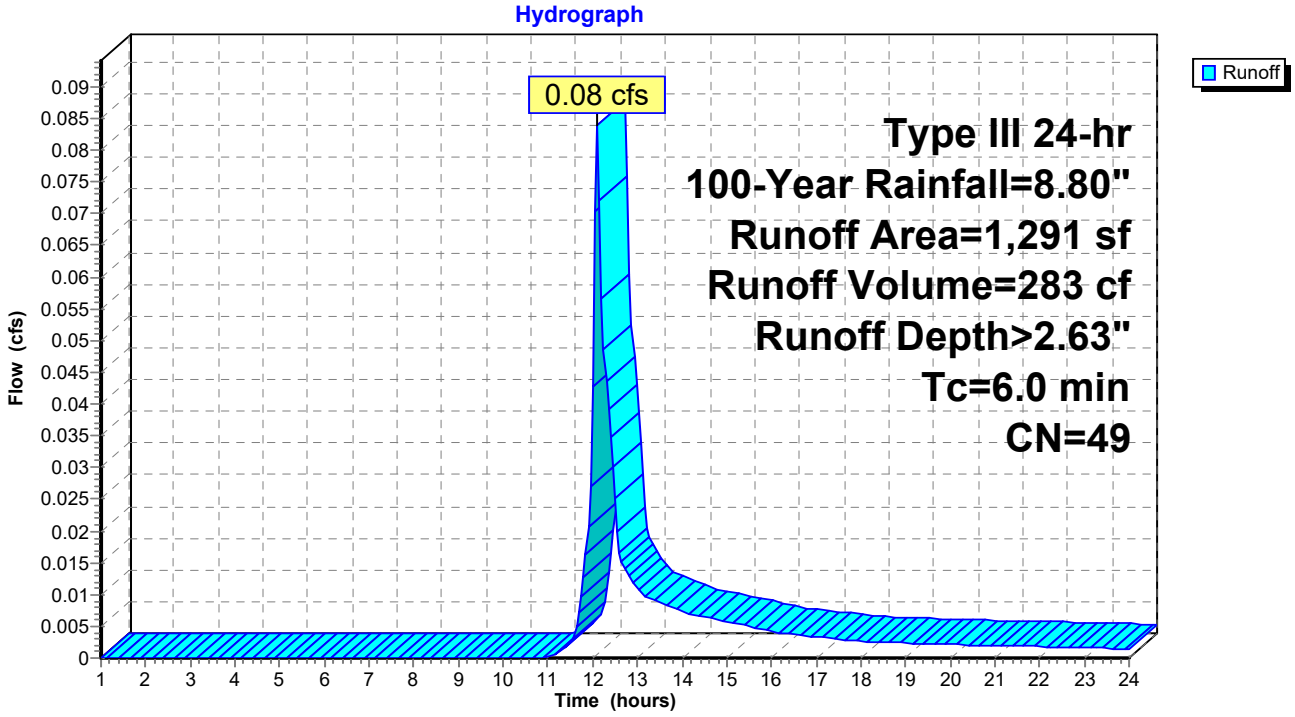
Runoff = 0.08 cfs @ 12.10 hrs, Volume= 283 cf, Depth> 2.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.80"

Area (sf)	CN	Description
1,187	48	Brush, Good, HSG B
104	61	>75% Grass cover, Good, HSG B
1,291	49	Weighted Average
1,291		100.00% Pervious Area

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

Subcatchment PR-5: TO OFFSITE EAST



Summary for Subcatchment PR-6: TO CB-4

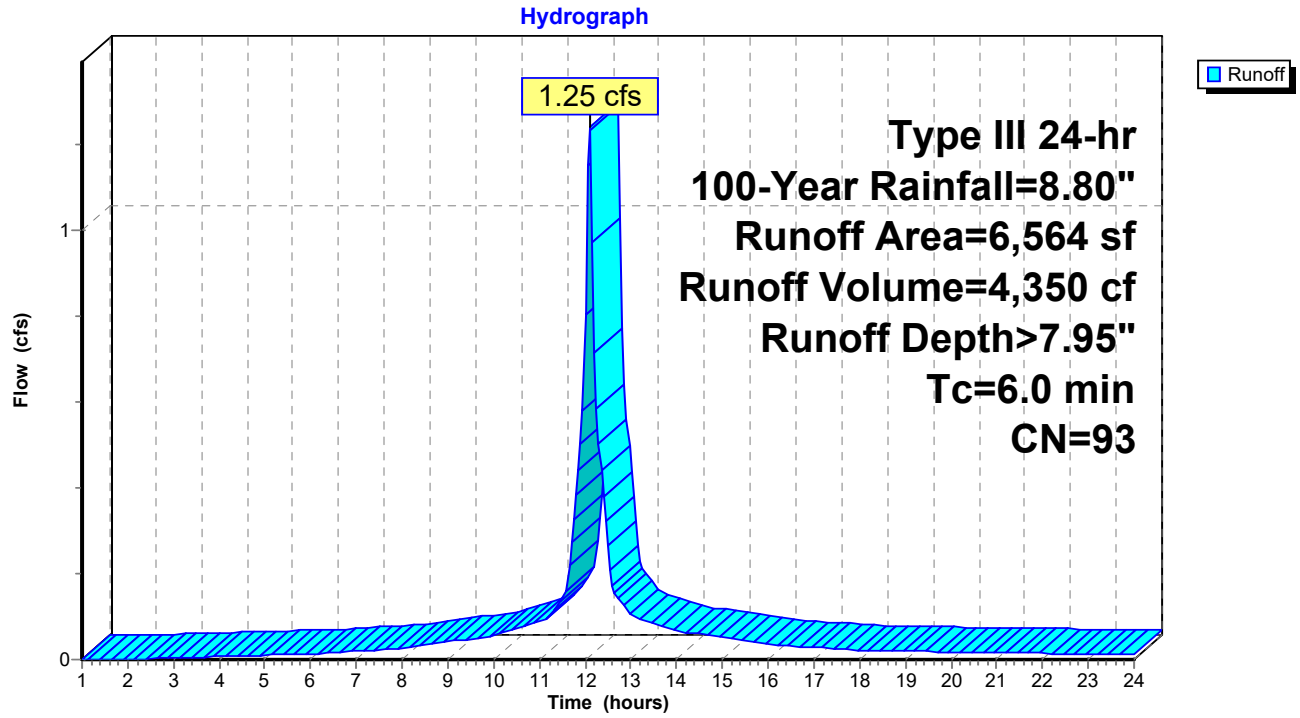
Runoff = 1.25 cfs @ 12.09 hrs, Volume= 4,350 cf, Depth> 7.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.80"

	Area (sf)	CN	Description
*	5,707	98	Impervious
	857	61	>75% Grass cover, Good, HSG B
	6,564	93	Weighted Average
	857		13.06% Pervious Area
	5,707		86.94% Impervious Area

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

Subcatchment PR-6: TO CB-4



Summary for Subcatchment PR-7: ROOF RUNOFF

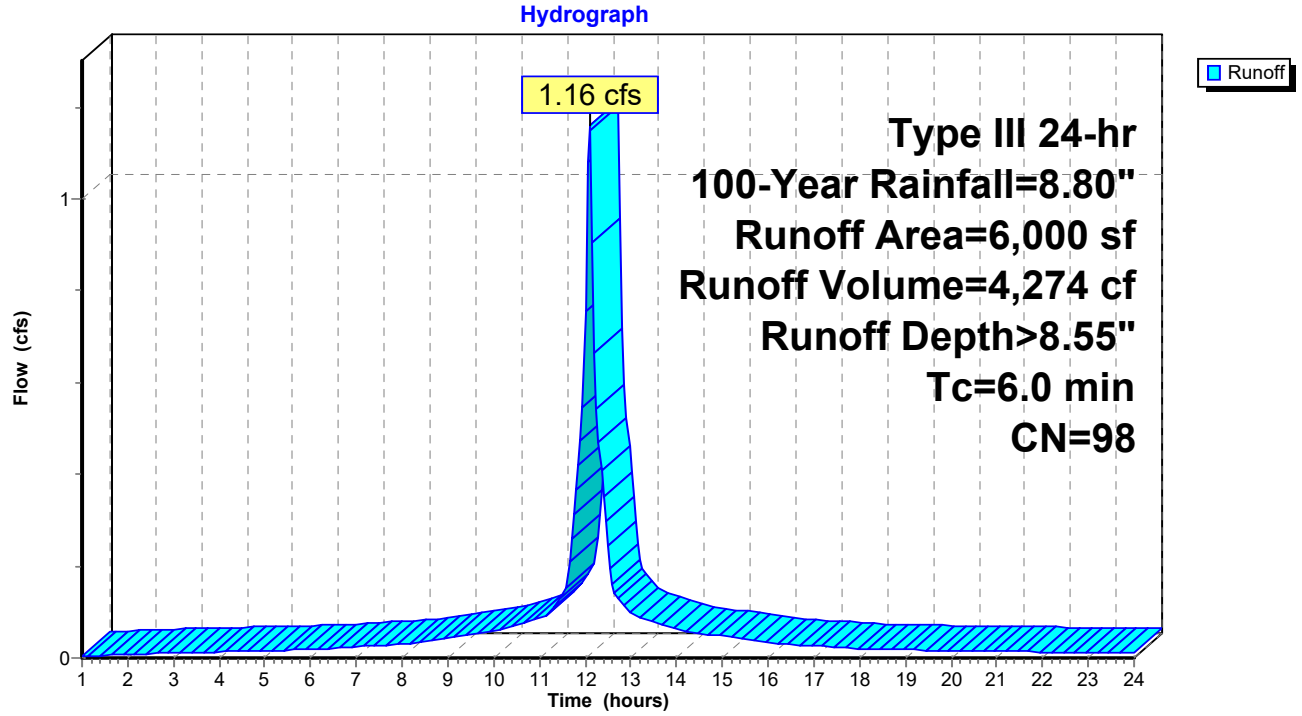
Runoff = 1.16 cfs @ 12.09 hrs, Volume= 4,274 cf, Depth> 8.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.80"

	Area (sf)	CN	Description
*	6,000	98	Impervious
	6,000		100.00% Impervious Area

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

Subcatchment PR-7: ROOF RUNOFF



Summary for Subcatchment PR-8: TO CB-5

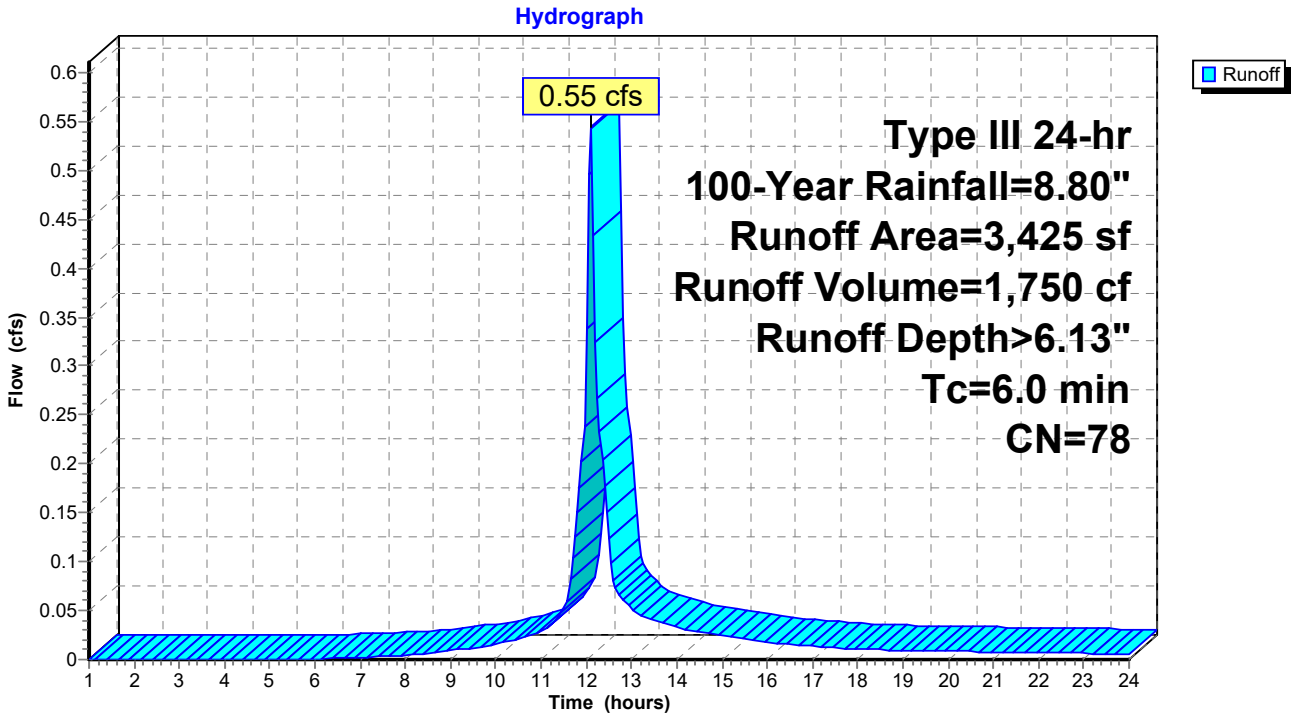
Runoff = 0.55 cfs @ 12.09 hrs, Volume= 1,750 cf, Depth> 6.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.80"

	Area (sf)	CN	Description
*	1,557	98	Impervious
	1,868	61	>75% Grass cover, Good, HSG B
	3,425	78	Weighted Average
	1,868		54.54% Pervious Area
	1,557		45.46% Impervious Area

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

Subcatchment PR-8: TO CB-5



Summary for Subcatchment PR-9: TO CB-6

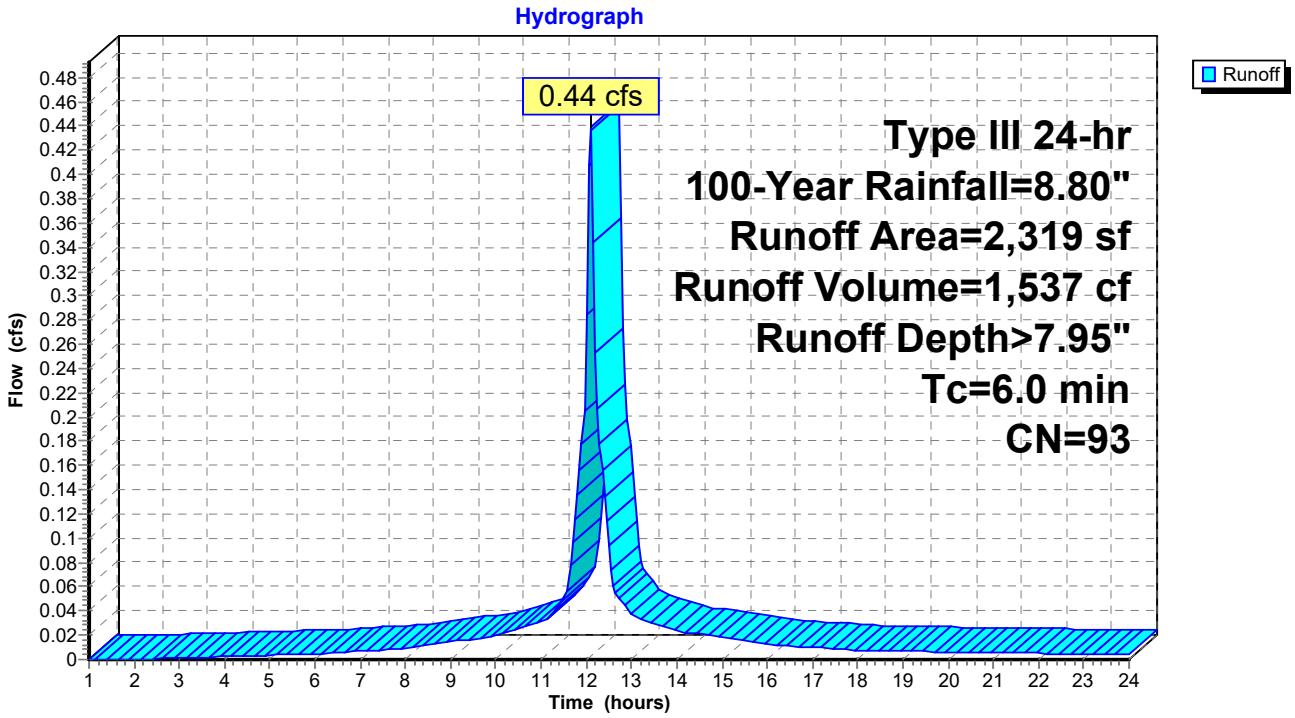
Runoff = 0.44 cfs @ 12.09 hrs, Volume= 1,537 cf, Depth> 7.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.80"

	Area (sf)	CN	Description
*	2,032	98	Impervious
	287	61	>75% Grass cover, Good, HSG B
	2,319	93	Weighted Average
	287		12.38% Pervious Area
	2,032		87.62% Impervious Area

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

Subcatchment PR-9: TO CB-6

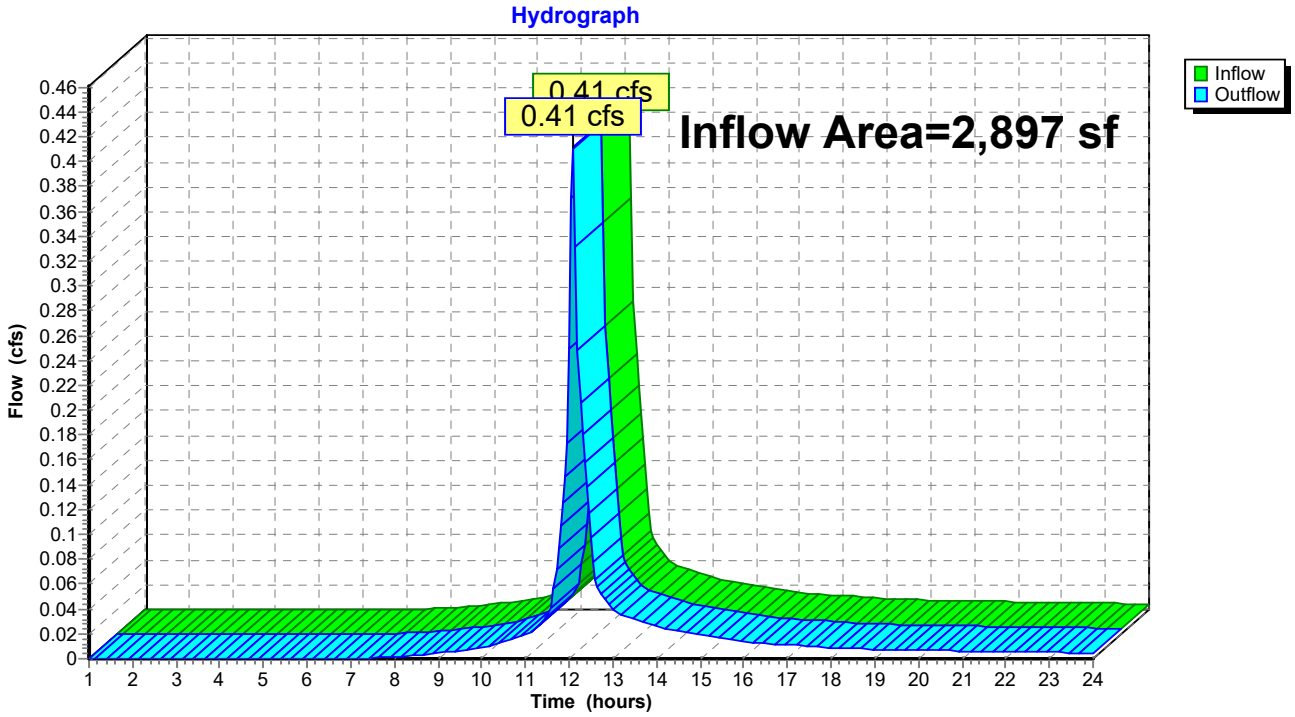


Summary for Reach 4R: MAZZEO DRIVE

Inflow Area = 2,897 sf, 30.55% Impervious, Inflow Depth > 5.40" for 100-Year event
Inflow = 0.41 cfs @ 12.09 hrs, Volume= 1,303 cf
Outflow = 0.41 cfs @ 12.09 hrs, Volume= 1,303 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs

Reach 4R: MAZZEO DRIVE

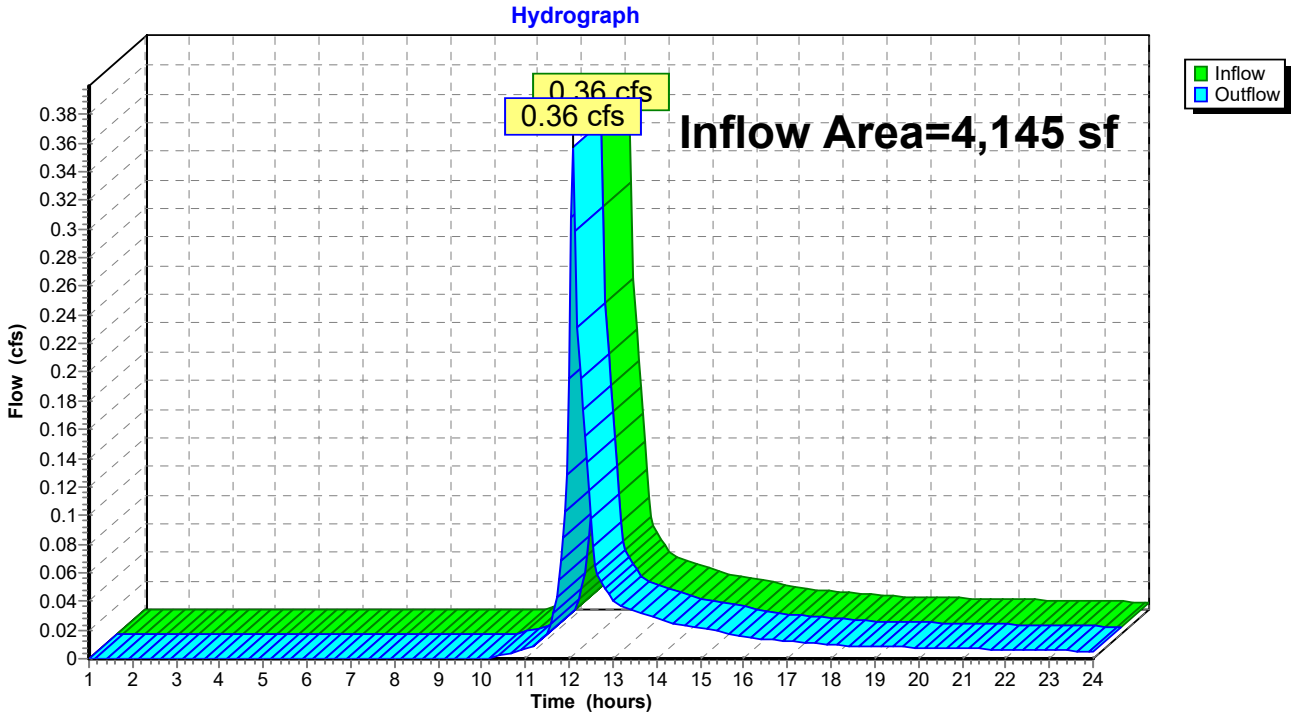


Summary for Reach 5R: OFFSITE WEST

Inflow Area = 4,145 sf, 0.00% Impervious, Inflow Depth > 3.34" for 100-Year event
Inflow = 0.36 cfs @ 12.10 hrs, Volume= 1,154 cf
Outflow = 0.36 cfs @ 12.10 hrs, Volume= 1,154 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs

Reach 5R: OFFSITE WEST

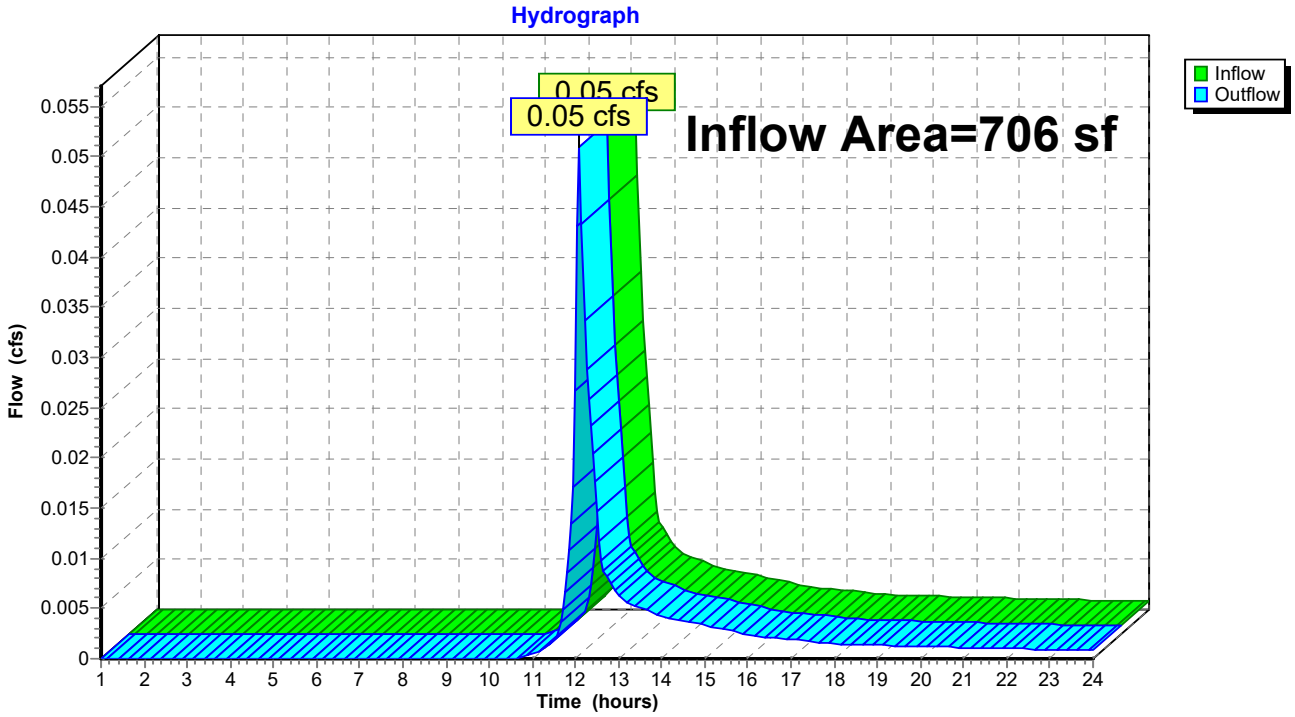


Summary for Reach 6R: OFFSITE NORTH

Inflow Area = 706 sf, 0.00% Impervious, Inflow Depth > 2.87" for 100-Year event
Inflow = 0.05 cfs @ 12.10 hrs, Volume= 169 cf
Outflow = 0.05 cfs @ 12.10 hrs, Volume= 169 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs

Reach 6R: OFFSITE NORTH

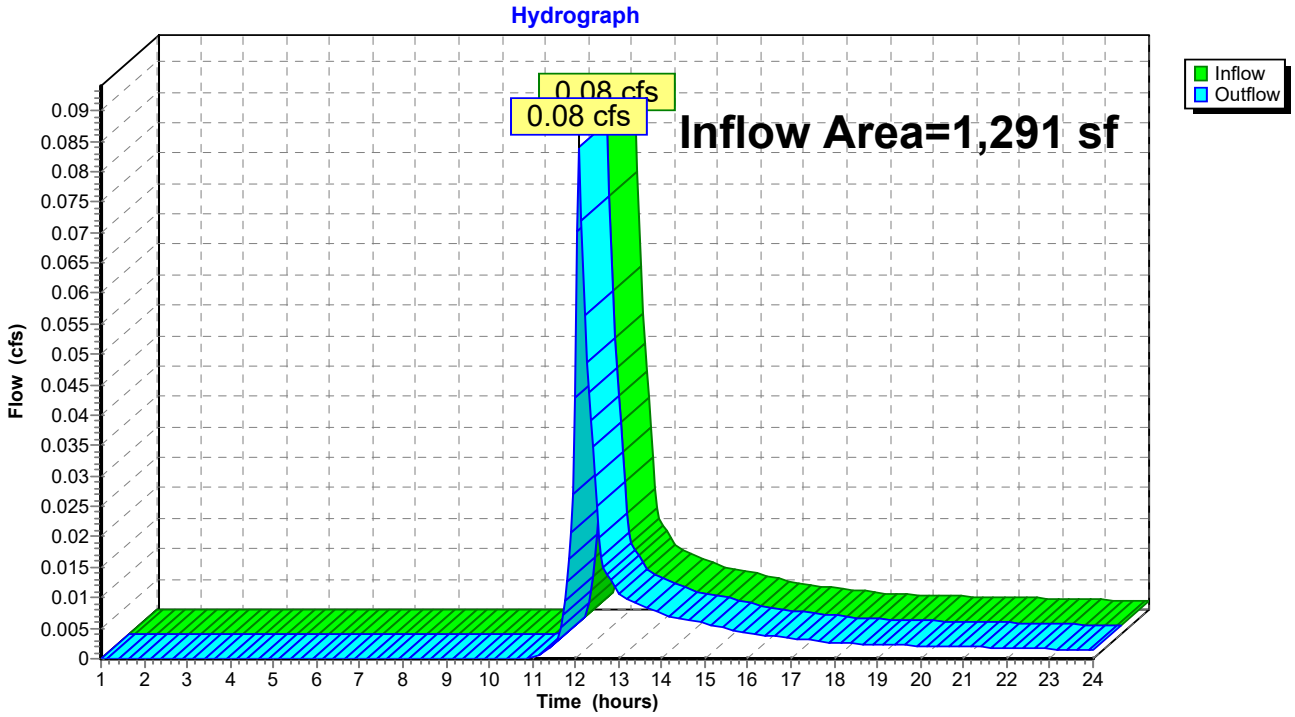


Summary for Reach 8R: OFFSITE EAST

Inflow Area = 1,291 sf, 0.00% Impervious, Inflow Depth > 2.63" for 100-Year event
Inflow = 0.08 cfs @ 12.10 hrs, Volume= 283 cf
Outflow = 0.08 cfs @ 12.10 hrs, Volume= 283 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs

Reach 8R: OFFSITE EAST



Summary for Pond CS1: CHAMBER SYSTEM 1

Inflow Area = 19,632 sf, 84.66% Impervious, Inflow Depth > 7.86" for 100-Year event
Inflow = 3.65 cfs @ 12.09 hrs, Volume= 12,854 cf
Outflow = 0.56 cfs @ 12.58 hrs, Volume= 12,852 cf, Atten= 85%, Lag= 29.3 min
Discarded = 0.56 cfs @ 12.58 hrs, Volume= 12,852 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 92.27' @ 12.58 hrs Surf.Area= 2,367 sf Storage= 3,730 cf

Plug-Flow detention time= 42.0 min calculated for 12,852 cf (100% of inflow)
Center-of-Mass det. time= 41.9 min (800.9 - 759.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	89.78'	1,647 cf	**27.75'W x 85.29'L x 2.71'H Field A** 6,410 cf Overall - 2,292 cf Embedded = 4,118 cf x 40.0% Voids
#2A	90.28'	2,292 cf	**Cultec R-180** x 104 Inside #1 Effective Size= 33.6"W x 20.0"H => 3.44 sf x 6.33'L = 21.8 cf Overall Size= 36.0"W x 20.5"H x 7.33'L with 1.00' Overlap Row Length Adjustment= +1.00' x 3.44 sf x 8 rows
		3,939 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	89.78'	**8.270 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.56 cfs @ 12.58 hrs HW=92.27' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.56 cfs)

Pond CS1: CHAMBER SYSTEM 1 - Chamber Wizard Field A

Chamber Model = Cultec R-180 (Cultec Recharger® 180HD)
Effective Size= 33.6"W x 20.0"H => 3.44 sf x 6.33'L = 21.8 cf
Overall Size= 36.0"W x 20.5"H x 7.33'L with 1.00' Overlap
Row Length Adjustment= +1.00' x 3.44 sf x 8 rows

36.0" Wide + 3.0" Spacing = 39.0" C-C Row Spacing

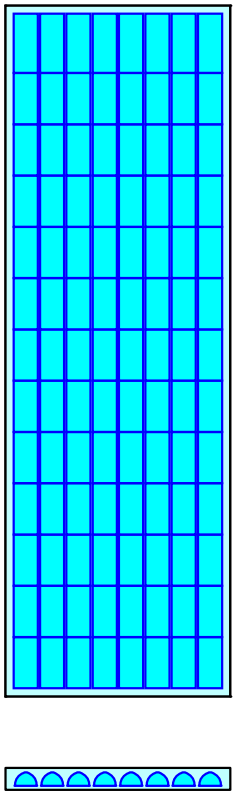
13 Chambers/Row x 6.33' Long +1.00' Row Adjustment = 83.29' Row Length +12.0" End Stone x 2 = 85.29' Base Length
8 Rows x 36.0" Wide + 3.0" Spacing x 7 + 12.0" Side Stone x 2 = 27.75' Base Width
6.0" Base + 20.5" Chamber Height + 6.0" Cover = 2.71' Field Height

104 Chambers x 21.8 cf +1.00' Row Adjustment x 3.44 sf x 8 Rows = 2,291.8 cf Chamber Storage

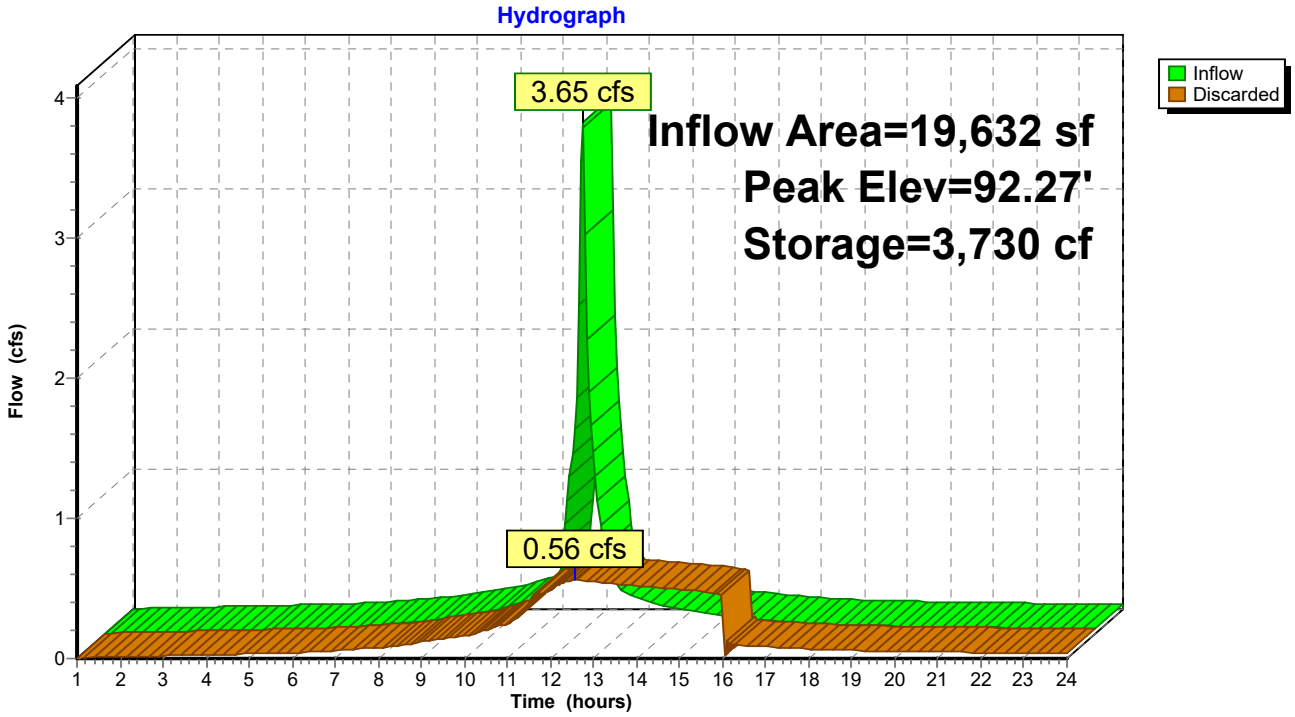
6,410.1 cf Field - 2,291.8 cf Chambers = 4,118.3 cf Stone x 40.0% Voids = 1,647.3 cf Stone Storage

Chamber Storage + Stone Storage = 3,939.1 cf = 0.090 af
Overall Storage Efficiency = 61.5%
Overall System Size = 85.29' x 27.75' x 2.71'

104 Chambers
237.4 cy Field
152.5 cy Stone



Pond CS1: CHAMBER SYSTEM 1



Summary for Pond CS2: CHAMBER SYSTEM 2

Inflow Area = 7,273 sf, 91.34% Impervious, Inflow Depth > 8.18" for 100-Year event
Inflow = 1.39 cfs @ 12.09 hrs, Volume= 4,955 cf
Outflow = 0.24 cfs @ 12.55 hrs, Volume= 4,954 cf, Atten= 83%, Lag= 27.8 min
Discarded = 0.24 cfs @ 12.55 hrs, Volume= 4,954 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 90.99' @ 12.55 hrs Surf.Area= 821 sf Storage= 1,403 cf

Plug-Flow detention time= 37.7 min calculated for 4,954 cf (100% of inflow)
Center-of-Mass det. time= 37.6 min (790.7 - 753.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	88.50'	737 cf	**11.17'W x 73.50'L x 3.54'H Field A** 2,907 cf Overall - 1,065 cf Embedded = 1,841 cf x 40.0% Voids
#2A	89.00'	1,065 cf	**Cultec R-330XLHD** x 20 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 2 rows
		1,802 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	88.50'	**8.270 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.24 cfs @ 12.55 hrs HW=90.99' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.24 cfs)

Pond CS2: CHAMBER SYSTEM 2 - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)
Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
Row Length Adjustment= +1.50' x 7.45 sf x 2 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

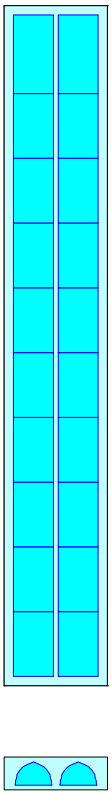
10 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 71.50' Row Length +12.0" End Stone x 2 = 73.50' Base Length
2 Rows x 52.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 11.17' Base Width
6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

20 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 2 Rows = 1,065.5 cf Chamber Storage

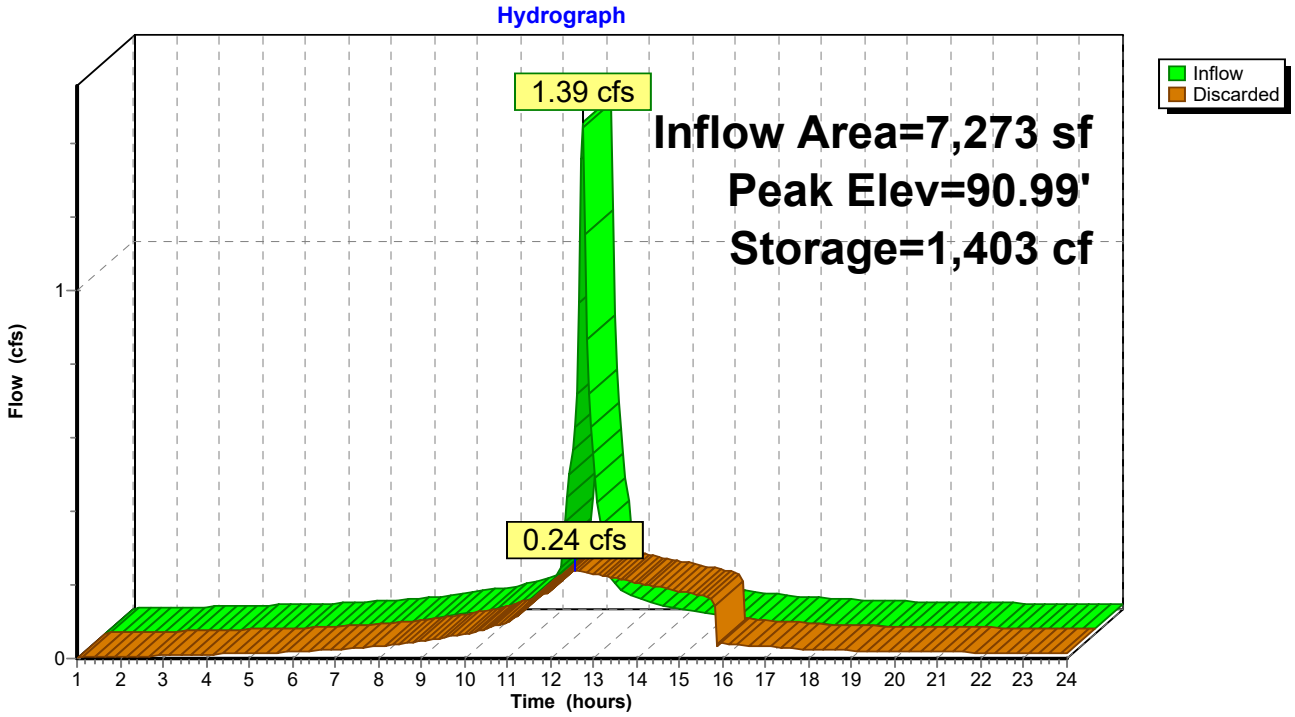
2,906.8 cf Field - 1,065.5 cf Chambers = 1,841.3 cf Stone x 40.0% Voids = 736.5 cf Stone Storage

Chamber Storage + Stone Storage = 1,802.0 cf = 0.041 af
Overall Storage Efficiency = 62.0%
Overall System Size = 73.50' x 11.17' x 3.54'

20 Chambers
107.7 cy Field
68.2 cy Stone



Pond CS2: CHAMBER SYSTEM 2



APPENDIX B: HYDRAULIC ANALYSIS

PIPE SIZING CALCULATIONS

MBL Land Development & Permitting, Corp.
Land Development, Transportation & Environmental Solutions

Project No.: 2021-054
Location: 33 Mazzeo Drive, Randolph
Calculated By: DT
Calculated On: January 27, 2022

25 YEAR STORM

WATERSHED CHARACTERISTICS												PIPE CHARACTERISTICS												FLOW CHARACTERISTICS			
LOCATION				LAND USE			FLOW TIME			FLOW						R = hydraulic radius = area/wetted perimeter											
Description	Cover	Increm. (ACRE)	Total_A (ACRE)	C	CA	Total CA	To Inlet (MIN)	In Pipe (MIN)	Tc (MIN)	I (IPH)	Q (CFS)	Structure	Invert	Pipe	Size (IN)	Length (FT)	Area (SF)	R (FT)	Slope	n	Qf (CFS)	Vf (FT/S)	Q/Qf	V/Vf	V (FT/S)	Tc L/V (MIN)
WS CB-1	LANDSCAPED	0.000		0.350																						
	IMPERVIOUS	0.022		0.850								From: CB-1	Out:													
	GRAVEL DRIVE	0.000		0.700										RCP	8	4	0.35	0.167	0.005	0.011	**1.01**	**2.89**	0.00	0.15	0.45	0.15
			0.022	0.019	0.000		6.00	NONE	6.00	6.39	**0.00**	To: WQU-1	In:													
												From: WQU-1	Out:													
WQU-1 TO CHAMBERS 2						0.000	6.00	0.15	6.15	6.36	**0.00**			RCP	8	3	0.35	0.167	0.005	0.011	**1.01**	**2.89**	**0.00**	**0.19**	**0.54**	**0.09**
												To: CHAMBERS 2	In:													
WS CB-3	LANDSCAPED	0.000		0.350																						
	IMPERVIOUS	0.058		0.850								From: CB-3	Out:													
	GRAVEL DRIVE	0.000		0.700										RCP	8	27	0.35	0.167	0.005	0.011	**1.01**	**2.89**	0.01	0.27	0.77	0.58
			0.058	0.049	0.003		6.00	NONE	6.00	6.39	**0.02**	To: DMH-1	In:													
WS CB-4	LANDSCAPED	0.020		0.350																						
	IMPERVIOUS	0.131		0.850								From: CB-4	Out:													
	GRAVEL DRIVE	0.000		0.000										RCP	8	5	0.35	0.167	0.005	0.011	**1.01**	**2.89**	0.06	0.45	1.32	0.06
			0.151	0.118	0.018		6.00	NONE	6.00	6.39	**0.11**	To: DMH-1	In:													
												From: DMH-1	Out:													
DMH-1 TO WQU-2						0.021	6.00	0.58	6.58	6.29	**0.13**			RCP	8	17	0.35	0.167	0.005	0.011	**1.01**	**2.89**	**0.13**	**0.58**	**1.67**	**0.17**
												To: WQU-2	In:													
WS CB-2	LANDSCAPED	0.014		0.350																						
	IMPERVIOUS	0.072		0.850								From: CB-2	Out:													
	GRAVEL DRIVE	0.000		0.000										RCP	8	4	0.35	0.167	0.005	0.011	**1.01**	**2.89**	0.02	0.33	0.95	0.07
			0.087	0.067	0.006		6.00	NONE	6.00	6.39	**0.04**	To: WQU-2	In:													
												From: WQU-2	Out:													
WQU-2 TO CHAMBERS 2						0.026	6.00	0.07	6.65	6.27	**0.17**			RCP	8	50	0.35	0.167	0.005	0.011	**1.01**	**2.89**	**0.16**	**0.62**	**1.79**	**0.46**
												To: CHAMBERS 2	In:													
WS CB-6	LANDSCAPED	0.007		0.350																						
	IMPERVIOUS	0.047		0.850								From: CB-6	Out:													
	GRAVEL DRIVE	0.000		0.000										HDPE	8	1	0.35	0.167	0.010	0.013	**1.21**	**3.46**	0.01	0.24	0.82	0.02
			0.053	0.042	0.002		6.00	NONE	6.00	6.39	**0.01**	To: DMH-2	In:													
WS CB-7	LANDSCAPED	0.000		0.350																						
	IMPERVIOUS	0.030		0.850								From: CB-7	Out:													
	GRAVEL DRIVE	0.000		0.349										HDPE	8	14	0.35	0.167	0.010	0.013	**1.21**	**3.46**	0.00	0.17	0.60	0.39
			0.030	0.026	0.001		6.00	NONE	6.00	6.39	**0.01**	To: DMH-2	In:													
												From: DMH-2	Out:													
DMH-2 TO WQU-3						0.003	6.00	0.39	6.39	6.32	**0.02**			HDPE	8	35	0.35	0.167	0.010	0.013	**1.21**	**3.46**	**0.02**	**0.31**	**1.09**	**0.54**
												To: WQU-3	In:													
WS CB-5	LANDSCAPED	0.045		0.350																						
	IMPERVIOUS	0.033		0.850								From: CB-5	Out:													
	GRAVEL DRIVE	0.000		0.000										HDPE	8	27	0.35	0.167	0.010	0.013	**1.21**	**3.46**	0.01	0.27	0.93	0.48
			0.079	0.044	0.003		6.00	NONE	6.00	6.39	**0.02**	To: DMH-2	In:													
												From: DMH-2	Out:													
DMH-2 TO WQU-3						0.144	6.00	0.48	6.87	6.24	**0.90**			HDPE	8	24	0.35	0.167	0.010	0.013	**1.21**	**3.46**	**0.75**	**0.96**	**3.33**	**0.12**
												To: WQU-3	In:													

APPENDIX C: GROUNDWATER RECHARGE CALCULATIONS & 72-HR DRAWDOWN CALCULATIONS

Groundwater Recharge Calculations (Chamber System 1)

Project No. 2021-054
Project: Proposed Car Wash
Location: 33 Mazzeo Drive, Randolph, MA
Date: January 27, 2022

Calculate the Required Recharge Volume (Chamber System 1):

NRCS Hydrologic Soil Group	Volume to Recharge (inches)	Impervious Area (square feet)	Required Recharge Volume (cubic feet)
A	0.60	0	0
B	0.35	16620	485
C	0.25	0	0
D	0.10	0	0
		Total Required Recharge Volume	485

Capture Area Adjustment

A minimum of 65% of the total site impervious area must be directed to a recharge BMP:

Impervious Area Directed to Recharge BMP (square feet)	Total Site Impervious Area (square feet)	% of Total Site Directed to Recharge BMP
16620	16620	100%

Calculate the Adjustment Factor:

Impervious Area Directed to Recharge BMP (square feet)	Total Site Impervious Area (square feet)	Ratio of Total Impervious Area to Impervious Area Directed to BMP
16620	16620	1.00

Calculate the Adjusted Required Recharge Volume:

Required Recharge Volume (cubic feet)	Ratio of Total Impervious Area to Impervious Area Directed to BMP	Adjusted Required Recharge Volume (cubic feet)
485	1.00	485
	Total Required Recharge Volume	485
	Provided Recharge Volume = (elev. 90.30 in Chambers)	510

Groundwater Recharge Calculations (Chamber System 2)

Project No. 2021-054
Project: Proposed Car Wash
Location: 33 Mazzeo Drive, Randolph, MA
Date: January 27, 2022

Calculate the Required Recharge Volume (Chamber System 2):

NRCS Hydrologic Soil Group	Volume to Recharge (inches)	Impervious Area (square feet)	Required Recharge Volume (cubic feet)
A	0.60	0	0
B	0.35	7528	220
C	0.25	0	0
D	0.10	0	0
		Total Required Recharge Volume	220

Capture Area Adjustment

A minimum of 65% of the total site impervious area must be directed to a recharge BMP:

Impervious Area Directed to Recharge BMP (square feet)	Total Site Impervious Area (square feet)	% of Total Site Directed to Recharge BMP
6443	7528	86%

Calculate the Adjustment Factor:

Impervious Area Directed to Recharge BMP (square feet)	Total Site Impervious Area (square feet)	Ratio of Total Impervious Area to Impervious Area Directed to BMP
6443	7528	1.17

Calculate the Adjusted Required Recharge Volume:

Required Recharge Volume (cubic feet)	Ratio of Total Impervious Area to Impervious Area Directed to BMP	Adjusted Required Recharge Volume (cubic feet)
220	1.17	257
	Total Required Recharge Volume	257
	Provided Recharge Volume = (elev. 89.19 in Chambers)	290

72 Hour Drawdown Calculations

Project No. 2021-054
Project: Proposed Car Wash
Location: 33 Mazzeo Drive, Randolph, MA
Date: January 27, 2022

According to the Massachusetts Stormwater Management Handbook, recharge BMP's must be designed to drain within 72 hours. Below is the drawdown calculation used:

$Time_{(Drawdown)} = R_v / (K*A)$

Where:

R_v: Recharge Volume (ft^3)

K: Recharge Rate (Rawl's Rate) used to size the infiltration BMP (in/hour)

A: Bottom Area of the Infiltration Facility (ft^2)

Location	R_v	K (in/hour)	K (ft/hr)	A	Drawdown Time (hrs)	Drawdown Time Less than 72 Hours?
Chamber System 1	510	8.27	0.69	2367	0.31	YES
Chamber System 2	290	8.27	0.69	821	0.51	YES

Drawdown Conforms to the Stormwater Management Standards

APPENDIX D: REQUIRED WATER QUALITY VOLUME & TSS REMOVAL CALCULATIONS

TSS Removal Spreadsheet

Project No. 2021-054
Project: Proposed Car Wash
Location: 33 Mazzeo Drive, Randolph, MA
Date: January 27, 2022

Treatment Train: **To Chamber System 1**

Pre-Treatment					
BMP	**TSS Removal Rate**	**Starting TSS Load**	**Amount Removed**	**Remaining Load**	**TSS Removed**
Deep Sump Hooded Catch Basins	**25.0%**	**100.0%**	**25.0%**	**75.0%**	**25.0%**
Water Quality Unit	**89.0%**	**75.0%**	**66.8%**	**8.3%**	**91.8%**

Since this site is located within a Critical Area, 44% pretreatment is required. Based on the calculations above, 92% of TSS is removed prior to the Recharge Chamber System.

Total TSS Removal					
BMP	**TSS Removal Rate**	**Starting TSS Load**	**Amount Removed**	**Remaining Load**	**TSS Removed**
Chamber System 1	**80.0%**	**8.3%**	**6.6%**	**1.7%**	**98.4%**

Per the MA Stormwater Handbook, 80% of TSS is required to be removed prior to discharging. Therefore, the project complies with the Stormwater Standards.

Treatment Train: **To Chamber System 2**

Pre-Treatment					
BMP	**TSS Removal Rate**	**Starting TSS Load**	**Amount Removed**	**Remaining Load**	**TSS Removed**
Deep Sump Hooded Catch Basins	**25.0%**	**100.0%**	**25.0%**	**75.0%**	**25.0%**
Water Quality Unit	**87.0%**	**75.0%**	**65.3%**	**9.8%**	**90.3%**

Since this site is located within a Critical Area, 44% pretreatment is required. Based on the calculations above, 90% of TSS is removed prior to the Recharge Chamber System.

Total TSS Removal					
BMP	**TSS Removal Rate**	**Starting TSS Load**	**Amount Removed**	**Remaining Load**	**TSS Removed**
Chamber System 2	**80.0%**	**9.8%**	**7.8%**	**2.0%**	**98.1%**

Per the MA Stormwater Handbook, 80% of TSS is required to be removed prior to discharging. Therefore, the

Water Quality Calculations (Chamber System 1)

Project No. 2021-054
Project: Proposed Car Wash
Location: 33 Mazzeo Drive, Randolph, MA
Date: January 27, 2022

Calculate the Required Water Quality Volume (Chamber System 1)

Depth of Runoff (inches)	Discharge To:	Total Impervious Area (square feet)	Required Water Quality Volume (cubic feet)
0.5	Not Discharging to a Critical Area		0
1	Discharging to a Critical Area	16620	1385
1	Soils with Rapid Infiltration Rate >2.41 "/hr		0
		Required Water Quality Volume	1385
		Provided Water Quality Volume (EL. 90.77 in Chambers)	1450

Water Quality Calculations (Chamber System 2)

Project No. 2021-054
Project: Proposed Car Wash
Location: 33 Mazzeo Drive, Randolph, MA
Date: January 27, 2022

Calculate the Required Water Quality Volume (Chamber System 2)

Depth of Runoff (inches)	Discharge To:	Total Impervious Area (square feet)	Required Water Quality Volume (cubic feet)
0.5	Not Discharging to a Critical Area		0
1	Discharging to a Critical Area	6443	537
1	Soils with Rapid Infiltration Rate >2.41 "/hr		0
		Required Water Quality Volume	537
		Provided Water Quality Volume (EL. 89.56 in Chambers)	538

WATER QUALITY UNIT SIZING

Brief Stormceptor Sizing Report - WQU-1

Project Information & Location			
Project Name	Car Wash	**Project Number**	2021-054
City	Randolph	**State/ Province**	Massachusetts
Country	United States of America	**Date**	1/12/2022
Designer Information		**EOR Information (optional)**	
Name	JUSTIN WILLIAMS	**Name**	
Company	MBL Land Development & Permitting Corp.	**Company**	
Phone #	781-706-7433	**Phone #**	
Email	Justin@MBLLandDevelopment.com	**Email**	

Stormwater Treatment Recommendation
The recommended Stormceptor Model(s) which achieve or exceed the user defined water quality objective for each site within the project are listed in the below Sizing Summary table.

Site Name	WQU-1
Target TSS Removal (%)	80
TSS Removal (%) Provided	97
Recommended Stormceptor Model	STC 450i

The recommended Stormceptor Model achieves the water quality objectives based on the selected inputs, historical rainfall records and selected particle size distribution.

Stormceptor Sizing Summary	
Stormceptor Model	**% TSS Removal Provided**
STC 450i	97
STC 900	99
STC 1200	99
STC 1800	99
STC 2400	99
STC 3600	99
STC 4800	100
STC 6000	100
STC 7200	100
STC 11000	100
STC 13000	100
STC 16000	100

Sizing Details

Drainage Area

Total Area (acres)	0.03
Imperviousness %	100.0

Rainfall

Station Name	BLUE HILL
State/Province	Massachusetts
Station ID #	0736
Years of Records	58
Latitude	42°12'44"N
Longitude	71°6'53"W

Water Quality Objective

TSS Removal (%)	80.0
Runoff Volume Capture (%)	
Oil Spill Capture Volume (Gal)	
Peak Conveyed Flow Rate (CFS)	
Water Quality Flow Rate (CFS)	

Up Stream Storage

Storage (ac-ft)	Discharge (cfs)
0.000	0.000

Up Stream Flow Diversion

Max. Flow to Stormceptor (cfs)	

Particle Size Distribution (PSD)
The selected PSD defines TSS removal

Fine Distribution

Particle Diameter (microns)	Distribution %	Specific Gravity
20.0	20.0	1.30
60.0	20.0	1.80
150.0	20.0	2.20
400.0	20.0	2.65
2000.0	20.0	2.65

Notes

• Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor, which uses the EPA Rainfall and Runoff modules.
• Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal defined by the selected PSD, and based on stable site conditions only, after construction is completed.
• For submerged applications or sites specific to spill control, please contact your local Stormceptor representative for further design assistance.

For Stormceptor Specifications and Drawings Please Visit:
https://www.conteches.com/technical-guides/search?filter=1WBC0O5EYX

Brief Stormceptor Sizing Report - WQU-2

Project Information & Location			
Project Name	Car Wash	**Project Number**	2021-054
City	Randolph	**State/ Province**	Massachusetts
Country	United States of America	**Date**	1/12/2022
Designer Information		**EOR Information (optional)**	
Name	JUSTIN WILLIAMS	**Name**	
Company	MBL Land Development & Permitting Corp.	**Company**	
Phone #	781-706-7433	**Phone #**	
Email	Justin@MBLLandDevelopment.com	**Email**	

Stormwater Treatment Recommendation
The recommended Stormceptor Model(s) which achieve or exceed the user defined water quality objective for each site within the project are listed in the below Sizing Summary table.

Site Name	WQU-2
Target TSS Removal (%)	80
TSS Removal (%) Provided	89
Recommended Stormceptor Model	STC 450i

The recommended Stormceptor Model achieves the water quality objectives based on the selected inputs, historical rainfall records and selected particle size distribution.

Stormceptor Sizing Summary	
Stormceptor Model	**% TSS Removal Provided**
STC 450i	89
STC 900	93
STC 1200	94
STC 1800	94
STC 2400	95
STC 3600	96
STC 4800	97
STC 6000	97
STC 7200	98
STC 11000	98
STC 13000	98
STC 16000	99

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A QUIKRETE COMPANY

Sizing Details

Drainage Area

Total Area (acres)	0.28
Imperviousness %	88.0

Rainfall

Station Name	BLUE HILL
State/Province	Massachusetts
Station ID #	0736
Years of Records	58
Latitude	42°12'44"N
Longitude	71°6'53"W

Water Quality Objective

TSS Removal (%)	80.0
Runoff Volume Capture (%)	
Oil Spill Capture Volume (Gal)	
Peak Conveyed Flow Rate (CFS)	
Water Quality Flow Rate (CFS)	

Up Stream Storage

Storage (ac-ft)	Discharge (cfs)
0.000	0.000

Up Stream Flow Diversion

Max. Flow to Stormceptor (cfs)	

Particle Size Distribution (PSD)
The selected PSD defines TSS removal

Fine Distribution

Particle Diameter (microns)	Distribution %	Specific Gravity
20.0	20.0	1.30
60.0	20.0	1.80
150.0	20.0	2.20
400.0	20.0	2.65
2000.0	20.0	2.65

Notes

• Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor, which uses the EPA Rainfall and Runoff modules.
• Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal defined by the selected PSD, and based on stable site conditions only, after construction is completed.
• For submerged applications or sites specific to spill control, please contact your local Stormceptor representative for further design assistance.

For Stormceptor Specifications and Drawings Please Visit:
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Brief Stormceptor Sizing Report - WQU-3

Project Information & Location			
Project Name	Car Wash	**Project Number**	2021-054
City	Randolph	**State/ Province**	Massachusetts
Country	United States of America	**Date**	1/12/2022
Designer Information		**EOR Information (optional)**	
Name	JUSTIN WILLIAMS	**Name**	
Company	MBL Land Development & Permitting Corp.	**Company**	
Phone #	781-706-7433	**Phone #**	
Email	Justin@MBLLandDevelopment.com	**Email**	

Stormwater Treatment Recommendation
The recommended Stormceptor Model(s) which achieve or exceed the user defined water quality objective for each site within the project are listed in the below Sizing Summary table.

Site Name	WQU-3
Target TSS Removal (%)	80
TSS Removal (%) Provided	88
Recommended Stormceptor Model	STC 450i

The recommended Stormceptor Model achieves the water quality objectives based on the selected inputs, historical rainfall records and selected particle size distribution.

Stormceptor Sizing Summary	
Stormceptor Model	**% TSS Removal Provided**
STC 450i	88
STC 900	92
STC 1200	92
STC 1800	93
STC 2400	94
STC 3600	95
STC 4800	96
STC 6000	96
STC 7200	97
STC 11000	98
STC 13000	98
STC 16000	98

Sizing Details

Drainage Area

Total Area (acres)	0.18
Imperviousness %	72.0

Rainfall

Station Name	BLUE HILL
State/Province	Massachusetts
Station ID #	0736
Years of Records	58
Latitude	42°12'44"N
Longitude	71°6'53"W

Water Quality Objective

TSS Removal (%)	80.0
Runoff Volume Capture (%)	
Oil Spill Capture Volume (Gal)	
Peak Conveyed Flow Rate (CFS)	
Water Quality Flow Rate (CFS)	

Up Stream Storage

Storage (ac-ft)	Discharge (cfs)
0.000	0.000

Up Stream Flow Diversion

Max. Flow to Stormceptor (cfs)	

Particle Size Distribution (PSD)
The selected PSD defines TSS removal

Fine Distribution

Particle Diameter (microns)	Distribution %	Specific Gravity
20.0	20.0	1.30
60.0	20.0	1.80
150.0	20.0	2.20
400.0	20.0	2.65
2000.0	20.0	2.65

Notes

• Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor, which uses the EPA Rainfall and Runoff modules.
• Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal defined by the selected PSD, and based on stable site conditions only, after construction is completed.
• For submerged applications or sites specific to spill control, please contact your local Stormceptor representative for further design assistance.

For Stormceptor Specifications and Drawings Please Visit:
https://www.conteches.com/technical-guides/search?filter=1WBC0O5EYX

APPENDIX E: CONSTRUCTION PERIOD POLLUTION PREVENTION PLAN

This construction period pollution prevention plan has been prepared in accordance with the Stormwater Management Policy issued by the Department of Environmental Protection (DEP), for the proposed site development at:

33 Mazzeo Drive, Randolph, Massachusetts

SECTION I: POTENTIAL SOURCES OF POLLUTION

The following potential sources of pollution should be monitored during construction.

WASTE MATERIALS

All waste materials will be collected and stored in a securely lidded dumpster located more than 100 feet from any resource area as is reasonably practical. The dumpster will meet all local and State solid waste management regulations. All trash and construction debris from the site will be deposited in the dumpster. No construction waste materials will be buried onsite. All personnel will be instructed regarding the correct procedure for waste disposal. Notices stating these practices will be posted in the office trailer, and the individual who manages day-to-day site operations will be responsible for seeing that these practices are followed.

HAZARDOUS WASTE

All hazardous waste materials will be disposed of in the manner specified by local or State regulation or by the manufacturer. Site personnel will be instructed in these practices and the individual, whom manages day-to-day site operations, will be responsible for seeing that these practices are followed.

SANITARY WASTE

All sanitary waste will be collected from the portable units a minimum of once per week by a licensed sanitary waste management contractor, as required by the local or State regulation.

NON-STORM WATER DISCHARGES

During construction activities at the site, some water from the site will be suitable for discharge. Uncontaminated groundwater from de-watering activities will be directed to recharge groundwater on-site. The construction de-watering and all non-stormwater discharges will be directed through a silt bag, dewatering or sedimentation basin prior to discharge to the wetlands. The general contractor will comply with the EPA.'s Final General Permit for Construction De-watering Discharges and the Stormwater Pollution Prevention Plan.

CONCRETE TRUCK WASHOUT AREAS

Concrete trucks will be directed to a washout area located outside of the 100-foot Wetland Buffer. Washout areas shall consist of a layer of polyurethane sheeting draped over a rectangular area built out of straw bales.

PROPER EQUIPMENT/ VEHICLE FUELING AND MAINTENANCE PRACTICES

Petroleum products related to the operation of said equipment will be stored and tightly sealed containers, which will be clearly labeled. Spray guns will be cleaned on a disposable tarp. Vehicles will not be allowed to refuel on-site.

SPILL PREVENTION AND CONTROL PLAN

Materials and equipment necessary for spill cleanup will be kept on-site. Equipment will include but not be limited to brooms, dustpans, mops, rags, gloves, goggles, kitty litter, sand, saw dust and plastic and metal trash containers. All spills will be cleaned up immediately upon discovery. Spills large enough to reach the stormwater management system shall be reported to the Massachusetts DEP or National Response Center at 1-800-424-8802.

SECTION II: BEST MANAGEMENT PRACTICES

An Erosion Control and Sedimentation Control program will be implemented to prevent indirect impact to the existing wetland, existing roadways, and surrounding sites during the construction. The program incorporates Best Management Practices (BMP's) as specified in the guidelines developed by DEP and the Environmental Protection Agency and complies with the requirements of the NPDES General Permit for Storm Water Discharges for Construction Activities. These measures include the installation of temporary erosion and sedimentation controls and construction sequencing. Areas of exposed soil will be kept to a minimum and/or phased during construction and a permanent vegetative cover or other forms of stabilization will be established as soon as practicable.

Proper implementation of the erosion and sedimentation control program will:

- Minimize exposed soils through temporary mulching or seeding or by sequencing so that the amount of exposed soil is kept to a minimum.
- Place erosion controls structures to manage erosion and site runoff.
- Managing the control structures through the life of the construction activities and repairing all damaged structures as well as removing trapped silt as soon as recommended.
- Establish a permanent vegetative cover or other forms of stabilization as soon as practicable.

The following erosion and sedimentation control BMP's are presented in the sequence to which they will be implemented at the site. The measures will be inspected on a weekly basis or immediately before and or after storm event greater than 0.5”. The controls will be routinely maintained throughout the duration of the project. Any damaged controls will be repaired and or replaced immediately. The locations of the specified sedimentation and erosion control measures are depicted on the proposed design drawings.

EROSION CONTROL BARRIERS

Erosion control barriers will be installed and inspected by the appropriate authority at the down gradient limit of work prior to construction. The barriers will consist of staked silt fence and will be entrenched into the ground to prevent under flow. When necessary, additional erosion controls will be installed immediately down gradient of the erosion prone areas, such as the base of steep exposed slopes, around material stockpile areas, throughout the construction phase of the project. A sufficient supply of material shall be kept on site to facilitate the repair or replacement of the proposed barriers.

STABILIZED CONSTRUCTION ENTRANCE

The stabilized construction entrance shall be installed after site clearing but before any earth moving activities. The entrance should be maintained in a condition that will prevent tracking or flowing of sediment onto public rights-of-way. This may require periodic topdressing with additional stone. Remove mud and sediment tracked or washed onto public road immediately. Reshape pad as needed for drainage and runoff control. Repair any broken road pavement immediately. All temporary erosion and sediment control measures shall be removed within 30 days after final site stabilization is achieved or after the temporary practices are no longer needed. Trapped sediment shall be removed or stabilized on site. Inspect the pad and sediment disposal area weekly and after heavy rains or heavy use.

TEMPORARY SURFACE AND SLOPE STABILIZATION

Any area of exposed soil that will remain unstabilized for a period of more than fourteen days will be covered with a layer of straw or mulch until the time of final loam and seeding.

TEMPORARY SEEDING

A temporary vegetative cover of fast-growing indigenous grasses will be established on areas of exposed soils that remain unstable for a period of fourteen days. Depending on the slope, the seeded surfaces will be covered with a layer of mulch.

PERMANENT SEEDING

Upon completion of the final grading, any area not covered by pavement, other forms of stabilization, or other landscaped methods will be loamed and seeded with New England Erosion Control/Restoration Mix (for dry sites) produced by New England Wetland Plants, Inc. (or approved equivalent). This mix includes grasses and broad leaf herbaceous plants that are indigenous to the northeastern Massachusetts. Depending on slope the seeded area will be covered with mulch or erosion control blanket. The seed mix will be applied at a rate of 25lbs/acre.

INFILTRATION PROTECTION

The following practices should be implemented by the contractor to protect the in-situ soils in the location of the infiltration chambers:

- Never allow heavy construction equipment to drive across areas;
- Limit smearing and compacting of soils in infiltration areas;
- Rotary till or disc harrow to a depth of 12” to restore infiltration rates after final grading.

SECTION III: INSPECTIONS

Construction Inspections: Construction inspections shall be performed by personnel from the site contractor and/or the Engineer of Record, as appointed by the owner. Inspection forms shall be executed for each corresponding inspection.

- Perimeter Sediment Controls: Silt fence will be laid and staked into the ground in advance of construction along the perimeter of the project site in locations shown on the Erosion & Sedimentation Control Plan. Such barriers shall be inspected within 12 hours

of a storm event in excess of 0.5" and weekly. Sediment deposits must be removed when the level of deposition reaches approximately one-half the height of the barrier.

- Construction Entrance: The temporary construction entrance should be maintained in a condition that will prevent tracking or flowing of sediment into the street. This may require periodic topdressing with additional stone.

  The entrance should be inspected weekly and within 12 hours of a storm event in excess of 0.5". Mud and soil particles will eventually clog the voids in the gravel and the effectiveness of the gravel pad. When this occurs, the pad should be top dressed with new stone. Complete replacement of the pad may be necessary when the pad becomes completely clogged.

- Catch Basin Inlet Protection: Silt sacks have been proposed in all catch basins to prevent sediment from entering the municipal drainage system prior to permanent stabilization. Silt sacks should be inspected after rainstorm in excess of 0.5" and weekly. Sediment should be disposed of in a suitable area and protected from erosion by either structural or vegetative means. Catch basin inlet protection should be removed and the area repaired as soon as the contributing drainage area to the inlet has been completely stabilized.

APPENDIX F: LONG TERM POLLUTION PREVENTION PLAN

To keep the stormwater management system functioning properly, a Long-Term Pollution Prevention Plan is required. Adherence to this Long-Term Pollution Prevention Plan will be the responsibility of the following:

New England Realty Trust
611 High Street, No. 190
Dedham, Massachusetts

LONG TERM POLLUTION PREVENTION PLAN TRAINING

Annual stormwater pollution prevention plan training shall be conducted. Training records shall be kept on file.

GOOD HOUSEKEEPING PRACTICES
Employees shall be trained in the importance of not spilling fluids and chemicals such as oil, antifreeze, etc. onto the bare ground. All areas exposed to the weather shall be kept clean.

SOLID WASTE MANAGMENT
Solid waste shall be kept in the covered dumpster and collected at a minimum of once per week and disposed of in a legal manner, at a state licensed recycling center or landfill.

REQUIREMENTS FOR STORAGE AND USE OF FERTILIZERS, HERBICIDES AND PESTICIDES
Excess fertilizers shall be swept up from all impervious surfaces and not be allowed to run into the stormwater management system.

All fertilizers, herbicides and pesticides shall be kept in a wrapped or sealed container and under cover.

SNOW DISPOSAL AND PLOWING PLANS
Snow shall be plowed to the area indicated on the permitting plans. If not possible to store the snow on-site, it shall be trucked away and disposed of in the same manner described above.

WINTER ROAD SALT/ SAND USE AND STORAGE RESTRICTIONS
Road salt shall not be used on the site. Sand is an acceptable alternative.

STREET SWEEPING SCHEDULE
Street sweeping shall be performed on paved surfaces no less than four times per year.

APPENDIX G: OPERATION & MAINTENANCE PLAN

To keep the stormwater management system functioning properly and to ensure that the Total Suspended Solids (TSS) are reduced, periodic inspections and maintenance of the system is required. The operation and maintenance of all components of the proposed stormwater management system will be the responsibility of the following:

New England Realty Trust
611 High Street, No. 190
Dedham, Massachusetts

The following is a guideline of the specific maintenance schedules and tasks on a component-by-component basis that is required to keep the stormwater management system functioning properly.

DEEP SUMP CATCH BASINS

Unscheduled Maintenance: At the end of foliage and snow-removal seasons, inspect or clean the basin. Remove any branches, trash or other large debris that could interfere with the proper operation of the stormwater management system. Whenever the depth of deposits is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe in the basin, remove any accumulated sediment with clamshell buckets or vacuum trucks.

Quarterly Maintenance: Inspect or clean the basin. Remove any branches, trash or other large debris that could interfere with the proper operation of the stormwater management system. Remove any accumulated sediment with clamshell buckets or vacuum trucks.

WATER QUALITY UNITS

See attached on the following pages, the operation and maintenance requirements and owner's manual for the Stormceptor Water Quality Units.

Quarterly Annual Maintenance: Check inlets, separation screens and outlets for clogging and remove any debris that could interfere with the proper operation of the system. Remove any accumulated sediment with vacuum trucks when it reaches 75% of the capacity in the sump.

CULTEC SUBSURFACE RECHARGE CHAMBERS

The subsurface recharge chambers shall be maintained per the manufacturer's recommendations (See full O&M requirements attached on following pages).

Monthly Maintenance (first year only): Check inlets and outlets for clogging and remove any debris that could interfere with the proper operation of the system. Check for depressions in areas over and surrounding the recharge system.

Semi-Annual Maintenance (Spring and Fall): Check inlets and outlets for clogging and remove any debris that could interfere with the proper

operation of the system. Check for depressions in areas over and surrounding the recharge system.

Annual Maintenance: Confirm that no unauthorized modifications have been made to the system.

1 Year After Commissioning and Every 3rd Year Following: Clean the inlets and outlets with vacuum trucks.

2 Years After Commissioning: Inspect the interior of the chambers through inspection port for deficiencies using CCTV or comparable technique. Clean the chambers and feed connectors of any debris with vacuum trucks.

9 Years After Commissioning and every 9 Years Following: Inspect the interior of the chambers through inspection port for deficiencies using CCTV or comparable technique.

ROOF LEADER AND GUTTERS

Unscheduled Maintenance: Maintain the gutters and downspouts in clean condition free of debris so they are able to quickly drain water from the roof and the building.

PAVED AREAS

Quarterly Maintenance: Sweep, vacuum, or clean paved areas to reduce the amount of sediment entering the stormwater management system.

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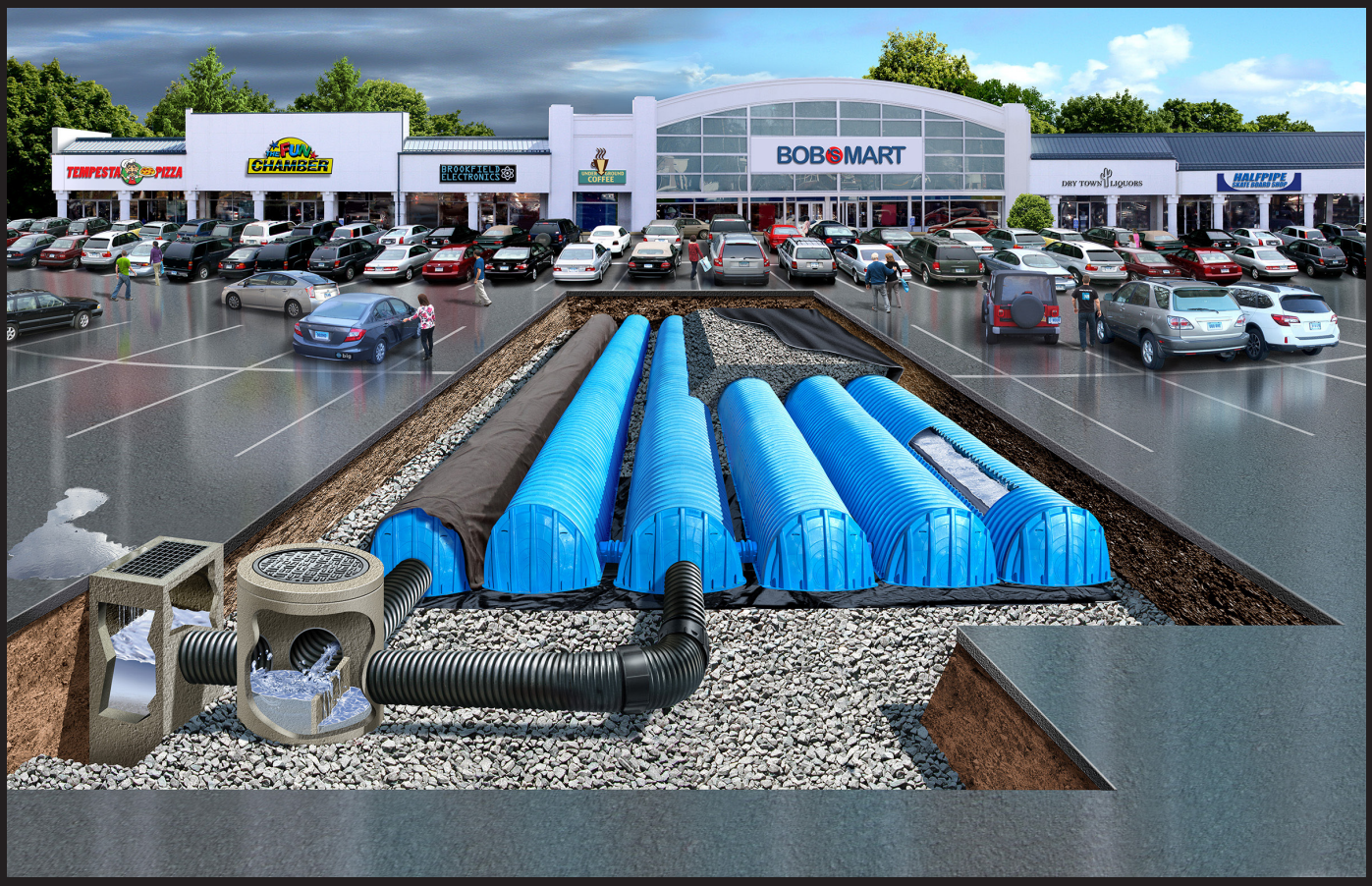

OPERATION & MAINTENANCE GUIDELINES

FOR CULTEC STORMWATER MANAGEMENT SYSTEMS

CULTEC®

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For technical support, please call (203)775-4416 ext. 203 or e-mail tech@cultec.com.

Visit www.cultec.com/downloads.html for Product Downloads and CAD details.

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January 2020

These instructions are for single-layer traffic applications only. For multi-layer applications, contact CULTEC.
All illustrations and photos shown herein are examples of typical situations. Be sure to follow the engineer's drawings.
Actual designs may vary.

This manual contains guidelines recommended by CULTEC, Inc. and may be used in conjunction with, but not to supersede, local regulations or regulatory authorities. OSHA Guidelines must be followed when inspecting or cleaning any structure.

Introduction

The CULTEC Subsurface Stormwater Management System is a high-density polyethylene (HDPE) chamber system arranged in parallel rows surrounded by washed stone. The CULTEC chambers create arch-shaped voids within the washed stone to provide stormwater detention, retention, infiltration, and reclamation. Filter fabric is placed between the native soil and stone interface to prevent the intrusion of fines into the system. In order to minimize the amount of sediment which may enter the CULTEC system, a sediment collection device (stormwater pretreatment device) is recommended upstream from the CULTEC chamber system. Examples of pretreatment devices include, but are not limited to, an appropriately sized catch basin with sump, pretreatment catchment device, oil grit separator, or baffled distribution box. Manufactured pretreatment devices may also be used in accordance with CULTEC chambers. Installation, operation, and maintenance of these devices shall be in accordance with manufacturer's recommendations. Almost all of the sediment entering the stormwater management system will be collected within the pretreatment device.

Best Management Practices allow for the maintenance of the preliminary collection systems prior to feeding the CULTEC chambers. The pretreatment structures shall be inspected for any debris that will restrict inlet flow rates. Outfall structures, if any, such as outlet control must also be inspected for any obstructions that would restrict outlet flow rates. OSHA Guidelines must be followed when inspecting or cleaning any structure.

Operation and Maintenance Requirements

I. Operation

CULTEC stormwater management systems shall be operated to receive only stormwater run-off in accordance with applicable local regulations. CULTEC subsurface stormwater management chambers operate at peak performance when installed in series with pretreatment. Pretreatment of suspended solids is superior to treatment of solids once they have been introduced into the system. The use of pretreatment is adequate as long as the structure is maintained and the site remains stable with finished impervious surfaces such as parking lots, walkways, and pervious areas are properly maintained. If there is to be an unstable condition, such as improvements to buildings or parking areas, all proper silt control measures shall be implemented according to local regulations.

II. Inspection and Maintenance Options

A. The CULTEC system may be equipped with an inspection port located on the inlet row. The inspection port is a circular cast box placed in a rectangular concrete collar. When the lid is removed, a 6-inch (150 mm) pipe with a screw-in plug will be exposed. Remove the plug. This will provide access to the CULTEC Chamber row below. From the surface, through this access, the sediment may be measured at this location. A stadia rod may be used to measure the depth of sediment if any in this row. If the depth of sediment is in excess of 3 inches (76 mm), then this row should be cleaned with high pressure water through a culvert cleaning nozzle. This would be carried out through an upstream manhole or through the CULTEC StormFilter Unit (or other pretreatment device). CCTV inspection of this row can be deployed through this access port to deter mine if any sediment has accumulated in the inlet row.

B. If the CULTEC bed is not equipped with an inspection port, then access to the inlet row will be through an upstream manhole or the CULTEC StormFilter.

1. Manhole Access
This inspection should only be carried out by persons trained in confined space entry and sewer inspection services. After the manhole cover has been removed a gas detector must be lowered into the manhole to ensure that there are not high concentrations of toxic gases present. The inspector should be lowered into the manhole with the proper safety equipment as per OSHA requirements. The inspector may be able to observe sediment from this location. If this is not possible, the inspector will need to deploy a CCTV robot to permit viewing of the sediment.

2. StormFilter Access
Remove the manhole cover to allow access to the unit. Typically a 30-inch (750 mm) pipe is used as a riser from the StormFilter to the surface. As in the case with manhole access, this access point requires a technician trained in confined space entry with proper gas detection equipment. This individual must be equipped with the proper safety equipment for entry into the StormFilter. The technician will be lowered onto the StormFilter unit. The hatch on the unit must be removed. Inside the unit are two filters which may be removed according to StormFilter maintenance guidelines. Once these filters are removed the inspector can enter the StormFilter unit to launch the CCTV camera robot.

C. The inlet row of the CULTEC system is placed on a polyethylene liner to prevent scouring of the washed stone beneath this row. This also facilitates the flushing of this row with high pressure water through a culvert cleaning nozzle. The nozzle is deployed through a manhole or the StormFilter and extended to the end of the row. The water is turned on and the inlet row is back-flushed into the manhole or StormFilter. This water is to be removed from the manhole or StormFilter using a vacuum truck.

III. Maintenance Guidelines

The following guidelines shall be adhered to for the operation and maintenance of the CULTEC stormwater management system:

A. The owner shall keep a maintenance log which shall include details of any events which would have an effect on the system's operational capacity.

B. The operation and maintenance procedure shall be reviewed periodically and changed to meet site conditions.

C. Maintenance of the stormwater management system shall be performed by qualified workers and shall follow applicable occupational health and safety requirements.

D. Debris removed from the stormwater management system shall be disposed of in accordance with applicable laws and regulations.

IV. Suggested Maintenance Schedules

A. Minor Maintenance
The following suggested schedule shall be followed for routine maintenance during the regular operation of the stormwater system:

Frequency	Action
Monthly in first year	Check inlets and outlets for clogging and remove any debris, as required.
Spring and Fall	Check inlets and outlets for clogging and remove any debris, as required.
One year after commissioning and every third year following	Check inlets and outlets for clogging and remove any debris, as required.

B. Major Maintenance
The following suggested maintenance schedule shall be followed to maintain the performance of the CULTEC stormwater management chambers. Additional work may be necessary due to insufficient performance and other issues that might be found during the inspection of the stormwater management chambers. (See table on next page)

	Frequency	Action
Inlets and Outlets	Every 3 years	• Obtain documentation that the inlets, outlets and vents have been cleaned and will function as intended.
	Spring and Fall	• Check inlet and outlets for clogging and remove any debris as required.
CULTEC Stormwater Chambers	2 years after commissioning	• Inspect the interior of the stormwater management chambers through inspection port for deficiencies using CCTV or comparable technique. • Obtain documentation that the stormwater management chambers and feed connectors will function as anticipated.
	9 years after commissioning every 9 years following	• Clean stormwater management chambers and feed connectors of any debris. • Inspect the interior of the stormwater management structures for deficiencies using CCTV or comparable technique. • Obtain documentation that the stormwater management chambers and feed connectors have been cleaned and will function as intended.
	45 years after commissioning	• Clean stormwater management chambers and feed connectors of any debris. • Determine the remaining life expectancy of the stormwater management chambers and recommended schedule and actions to rehabilitate the stormwater management chambers as required. • Inspect the interior of the stormwater management chambers for deficiencies using CCTV or comparable technique. • Replace or restore the stormwater management chambers in accordance with the schedule determined at the 45-year inspection. • Attain the appropriate approvals as required. • Establish a new operation and maintenance schedule.
Surrounding Site	Monthly in 1st year	• Check for depressions in areas over and surrounding the stormwater management system.
	Spring and Fall	• Check for depressions in areas over and surrounding the stormwater management system.
	Yearly	• Confirm that no unauthorized modifications have been performed to the site.

For additional information concerning the maintenance of CULTEC Subsurface Stormwater Management Chambers, please contact CULTEC, Inc. at 1-800-428-5832.

WQMP
Operation & Maintenance (O&M) Plan

Project Name:_____

Prepared for:

Project Name: _____

Address:_____

City, State Zip:_____

Prepared on:

Date:_____

This O&M Plan describes the designated responsible party for implementation of this WQMP, including: operation and maintenance of all the structural BMP(s), conducting the training/educational program and duties, and any other necessary activities. The O&M Plan includes detailed inspection and maintenance requirements for all structural BMPs, including copies of any maintenance contract agreements, manufacturer's maintenance requirements, permits, etc.

8.1.1 Project Information

Project name	
Address	
City, State Zip	
Site size	
List of structural BMPs, number of each	
Other notes	

8.1.2 Responsible Party

The responsible party for implementation of this WQMP is:

Name of Person or HOA Property Manager	
Address	
City, State Zip	
Phone number	
24-Hour Emergency Contact number	
Email	

8.1.3 Record Keeping

Parties responsible for the O&M plan shall retain records for at least 5 years.

All training and educational activities and BMP operation and maintenance shall be documented to verify compliance with this O&M Plan. A sample Training Log and Inspection and Maintenance Log are included in this document.

8.1.4 Electronic Data Submittal

This document along with the Site Plan and Attachments shall be provided in PDF format. AutoCAD files and/or GIS coordinates of BMPs shall also be submitted to the City.

Appendix ____

BMP SITE PLAN

Site plan is preferred on minimum 11” by 17” colored sheets, as long as legible.

BMP OPERATION & MAINTENANCE LOG

Project Name: _____

Today's Date: _____

Name of Person Performing Activity (Printed): _____

Signature: _____

BMP Name (As Shown in O&M Plan)	Brief Description of Implementation, Maintenance, and Inspection Activity Performed

Minor Maintenance

Frequency		Action
Monthly in first year		Check inlets and outlets for clogging and remove any debris, as required.
		Notes
□ Month 1	Date:	
□ Month 2	Date:	
□ Month 3	Date:	
□ Month 4	Date	
□ Month 5	Date:	
□ Month 6	Date:	
□ Month 7	Date:	
□ Month 8	Date:	
□ Month 9	Date:	
□ Month 10	Date:	
□ Month 11	Date:	
□ Month 12	Date:	
Spring and Fall		Check inlets and outlets for clogging and remove any debris, as required.
		Notes
□ Spring	Date:	
□ Fall	Date:	
□ Spring	Date:	
□ Fall	Date:	
□ Spring	Date:	
□ Fall	Date:	
□ Spring	Date:	
□ Fall	Date:	
□ Spring	Date:	
□ Fall	Date:	
□ Spring	Date:	
□ Fall	Date:	
One year after commissioning and every third year following		Check inlets and outlets for clogging and remove any debris, as required.
		Notes
□ Year 1	Date:	
□ Year 4	Date:	
□ Year 7	Date:	
□ Year 10	Date:	
□ Year 13	Date:	
□ Year 16	Date:	
□ Year 19	Date:	
□ Year 22	Date:	

Major Maintenance

	Frequency		Action
Inlets and Outlets	**Every 3 years**		Obtain documentation that the inlets, outlets and vents have been cleaned and will function as intended.
			Notes
	□ Year 1	Date:	
	□ Year 4	Date:	
	□ Year 7	Date:	
	□ Year 10	Date:	
	□ Year 13	Date:	
	□ Year 16	Date:	
	□ Year 19	Date:	
	□ Year 22	Date:	
	Spring and Fall		Check inlet and outlets for clogging and remove any debris, as required.
			Notes
	□ Spring	Date:	
	□ Fall	Date:	
	□ Spring	Date:	
	□ Fall	Date:	
	□ Spring	Date:	
	□ Fall	Date:	
	□ Spring	Date:	
	□ Fall	Date:	
	□ Spring	Date:	
	□ Fall	Date:	
	□ Spring	Date:	
	□ Fall	Date:	
CULTEC Stormwater Chambers	**2 years after commissioning**		□ Inspect the interior of the stormwater management chambers through inspection port for deficiencies using CCTV or comparable technique. □ Obtain documentation that the stormwater management chambers and feed connectors will function as anticipated.
			Notes
	□ Year 2	Date:	

Major Maintenance

	Frequency		Action
CULTEC Stormwater Chambers	**9 years after commissioning every 9 years following**		□ Clean stormwater management chambers and feed connectors of any debris. □ Inspect the interior of the stormwater management structures for deficiencies using CCTV or comparable technique. □ Obtain documentation that the stormwater management chambers and feed connectors have been cleaned and will function as intended.
			Notes
	□ Year 9	Date:	
	□ Year 18	Date:	
	□ Year 27	Date:	
	□ Year 36	Date:	
	45 years after commissioning		□ Clean stormwater management chambers and feed connectors of any debris. □ Determine the remaining life expectancy of the stormwater management chambers and recommended schedule and actions to rehabilitate the stormwater management chambers as required. □ Inspect the interior of the stormwater management chambers for deficiencies using CCTV or comparable technique. □ Replace or restore the stormwater management chambers in accordance with the schedule determined at the 45-year inspection. □ Attain the appropriate approvals as required. □ Establish a new operation and maintenance schedule.
			Notes
	□ Year 45	Date:	

Major Maintenance

	Frequency		Action
Surrounding Site	**Monthly in 1st year**		□ Check for depressions in areas over and surrounding the stormwater management system.
			Notes
	□ Month 1	Date:	
	□ Month 2	Date:	
	□ Month 3	Date:	
	□ Month 4	Date:	
	□ Month 5	Date:	
	□ Month 6	Date:	
	□ Month 7	Date:	
	□ Month 8	Date:	
	□ Month 9	Date:	
	□ Month 10	Date:	
	□ Month 11	Date:	
	□ Month 12	Date:	
	Spring and Fall		□ Check for depressions in areas over and surrounding the stormwater management system.
			Notes
	□ Spring	Date:	
	□ Fall	Date:	
	□ Spring	Date:	
	□ Fall	Date:	
	□ Spring	Date:	
	□ Fall	Date:	
	□ Spring	Date:	
	□ Fall	Date:	
	□ Spring	Date:	
	□ Fall	Date:	
	□ Spring	Date:	
	□ Fall	Date:	
	Yearly		□ Confirm that no unauthorized modifications have been performed to the site.
			Notes
	□ Year 1	Date:	
	□ Year 2	Date:	
	□ Year 3	Date:	
	□ Year 4	Date:	
	□ Year 5	Date:	
	□ Year 6	Date:	
	□ Year 7	Date:	

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RETENTION • DETENTION • INFILTRATION • WATER QUALITY

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CDS® Inspection and Maintenance Guide – New Jersey

CDS TECHNOLOGIES

Maintenance

The CDS system should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on site activities than the size of the unit. For example, unstable soils or heavy winter sanding will cause the grit chamber to fill more quickly but regular sweeping of paved surfaces will slow accumulation.

Inspection

Inspection is the key to effective maintenance and is easily performed. Pollutant transport and deposition may vary from year to year and regular inspections will help ensure that the system is cleaned out at the appropriate time. At a minimum, inspections should be performed twice per year (e.g. spring and fall) however more frequent inspections may be necessary in climates where winter sanding operations may lead to rapid accumulations, or in equipment washdown areas. Installations should also be inspected more frequently where excessive amounts of trash are expected.

The visual inspection should ascertain that the system components are in working order and that there are no blockages or obstructions in the inlet and separation screen. The inspection should also quantify the accumulation of hydrocarbons, trash, and sediment in the system. Measuring pollutant accumulation can be done with a calibrated dipstick, tape measure or other measuring instrument. If absorbent material is used for enhanced removal of hydrocarbons, the level of discoloration of the sorbent material should also be identified during inspection. It is useful and often required as part of an operating permit to keep a record of each inspection. A simple form for doing so is provided.

Access to the CDS unit is typically achieved through two manhole access covers. One opening allows for inspection and cleanout of the separation chamber (cylinder and screen) and isolated sump. The other allows for inspection and cleanout of sediment captured and retained outside the screen. For deep units, a single manhole access point allows both sump cleanout and access outside the screen.

The CDS system should be cleaned when the level of sediment has reached 75% of capacity in the isolated sump or when an appreciable level of hydrocarbons and trash has accumulated. If absorbent material is used, it should be replaced when significant discoloration has occurred. Performance will not be impacted until 100% of the sump capacity is exceeded however it is recommended that the system be cleaned prior to that for easier removal of sediment. The level of sediment is easily determined by measuring from finished grade down to the top of the sediment pile. To avoid underestimating the level of sediment in the chamber, the measuring device must be lowered to the top of the sediment pile carefully. Particles at the top of the pile typically offer less resistance to the end of the rod than consolidated particles toward the bottom of the pile. Once this measurement is recorded, it should be compared to the as-built drawing for the unit to determine weather the height of the sediment pile off the bottom of the sump floor exceeds 75% of the total height of isolated sump. Refer to Table 1 for depth from water surface to top of sediment pile for each model size indicating that maintenance is required.

Cleaning

Cleaning of a CDS systems should be done during dry weather conditions when no flow is entering the system. The use of a vacuum truck is generally the most effective and convenient method of removing pollutants from the system. Simply remove the manhole covers and insert the vacuum hose into the sump. The system should be completely drained down and the sump fully evacuated of sediment. The area outside the screen should also be cleaned out if pollutant build-up exists in this area.

In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, the system should be cleaned out immediately in the event of an oil or gasoline spill should be cleaned out immediately. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use absorbent pads since they are usually less expensive to dispose than the oil/water emulsion that may be created by vacuuming the oily layer. Trash and debris can be netted out to separate it from the other pollutants. The screen should be power washed to ensure it is free of trash and debris.

Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and also to ensure that proper safety precautions have been followed. Confined space entry procedures need to be followed if physical access is required. Disposal of all material removed from the CDS system should be done in accordance with local regulations. In many jurisdictions, disposal of the sediments may be handled in the same manner as the disposal of sediments removed from catch basins or deep sump manholes.

CDS Model	Diameter		Distance from Water Surface to Top of Sediment Pile[1]		Sediment Storage Capacity	
	ft	m	ft	m	yd^3	m^3
CDS-4	4	1.2	3.0	0.9	0.9	0.7
CDS-5	5	1.5	3.7	1.1	1.5	1.1
CDS-6	6	1.8	4.7	1.4	2.1	1.6
CDS-8	8	2.4	5.8	1.8	3.7	2.8
CDS-10	10	3.0	7.4	2.3	5.8	4.4
CDS-12	12	3.4	8.0	2.4	8.4	6.4

Table 1: CDS Maintenance Indicators and Sediment Storage Capacities

[1] Distances from water surface to top of sediment pile are based on 75% of sump capacity being occupied.

Support

- Drawings and specifications are available at www.contechstormwater.com.
- Site-specific design support is available from our engineers.

Contech Engineered Solutions LLC provides site solutions for the civil engineering industry. Contech's portfolio includes bridges, drainage, sanitary sewer, stormwater, earth stabilization and wastewater treament products. For information, visit www.ContechES.com or call 800.338.1122

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CDS Inspection & Maintenance Log

CDS Model: _____ Location: _____

Date	Water depth to sediment[1]	Floatable Layer Thickness[2]	Describe Maintenance Performed	Maintenance Personnel	Comments

1. The water depth to sediment is determined by taking two measurements with a stadia rod: one measurement from the manhole opening to the top of the sediment pile and the other from the manhole opening to the water surface. If the difference between these measurements is less than the values listed in table 1 the system should be cleaned out. **Note: to avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile.**

2. For optimum performance, the system should be cleaned out when the floating hydrocarbon layer accumulates to an appreciable thickness. In the event of an oil spill, the system should be cleaned immediately.

APPENDIX H: ILLICIT DISCHARGE COMPLIANCE STATEMENT

An illicit discharge is any discharge to a municipal separate storm sewer that is not comprised entirely of stormwater, discharges from fire-fighting activities, and certain non-designated non-stormwater discharges.

To the best of my knowledge, no detectable illicit discharges exist on-site. The site plans included with this report detail the stormwater management system that manages stormwater on the site and demonstrate that the system does not include the entry of an illicit discharge. As the owner, I will ultimately be responsible for implementing the Long-Term Pollution Prevention Plan which includes measures to prevent illicit discharges.

Signature: Carl V. Dahlgren (Jan 23, 2022 22:57 EST)

Owner