DRAINAGE REPORT

KING STREET COMMONS
MIXED-USE SUBDIVISION

ASSESSORS MAP U08, LOT 10-0
550 KING STREET
LITTLETON, MASSACHUSETTS

Prepared for:

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

Checklist for Stormwater Report

A. Introduction

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

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

The Stormwater Report must include:

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

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

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

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

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

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

Massachusetts Department of Environmental Protection
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Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature

Signature and Date

Checklist

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

☐ New development

☒ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

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

☒ No disturbance to any Wetland Resource Areas

☒ Site Design Practices (e.g. clustered development, reduced frontage setbacks)

☐ Reduced Impervious Area (Redevelopment Only)

☐ Minimizing disturbance to existing trees and shrubs

☐ LID Site Design Credit Requested:

- ☐ Credit 1
- ☐ Credit 2
- ☐ Credit 3

☐ Use of "country drainage" versus curb and gutter conveyance and pipe

☒ Bioretention Cells (includes Rain Gardens)

☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)

☐ Treebox Filter

☐ Water Quality Swale

☐ Grass Channel

☐ Green Roof

☒ Other (describe): Water Quality Units

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.

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Narrative

Introduction

550 King Street, LLC, "the Applicant" is proposing a mixed-use subdivision at 550 King Street comprised of 22 lots with 780 residential units, 70,000 SF of commercial/retail space, 20,000 SF of office space, and a re-use of the existing IBM office buildings which total 480,000 SF. The project is identified on the Town of Littleton's Assessors Map U08, Lot 10-0 within the King Street Common Zoning District. The project site, "the Site", occupies a portion of the total 43.2 acreage, approximately 6.2 acres that will become a public right-of-way. The Site is situated between the intersection of King Street (southeasterly bound), Great Road (southwesterly bound), and Route 495 (northerly bound) as defined on the *Project Location Map* (Figure 1).

The Applicant is proposing to redevelop the Site by constructing a boulevard-style two lane road with 163 on-street parking spaces, utilities which will service the subdivided parcels, stormwater management infrastructure, and landscaped areas. The Preliminary Subdivision Plan has been approved by the Town of Littleton Planning Board and is seeking further review and approval from the Planning Board with the submittal of a Definitive Subdivision Plan.

This drainage study was performed in order to assess the potential impacts of the proposed improvements and to provide measures to mitigate any impacts of the project. Currently, the Site consists of paved roadway and parking areas, concrete sidewalks, and landscaped areas. Runoff from the existing Site is collected in catch basins and directed to a large man-made stormwater wetland in the west corner of the site, or to the existing storm drain system in King Street. The project will provide a stormwater management system incorporating traditional and Low Impact Design (LID) Best Management Practices (BMPs). This analysis has been prepared to verify that the project will not have an adverse effect on the stormwater conditions both on-site and off-site.

The Stormwater Management Plan has been designed to comply with all pertinent state and local standards including the Massachusetts Stormwater Handbook. The proposed project improves upon existing conditions by

reducing peak runoff rates, decreasing the risk of erosion and sedimentation, and improving stormwater runoff quality by removing total suspended solids (TSS).

Existing Conditions

The existing Site is approximately 6.2 acres consisting of 52.7% impervious paved site driveways, parking areas, sidewalks, and 47.3% pervious landscaped islands and vegetated areas. Site topography generally grades away from the middle of the site, where runoff is conveyed via catch basins and drainage pipe networks to an existing stormwater basin at the northwest corner of the site. The elevation on site ranges from approximately 301 feet in the center of the Site, to 257 feet at the west corner of the site and 281 feet at the east corner. The Site has two major 2:1 sloping hills, one in the center of the Site and one at the northwest corner of the Site. Another gently sloping hill exists at the west corner of the Site. The remainder of the Site is gently sloping.

The site is comprised of a variety of soil groups according to the Natural Resources Conservation Service Web Soil Survey (NRCS), which includes Paxton-Urban land complex, Udorthents-urban land complex, Woodbridge fine sandy loam, Merrimac-Urban land complex, Scarboro mucky fine sandy loam, and Canton fine sandy loam, which span from hydraulic soil groups A to D. Please refer to Figure 2 to review the NRCS Soil Map which depicts the various soils present at and around the Site.

According to the FEMA Flood Insurance Rate Maps (FIRM), map number 25017C0236F, dated July 7, 2014, the project is located within an area of minimal flood hazard, denoted Zone X. Please see attached FEMA National Flood Hazard Layer FIRMette.

Proposed Conditions

The proposed Site will consist of boulevard-style two lane road with 163 on-street parking spaces, utilities which will service the subdivided parcels, stormwater management infrastructure, and landscaped areas. The proposed conditions will have 64% impervious area consisting of paved roadway and parking areas, curbing, cement concrete sidewalks, and retaining wall, and 36% pervious landscaped areas. The proposed stormwater management system has been designed in accordance with the Massachusetts Stormwater Handbook and includes traditional and LID BMPs. The proposed stormwater treatment system includes traditional deep sump and hooded catch basins, a rain garden, and water quality units for the reduction of the peak runoff and removal of TSS in post-construction conditions.

Methodology

The Stormwater Management Plan, which will be implemented as part of this project, will provide adequate collection, management, and treatment of the stormwater runoff. The proposed stormwater management system will comply with the standards set forth in the Massachusetts Stormwater Handbook.

Existing and proposed hydrologic conditions were analyzed using HydroCAD, an SCS TR-20 based program, to calculate existing and proposed peak discharge rates. This method takes into account existing and proposed pervious and impervious areas including soil types and hydrologic classifications. Peak rainfall data was collected for the Site from the NRCS rainfall data. The 2-, 10-, 25-, 50- and 100-year, 24-hour storm frequencies were used in the analysis in accordance with the Massachusetts Department of Environmental Protection (MassDEP) and City of Haverhill requirements. The "Regulatory Compliance" portion of this report addresses the ten MassDEP Stormwater Standards listed in the Massachusetts Stormwater Handbook.

Pre-Development Runoff

In the Site's current condition, there are six existing subcatchment areas. The *Pre-Development Drainage Areas* are depicted in Figure D-1 of this report. This figure presents the delineation of the existing catchment areas and design points DP-1 and DP-2.

Existing Subcatchment Area 1 (EX-1) consists of 15,199 SF of pervious area consisting of landscaped and vegetated areas. Stormwater runoff from EX-1 either infiltrates into the ground or sheet flows into the existing stormwater pond, Design Point #1 (DP-1).

Existing Subcatchment Area 2 (EX-2) consists of 9,254 SF of impervious area consisting of paved roadway, and 8,650 SF of pervious area consisting of landscaped areas. Stormwater runoff from EX-2 either infiltrates into the ground or is captured in catch basins and outletted into the landscaped area which abuts the existing stormwater pond, Design Point #1 (DP-1).

Existing Subcatchment Area 3 (EX-3) consists of 34,503 SF of impervious area consisting of paved roadway and parking areas, and 34,678 SF of pervious area consisting of landscaped islands and areas. Stormwater runoff from EX-3 either infiltrates into the ground or is captured in catch basins and routed to the existing stormwater pond, Design Point #1 (DP-1).

Existing Subcatchment Area 4 (EX-4) consists of 40,692 SF of impervious area consisting of paved parking areas, and 9,291 SF of pervious area

consisting of landscaped islands. Stormwater runoff from EX-4 is captured in catch basins and routed to the existing stormwater pond, Design Point #1 (DP-1).

Existing Subcatchment Area 5 (EX-5) consists of 53,177 SF of impervious area consisting of paved roadway and parking areas, cement concrete sidewalks, and 46,426 SF of pervious area consisting of landscaped islands and areas. Stormwater runoff from EX-5 either infiltrates into the ground or is captured in catch basins and routed to the existing stormwater pond, Design Point #1 (DP-1).

Existing Subcatchment Area 6 (EX-6) consists of 4,523 SF of impervious area consisting of paved roadway, and 13,450 SF of pervious area consisting of landscaped or wooded areas. Stormwater runoff from EX-6 either infiltrates into the ground or is captured in catch basins and routed to the closed drainage system which runs along King Street, Design Point #2 (DP-2).

Post-Development Runoff

The proposed stormwater management system is designed to mitigate the effects of the proposed development by reducing the peak runoff rates compared to the existing conditions. In the Site's proposed conditions, there are 12 subcatchment areas directed to the existing stormwater pond, Design Point #1 (DP-1). The proposed conditions eliminate the need to outlet into the closed drainage system which runs along King Street, Design Point #2 (DP-2). The post-development subcatchment areas are identified in Figure D-2, *Post-Development Drainage Areas.*

Proposed Subcatchment Area 1 (PR-1) is comprised of 11,288 SF of impervious area consisting of paved roadway and cement concrete sidewalks, and 22,955 SF of pervious area consisting of landscaped areas. Stormwater runoff from PR-1 either infiltrates into the ground or is captured in catch basins and routed to a proposed rain garden where stormwater either infiltrates into the ground or flows into the existing stormwater pond, Design Point #1 (DP-1).

Proposed Subcatchment Area 2 (PR-2) is comprised of 13,316 SF of impervious area consisting of paved roadway, parking areas, and cement concrete sidewalks, and 6,625 SF of pervious area consisting of landscaped islands and areas. Stormwater runoff from PR-2 either infiltrates into the ground or is captured in catch basins and routed to the existing stormwater pond, Design Point #1 (DP-1).

Proposed Subcatchment Area 3 (PR-3) is comprised of 16,698 SF of impervious area consisting of paved roadway, parking areas, and cement concrete sidewalks, and 7,939 SF of pervious area consisting of landscaped islands and areas. Stormwater runoff from PR-3 either infiltrates into the

ground or is captured in catch basins and routed to the existing stormwater pond, Design Point #1 (DP-1).

Proposed Subcatchment Area 4 (PR-4) is comprised of 26,448 SF of impervious area consisting of paved roadway, parking areas, and cement concrete sidewalks, and 23,524 SF of pervious area consisting of landscaped islands and areas. Stormwater runoff from PR-4 either infiltrates into the ground or is captured in catch basins and routed to the existing stormwater pond, Design Point #1 (DP-1).

Proposed Subcatchment Area 5 (PR-5) is comprised of 14,464 SF of impervious area consisting of paved roadway, parking areas, and cement concrete sidewalks, and 7,212 SF of pervious area consisting of landscaped islands and areas. Stormwater runoff from PR-5 either infiltrates into the ground or is captured in catch basins and routed to the existing stormwater pond, Design Point #1 (DP-1).

Proposed Subcatchment Area 6 (PR-6) is comprised of 14,972 SF of impervious area consisting of paved roadway, parking areas, and cement concrete sidewalks, and 2,035 SF of pervious area consisting of landscaped islands and areas. Stormwater runoff from PR-6 either infiltrates into the ground or is captured in catch basins and routed to the existing stormwater pond, Design Point #1 (DP-1).

Proposed Subcatchment Area 7 (PR-7) is comprised of 6,148 SF of impervious area consisting of paved roadway and cement concrete sidewalks, and 4,312 SF of pervious area consisting of landscaped islands and areas. Stormwater runoff from PR-7 either infiltrates into the ground or is captured in catch basins and routed to the existing stormwater pond, Design Point #1 (DP-1).

Proposed Subcatchment Area 8 (PR-8) is comprised of 7,376 SF of impervious area consisting of paved roadway and cement concrete sidewalks, and 4,226 SF of pervious area consisting of landscaped islands and areas. Stormwater runoff from PR-8 either infiltrates into the ground or is captured in catch basins and routed to the existing stormwater pond, Design Point #1 (DP-1).

Proposed Subcatchment Area 9 (PR-9) is comprised of 13,310 SF of impervious area consisting of paved roadway, parking areas, and cement concrete sidewalks, and 2,202 SF of pervious area consisting of landscaped islands and areas. Stormwater runoff from PR-9 either infiltrates into the ground or is captured in catch basins and routed to the existing stormwater pond, Design Point #1 (DP-1).

Proposed Subcatchment Area 10 (PR-10) is comprised of 23,218 SF of impervious area consisting of paved roadway, parking areas, and cement concrete sidewalks, and 7,598 SF of pervious area consisting of landscaped

islands and areas. Stormwater runoff from PR-10 either infiltrates into the ground or is captured in catch basins and routed to the existing stormwater pond, Design Point #1 (DP-1).

Proposed Subcatchment Area 11 (PR-11) is comprised of 12,531 SF of impervious area consisting of paved roadway, parking areas, and cement concrete sidewalks, and 2,352 SF of pervious area consisting of landscaped islands and areas. Stormwater runoff from PR-11 either infiltrates into the ground or is captured in catch basins and routed to the existing stormwater pond, Design Point #1 (DP-1).

Proposed Subcatchment Area 12 (PR-12) is comprised of 12,855 SF of impervious area consisting of paved roadway, parking areas, and cement concrete sidewalks, and 6,339SF of pervious area consisting of landscaped islands and areas. Stormwater runoff from PR-12 either infiltrates into the ground or is captured in catch basins and routed to the existing stormwater pond, Design Point #1 (DP-1).

Regulatory Compliance

The project is considered a redevelopment project with approximately 35,475 SF of new development. The Site's stormwater management design will improve upon existing conditions, and meet the Massachusetts Stormwater Management Standards 2, 3, 4, 5, and 6 only to the maximum extent practicable, and fully meet Standards 1, 7, 8, 9, and 10.

Standard 1: No New Untreated Discharges

No new untreated discharges are proposed or will be permitted as part of this development. The proposed conditions will discharge to the existing stormwater pond. Erosion will be prevented by the construction of a rip-rap apron at the outlet in accordance with the Federal Highway Administration (FHWA) and the Natural Resource Conservation Service (NRCS) design methods. See Appendix B for apron sizing calculations. The proposed conditions will greatly improve upon the erosion control at the outfall location.

Standard 2: Peak Rate Attenuation

The proposed project meets Standard 2. The project will increase impervious area by 35,475 SF. The post-development peak flow is mitigated by the proposed rain garden and the existing stormwater pond. Peak discharges were calculated using HydroCAD, a TR-20 program. With the exception of the 2-year storm event for Design Point #1 (DP-1), the post-development peak discharge rates to not exceed pre-development peak discharge rates for all other storm events. Please see Appendix A for the full hydrologic calculations.

Table 1 (Peak Flow Summary)

	2-Year Storm		10-Year Storm		25-Year Storm		50-Year Storm		100-Year Storm	
Design Point	Exist (cfs)	Prop (cfs)	Exist (cfs)	Prop (cfs)	Exist (cfs)	Prop (cfs)	Exist (cfs)	Prop (cfs)	Exist (cfs)	Prop (cfs)
DP-1	12.75	12.93	20.65	20.64	26.80	26.63	32.59	32.14	39.59	38.75
DP-2	0.75	0.00	1.35	0.00	1.83	0.00	2.27	0.00	2.80	0.00

Standard 3: Recharge

Given that this project is considered a redevelopment project, Standard 3 must be met to the maximum extent practicable. The NRCS Soil Resource Report indicates that the site in comprised mostly of hydrologic group C/D soils. Only a small area of hydrologic group A soils are present on site, which is where the proposed rain garden is located. The size of the rain garden has been maximized within the right-of-way to increase the infiltration area. Design modifications were taken into consideration in order to reduce the required recharge volume by decreasing impervious surfaces. The required recharge volume was calculated based on the proposed increase in impervious area covering each soil type present onsite. The 35,475 SF increase in impervious area is dispersed over multiple soil groups, which include approximately 10% over group A soils (3,548 SF), 20% over group C soils (7,095 SF), and 70% over group D soils (24,833 SF). The required recharge volume was calculated to be 6,386 CF, as seen in Table 2.

Required Recharge Volume:

Rv = F x impervious area
Rv = Required Recharge Volume, expressed in Ft3, cubic yards, or acre-feet
F = Target Depth Factor associated with each Hydrologic Soil Group
Impervious Area = pavement, cement concrete sidewalk, building roof, retaining wall, and wetlands

Table 2 (Required Recharge Volume)

Hydrologic Soil Group	F	Impervious Area (SF)	Rv (CF)
A	0.60 inch	3,548	2,129
C	0.25 inch	7,095	1,774
D	0.10 inch	24,833	2,483
Total		35,475	6,386

The required recharge volume will be infiltrated to the maximum extent practicable by the proposed rain garden which infiltrates 6,180 CF of runoff, 97% of the required 6,386 CF.

Standard 4: Water Quality

Currently, there are no TSS removal BMPs onsite; runoff flows overland or directly into catch basins before being discharged to the existing stormwater pond or closed drainage system along Kind Street, or it infiltrates into the ground. The Water Quality Volume was calculated based on the proposed impervious cover. The calculated Water Quality Volume is 14,385 CF, equal to 0.33 acre-feet (AF). This water quality volume is treated by a proposed rain garden and two water quality units. The proposed rain garden holds a total WQV of 2,853 CF, treating the WQV to the maximum extent practicable. The proposed water quality units have a treatment capacity of 2.4 CFS (Table 3), treating the WQF to the maximum extent practicable. Cumulatively, the proposed rain garden and water quality units treat a greater runoff volume than the required water quality volume/flow with greater than 80% TSS removal. This project meets Standard 4 and will greatly improve the water quality of the runoff draining to the existing stormwater pond.

Water Quality Volume:

V_{WQ} = Required Water Quality Volume (in cubic feet)
D_{WQ} = Water Quality Depth: 1-inch
A_{IMP} = Impervious Area (in acres)
V_{WQ} = D_{WQ} x A_{IMP}
= [(1 inch)(172,624 SF)] x [1 FT / 12 in]
= 14,385 CF (0.33 AF)

Water Quality Flow:

Q = Required Water Quality Flow (in cfs)
CN = 98
Tc = 6 min
qu = 774 csm/in
Q = (qu)(A)(WQV)
Q = (774 csm/in)(172,624 SF)(3.587x10^-8 mi^2 / 1 SF)(1 inch) = 4.79 cfs

Table 3 (Water Quality Unit Summary)

Unit	Contributing Impervious Area (SF (AC))	Peak Water Quality Flow (CFS)	Model to Treat WQF	Treatment Capacity (CFS)	TSS Removal Provided (%)
WQU-1	235,244 (5.4)	38.75	CDS 2025-5	1.5	80.0
WQU-2	34,238 (0.78)	2.84	CDS 2015-4	0.9	80.0

Treatment train #1 treats runoff from subcatchment areas PR-2 to PR-12, which includes a LUHPPL parking lot, roadway, and sidewalks. Runoff is collected in deep-sump and hooded catch basins and routed to a water quality unit (WQU-1). Runoff is then conveyed to the existing stormwater pond. This treatment train receives 86% TSS removal credit (See Appendix B).

Treatment train #1 treats runoff from subcatchment area PR-1, which includes a LUHPPL parking lot, roadway, and sidewalks. Runoff is collected in deep-sump and hooded catch basins and routed to a water quality unit

(WQU-2). Runoff is then conveyed to the proposed rain garden. This treatment train receives 99% TSS removal credit (See Appendix B).

Standard 5: Land Uses with Higher Potential Pollutant Loads

The site includes a high-intensity use parking lot with an estimated greater than 1000 trips per day. Therefore, the site is a Land Use with a Higher Potential Pollutant Load (LUHPPL). This standard has been met by using 1 inch to calculate the required recharge volume (see Standard 3). The 44% LUHPPL TSS pre-treatment requirement prior to infiltration is exceeded (see Standard 4). Non-metal roof runoff that does not come into contact with the LUHPPL is exempt from the pre-treatment requirement.

Standard 6: Critical Areas

Stormwater will not discharge to any critical areas.

Standard 7: Redevelopment Projects

This project is considered a redevelopment project with some new development. There will be a total increase of approximately 35,475 SF of impervious area.

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

This project is covered by an NPDES Construction General Permit. The CPPP and Erosion Prevention & Sedimentation Control Plan can be found in Appendix E of this report.

Standard 9: Operation and Maintenance Plan

The roadway will be maintained by the owner as described in the O&M procedures. Standard O&M procedures will be used on the parking lot including catch basin cleaning, and inspection of drainage infrastructure. Please see the Operation & Maintenance Plan in Appendix D of this report for more detail.

Standard 10: Illicit Discharges

No illicit discharges are expected nor will be permitted as part of the redevelopment project. An Illicit Discharge Compliance Statement can be found in Appendix F of this report.

Conclusion

The proposed site redevelopment will transform the existing site into a mixed-use development offering quality residential and commercial opportunities. The project also provides a stormwater management system to mitigate the impervious area associated with the project and drastically increase the quality of runoff leaving the site. The stormwater management plan controls the flow of stormwater, reduces peak runoff rates, and provides water quality treatment. The stormwater management plan provides erosion

and sediment control resulting in cleaner stormwater runoff. The project has been designed in accordance with the Massachusetts Stormwater Handbook and will not adversely impact resource areas or abutting properties.

Figure 1 – Project Location Map
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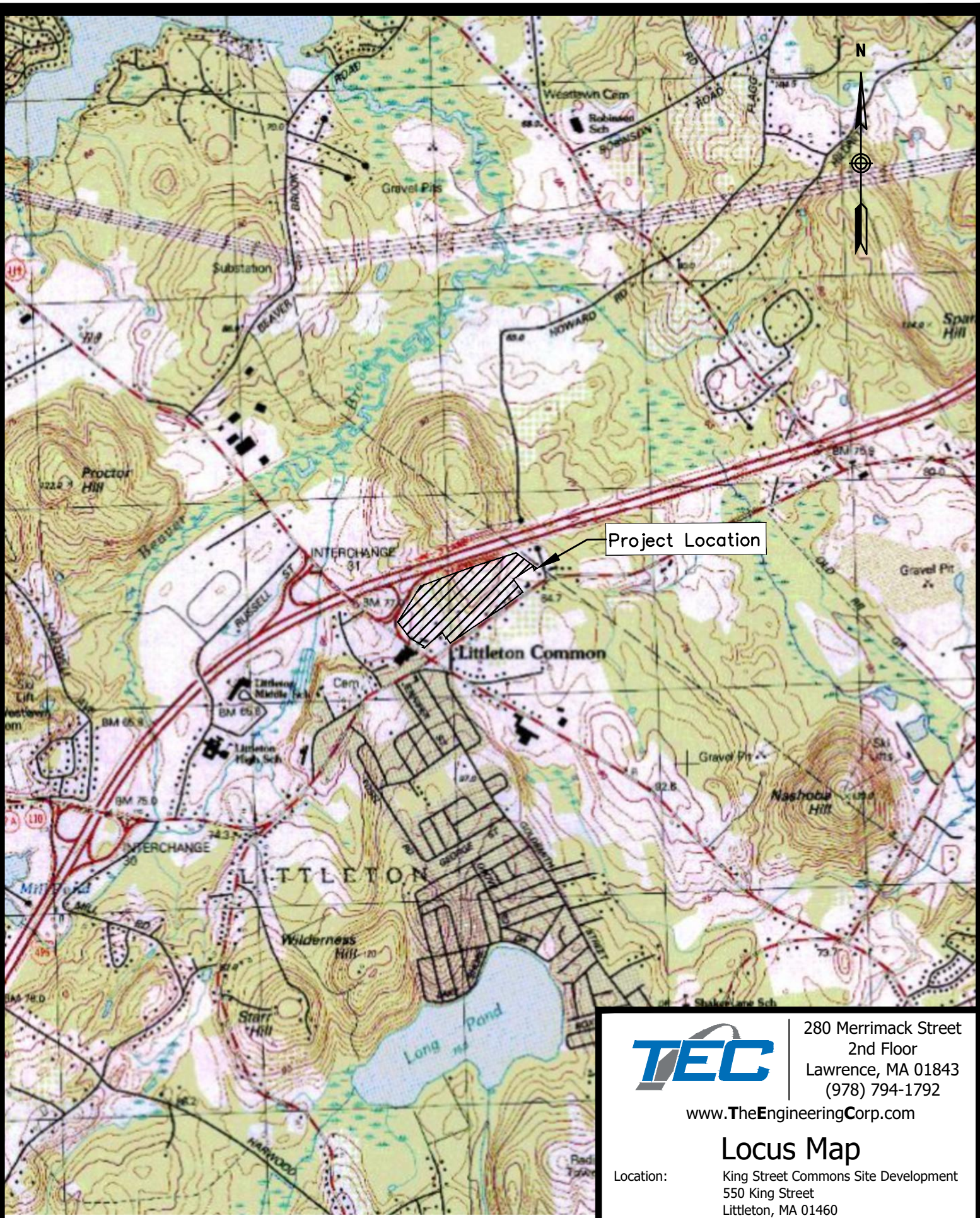

August 15, 2023

280 Merrimack Street
2nd Floor
Lawrence, MA 01843
(978) 794-1792
www.TheEngineeringCorp.com

Locus Map

Location: King Street Commons Site Development
550 King Street
Littleton, MA 01460

Prepared For: 550 King Street, LLC
290 Merrimack Street
Lawrence, MA 01843

Figure 2 – NRCS Soil Map
(Intentionally LEFT BLANK)

Custom Soil Resource Report
Soil Map

Map Scale: 1:5,620 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 50 100 200 300

Feet
0 250 500 1000 1500

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

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 22, Sep 9, 2022

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

Date(s) aerial images were photographed: May 22, 2022—Jun 5, 2022

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

Figure 3 – FEMA FIRM
(Intentionally LEFT BLANK)

National Flood Hazard Layer FIRMette

FEMA

71°28'34"W 42°33'12"N

71°27'56"W 42°32'46"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Basemap Imagery Source: USGS National Map 2023

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance / Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 8/15/2023 at 10:23 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

Figure D-1 Pre-Development Drainage Areas
(Intentionally LEFT BLANK)

EXISTING LOT COVERAGE TABLE	
PAVEMENT	138,564 SF (51.4%)
SIDEWALK	3,585 SF (1.3%)
LANDSCAPE	127,694 SF (47.3%)
TOTAL	269,843 SF

N

DP-1

EX-1

EX-2

EX-3

EX-4

EX-5

EX-6

DP-2

Pre-Development Drainage Areas

550 King Street
Littleton, Massachusetts

Scale: 1" = 60'

August 22, 2023

100 0 100 200
SCALE IN FEET

TEC
282 Merrimack Street
2nd Floor
Lawrence, MA 01843
t: (978) 794-1792
169 Ocean Boulevard
Unit 101, PO Box 249
Hampton, NH 03842
TheEngineeringCorp.com

Figure D-2 – Post Development Drainage Areas
(Intentionally LEFT BLANK)

PROPOSED LOT COVERAGE TABLE	
PAVEMENT	140,803 SF (52.2%)
SIDEWALK	31,821 SF (11.8%)
LANDSCAPE	97,219 SF (36.0%)
TOTAL	269,843 SF

DP-1

PR-1

PR-2

PR-3

PR-4

PR-5

PR-6

PR-7

PR-8

PR-9

PR-10

PR-11

PR-12

DP-2

Pre-Development Drainage Areas

550 King Street
Littleton, Massachusetts

Scale: 1" = 60'

August 22, 2023

100 0 100 200
SCALE IN FEET

TEC
282 Merrimack Street
2nd Floor
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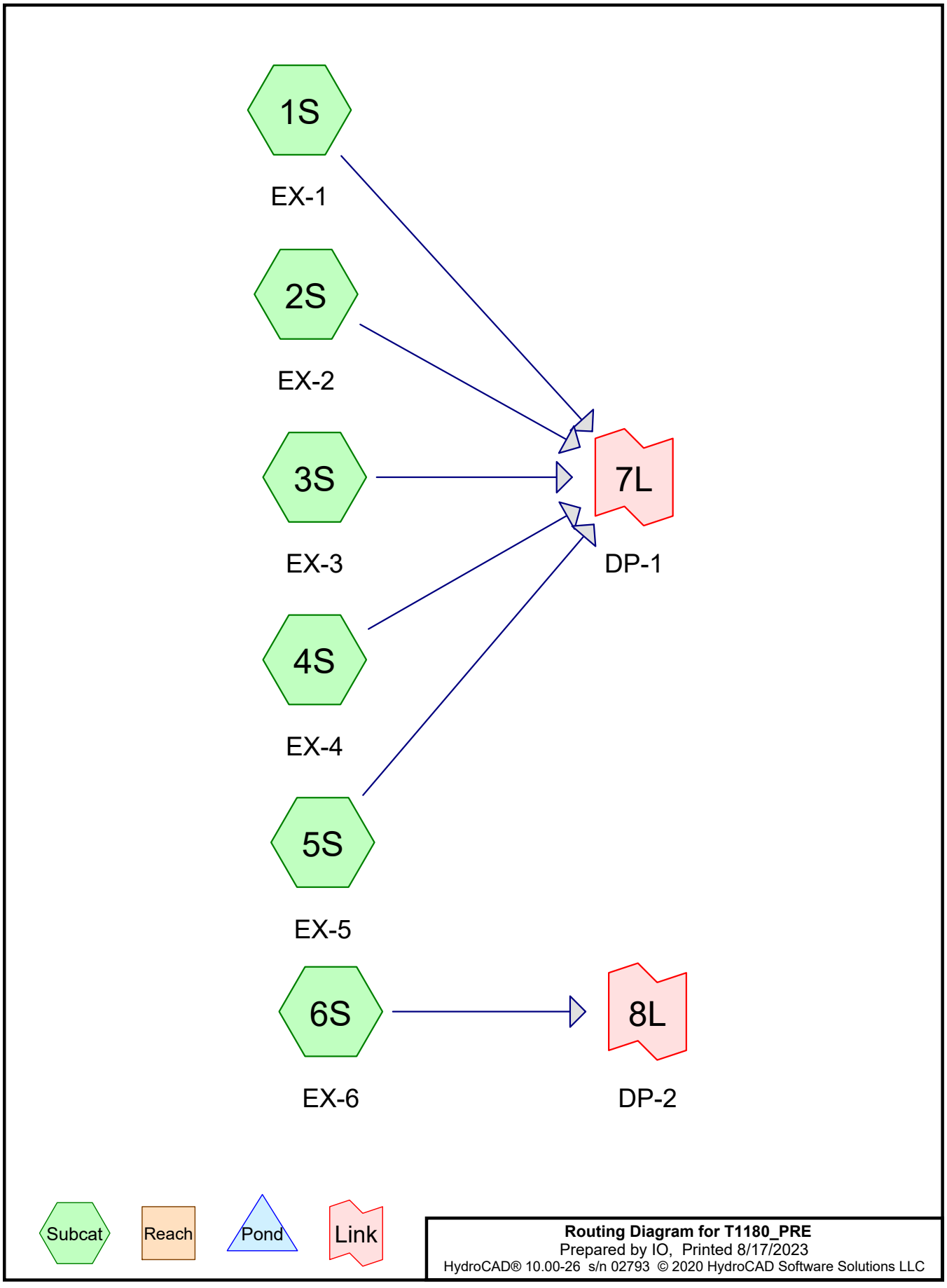
2

Appendix

A

Hydrologic Calculations



Routing Diagram for T1180_PRE
Prepared by IO, Printed 8/17/2023

Project Notes

Rainfall events imported from "NRCS-Rain.txt" for 4157 MA Littleton Middlesex County Central

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.796	79	50-75% Grass cover, Fair, HSG C (3S)
0.199	68	<50% Grass cover, Poor, HSG A (2S)
1.279	89	<50% Grass cover, Poor, HSG D (4S, 5S)
0.349	39	>75% Grass cover, Good, HSG A (1S)
0.309	80	>75% Grass cover, Good, HSG D (6S)
0.082	98	Cement Concrete Sidewalk, HSG D (5S)
0.212	98	Paved parking, HSG A (2S)
0.792	98	Paved parking, HSG C (3S)
2.176	98	Paved parking, HSG D (4S, 5S, 6S)
6.195	**89**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.760	HSG A	1S, 2S
0.000	HSG B	
1.588	HSG C	3S
3.847	HSG D	4S, 5S, 6S
0.000	Other	
6.195		**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	0.000	0.796	0.000	0.000	0.796	50-75% Grass cover, Fair	3S
0.199	0.000	0.000	1.279	0.000	1.478	<50% Grass cover, Poor	2S, 4S, 5S
0.349	0.000	0.000	0.309	0.000	0.658	>75% Grass cover, Good	1S, 6S
0.000	0.000	0.000	0.082	0.000	0.082	Cement Concrete Sidewalk	5S
0.212	0.000	0.792	2.176	0.000	3.181	Paved parking	2S, 3S, 4S, 5S, 6S
0.760	**0.000**	**1.588**	**3.847**	**0.000**	**6.195**	**TOTAL AREA**	

Time span=0.00-36.00 hrs, dt=0.04 hrs, 901 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: EX-1 Runoff Area=15,199 sf 0.00% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=39 Runoff=0.00 cfs 0.000 af

Subcatchment 2S: EX-2 Runoff Area=17,904 sf 51.69% Impervious Runoff Depth=1.59"
Tc=6.0 min CN=84 Runoff=0.71 cfs 0.054 af

Subcatchment 3S: EX-3 Runoff Area=69,181 sf 49.87% Impervious Runoff Depth=1.90"
Tc=6.0 min CN=88 Runoff=3.26 cfs 0.251 af

Subcatchment 4S: EX-4 Runoff Area=49,983 sf 81.41% Impervious Runoff Depth=2.64"
Tc=6.0 min CN=96 Runoff=3.03 cfs 0.253 af

Subcatchment 5S: EX-5 Runoff Area=99,603 sf 53.39% Impervious Runoff Depth=2.44"
Tc=6.0 min CN=94 Runoff=5.75 cfs 0.464 af

Subcatchment 6S: EX-6 Runoff Area=17,973 sf 25.17% Impervious Runoff Depth=1.66"
Tc=6.0 min CN=85 Runoff=0.75 cfs 0.057 af

Link 7L: DP-1 Inflow=12.75 cfs 1.023 af
Primary=12.75 cfs 1.023 af

Link 8L: DP-2 Inflow=0.75 cfs 0.057 af
Primary=0.75 cfs 0.057 af

Total Runoff Area = 6.195 ac Runoff Volume = 1.080 af Average Runoff Depth = 2.09"
47.32% Pervious = 2.931 ac 52.68% Impervious = 3.263 ac

Summary for Subcatchment 1S: EX-1

[45] Hint: Runoff=Zero

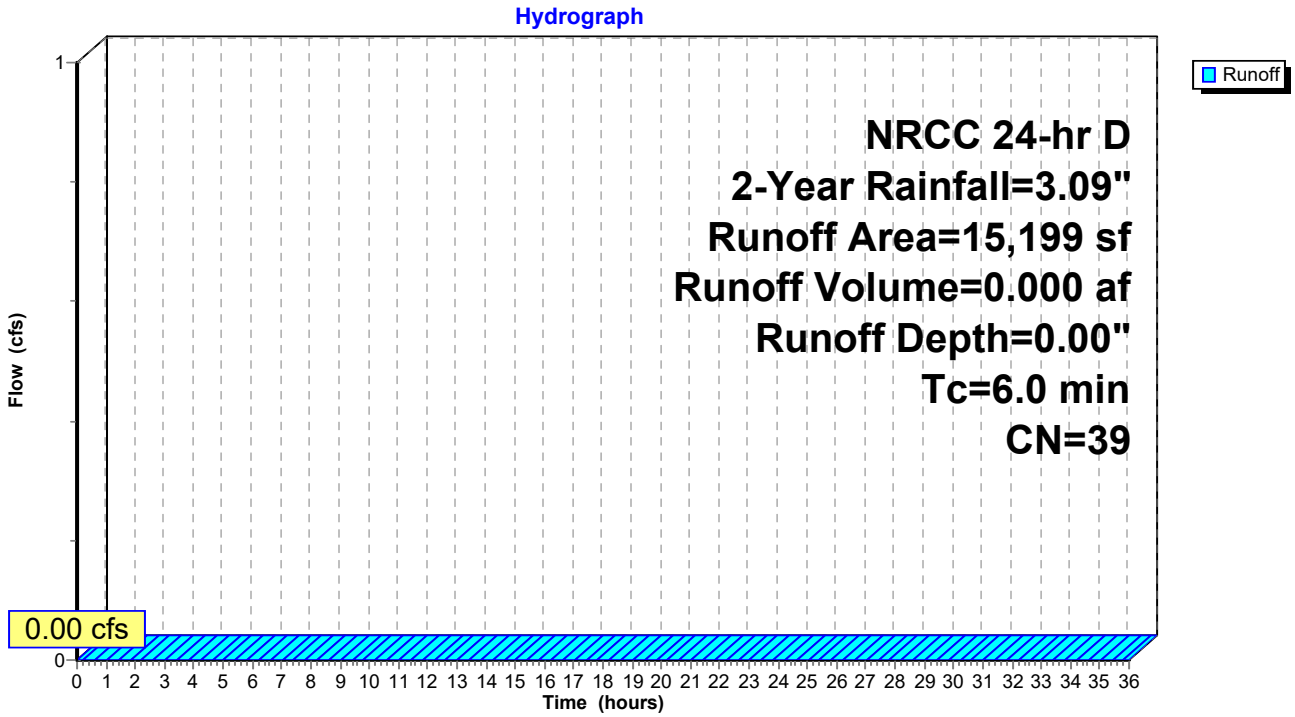
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 2-Year Rainfall=3.09"

Area (sf)	CN	Description
15,199	39	>75% Grass cover, Good, HSG A
15,199		100.00% Pervious Area

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

Subcatchment 1S: EX-1



Summary for Subcatchment 2S: EX-2

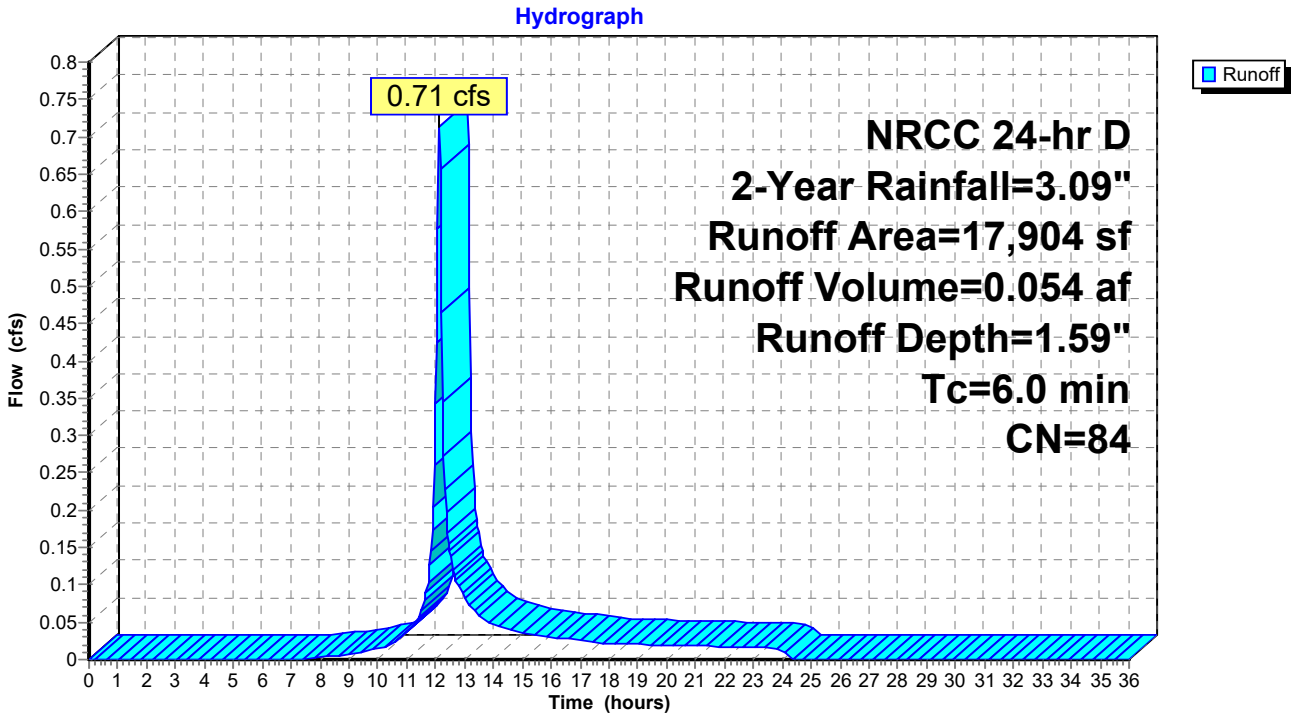
Runoff = 0.71 cfs @ 12.13 hrs, Volume= 0.054 af, Depth= 1.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 2-Year Rainfall=3.09"

Area (sf)	CN	Description
8,650	68	<50% Grass cover, Poor, HSG A
9,254	98	Paved parking, HSG A
17,904	84	Weighted Average
8,650		48.31% Pervious Area
9,254		51.69% Impervious Area

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

Subcatchment 2S: EX-2



Summary for Subcatchment 3S: EX-3

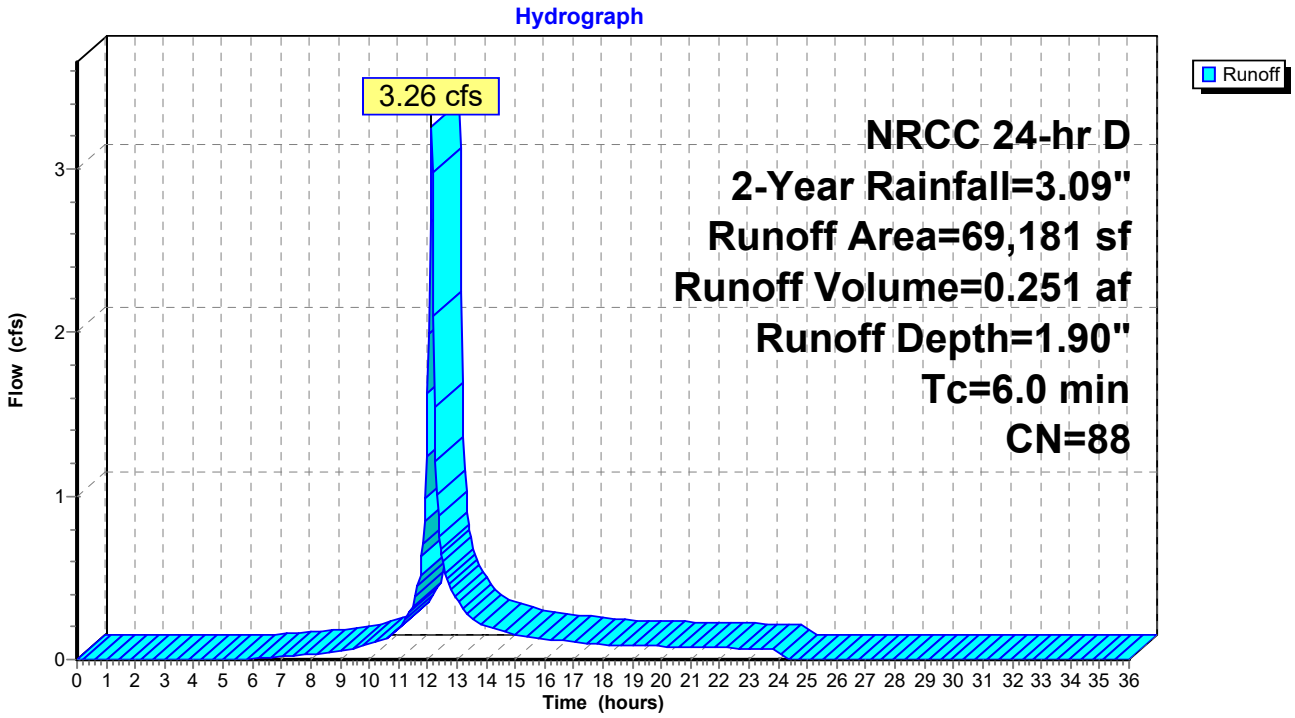
Runoff = 3.26 cfs @ 12.13 hrs, Volume= 0.251 af, Depth= 1.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 2-Year Rainfall=3.09"

Area (sf)	CN	Description
34,503	98	Paved parking, HSG C
34,678	79	50-75% Grass cover, Fair, HSG C
69,181	88	Weighted Average
34,678		50.13% Pervious Area
34,503		49.87% Impervious Area

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

Subcatchment 3S: EX-3



Summary for Subcatchment 4S: EX-4

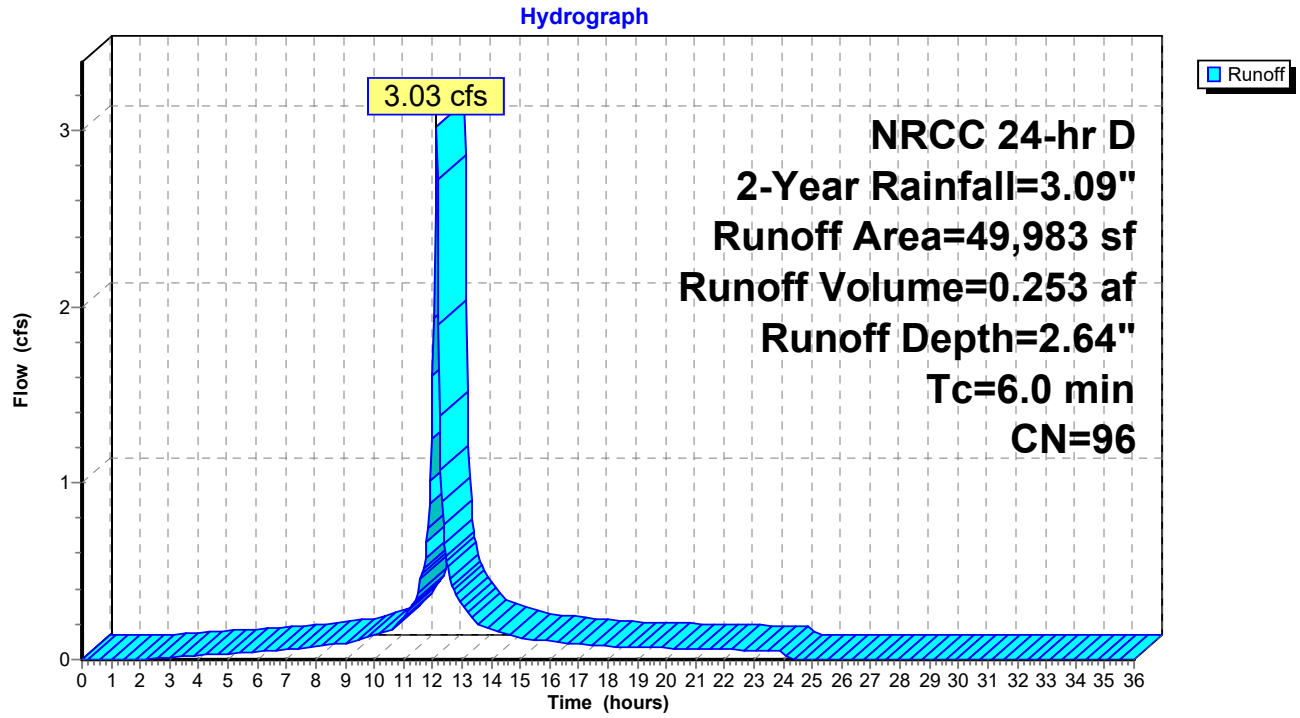
Runoff = 3.03 cfs @ 12.12 hrs, Volume= 0.253 af, Depth= 2.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 2-Year Rainfall=3.09"

Area (sf)	CN	Description
40,692	98	Paved parking, HSG D
9,291	89	<50% Grass cover, Poor, HSG D
49,983	96	Weighted Average
9,291		18.59% Pervious Area
40,692		81.41% Impervious Area

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

Subcatchment 4S: EX-4



Summary for Subcatchment 5S: EX-5

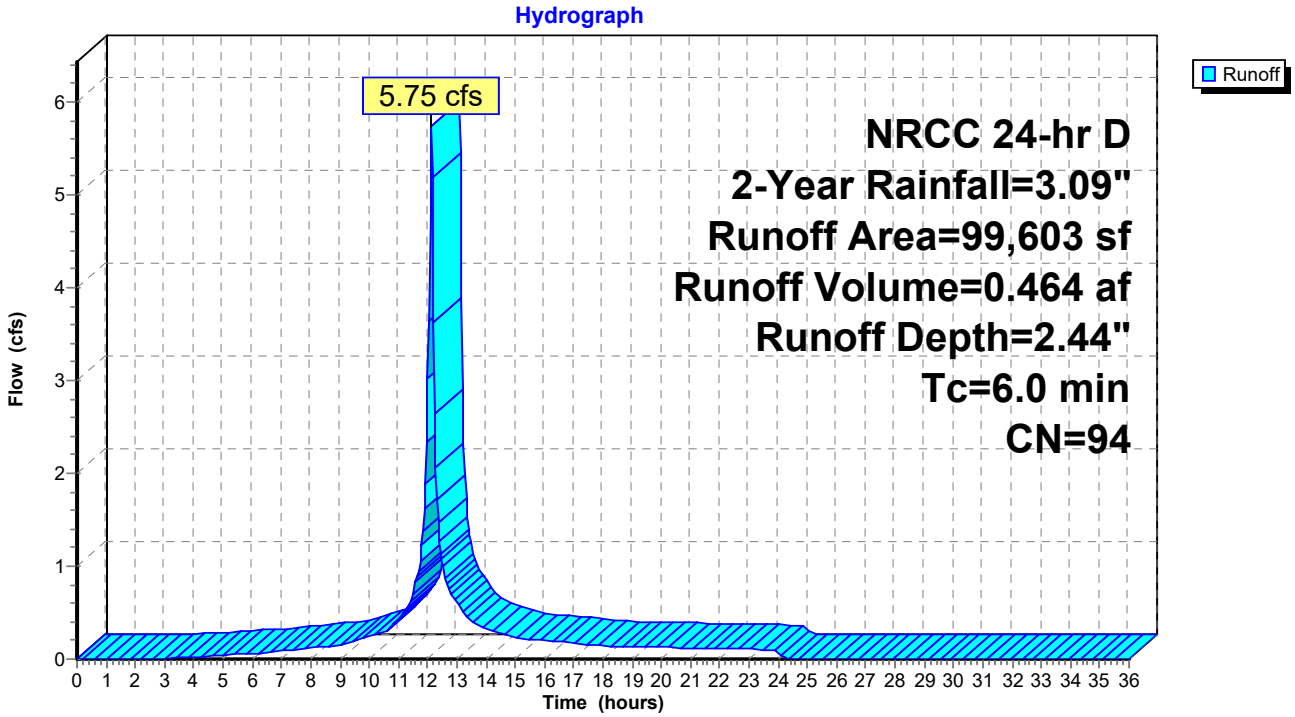
Runoff = 5.75 cfs @ 12.13 hrs, Volume= 0.464 af, Depth= 2.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 2-Year Rainfall=3.09"

	Area (sf)	CN	Description
	49,592	98	Paved parking, HSG D
*	3,585	98	Cement Concrete Sidewalk, HSG D
	46,426	89	<50% Grass cover, Poor, HSG D
	99,603	94	Weighted Average
	46,426		46.61% Pervious Area
	53,177		53.39% Impervious Area

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

Subcatchment 5S: EX-5



Summary for Subcatchment 6S: EX-6

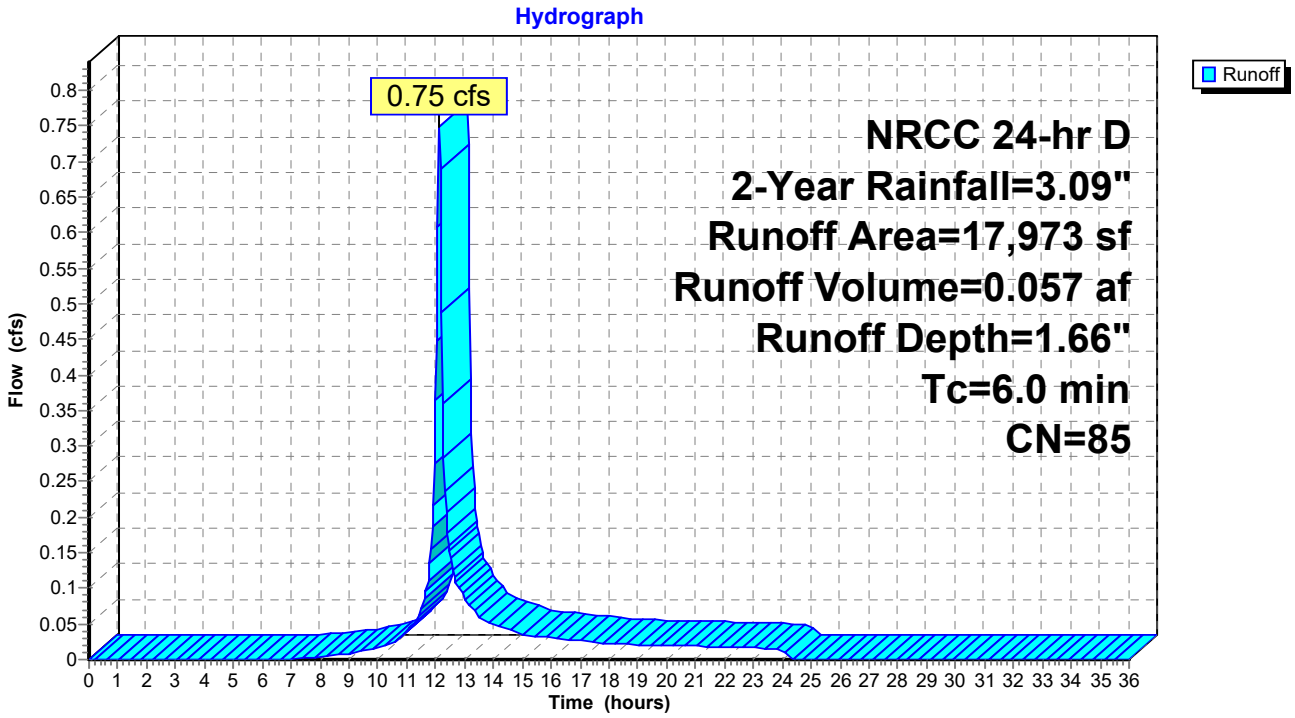
Runoff = 0.75 cfs @ 12.13 hrs, Volume= 0.057 af, Depth= 1.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 2-Year Rainfall=3.09"

Area (sf)	CN	Description
4,523	98	Paved parking, HSG D
13,450	80	>75% Grass cover, Good, HSG D
17,973	85	Weighted Average
13,450		74.83% Pervious Area
4,523		25.17% Impervious Area

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

Subcatchment 6S: EX-6

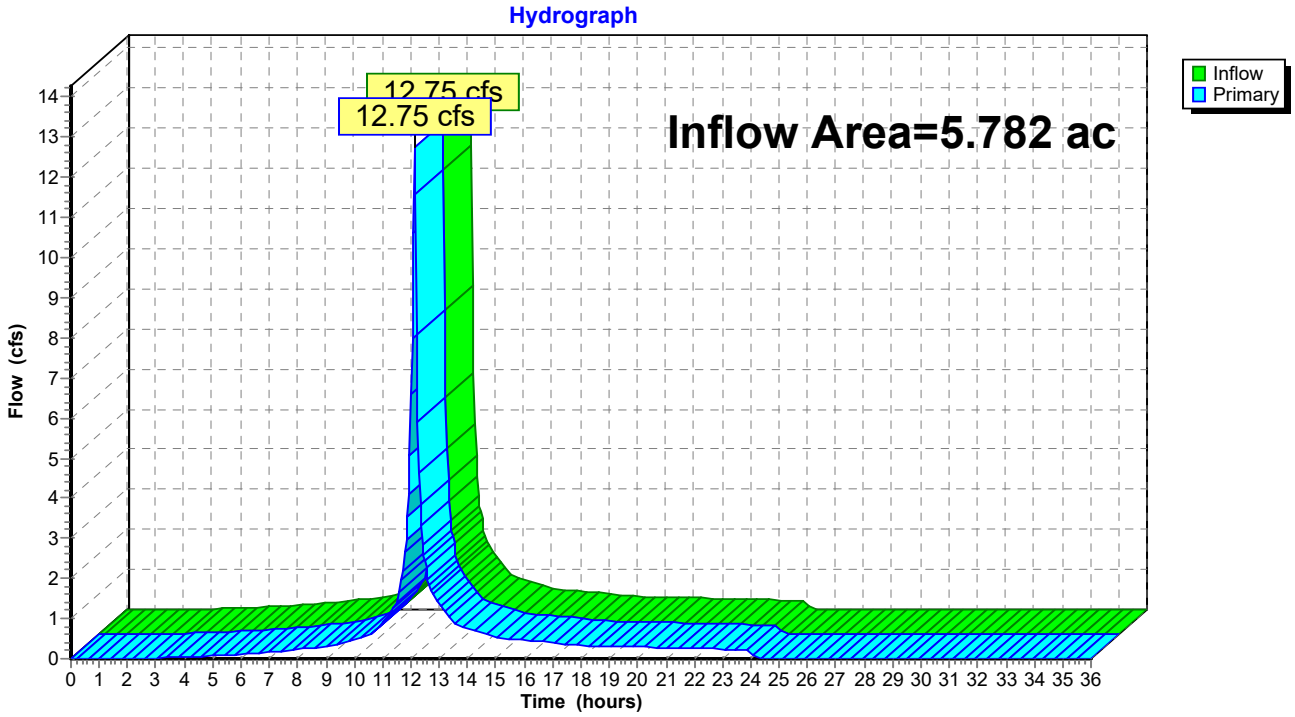


Summary for Link 7L: DP-1

Inflow Area = 5.782 ac, 54.64% Impervious, Inflow Depth = 2.12" for 2-Year event
Inflow = 12.75 cfs @ 12.13 hrs, Volume= 1.023 af
Primary = 12.75 cfs @ 12.13 hrs, Volume= 1.023 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs

Link 7L: DP-1

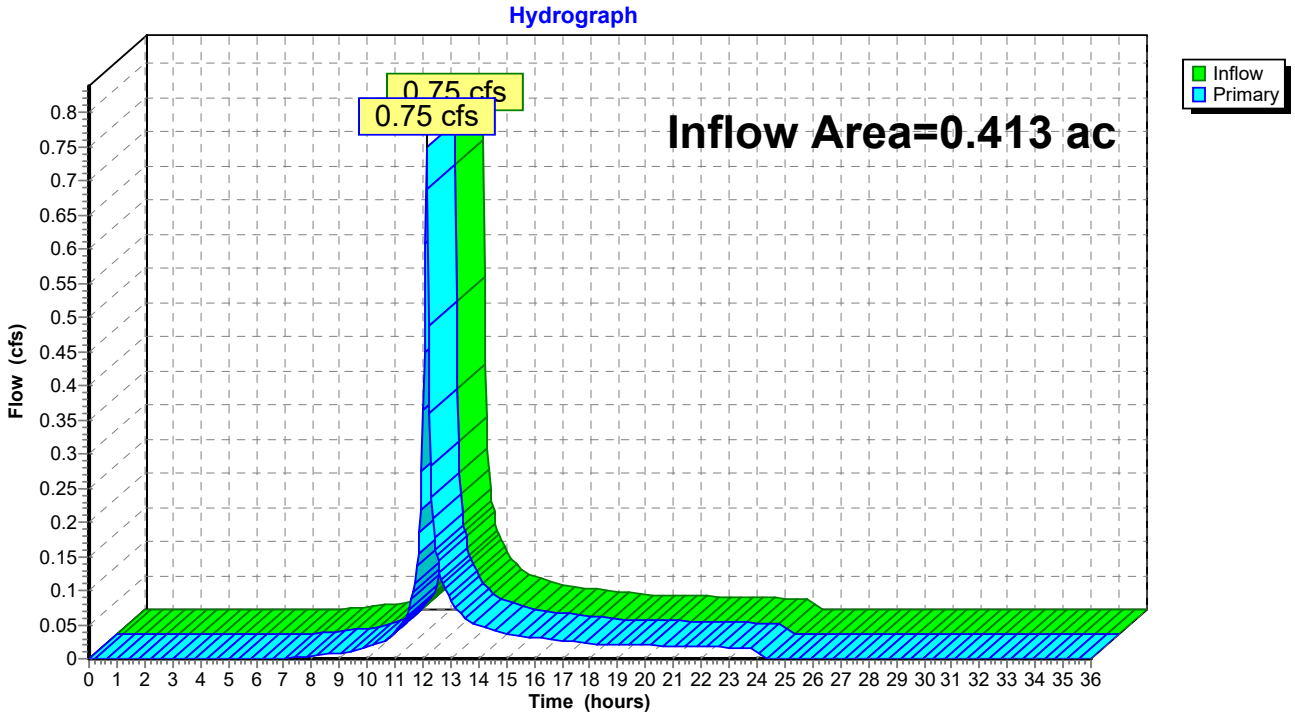


Summary for Link 8L: DP-2

Inflow Area = 0.413 ac, 25.17% Impervious, Inflow Depth = 1.66" for 2-Year event
Inflow = 0.75 cfs @ 12.13 hrs, Volume= 0.057 af
Primary = 0.75 cfs @ 12.13 hrs, Volume= 0.057 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs

Link 8L: DP-2



Time span=0.00-36.00 hrs, dt=0.04 hrs, 901 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: EX-1 Runoff Area=15,199 sf 0.00% Impervious Runoff Depth=0.13"
Tc=6.0 min CN=39 Runoff=0.00 cfs 0.004 af

Subcatchment 2S: EX-2 Runoff Area=17,904 sf 51.69% Impervious Runoff Depth=2.95"
Tc=6.0 min CN=84 Runoff=1.31 cfs 0.101 af

Subcatchment 3S: EX-3 Runoff Area=69,181 sf 49.87% Impervious Runoff Depth=3.34"
Tc=6.0 min CN=88 Runoff=5.61 cfs 0.442 af

Subcatchment 4S: EX-4 Runoff Area=49,983 sf 81.41% Impervious Runoff Depth=4.18"
Tc=6.0 min CN=96 Runoff=4.67 cfs 0.400 af

Subcatchment 5S: EX-5 Runoff Area=99,603 sf 53.39% Impervious Runoff Depth=3.96"
Tc=6.0 min CN=94 Runoff=9.07 cfs 0.755 af

Subcatchment 6S: EX-6 Runoff Area=17,973 sf 25.17% Impervious Runoff Depth=3.05"
Tc=6.0 min CN=85 Runoff=1.35 cfs 0.105 af

Link 7L: DP-1 Inflow=20.65 cfs 1.702 af
Primary=20.65 cfs 1.702 af

Link 8L: DP-2 Inflow=1.35 cfs 0.105 af
Primary=1.35 cfs 0.105 af

Total Runoff Area = 6.195 ac Runoff Volume = 1.807 af Average Runoff Depth = 3.50"
47.32% Pervious = 2.931 ac 52.68% Impervious = 3.263 ac

Summary for Subcatchment 1S: EX-1

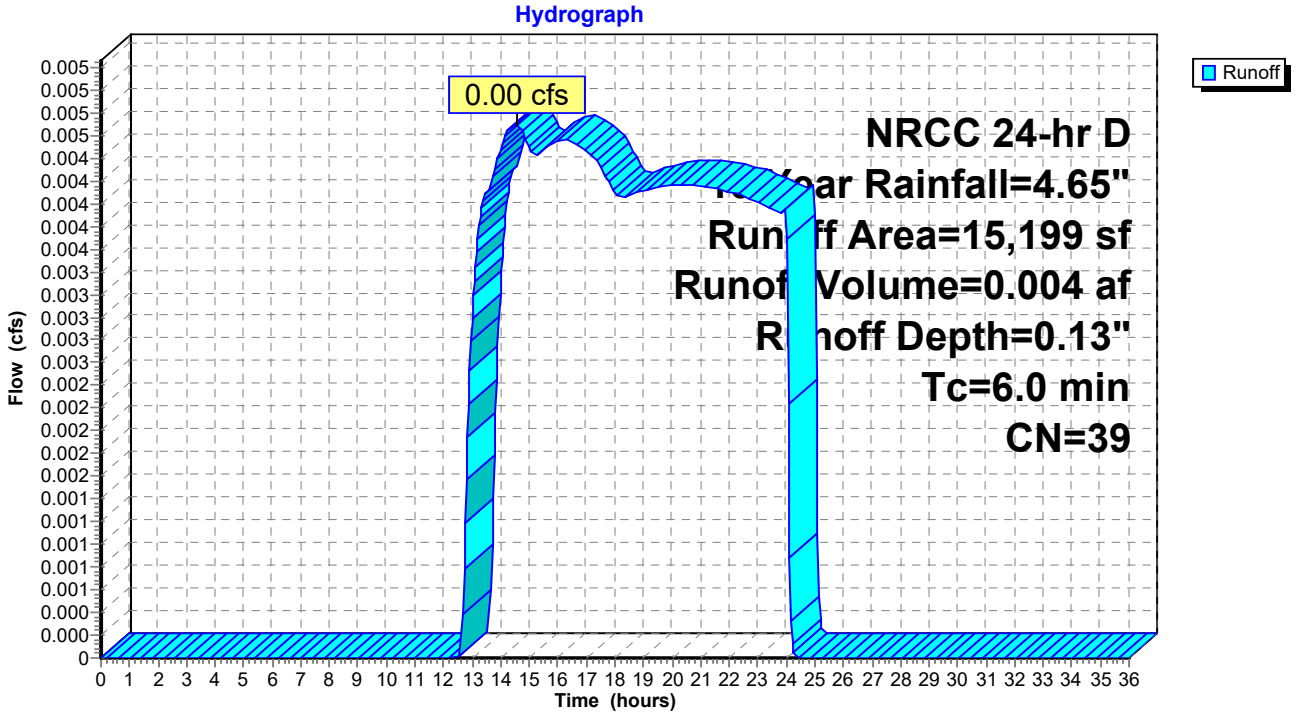
Runoff = 0.00 cfs @ 14.55 hrs, Volume= 0.004 af, Depth= 0.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 10-Year Rainfall=4.65"

Area (sf)	CN	Description
15,199	39	>75% Grass cover, Good, HSG A
15,199		100.00% Pervious Area

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

Subcatchment 1S: EX-1



Summary for Subcatchment 2S: EX-2

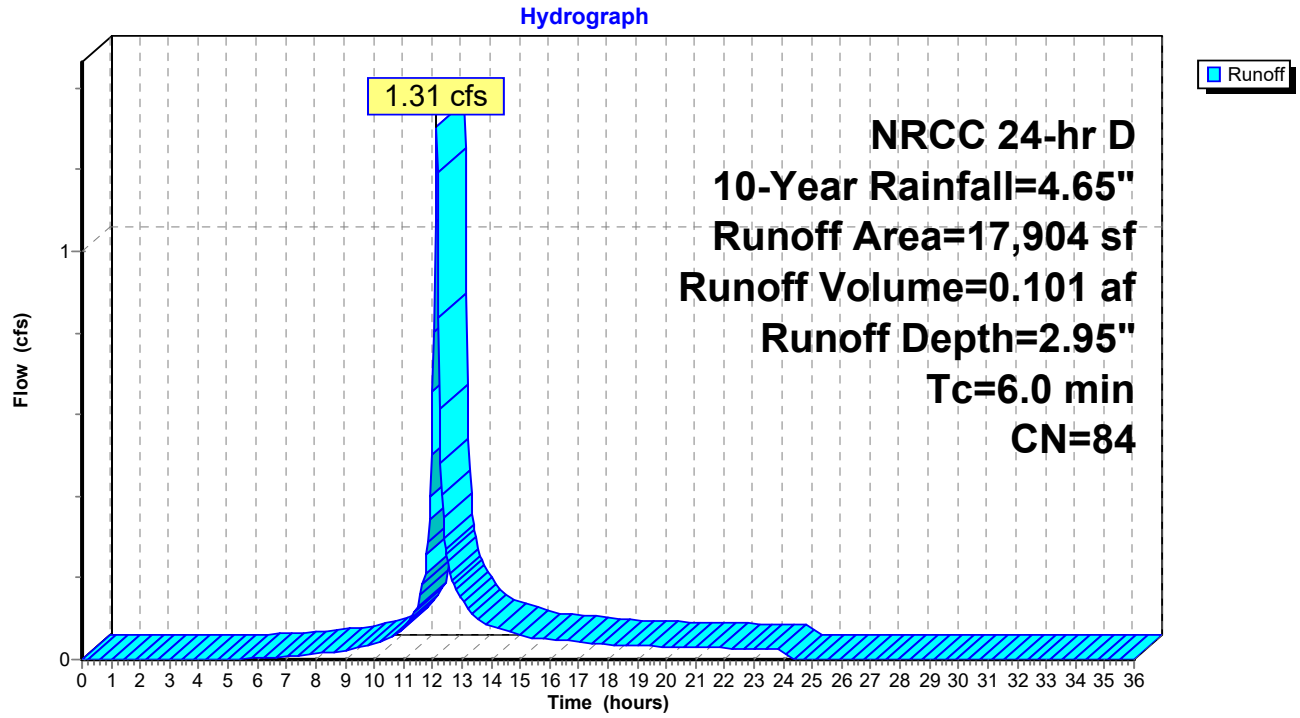
Runoff = 1.31 cfs @ 12.13 hrs, Volume= 0.101 af, Depth= 2.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 10-Year Rainfall=4.65"

Area (sf)	CN	Description
8,650	68	<50% Grass cover, Poor, HSG A
9,254	98	Paved parking, HSG A
17,904	84	Weighted Average
8,650		48.31% Pervious Area
9,254		51.69% Impervious Area

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

Subcatchment 2S: EX-2



Summary for Subcatchment 3S: EX-3

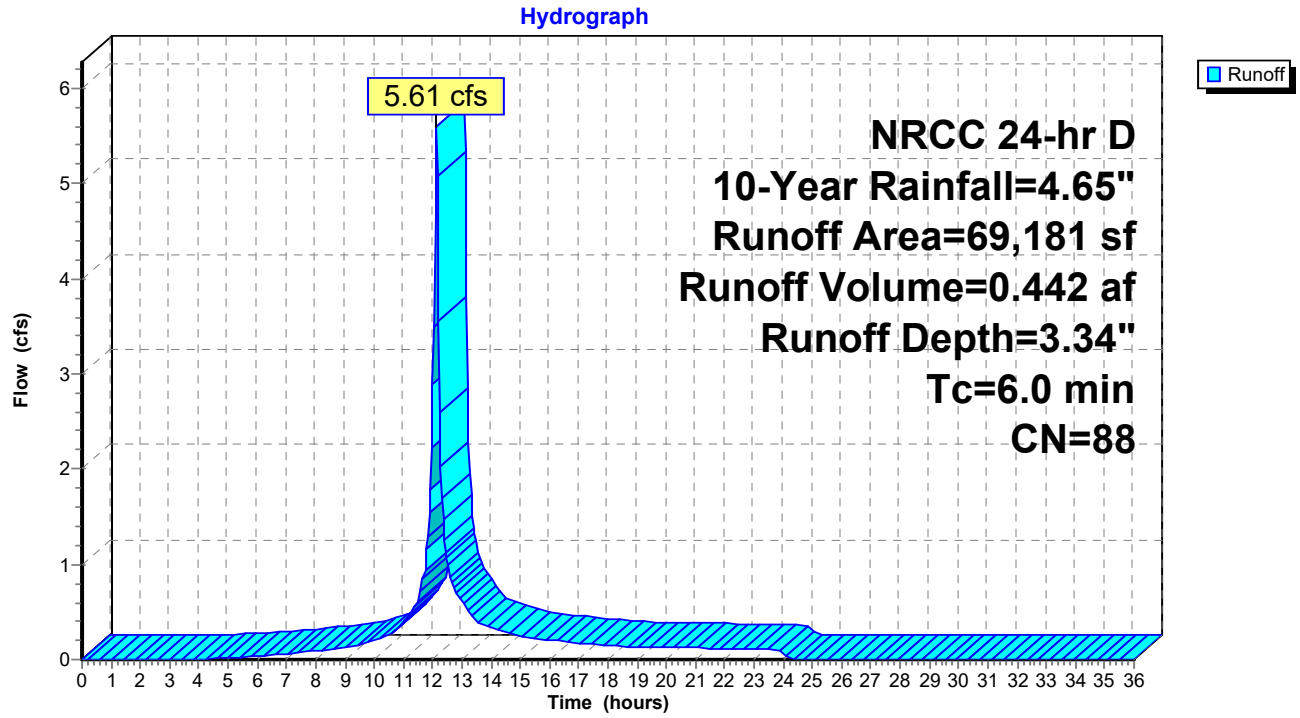
Runoff = 5.61 cfs @ 12.13 hrs, Volume= 0.442 af, Depth= 3.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 10-Year Rainfall=4.65"

Area (sf)	CN	Description
34,503	98	Paved parking, HSG C
34,678	79	50-75% Grass cover, Fair, HSG C
69,181	88	Weighted Average
34,678		50.13% Pervious Area
34,503		49.87% Impervious Area

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

Subcatchment 3S: EX-3



Summary for Subcatchment 4S: EX-4

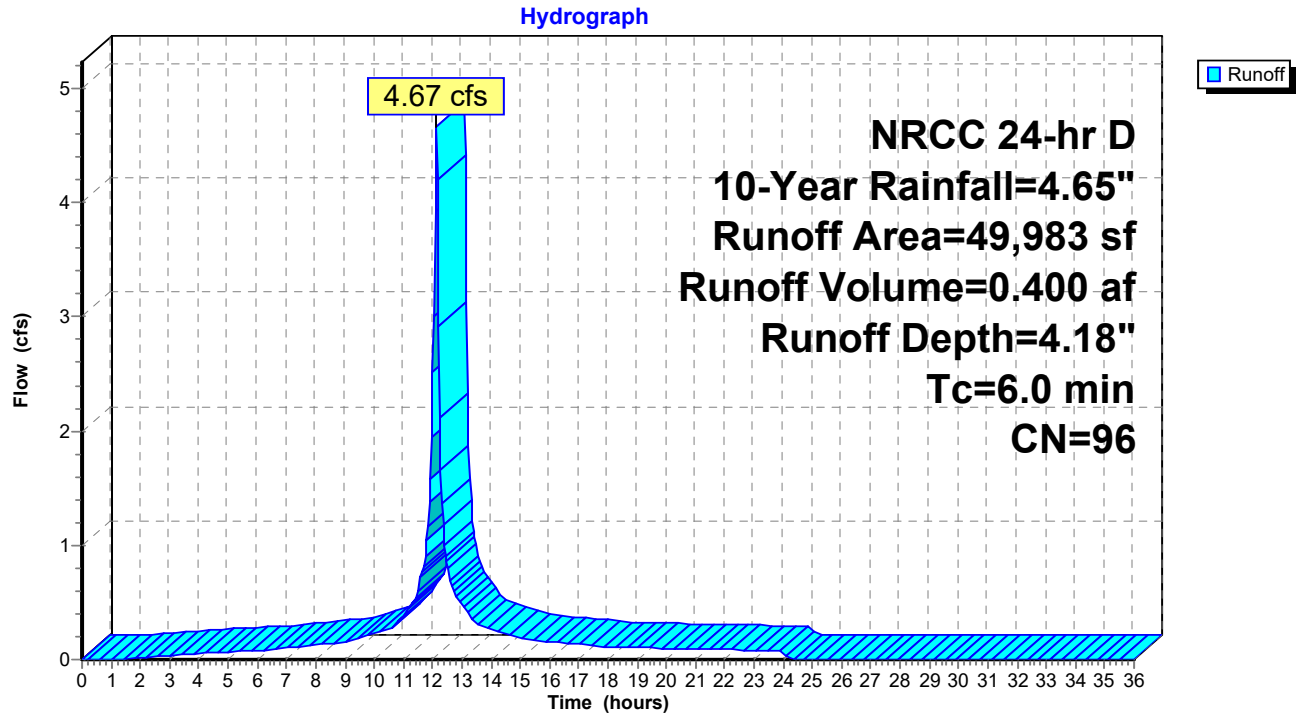
Runoff = 4.67 cfs @ 12.12 hrs, Volume= 0.400 af, Depth= 4.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 10-Year Rainfall=4.65"

Area (sf)	CN	Description
40,692	98	Paved parking, HSG D
9,291	89	<50% Grass cover, Poor, HSG D
49,983	96	Weighted Average
9,291		18.59% Pervious Area
40,692		81.41% Impervious Area

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

Subcatchment 4S: EX-4



Summary for Subcatchment 5S: EX-5

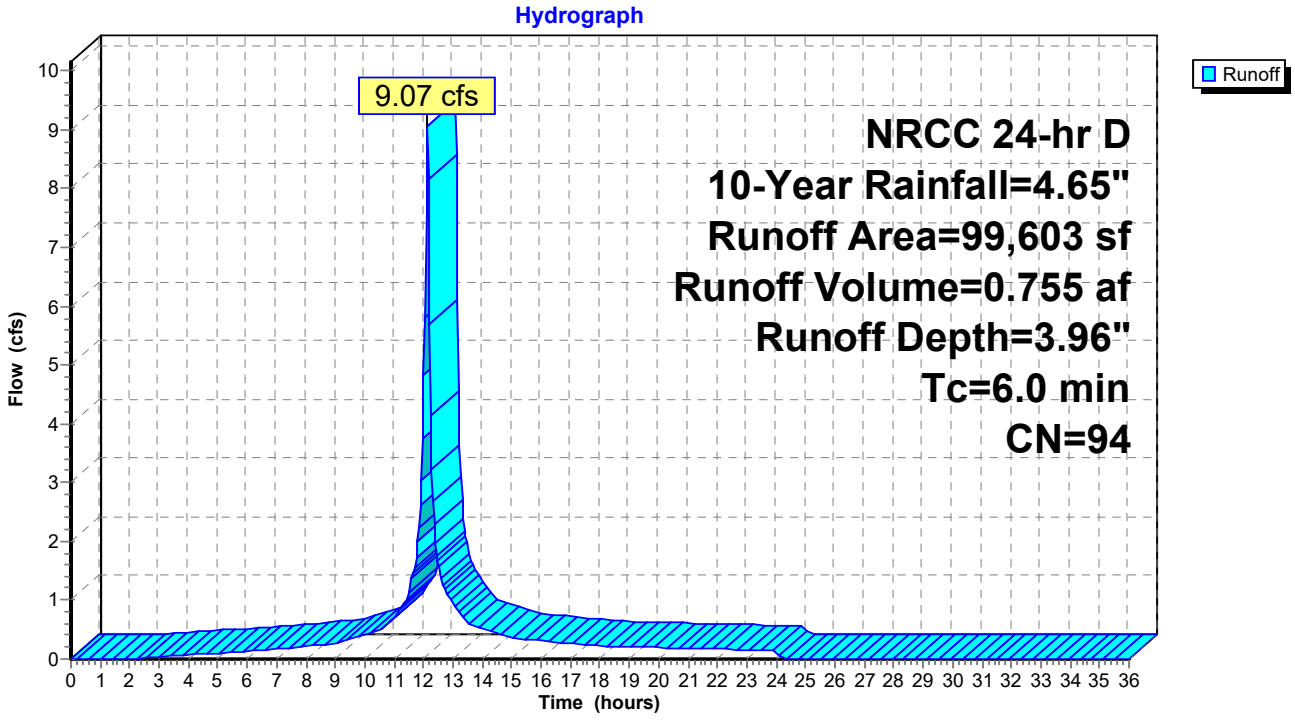
Runoff = 9.07 cfs @ 12.12 hrs, Volume= 0.755 af, Depth= 3.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 10-Year Rainfall=4.65"

	Area (sf)	CN	Description
	49,592	98	Paved parking, HSG D
*	3,585	98	Cement Concrete Sidewalk, HSG D
	46,426	89	<50% Grass cover, Poor, HSG D
	99,603	94	Weighted Average
	46,426		46.61% Pervious Area
	53,177		53.39% Impervious Area

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

Subcatchment 5S: EX-5



Summary for Subcatchment 6S: EX-6

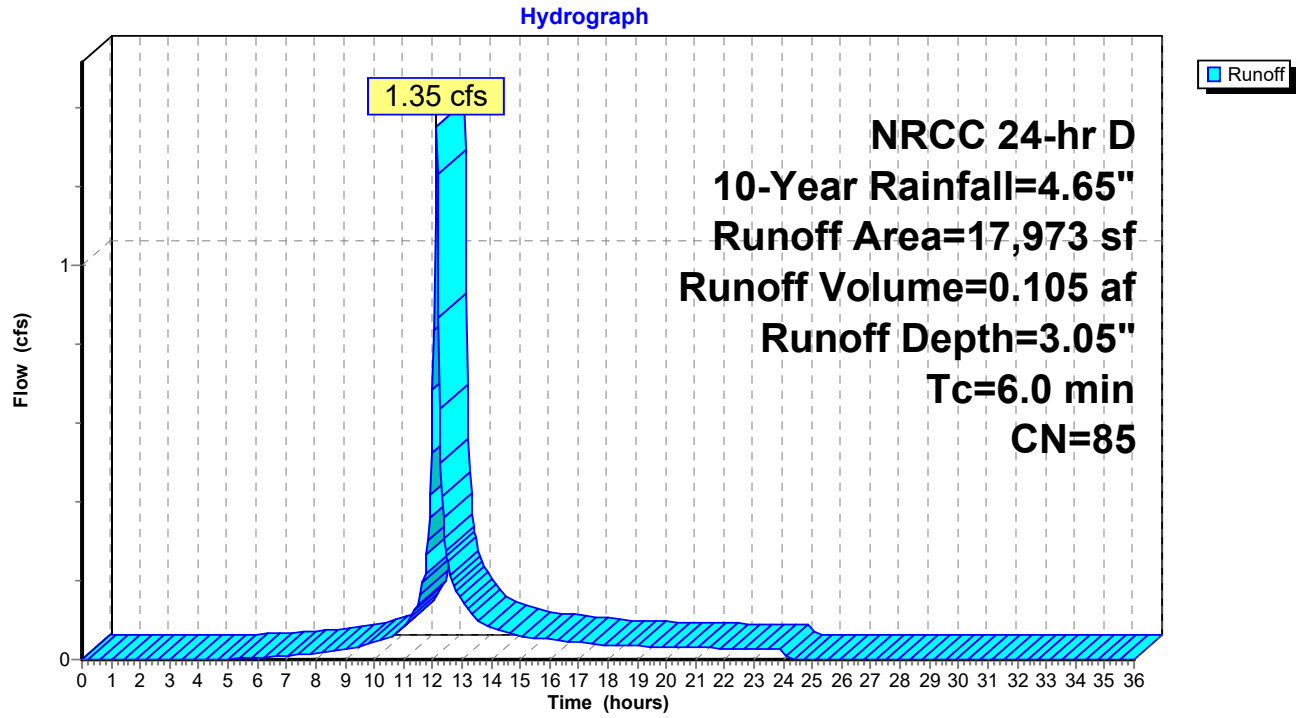
Runoff = 1.35 cfs @ 12.13 hrs, Volume= 0.105 af, Depth= 3.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 10-Year Rainfall=4.65"

Area (sf)	CN	Description
4,523	98	Paved parking, HSG D
13,450	80	>75% Grass cover, Good, HSG D
17,973	85	Weighted Average
13,450		74.83% Pervious Area
4,523		25.17% Impervious Area

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

Subcatchment 6S: EX-6

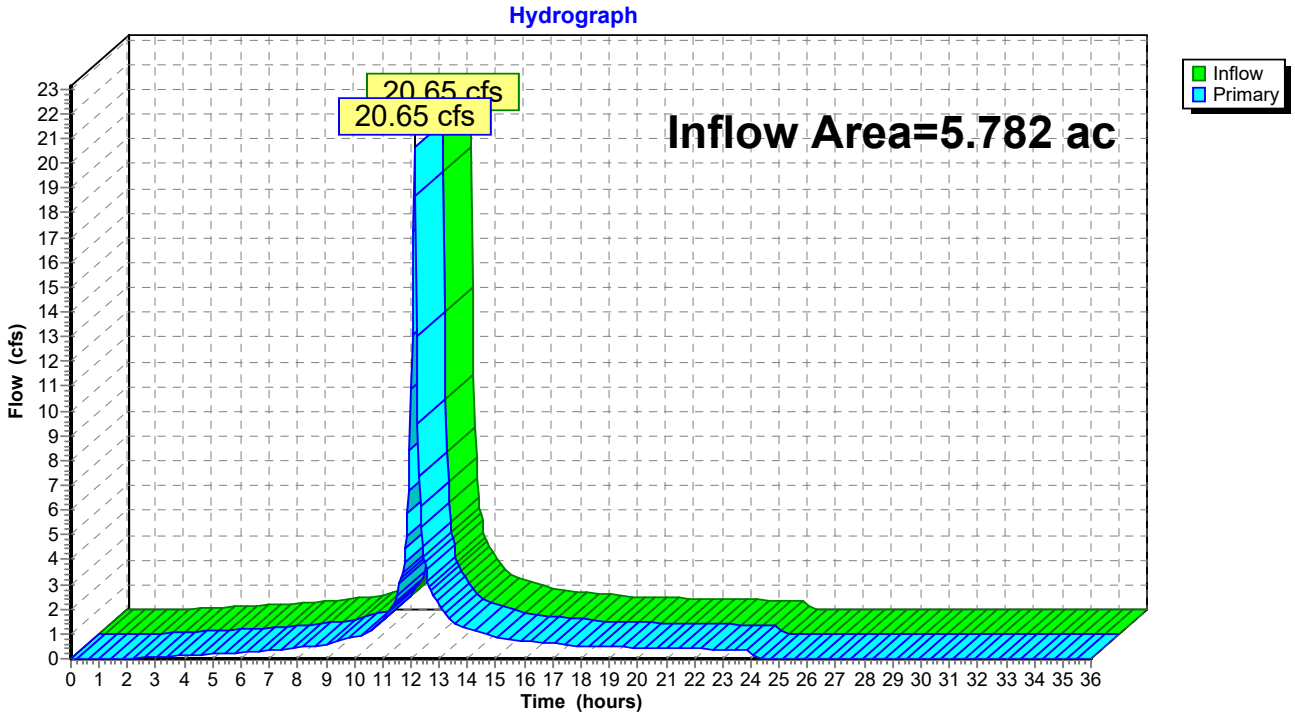


Summary for Link 7L: DP-1

Inflow Area = 5.782 ac, 54.64% Impervious, Inflow Depth = 3.53" for 10-Year event
Inflow = 20.65 cfs @ 12.13 hrs, Volume= 1.702 af
Primary = 20.65 cfs @ 12.13 hrs, Volume= 1.702 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs

Link 7L: DP-1

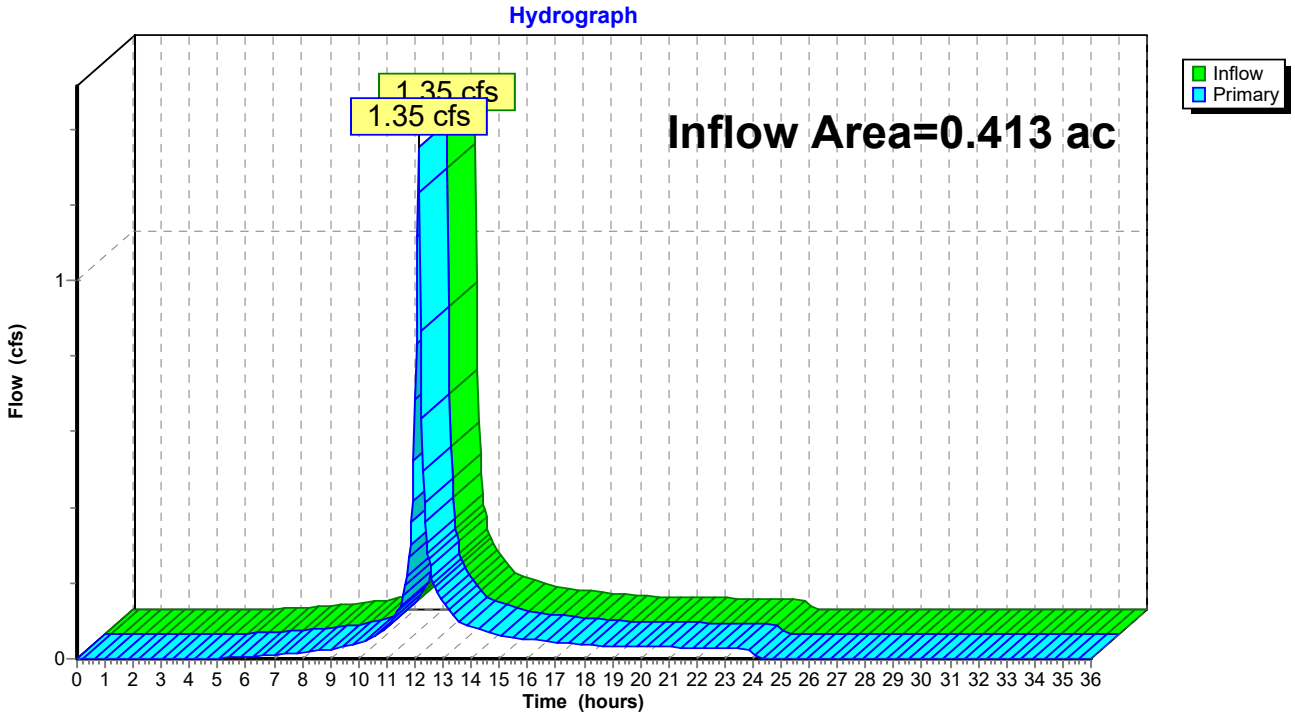


Summary for Link 8L: DP-2

Inflow Area = 0.413 ac, 25.17% Impervious, Inflow Depth = 3.05" for 10-Year event
Inflow = 1.35 cfs @ 12.13 hrs, Volume= 0.105 af
Primary = 1.35 cfs @ 12.13 hrs, Volume= 0.105 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs

Link 8L: DP-2



Time span=0.00-36.00 hrs, dt=0.04 hrs, 901 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: EX-1 Runoff Area=15,199 sf 0.00% Impervious Runoff Depth=0.41"
Tc=6.0 min CN=39 Runoff=0.03 cfs 0.012 af

Subcatchment 2S: EX-2 Runoff Area=17,904 sf 51.69% Impervious Runoff Depth=4.07"
Tc=6.0 min CN=84 Runoff=1.78 cfs 0.140 af

Subcatchment 3S: EX-3 Runoff Area=69,181 sf 49.87% Impervious Runoff Depth=4.50"
Tc=6.0 min CN=88 Runoff=7.44 cfs 0.596 af

Subcatchment 4S: EX-4 Runoff Area=49,983 sf 81.41% Impervious Runoff Depth=5.40"
Tc=6.0 min CN=96 Runoff=5.94 cfs 0.516 af

Subcatchment 5S: EX-5 Runoff Area=99,603 sf 53.39% Impervious Runoff Depth=5.17"
Tc=6.0 min CN=94 Runoff=11.63 cfs 0.985 af

Subcatchment 6S: EX-6 Runoff Area=17,973 sf 25.17% Impervious Runoff Depth=4.18"
Tc=6.0 min CN=85 Runoff=1.83 cfs 0.144 af

Link 7L: DP-1 Inflow=26.80 cfs 2.248 af
Primary=26.80 cfs 2.248 af

Link 8L: DP-2 Inflow=1.83 cfs 0.144 af
Primary=1.83 cfs 0.144 af

Total Runoff Area = 6.195 ac Runoff Volume = 2.392 af Average Runoff Depth = 4.63"
47.32% Pervious = 2.931 ac 52.68% Impervious = 3.263 ac

Summary for Subcatchment 1S: EX-1

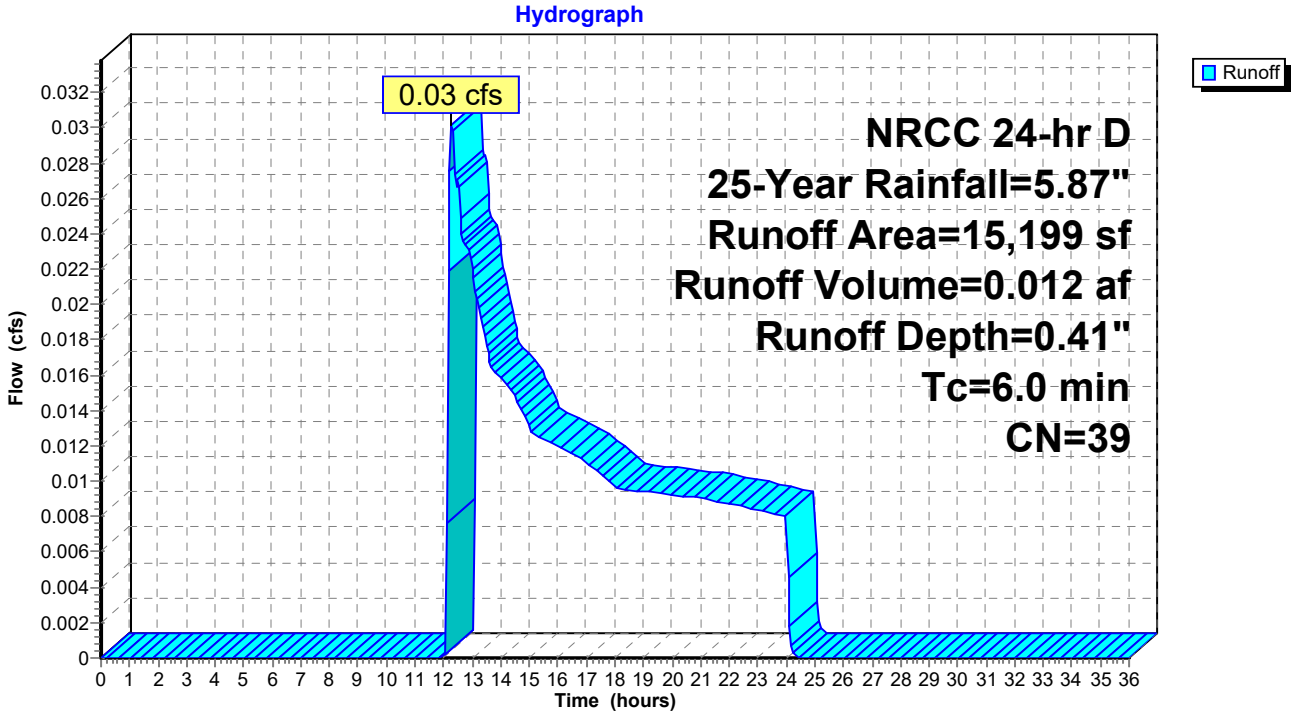
Runoff = 0.03 cfs @ 12.28 hrs, Volume= 0.012 af, Depth= 0.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 25-Year Rainfall=5.87"

Area (sf)	CN	Description
15,199	39	>75% Grass cover, Good, HSG A
15,199		100.00% Pervious Area

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

Subcatchment 1S: EX-1



Summary for Subcatchment 2S: EX-2

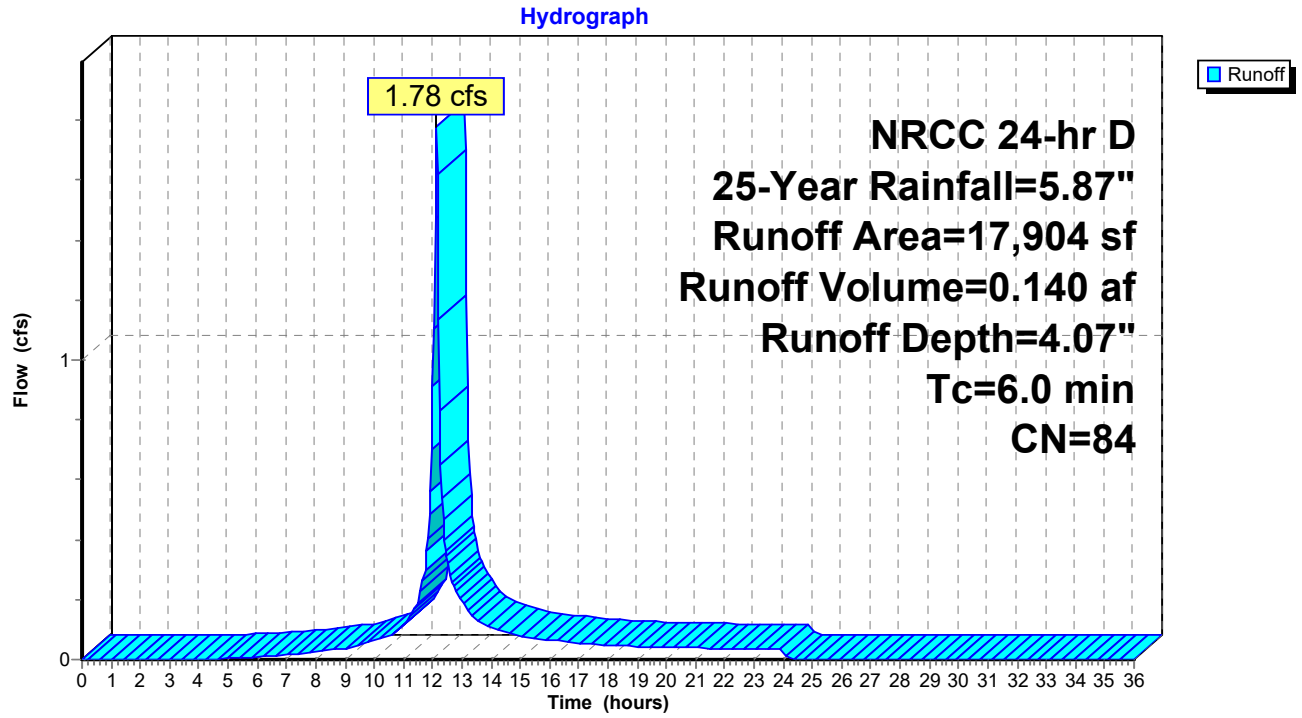
Runoff = 1.78 cfs @ 12.13 hrs, Volume= 0.140 af, Depth= 4.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 25-Year Rainfall=5.87"

Area (sf)	CN	Description
8,650	68	<50% Grass cover, Poor, HSG A
9,254	98	Paved parking, HSG A
17,904	84	Weighted Average
8,650		48.31% Pervious Area
9,254		51.69% Impervious Area

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

Subcatchment 2S: EX-2



Summary for Subcatchment 3S: EX-3

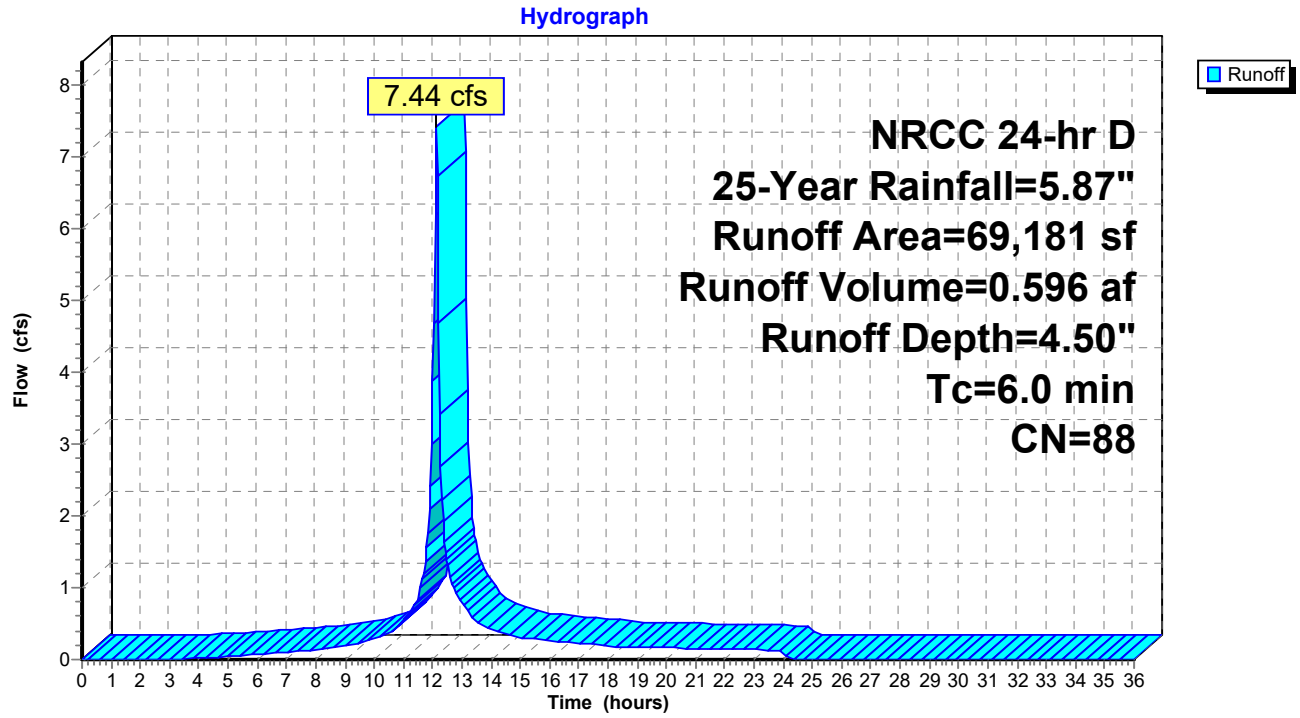
Runoff = 7.44 cfs @ 12.13 hrs, Volume= 0.596 af, Depth= 4.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 25-Year Rainfall=5.87"

Area (sf)	CN	Description
34,503	98	Paved parking, HSG C
34,678	79	50-75% Grass cover, Fair, HSG C
69,181	88	Weighted Average
34,678		50.13% Pervious Area
34,503		49.87% Impervious Area

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

Subcatchment 3S: EX-3



Summary for Subcatchment 4S: EX-4

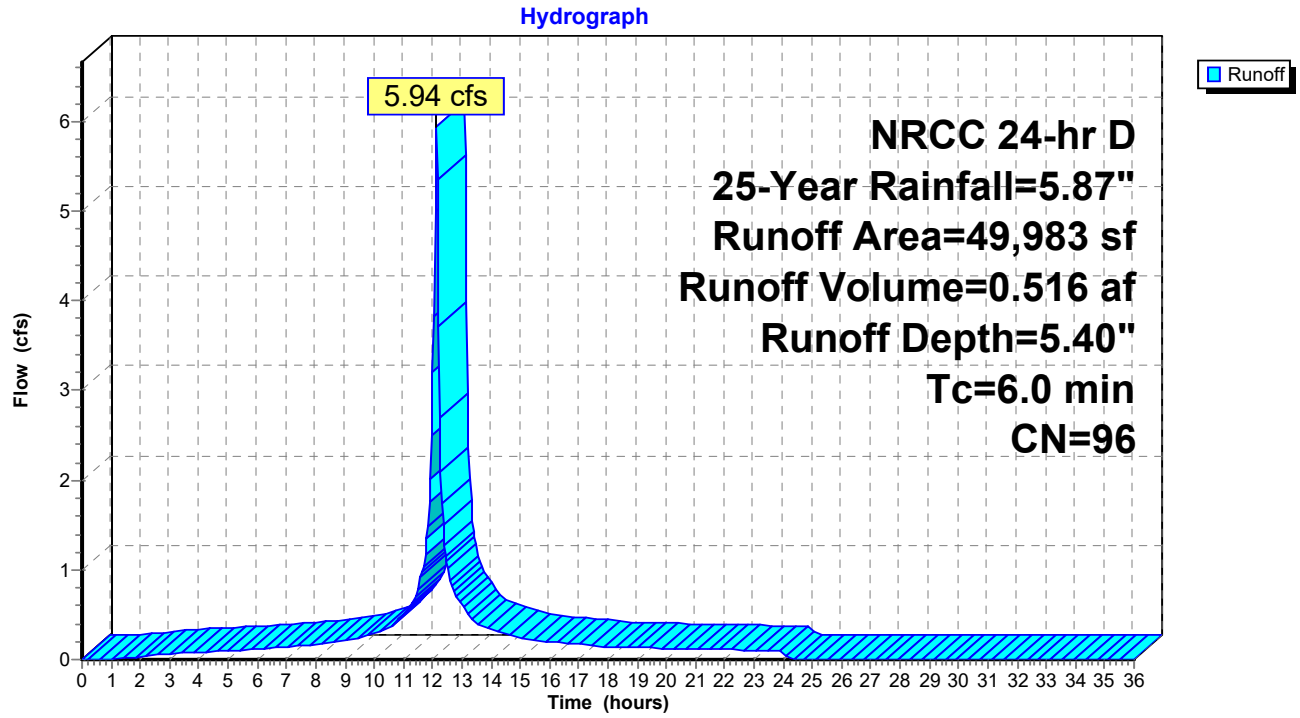
Runoff = 5.94 cfs @ 12.12 hrs, Volume= 0.516 af, Depth= 5.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 25-Year Rainfall=5.87"

Area (sf)	CN	Description
40,692	98	Paved parking, HSG D
9,291	89	<50% Grass cover, Poor, HSG D
49,983	96	Weighted Average
9,291		18.59% Pervious Area
40,692		81.41% Impervious Area

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

Subcatchment 4S: EX-4



Summary for Subcatchment 5S: EX-5

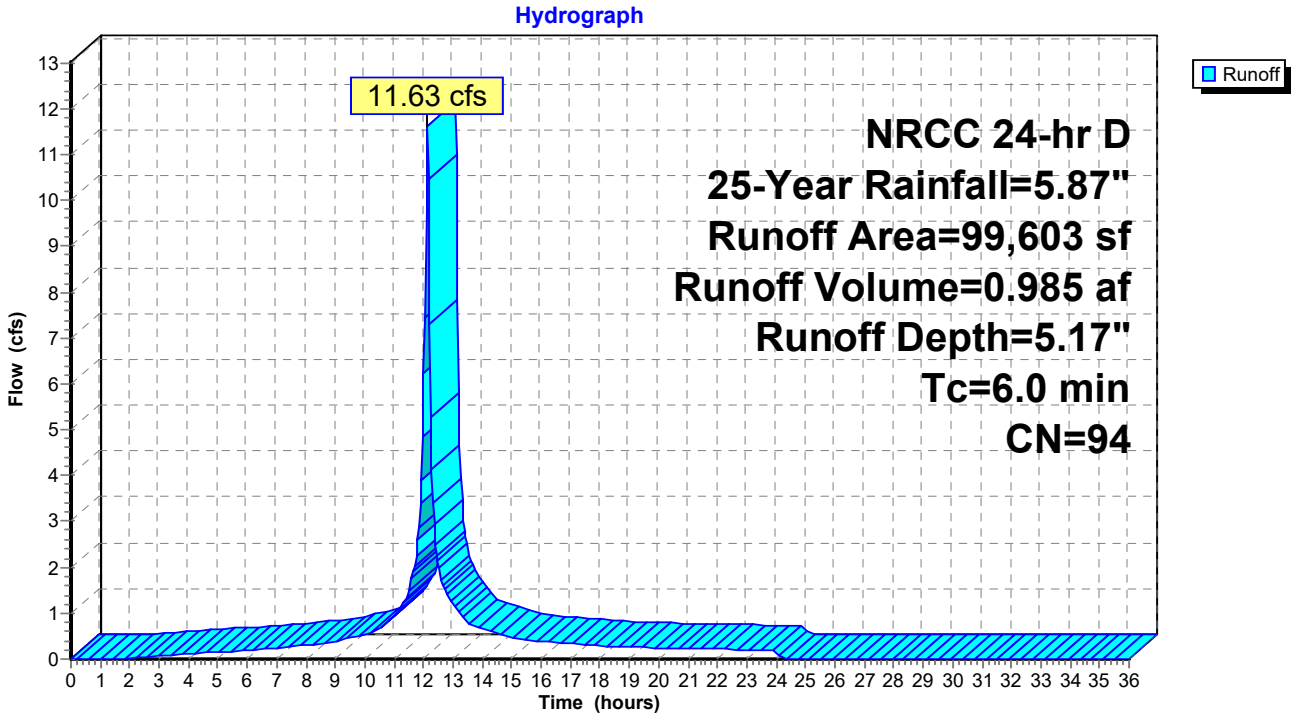
Runoff = 11.63 cfs @ 12.12 hrs, Volume= 0.985 af, Depth= 5.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 25-Year Rainfall=5.87"

	Area (sf)	CN	Description
	49,592	98	Paved parking, HSG D
*	3,585	98	Cement Concrete Sidewalk, HSG D
	46,426	89	<50% Grass cover, Poor, HSG D
	99,603	94	Weighted Average
	46,426		46.61% Pervious Area
	53,177		53.39% Impervious Area

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

Subcatchment 5S: EX-5



Summary for Subcatchment 6S: EX-6

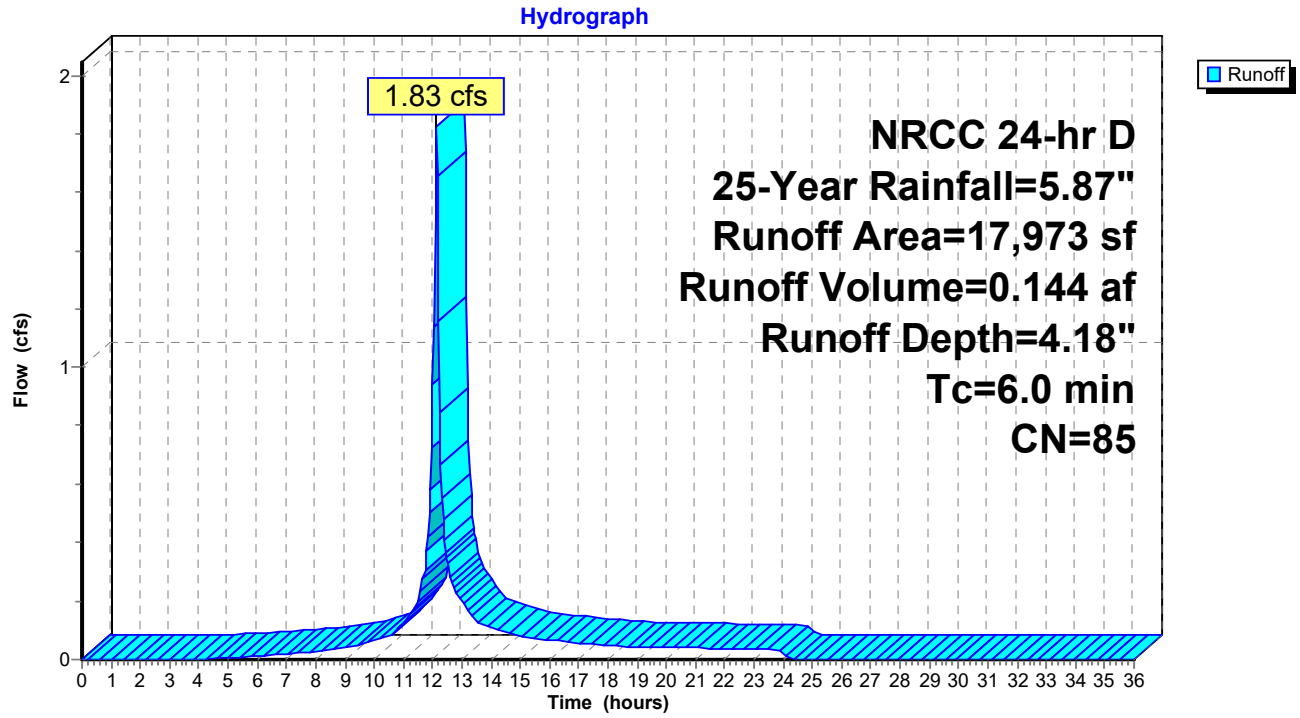
Runoff = 1.83 cfs @ 12.13 hrs, Volume= 0.144 af, Depth= 4.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 25-Year Rainfall=5.87"

Area (sf)	CN	Description
4,523	98	Paved parking, HSG D
13,450	80	>75% Grass cover, Good, HSG D
17,973	85	Weighted Average
13,450		74.83% Pervious Area
4,523		25.17% Impervious Area

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

Subcatchment 6S: EX-6

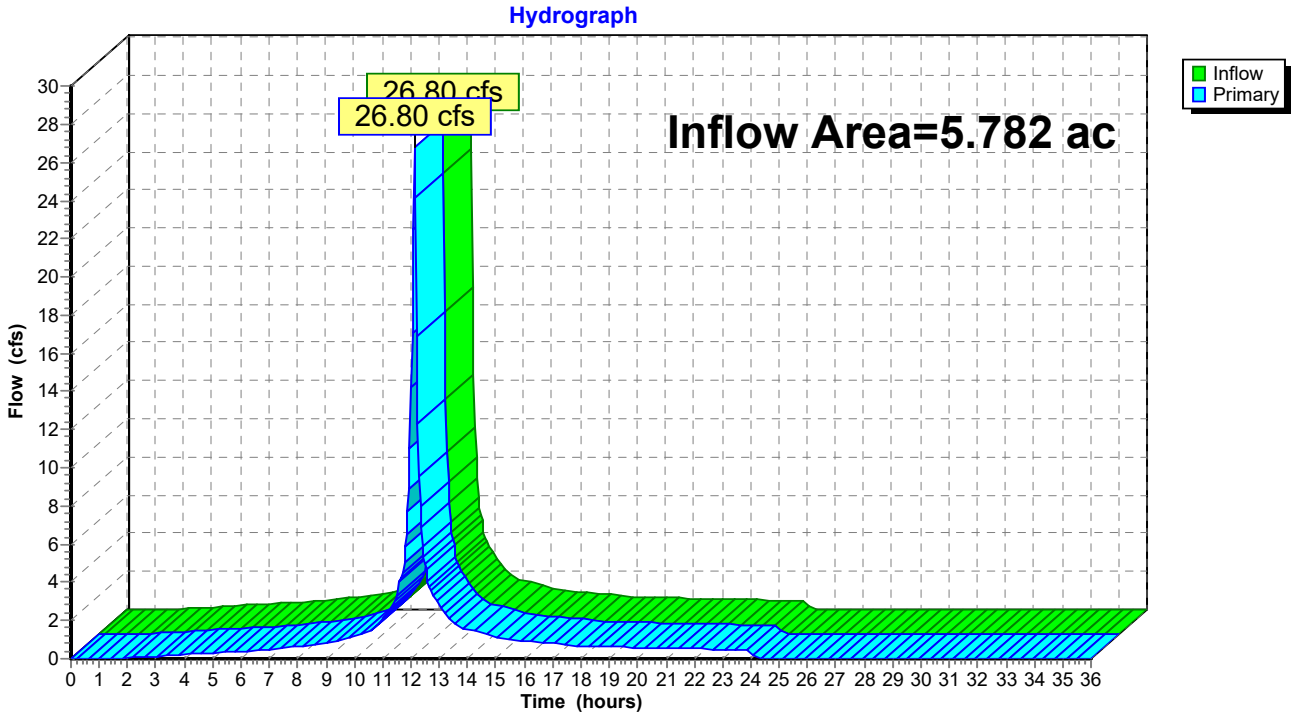


Summary for Link 7L: DP-1

Inflow Area = 5.782 ac, 54.64% Impervious, Inflow Depth = 4.67" for 25-Year event
Inflow = 26.80 cfs @ 12.13 hrs, Volume= 2.248 af
Primary = 26.80 cfs @ 12.13 hrs, Volume= 2.248 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs

Link 7L: DP-1

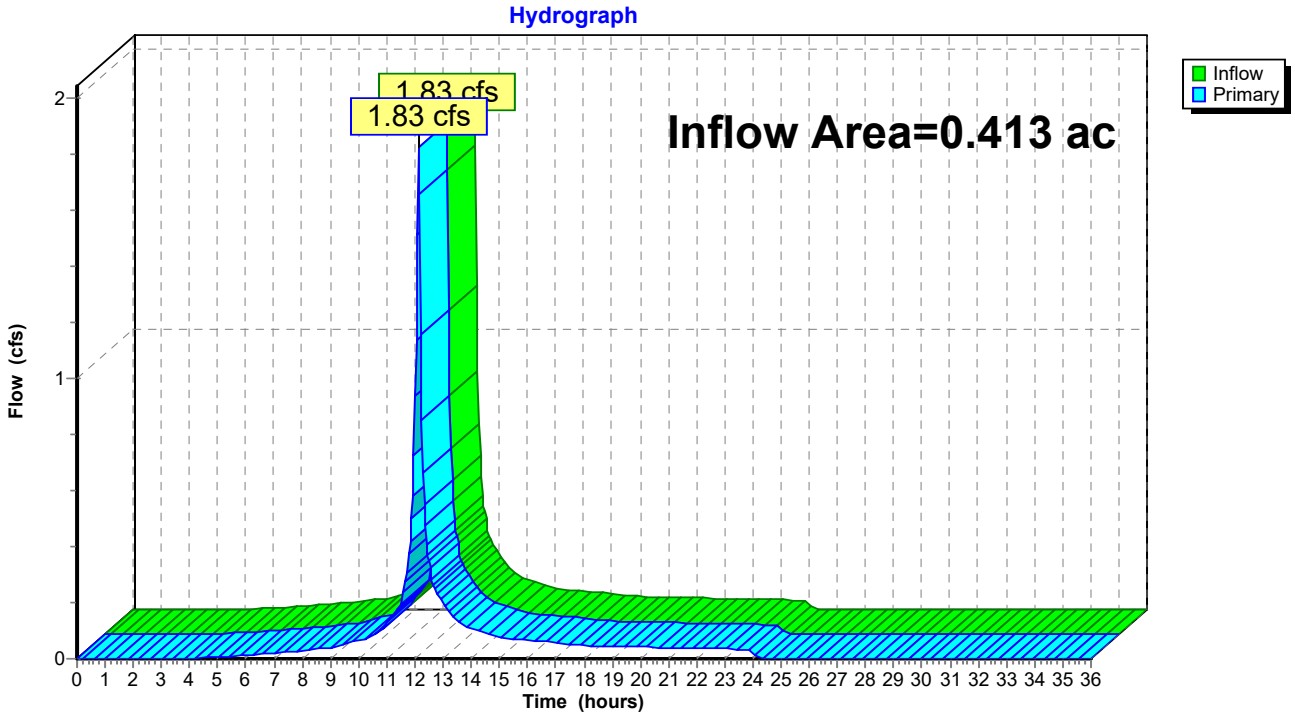


Summary for Link 8L: DP-2

Inflow Area = 0.413 ac, 25.17% Impervious, Inflow Depth = 4.18" for 25-Year event
Inflow = 1.83 cfs @ 12.13 hrs, Volume= 0.144 af
Primary = 1.83 cfs @ 12.13 hrs, Volume= 0.144 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs

Link 8L: DP-2



Time span=0.00-36.00 hrs, dt=0.04 hrs, 901 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: EX-1 Runoff Area=15,199 sf 0.00% Impervious Runoff Depth=0.77"
Tc=6.0 min CN=39 Runoff=0.15 cfs 0.022 af

Subcatchment 2S: EX-2 Runoff Area=17,904 sf 51.69% Impervious Runoff Depth=5.14"
Tc=6.0 min CN=84 Runoff=2.22 cfs 0.176 af

Subcatchment 3S: EX-3 Runoff Area=69,181 sf 49.87% Impervious Runoff Depth=5.59"
Tc=6.0 min CN=88 Runoff=9.12 cfs 0.740 af

Subcatchment 4S: EX-4 Runoff Area=49,983 sf 81.41% Impervious Runoff Depth=6.52"
Tc=6.0 min CN=96 Runoff=7.12 cfs 0.624 af

Subcatchment 5S: EX-5 Runoff Area=99,603 sf 53.39% Impervious Runoff Depth=6.29"
Tc=6.0 min CN=94 Runoff=13.99 cfs 1.198 af

Subcatchment 6S: EX-6 Runoff Area=17,973 sf 25.17% Impervious Runoff Depth=5.25"
Tc=6.0 min CN=85 Runoff=2.27 cfs 0.181 af

Link 7L: DP-1 Inflow=32.59 cfs 2.761 af
Primary=32.59 cfs 2.761 af

Link 8L: DP-2 Inflow=2.27 cfs 0.181 af
Primary=2.27 cfs 0.181 af

Total Runoff Area = 6.195 ac Runoff Volume = 2.941 af Average Runoff Depth = 5.70"
47.32% Pervious = 2.931 ac 52.68% Impervious = 3.263 ac

Summary for Subcatchment 1S: EX-1

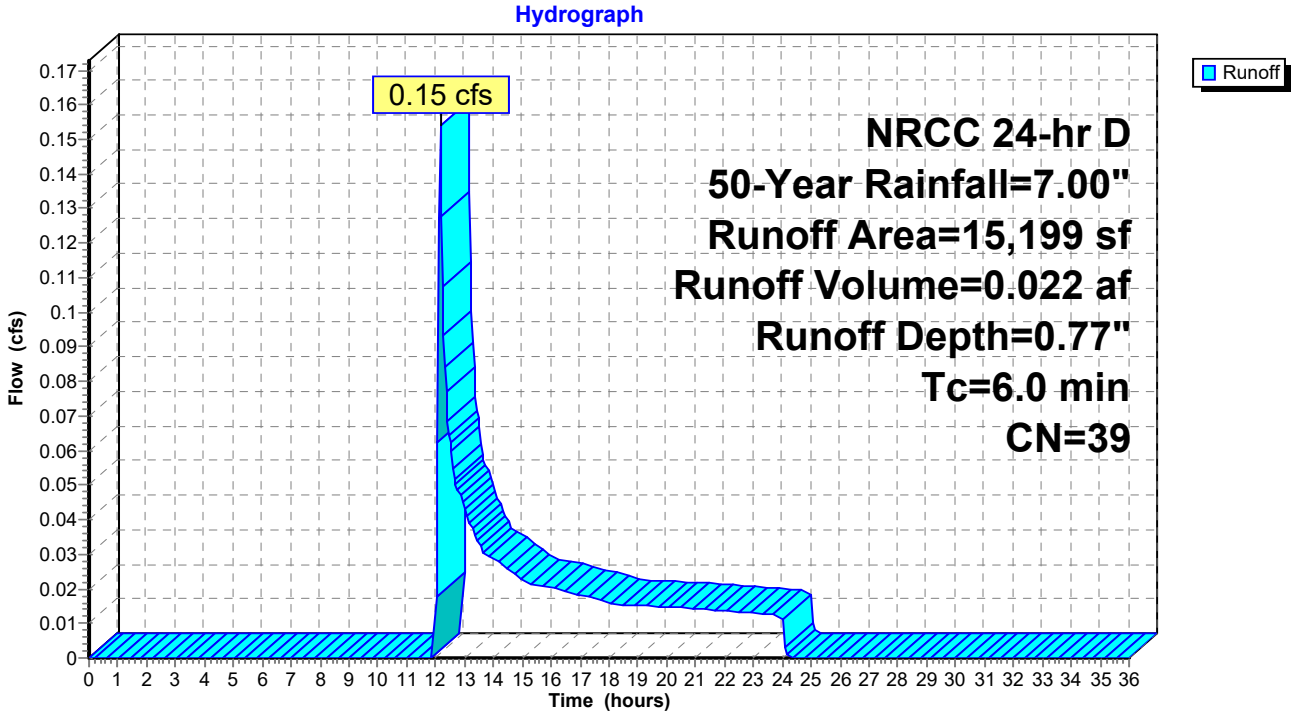
Runoff = 0.15 cfs @ 12.16 hrs, Volume= 0.022 af, Depth= 0.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 50-Year Rainfall=7.00"

Area (sf)	CN	Description
15,199	39	>75% Grass cover, Good, HSG A
15,199		100.00% Pervious Area

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

Subcatchment 1S: EX-1



Summary for Subcatchment 2S: EX-2

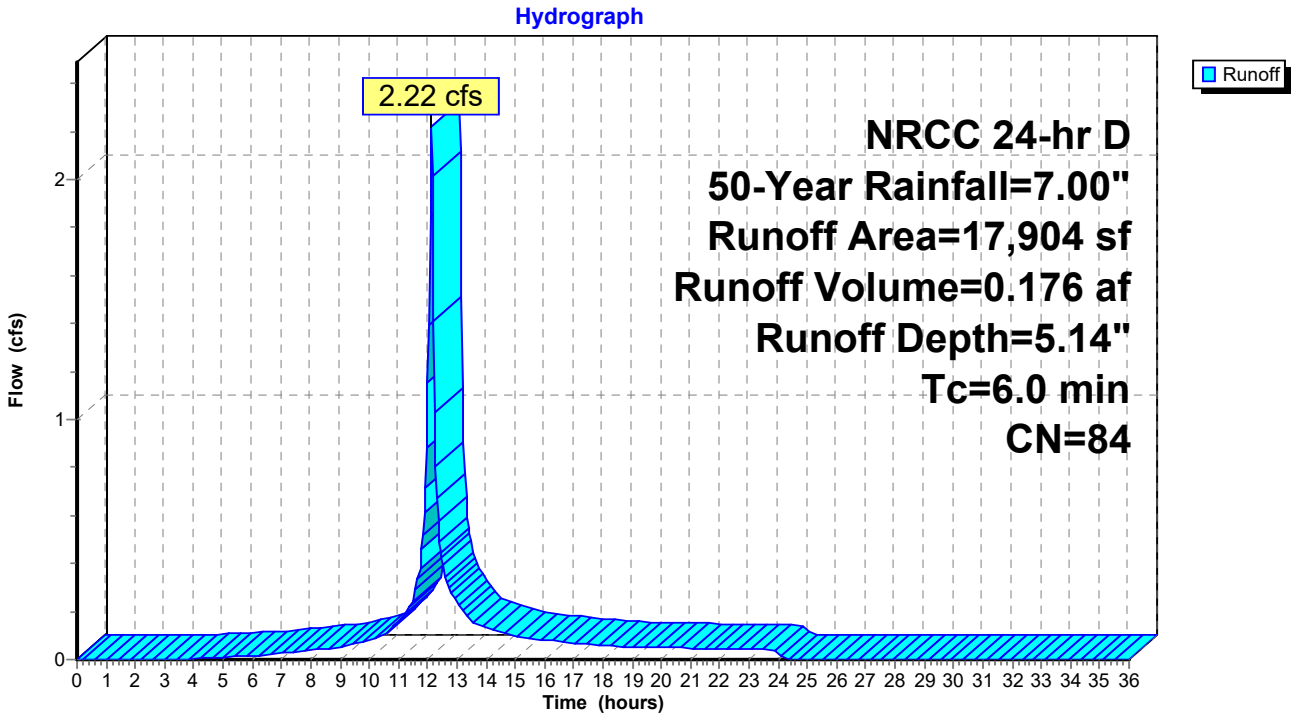
Runoff = 2.22 cfs @ 12.13 hrs, Volume= 0.176 af, Depth= 5.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 50-Year Rainfall=7.00"

Area (sf)	CN	Description
8,650	68	<50% Grass cover, Poor, HSG A
9,254	98	Paved parking, HSG A
17,904	84	Weighted Average
8,650		48.31% Pervious Area
9,254		51.69% Impervious Area

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

Subcatchment 2S: EX-2



Summary for Subcatchment 3S: EX-3

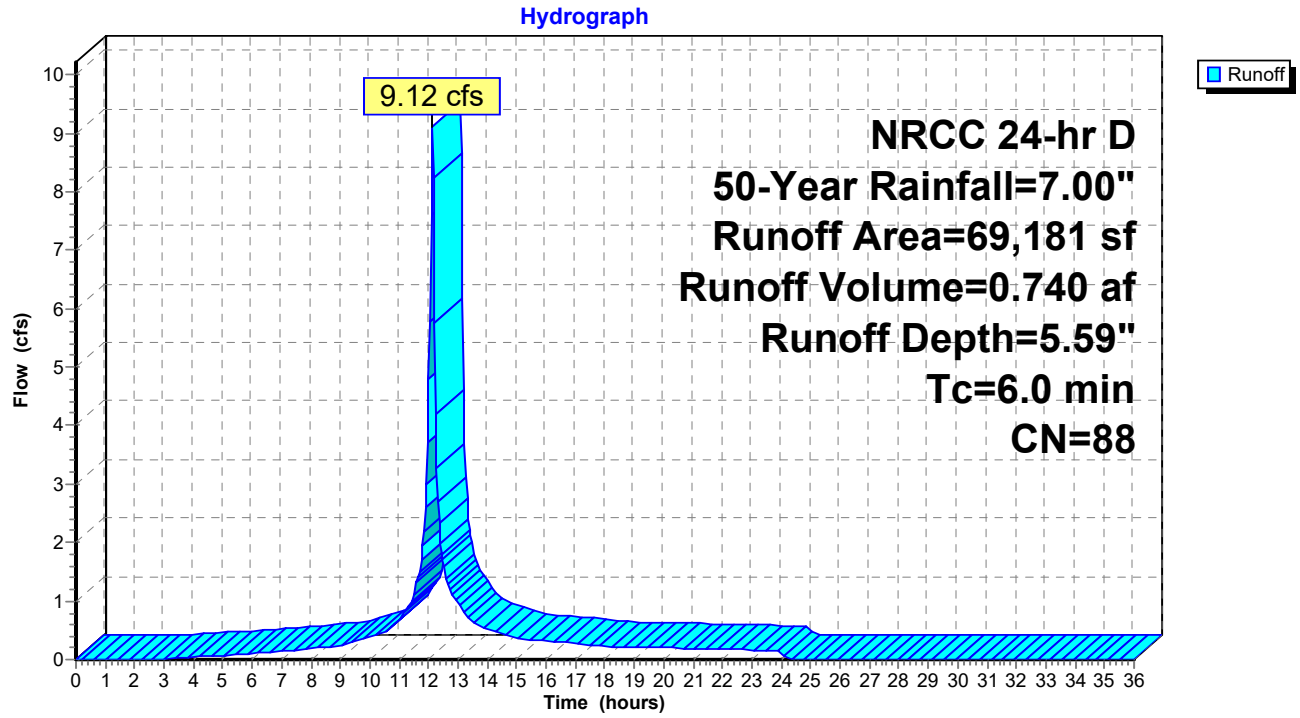
Runoff = 9.12 cfs @ 12.13 hrs, Volume= 0.740 af, Depth= 5.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 50-Year Rainfall=7.00"

Area (sf)	CN	Description
34,503	98	Paved parking, HSG C
34,678	79	50-75% Grass cover, Fair, HSG C
69,181	88	Weighted Average
34,678		50.13% Pervious Area
34,503		49.87% Impervious Area

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

Subcatchment 3S: EX-3



Summary for Subcatchment 4S: EX-4

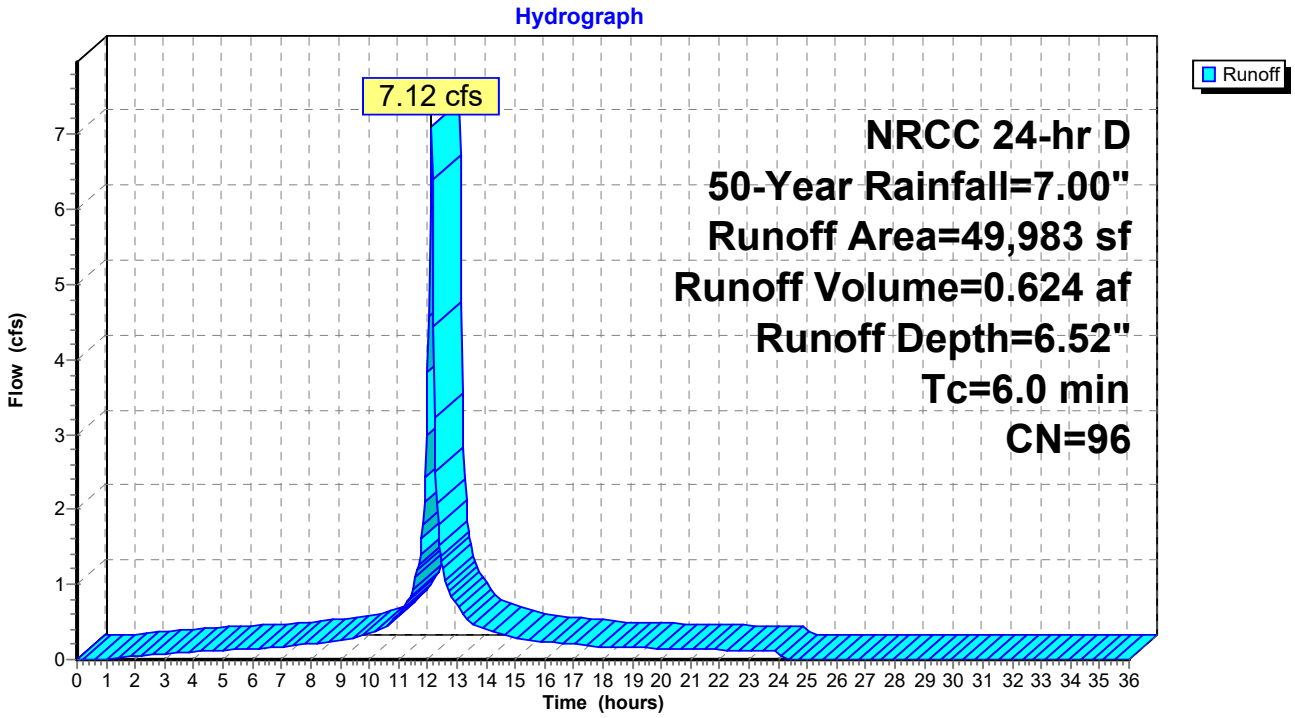
Runoff = 7.12 cfs @ 12.12 hrs, Volume= 0.624 af, Depth= 6.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 50-Year Rainfall=7.00"

Area (sf)	CN	Description
40,692	98	Paved parking, HSG D
9,291	89	<50% Grass cover, Poor, HSG D
49,983	96	Weighted Average
9,291		18.59% Pervious Area
40,692		81.41% Impervious Area

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

Subcatchment 4S: EX-4



Summary for Subcatchment 5S: EX-5

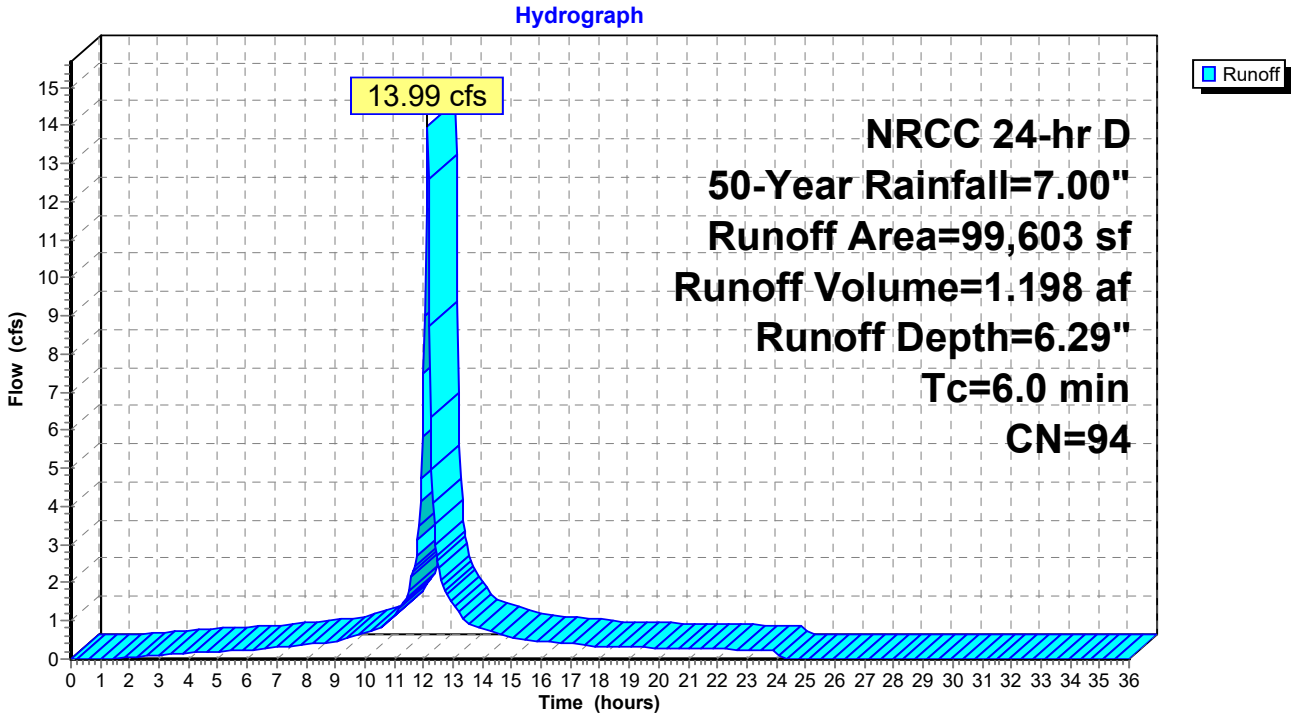
Runoff = 13.99 cfs @ 12.12 hrs, Volume= 1.198 af, Depth= 6.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 50-Year Rainfall=7.00"

	Area (sf)	CN	Description
	49,592	98	Paved parking, HSG D
*	3,585	98	Cement Concrete Sidewalk, HSG D
	46,426	89	<50% Grass cover, Poor, HSG D
	99,603	94	Weighted Average
	46,426		46.61% Pervious Area
	53,177		53.39% Impervious Area

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

Subcatchment 5S: EX-5



Summary for Subcatchment 6S: EX-6

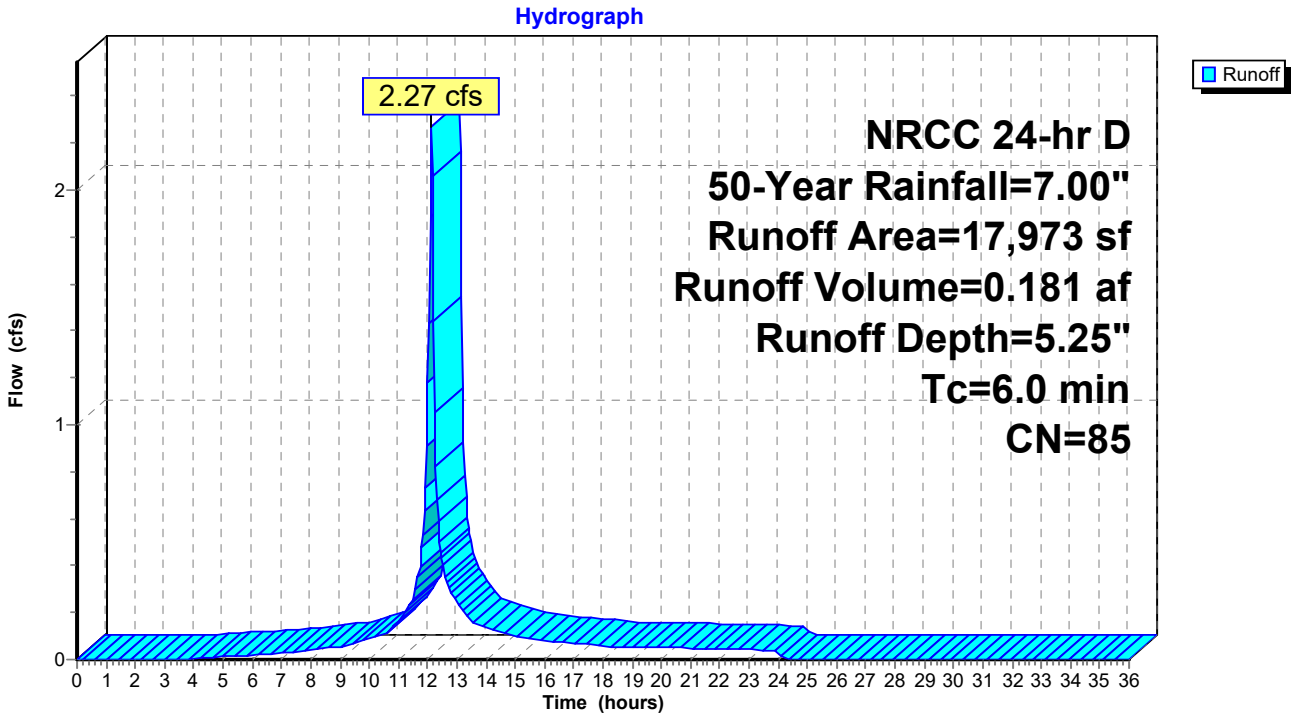
Runoff = 2.27 cfs @ 12.13 hrs, Volume= 0.181 af, Depth= 5.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 50-Year Rainfall=7.00"

Area (sf)	CN	Description
4,523	98	Paved parking, HSG D
13,450	80	>75% Grass cover, Good, HSG D
17,973	85	Weighted Average
13,450		74.83% Pervious Area
4,523		25.17% Impervious Area

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

Subcatchment 6S: EX-6

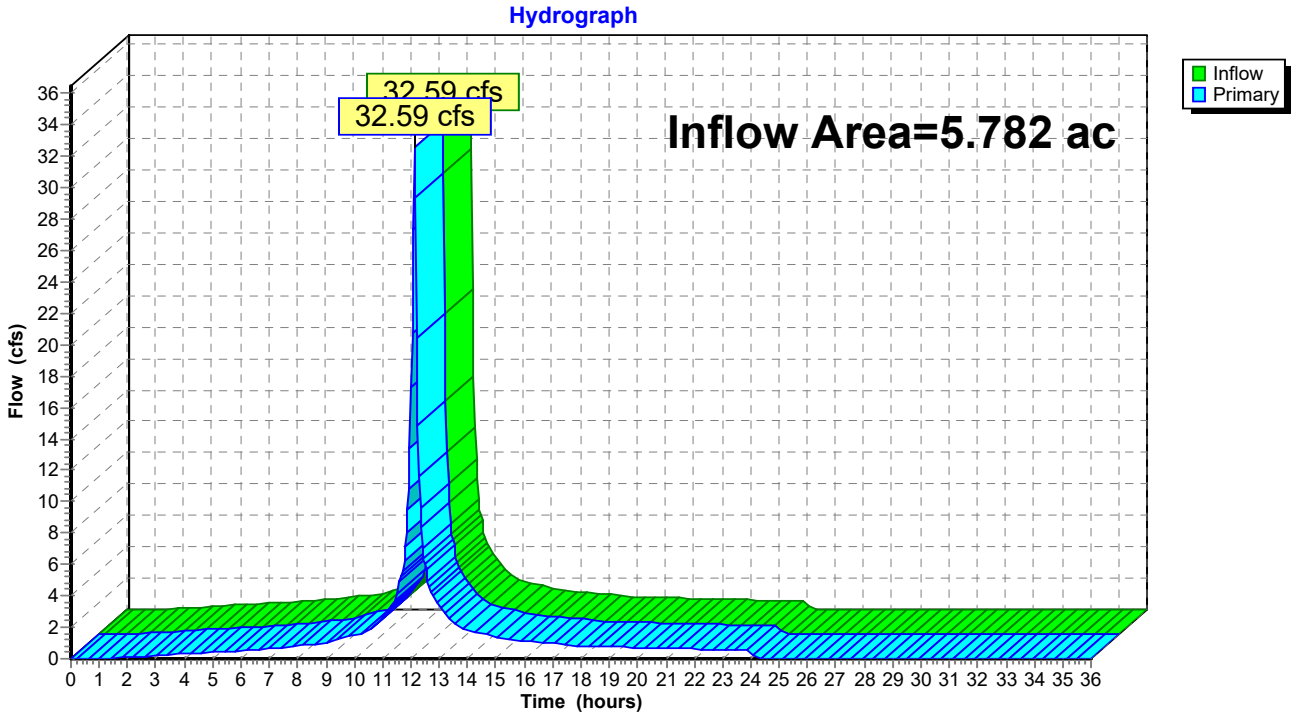


Summary for Link 7L: DP-1

Inflow Area = 5.782 ac, 54.64% Impervious, Inflow Depth = 5.73" for 50-Year event
Inflow = 32.59 cfs @ 12.13 hrs, Volume= 2.761 af
Primary = 32.59 cfs @ 12.13 hrs, Volume= 2.761 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs

Link 7L: DP-1

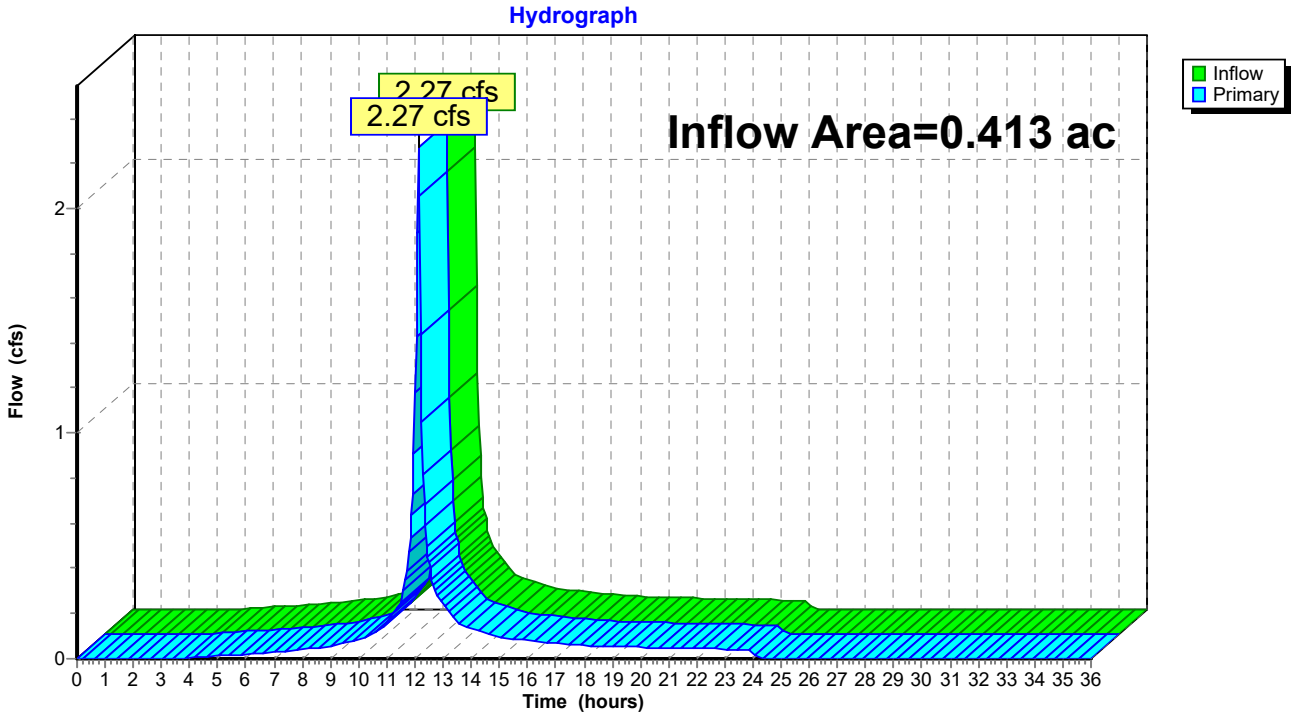


Summary for Link 8L: DP-2

Inflow Area = 0.413 ac, 25.17% Impervious, Inflow Depth = 5.25" for 50-Year event
Inflow = 2.27 cfs @ 12.13 hrs, Volume= 0.181 af
Primary = 2.27 cfs @ 12.13 hrs, Volume= 0.181 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs

Link 8L: DP-2



Time span=0.00-36.00 hrs, dt=0.04 hrs, 901 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: EX-1 Runoff Area=15,199 sf 0.00% Impervious Runoff Depth=1.31"
Tc=6.0 min CN=39 Runoff=0.37 cfs 0.038 af

Subcatchment 2S: EX-2 Runoff Area=17,904 sf 51.69% Impervious Runoff Depth=6.44"
Tc=6.0 min CN=84 Runoff=2.75 cfs 0.221 af

Subcatchment 3S: EX-3 Runoff Area=69,181 sf 49.87% Impervious Runoff Depth=6.92"
Tc=6.0 min CN=88 Runoff=11.14 cfs 0.916 af

Subcatchment 4S: EX-4 Runoff Area=49,983 sf 81.41% Impervious Runoff Depth=7.88"
Tc=6.0 min CN=96 Runoff=8.52 cfs 0.753 af

Subcatchment 5S: EX-5 Runoff Area=99,603 sf 53.39% Impervious Runoff Depth=7.64"
Tc=6.0 min CN=94 Runoff=16.82 cfs 1.456 af

Subcatchment 6S: EX-6 Runoff Area=17,973 sf 25.17% Impervious Runoff Depth=6.56"
Tc=6.0 min CN=85 Runoff=2.80 cfs 0.226 af

Link 7L: DP-1 Inflow=39.59 cfs 3.384 af
Primary=39.59 cfs 3.384 af

Link 8L: DP-2 Inflow=2.80 cfs 0.226 af
Primary=2.80 cfs 0.226 af

Total Runoff Area = 6.195 ac Runoff Volume = 3.610 af Average Runoff Depth = 6.99"
47.32% Pervious = 2.931 ac 52.68% Impervious = 3.263 ac

Summary for Subcatchment 1S: EX-1

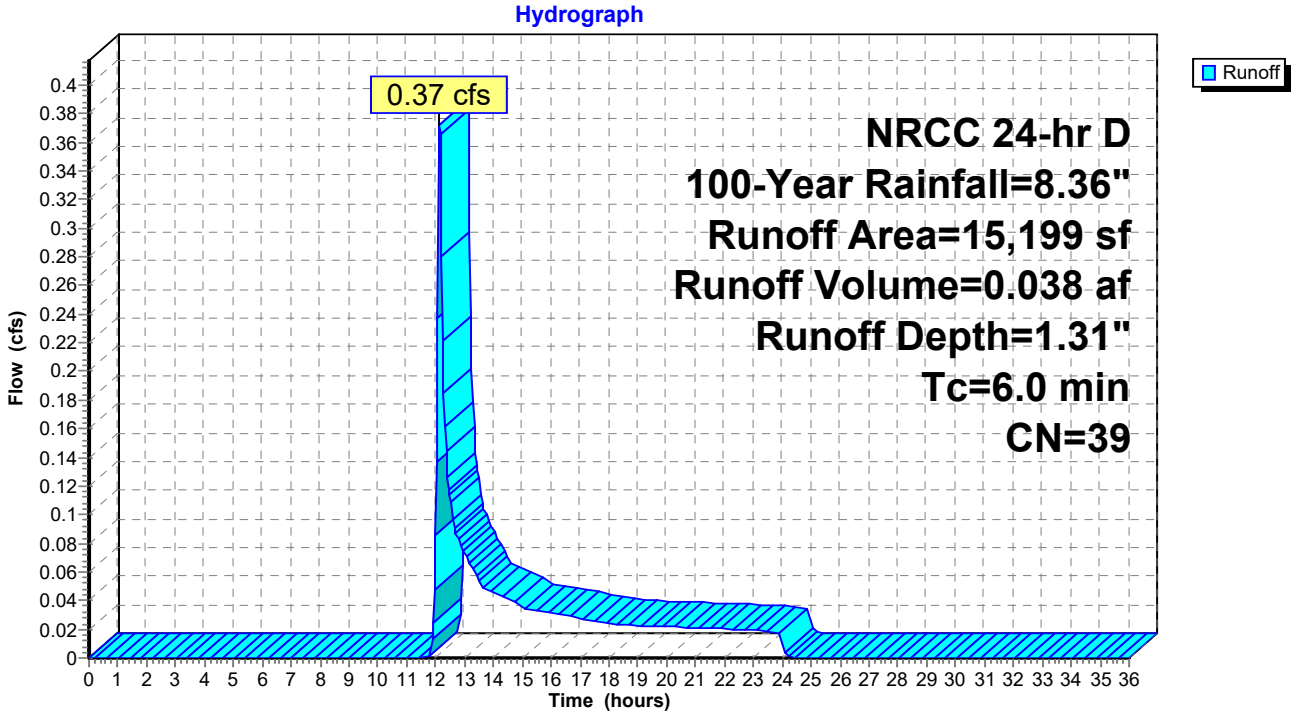
Runoff = 0.37 cfs @ 12.15 hrs, Volume= 0.038 af, Depth= 1.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 100-Year Rainfall=8.36"

Area (sf)	CN	Description
15,199	39	>75% Grass cover, Good, HSG A
15,199		100.00% Pervious Area

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

Subcatchment 1S: EX-1



Summary for Subcatchment 2S: EX-2

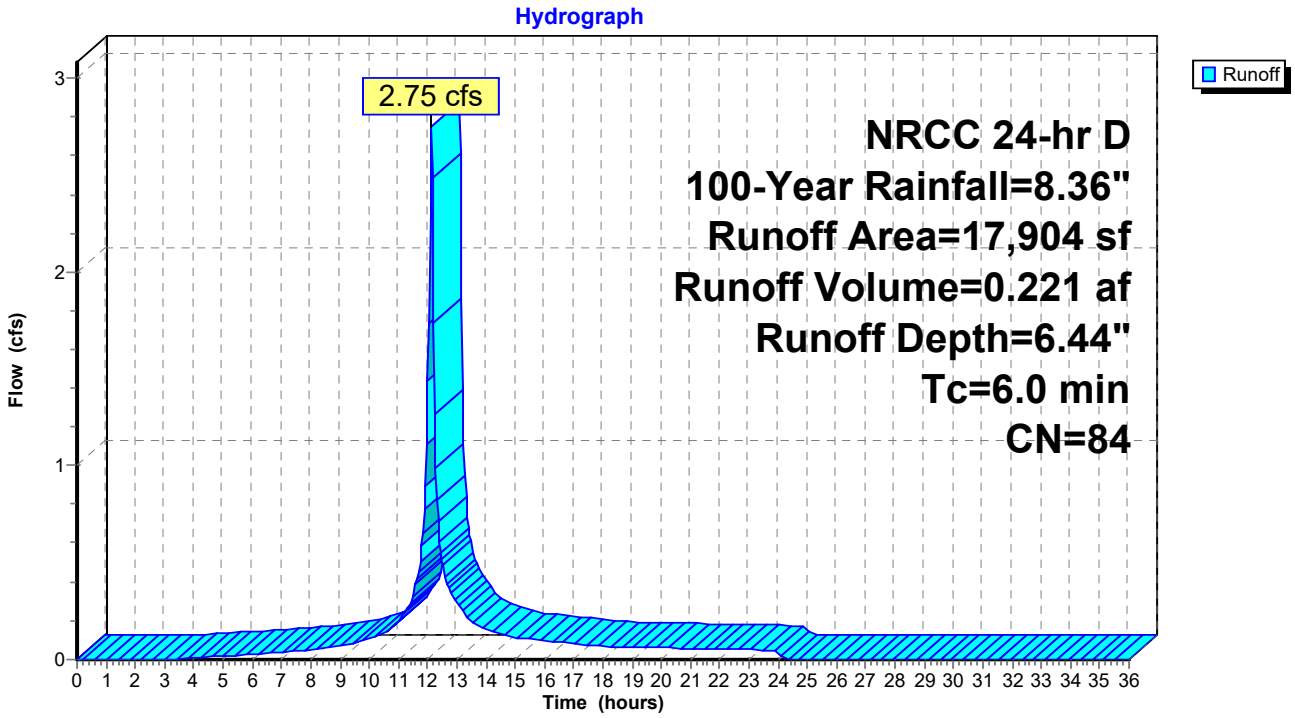
Runoff = 2.75 cfs @ 12.13 hrs, Volume= 0.221 af, Depth= 6.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 100-Year Rainfall=8.36"

Area (sf)	CN	Description
8,650	68	<50% Grass cover, Poor, HSG A
9,254	98	Paved parking, HSG A
17,904	84	Weighted Average
8,650		48.31% Pervious Area
9,254		51.69% Impervious Area

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

Subcatchment 2S: EX-2



Summary for Subcatchment 3S: EX-3

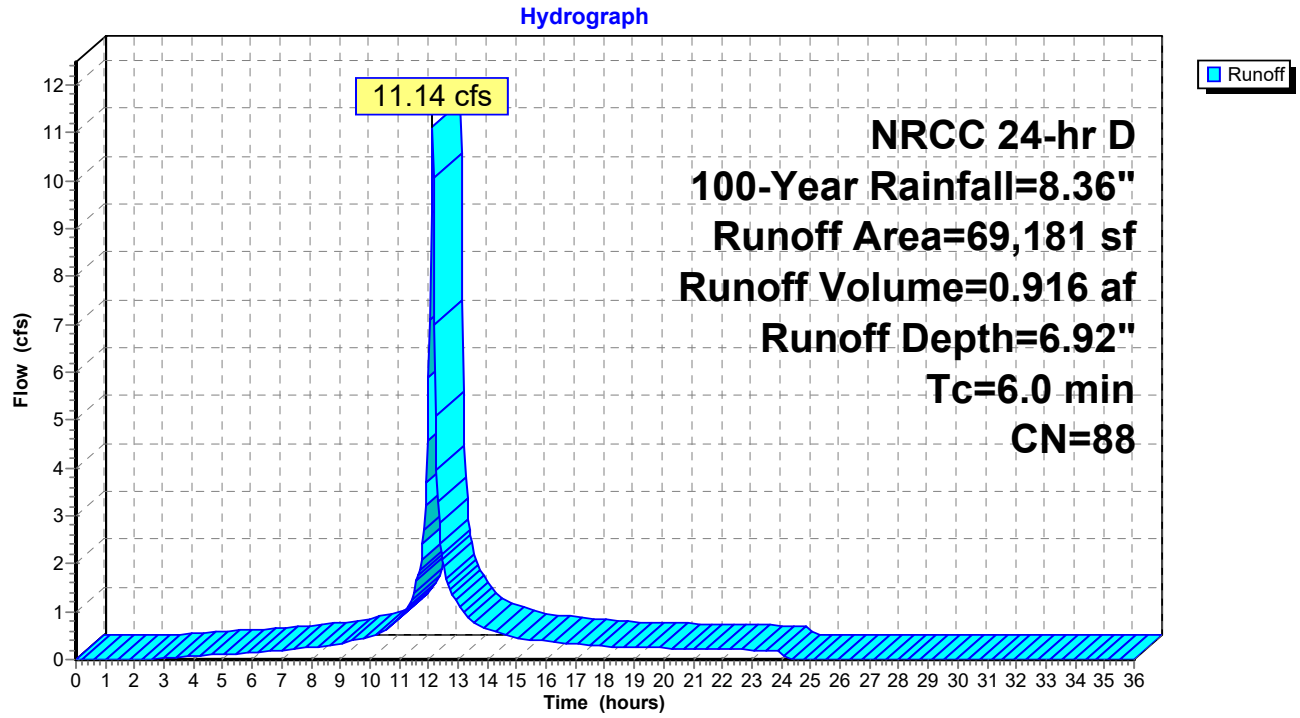
Runoff = 11.14 cfs @ 12.13 hrs, Volume= 0.916 af, Depth= 6.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 100-Year Rainfall=8.36"

Area (sf)	CN	Description
34,503	98	Paved parking, HSG C
34,678	79	50-75% Grass cover, Fair, HSG C
69,181	88	Weighted Average
34,678		50.13% Pervious Area
34,503		49.87% Impervious Area

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

Subcatchment 3S: EX-3



Summary for Subcatchment 4S: EX-4

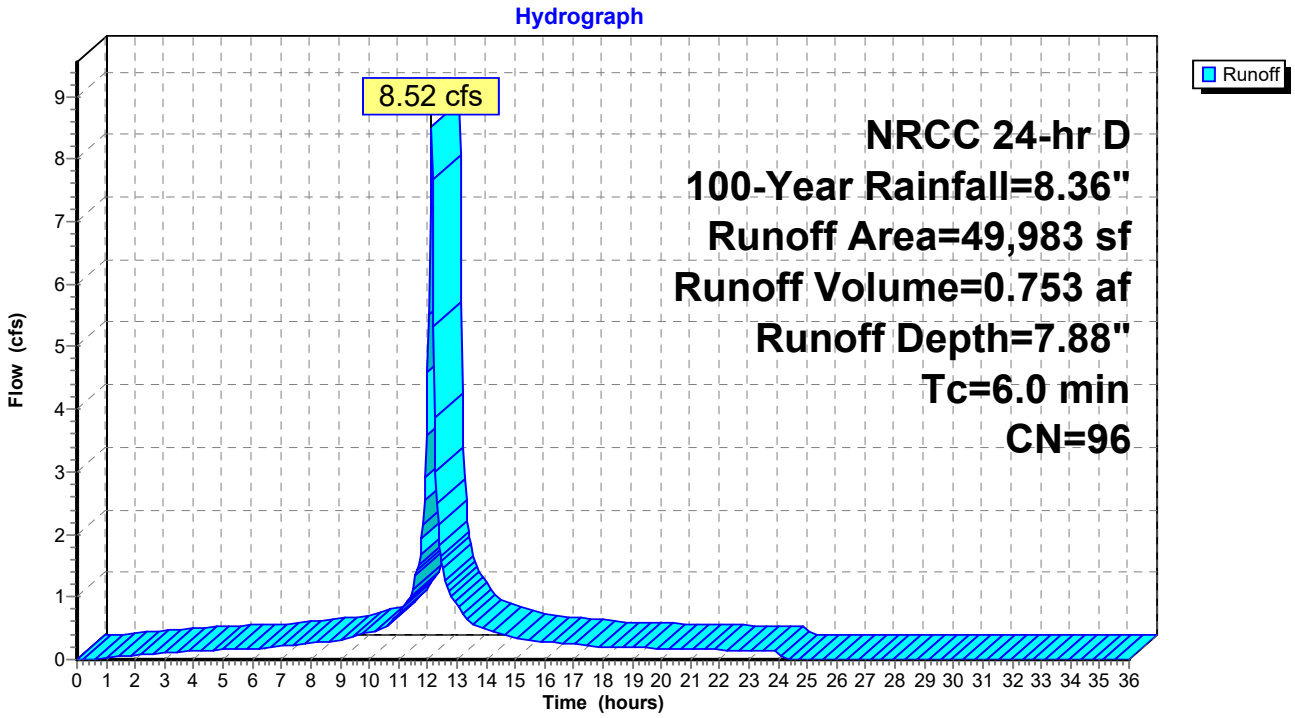
Runoff = 8.52 cfs @ 12.12 hrs, Volume= 0.753 af, Depth= 7.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 100-Year Rainfall=8.36"

Area (sf)	CN	Description
40,692	98	Paved parking, HSG D
9,291	89	<50% Grass cover, Poor, HSG D
49,983	96	Weighted Average
9,291		18.59% Pervious Area
40,692		81.41% Impervious Area

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

Subcatchment 4S: EX-4



Summary for Subcatchment 5S: EX-5

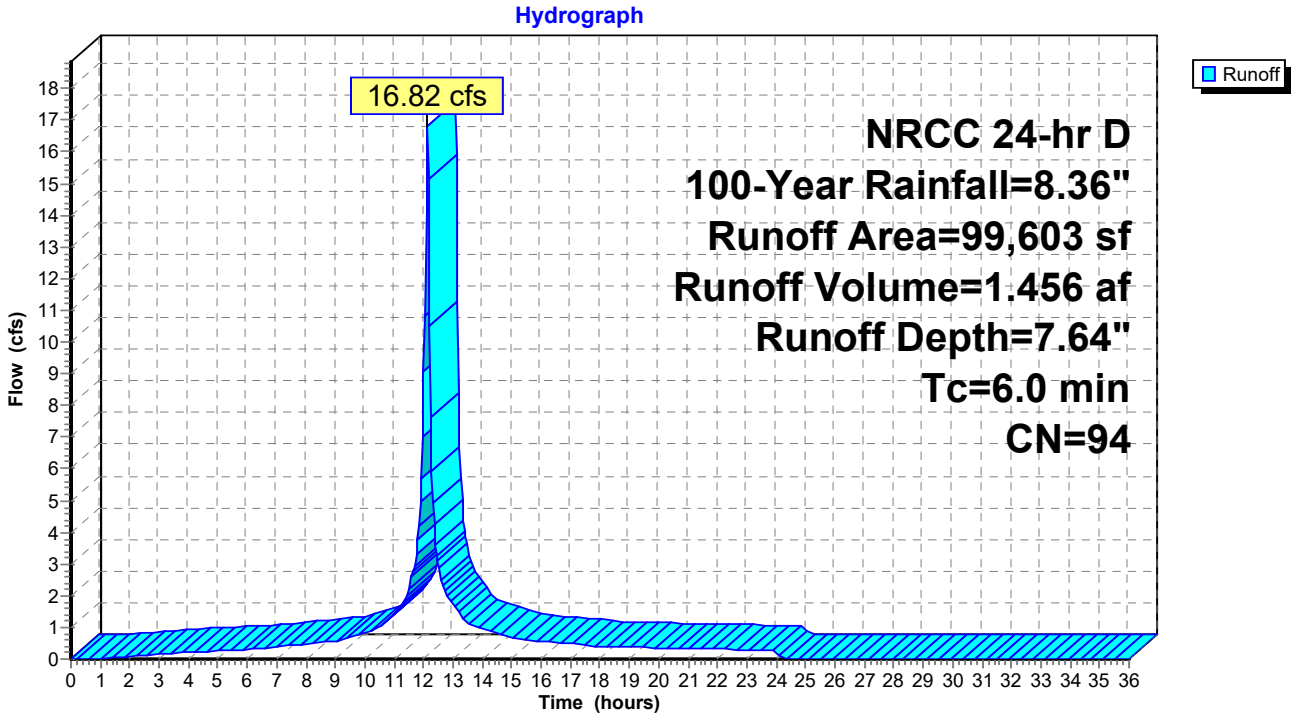
Runoff = 16.82 cfs @ 12.12 hrs, Volume= 1.456 af, Depth= 7.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 100-Year Rainfall=8.36"

	Area (sf)	CN	Description
	49,592	98	Paved parking, HSG D
*	3,585	98	Cement Concrete Sidewalk, HSG D
	46,426	89	<50% Grass cover, Poor, HSG D
	99,603	94	Weighted Average
	46,426		46.61% Pervious Area
	53,177		53.39% Impervious Area

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

Subcatchment 5S: EX-5



Summary for Subcatchment 6S: EX-6

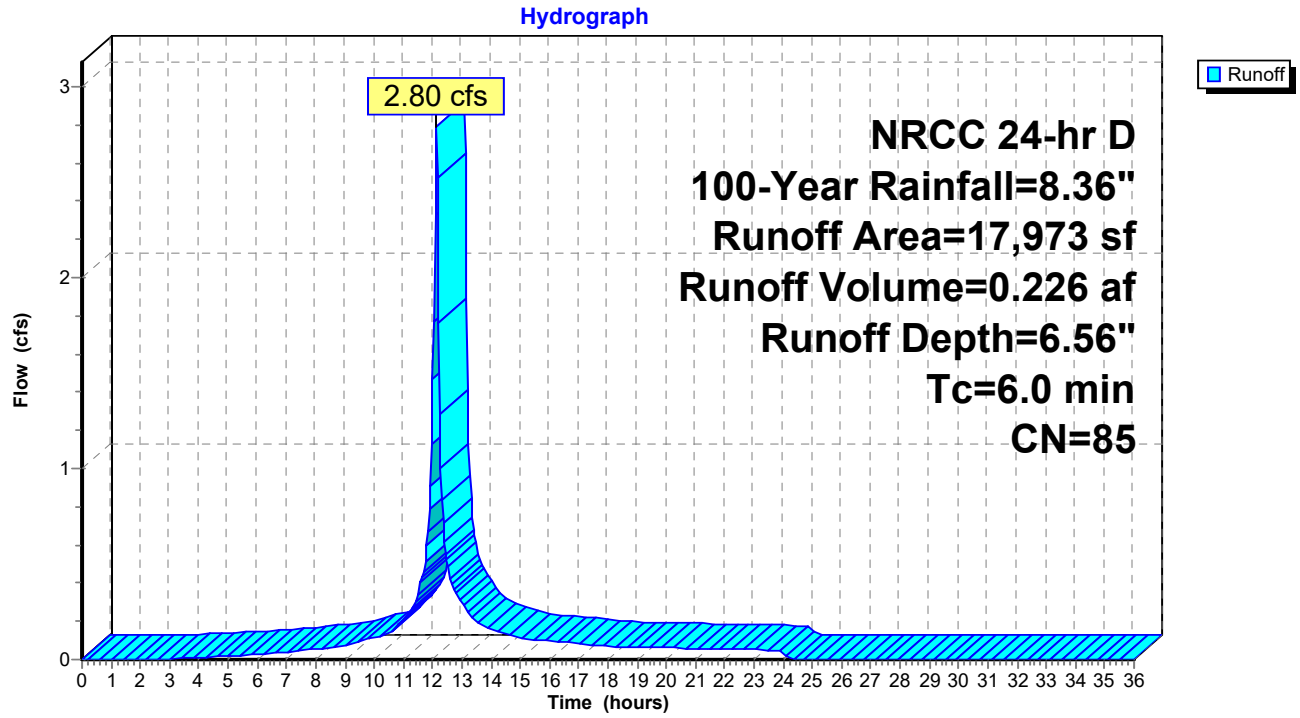
Runoff = 2.80 cfs @ 12.13 hrs, Volume= 0.226 af, Depth= 6.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 100-Year Rainfall=8.36"

Area (sf)	CN	Description
4,523	98	Paved parking, HSG D
13,450	80	>75% Grass cover, Good, HSG D
17,973	85	Weighted Average
13,450		74.83% Pervious Area
4,523		25.17% Impervious Area

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

Subcatchment 6S: EX-6

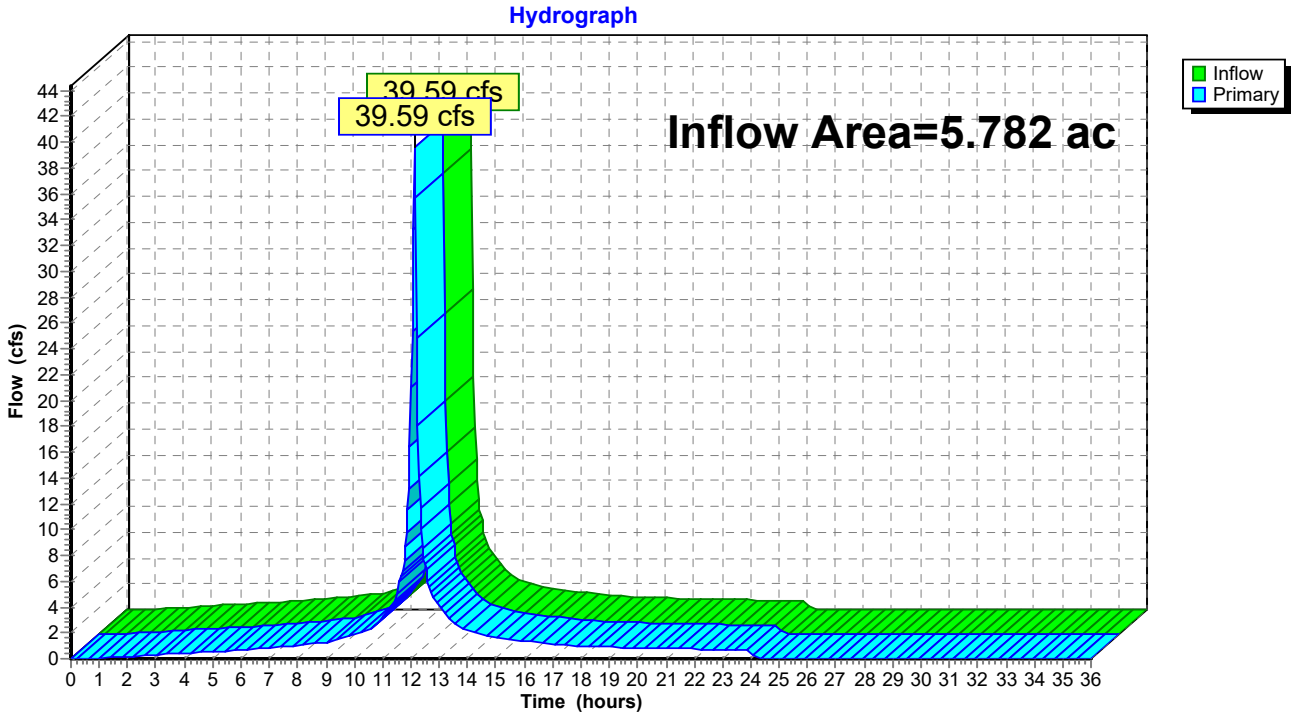


Summary for Link 7L: DP-1

Inflow Area = 5.782 ac, 54.64% Impervious, Inflow Depth = 7.02" for 100-Year event
Inflow = 39.59 cfs @ 12.12 hrs, Volume= 3.384 af
Primary = 39.59 cfs @ 12.12 hrs, Volume= 3.384 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs

Link 7L: DP-1

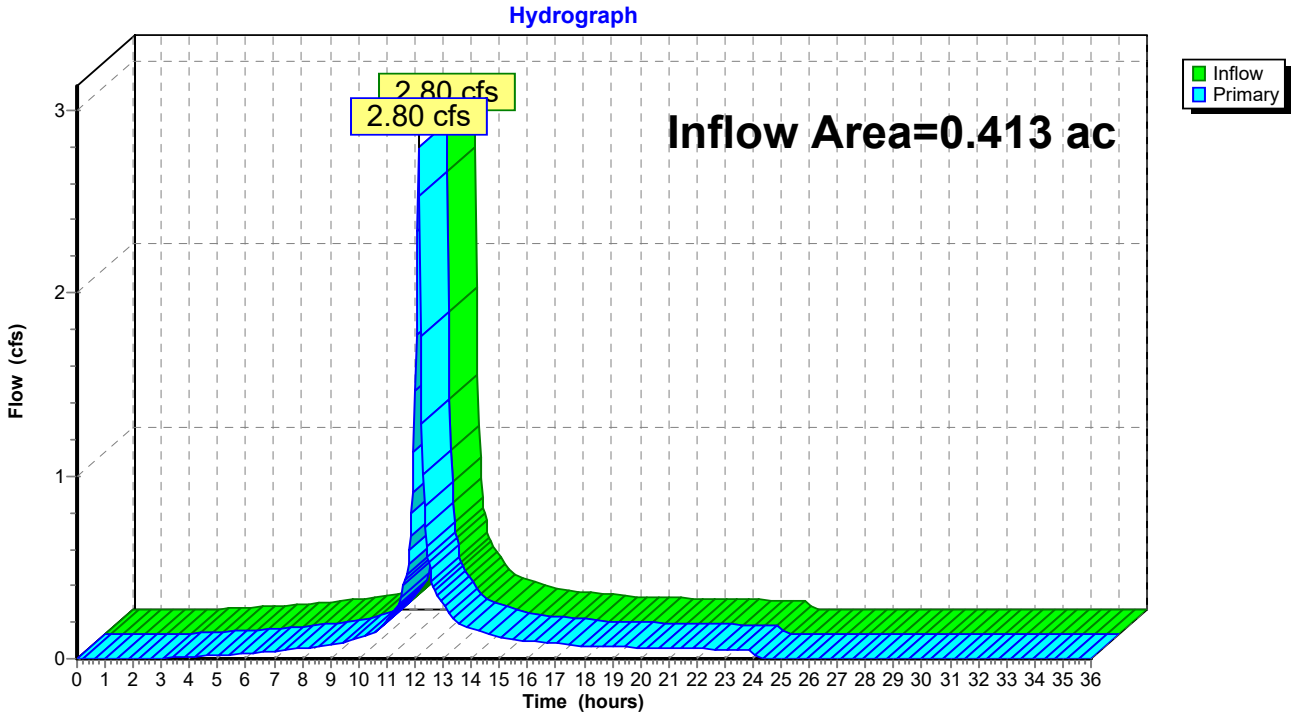


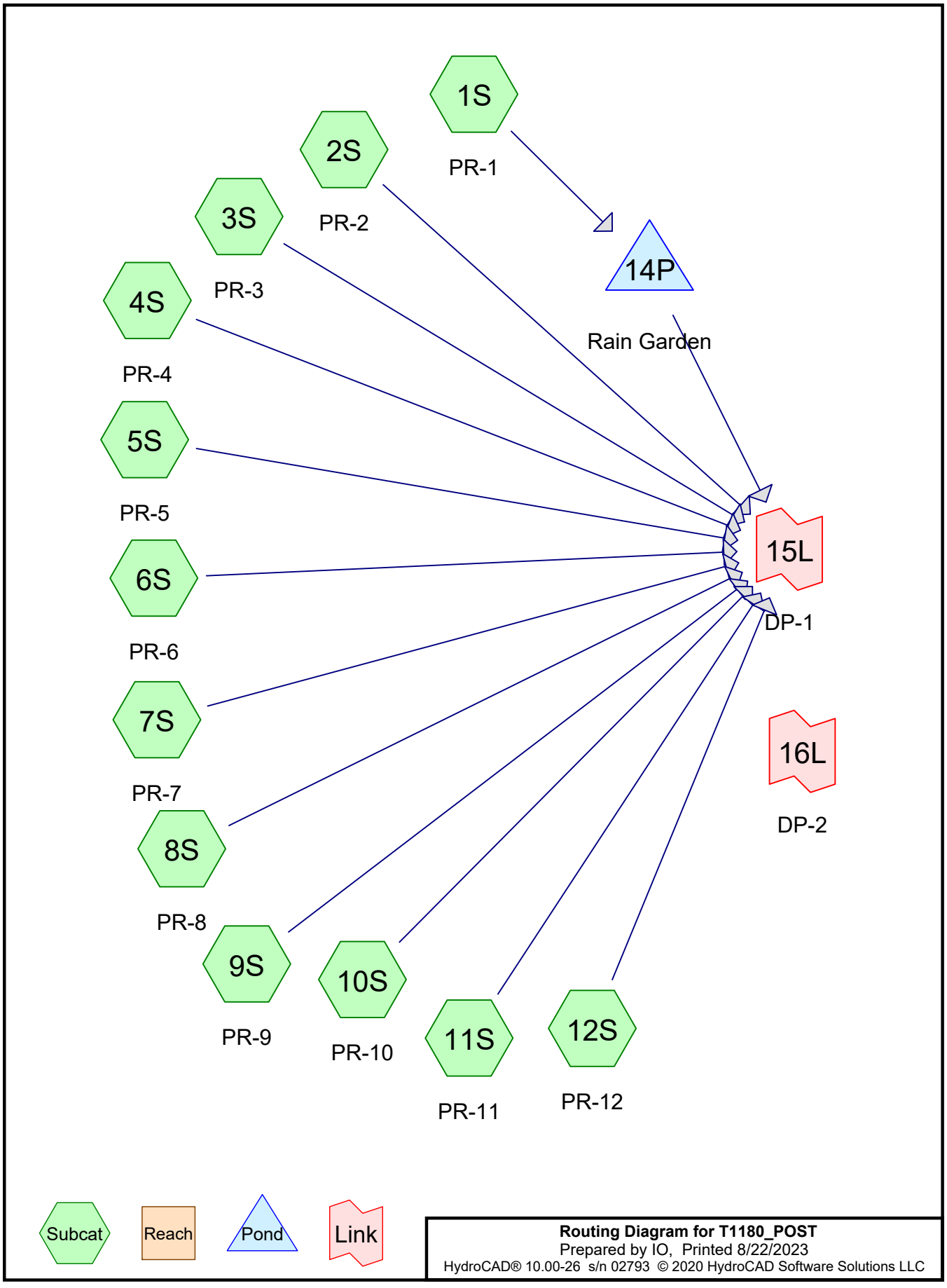
Summary for Link 8L: DP-2

Inflow Area = 0.413 ac, 25.17% Impervious, Inflow Depth = 6.56" for 100-Year event
Inflow = 2.80 cfs @ 12.13 hrs, Volume= 0.226 af
Primary = 2.80 cfs @ 12.13 hrs, Volume= 0.226 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs

Link 8L: DP-2




1S
PR-1
2S
PR-2
3S
PR-3
4S
PR-4
5S
PR-5
6S
PR-6
7S
PR-7
8S
PR-8
9S
PR-9
10S
PR-10
11S
PR-11
12S
PR-12
14P
Rain Garden
15L
DP-1
16L
DP-2
Subcat
Reach
Pond
Link
Routing Diagram for T1180_POST
Prepared by IO, Printed 8/22/2023
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Project Notes

Rainfall events imported from "NRCS-Rain.txt" for 4157 MA Littleton Middlesex County Central

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.540	79	50-75% Grass cover, Fair, HSG C (4S)
0.623	89	<50% Grass cover, Poor, HSG D (2S, 6S, 9S, 10S, 11S, 12S)
0.527	39	>75% Grass cover, Good, HSG A (1S)
0.182	74	>75% Grass cover, Good, HSG C (3S)
0.362	80	>75% Grass cover, Good, HSG D (5S, 7S, 8S)
0.047	98	Cement Concrete Sidewalk, HSG A (1S)
0.201	98	Cement Concrete Sidewalk, HSG C (3S, 4S)
0.482	98	Cement Concrete Sidewalk, HSG D (2S, 5S, 6S, 7S, 8S, 9S, 10S, 11S, 12S)
0.212	98	Paved parking, HSG A (1S)
0.790	98	Paved parking, HSG C (3S, 4S)
2.231	98	Paved parking, HSG D (2S, 5S, 6S, 7S, 8S, 9S, 10S, 11S, 12S)
6.197	**89**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.786	HSG A	1S
0.000	HSG B	
1.713	HSG C	3S, 4S
3.698	HSG D	2S, 5S, 6S, 7S, 8S, 9S, 10S, 11S, 12S
0.000	Other	
6.197		**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	0.000	0.540	0.000	0.000	0.540	50-75% Grass cover, Fair	4S
0.000	0.000	0.000	0.623	0.000	0.623	<50% Grass cover, Poor	2S, 6S, 9S, 10S, 11S, 12S
0.527	0.000	0.182	0.362	0.000	1.071	>75% Grass cover, Good	1S, 3S, 5S, 7S, 8S
0.047	0.000	0.201	0.482	0.000	0.731	Cement Concrete Sidewalk	1S, 2S, 3S, 4S, 5S, 6S, 7S, 8S, 9S, 10S, 11S, 12S
0.212	0.000	0.790	2.231	0.000	3.232	Paved parking	1S, 2S, 3S, 4S, 5S, 6S, 7S, 8S, 9S, 10S, 11S, 12S
0.786	**0.000**	**1.713**	**3.698**	**0.000**	**6.197**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	14P	254.50	253.50	20.0	0.0500	0.012	12.0	0.0	0.0

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: PR-1 Runoff Area=34,243 sf 32.96% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=58 Runoff=0.00 cfs 0.000 af

Subcatchment 2S: PR-2 Runoff Area=19,941 sf 66.78% Impervious Runoff Depth=0.56"
Tc=6.0 min CN=95 Runoff=0.28 cfs 0.021 af

Subcatchment 3S: PR-3 Runoff Area=24,637 sf 67.78% Impervious Runoff Depth=0.32"
Tc=6.0 min CN=90 Runoff=0.19 cfs 0.015 af

Subcatchment 4S: PR-4 Runoff Area=49,972 sf 52.93% Impervious Runoff Depth=0.28"
Tc=6.0 min CN=89 Runoff=0.34 cfs 0.027 af

Subcatchment 5S: PR-5 Runoff Area=21,676 sf 66.73% Impervious Runoff Depth=0.40"
Tc=6.0 min CN=92 Runoff=0.21 cfs 0.017 af

Subcatchment 6S: PR-6 Runoff Area=17,007 sf 88.03% Impervious Runoff Depth=0.71"
Tc=6.0 min CN=97 Runoff=0.29 cfs 0.023 af

Subcatchment 7S: PR-7 Runoff Area=10,460 sf 58.78% Impervious Runoff Depth=0.36"
Tc=6.0 min CN=91 Runoff=0.09 cfs 0.007 af

Subcatchment 8S: PR-8 Runoff Area=11,602 sf 63.58% Impervious Runoff Depth=0.36"
Tc=6.0 min CN=91 Runoff=0.10 cfs 0.008 af

Subcatchment 9S: PR-9 Runoff Area=15,512 sf 85.80% Impervious Runoff Depth=0.71"
Tc=6.0 min CN=97 Runoff=0.26 cfs 0.021 af

Subcatchment 10S: PR-10 Runoff Area=30,816 sf 75.34% Impervious Runoff Depth=0.63"
Tc=6.0 min CN=96 Runoff=0.47 cfs 0.037 af

Subcatchment 11S: PR-11 Runoff Area=14,883 sf 84.20% Impervious Runoff Depth=0.71"
Tc=6.0 min CN=97 Runoff=0.25 cfs 0.020 af

Subcatchment 12S: PR-12 Runoff Area=19,194 sf 66.97% Impervious Runoff Depth=0.56"
Tc=6.0 min CN=95 Runoff=0.27 cfs 0.021 af

Pond 14P: Rain Garden Peak Elev=254.00' Storage=0 cf Inflow=0.00 cfs 0.000 af
Discarded=0.00 cfs 0.000 af Primary=0.00 cfs 0.000 af Outflow=0.00 cfs 0.000 af

Link 15L: DP-1 Inflow=2.75 cfs 0.218 af
Primary=2.75 cfs 0.218 af

Link 16L: DP-2
Primary=0.00 cfs 0.000 af

Total Runoff Area = 6.197 ac Runoff Volume = 0.218 af Average Runoff Depth = 0.42"
36.05% Pervious = 2.234 ac 63.95% Impervious = 3.963 ac

Summary for Subcatchment 1S: PR-1

[45] Hint: Runoff=Zero

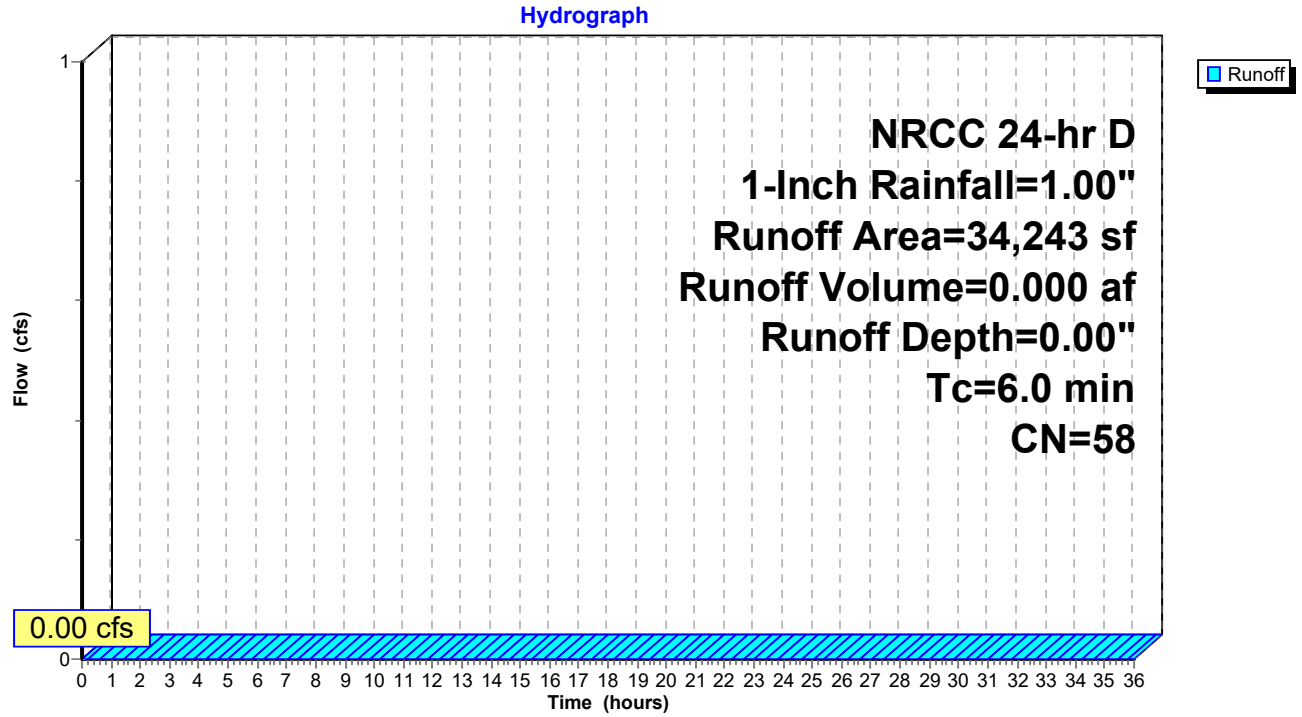
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 1-Inch Rainfall=1.00"

	Area (sf)	CN	Description
	9,225	98	Paved parking, HSG A
*	2,063	98	Cement Concrete Sidewalk, HSG A
	22,955	39	>75% Grass cover, Good, HSG A
	34,243	58	Weighted Average
	22,955		67.04% Pervious Area
	11,288		32.96% Impervious Area

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

Subcatchment 1S: PR-1



Summary for Subcatchment 2S: PR-2

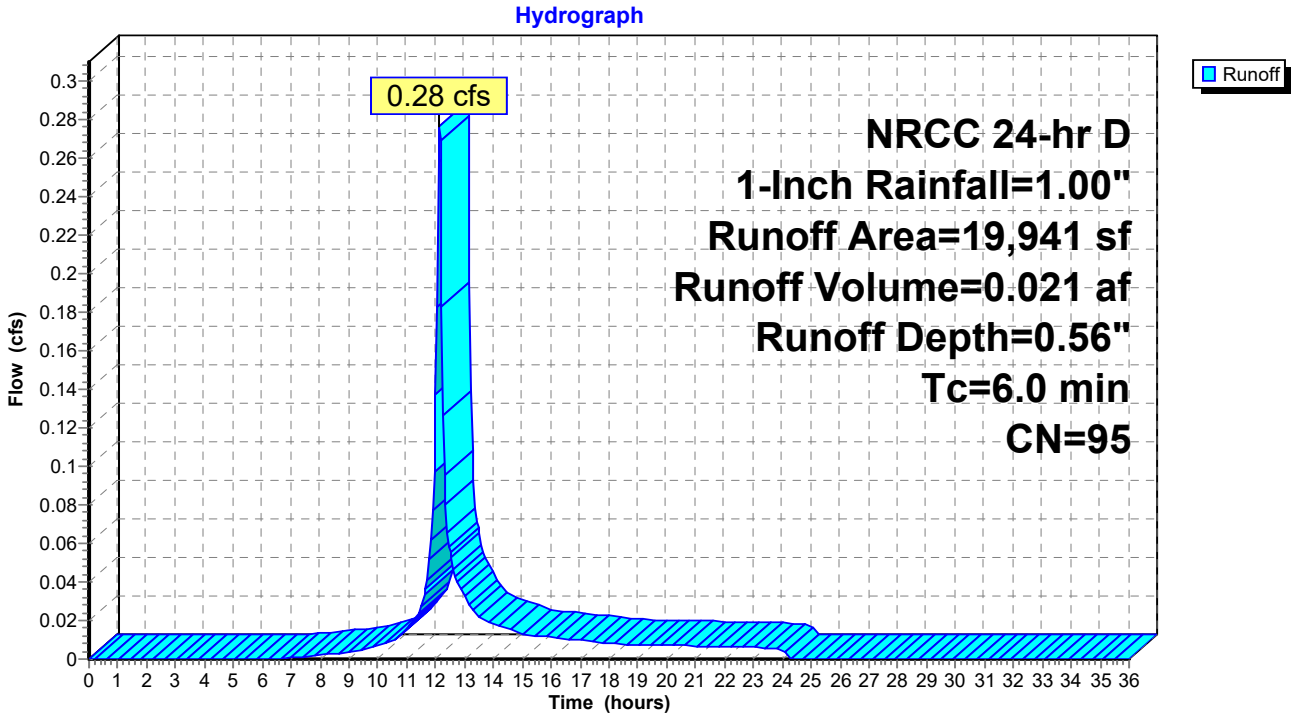
Runoff = 0.28 cfs @ 12.13 hrs, Volume= 0.021 af, Depth= 0.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 1-Inch Rainfall=1.00"

	Area (sf)	CN	Description
	11,050	98	Paved parking, HSG D
*	2,266	98	Cement Concrete Sidewalk, HSG D
	6,625	89	<50% Grass cover, Poor, HSG D
	19,941	95	Weighted Average
	6,625		33.22% Pervious Area
	13,316		66.78% Impervious Area

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

Subcatchment 2S: PR-2



Summary for Subcatchment 3S: PR-3

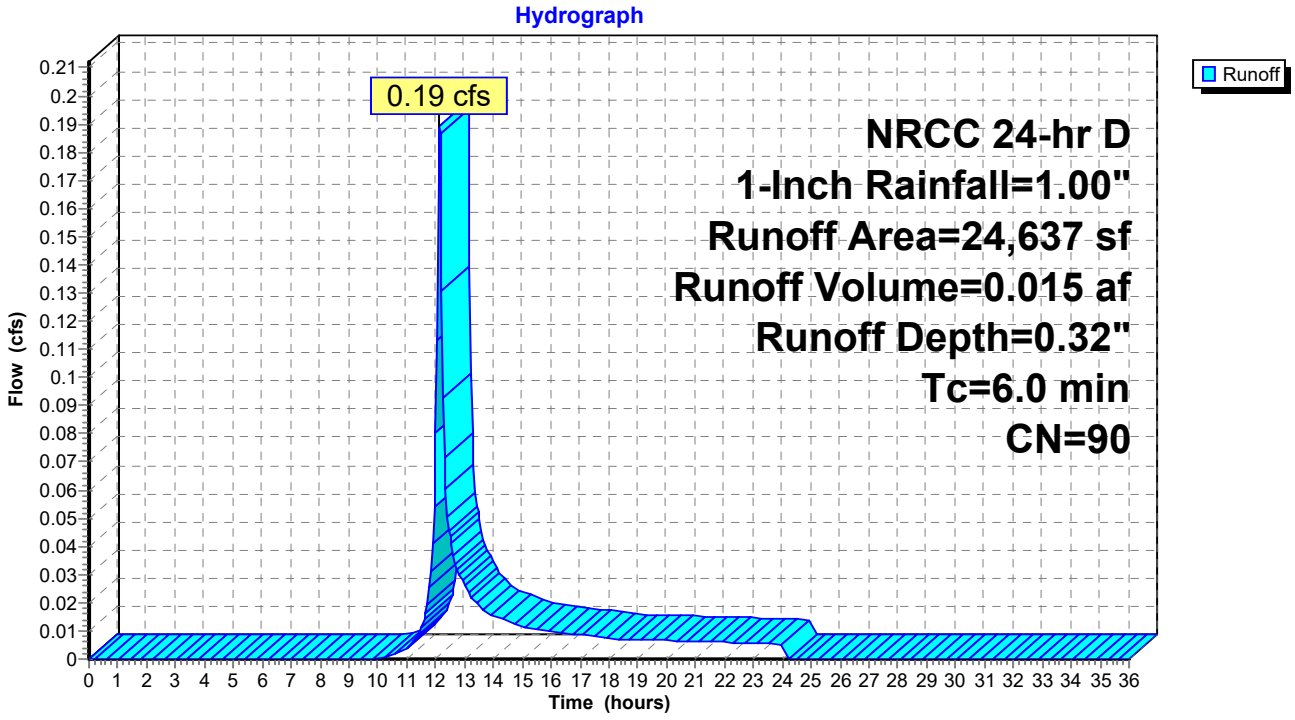
Runoff = 0.19 cfs @ 12.14 hrs, Volume= 0.015 af, Depth= 0.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 1-Inch Rainfall=1.00"

	Area (sf)	CN	Description
	13,876	98	Paved parking, HSG C
*	2,822	98	Cement Concrete Sidewalk, HSG C
	7,939	74	>75% Grass cover, Good, HSG C
	24,637	90	Weighted Average
	7,939		32.22% Pervious Area
	16,698		67.78% Impervious Area

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

Subcatchment 3S: PR-3



Summary for Subcatchment 4S: PR-4

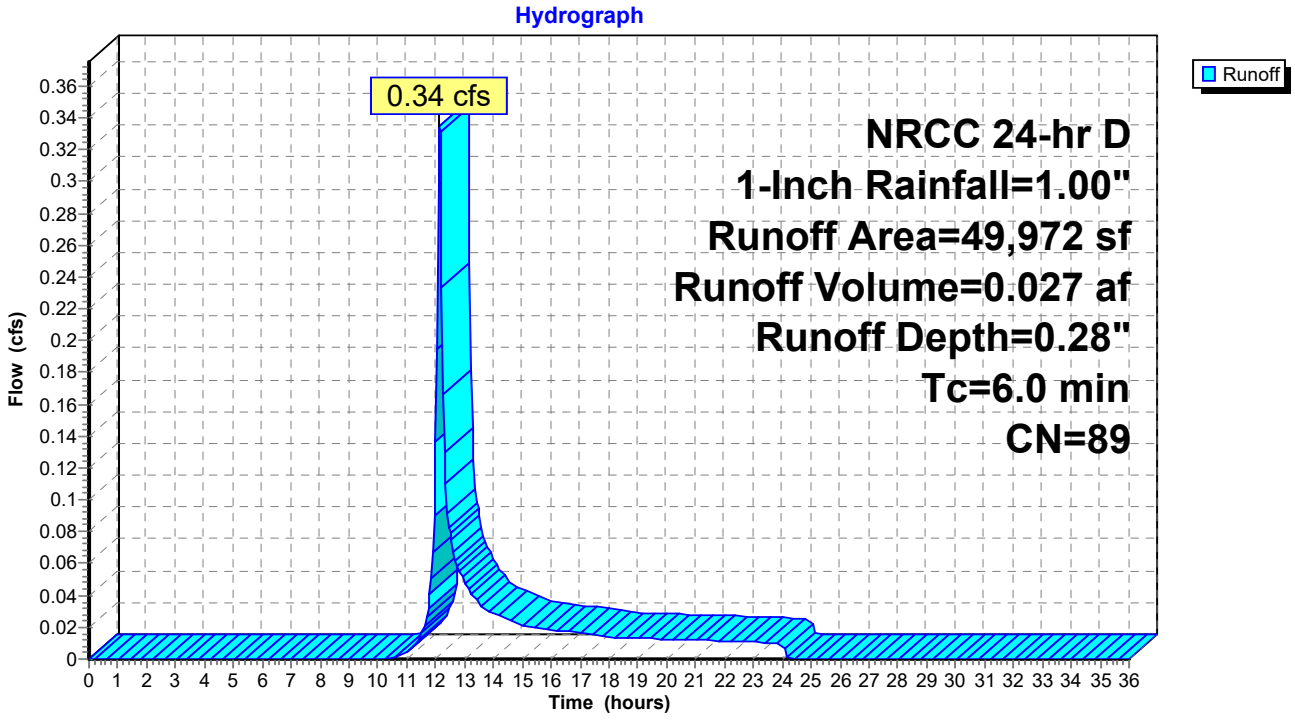
Runoff = 0.34 cfs @ 12.14 hrs, Volume= 0.027 af, Depth= 0.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 1-Inch Rainfall=1.00"

	Area (sf)	CN	Description
	20,528	98	Paved parking, HSG C
*	5,920	98	Cement Concrete Sidewalk, HSG C
	23,524	79	50-75% Grass cover, Fair, HSG C
	49,972	89	Weighted Average
	23,524		47.07% Pervious Area
	26,448		52.93% Impervious Area

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

Subcatchment 4S: PR-4



Summary for Subcatchment 5S: PR-5

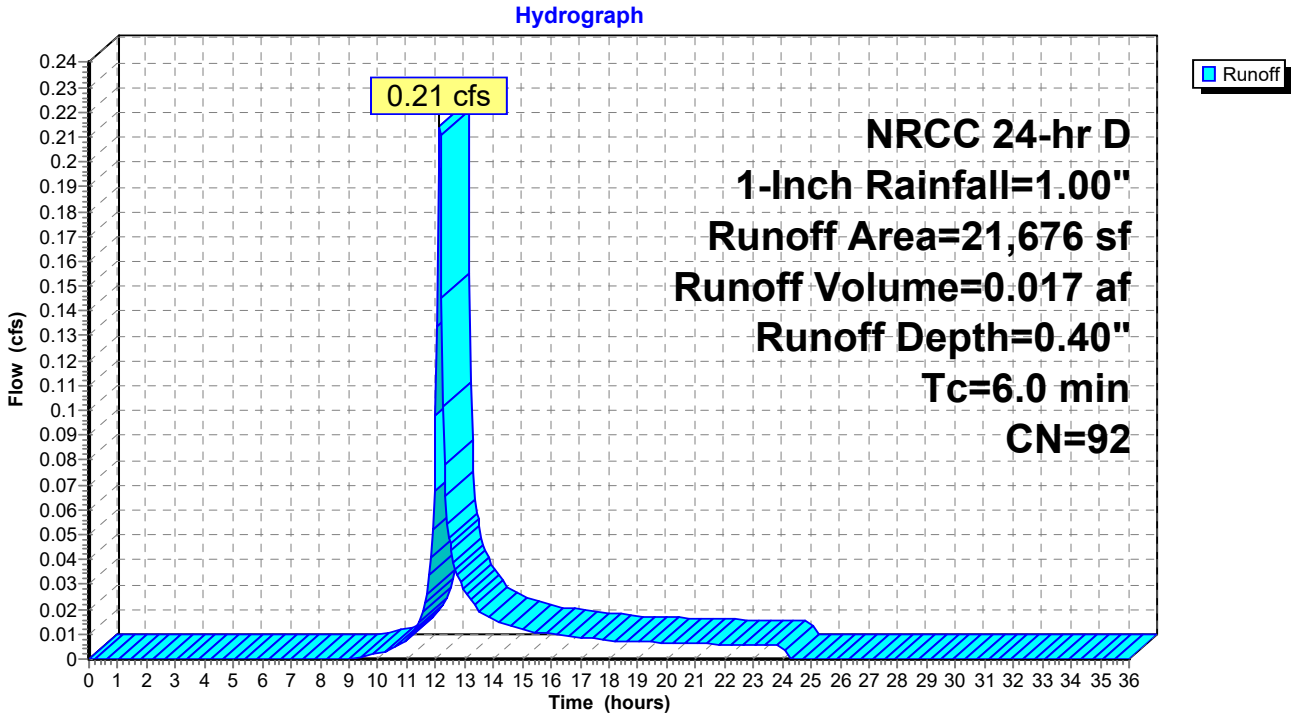
Runoff = 0.21 cfs @ 12.13 hrs, Volume= 0.017 af, Depth= 0.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 1-Inch Rainfall=1.00"

	Area (sf)	CN	Description
	11,952	98	Paved parking, HSG D
*	2,512	98	Cement Concrete Sidewalk, HSG D
	7,212	80	>75% Grass cover, Good, HSG D
	21,676	92	Weighted Average
	7,212		33.27% Pervious Area
	14,464		66.73% Impervious Area

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

Subcatchment 5S: PR-5



Summary for Subcatchment 6S: PR-6

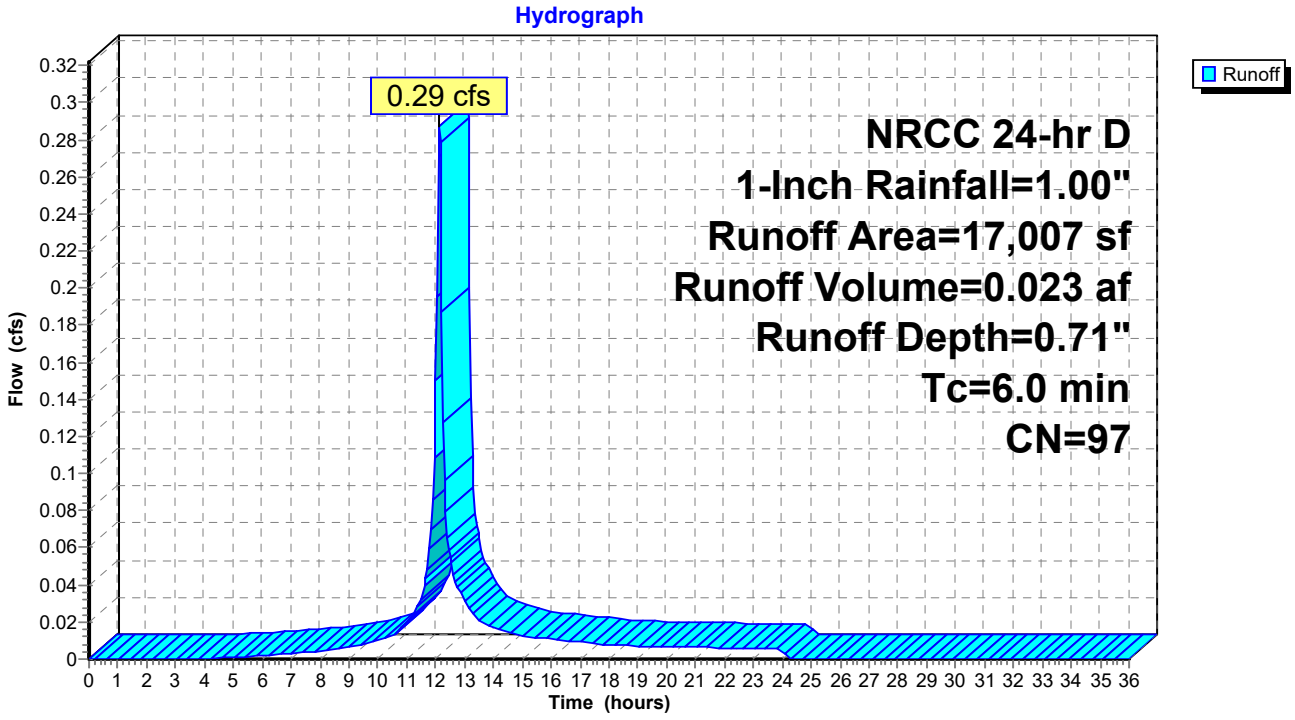
Runoff = 0.29 cfs @ 12.13 hrs, Volume= 0.023 af, Depth= 0.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 1-Inch Rainfall=1.00"

	Area (sf)	CN	Description
	11,871	98	Paved parking, HSG D
*	3,101	98	Cement Concrete Sidewalk, HSG D
	2,035	89	<50% Grass cover, Poor, HSG D
	17,007	97	Weighted Average
	2,035		11.97% Pervious Area
	14,972		88.03% Impervious Area

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

Subcatchment 6S: PR-6



Summary for Subcatchment 7S: PR-7

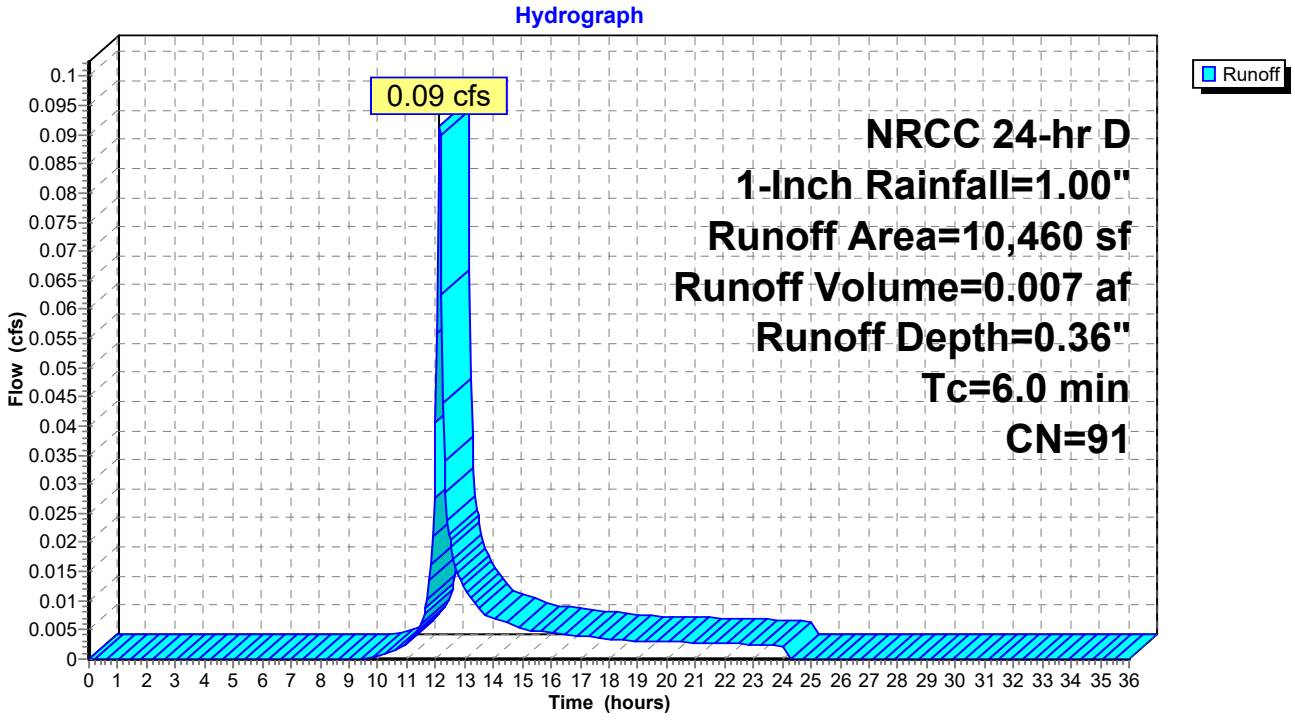
Runoff = 0.09 cfs @ 12.13 hrs, Volume= 0.007 af, Depth= 0.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 1-Inch Rainfall=1.00"

	Area (sf)	CN	Description
	5,793	98	Paved parking, HSG D
*	355	98	Cement Concrete Sidewalk, HSG D
	4,312	80	>75% Grass cover, Good, HSG D
	10,460	91	Weighted Average
	4,312		41.22% Pervious Area
	6,148		58.78% Impervious Area

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

Subcatchment 7S: PR-7



Summary for Subcatchment 8S: PR-8

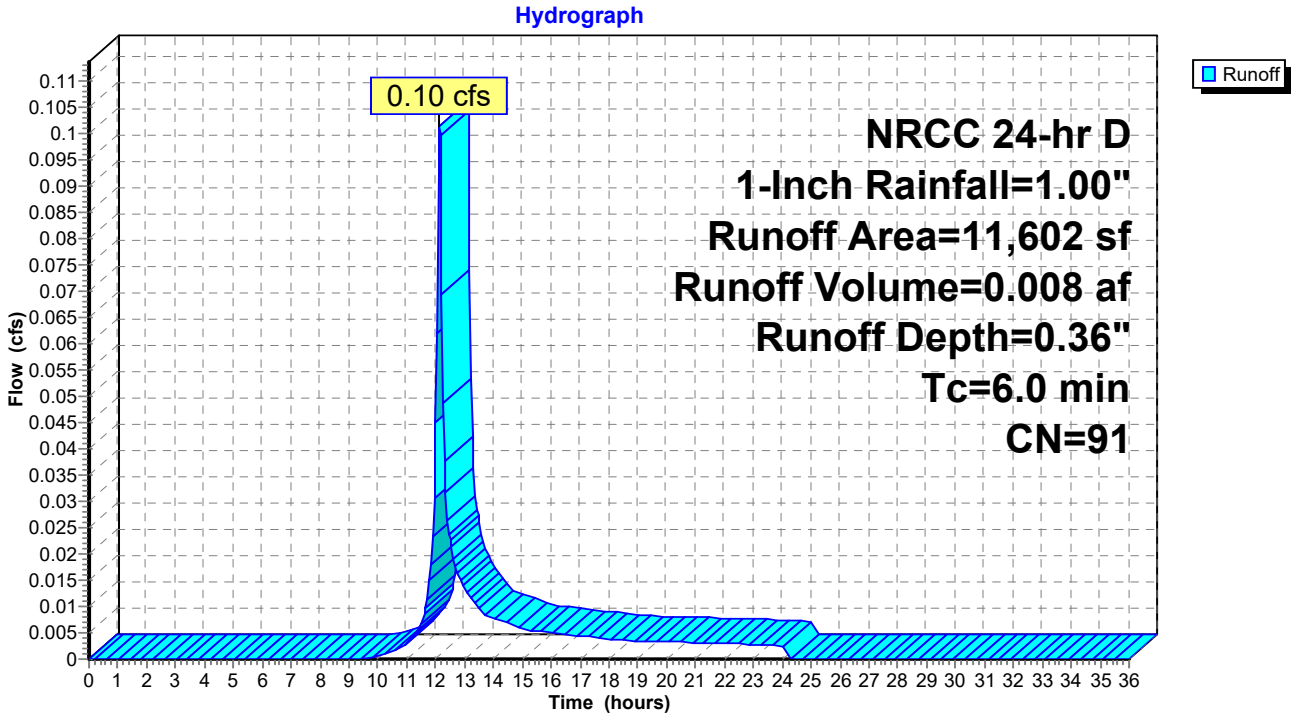
Runoff = 0.10 cfs @ 12.13 hrs, Volume= 0.008 af, Depth= 0.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 1-Inch Rainfall=1.00"

	Area (sf)	CN	Description
	6,124	98	Paved parking, HSG D
*	1,252	98	Cement Concrete Sidewalk, HSG D
	4,226	80	>75% Grass cover, Good, HSG D
	11,602	91	Weighted Average
	4,226		36.42% Pervious Area
	7,376		63.58% Impervious Area

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

Subcatchment 8S: PR-8



Summary for Subcatchment 9S: PR-9

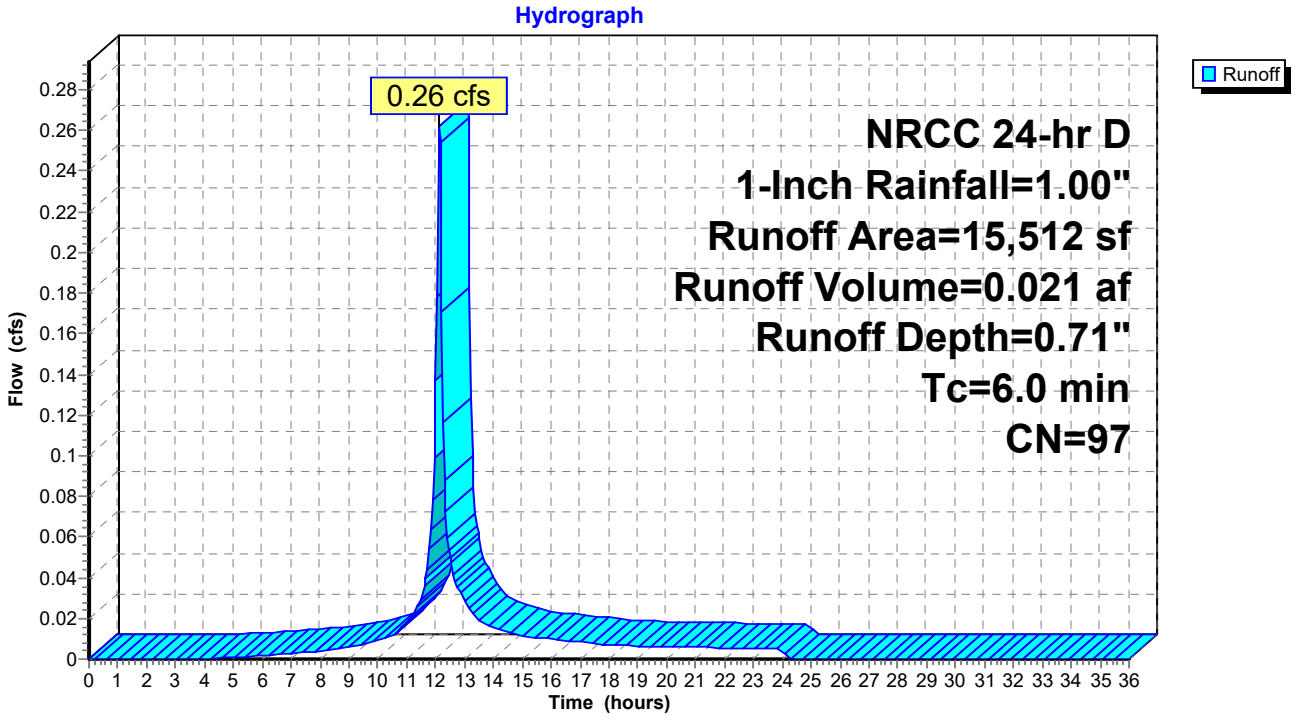
Runoff = 0.26 cfs @ 12.13 hrs, Volume= 0.021 af, Depth= 0.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 1-Inch Rainfall=1.00"

	Area (sf)	CN	Description
	10,514	98	Paved parking, HSG D
*	2,796	98	Cement Concrete Sidewalk, HSG D
	2,202	89	<50% Grass cover, Poor, HSG D
	15,512	97	Weighted Average
	2,202		14.20% Pervious Area
	13,310		85.80% Impervious Area

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

Subcatchment 9S: PR-9



Summary for Subcatchment 10S: PR-10

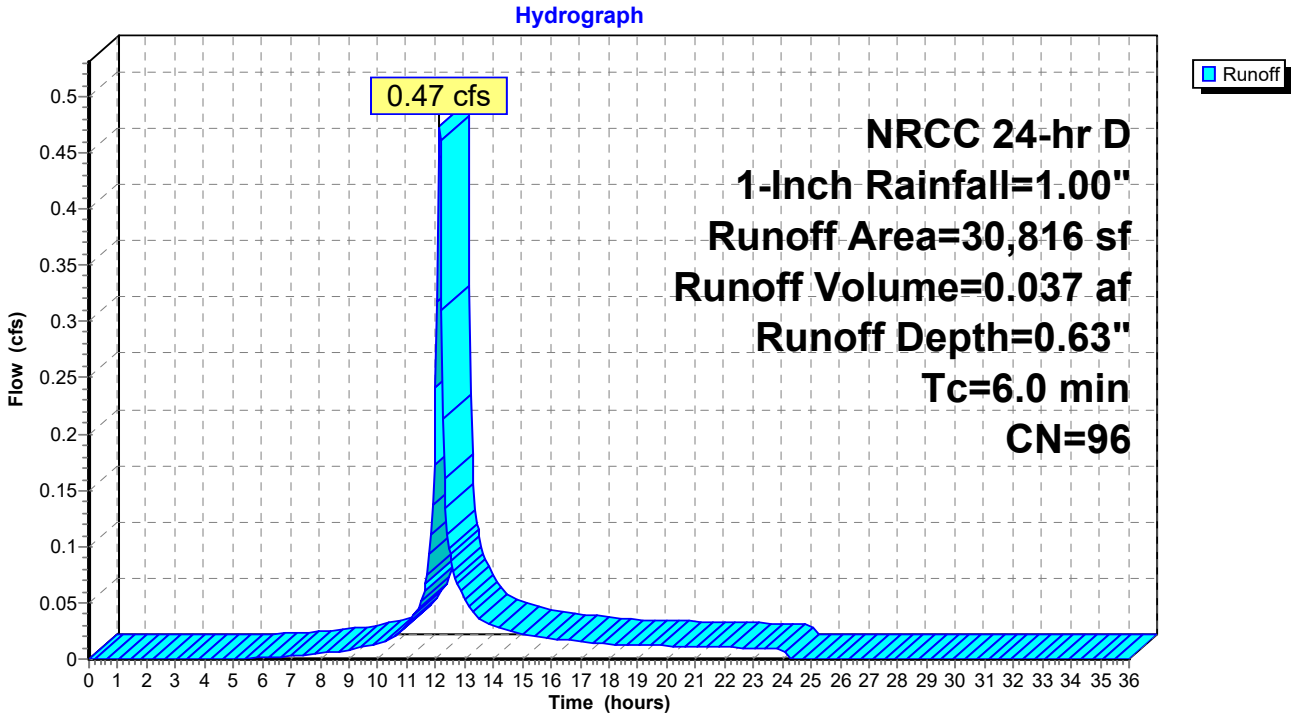
Runoff = 0.47 cfs @ 12.13 hrs, Volume= 0.037 af, Depth= 0.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 1-Inch Rainfall=1.00"

	Area (sf)	CN	Description
	19,051	98	Paved parking, HSG D
*	4,167	98	Cement Concrete Sidewalk, HSG D
	7,598	89	<50% Grass cover, Poor, HSG D
	30,816	96	Weighted Average
	7,598		24.66% Pervious Area
	23,218		75.34% Impervious Area

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

Subcatchment 10S: PR-10



Summary for Subcatchment 11S: PR-11

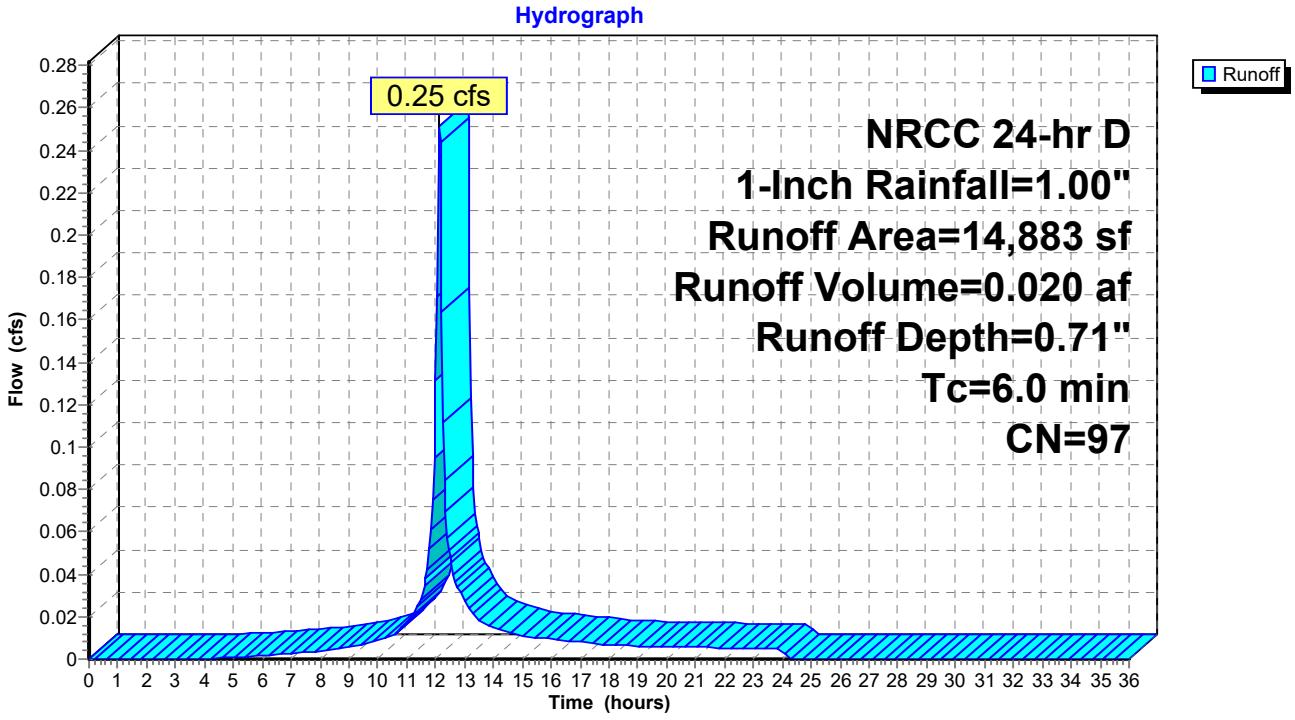
Runoff = 0.25 cfs @ 12.13 hrs, Volume= 0.020 af, Depth= 0.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 1-Inch Rainfall=1.00"

	Area (sf)	CN	Description
	10,677	98	Paved parking, HSG D
*	1,854	98	Cement Concrete Sidewalk, HSG D
	2,352	89	<50% Grass cover, Poor, HSG D
	14,883	97	Weighted Average
	2,352		15.80% Pervious Area
	12,531		84.20% Impervious Area

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

Subcatchment 11S: PR-11



Summary for Subcatchment 12S: PR-12

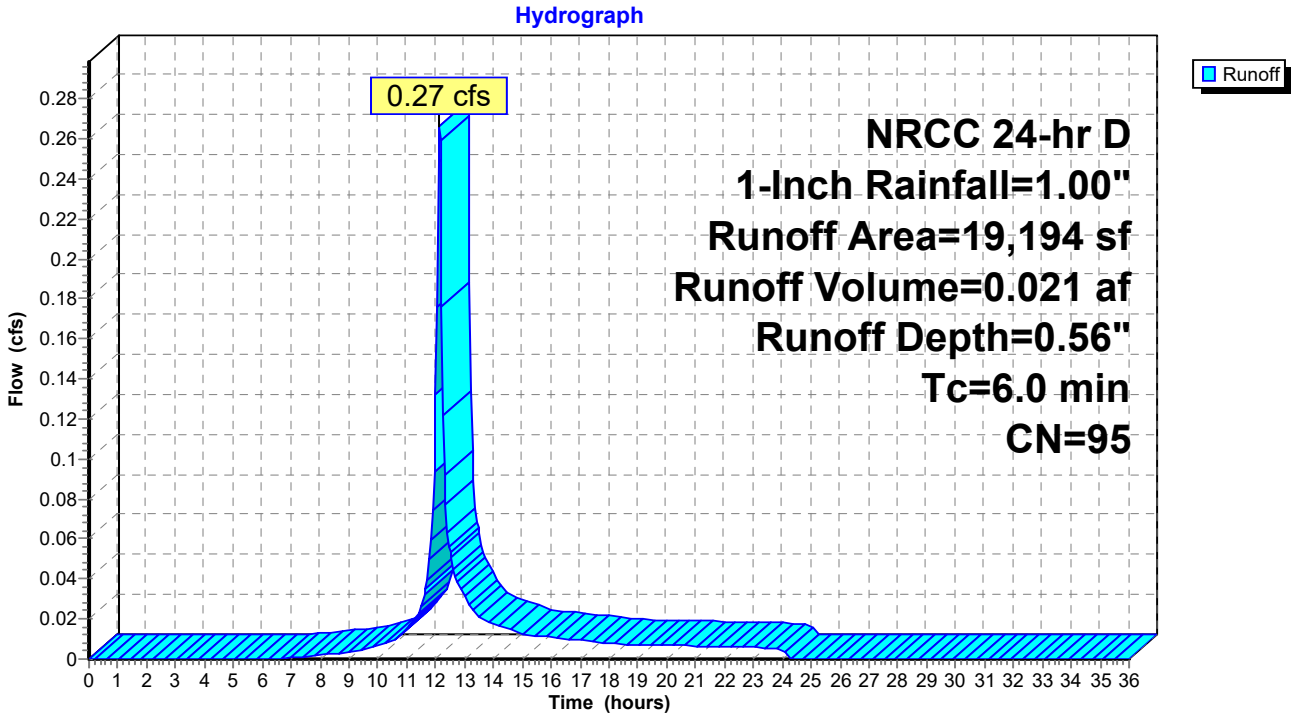
Runoff = 0.27 cfs @ 12.13 hrs, Volume= 0.021 af, Depth= 0.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 1-Inch Rainfall=1.00"

	Area (sf)	CN	Description
	10,142	98	Paved parking, HSG D
*	2,713	98	Cement Concrete Sidewalk, HSG D
	6,339	89	<50% Grass cover, Poor, HSG D
	19,194	95	Weighted Average
	6,339		33.03% Pervious Area
	12,855		66.97% Impervious Area

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

Subcatchment 12S: PR-12



Summary for Pond 14P: Rain Garden

Inflow Area = 0.786 ac, 32.96% Impervious, Inflow Depth = 0.00" for 1-Inch event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min
Discarded = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 254.00' @ 0.00 hrs Surf.Area= 540 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	254.00'	6,180 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

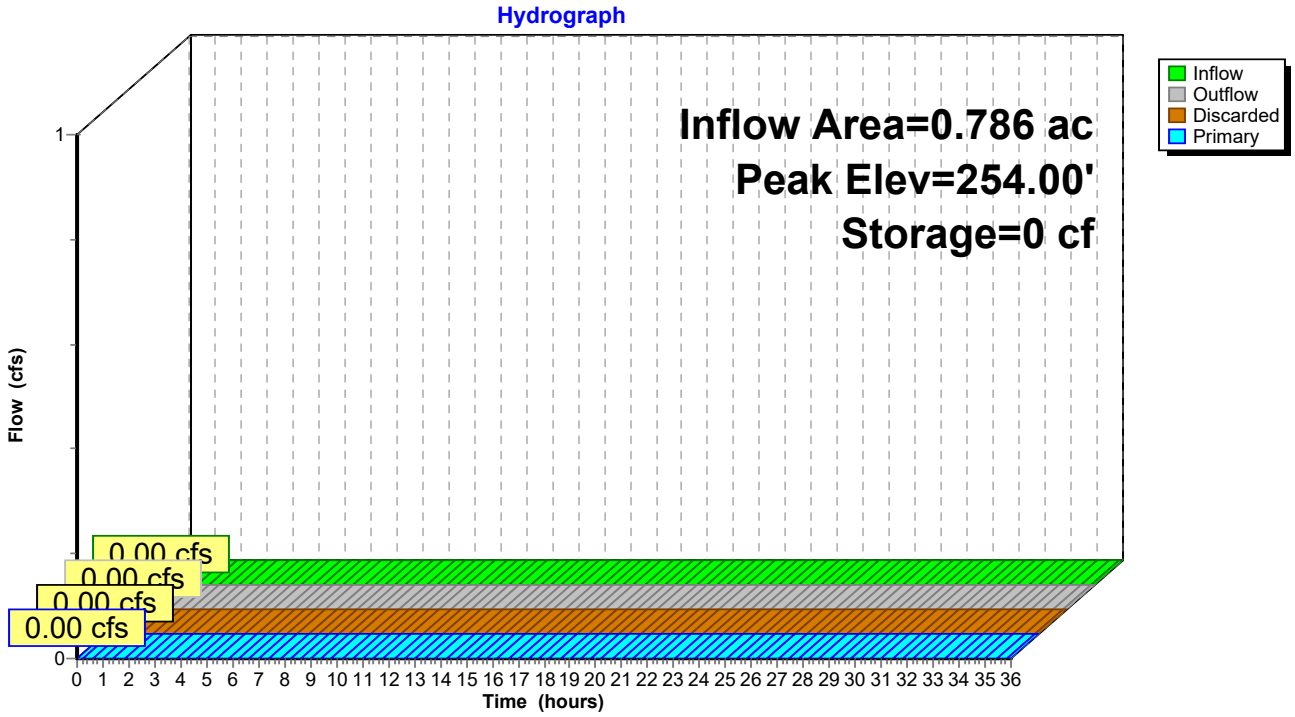
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
254.00	540	103.7	0	0	540
255.00	1,364	159.3	921	921	1,711
256.00	2,563	215.7	1,932	2,853	3,405
257.00	4,155	273.9	3,327	6,180	5,685

Device	Routing	Invert	Outlet Devices
#1	Primary	254.50'	**12.0" Round Culvert** L= 20.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 254.50' / 253.50' S= 0.0500 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#2	Device 1	256.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 2	256.50'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Discarded	254.00'	**2.400 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 250.00'

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=254.00' (Free Discharge)
└**4=Exfiltration** (Passes 0.00 cfs of 0.03 cfs potential flow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=254.00' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Controls 0.00 cfs)
  └**2=Orifice/Grate** (Controls 0.00 cfs)
    └**3=Orifice/Grate** (Controls 0.00 cfs)

Pond 14P: Rain Garden



Stage-Area-Storage for Pond 14P: Rain Garden

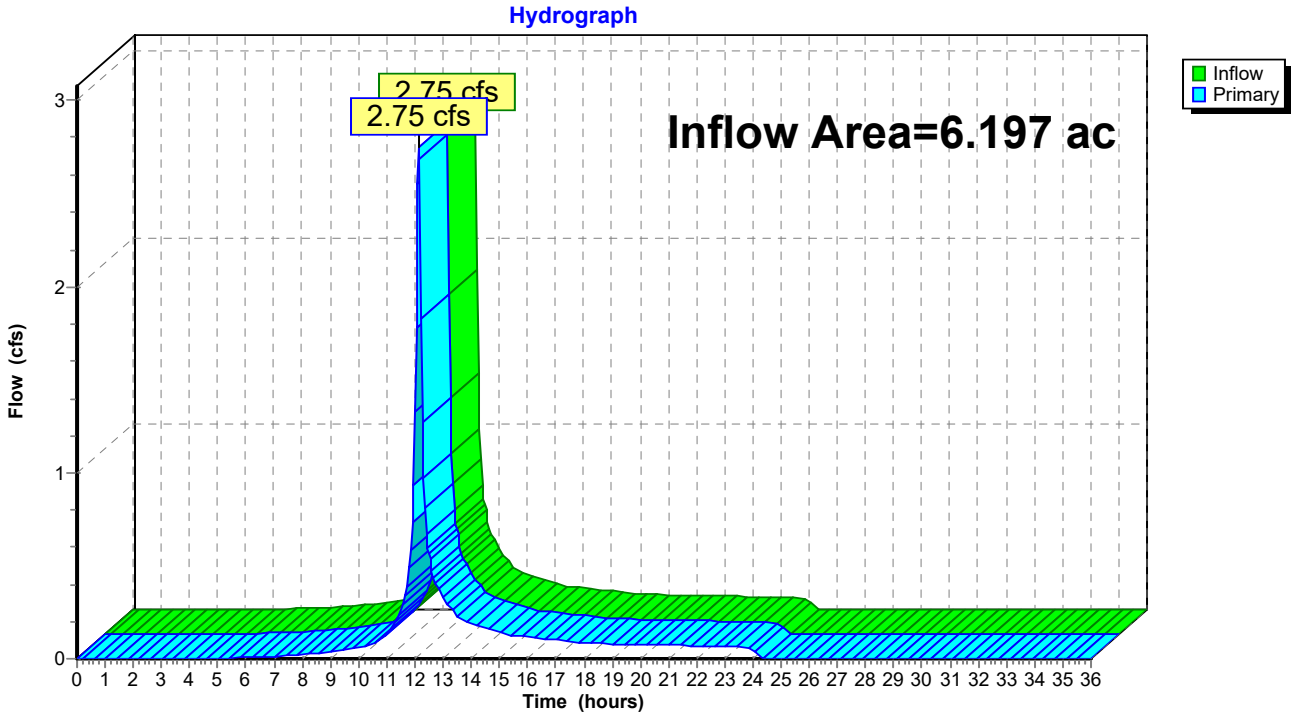
Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
254.00	540	0
254.10	606	57
254.20	675	121
254.30	748	192
254.40	825	271
254.50	905	357
254.60	989	452
254.70	1,077	555
254.80	1,169	668
254.90	1,265	789
255.00	1,364	921
255.10	1,467	1,062
255.20	1,574	1,214
255.30	1,684	1,377
255.40	1,799	1,551
255.50	1,917	1,737
255.60	2,038	1,935
255.70	2,164	2,145
255.80	2,293	2,368
255.90	2,426	2,604
256.00	2,563	2,853
256.10	2,705	3,116
256.20	2,851	3,394
256.30	3,000	3,687
256.40	3,154	3,994
256.50	3,311	4,318
256.60	3,472	4,657
256.70	3,637	5,012
256.80	3,806	5,384
256.90	3,979	5,773
257.00	**4,155**	**6,180**

Summary for Link 15L: DP-1

Inflow Area = 6.197 ac, 63.95% Impervious, Inflow Depth = 0.42" for 1-Inch event
Inflow = 2.75 cfs @ 12.13 hrs, Volume= 0.218 af
Primary = 2.75 cfs @ 12.13 hrs, Volume= 0.218 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Link 15L: DP-1



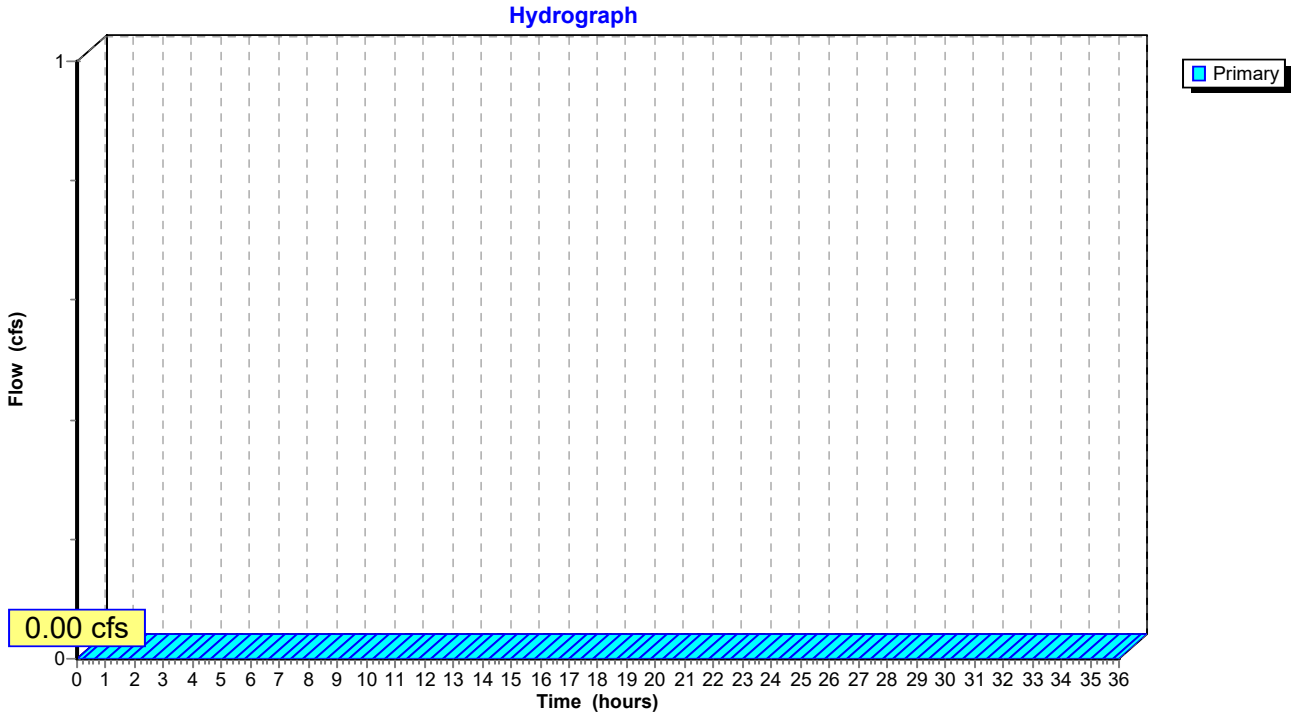
Summary for Link 16L: DP-2

[43] Hint: Has no inflow (Outflow=Zero)

Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Link 16L: DP-2



Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: PR-1 Runoff Area=34,243 sf 32.96% Impervious Runoff Depth=0.30"
Tc=6.0 min CN=58 Runoff=0.11 cfs 0.020 af

Subcatchment 2S: PR-2 Runoff Area=19,941 sf 66.78% Impervious Runoff Depth=2.54"
Tc=6.0 min CN=95 Runoff=1.16 cfs 0.097 af

Subcatchment 3S: PR-3 Runoff Area=24,637 sf 67.78% Impervious Runoff Depth=2.07"
Tc=6.0 min CN=90 Runoff=1.23 cfs 0.097 af

Subcatchment 4S: PR-4 Runoff Area=49,972 sf 52.93% Impervious Runoff Depth=1.98"
Tc=6.0 min CN=89 Runoff=2.41 cfs 0.189 af

Subcatchment 5S: PR-5 Runoff Area=21,676 sf 66.73% Impervious Runoff Depth=2.25"
Tc=6.0 min CN=92 Runoff=1.16 cfs 0.093 af

Subcatchment 6S: PR-6 Runoff Area=17,007 sf 88.03% Impervious Runoff Depth=2.75"
Tc=6.0 min CN=97 Runoff=1.03 cfs 0.089 af

Subcatchment 7S: PR-7 Runoff Area=10,460 sf 58.78% Impervious Runoff Depth=2.16"
Tc=6.0 min CN=91 Runoff=0.54 cfs 0.043 af

Subcatchment 8S: PR-8 Runoff Area=11,602 sf 63.58% Impervious Runoff Depth=2.16"
Tc=6.0 min CN=91 Runoff=0.60 cfs 0.048 af

Subcatchment 9S: PR-9 Runoff Area=15,512 sf 85.80% Impervious Runoff Depth=2.75"
Tc=6.0 min CN=97 Runoff=0.94 cfs 0.082 af

Subcatchment 10S: PR-10 Runoff Area=30,816 sf 75.34% Impervious Runoff Depth=2.64"
Tc=6.0 min CN=96 Runoff=1.83 cfs 0.156 af

Subcatchment 11S: PR-11 Runoff Area=14,883 sf 84.20% Impervious Runoff Depth=2.75"
Tc=6.0 min CN=97 Runoff=0.90 cfs 0.078 af

Subcatchment 12S: PR-12 Runoff Area=19,194 sf 66.97% Impervious Runoff Depth=2.54"
Tc=6.0 min CN=95 Runoff=1.12 cfs 0.093 af

Pond 14P: Rain Garden Peak Elev=254.14' Storage=80 cf Inflow=0.11 cfs 0.020 af
Discarded=0.04 cfs 0.020 af Primary=0.00 cfs 0.000 af Outflow=0.04 cfs 0.020 af

Link 15L: DP-1 Inflow=12.93 cfs 1.066 af
Primary=12.93 cfs 1.066 af

Link 16L: DP-2
Primary=0.00 cfs 0.000 af

Total Runoff Area = 6.197 ac Runoff Volume = 1.086 af Average Runoff Depth = 2.10"
36.05% Pervious = 2.234 ac 63.95% Impervious = 3.963 ac

Summary for Subcatchment 1S: PR-1

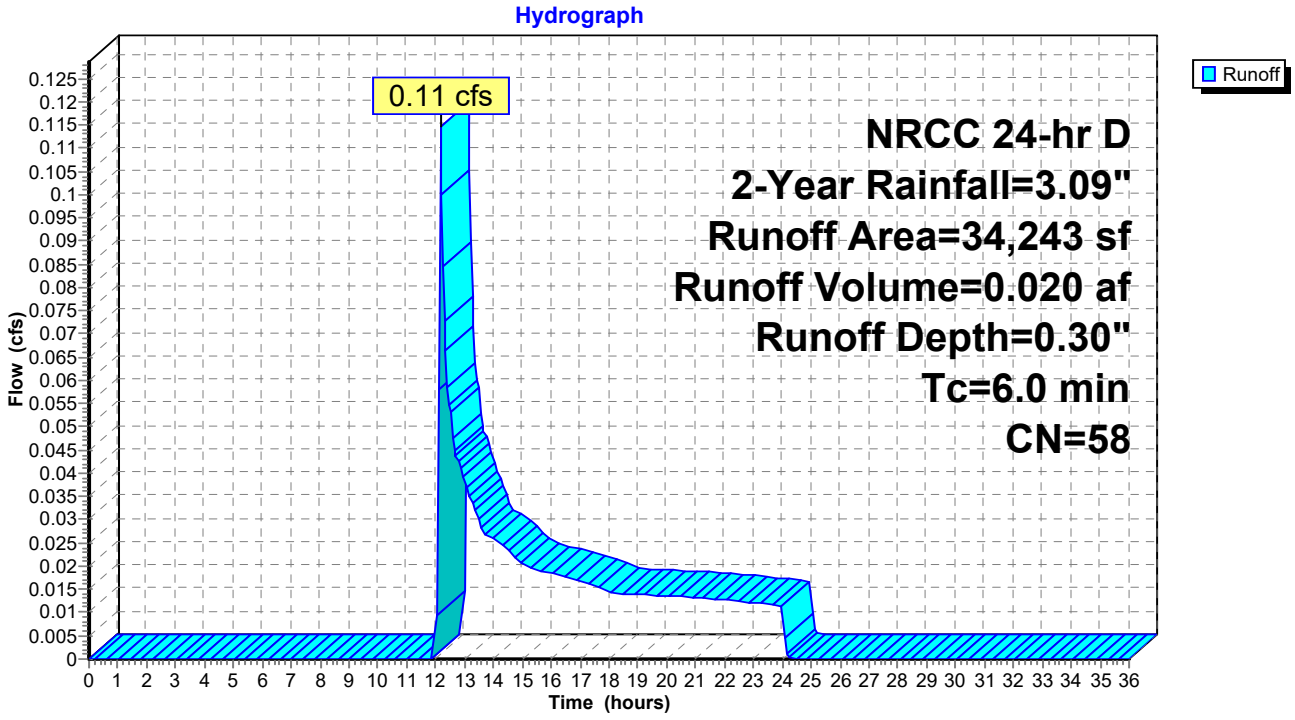
Runoff = 0.11 cfs @ 12.17 hrs, Volume= 0.020 af, Depth= 0.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 2-Year Rainfall=3.09"

	Area (sf)	CN	Description
	9,225	98	Paved parking, HSG A
*	2,063	98	Cement Concrete Sidewalk, HSG A
	22,955	39	>75% Grass cover, Good, HSG A
	34,243	58	Weighted Average
	22,955		67.04% Pervious Area
	11,288		32.96% Impervious Area

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

Subcatchment 1S: PR-1



Summary for Subcatchment 2S: PR-2

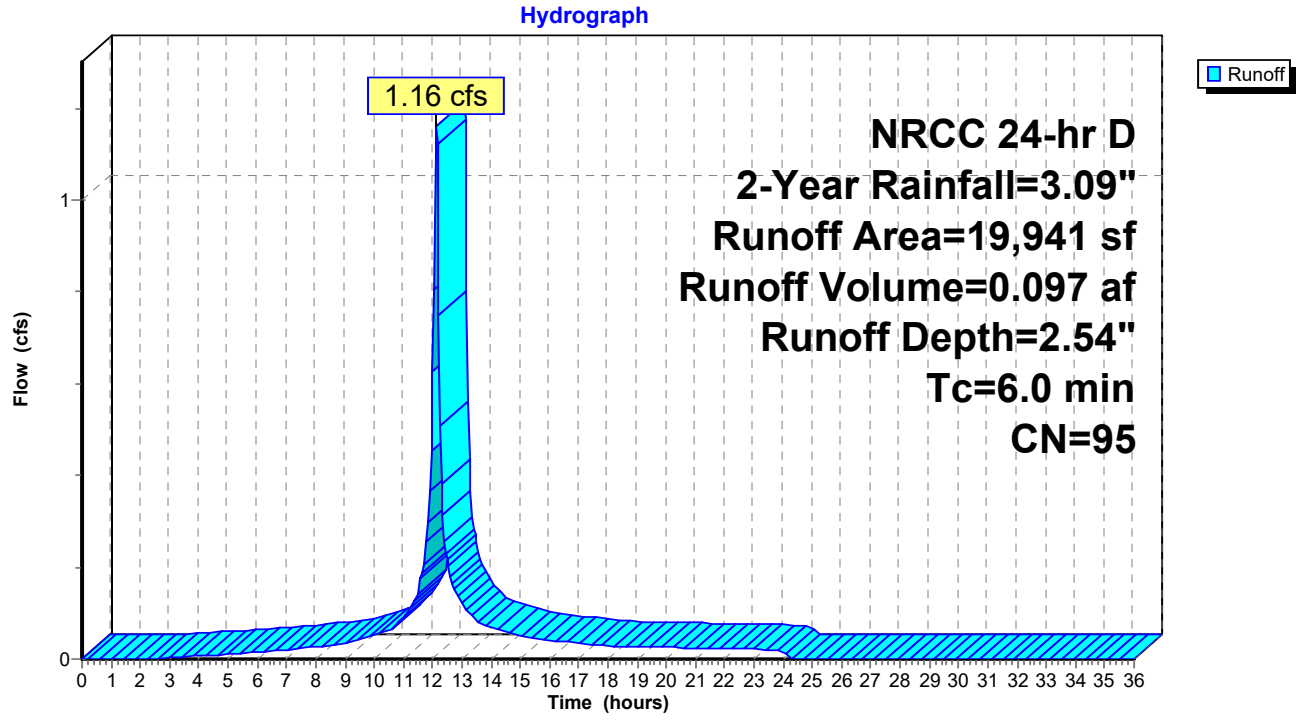
Runoff = 1.16 cfs @ 12.13 hrs, Volume= 0.097 af, Depth= 2.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 2-Year Rainfall=3.09"

	Area (sf)	CN	Description
	11,050	98	Paved parking, HSG D
*	2,266	98	Cement Concrete Sidewalk, HSG D
	6,625	89	<50% Grass cover, Poor, HSG D
	19,941	95	Weighted Average
	6,625		33.22% Pervious Area
	13,316		66.78% Impervious Area

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

Subcatchment 2S: PR-2



Summary for Subcatchment 3S: PR-3

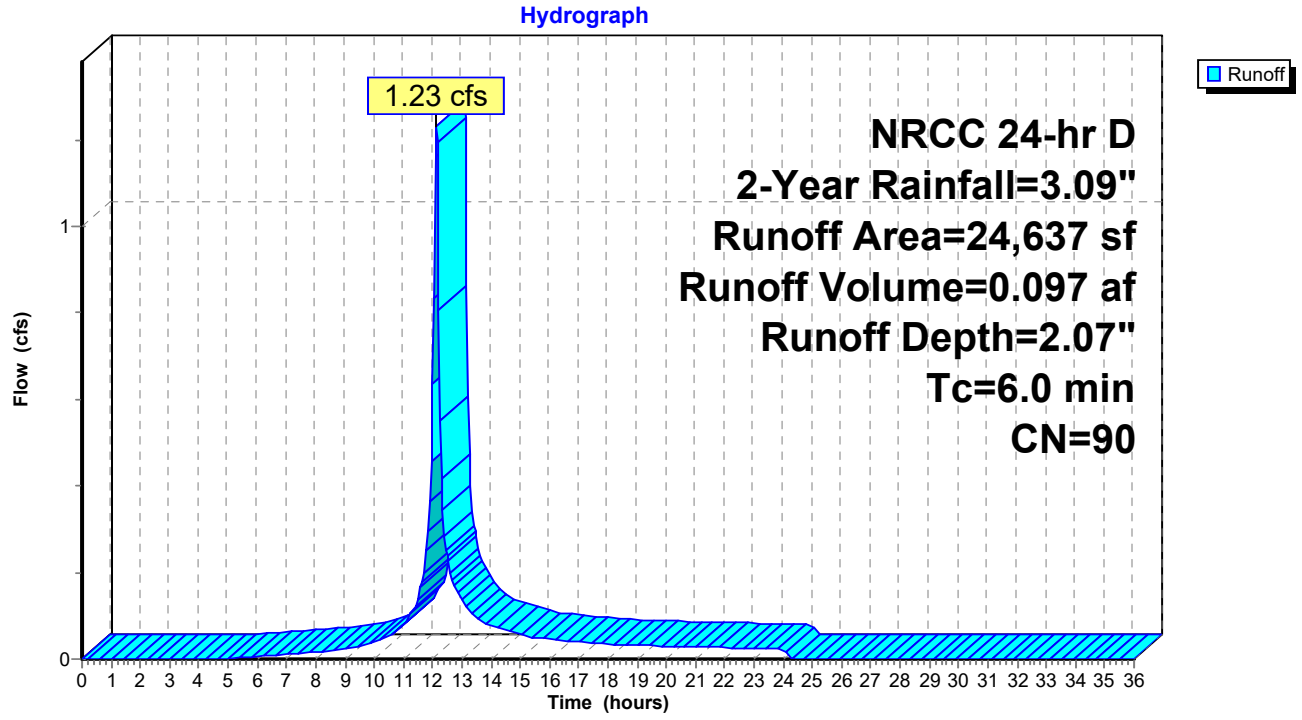
Runoff = 1.23 cfs @ 12.13 hrs, Volume= 0.097 af, Depth= 2.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 2-Year Rainfall=3.09"

	Area (sf)	CN	Description
	13,876	98	Paved parking, HSG C
*	2,822	98	Cement Concrete Sidewalk, HSG C
	7,939	74	>75% Grass cover, Good, HSG C
	24,637	90	Weighted Average
	7,939		32.22% Pervious Area
	16,698		67.78% Impervious Area

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

Subcatchment 3S: PR-3



Summary for Subcatchment 4S: PR-4

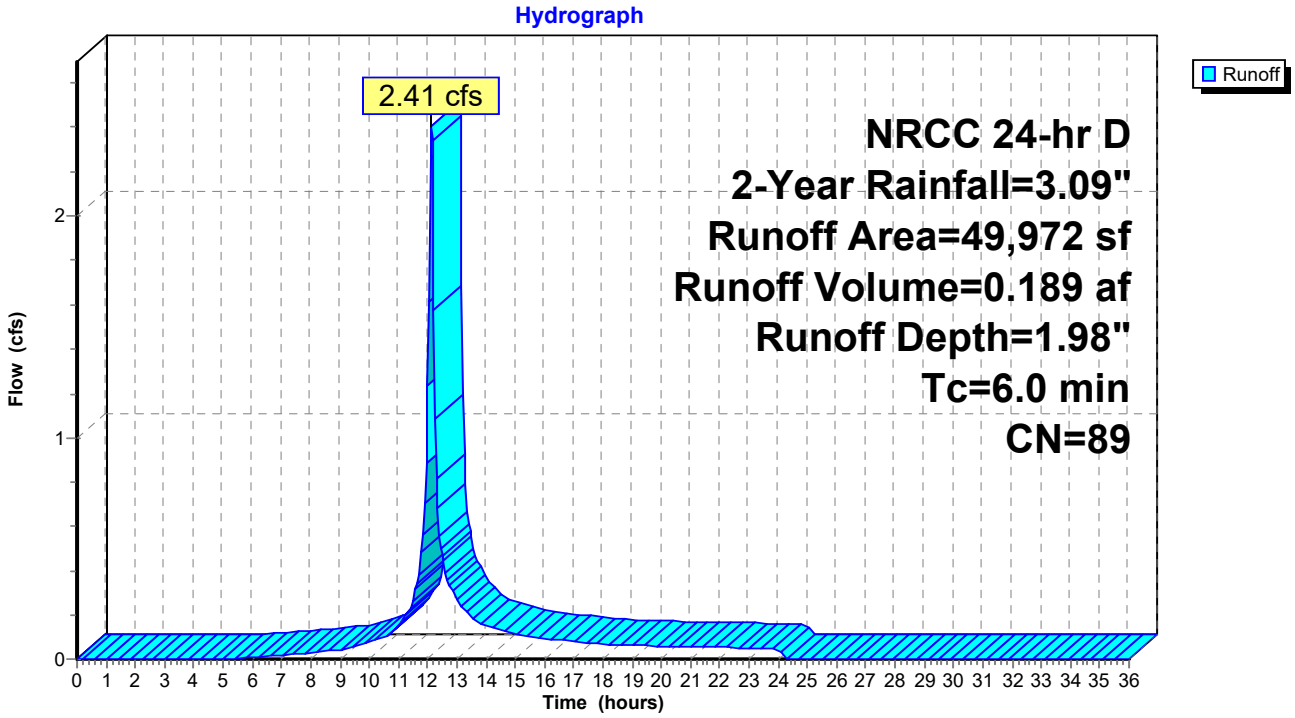
Runoff = 2.41 cfs @ 12.13 hrs, Volume= 0.189 af, Depth= 1.98"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 2-Year Rainfall=3.09"

	Area (sf)	CN	Description
	20,528	98	Paved parking, HSG C
*	5,920	98	Cement Concrete Sidewalk, HSG C
	23,524	79	50-75% Grass cover, Fair, HSG C
	49,972	89	Weighted Average
	23,524		47.07% Pervious Area
	26,448		52.93% Impervious Area

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

Subcatchment 4S: PR-4



Summary for Subcatchment 5S: PR-5

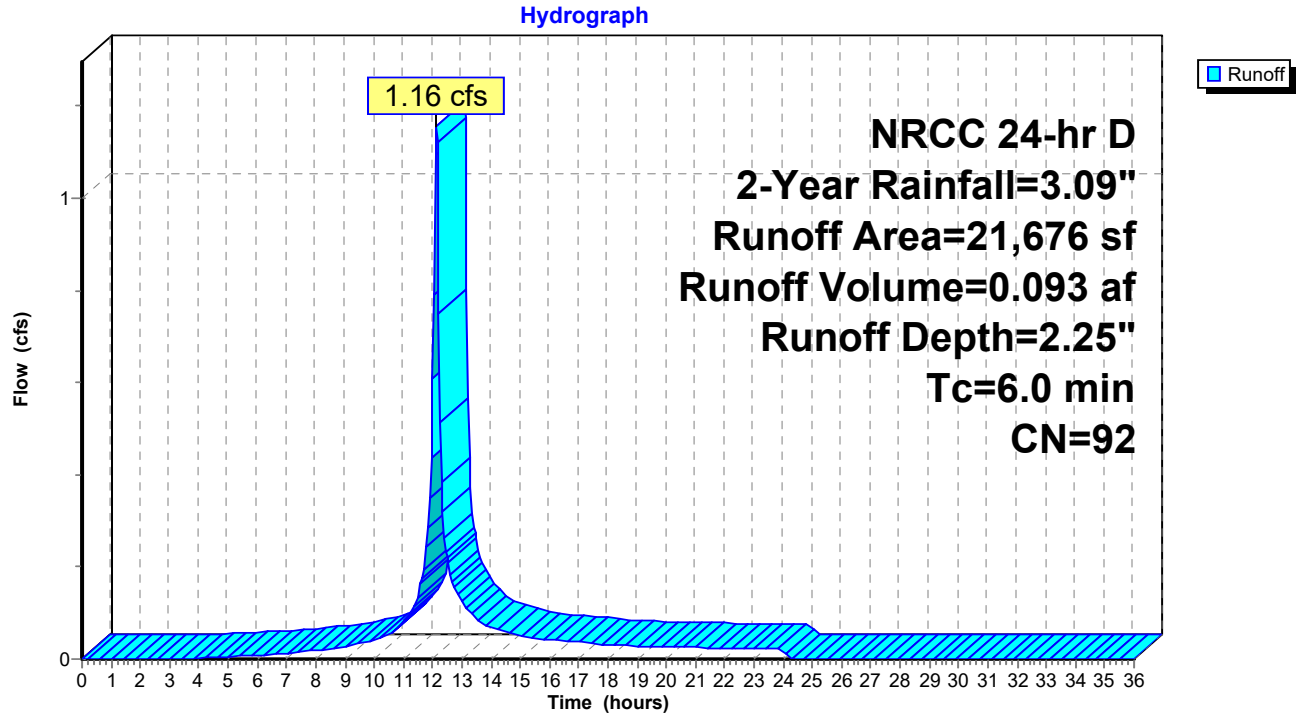
Runoff = 1.16 cfs @ 12.13 hrs, Volume= 0.093 af, Depth= 2.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 2-Year Rainfall=3.09"

	Area (sf)	CN	Description
	11,952	98	Paved parking, HSG D
*	2,512	98	Cement Concrete Sidewalk, HSG D
	7,212	80	>75% Grass cover, Good, HSG D
	21,676	92	Weighted Average
	7,212		33.27% Pervious Area
	14,464		66.73% Impervious Area

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

Subcatchment 5S: PR-5



Summary for Subcatchment 6S: PR-6

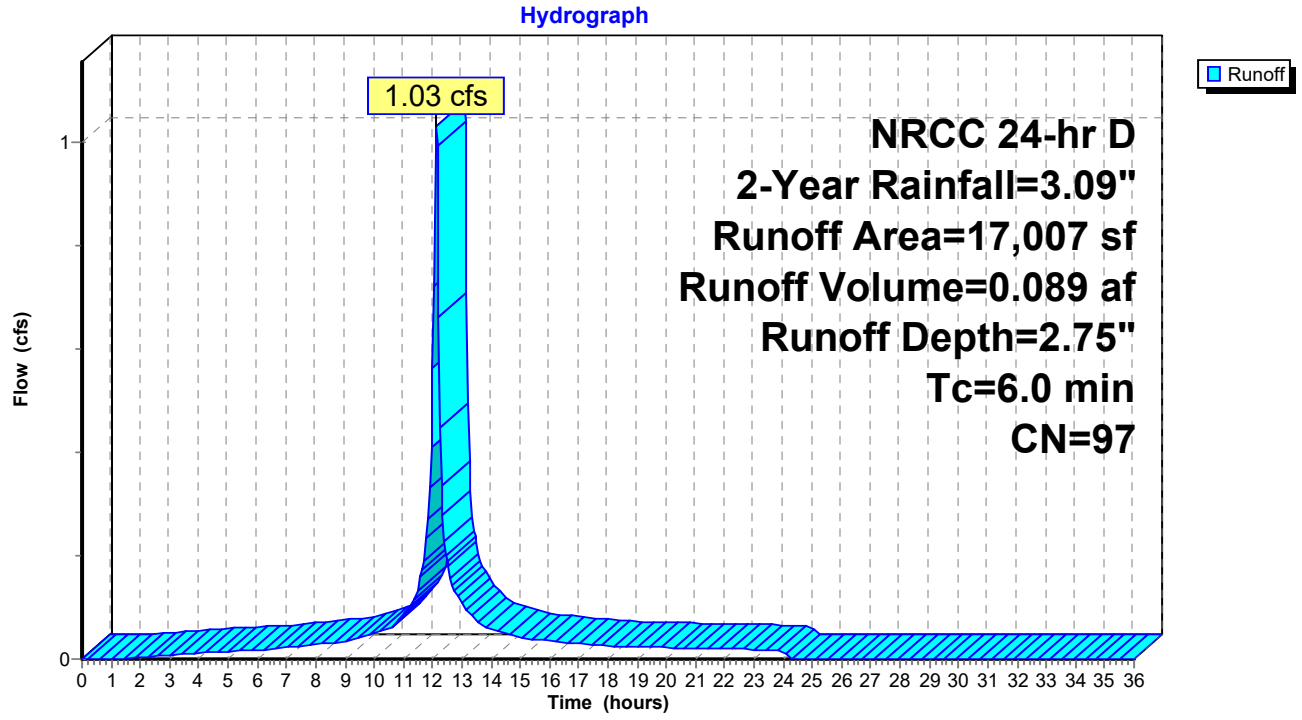
Runoff = 1.03 cfs @ 12.13 hrs, Volume= 0.089 af, Depth= 2.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 2-Year Rainfall=3.09"

	Area (sf)	CN	Description
	11,871	98	Paved parking, HSG D
*	3,101	98	Cement Concrete Sidewalk, HSG D
	2,035	89	<50% Grass cover, Poor, HSG D
	17,007	97	Weighted Average
	2,035		11.97% Pervious Area
	14,972		88.03% Impervious Area

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

Subcatchment 6S: PR-6



Summary for Subcatchment 7S: PR-7

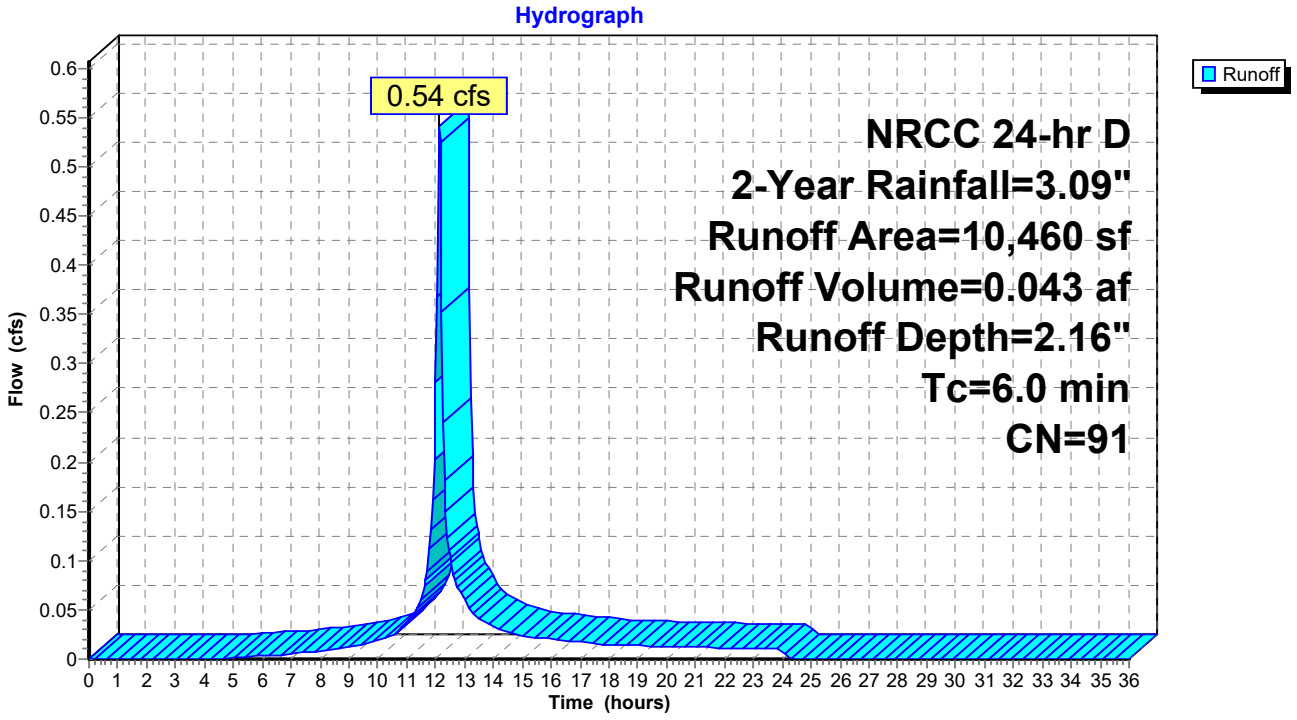
Runoff = 0.54 cfs @ 12.13 hrs, Volume= 0.043 af, Depth= 2.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 2-Year Rainfall=3.09"

	Area (sf)	CN	Description
	5,793	98	Paved parking, HSG D
*	355	98	Cement Concrete Sidewalk, HSG D
	4,312	80	>75% Grass cover, Good, HSG D
	10,460	91	Weighted Average
	4,312		41.22% Pervious Area
	6,148		58.78% Impervious Area

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

Subcatchment 7S: PR-7



Summary for Subcatchment 8S: PR-8

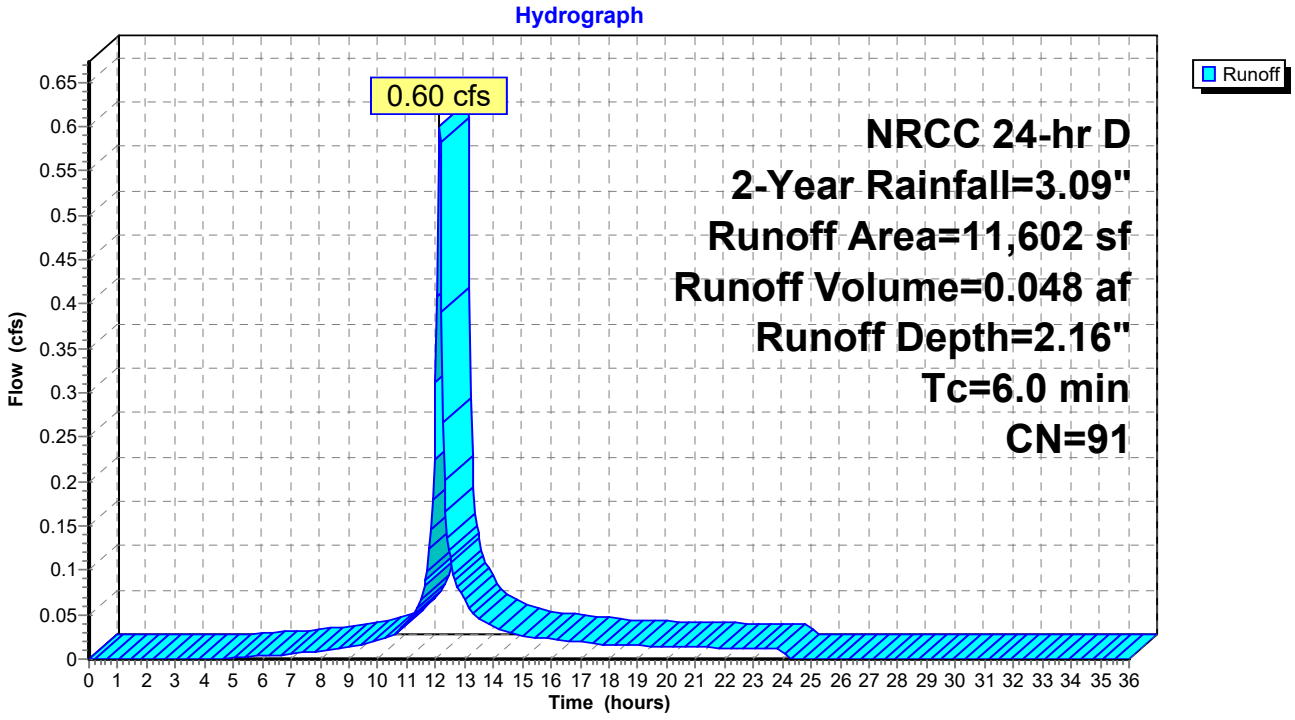
Runoff = 0.60 cfs @ 12.13 hrs, Volume= 0.048 af, Depth= 2.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 2-Year Rainfall=3.09"

	Area (sf)	CN	Description
	6,124	98	Paved parking, HSG D
*	1,252	98	Cement Concrete Sidewalk, HSG D
	4,226	80	>75% Grass cover, Good, HSG D
	11,602	91	Weighted Average
	4,226		36.42% Pervious Area
	7,376		63.58% Impervious Area

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

Subcatchment 8S: PR-8



Summary for Subcatchment 9S: PR-9

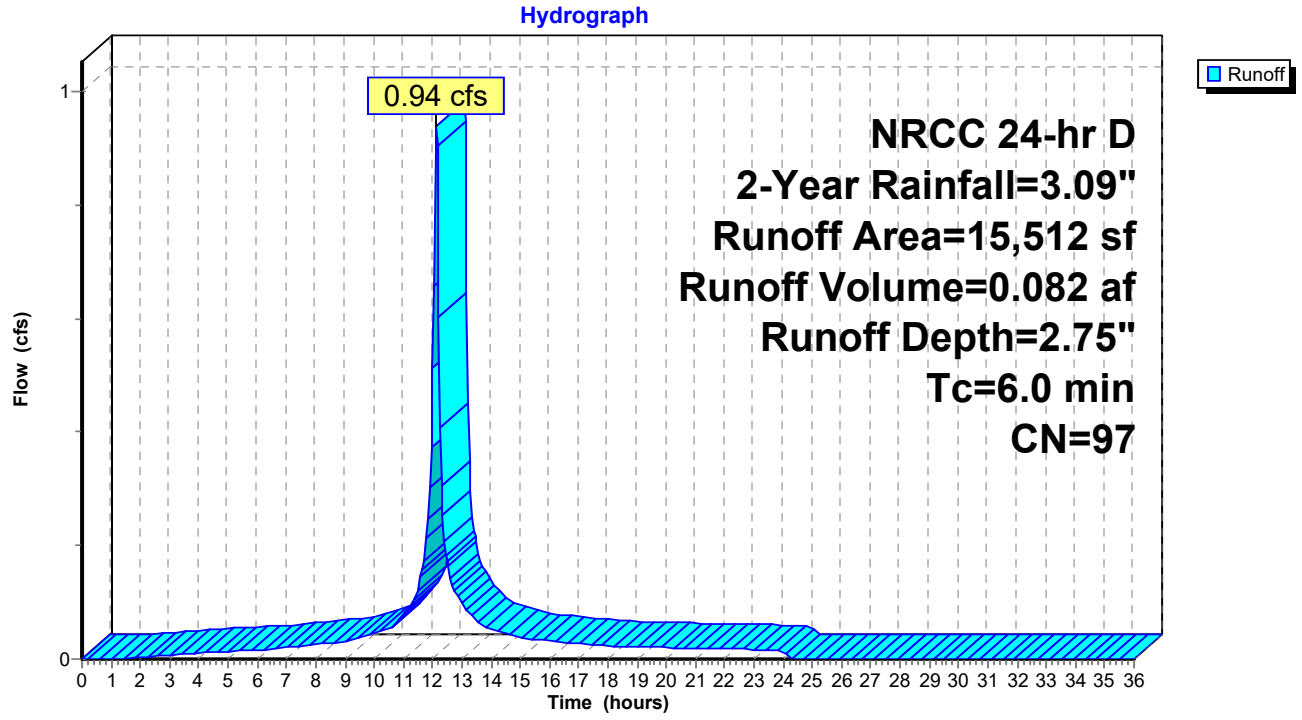
Runoff = 0.94 cfs @ 12.13 hrs, Volume= 0.082 af, Depth= 2.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 2-Year Rainfall=3.09"

	Area (sf)	CN	Description
	10,514	98	Paved parking, HSG D
*	2,796	98	Cement Concrete Sidewalk, HSG D
	2,202	89	<50% Grass cover, Poor, HSG D
	15,512	97	Weighted Average
	2,202		14.20% Pervious Area
	13,310		85.80% Impervious Area

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

Subcatchment 9S: PR-9



Summary for Subcatchment 10S: PR-10

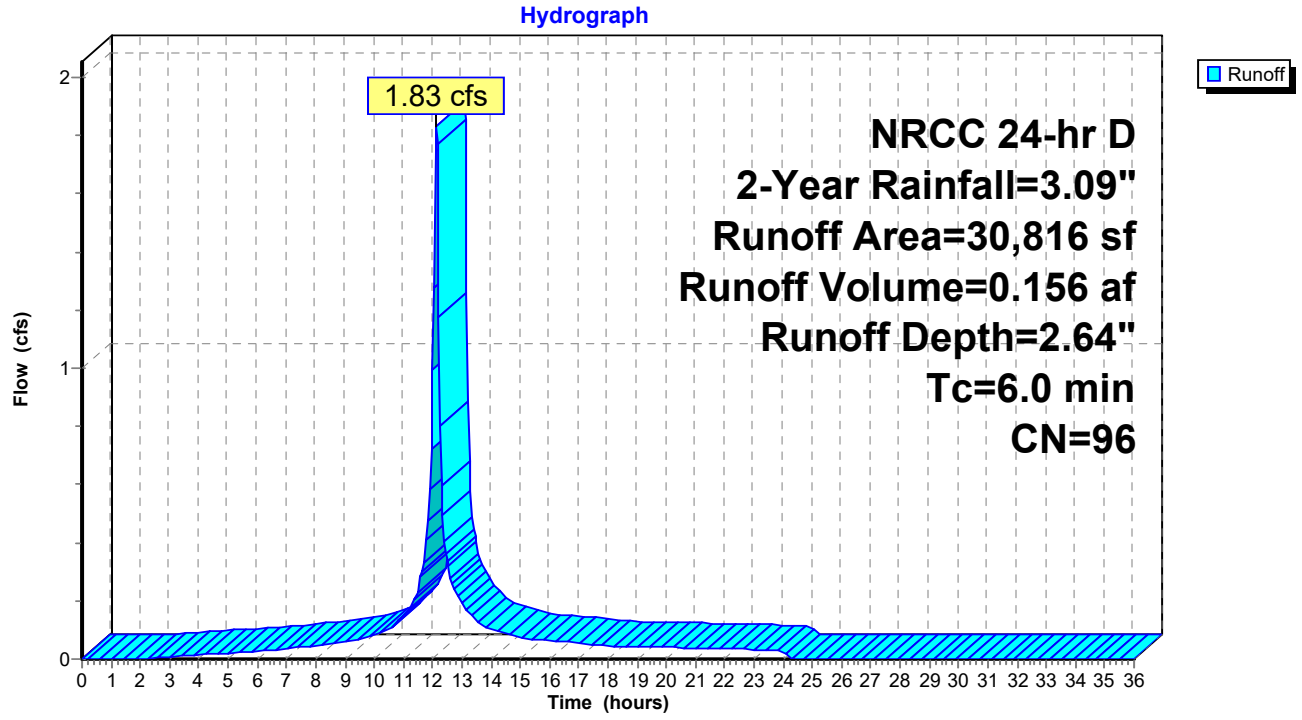
Runoff = 1.83 cfs @ 12.13 hrs, Volume= 0.156 af, Depth= 2.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 2-Year Rainfall=3.09"

	Area (sf)	CN	Description
	19,051	98	Paved parking, HSG D
*	4,167	98	Cement Concrete Sidewalk, HSG D
	7,598	89	<50% Grass cover, Poor, HSG D
	30,816	96	Weighted Average
	7,598		24.66% Pervious Area
	23,218		75.34% Impervious Area

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

Subcatchment 10S: PR-10



Summary for Subcatchment 11S: PR-11

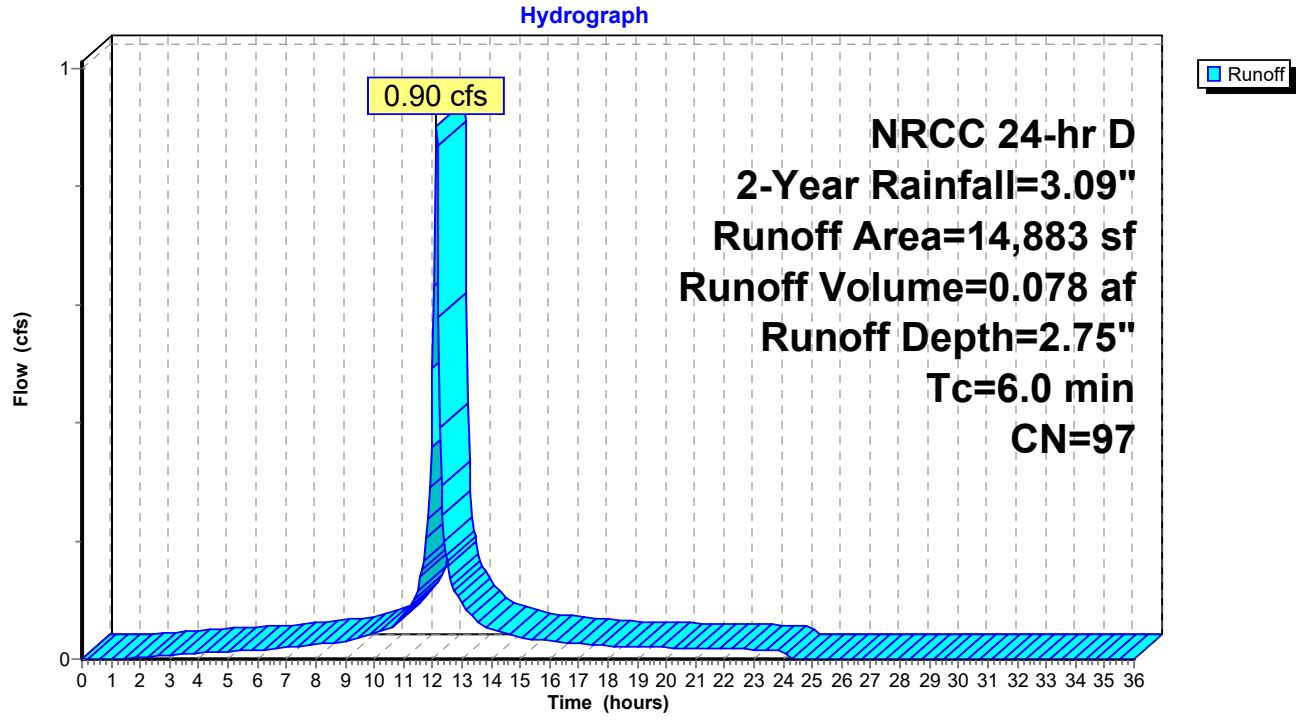
Runoff = 0.90 cfs @ 12.13 hrs, Volume= 0.078 af, Depth= 2.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 2-Year Rainfall=3.09"

	Area (sf)	CN	Description
	10,677	98	Paved parking, HSG D
*	1,854	98	Cement Concrete Sidewalk, HSG D
	2,352	89	<50% Grass cover, Poor, HSG D
	14,883	97	Weighted Average
	2,352		15.80% Pervious Area
	12,531		84.20% Impervious Area

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

Subcatchment 11S: PR-11



Summary for Subcatchment 12S: PR-12

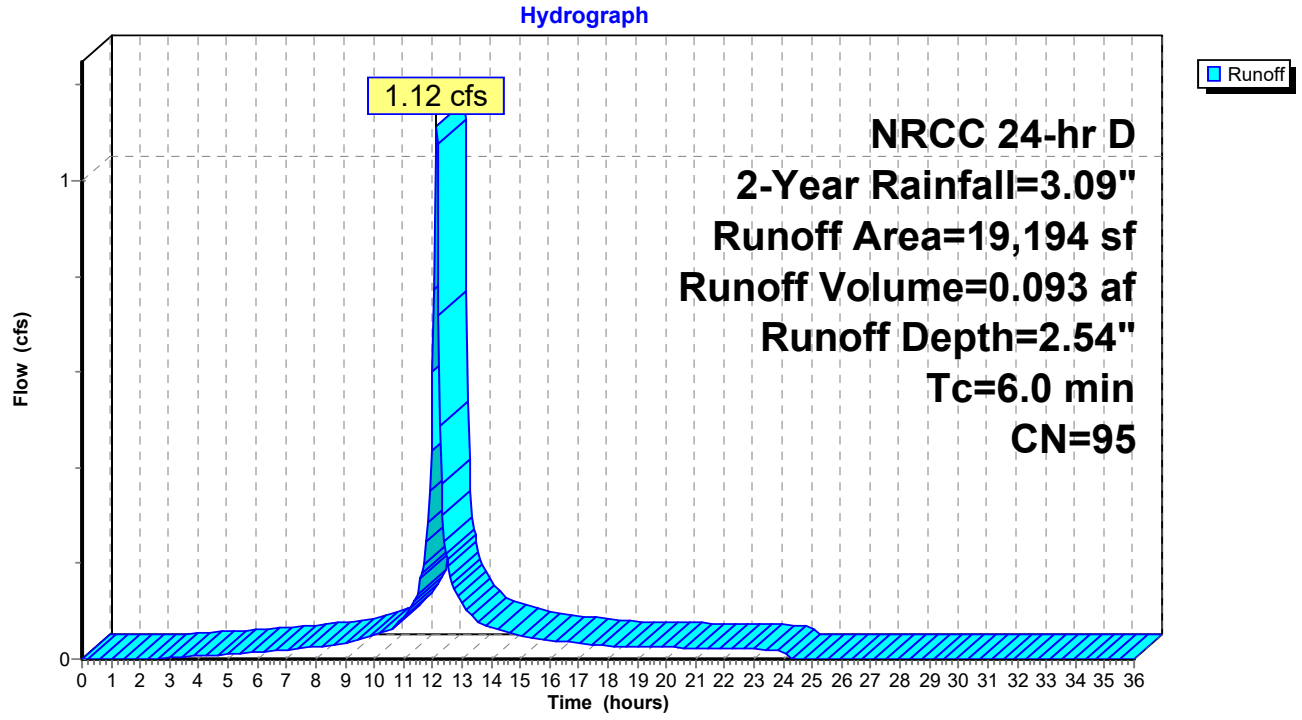
Runoff = 1.12 cfs @ 12.13 hrs, Volume= 0.093 af, Depth= 2.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 2-Year Rainfall=3.09"

	Area (sf)	CN	Description
	10,142	98	Paved parking, HSG D
*	2,713	98	Cement Concrete Sidewalk, HSG D
	6,339	89	<50% Grass cover, Poor, HSG D
	19,194	95	Weighted Average
	6,339		33.03% Pervious Area
	12,855		66.97% Impervious Area

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

Subcatchment 12S: PR-12



Summary for Pond 14P: Rain Garden

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=84)

Inflow Area = 0.786 ac, 32.96% Impervious, Inflow Depth = 0.30" for 2-Year event
Inflow = 0.11 cfs @ 12.17 hrs, Volume= 0.020 af
Outflow = 0.04 cfs @ 13.11 hrs, Volume= 0.020 af, Atten= 69%, Lag= 56.8 min
Discarded = 0.04 cfs @ 13.11 hrs, Volume= 0.020 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 254.14' @ 13.11 hrs Surf.Area= 630 sf Storage= 80 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 12.6 min (1,000.3 - 987.7)

Volume	Invert	Avail.Storage	Storage Description
#1	254.00'	6,180 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

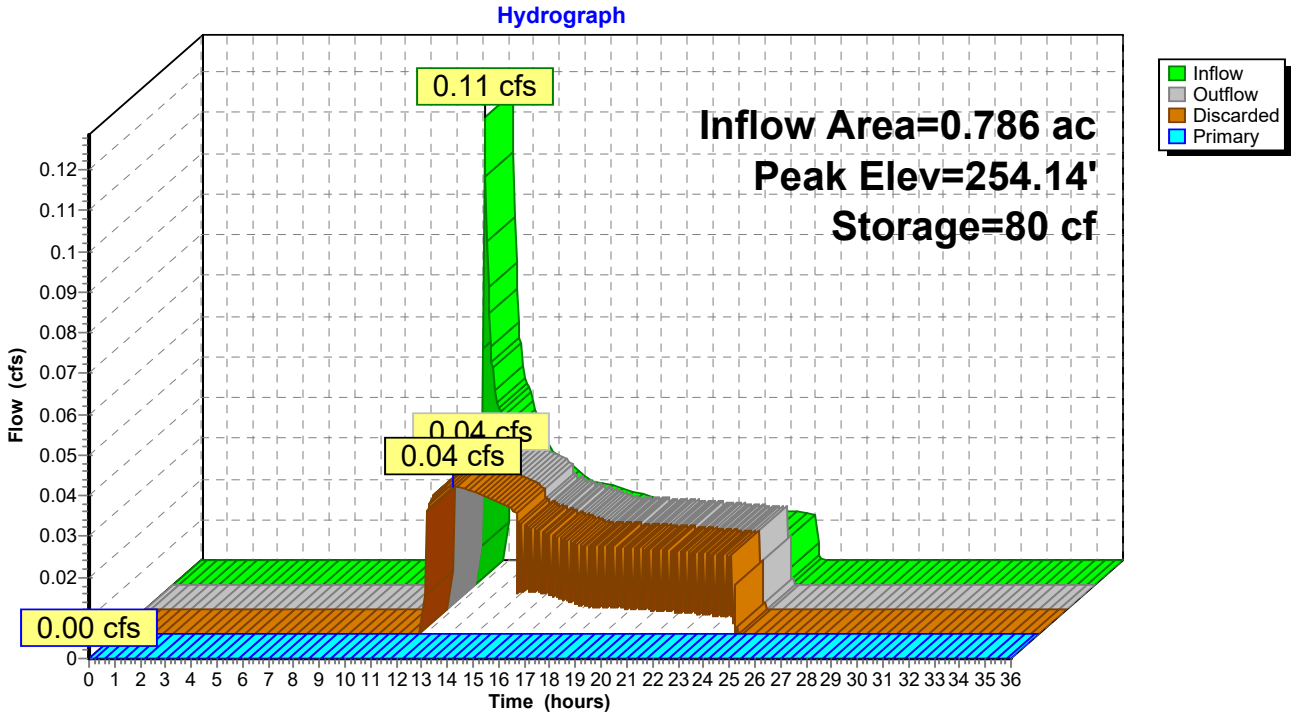
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
254.00	540	103.7	0	0	540
255.00	1,364	159.3	921	921	1,711
256.00	2,563	215.7	1,932	2,853	3,405
257.00	4,155	273.9	3,327	6,180	5,685

Device	Routing	Invert	Outlet Devices
#1	Primary	254.50'	**12.0" Round Culvert** L= 20.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 254.50' / 253.50' S= 0.0500 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#2	Device 1	256.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 2	256.50'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Discarded	254.00'	**2.400 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 250.00'

Discarded OutFlow Max=0.04 cfs @ 13.11 hrs HW=254.14' (Free Discharge)
↑└**4=Exfiltration** (Controls 0.04 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=254.00' TW=0.00' (Dynamic Tailwater)
↑└**1=Culvert** (Controls 0.00 cfs)
  ↑└**2=Orifice/Grate** (Controls 0.00 cfs)
    ↑└**3=Orifice/Grate** (Controls 0.00 cfs)

Pond 14P: Rain Garden



Stage-Area-Storage for Pond 14P: Rain Garden

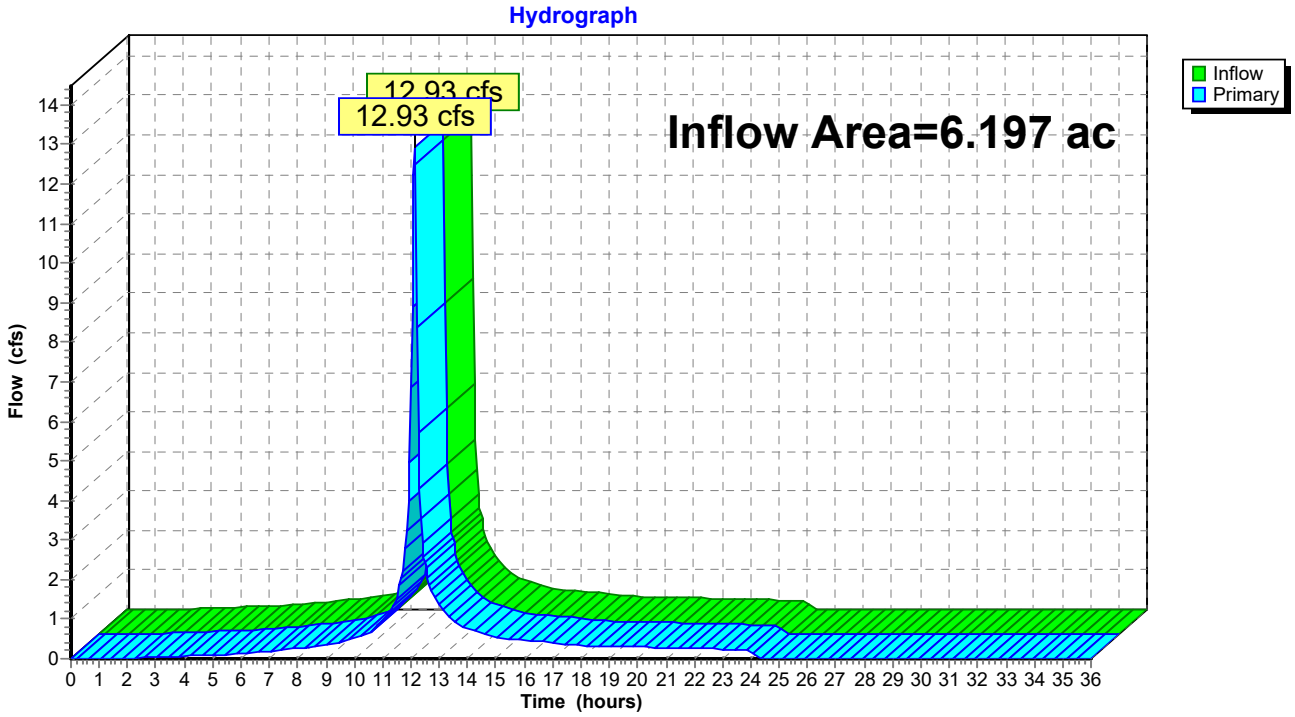
Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
254.00	540	0
254.10	606	57
254.20	675	121
254.30	748	192
254.40	825	271
254.50	905	357
254.60	989	452
254.70	1,077	555
254.80	1,169	668
254.90	1,265	789
255.00	1,364	921
255.10	1,467	1,062
255.20	1,574	1,214
255.30	1,684	1,377
255.40	1,799	1,551
255.50	1,917	1,737
255.60	2,038	1,935
255.70	2,164	2,145
255.80	2,293	2,368
255.90	2,426	2,604
256.00	2,563	2,853
256.10	2,705	3,116
256.20	2,851	3,394
256.30	3,000	3,687
256.40	3,154	3,994
256.50	3,311	4,318
256.60	3,472	4,657
256.70	3,637	5,012
256.80	3,806	5,384
256.90	3,979	5,773
257.00	**4,155**	**6,180**

Summary for Link 15L: DP-1

Inflow Area = 6.197 ac, 63.95% Impervious, Inflow Depth = 2.06" for 2-Year event
Inflow = 12.93 cfs @ 12.13 hrs, Volume= 1.066 af
Primary = 12.93 cfs @ 12.13 hrs, Volume= 1.066 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Link 15L: DP-1



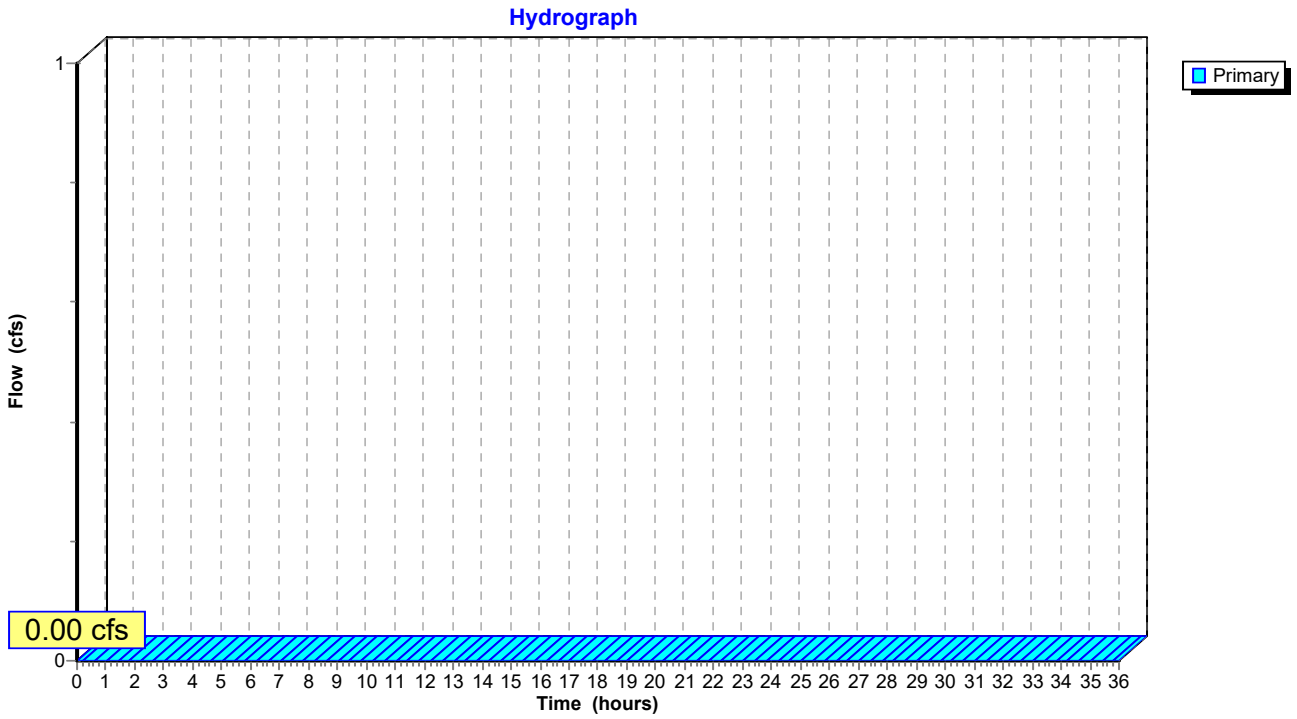
Summary for Link 16L: DP-2

[43] Hint: Has no inflow (Outflow=Zero)

Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Link 16L: DP-2



Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: PR-1 Runoff Area=34,243 sf 32.96% Impervious Runoff Depth=0.98"
Tc=6.0 min CN=58 Runoff=0.73 cfs 0.064 af

Subcatchment 2S: PR-2 Runoff Area=19,941 sf 66.78% Impervious Runoff Depth=4.07"
Tc=6.0 min CN=95 Runoff=1.81 cfs 0.155 af

Subcatchment 3S: PR-3 Runoff Area=24,637 sf 67.78% Impervious Runoff Depth=3.54"
Tc=6.0 min CN=90 Runoff=2.05 cfs 0.167 af

Subcatchment 4S: PR-4 Runoff Area=49,972 sf 52.93% Impervious Runoff Depth=3.44"
Tc=6.0 min CN=89 Runoff=4.07 cfs 0.329 af

Subcatchment 5S: PR-5 Runoff Area=21,676 sf 66.73% Impervious Runoff Depth=3.75"
Tc=6.0 min CN=92 Runoff=1.88 cfs 0.155 af

Subcatchment 6S: PR-6 Runoff Area=17,007 sf 88.03% Impervious Runoff Depth=4.30"
Tc=6.0 min CN=97 Runoff=1.58 cfs 0.140 af

Subcatchment 7S: PR-7 Runoff Area=10,460 sf 58.78% Impervious Runoff Depth=3.64"
Tc=6.0 min CN=91 Runoff=0.89 cfs 0.073 af

Subcatchment 8S: PR-8 Runoff Area=11,602 sf 63.58% Impervious Runoff Depth=3.64"
Tc=6.0 min CN=91 Runoff=0.99 cfs 0.081 af

Subcatchment 9S: PR-9 Runoff Area=15,512 sf 85.80% Impervious Runoff Depth=4.30"
Tc=6.0 min CN=97 Runoff=1.44 cfs 0.128 af

Subcatchment 10S: PR-10 Runoff Area=30,816 sf 75.34% Impervious Runoff Depth=4.18"
Tc=6.0 min CN=96 Runoff=2.83 cfs 0.247 af

Subcatchment 11S: PR-11 Runoff Area=14,883 sf 84.20% Impervious Runoff Depth=4.30"
Tc=6.0 min CN=97 Runoff=1.38 cfs 0.122 af

Subcatchment 12S: PR-12 Runoff Area=19,194 sf 66.97% Impervious Runoff Depth=4.07"
Tc=6.0 min CN=95 Runoff=1.74 cfs 0.150 af

Pond 14P: Rain Garden Peak Elev=254.92' Storage=813 cf Inflow=0.73 cfs 0.064 af
Discarded=0.08 cfs 0.064 af Primary=0.00 cfs 0.000 af Outflow=0.08 cfs 0.064 af

Link 15L: DP-1 Inflow=20.64 cfs 1.746 af
Primary=20.64 cfs 1.746 af

Link 16L: DP-2
Primary=0.00 cfs 0.000 af

Total Runoff Area = 6.197 ac Runoff Volume = 1.810 af Average Runoff Depth = 3.51"
36.05% Pervious = 2.234 ac 63.95% Impervious = 3.963 ac

Summary for Subcatchment 1S: PR-1

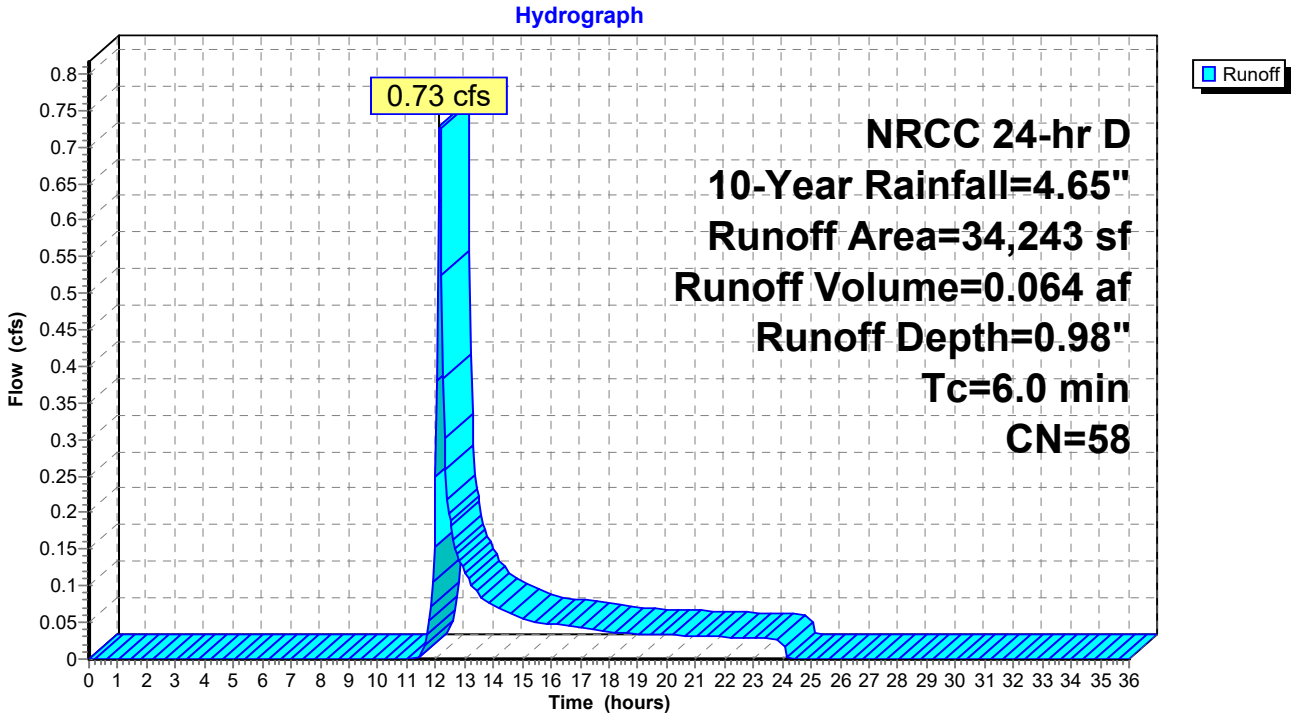
Runoff = 0.73 cfs @ 12.14 hrs, Volume= 0.064 af, Depth= 0.98"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 10-Year Rainfall=4.65"

	Area (sf)	CN	Description
	9,225	98	Paved parking, HSG A
*	2,063	98	Cement Concrete Sidewalk, HSG A
	22,955	39	>75% Grass cover, Good, HSG A
	34,243	58	Weighted Average
	22,955		67.04% Pervious Area
	11,288		32.96% Impervious Area

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

Subcatchment 1S: PR-1



Summary for Subcatchment 2S: PR-2

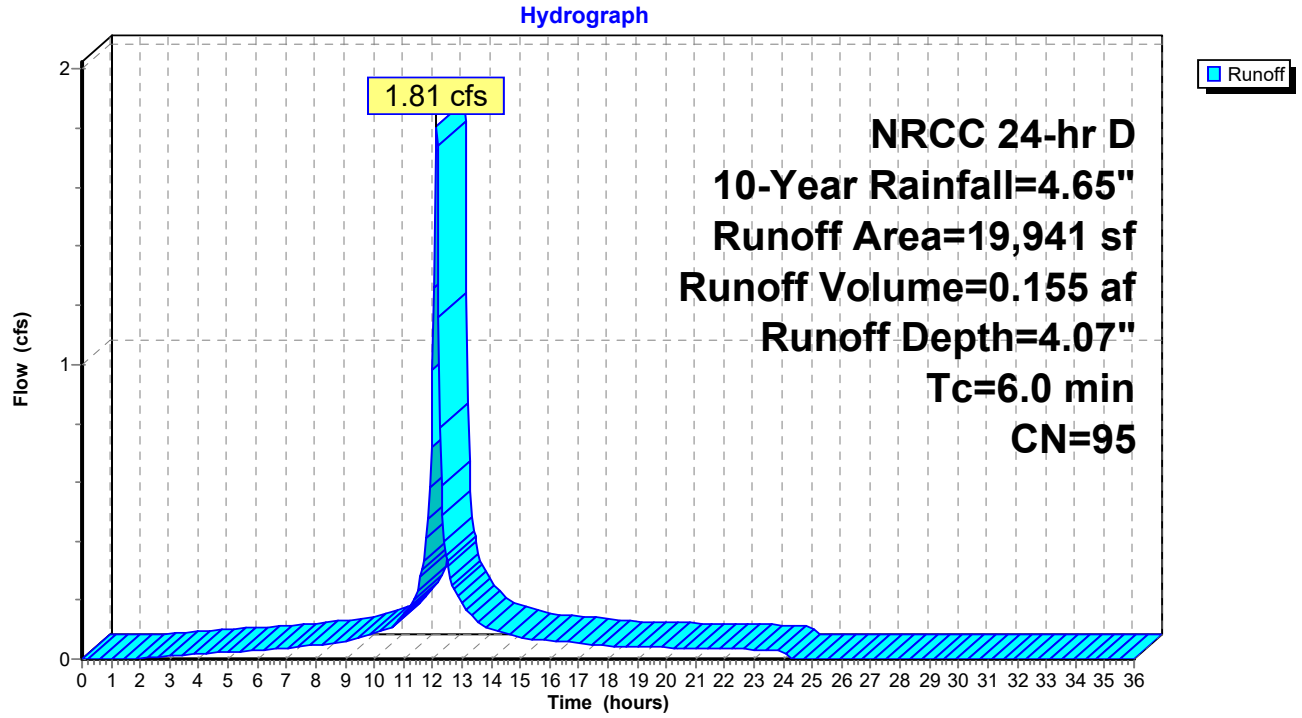
Runoff = 1.81 cfs @ 12.13 hrs, Volume= 0.155 af, Depth= 4.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 10-Year Rainfall=4.65"

	Area (sf)	CN	Description
	11,050	98	Paved parking, HSG D
*	2,266	98	Cement Concrete Sidewalk, HSG D
	6,625	89	<50% Grass cover, Poor, HSG D
	19,941	95	Weighted Average
	6,625		33.22% Pervious Area
	13,316		66.78% Impervious Area

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

Subcatchment 2S: PR-2



Summary for Subcatchment 3S: PR-3

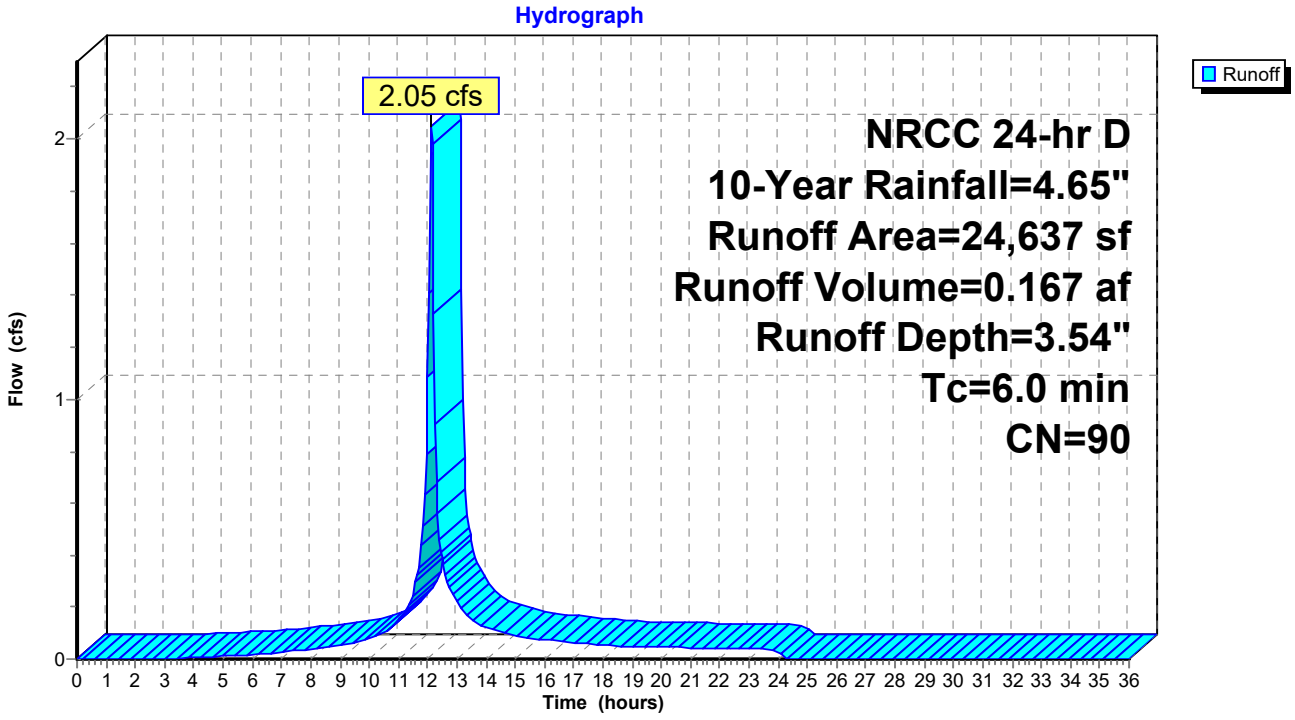
Runoff = 2.05 cfs @ 12.13 hrs, Volume= 0.167 af, Depth= 3.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 10-Year Rainfall=4.65"

	Area (sf)	CN	Description
	13,876	98	Paved parking, HSG C
*	2,822	98	Cement Concrete Sidewalk, HSG C
	7,939	74	>75% Grass cover, Good, HSG C
	24,637	90	Weighted Average
	7,939		32.22% Pervious Area
	16,698		67.78% Impervious Area

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

Subcatchment 3S: PR-3



Summary for Subcatchment 4S: PR-4

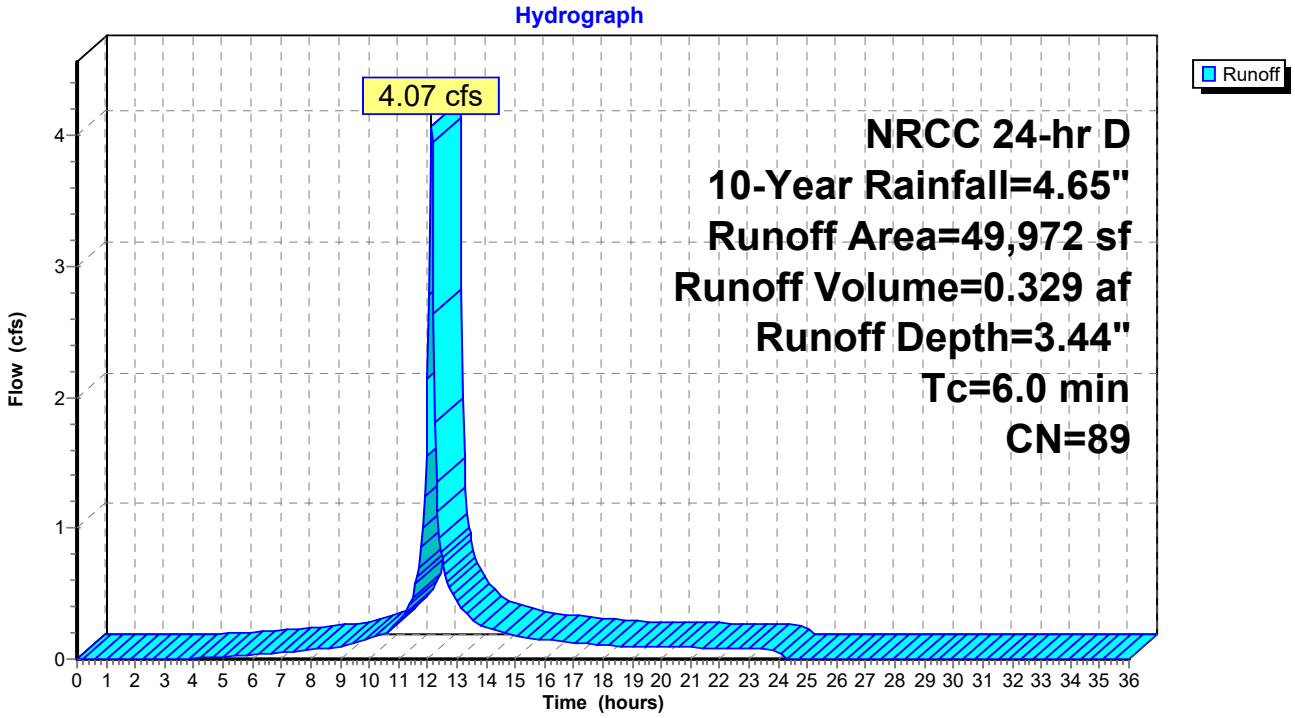
Runoff = 4.07 cfs @ 12.13 hrs, Volume= 0.329 af, Depth= 3.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 10-Year Rainfall=4.65"

	Area (sf)	CN	Description
	20,528	98	Paved parking, HSG C
*	5,920	98	Cement Concrete Sidewalk, HSG C
	23,524	79	50-75% Grass cover, Fair, HSG C
	49,972	89	Weighted Average
	23,524		47.07% Pervious Area
	26,448		52.93% Impervious Area

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

Subcatchment 4S: PR-4



Summary for Subcatchment 5S: PR-5

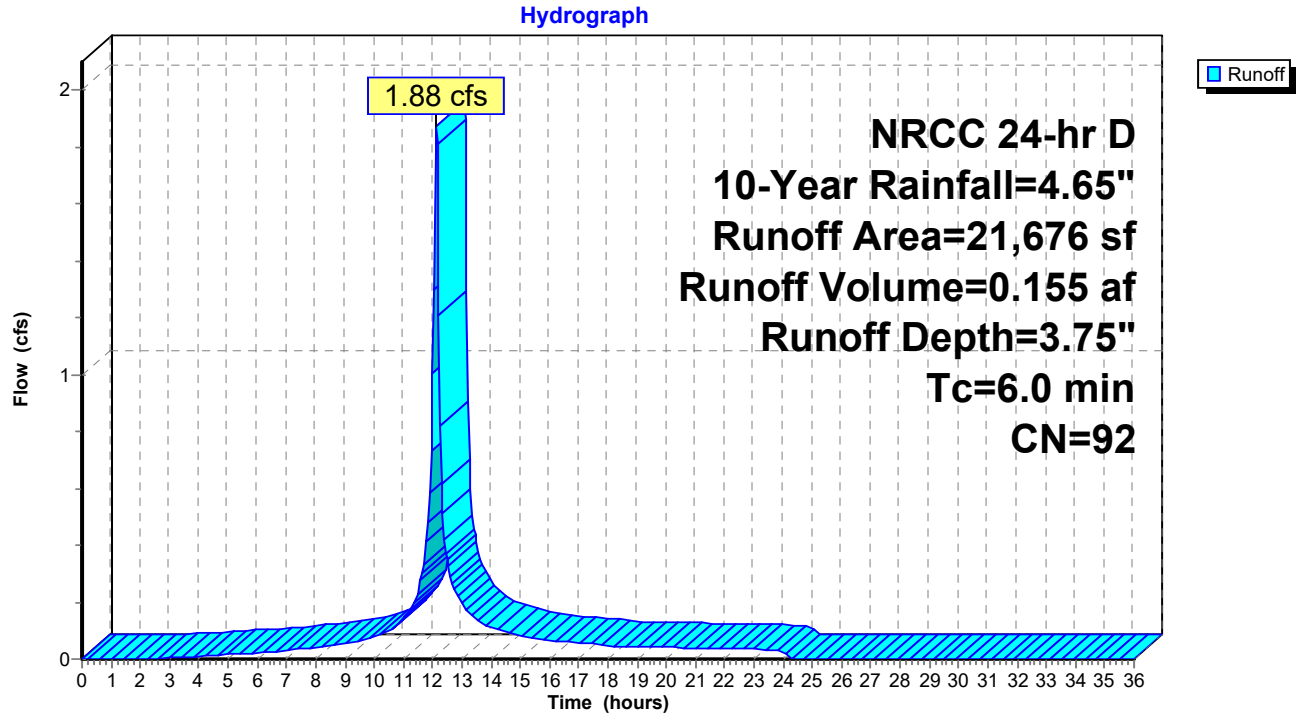
Runoff = 1.88 cfs @ 12.13 hrs, Volume= 0.155 af, Depth= 3.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 10-Year Rainfall=4.65"

	Area (sf)	CN	Description
	11,952	98	Paved parking, HSG D
*	2,512	98	Cement Concrete Sidewalk, HSG D
	7,212	80	>75% Grass cover, Good, HSG D
	21,676	92	Weighted Average
	7,212		33.27% Pervious Area
	14,464		66.73% Impervious Area

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

Subcatchment 5S: PR-5



Summary for Subcatchment 6S: PR-6

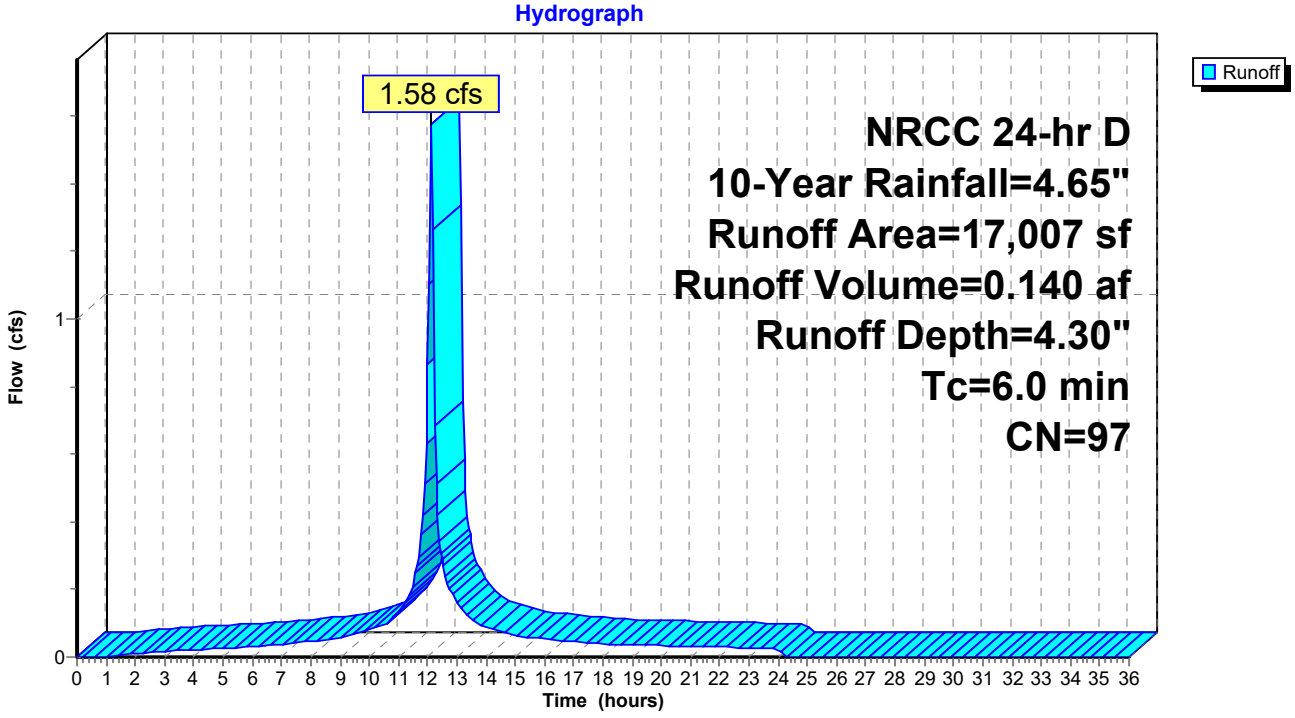
Runoff = 1.58 cfs @ 12.13 hrs, Volume= 0.140 af, Depth= 4.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 10-Year Rainfall=4.65"

	Area (sf)	CN	Description
	11,871	98	Paved parking, HSG D
*	3,101	98	Cement Concrete Sidewalk, HSG D
	2,035	89	<50% Grass cover, Poor, HSG D
	17,007	97	Weighted Average
	2,035		11.97% Pervious Area
	14,972		88.03% Impervious Area

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

Subcatchment 6S: PR-6



Summary for Subcatchment 7S: PR-7

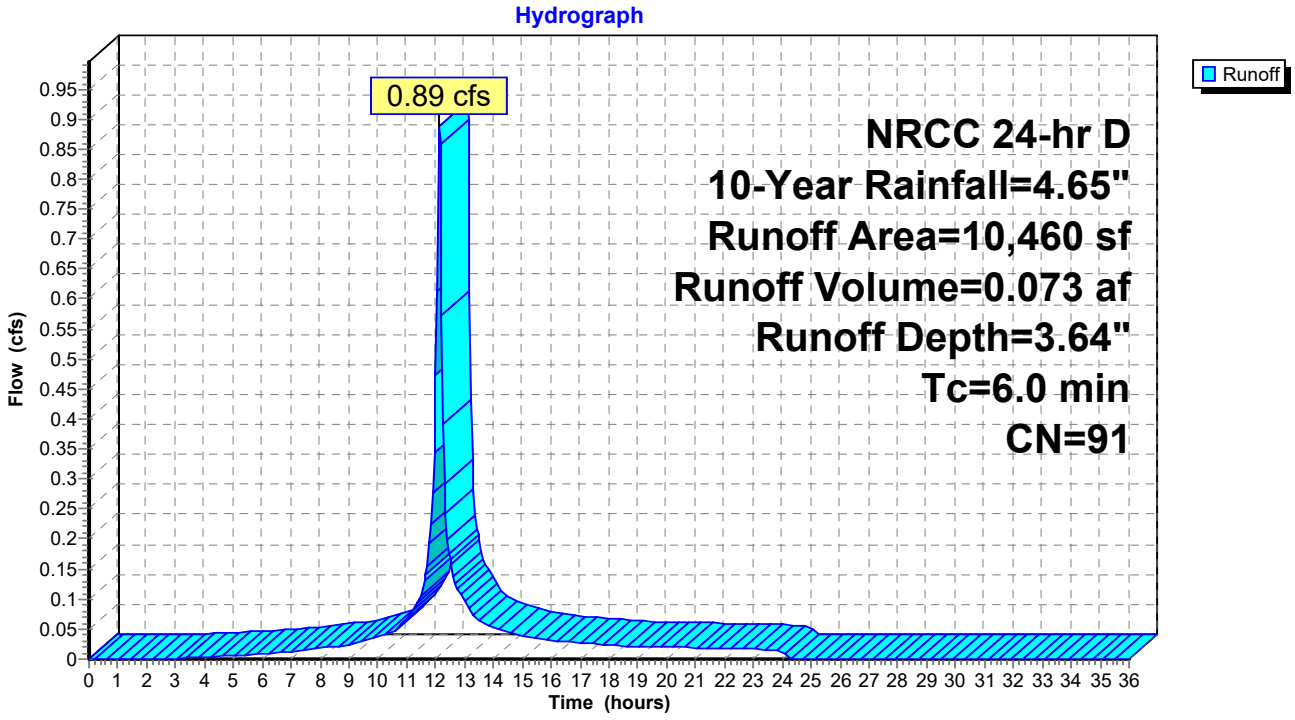
Runoff = 0.89 cfs @ 12.13 hrs, Volume= 0.073 af, Depth= 3.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 10-Year Rainfall=4.65"

	Area (sf)	CN	Description
	5,793	98	Paved parking, HSG D
*	355	98	Cement Concrete Sidewalk, HSG D
	4,312	80	>75% Grass cover, Good, HSG D
	10,460	91	Weighted Average
	4,312		41.22% Pervious Area
	6,148		58.78% Impervious Area

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

Subcatchment 7S: PR-7



Summary for Subcatchment 8S: PR-8

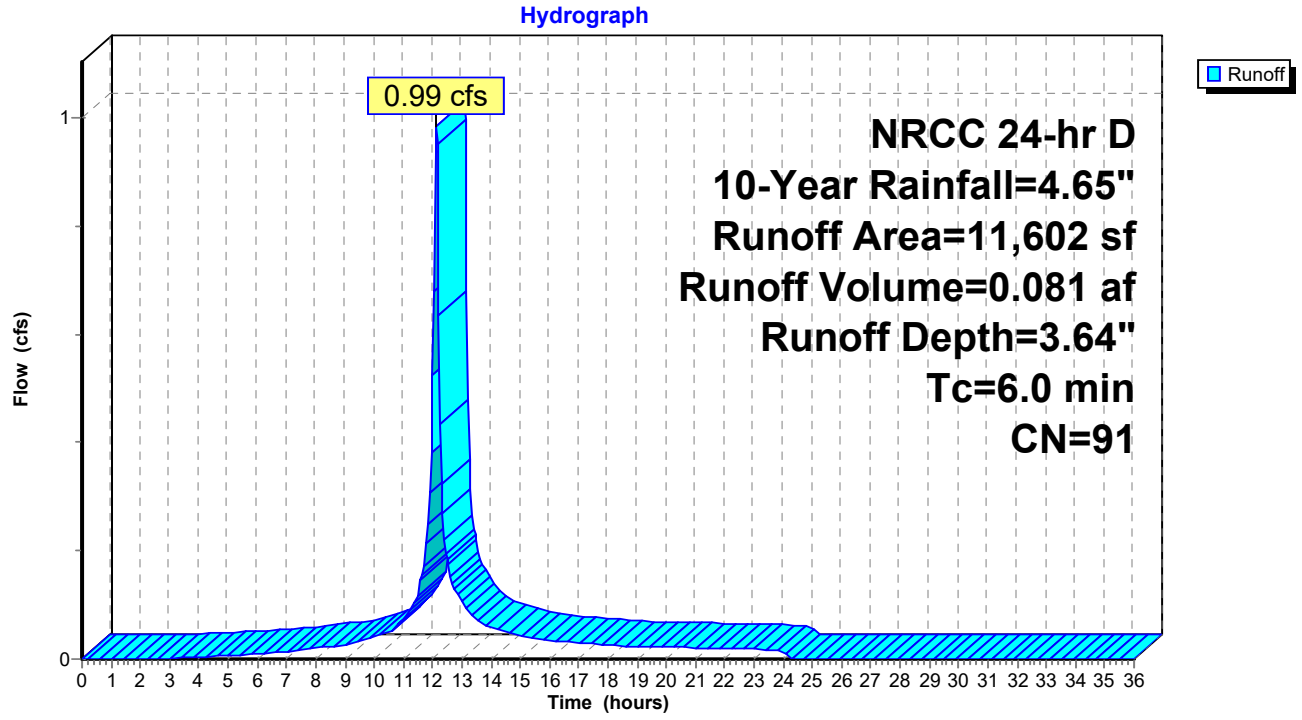
Runoff = 0.99 cfs @ 12.13 hrs, Volume= 0.081 af, Depth= 3.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 10-Year Rainfall=4.65"

	Area (sf)	CN	Description
	6,124	98	Paved parking, HSG D
*	1,252	98	Cement Concrete Sidewalk, HSG D
	4,226	80	>75% Grass cover, Good, HSG D
	11,602	91	Weighted Average
	4,226		36.42% Pervious Area
	7,376		63.58% Impervious Area

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

Subcatchment 8S: PR-8



Summary for Subcatchment 9S: PR-9

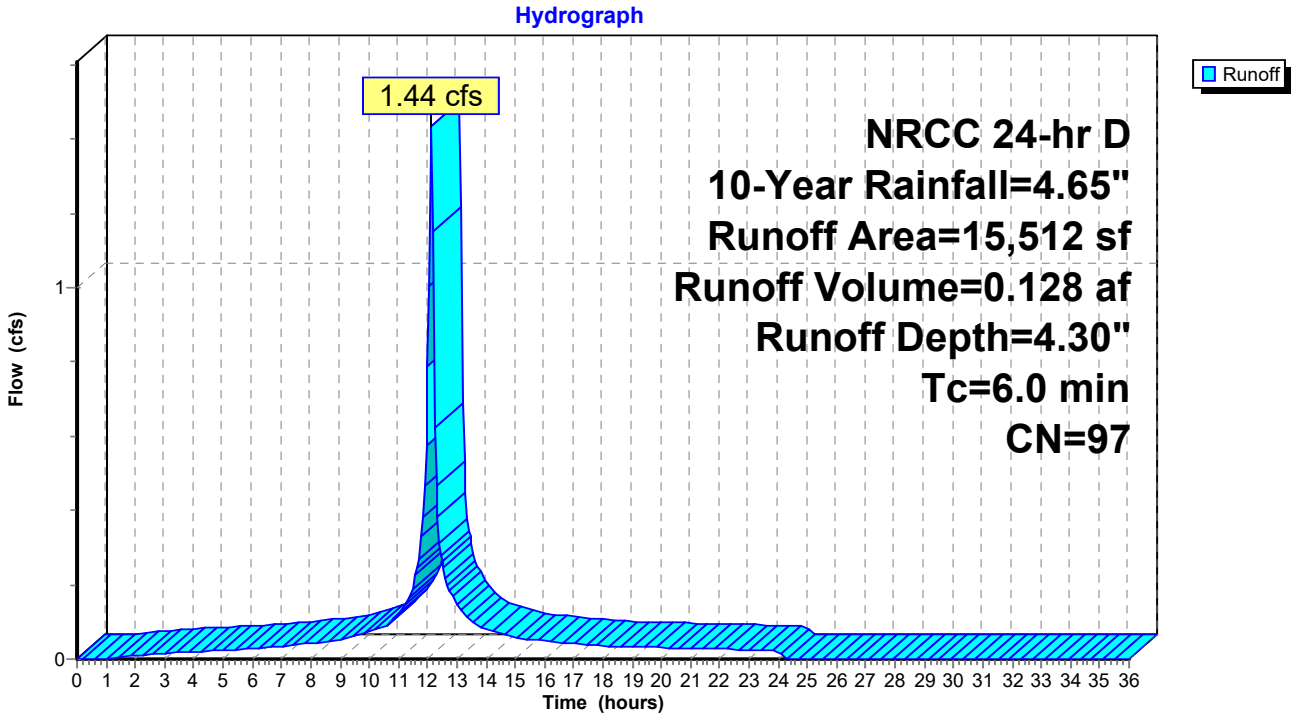
Runoff = 1.44 cfs @ 12.13 hrs, Volume= 0.128 af, Depth= 4.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 10-Year Rainfall=4.65"

	Area (sf)	CN	Description
	10,514	98	Paved parking, HSG D
*	2,796	98	Cement Concrete Sidewalk, HSG D
	2,202	89	<50% Grass cover, Poor, HSG D
	15,512	97	Weighted Average
	2,202		14.20% Pervious Area
	13,310		85.80% Impervious Area

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

Subcatchment 9S: PR-9



Summary for Subcatchment 10S: PR-10

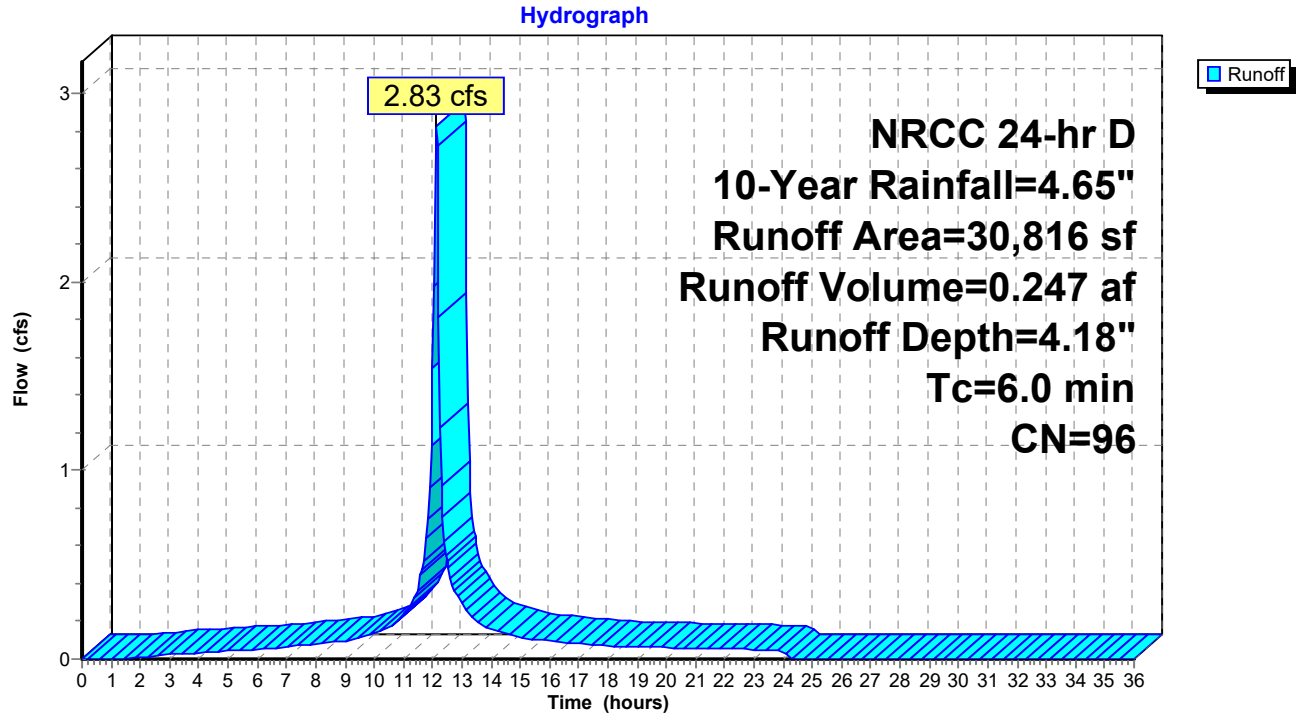
Runoff = 2.83 cfs @ 12.13 hrs, Volume= 0.247 af, Depth= 4.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 10-Year Rainfall=4.65"

	Area (sf)	CN	Description
	19,051	98	Paved parking, HSG D
*	4,167	98	Cement Concrete Sidewalk, HSG D
	7,598	89	<50% Grass cover, Poor, HSG D
	30,816	96	Weighted Average
	7,598		24.66% Pervious Area
	23,218		75.34% Impervious Area

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

Subcatchment 10S: PR-10



Summary for Subcatchment 11S: PR-11

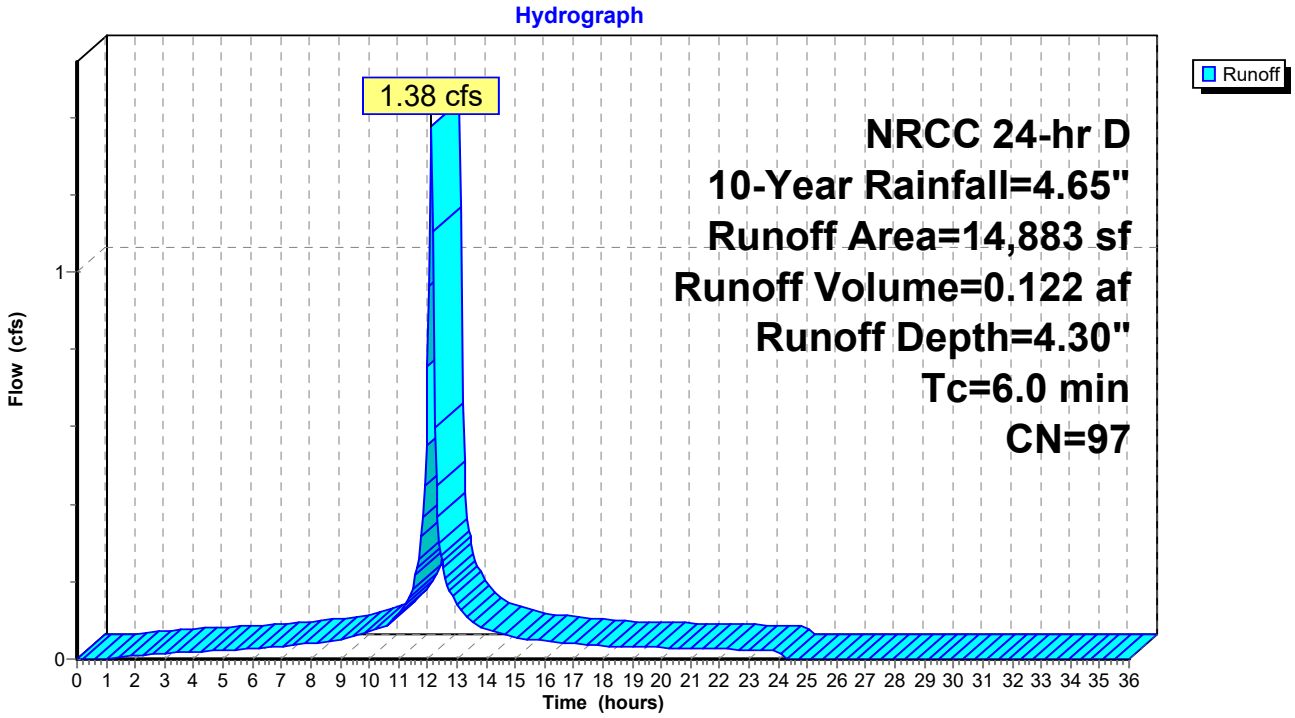
Runoff = 1.38 cfs @ 12.13 hrs, Volume= 0.122 af, Depth= 4.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 10-Year Rainfall=4.65"

	Area (sf)	CN	Description
	10,677	98	Paved parking, HSG D
*	1,854	98	Cement Concrete Sidewalk, HSG D
	2,352	89	<50% Grass cover, Poor, HSG D
	14,883	97	Weighted Average
	2,352		15.80% Pervious Area
	12,531		84.20% Impervious Area

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

Subcatchment 11S: PR-11



Summary for Subcatchment 12S: PR-12

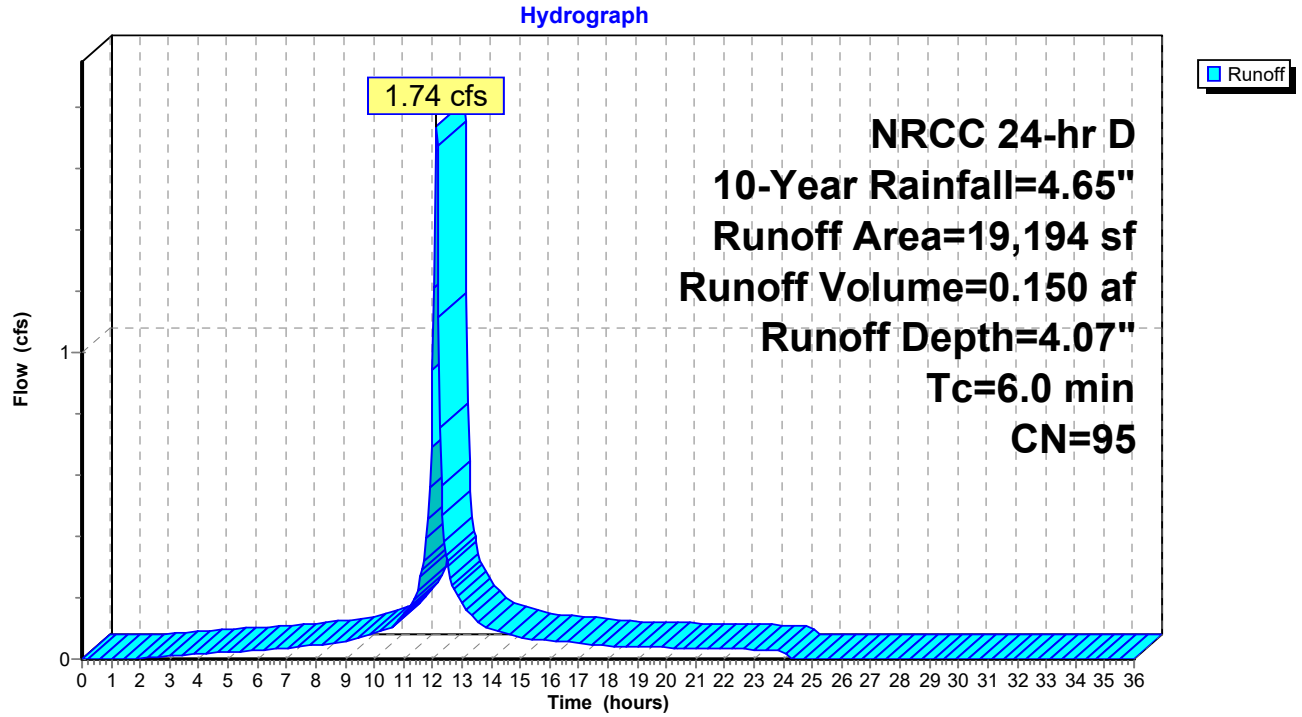
Runoff = 1.74 cfs @ 12.13 hrs, Volume= 0.150 af, Depth= 4.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 10-Year Rainfall=4.65"

	Area (sf)	CN	Description
	10,142	98	Paved parking, HSG D
*	2,713	98	Cement Concrete Sidewalk, HSG D
	6,339	89	<50% Grass cover, Poor, HSG D
	19,194	95	Weighted Average
	6,339		33.03% Pervious Area
	12,855		66.97% Impervious Area

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

Subcatchment 12S: PR-12



Summary for Pond 14P: Rain Garden

Inflow Area = 0.786 ac, 32.96% Impervious, Inflow Depth = 0.98" for 10-Year event
Inflow = 0.73 cfs @ 12.14 hrs, Volume= 0.064 af
Outflow = 0.08 cfs @ 13.58 hrs, Volume= 0.064 af, Atten= 89%, Lag= 86.3 min
Discarded = 0.08 cfs @ 13.58 hrs, Volume= 0.064 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 254.92' @ 13.58 hrs Surf.Area= 1,283 sf Storage= 813 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 120.3 min (1,047.3 - 927.0)

Volume	Invert	Avail.Storage	Storage Description
#1	254.00'	6,180 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

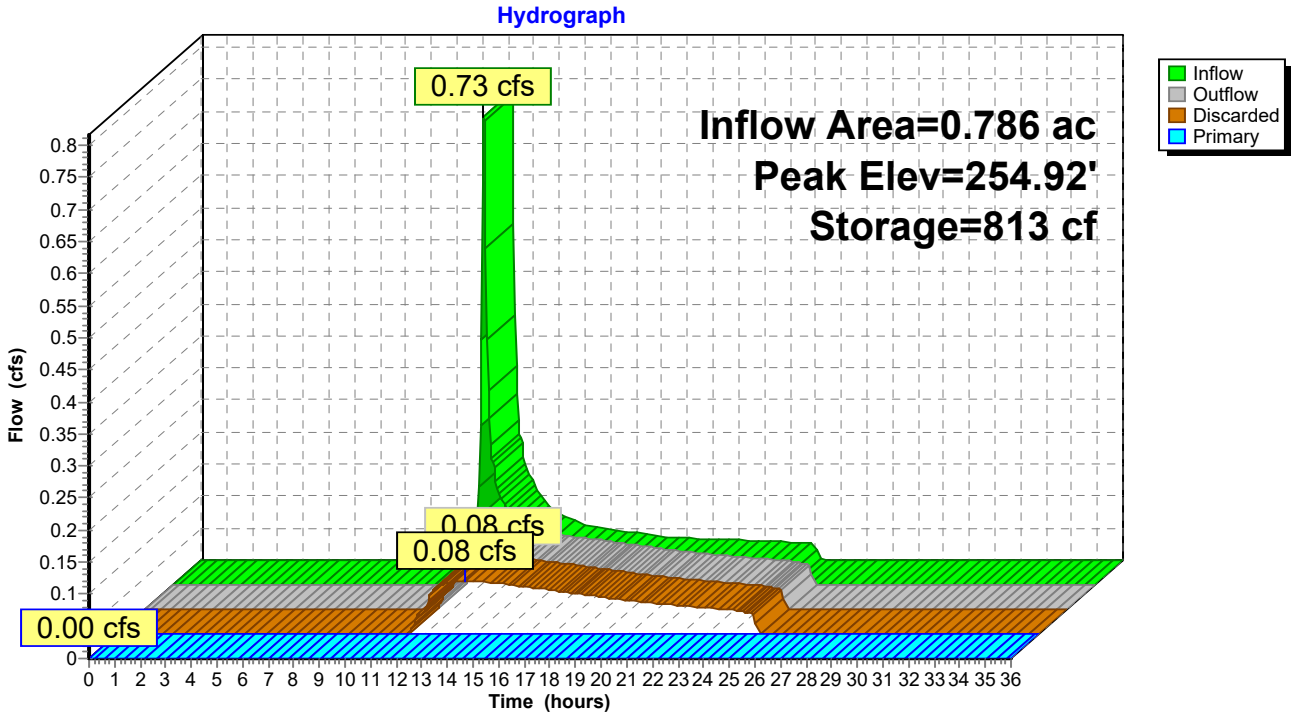
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
254.00	540	103.7	0	0	540
255.00	1,364	159.3	921	921	1,711
256.00	2,563	215.7	1,932	2,853	3,405
257.00	4,155	273.9	3,327	6,180	5,685

Device	Routing	Invert	Outlet Devices
#1	Primary	254.50'	**12.0" Round Culvert** L= 20.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 254.50' / 253.50' S= 0.0500 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#2	Device 1	256.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 2	256.50'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Discarded	254.00'	**2.400 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 250.00'

Discarded OutFlow Max=0.08 cfs @ 13.58 hrs HW=254.92' (Free Discharge)
└**4=Exfiltration** (Controls 0.08 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=254.00' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Controls 0.00 cfs)
└**2=Orifice/Grate** (Controls 0.00 cfs)
└**3=Orifice/Grate** (Controls 0.00 cfs)

Pond 14P: Rain Garden



Stage-Area-Storage for Pond 14P: Rain Garden

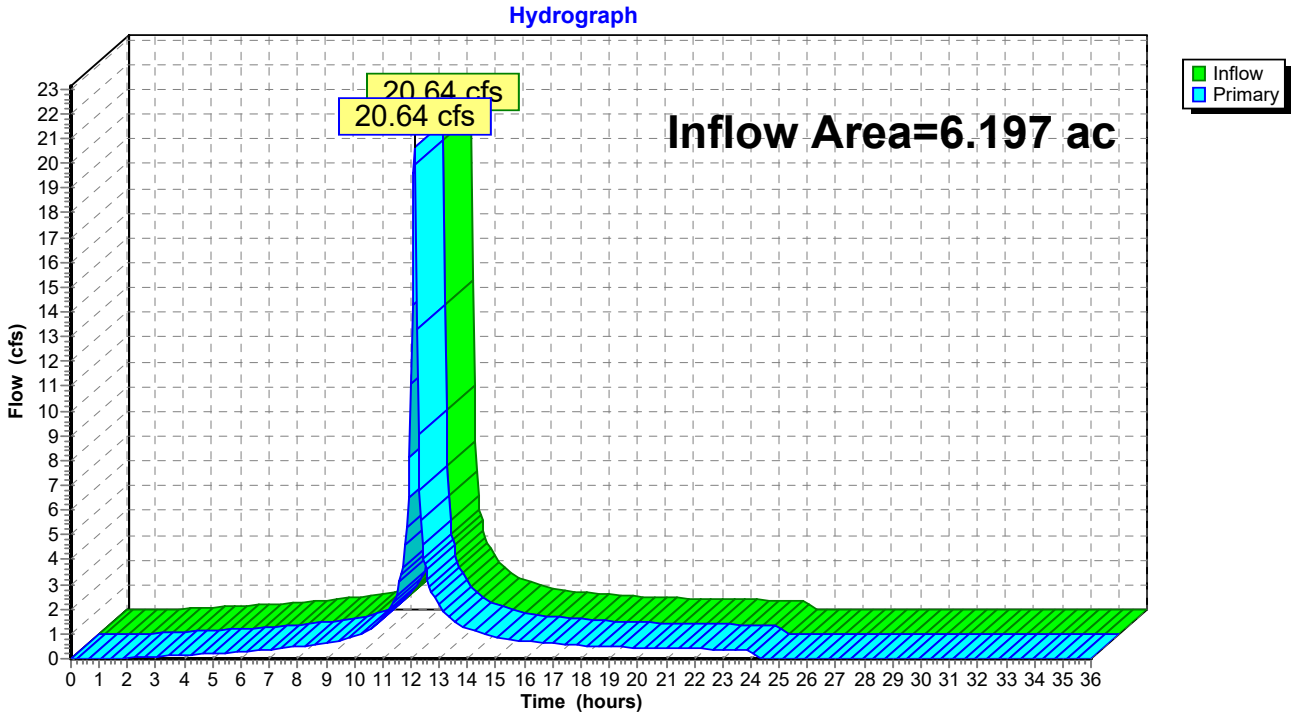
Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
254.00	540	0
254.10	606	57
254.20	675	121
254.30	748	192
254.40	825	271
254.50	905	357
254.60	989	452
254.70	1,077	555
254.80	1,169	668
254.90	1,265	789
255.00	1,364	921
255.10	1,467	1,062
255.20	1,574	1,214
255.30	1,684	1,377
255.40	1,799	1,551
255.50	1,917	1,737
255.60	2,038	1,935
255.70	2,164	2,145
255.80	2,293	2,368
255.90	2,426	2,604
256.00	2,563	2,853
256.10	2,705	3,116
256.20	2,851	3,394
256.30	3,000	3,687
256.40	3,154	3,994
256.50	3,311	4,318
256.60	3,472	4,657
256.70	3,637	5,012
256.80	3,806	5,384
256.90	3,979	5,773
257.00	**4,155**	**6,180**

Summary for Link 15L: DP-1

Inflow Area = 6.197 ac, 63.95% Impervious, Inflow Depth = 3.38" for 10-Year event
Inflow = 20.64 cfs @ 12.13 hrs, Volume= 1.746 af
Primary = 20.64 cfs @ 12.13 hrs, Volume= 1.746 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Link 15L: DP-1



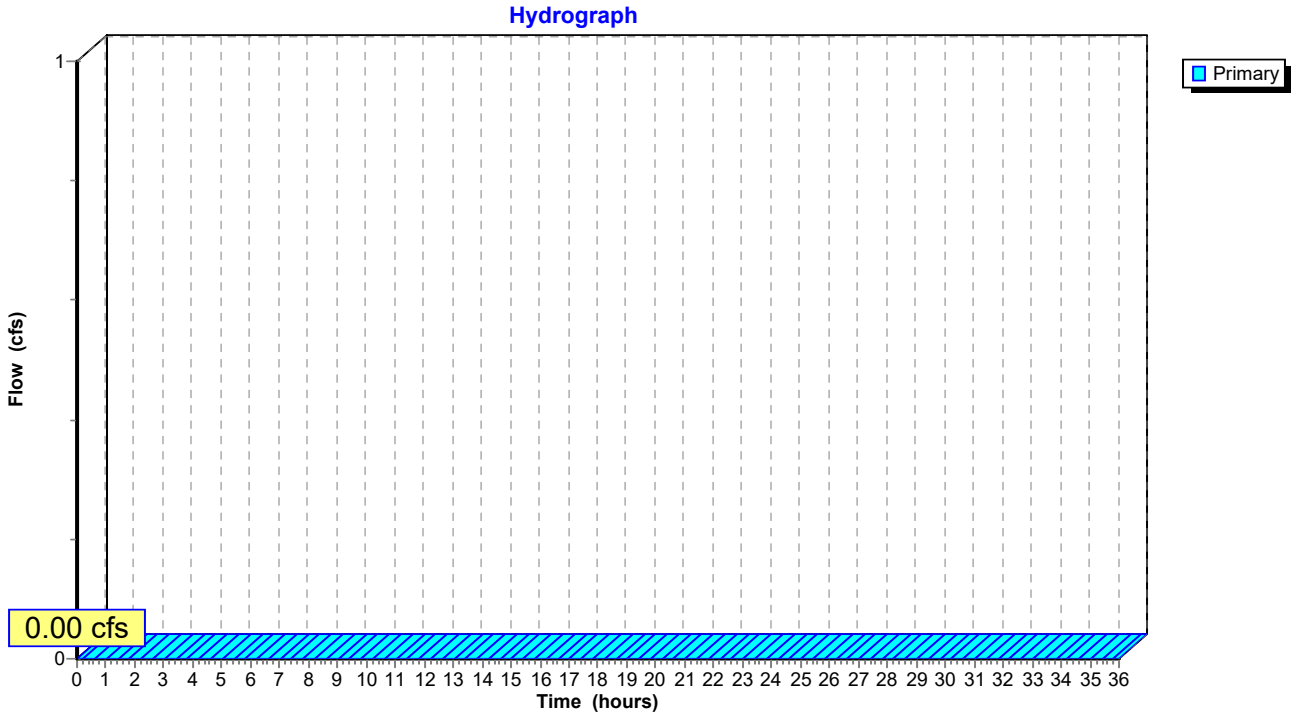
Summary for Link 16L: DP-2

[43] Hint: Has no inflow (Outflow=Zero)

Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Link 16L: DP-2



Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: PR-1 Runoff Area=34,243 sf 32.96% Impervious Runoff Depth=1.68"
Tc=6.0 min CN=58 Runoff=1.35 cfs 0.110 af

Subcatchment 2S: PR-2 Runoff Area=19,941 sf 66.78% Impervious Runoff Depth=5.28"
Tc=6.0 min CN=95 Runoff=2.31 cfs 0.202 af

Subcatchment 3S: PR-3 Runoff Area=24,637 sf 67.78% Impervious Runoff Depth=4.72"
Tc=6.0 min CN=90 Runoff=2.69 cfs 0.222 af

Subcatchment 4S: PR-4 Runoff Area=49,972 sf 52.93% Impervious Runoff Depth=4.61"
Tc=6.0 min CN=89 Runoff=5.37 cfs 0.441 af

Subcatchment 5S: PR-5 Runoff Area=21,676 sf 66.73% Impervious Runoff Depth=4.94"
Tc=6.0 min CN=92 Runoff=2.43 cfs 0.205 af

Subcatchment 6S: PR-6 Runoff Area=17,007 sf 88.03% Impervious Runoff Depth=5.51"
Tc=6.0 min CN=97 Runoff=2.00 cfs 0.179 af

Subcatchment 7S: PR-7 Runoff Area=10,460 sf 58.78% Impervious Runoff Depth=4.83"
Tc=6.0 min CN=91 Runoff=1.16 cfs 0.097 af

Subcatchment 8S: PR-8 Runoff Area=11,602 sf 63.58% Impervious Runoff Depth=4.83"
Tc=6.0 min CN=91 Runoff=1.28 cfs 0.107 af

Subcatchment 9S: PR-9 Runoff Area=15,512 sf 85.80% Impervious Runoff Depth=5.51"
Tc=6.0 min CN=97 Runoff=1.82 cfs 0.164 af

Subcatchment 10S: PR-10 Runoff Area=30,816 sf 75.34% Impervious Runoff Depth=5.40"
Tc=6.0 min CN=96 Runoff=3.60 cfs 0.318 af

Subcatchment 11S: PR-11 Runoff Area=14,883 sf 84.20% Impervious Runoff Depth=5.51"
Tc=6.0 min CN=97 Runoff=1.75 cfs 0.157 af

Subcatchment 12S: PR-12 Runoff Area=19,194 sf 66.97% Impervious Runoff Depth=5.28"
Tc=6.0 min CN=95 Runoff=2.22 cfs 0.194 af

Pond 14P: Rain Garden Peak Elev=255.47' Storage=1,677 cf Inflow=1.35 cfs 0.110 af
Discarded=0.13 cfs 0.110 af Primary=0.00 cfs 0.000 af Outflow=0.13 cfs 0.110 af

Link 15L: DP-1 Inflow=26.63 cfs 2.286 af
Primary=26.63 cfs 2.286 af

Link 16L: DP-2
Primary=0.00 cfs 0.000 af

Total Runoff Area = 6.197 ac Runoff Volume = 2.395 af Average Runoff Depth = 4.64"
36.05% Pervious = 2.234 ac 63.95% Impervious = 3.963 ac

Summary for Subcatchment 1S: PR-1

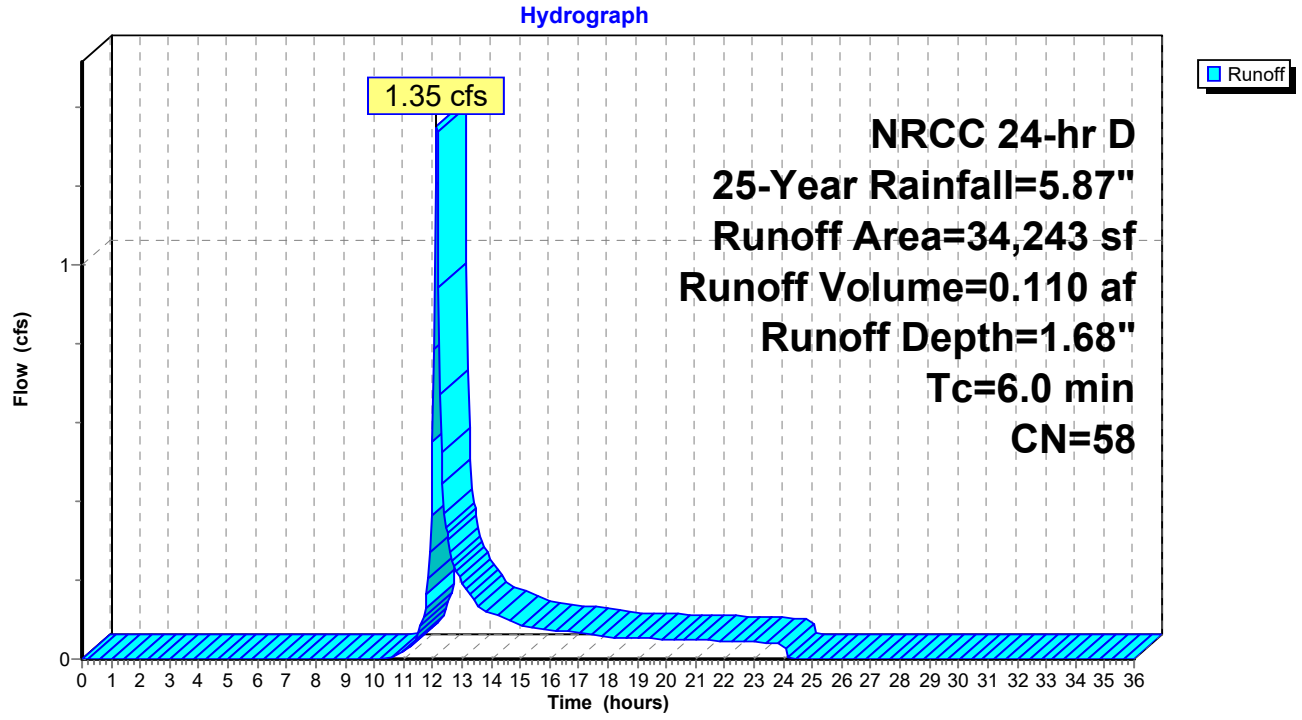
Runoff = 1.35 cfs @ 12.14 hrs, Volume= 0.110 af, Depth= 1.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 25-Year Rainfall=5.87"

	Area (sf)	CN	Description
	9,225	98	Paved parking, HSG A
*	2,063	98	Cement Concrete Sidewalk, HSG A
	22,955	39	>75% Grass cover, Good, HSG A
	34,243	58	Weighted Average
	22,955		67.04% Pervious Area
	11,288		32.96% Impervious Area

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

Subcatchment 1S: PR-1



Summary for Subcatchment 2S: PR-2

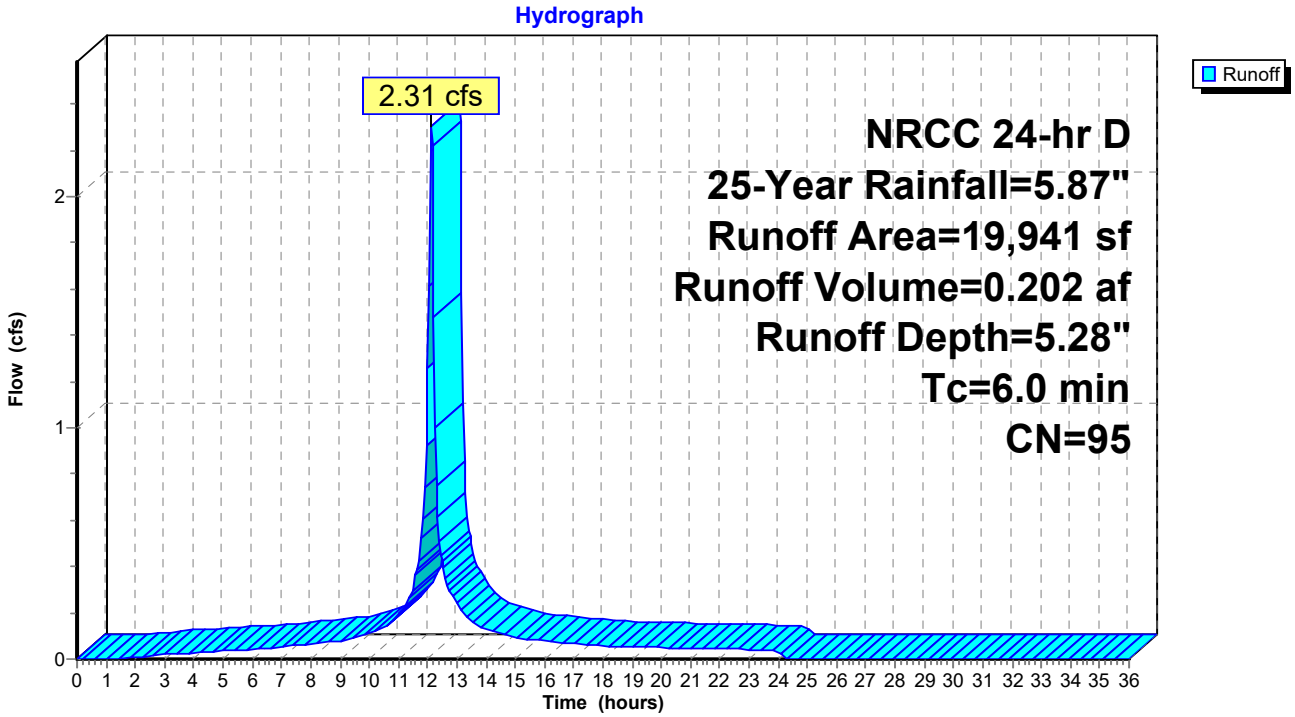
Runoff = 2.31 cfs @ 12.13 hrs, Volume= 0.202 af, Depth= 5.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 25-Year Rainfall=5.87"

	Area (sf)	CN	Description
	11,050	98	Paved parking, HSG D
*	2,266	98	Cement Concrete Sidewalk, HSG D
	6,625	89	<50% Grass cover, Poor, HSG D
	19,941	95	Weighted Average
	6,625		33.22% Pervious Area
	13,316		66.78% Impervious Area

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

Subcatchment 2S: PR-2



Summary for Subcatchment 3S: PR-3

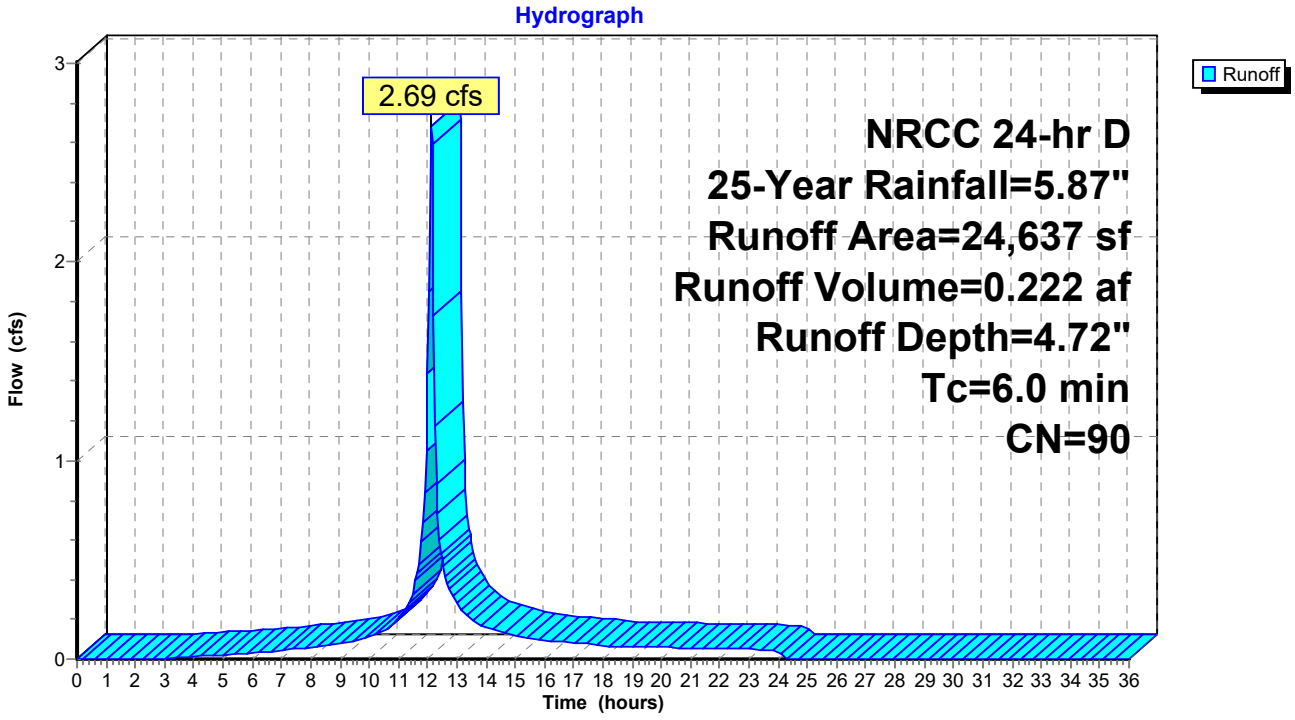
Runoff = 2.69 cfs @ 12.13 hrs, Volume= 0.222 af, Depth= 4.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 25-Year Rainfall=5.87"

	Area (sf)	CN	Description
	13,876	98	Paved parking, HSG C
*	2,822	98	Cement Concrete Sidewalk, HSG C
	7,939	74	>75% Grass cover, Good, HSG C
	24,637	90	Weighted Average
	7,939		32.22% Pervious Area
	16,698		67.78% Impervious Area

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

Subcatchment 3S: PR-3



Summary for Subcatchment 4S: PR-4

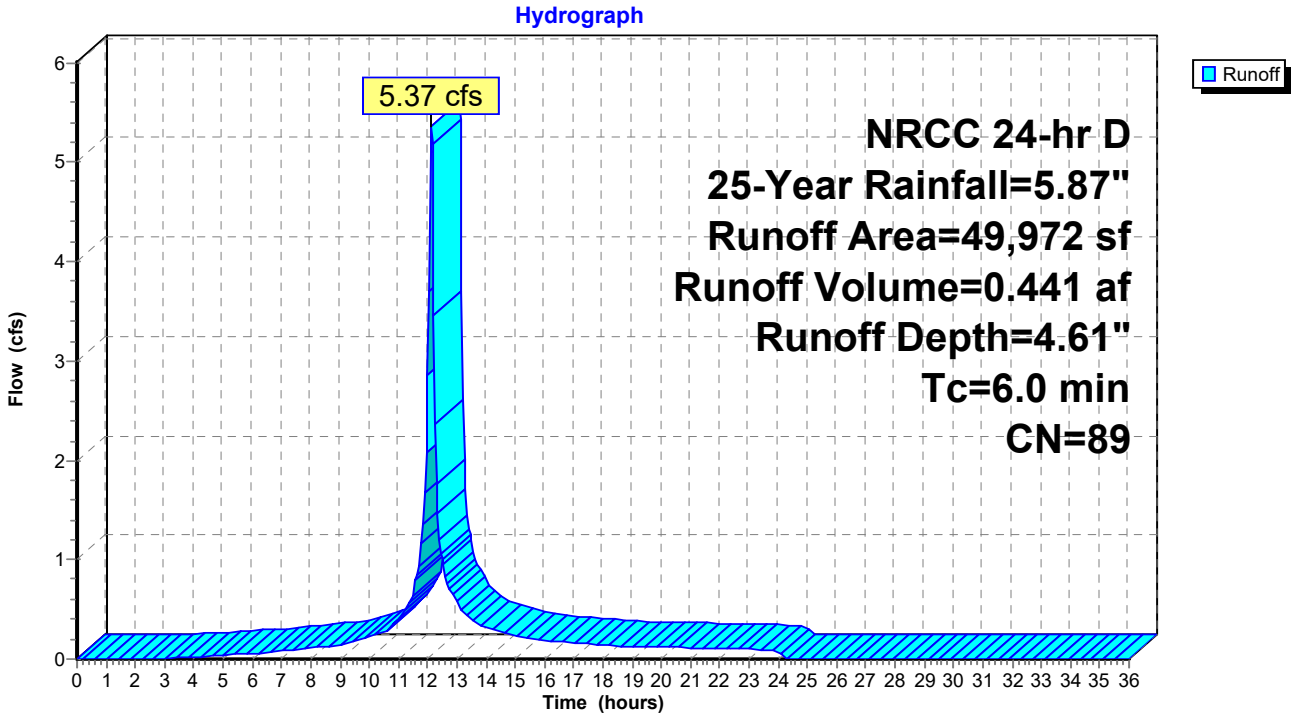
Runoff = 5.37 cfs @ 12.13 hrs, Volume= 0.441 af, Depth= 4.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 25-Year Rainfall=5.87"

	Area (sf)	CN	Description
	20,528	98	Paved parking, HSG C
*	5,920	98	Cement Concrete Sidewalk, HSG C
	23,524	79	50-75% Grass cover, Fair, HSG C
	49,972	89	Weighted Average
	23,524		47.07% Pervious Area
	26,448		52.93% Impervious Area

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

Subcatchment 4S: PR-4



Summary for Subcatchment 5S: PR-5

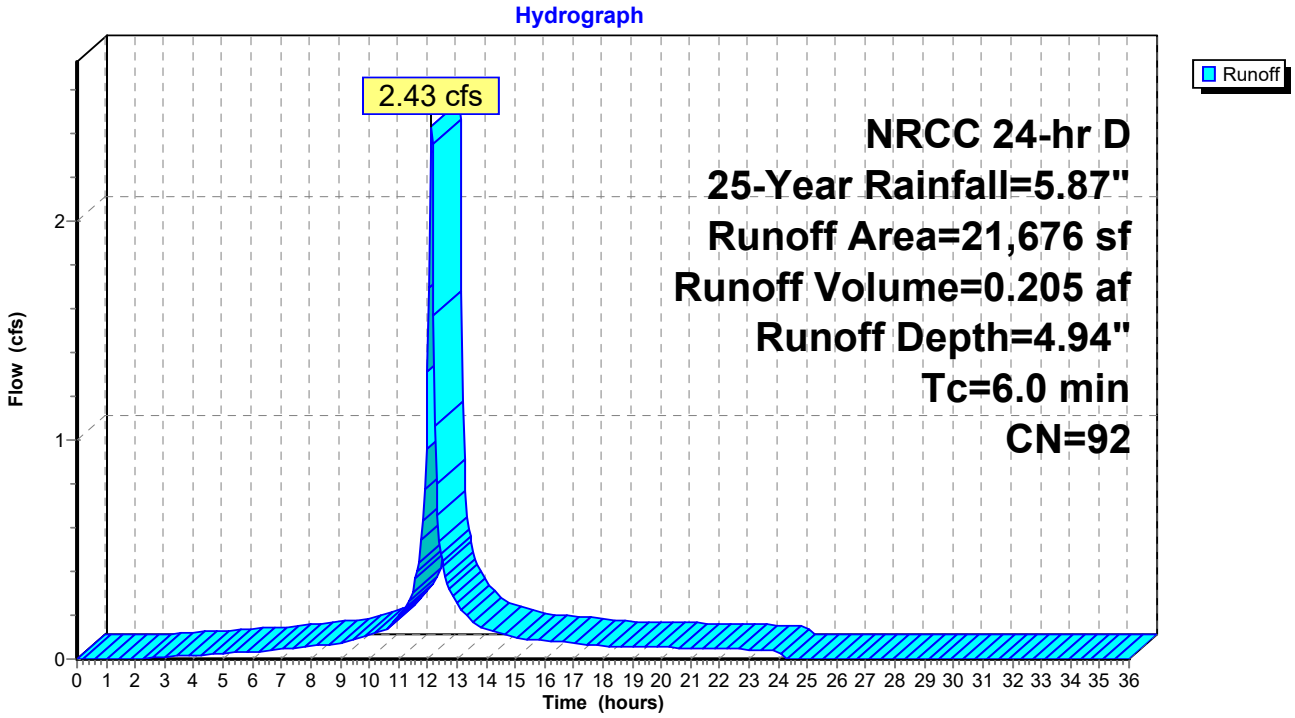
Runoff = 2.43 cfs @ 12.13 hrs, Volume= 0.205 af, Depth= 4.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 25-Year Rainfall=5.87"

	Area (sf)	CN	Description
	11,952	98	Paved parking, HSG D
*	2,512	98	Cement Concrete Sidewalk, HSG D
	7,212	80	>75% Grass cover, Good, HSG D
	21,676	92	Weighted Average
	7,212		33.27% Pervious Area
	14,464		66.73% Impervious Area

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

Subcatchment 5S: PR-5



Summary for Subcatchment 6S: PR-6

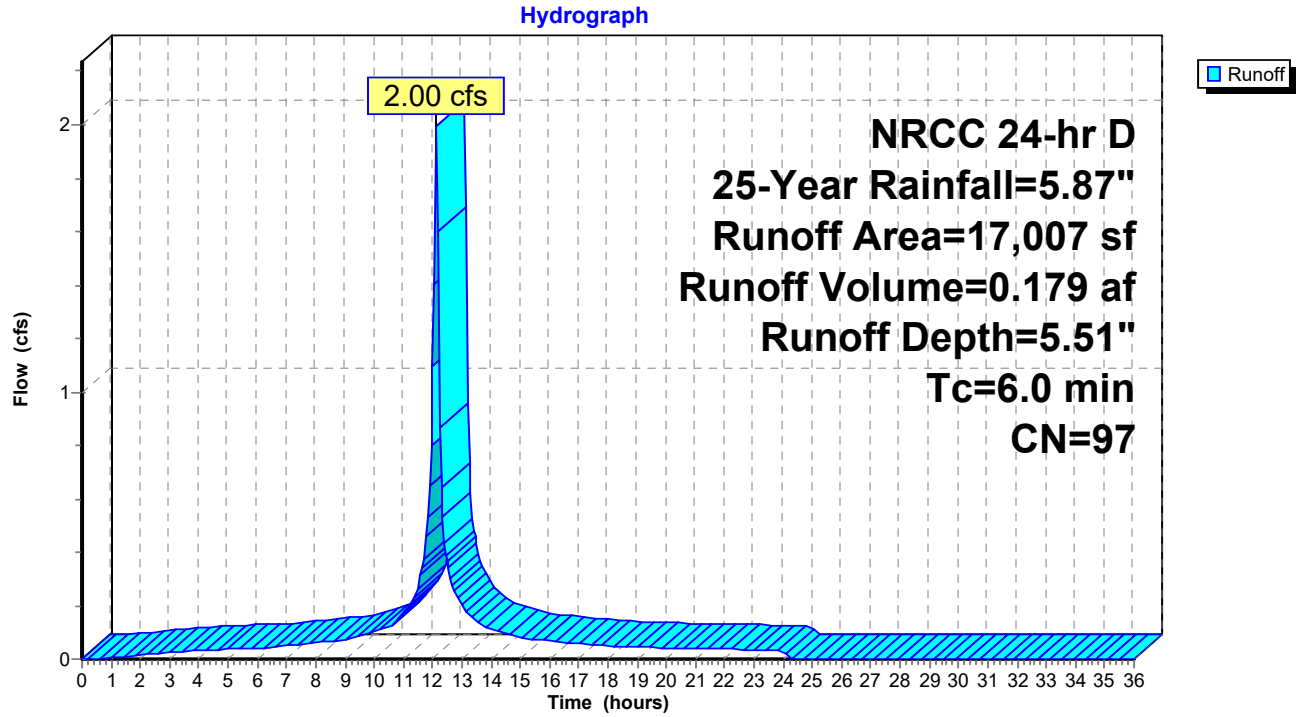
Runoff = 2.00 cfs @ 12.13 hrs, Volume= 0.179 af, Depth= 5.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 25-Year Rainfall=5.87"

	Area (sf)	CN	Description
	11,871	98	Paved parking, HSG D
*	3,101	98	Cement Concrete Sidewalk, HSG D
	2,035	89	<50% Grass cover, Poor, HSG D
	17,007	97	Weighted Average
	2,035		11.97% Pervious Area
	14,972		88.03% Impervious Area

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

Subcatchment 6S: PR-6



Summary for Subcatchment 7S: PR-7

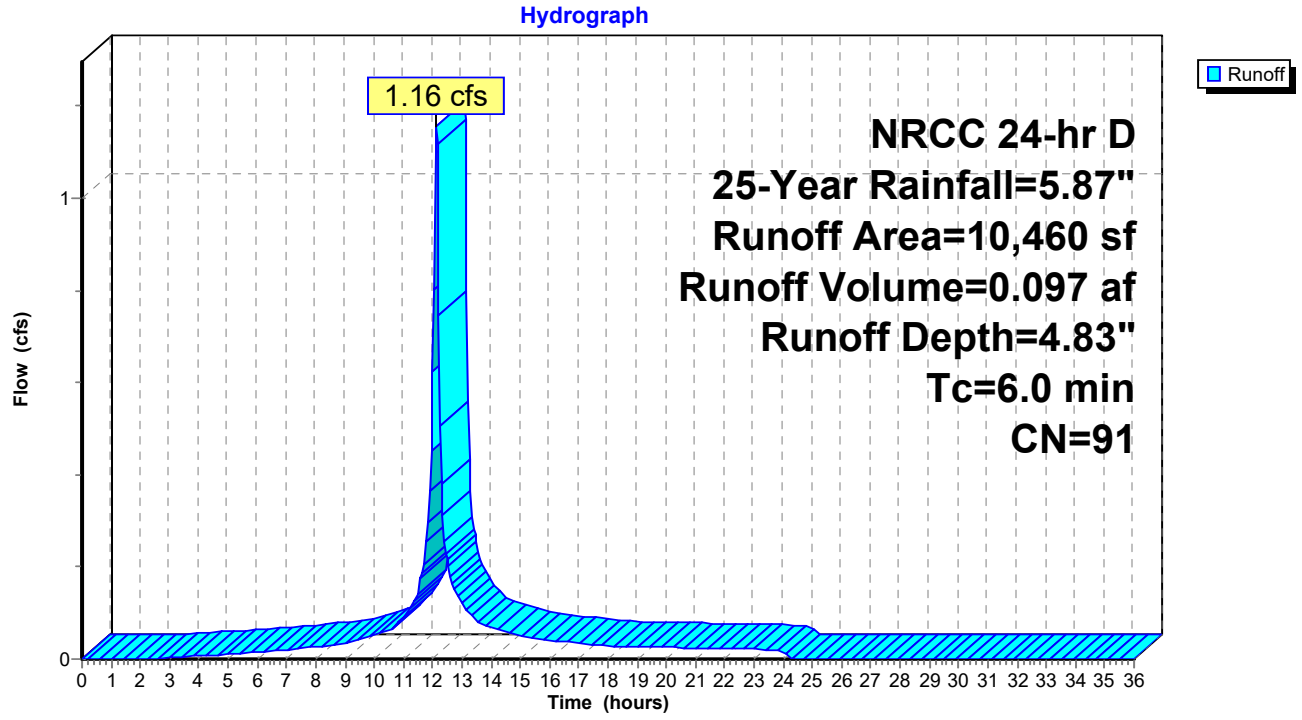
Runoff = 1.16 cfs @ 12.13 hrs, Volume= 0.097 af, Depth= 4.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 25-Year Rainfall=5.87"

	Area (sf)	CN	Description
	5,793	98	Paved parking, HSG D
*	355	98	Cement Concrete Sidewalk, HSG D
	4,312	80	>75% Grass cover, Good, HSG D
	10,460	91	Weighted Average
	4,312		41.22% Pervious Area
	6,148		58.78% Impervious Area

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

Subcatchment 7S: PR-7



Summary for Subcatchment 8S: PR-8

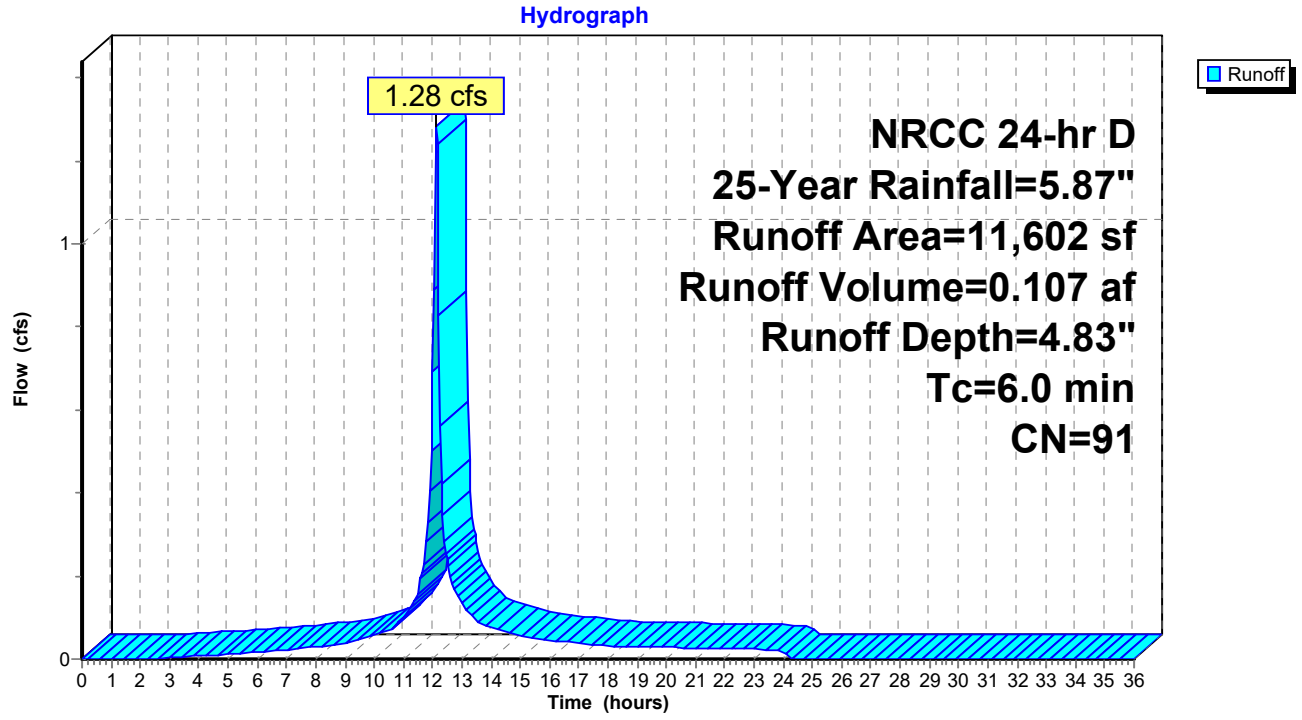
Runoff = 1.28 cfs @ 12.13 hrs, Volume= 0.107 af, Depth= 4.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 25-Year Rainfall=5.87"

	Area (sf)	CN	Description
	6,124	98	Paved parking, HSG D
*	1,252	98	Cement Concrete Sidewalk, HSG D
	4,226	80	>75% Grass cover, Good, HSG D
	11,602	91	Weighted Average
	4,226		36.42% Pervious Area
	7,376		63.58% Impervious Area

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

Subcatchment 8S: PR-8



Summary for Subcatchment 9S: PR-9

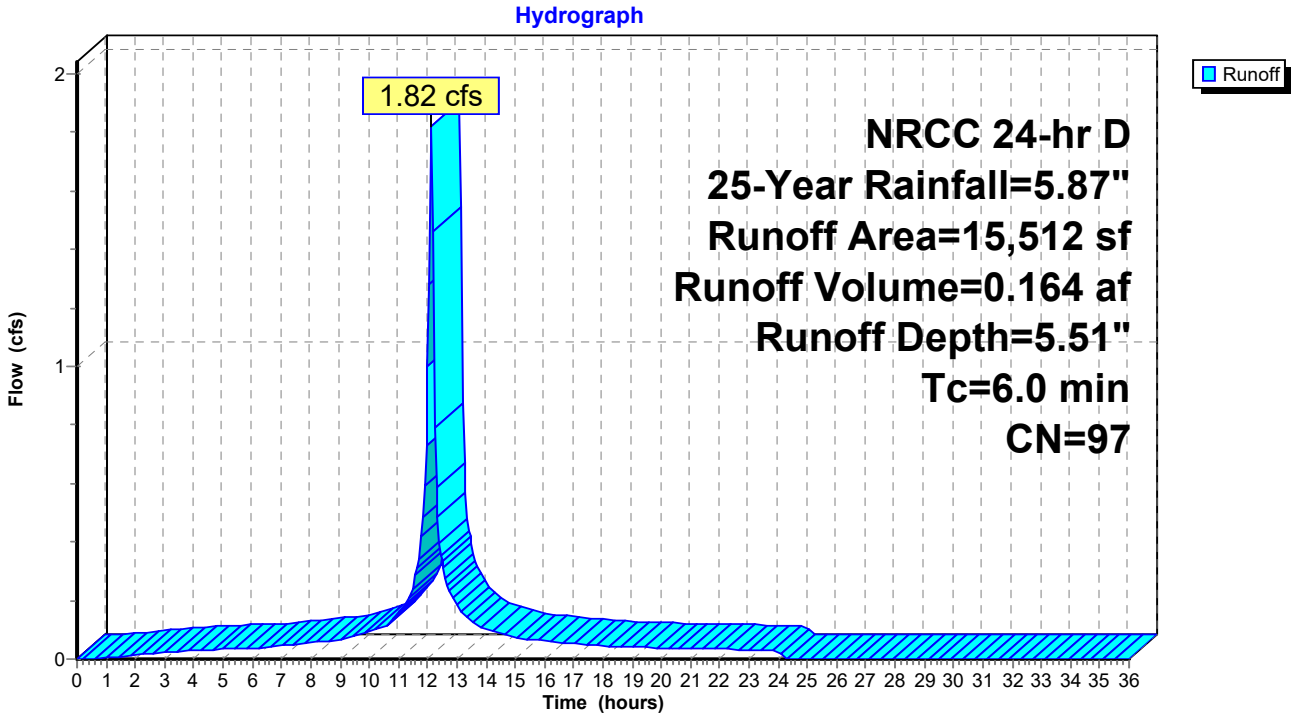
Runoff = 1.82 cfs @ 12.13 hrs, Volume= 0.164 af, Depth= 5.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 25-Year Rainfall=5.87"

	Area (sf)	CN	Description
	10,514	98	Paved parking, HSG D
*	2,796	98	Cement Concrete Sidewalk, HSG D
	2,202	89	<50% Grass cover, Poor, HSG D
	15,512	97	Weighted Average
	2,202		14.20% Pervious Area
	13,310		85.80% Impervious Area

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

Subcatchment 9S: PR-9



Summary for Subcatchment 10S: PR-10

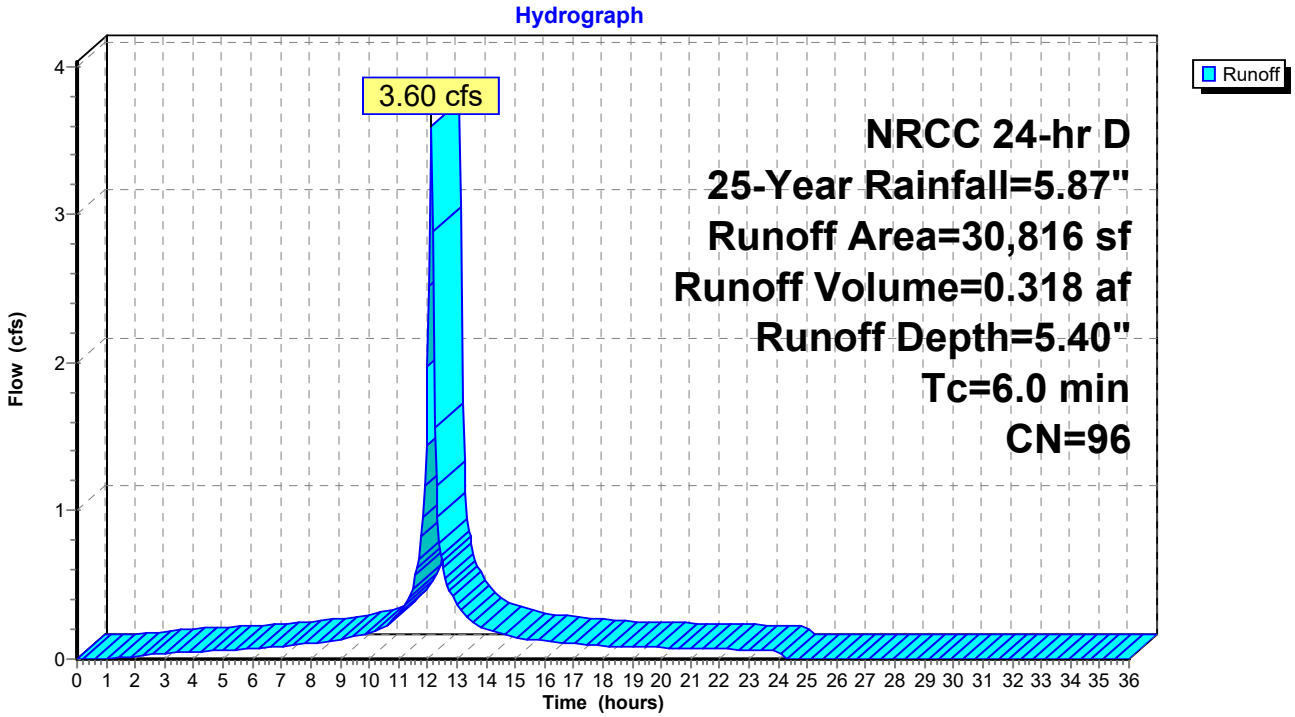
Runoff = 3.60 cfs @ 12.13 hrs, Volume= 0.318 af, Depth= 5.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 25-Year Rainfall=5.87"

	Area (sf)	CN	Description
	19,051	98	Paved parking, HSG D
*	4,167	98	Cement Concrete Sidewalk, HSG D
	7,598	89	<50% Grass cover, Poor, HSG D
	30,816	96	Weighted Average
	7,598		24.66% Pervious Area
	23,218		75.34% Impervious Area

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

Subcatchment 10S: PR-10



Summary for Subcatchment 11S: PR-11

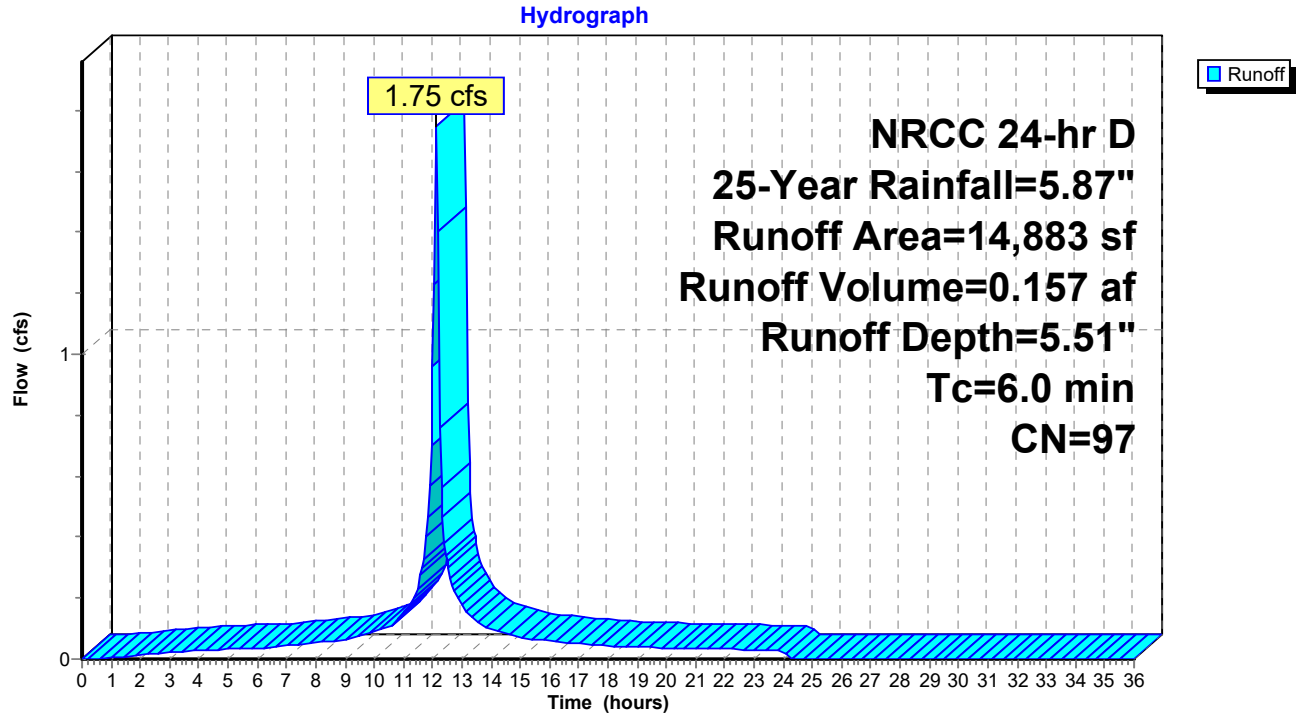
Runoff = 1.75 cfs @ 12.13 hrs, Volume= 0.157 af, Depth= 5.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 25-Year Rainfall=5.87"

	Area (sf)	CN	Description
	10,677	98	Paved parking, HSG D
*	1,854	98	Cement Concrete Sidewalk, HSG D
	2,352	89	<50% Grass cover, Poor, HSG D
	14,883	97	Weighted Average
	2,352		15.80% Pervious Area
	12,531		84.20% Impervious Area

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

Subcatchment 11S: PR-11



Summary for Subcatchment 12S: PR-12

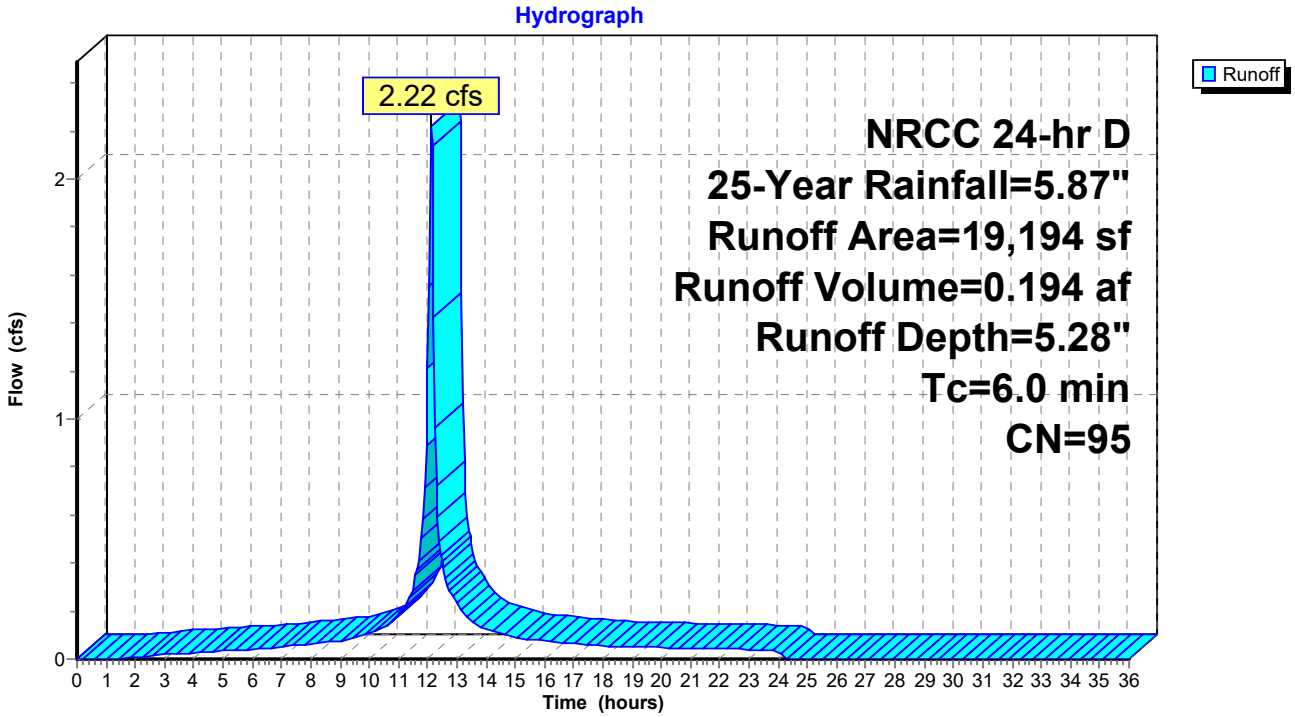
Runoff = 2.22 cfs @ 12.13 hrs, Volume= 0.194 af, Depth= 5.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 25-Year Rainfall=5.87"

	Area (sf)	CN	Description
	10,142	98	Paved parking, HSG D
*	2,713	98	Cement Concrete Sidewalk, HSG D
	6,339	89	<50% Grass cover, Poor, HSG D
	19,194	95	Weighted Average
	6,339		33.03% Pervious Area
	12,855		66.97% Impervious Area

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

Subcatchment 12S: PR-12



Summary for Pond 14P: Rain Garden

Inflow Area = 0.786 ac, 32.96% Impervious, Inflow Depth = 1.68" for 25-Year event
Inflow = 1.35 cfs @ 12.14 hrs, Volume= 0.110 af
Outflow = 0.13 cfs @ 13.65 hrs, Volume= 0.110 af, Atten= 91%, Lag= 90.7 min
Discarded = 0.13 cfs @ 13.65 hrs, Volume= 0.110 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 255.47' @ 13.65 hrs Surf.Area= 1,879 sf Storage= 1,677 cf

Plug-Flow detention time= 174.2 min calculated for 0.110 af (100% of inflow)
Center-of-Mass det. time= 174.4 min (1,078.9 - 904.5)

Volume	Invert	Avail.Storage	Storage Description
#1	254.00'	6,180 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

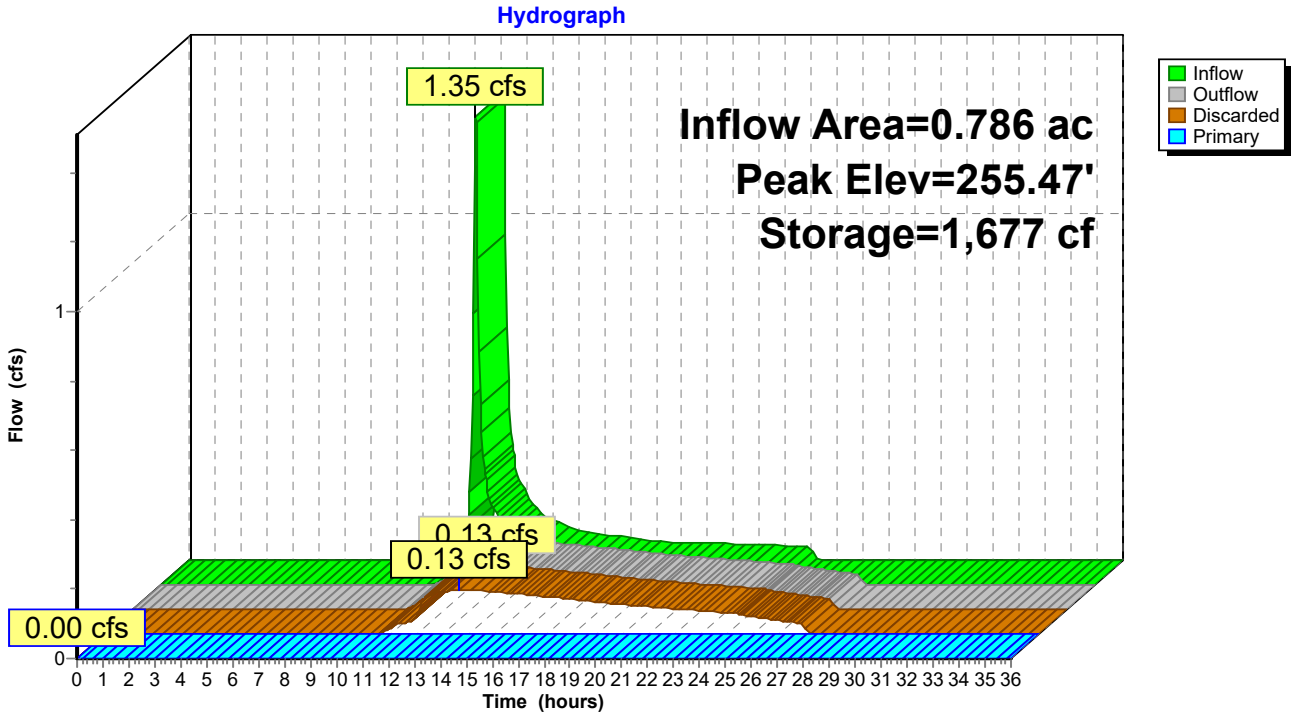
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
254.00	540	103.7	0	0	540
255.00	1,364	159.3	921	921	1,711
256.00	2,563	215.7	1,932	2,853	3,405
257.00	4,155	273.9	3,327	6,180	5,685

Device	Routing	Invert	Outlet Devices
#1	Primary	254.50'	**12.0" Round Culvert** L= 20.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 254.50' / 253.50' S= 0.0500 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#2	Device 1	256.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 2	256.50'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Discarded	254.00'	**2.400 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 250.00'

Discarded OutFlow Max=0.13 cfs @ 13.65 hrs HW=255.47' (Free Discharge)
└**4=Exfiltration** (Controls 0.13 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=254.00' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Controls 0.00 cfs)
└**2=Orifice/Grate** (Controls 0.00 cfs)
└**3=Orifice/Grate** (Controls 0.00 cfs)

Pond 14P: Rain Garden



Stage-Area-Storage for Pond 14P: Rain Garden

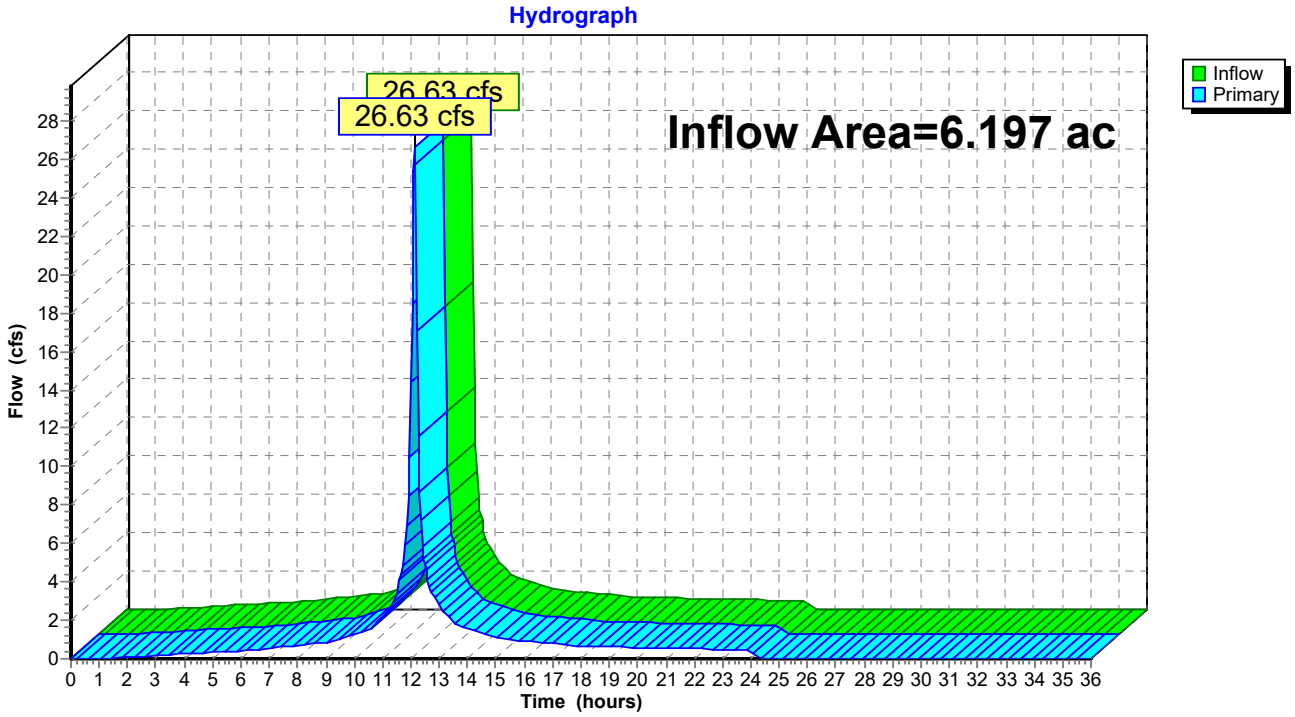
Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
254.00	540	0
254.10	606	57
254.20	675	121
254.30	748	192
254.40	825	271
254.50	905	357
254.60	989	452
254.70	1,077	555
254.80	1,169	668
254.90	1,265	789
255.00	1,364	921
255.10	1,467	1,062
255.20	1,574	1,214
255.30	1,684	1,377
255.40	1,799	1,551
255.50	1,917	1,737
255.60	2,038	1,935
255.70	2,164	2,145
255.80	2,293	2,368
255.90	2,426	2,604
256.00	2,563	2,853
256.10	2,705	3,116
256.20	2,851	3,394
256.30	3,000	3,687
256.40	3,154	3,994
256.50	3,311	4,318
256.60	3,472	4,657
256.70	3,637	5,012
256.80	3,806	5,384
256.90	3,979	5,773
257.00	**4,155**	**6,180**

Summary for Link 15L: DP-1

Inflow Area = 6.197 ac, 63.95% Impervious, Inflow Depth = 4.43" for 25-Year event
Inflow = 26.63 cfs @ 12.13 hrs, Volume= 2.286 af
Primary = 26.63 cfs @ 12.13 hrs, Volume= 2.286 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Link 15L: DP-1



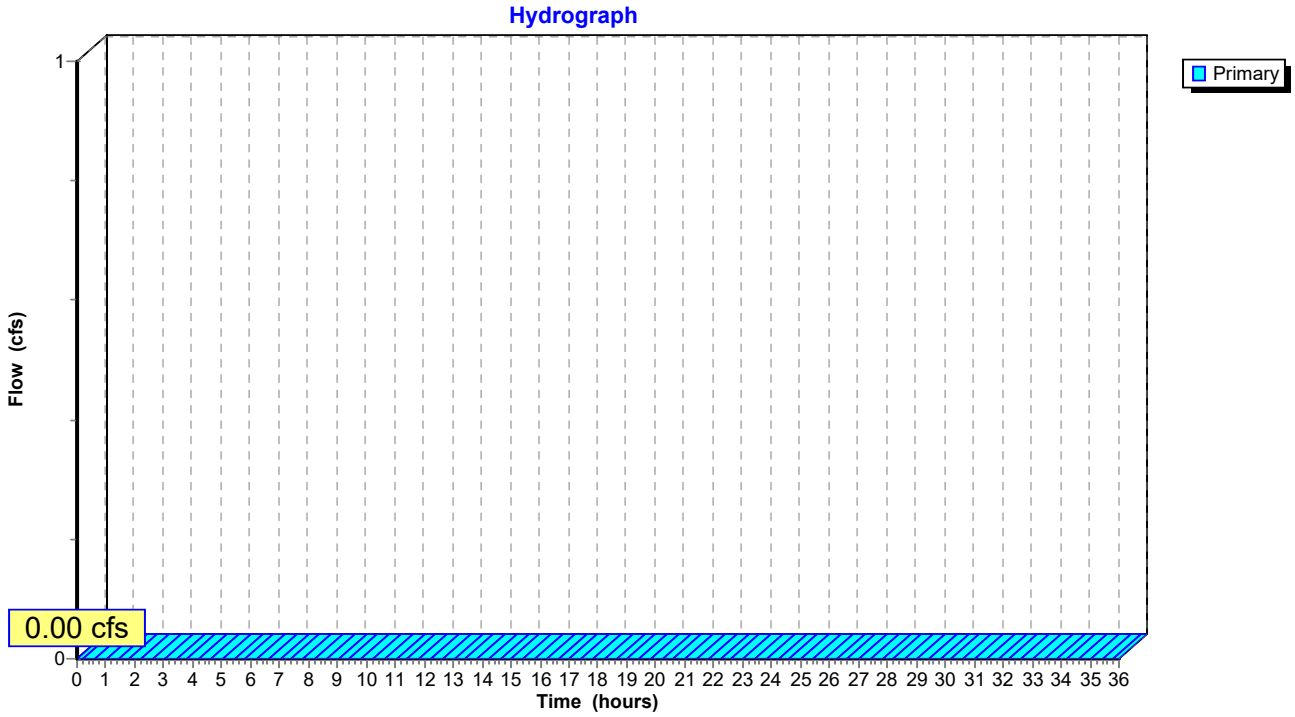
Summary for Link 16L: DP-2

[43] Hint: Has no inflow (Outflow=Zero)

Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Link 16L: DP-2



Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: PR-1 Runoff Area=34,243 sf 32.96% Impervious Runoff Depth=2.41"
Tc=6.0 min CN=58 Runoff=2.00 cfs 0.158 af

Subcatchment 2S: PR-2 Runoff Area=19,941 sf 66.78% Impervious Runoff Depth=6.41"
Tc=6.0 min CN=95 Runoff=2.77 cfs 0.244 af

Subcatchment 3S: PR-3 Runoff Area=24,637 sf 67.78% Impervious Runoff Depth=5.82"
Tc=6.0 min CN=90 Runoff=3.27 cfs 0.274 af

Subcatchment 4S: PR-4 Runoff Area=49,972 sf 52.93% Impervious Runoff Depth=5.71"
Tc=6.0 min CN=89 Runoff=6.56 cfs 0.546 af

Subcatchment 5S: PR-5 Runoff Area=21,676 sf 66.73% Impervious Runoff Depth=6.05"
Tc=6.0 min CN=92 Runoff=2.94 cfs 0.251 af

Subcatchment 6S: PR-6 Runoff Area=17,007 sf 88.03% Impervious Runoff Depth=6.64"
Tc=6.0 min CN=97 Runoff=2.39 cfs 0.216 af

Subcatchment 7S: PR-7 Runoff Area=10,460 sf 58.78% Impervious Runoff Depth=5.94"
Tc=6.0 min CN=91 Runoff=1.40 cfs 0.119 af

Subcatchment 8S: PR-8 Runoff Area=11,602 sf 63.58% Impervious Runoff Depth=5.94"
Tc=6.0 min CN=91 Runoff=1.56 cfs 0.132 af

Subcatchment 9S: PR-9 Runoff Area=15,512 sf 85.80% Impervious Runoff Depth=6.64"
Tc=6.0 min CN=97 Runoff=2.18 cfs 0.197 af

Subcatchment 10S: PR-10 Runoff Area=30,816 sf 75.34% Impervious Runoff Depth=6.52"
Tc=6.0 min CN=96 Runoff=4.31 cfs 0.385 af

Subcatchment 11S: PR-11 Runoff Area=14,883 sf 84.20% Impervious Runoff Depth=6.64"
Tc=6.0 min CN=97 Runoff=2.09 cfs 0.189 af

Subcatchment 12S: PR-12 Runoff Area=19,194 sf 66.97% Impervious Runoff Depth=6.41"
Tc=6.0 min CN=95 Runoff=2.67 cfs 0.235 af

Pond 14P: Rain Garden Peak Elev=255.92' Storage=2,650 cf Inflow=2.00 cfs 0.158 af
Discarded=0.17 cfs 0.158 af Primary=0.00 cfs 0.000 af Outflow=0.17 cfs 0.158 af

Link 15L: DP-1 Inflow=32.14 cfs 2.788 af
Primary=32.14 cfs 2.788 af

Link 16L: DP-2
Primary=0.00 cfs 0.000 af

Total Runoff Area = 6.197 ac Runoff Volume = 2.946 af Average Runoff Depth = 5.71"
36.05% Pervious = 2.234 ac 63.95% Impervious = 3.963 ac

Summary for Subcatchment 1S: PR-1

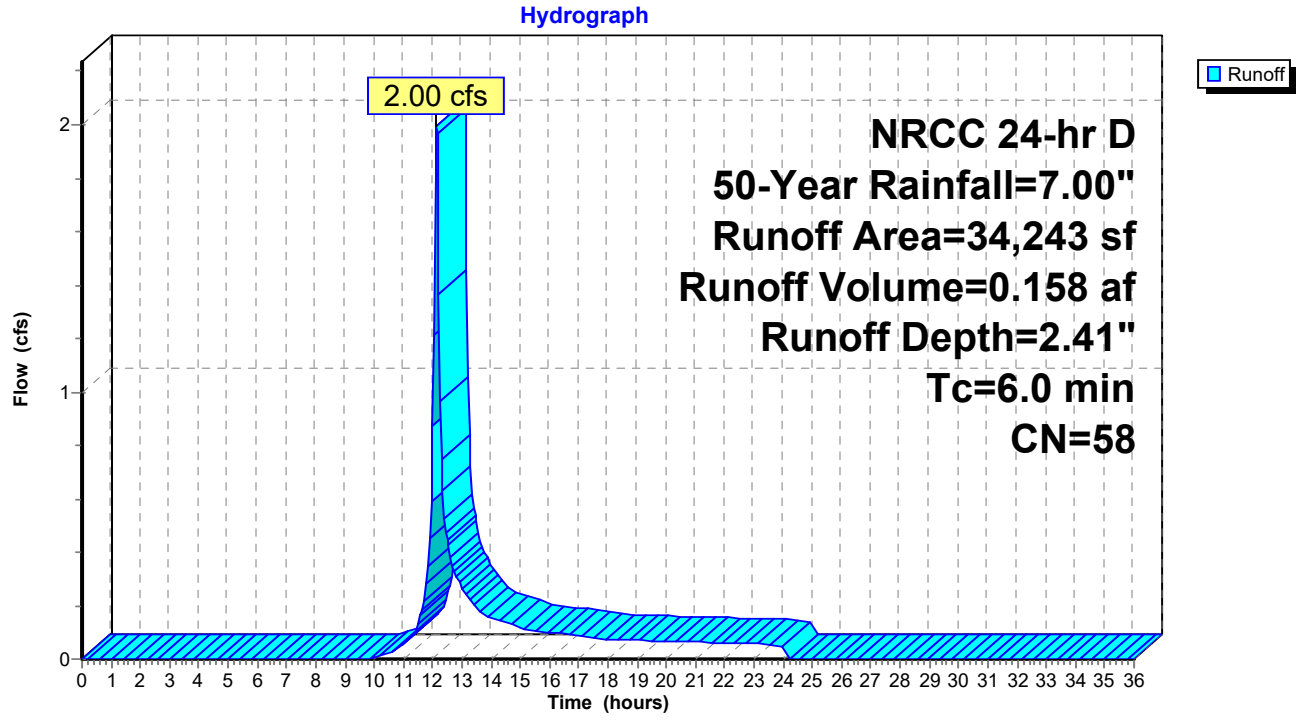
Runoff = 2.00 cfs @ 12.14 hrs, Volume= 0.158 af, Depth= 2.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 50-Year Rainfall=7.00"

	Area (sf)	CN	Description
	9,225	98	Paved parking, HSG A
*	2,063	98	Cement Concrete Sidewalk, HSG A
	22,955	39	>75% Grass cover, Good, HSG A
	34,243	58	Weighted Average
	22,955		67.04% Pervious Area
	11,288		32.96% Impervious Area

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

Subcatchment 1S: PR-1



Summary for Subcatchment 2S: PR-2

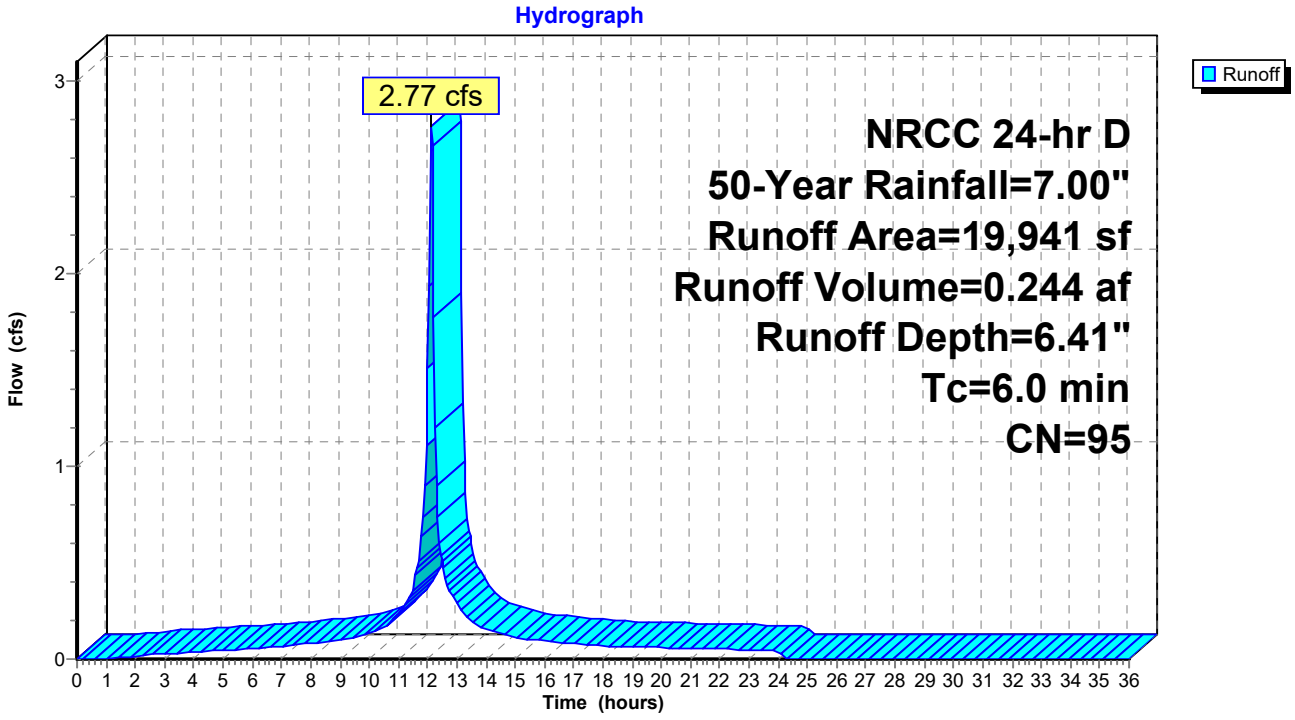
Runoff = 2.77 cfs @ 12.13 hrs, Volume= 0.244 af, Depth= 6.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 50-Year Rainfall=7.00"

	Area (sf)	CN	Description
	11,050	98	Paved parking, HSG D
*	2,266	98	Cement Concrete Sidewalk, HSG D
	6,625	89	<50% Grass cover, Poor, HSG D
	19,941	95	Weighted Average
	6,625		33.22% Pervious Area
	13,316		66.78% Impervious Area

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

Subcatchment 2S: PR-2



Summary for Subcatchment 3S: PR-3

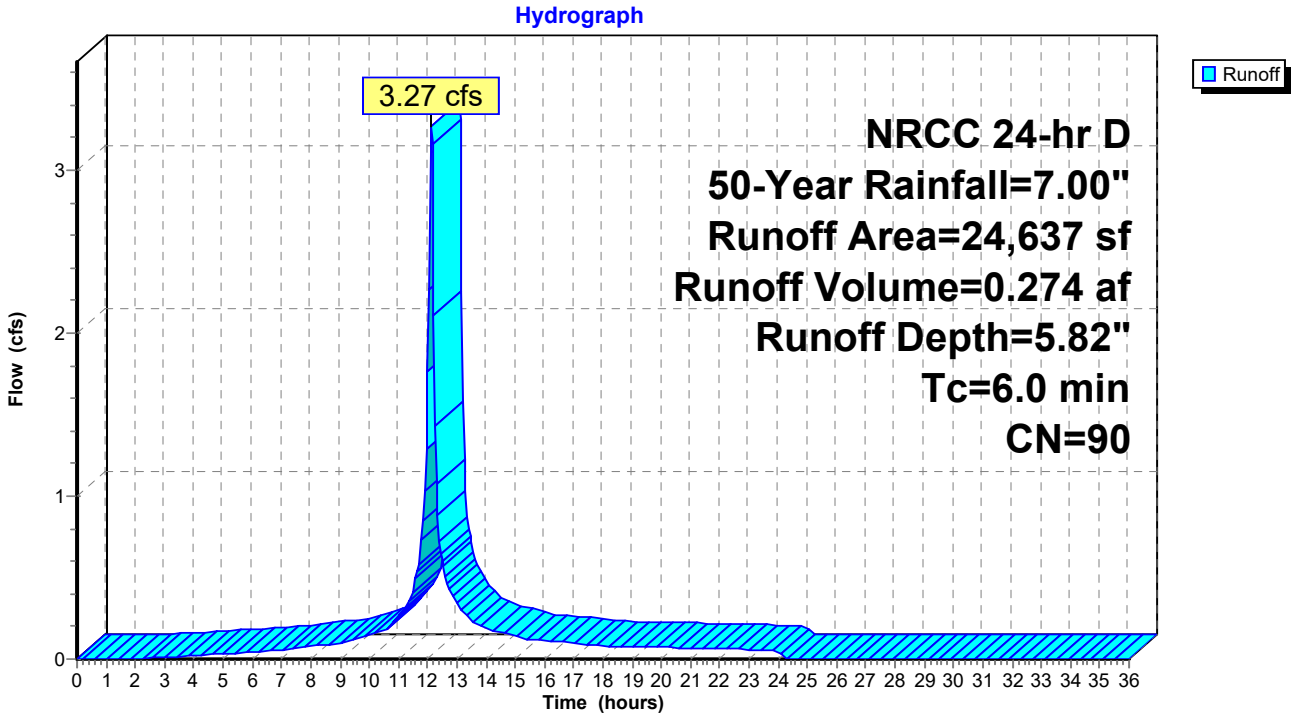
Runoff = 3.27 cfs @ 12.13 hrs, Volume= 0.274 af, Depth= 5.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 50-Year Rainfall=7.00"

	Area (sf)	CN	Description
	13,876	98	Paved parking, HSG C
*	2,822	98	Cement Concrete Sidewalk, HSG C
	7,939	74	>75% Grass cover, Good, HSG C
	24,637	90	Weighted Average
	7,939		32.22% Pervious Area
	16,698		67.78% Impervious Area

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

Subcatchment 3S: PR-3



Summary for Subcatchment 4S: PR-4

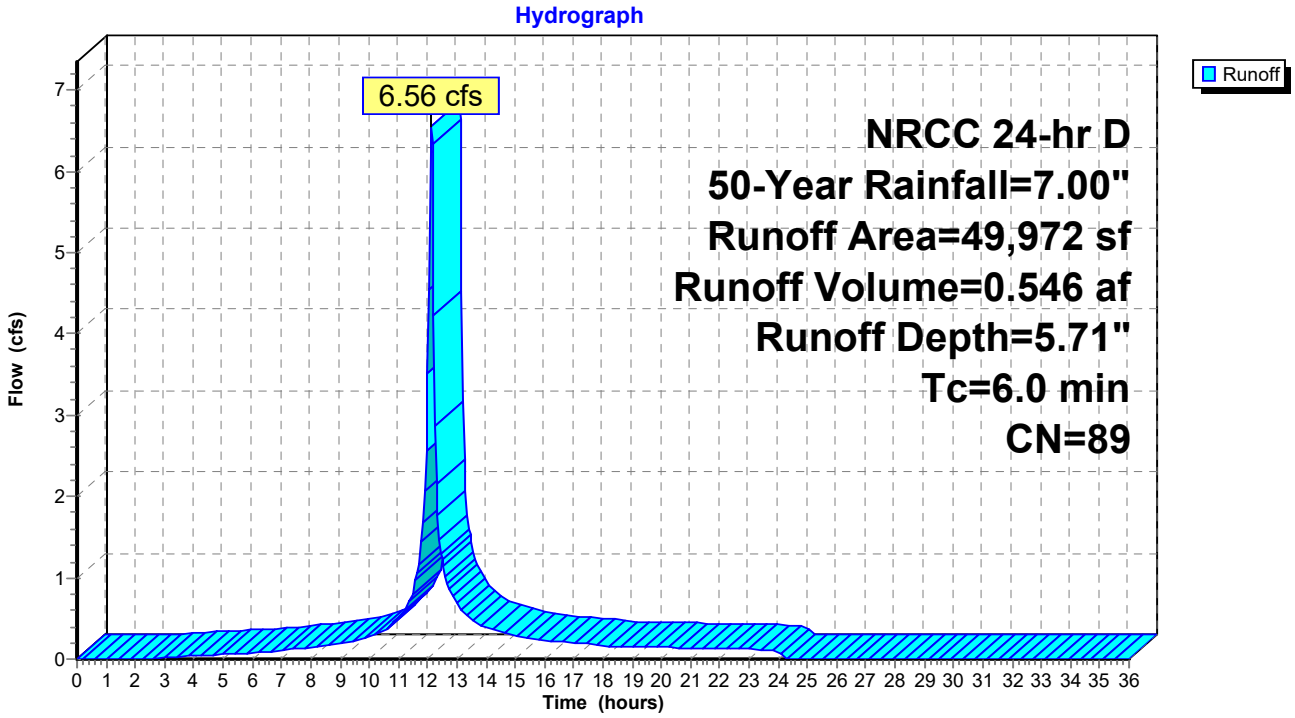
Runoff = 6.56 cfs @ 12.13 hrs, Volume= 0.546 af, Depth= 5.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 50-Year Rainfall=7.00"

	Area (sf)	CN	Description
	20,528	98	Paved parking, HSG C
*	5,920	98	Cement Concrete Sidewalk, HSG C
	23,524	79	50-75% Grass cover, Fair, HSG C
	49,972	89	Weighted Average
	23,524		47.07% Pervious Area
	26,448		52.93% Impervious Area

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

Subcatchment 4S: PR-4



Summary for Subcatchment 5S: PR-5

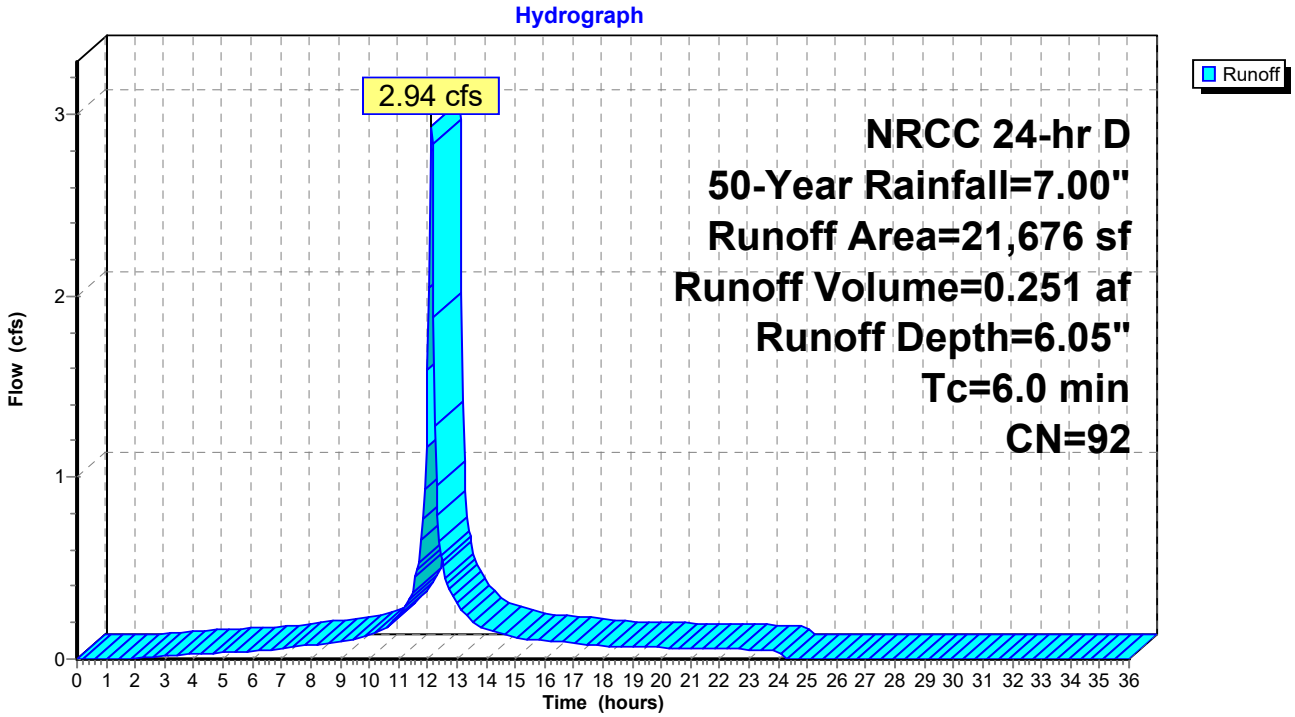
Runoff = 2.94 cfs @ 12.13 hrs, Volume= 0.251 af, Depth= 6.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 50-Year Rainfall=7.00"

	Area (sf)	CN	Description
	11,952	98	Paved parking, HSG D
*	2,512	98	Cement Concrete Sidewalk, HSG D
	7,212	80	>75% Grass cover, Good, HSG D
	21,676	92	Weighted Average
	7,212		33.27% Pervious Area
	14,464		66.73% Impervious Area

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

Subcatchment 5S: PR-5



Summary for Subcatchment 6S: PR-6

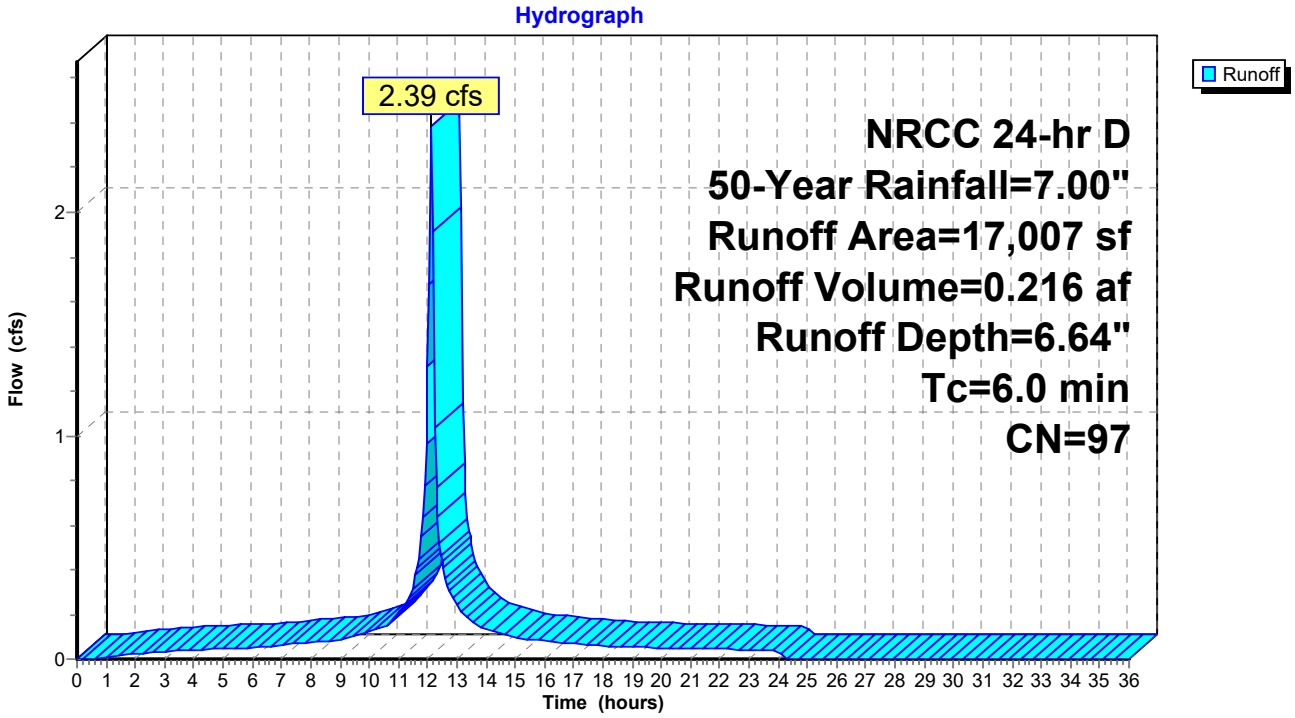
Runoff = 2.39 cfs @ 12.13 hrs, Volume= 0.216 af, Depth= 6.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 50-Year Rainfall=7.00"

	Area (sf)	CN	Description
	11,871	98	Paved parking, HSG D
*	3,101	98	Cement Concrete Sidewalk, HSG D
	2,035	89	<50% Grass cover, Poor, HSG D
	17,007	97	Weighted Average
	2,035		11.97% Pervious Area
	14,972		88.03% Impervious Area

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

Subcatchment 6S: PR-6



Summary for Subcatchment 7S: PR-7

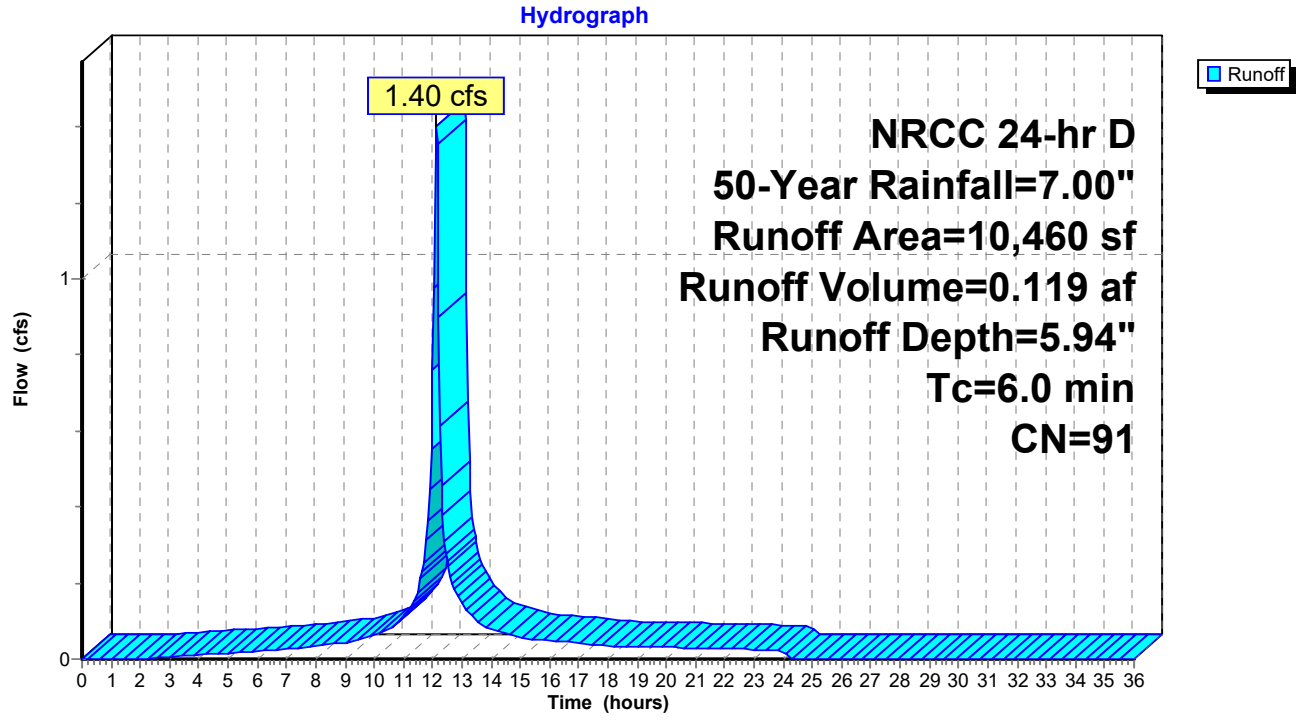
Runoff = 1.40 cfs @ 12.13 hrs, Volume= 0.119 af, Depth= 5.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 50-Year Rainfall=7.00"

	Area (sf)	CN	Description
	5,793	98	Paved parking, HSG D
*	355	98	Cement Concrete Sidewalk, HSG D
	4,312	80	>75% Grass cover, Good, HSG D
	10,460	91	Weighted Average
	4,312		41.22% Pervious Area
	6,148		58.78% Impervious Area

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

Subcatchment 7S: PR-7



Summary for Subcatchment 8S: PR-8

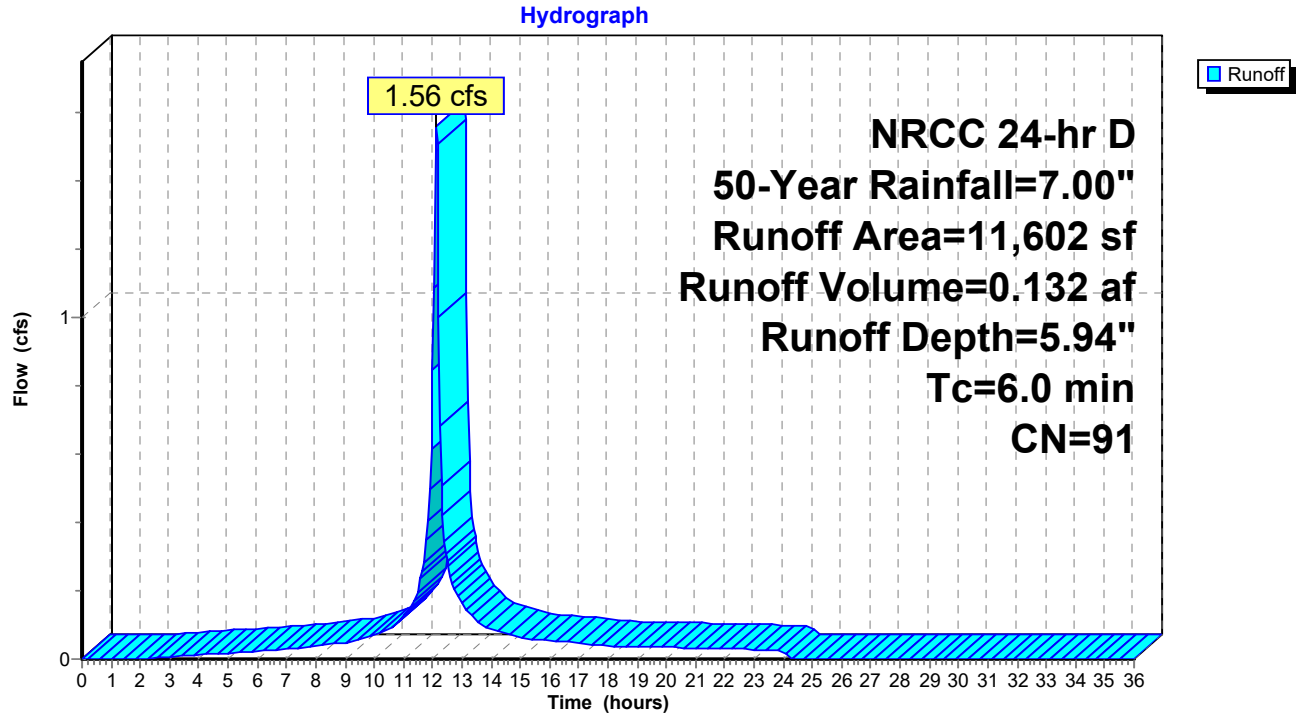
Runoff = 1.56 cfs @ 12.13 hrs, Volume= 0.132 af, Depth= 5.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 50-Year Rainfall=7.00"

	Area (sf)	CN	Description
	6,124	98	Paved parking, HSG D
*	1,252	98	Cement Concrete Sidewalk, HSG D
	4,226	80	>75% Grass cover, Good, HSG D
	11,602	91	Weighted Average
	4,226		36.42% Pervious Area
	7,376		63.58% Impervious Area

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

Subcatchment 8S: PR-8



Summary for Subcatchment 9S: PR-9

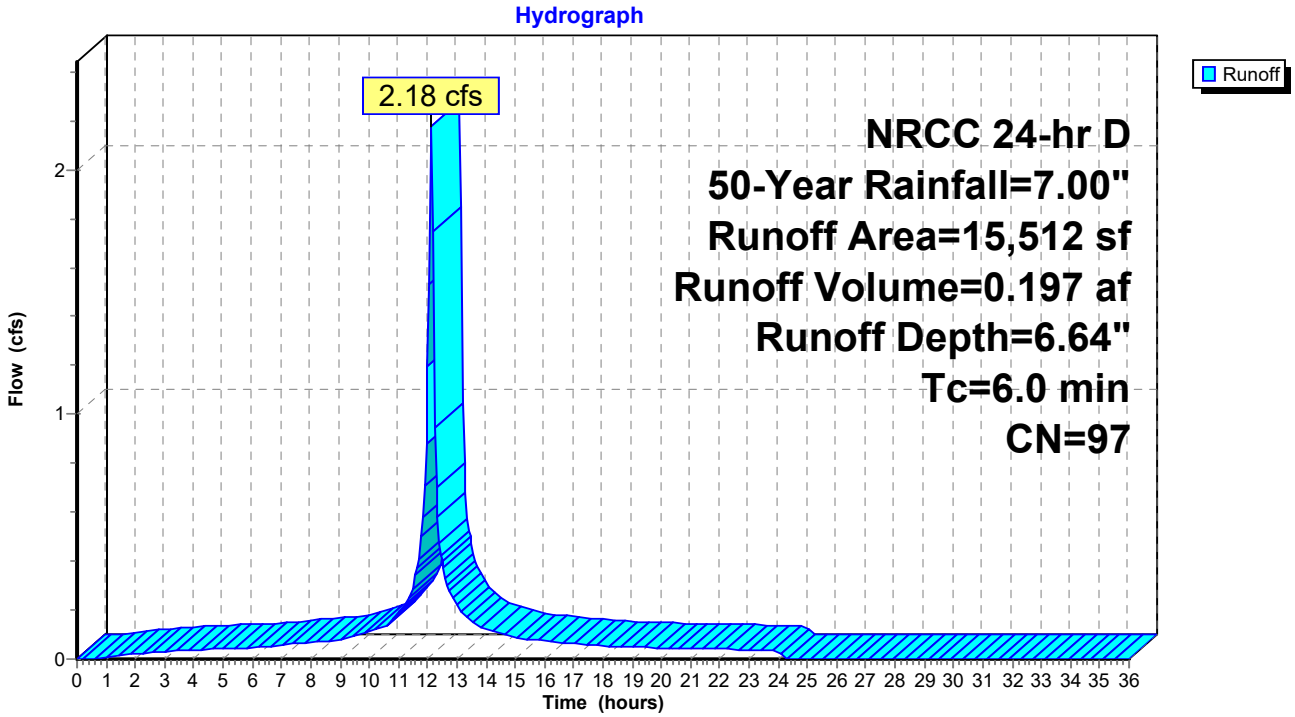
Runoff = 2.18 cfs @ 12.13 hrs, Volume= 0.197 af, Depth= 6.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 50-Year Rainfall=7.00"

	Area (sf)	CN	Description
	10,514	98	Paved parking, HSG D
*	2,796	98	Cement Concrete Sidewalk, HSG D
	2,202	89	<50% Grass cover, Poor, HSG D
	15,512	97	Weighted Average
	2,202		14.20% Pervious Area
	13,310		85.80% Impervious Area

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

Subcatchment 9S: PR-9



Summary for Subcatchment 10S: PR-10

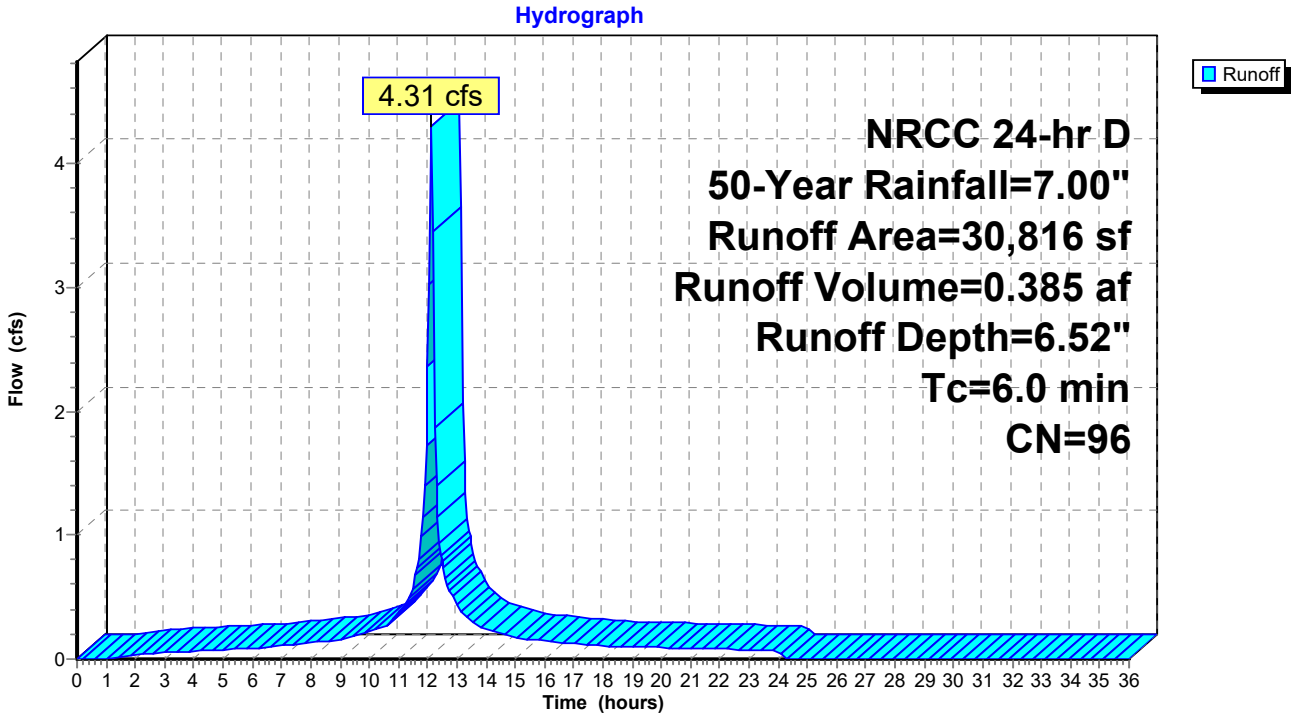
Runoff = 4.31 cfs @ 12.13 hrs, Volume= 0.385 af, Depth= 6.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 50-Year Rainfall=7.00"

	Area (sf)	CN	Description
	19,051	98	Paved parking, HSG D
*	4,167	98	Cement Concrete Sidewalk, HSG D
	7,598	89	<50% Grass cover, Poor, HSG D
	30,816	96	Weighted Average
	7,598		24.66% Pervious Area
	23,218		75.34% Impervious Area

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

Subcatchment 10S: PR-10



Summary for Subcatchment 11S: PR-11

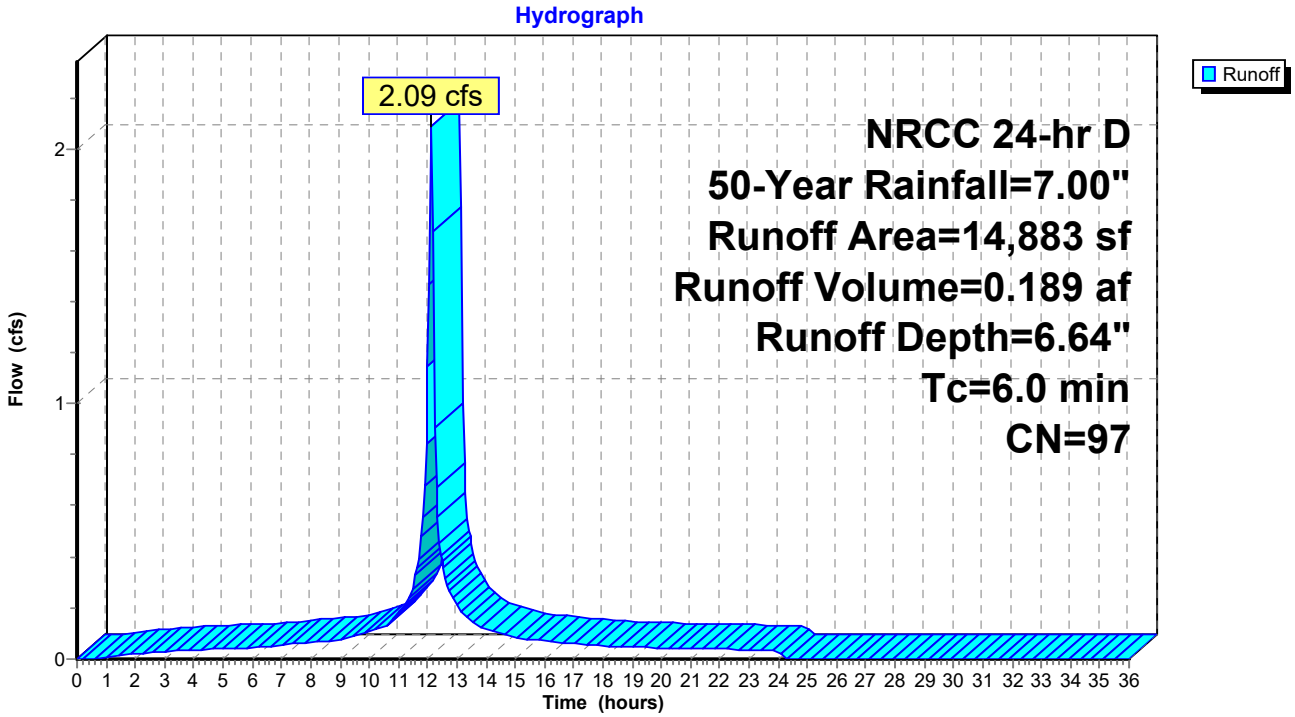
Runoff = 2.09 cfs @ 12.13 hrs, Volume= 0.189 af, Depth= 6.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 50-Year Rainfall=7.00"

	Area (sf)	CN	Description
	10,677	98	Paved parking, HSG D
*	1,854	98	Cement Concrete Sidewalk, HSG D
	2,352	89	<50% Grass cover, Poor, HSG D
	14,883	97	Weighted Average
	2,352		15.80% Pervious Area
	12,531		84.20% Impervious Area

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

Subcatchment 11S: PR-11



Summary for Subcatchment 12S: PR-12

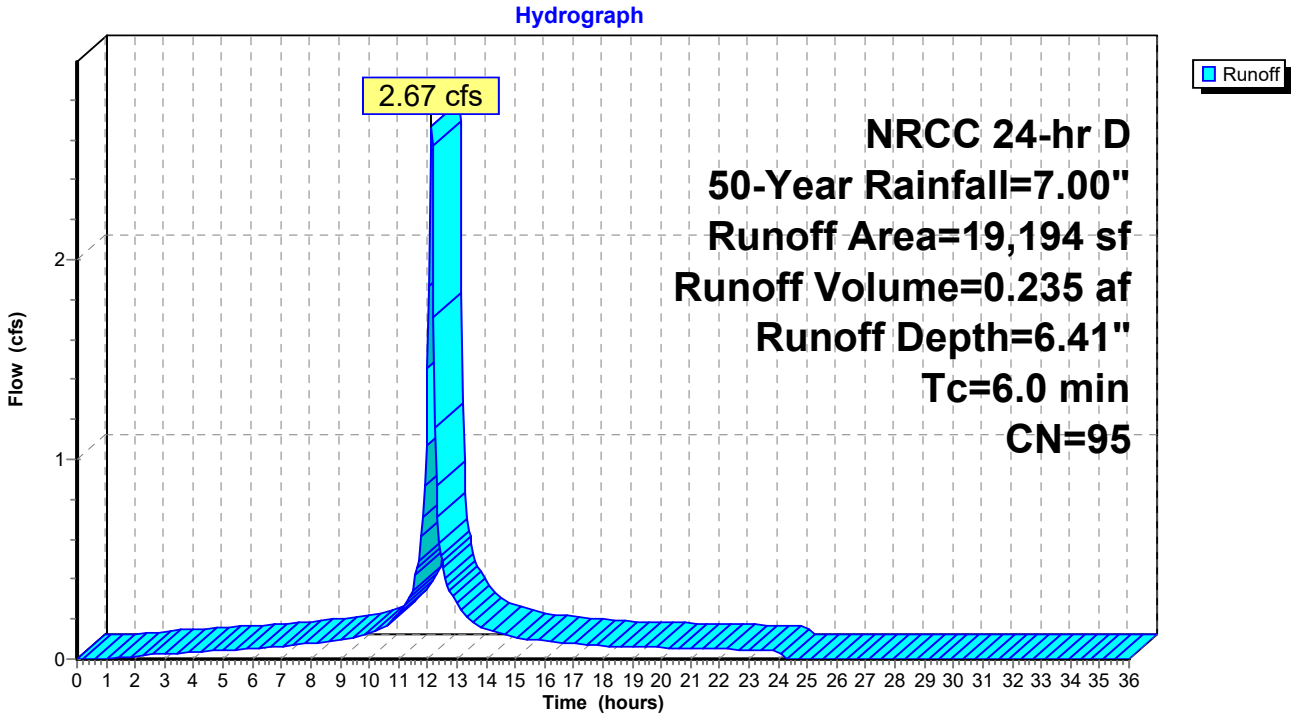
Runoff = 2.67 cfs @ 12.13 hrs, Volume= 0.235 af, Depth= 6.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 50-Year Rainfall=7.00"

	Area (sf)	CN	Description
	10,142	98	Paved parking, HSG D
*	2,713	98	Cement Concrete Sidewalk, HSG D
	6,339	89	<50% Grass cover, Poor, HSG D
	19,194	95	Weighted Average
	6,339		33.03% Pervious Area
	12,855		66.97% Impervious Area

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

Subcatchment 12S: PR-12



Summary for Pond 14P: Rain Garden

Inflow Area = 0.786 ac, 32.96% Impervious, Inflow Depth = 2.41" for 50-Year event
Inflow = 2.00 cfs @ 12.14 hrs, Volume= 0.158 af
Outflow = 0.17 cfs @ 13.70 hrs, Volume= 0.158 af, Atten= 92%, Lag= 94.1 min
Discarded = 0.17 cfs @ 13.70 hrs, Volume= 0.158 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 255.92' @ 13.70 hrs Surf.Area= 2,452 sf Storage= 2,650 cf

Plug-Flow detention time= 209.3 min calculated for 0.158 af (100% of inflow)
Center-of-Mass det. time= 209.5 min (1,099.8 - 890.3)

Volume	Invert	Avail.Storage	Storage Description
#1	254.00'	6,180 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

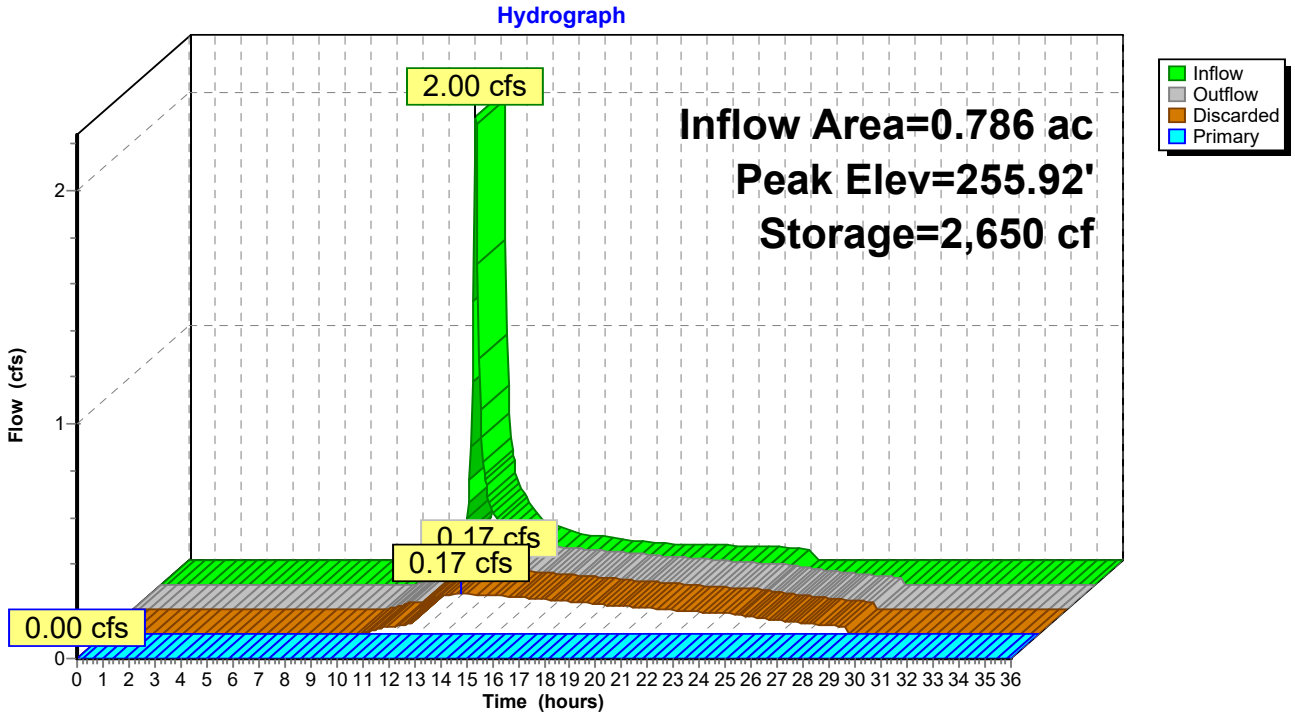
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
254.00	540	103.7	0	0	540
255.00	1,364	159.3	921	921	1,711
256.00	2,563	215.7	1,932	2,853	3,405
257.00	4,155	273.9	3,327	6,180	5,685

Device	Routing	Invert	Outlet Devices
#1	Primary	254.50'	**12.0" Round Culvert** L= 20.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 254.50' / 253.50' S= 0.0500 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#2	Device 1	256.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 2	256.50'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Discarded	254.00'	**2.400 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 250.00'

Discarded OutFlow Max=0.17 cfs @ 13.70 hrs HW=255.92' (Free Discharge)
└**4=Exfiltration** (Controls 0.17 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=254.00' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Controls 0.00 cfs)
└**2=Orifice/Grate** (Controls 0.00 cfs)
└**3=Orifice/Grate** (Controls 0.00 cfs)

Pond 14P: Rain Garden



Stage-Area-Storage for Pond 14P: Rain Garden

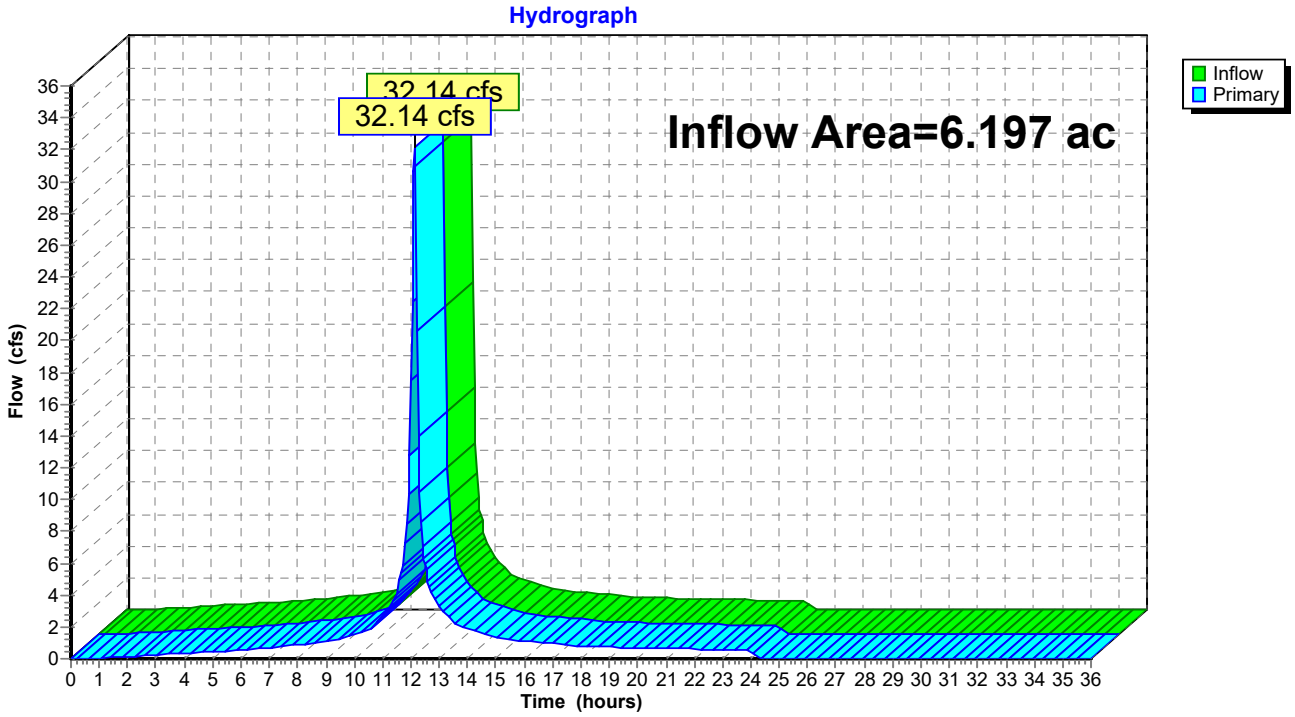
Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
254.00	540	0
254.10	606	57
254.20	675	121
254.30	748	192
254.40	825	271
254.50	905	357
254.60	989	452
254.70	1,077	555
254.80	1,169	668
254.90	1,265	789
255.00	1,364	921
255.10	1,467	1,062
255.20	1,574	1,214
255.30	1,684	1,377
255.40	1,799	1,551
255.50	1,917	1,737
255.60	2,038	1,935
255.70	2,164	2,145
255.80	2,293	2,368
255.90	2,426	2,604
256.00	2,563	2,853
256.10	2,705	3,116
256.20	2,851	3,394
256.30	3,000	3,687
256.40	3,154	3,994
256.50	3,311	4,318
256.60	3,472	4,657
256.70	3,637	5,012
256.80	3,806	5,384
256.90	3,979	5,773
257.00	**4,155**	**6,180**

Summary for Link 15L: DP-1

Inflow Area = 6.197 ac, 63.95% Impervious, Inflow Depth = 5.40" for 50-Year event
Inflow = 32.14 cfs @ 12.13 hrs, Volume= 2.788 af
Primary = 32.14 cfs @ 12.13 hrs, Volume= 2.788 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Link 15L: DP-1



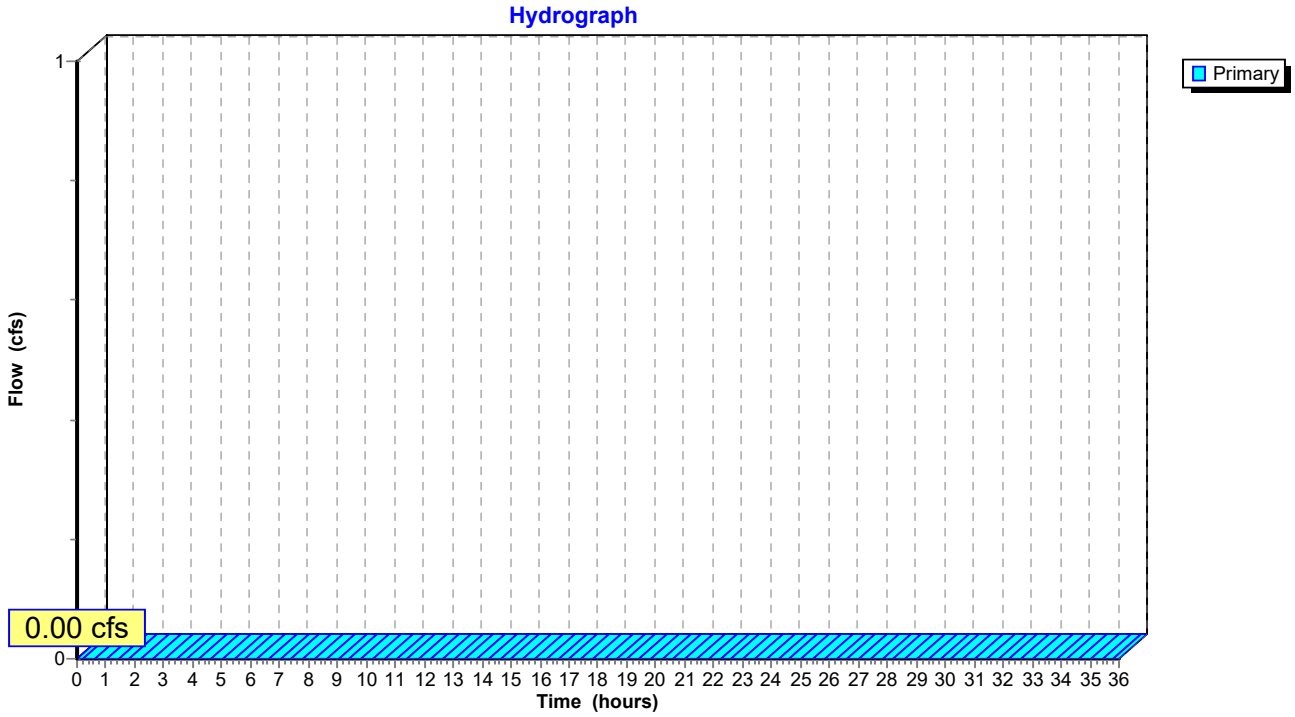
Summary for Link 16L: DP-2

[43] Hint: Has no inflow (Outflow=Zero)

Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Link 16L: DP-2



Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: PR-1 Runoff Area=34,243 sf 32.96% Impervious Runoff Depth=3.38"
Tc=6.0 min CN=58 Runoff=2.84 cfs 0.221 af

Subcatchment 2S: PR-2 Runoff Area=19,941 sf 66.78% Impervious Runoff Depth=7.76"
Tc=6.0 min CN=95 Runoff=3.33 cfs 0.296 af

Subcatchment 3S: PR-3 Runoff Area=24,637 sf 67.78% Impervious Runoff Depth=7.16"
Tc=6.0 min CN=90 Runoff=3.97 cfs 0.337 af

Subcatchment 4S: PR-4 Runoff Area=49,972 sf 52.93% Impervious Runoff Depth=7.04"
Tc=6.0 min CN=89 Runoff=7.98 cfs 0.673 af

Subcatchment 5S: PR-5 Runoff Area=21,676 sf 66.73% Impervious Runoff Depth=7.40"
Tc=6.0 min CN=92 Runoff=3.55 cfs 0.307 af

Subcatchment 6S: PR-6 Runoff Area=17,007 sf 88.03% Impervious Runoff Depth=8.00"
Tc=6.0 min CN=97 Runoff=2.86 cfs 0.260 af

Subcatchment 7S: PR-7 Runoff Area=10,460 sf 58.78% Impervious Runoff Depth=7.28"
Tc=6.0 min CN=91 Runoff=1.70 cfs 0.146 af

Subcatchment 8S: PR-8 Runoff Area=11,602 sf 63.58% Impervious Runoff Depth=7.28"
Tc=6.0 min CN=91 Runoff=1.89 cfs 0.162 af

Subcatchment 9S: PR-9 Runoff Area=15,512 sf 85.80% Impervious Runoff Depth=8.00"
Tc=6.0 min CN=97 Runoff=2.61 cfs 0.237 af

Subcatchment 10S: PR-10 Runoff Area=30,816 sf 75.34% Impervious Runoff Depth=7.88"
Tc=6.0 min CN=96 Runoff=5.16 cfs 0.465 af

Subcatchment 11S: PR-11 Runoff Area=14,883 sf 84.20% Impervious Runoff Depth=8.00"
Tc=6.0 min CN=97 Runoff=2.50 cfs 0.228 af

Subcatchment 12S: PR-12 Runoff Area=19,194 sf 66.97% Impervious Runoff Depth=7.76"
Tc=6.0 min CN=95 Runoff=3.20 cfs 0.285 af

Pond 14P: Rain Garden Peak Elev=256.40' Storage=3,993 cf Inflow=2.84 cfs 0.221 af
Discarded=0.22 cfs 0.221 af Primary=0.00 cfs 0.000 af Outflow=0.22 cfs 0.221 af

Link 15L: DP-1 Inflow=38.75 cfs 3.396 af
Primary=38.75 cfs 3.396 af

Link 16L: DP-2
Primary=0.00 cfs 0.000 af

Total Runoff Area = 6.197 ac Runoff Volume = 3.617 af Average Runoff Depth = 7.00"
36.05% Pervious = 2.234 ac 63.95% Impervious = 3.963 ac

Summary for Subcatchment 1S: PR-1

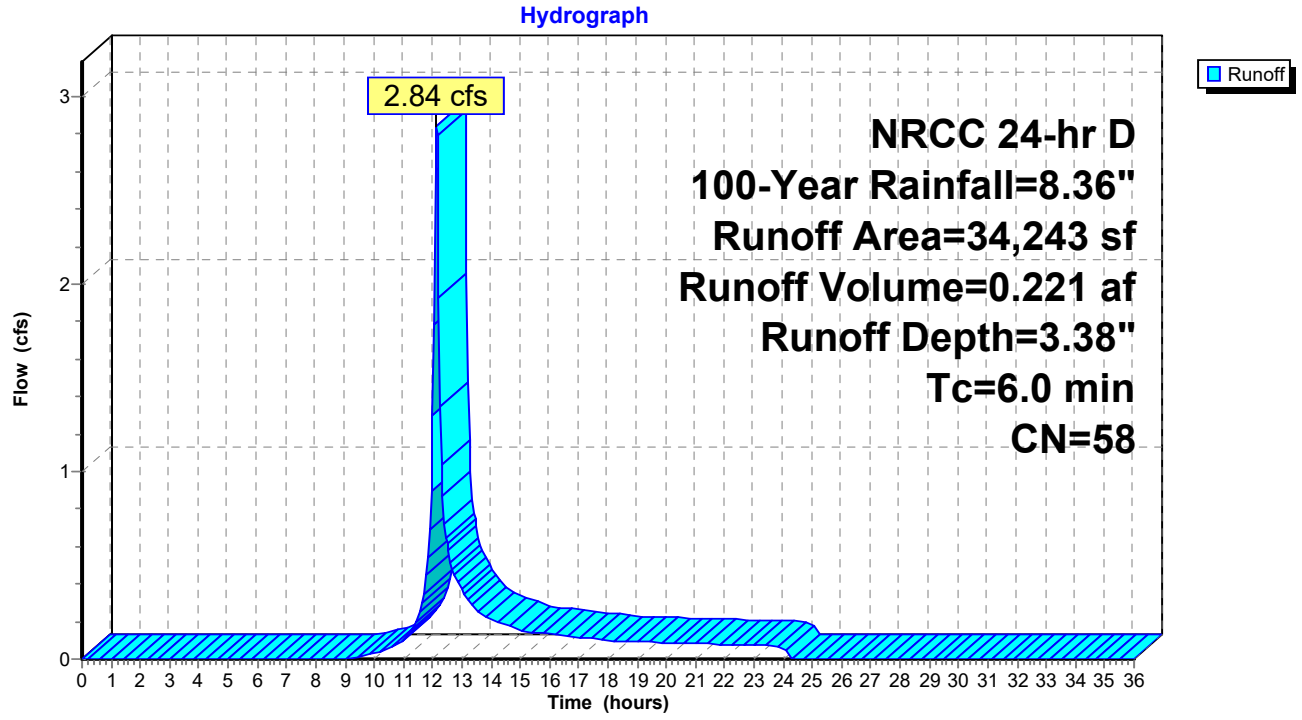
Runoff = 2.84 cfs @ 12.13 hrs, Volume= 0.221 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 100-Year Rainfall=8.36"

	Area (sf)	CN	Description
	9,225	98	Paved parking, HSG A
*	2,063	98	Cement Concrete Sidewalk, HSG A
	22,955	39	>75% Grass cover, Good, HSG A
	34,243	58	Weighted Average
	22,955		67.04% Pervious Area
	11,288		32.96% Impervious Area

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

Subcatchment 1S: PR-1



Summary for Subcatchment 2S: PR-2

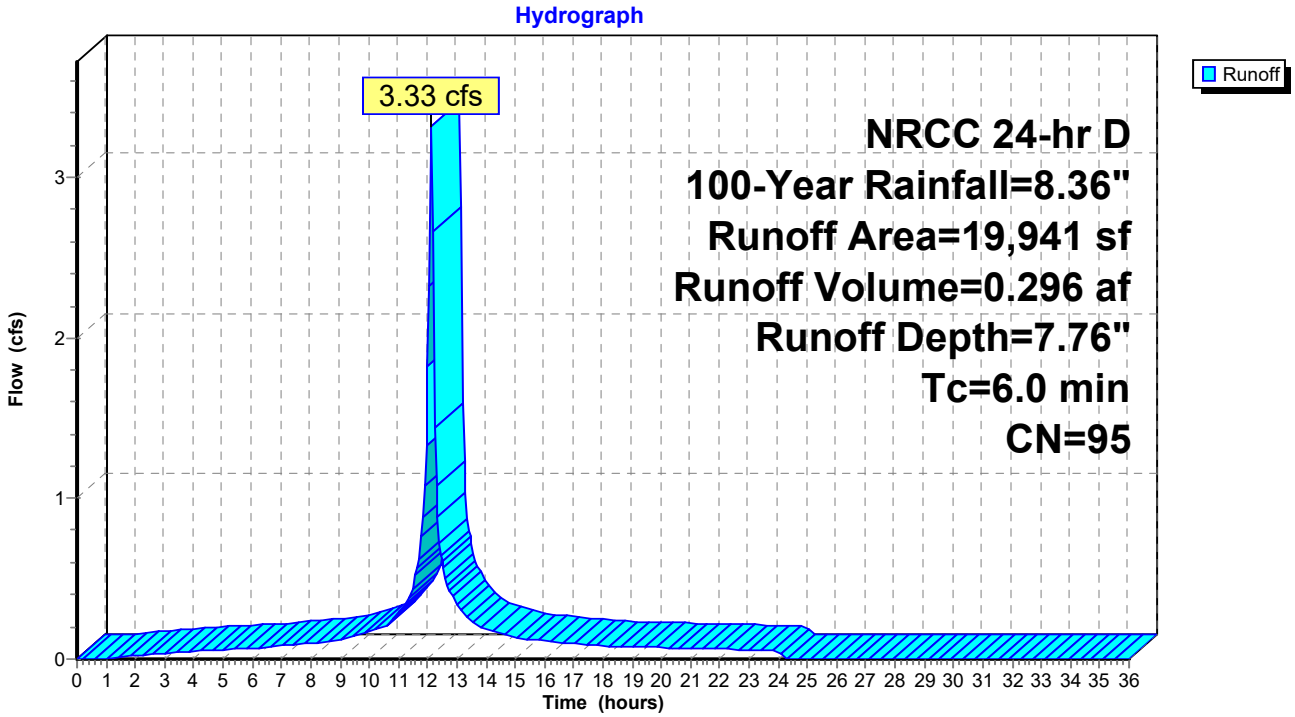
Runoff = 3.33 cfs @ 12.13 hrs, Volume= 0.296 af, Depth= 7.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 100-Year Rainfall=8.36"

	Area (sf)	CN	Description
	11,050	98	Paved parking, HSG D
*	2,266	98	Cement Concrete Sidewalk, HSG D
	6,625	89	<50% Grass cover, Poor, HSG D
	19,941	95	Weighted Average
	6,625		33.22% Pervious Area
	13,316		66.78% Impervious Area

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

Subcatchment 2S: PR-2



Summary for Subcatchment 3S: PR-3

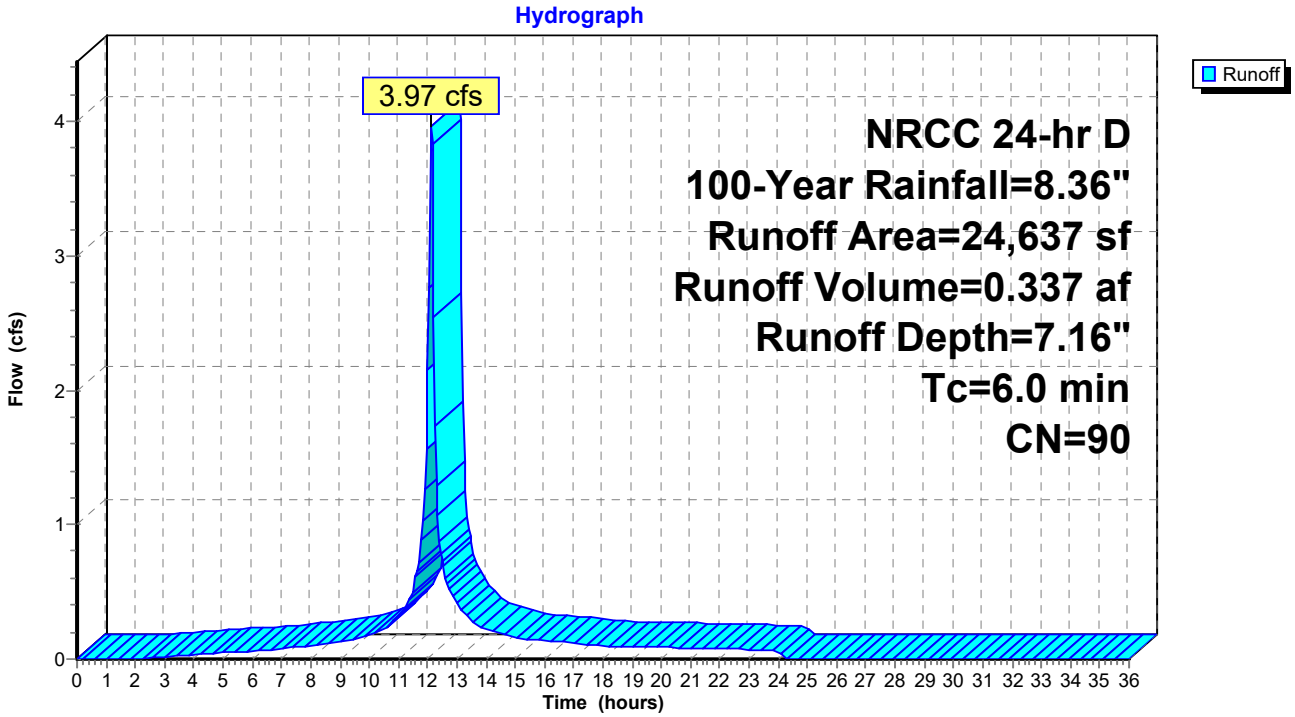
Runoff = 3.97 cfs @ 12.13 hrs, Volume= 0.337 af, Depth= 7.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 100-Year Rainfall=8.36"

	Area (sf)	CN	Description
	13,876	98	Paved parking, HSG C
*	2,822	98	Cement Concrete Sidewalk, HSG C
	7,939	74	>75% Grass cover, Good, HSG C
	24,637	90	Weighted Average
	7,939		32.22% Pervious Area
	16,698		67.78% Impervious Area

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

Subcatchment 3S: PR-3



Summary for Subcatchment 4S: PR-4

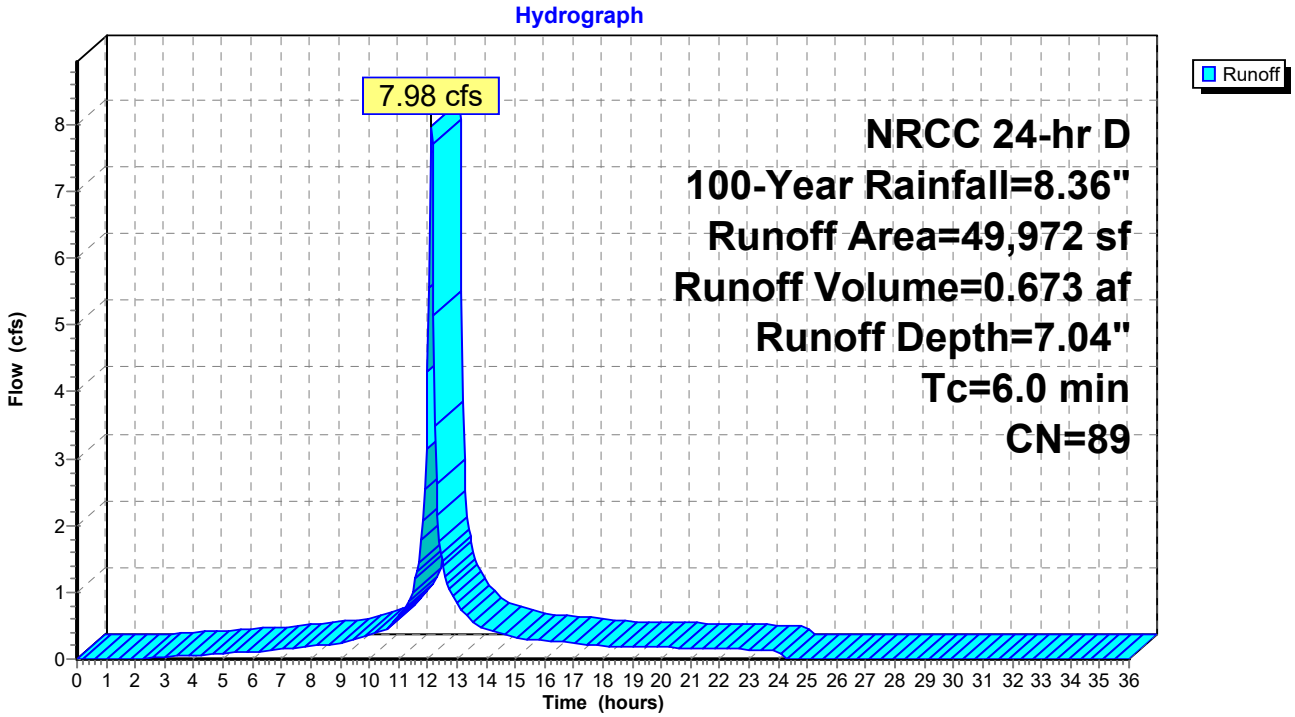
Runoff = 7.98 cfs @ 12.13 hrs, Volume= 0.673 af, Depth= 7.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 100-Year Rainfall=8.36"

	Area (sf)	CN	Description
	20,528	98	Paved parking, HSG C
*	5,920	98	Cement Concrete Sidewalk, HSG C
	23,524	79	50-75% Grass cover, Fair, HSG C
	49,972	89	Weighted Average
	23,524		47.07% Pervious Area
	26,448		52.93% Impervious Area

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

Subcatchment 4S: PR-4



Summary for Subcatchment 5S: PR-5

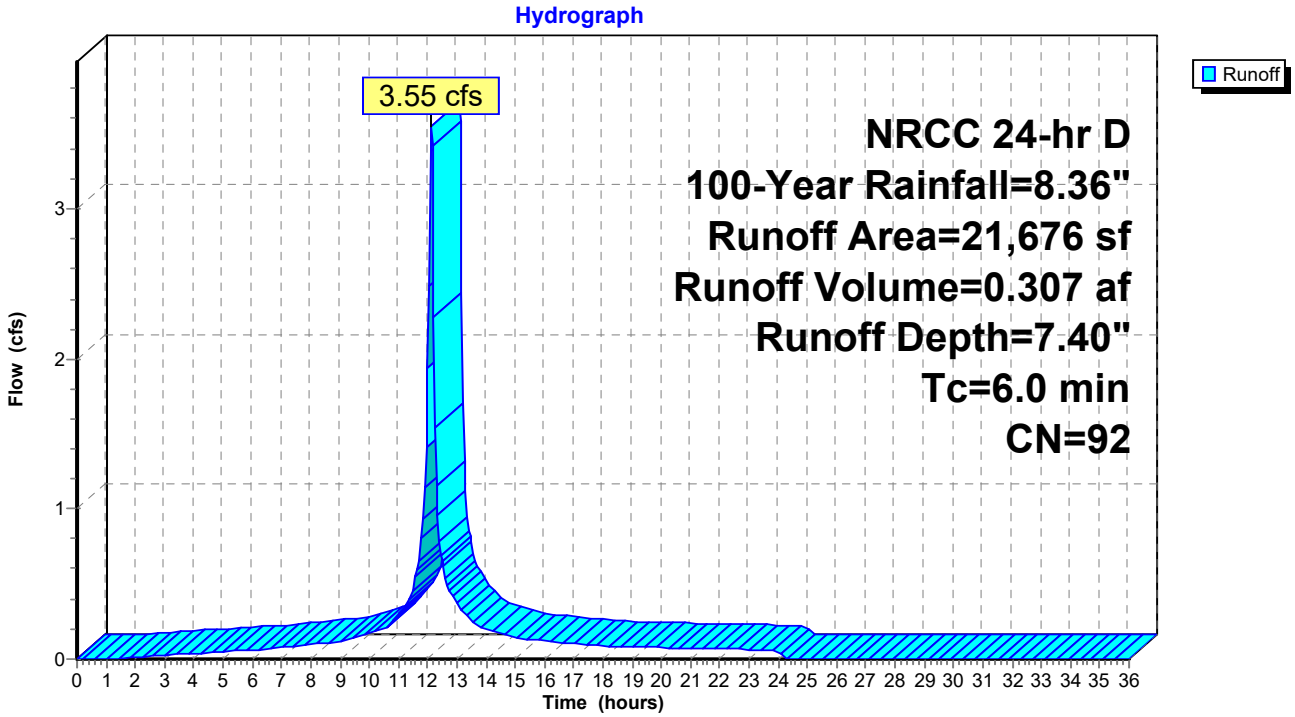
Runoff = 3.55 cfs @ 12.13 hrs, Volume= 0.307 af, Depth= 7.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 100-Year Rainfall=8.36"

	Area (sf)	CN	Description
	11,952	98	Paved parking, HSG D
*	2,512	98	Cement Concrete Sidewalk, HSG D
	7,212	80	>75% Grass cover, Good, HSG D
	21,676	92	Weighted Average
	7,212		33.27% Pervious Area
	14,464		66.73% Impervious Area

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

Subcatchment 5S: PR-5



Summary for Subcatchment 6S: PR-6

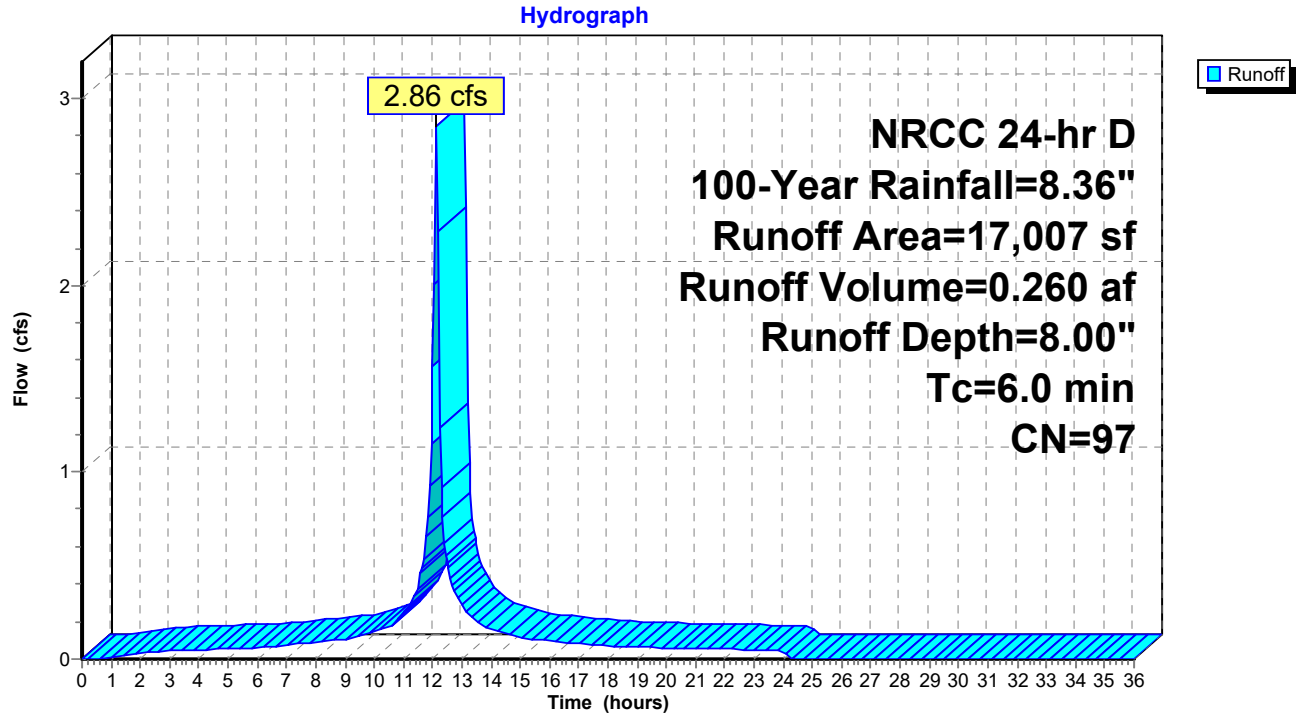
Runoff = 2.86 cfs @ 12.13 hrs, Volume= 0.260 af, Depth= 8.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 100-Year Rainfall=8.36"

	Area (sf)	CN	Description
	11,871	98	Paved parking, HSG D
*	3,101	98	Cement Concrete Sidewalk, HSG D
	2,035	89	<50% Grass cover, Poor, HSG D
	17,007	97	Weighted Average
	2,035		11.97% Pervious Area
	14,972		88.03% Impervious Area

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

Subcatchment 6S: PR-6



Summary for Subcatchment 7S: PR-7

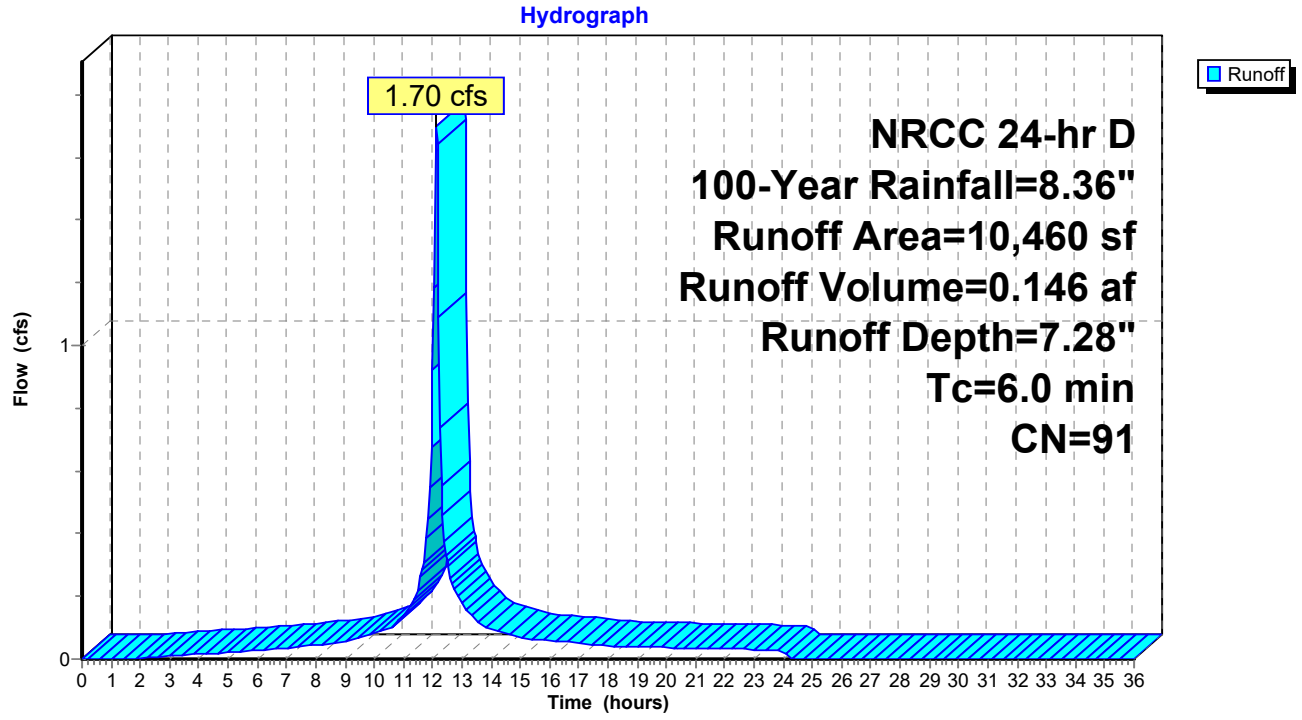
Runoff = 1.70 cfs @ 12.13 hrs, Volume= 0.146 af, Depth= 7.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 100-Year Rainfall=8.36"

	Area (sf)	CN	Description
	5,793	98	Paved parking, HSG D
*	355	98	Cement Concrete Sidewalk, HSG D
	4,312	80	>75% Grass cover, Good, HSG D
	10,460	91	Weighted Average
	4,312		41.22% Pervious Area
	6,148		58.78% Impervious Area

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

Subcatchment 7S: PR-7



Summary for Subcatchment 8S: PR-8

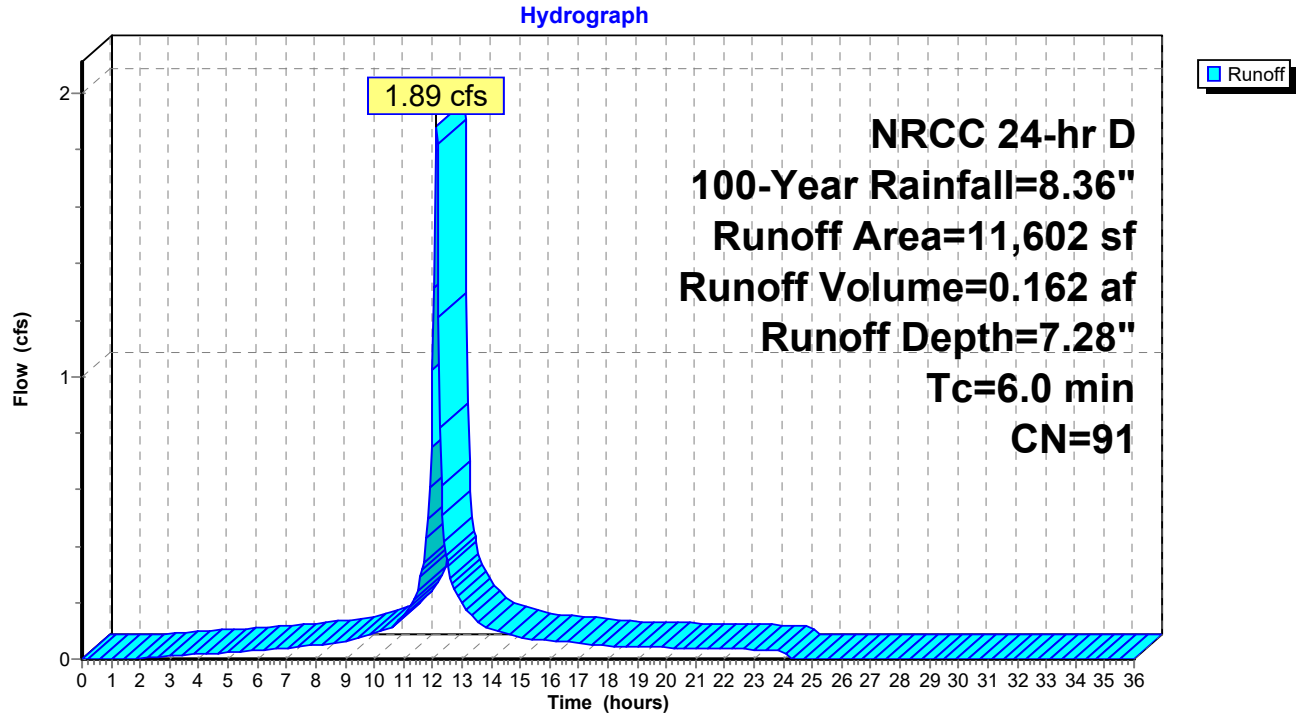
Runoff = 1.89 cfs @ 12.13 hrs, Volume= 0.162 af, Depth= 7.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 100-Year Rainfall=8.36"

	Area (sf)	CN	Description
	6,124	98	Paved parking, HSG D
*	1,252	98	Cement Concrete Sidewalk, HSG D
	4,226	80	>75% Grass cover, Good, HSG D
	11,602	91	Weighted Average
	4,226		36.42% Pervious Area
	7,376		63.58% Impervious Area

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

Subcatchment 8S: PR-8



Summary for Subcatchment 9S: PR-9

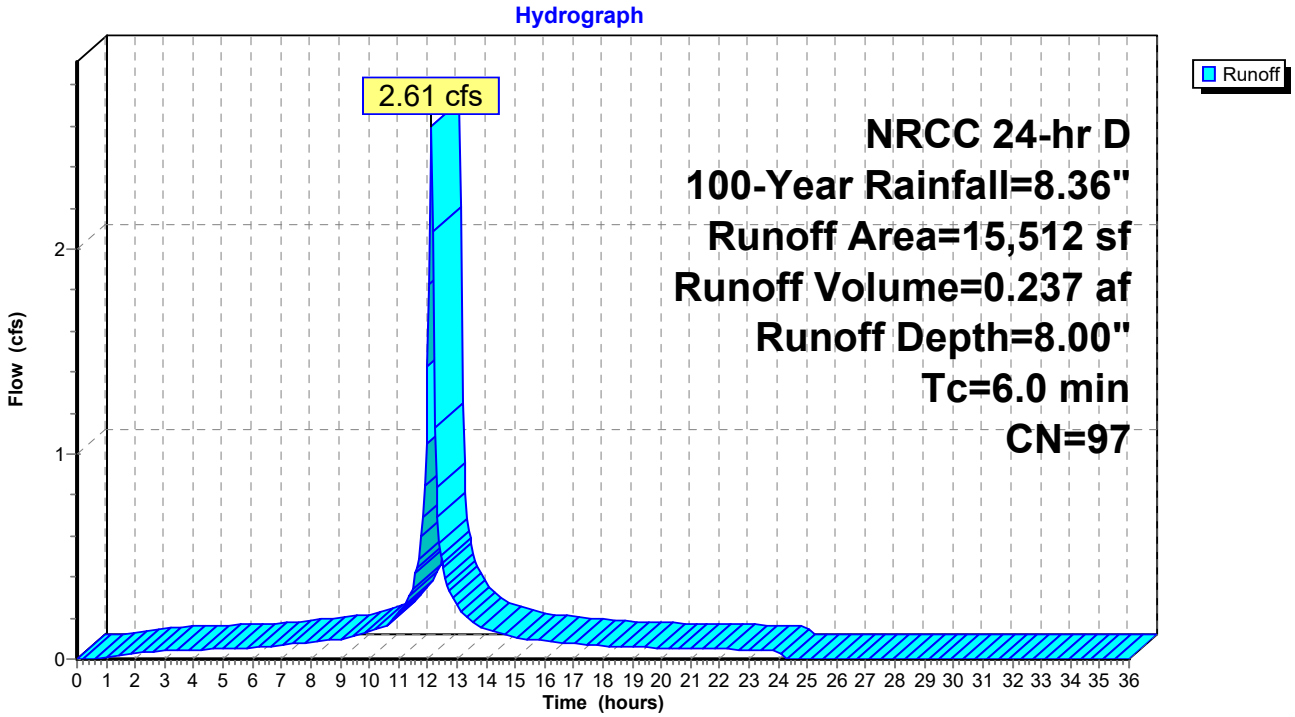
Runoff = 2.61 cfs @ 12.13 hrs, Volume= 0.237 af, Depth= 8.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 100-Year Rainfall=8.36"

	Area (sf)	CN	Description
	10,514	98	Paved parking, HSG D
*	2,796	98	Cement Concrete Sidewalk, HSG D
	2,202	89	<50% Grass cover, Poor, HSG D
	15,512	97	Weighted Average
	2,202		14.20% Pervious Area
	13,310		85.80% Impervious Area

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

Subcatchment 9S: PR-9



Summary for Subcatchment 10S: PR-10

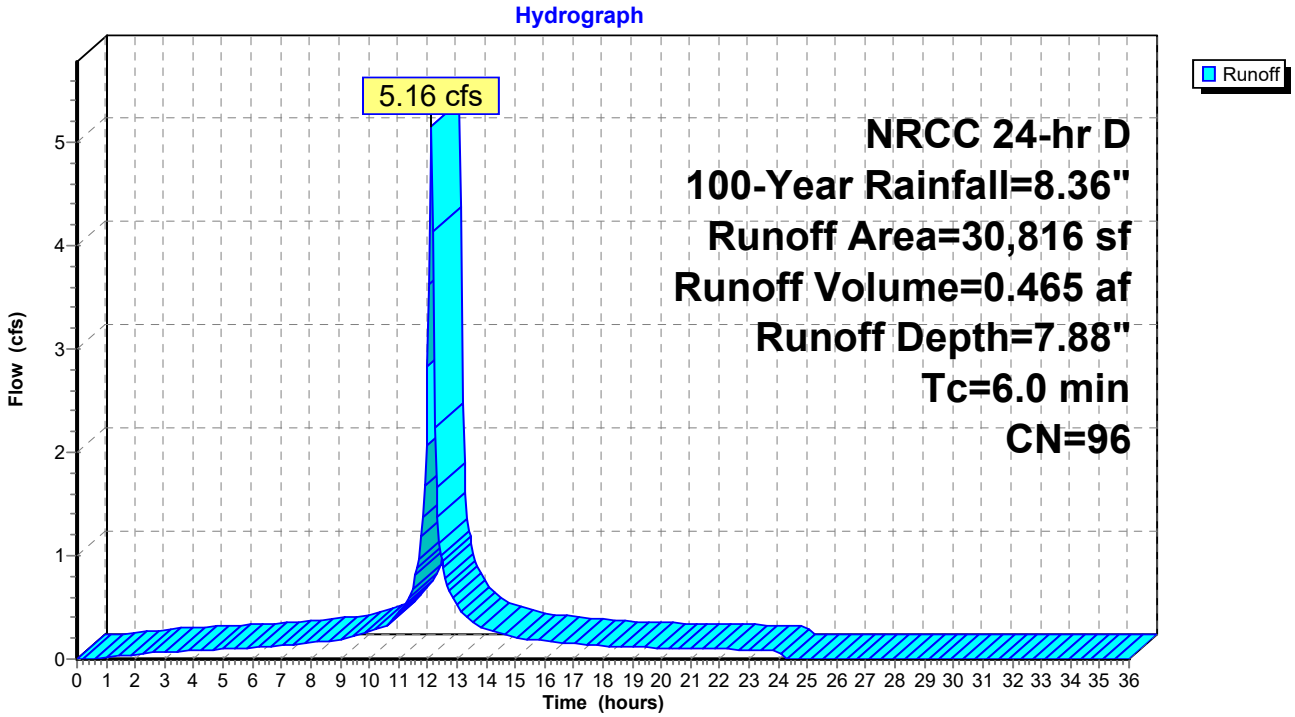
Runoff = 5.16 cfs @ 12.13 hrs, Volume= 0.465 af, Depth= 7.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 100-Year Rainfall=8.36"

	Area (sf)	CN	Description
	19,051	98	Paved parking, HSG D
*	4,167	98	Cement Concrete Sidewalk, HSG D
	7,598	89	<50% Grass cover, Poor, HSG D
	30,816	96	Weighted Average
	7,598		24.66% Pervious Area
	23,218		75.34% Impervious Area

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

Subcatchment 10S: PR-10



Summary for Subcatchment 11S: PR-11

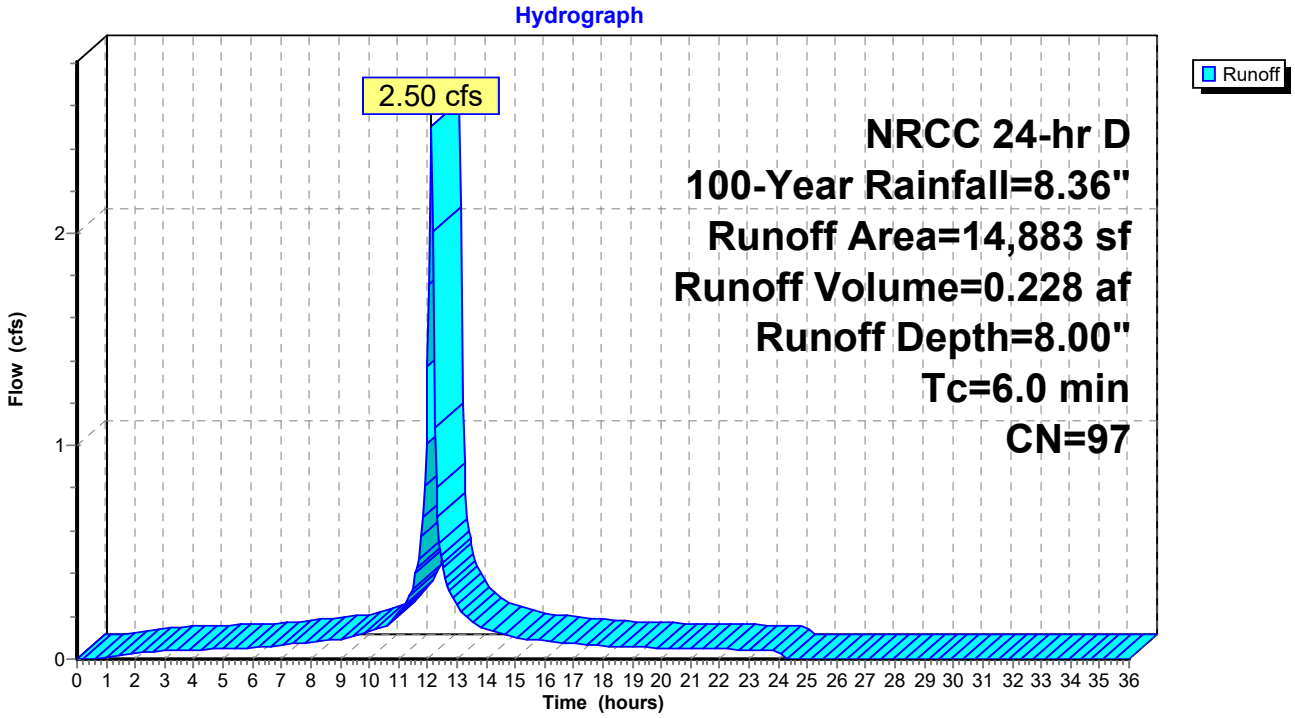
Runoff = 2.50 cfs @ 12.13 hrs, Volume= 0.228 af, Depth= 8.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 100-Year Rainfall=8.36"

	Area (sf)	CN	Description
	10,677	98	Paved parking, HSG D
*	1,854	98	Cement Concrete Sidewalk, HSG D
	2,352	89	<50% Grass cover, Poor, HSG D
	14,883	97	Weighted Average
	2,352		15.80% Pervious Area
	12,531		84.20% Impervious Area

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

Subcatchment 11S: PR-11



Summary for Subcatchment 12S: PR-12

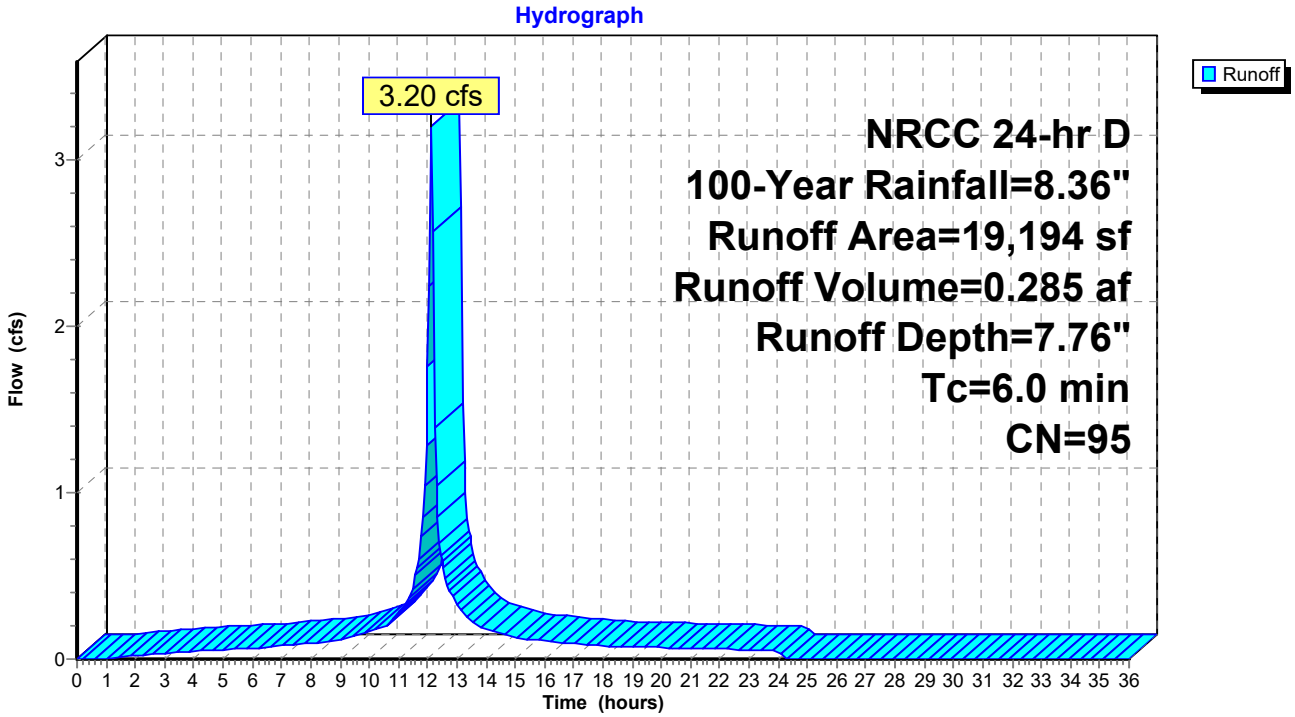
Runoff = 3.20 cfs @ 12.13 hrs, Volume= 0.285 af, Depth= 7.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 100-Year Rainfall=8.36"

	Area (sf)	CN	Description
	10,142	98	Paved parking, HSG D
*	2,713	98	Cement Concrete Sidewalk, HSG D
	6,339	89	<50% Grass cover, Poor, HSG D
	19,194	95	Weighted Average
	6,339		33.03% Pervious Area
	12,855		66.97% Impervious Area

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

Subcatchment 12S: PR-12



Summary for Pond 14P: Rain Garden

Inflow Area = 0.786 ac, 32.96% Impervious, Inflow Depth = 3.38" for 100-Year event
Inflow = 2.84 cfs @ 12.13 hrs, Volume= 0.221 af
Outflow = 0.22 cfs @ 13.76 hrs, Volume= 0.221 af, Atten= 92%, Lag= 97.5 min
Discarded = 0.22 cfs @ 13.76 hrs, Volume= 0.221 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 256.40' @ 13.76 hrs Surf.Area= 3,153 sf Storage= 3,993 cf

Plug-Flow detention time= 242.0 min calculated for 0.221 af (100% of inflow)
Center-of-Mass det. time= 242.2 min (1,119.7 - 877.5)

Volume	Invert	Avail.Storage	Storage Description
#1	254.00'	6,180 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

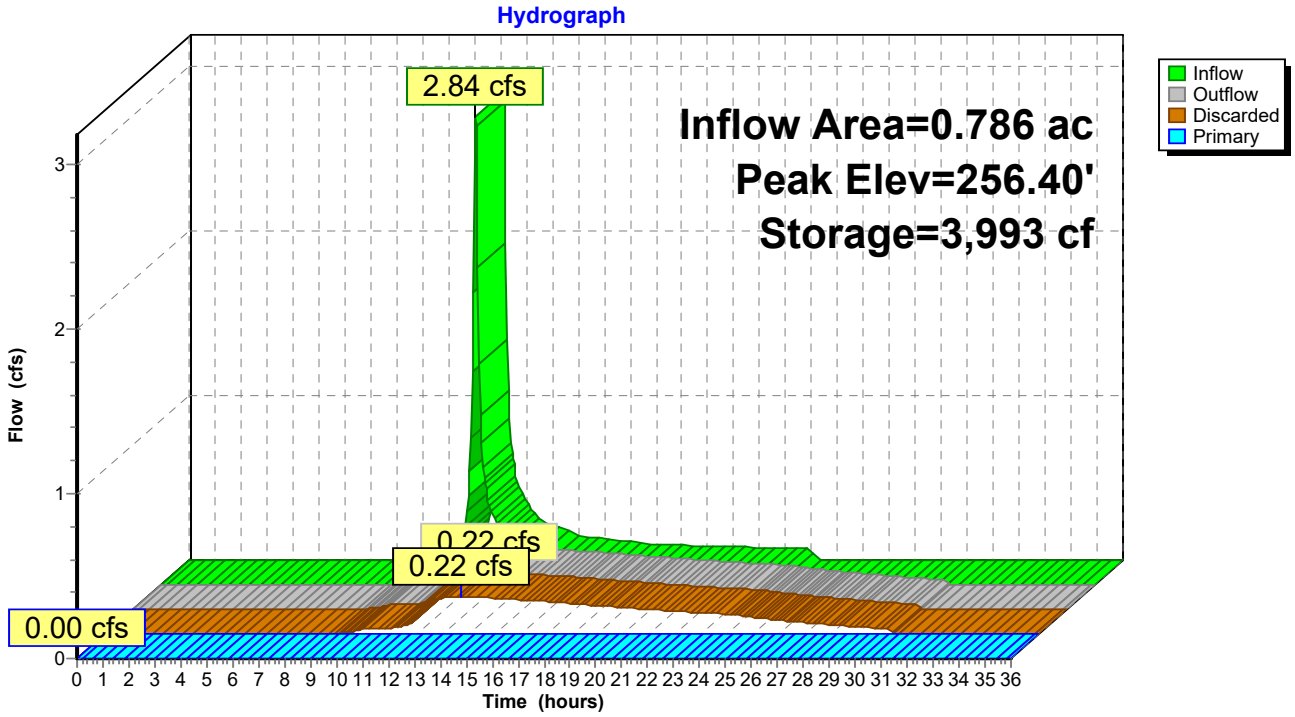
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
254.00	540	103.7	0	0	540
255.00	1,364	159.3	921	921	1,711
256.00	2,563	215.7	1,932	2,853	3,405
257.00	4,155	273.9	3,327	6,180	5,685

Device	Routing	Invert	Outlet Devices
#1	Primary	254.50'	**12.0" Round Culvert** L= 20.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 254.50' / 253.50' S= 0.0500 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#2	Device 1	256.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 2	256.50'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Discarded	254.00'	**2.400 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 250.00'

Discarded OutFlow Max=0.22 cfs @ 13.76 hrs HW=256.40' (Free Discharge)
└**4=Exfiltration** (Controls 0.22 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=254.00' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Controls 0.00 cfs)
└**2=Orifice/Grate** (Controls 0.00 cfs)
└**3=Orifice/Grate** (Controls 0.00 cfs)

Pond 14P: Rain Garden



Stage-Area-Storage for Pond 14P: Rain Garden

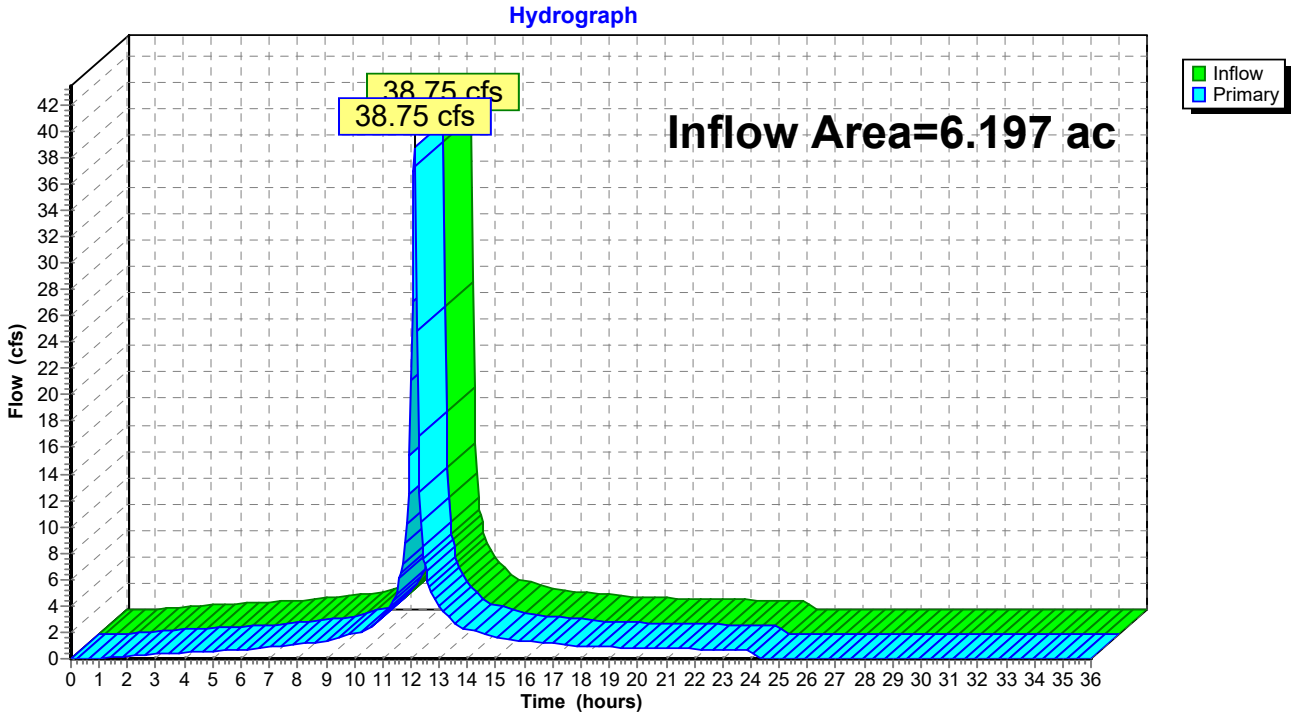
Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
254.00	540	0
254.10	606	57
254.20	675	121
254.30	748	192
254.40	825	271
254.50	905	357
254.60	989	452
254.70	1,077	555
254.80	1,169	668
254.90	1,265	789
255.00	1,364	921
255.10	1,467	1,062
255.20	1,574	1,214
255.30	1,684	1,377
255.40	1,799	1,551
255.50	1,917	1,737
255.60	2,038	1,935
255.70	2,164	2,145
255.80	2,293	2,368
255.90	2,426	2,604
256.00	2,563	2,853
256.10	2,705	3,116
256.20	2,851	3,394
256.30	3,000	3,687
256.40	3,154	3,994
256.50	3,311	4,318
256.60	3,472	4,657
256.70	3,637	5,012
256.80	3,806	5,384
256.90	3,979	5,773
257.00	**4,155**	**6,180**

Summary for Link 15L: DP-1

Inflow Area = 6.197 ac, 63.95% Impervious, Inflow Depth = 6.58" for 100-Year event
Inflow = 38.75 cfs @ 12.13 hrs, Volume= 3.396 af
Primary = 38.75 cfs @ 12.13 hrs, Volume= 3.396 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Link 15L: DP-1



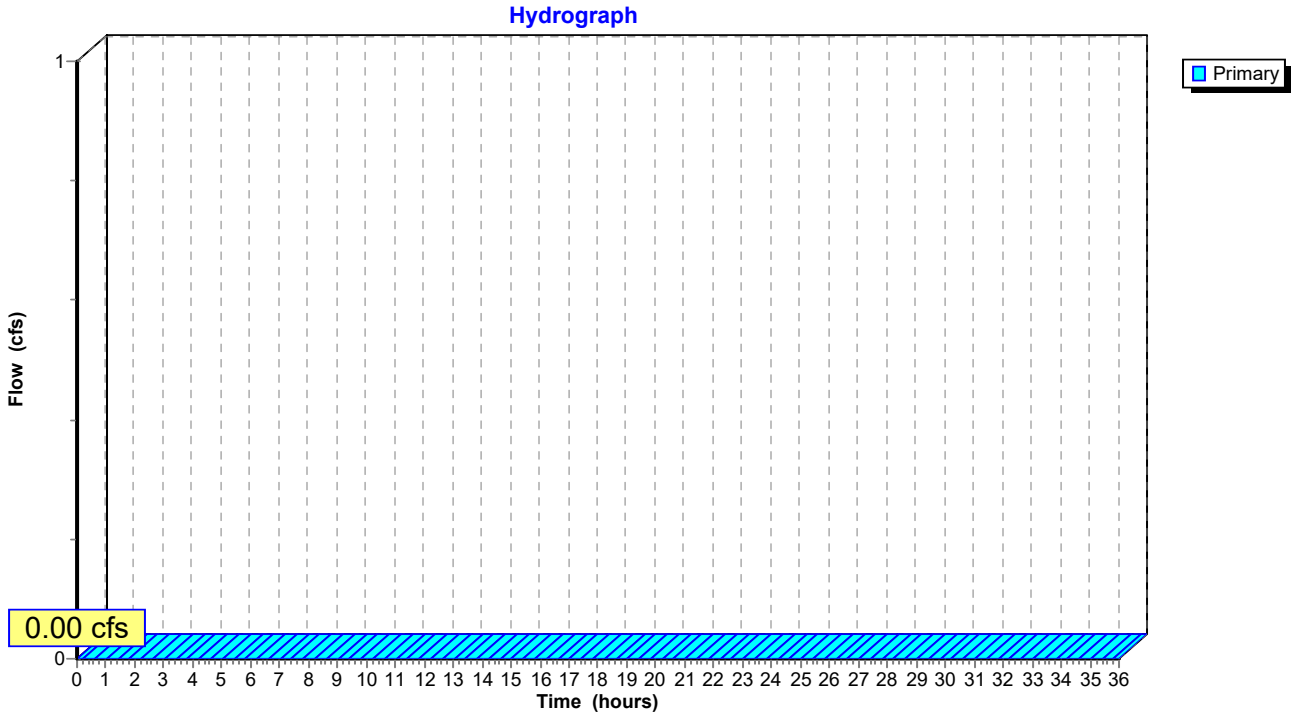
Summary for Link 16L: DP-2

[43] Hint: Has no inflow (Outflow=Zero)

Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Link 16L: DP-2



B

Water Quality Data

Location: **Treatment Train #1**

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Street Sweeping	**0.05**	**1.00**	**0.05**	**0.95**
Deep Sump and Hooded Catch Basins	**0.25**	**0.95**	**0.24**	**0.71**
Water Quality Unit	**0.80**	**0.71**	**0.57**	**0.14**

Total TSS Removal = **86%**

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

Project: **King Street Commons**
Prepared By: **TEC, Inc.**
Date: **8/22/2023**

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

Location: **Treatment Train #2**

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Street Sweeping	**0.05**	**1.00**	**0.05**	**0.95**
Deep Sump and Hooded Catch Basins	**0.25**	**0.95**	**0.24**	**0.71**
Water Quality Unit	**0.80**	**0.71**	**0.57**	**0.14**
Rain Garden	**0.90**	**0.14**	**0.13**	**0.01**

Total TSS Removal = **99%**

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

Project: **King Street Commons**
Prepared By: **TEC, Inc.**
Date: **8/22/2023**

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

Hydrodynamic Separation Product Calculator

King Street Commons

Treatment #1

CDS 2025-5

Project Information					
Project Name	King Street Commons			**Option #**	A
Country	UNITED_STATES	**State**	Massachusetts	**City**	Littleton

Contact Information			
First Name	Matt	**Last Name**	Perry
Company	TEC, Inc.	**Phone #**	603-601-8154
Email	mperry@theengineeringcorp.com		

Design Criteria					
Site Designation	Treatment #1			**Sizing Method**	Net Annual
Screening Required?	Yes	**Drainage Area (ac)**	5.40	**Peak Flow (cfs)**	38.75
Groundwater Depth (ft)	10 - 15	**Pipe Invert Depth (ft)**	5 - 10	**Bedrock Depth (ft)**	>15
Multiple Inlets?	No	**Grate Inlet Required?**	No	**Pipe Size (in)**	12.00
Required Particle Size Distribution?	No	**90° between two inlets?**	N/A	**180° between inlet and outlet?**	No
Runoff Coefficient	0.90	**Rainfall Station**	69 - Boston Airport, MA	**TC (Min)**	6

Treatment Selection					
Treatment Unit	CDS	**System Model**	2025-5		
Target Removal	80%	**Particle Size Distribution (PSD)**	125	**Predicted Net Annual Removal**	80.69%

CONTECH ENGINEERED SOLUTIONS

Hydrodynamic Separation Product Calculator

King Street Commons

Treatment #1

CDS 2025-5

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION BASED ON THE RATIONAL RAINFALL METHOD								
Rainfall Intensity[1] (in/hr)	% Rainfall Volume[1]	Cumulative Rainfall Volume	Rainfall Volume Treated	Total Flowrate (cfs)	Treated Flowrate (cfs)	Operating Rate (%)	Removal Efficiency (%)	Incremental Removal (%)
0.0200	10.17%	10.17%	10.17%	0.0972	0.0972	6.08%	100.00%	10.17%
0.0400	9.65%	19.82%	9.65%	0.1944	0.1944	12.15%	98.98%	9.55%
0.0600	9.45%	29.27%	9.45%	0.2916	0.2916	18.23%	97.76%	9.24%
0.0800	7.74%	37.01%	7.74%	0.3888	0.3888	24.30%	96.55%	7.47%
0.1000	8.57%	45.58%	8.57%	0.4860	0.4860	30.38%	95.33%	8.17%
0.1200	6.30%	51.88%	6.30%	0.5832	0.5832	36.45%	94.12%	5.93%
0.1400	4.66%	56.54%	4.66%	0.6804	0.6804	42.53%	92.90%	4.33%
0.1600	4.64%	61.18%	4.64%	0.7776	0.7776	48.60%	91.69%	4.25%
0.1800	3.54%	64.72%	3.54%	0.8748	0.8748	54.68%	90.47%	3.20%
0.2000	4.34%	69.06%	4.34%	0.9720	0.9720	60.75%	89.25%	3.87%
0.2500	8.00%	77.06%	8.00%	1.2150	1.2150	75.94%	86.21%	6.90%
0.3000	5.59%	82.65%	5.59%	1.4580	1.4580	91.13%	83.17%	4.65%
0.3500	4.37%	87.02%	4.11%	1.7010	1.6000	100.00%	76.57%	3.35%
0.4000	2.53%	89.55%	2.08%	1.9440	1.6000	100.00%	67.00%	1.70%
0.4500	2.53%	92.08%	1.85%	2.1870	1.6000	100.00%	59.55%	1.51%
0.5000	1.38%	93.46%	0.91%	2.4300	1.6000	100.00%	53.60%	0.74%
0.7500	5.04%	98.50%	2.21%	3.6450	1.6000	100.00%	35.73%	1.80%
1.0000	1.01%	99.51%	0.33%	4.8600	1.6000	100.00%	26.80%	0.27%
1.5000	0.00%	99.51%	0.00%	7.2900	1.6000	100.00%	17.87%	0.00%
2.0000	0.00%	99.51%	0.00%	9.7200	1.6000	100.00%	13.40%	0.00%
3.0000	0.48%	99.99%	0.05%	14.5800	1.6000	100.00%	8.93%	0.04%
								87.14%
							Removal Efficiency Adjustment[2] =	6.45%
							Predicted % Annual Rainfall Treated =	87.74%
							Predicted Net Annual Load Removal Efficiency =	80.69%

1 - Based on 10 years of hourly precipitation data from NCDC Station 770, Boston WSFO AP, Suffolk County, MA

2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

SECTION (_____)
STORM WATER TREATMENT DEVICE

1.0 GENERAL

1.1 This item shall govern the furnishing and installation of the CDS® by Contech Engineered Solutions LLC, complete and operable as shown and as specified herein, in accordance with the requirements of the plans and contract documents.

1.2 The Contractor shall furnish all labor, equipment and materials necessary to install the storm water treatment device(s) (SWTD) and appurtenances specified in the Drawings and these specifications.

1.3 The manufacturer of the SWTD shall be one that is regularly engaged in the engineering design and production of systems deployed for the treatment of storm water runoff for at least five (5) years and which have a history of successful production, acceptable to the Engineer. In accordance with the Drawings, the SWTD(s) shall be a CDS® device manufactured by:

Contech Engineered Solutions LLC
9025 Centre Pointe Drive
West Chester, OH, 45069
Tel: 1 800 338 1122

1.4 Related Sections

1.4.1 Section 02240: Dewatering
1.4.2 Section 02260: Excavation Support and Protection
1.4.3 Section 02315: Excavation and Fill
1.4.4 Section 02340: Soil Stabilization

1.5 All components shall be subject to inspection by the engineer at the place of manufacture and/or installation. All components are subject to being rejected or identified for repair if the quality of materials and manufacturing do not comply with the requirements of this specification. Components which have been identified as defective may be subject for repair where final acceptance of the component is contingent on the discretion of the Engineer.

1.6 The manufacturer shall guarantee the SWTD components against all manufacturer originated defects in materials or workmanship for a period of twelve (12) months from the date the components are delivered to the owner for installation. The manufacturer shall upon its determination repair, correct or replace any manufacturer originated defects advised in writing to the manufacturer within the referenced warranty period. The use of SWTD components shall be limited to the application for which it was specifically designed.

1.7 The SWTD manufacturer shall submit to the Engineer of Record a “Manufacturer’s Performance Certification” certifying that each SWTD is capable of achieving the specified removal efficiencies listed in these specifications. The certification shall be supported by independent third-party research

1.8 No product substitutions shall be accepted unless submitted 10 days prior to project bid date, or as directed by the Engineer of Record. Submissions for substitutions require review and approval by the Engineer of Record, for hydraulic performance, impact to project designs, equivalent treatment performance, and any required project plan and report (hydrology/hydraulic, water quality, stormwater pollution) modifications that would be required by the approving jurisdictions/agencies. Contractor to coordinate with the Engineer of Record any applicable modifications to the project estimates of cost, bonding amount determinations, plan check fees for changes to approved documents, and/or any other regulatory requirements resulting from the product substitution.

2.0 MATERIALS

2.1 Housing unit of stormwater treatment device shall be constructed of pre-cast or cast-in-place concrete, no exceptions. Precast concrete components shall conform to applicable sections of ASTM C 478, ASTM C 857 and ASTM C 858 and the following:

- 2.1.1 Concrete shall achieve a minimum 28-day compressive strength of 4,000 pounds per square-inch (psi);
- 2.1.2 Unless otherwise noted, the precast concrete sections shall be designed to withstand lateral earth and AASHTO H-20 traffic loads;
- 2.1.3 Cement shall be Type III Portland Cement conforming to ASTM C 150;
- 2.1.4 Aggregates shall conform to ASTM C 33;
- 2.1.5 Reinforcing steel shall be deformed billet-steel bars, welded steel wire or deformed welded steel wire conforming to ASTM A 615, A 185, or A 497.
- 2.1.6 Joints shall be sealed with preformed joint sealing compound conforming to ASTM C 990.
- 2.1.7 Shipping of components shall not be initiated until a minimum compressive strength of 4,000 psi is attained or five (5) calendar days after fabrication has expired, whichever occurs first.

2.2 Internal Components and appurtenances shall conform to the following:

- 2.2.1 Screen and support structure shall be manufactured of Type 316 and 316L stainless steel conforming to ASTM F 1267-01;
- 2.2.2 Hardware shall be manufactured of Type 316 stainless steel conforming to ASTM A 320;
- 2.2.3 Fiberglass components shall conform to applicable sections of ASTM D-4097
- 2.2.4 Access system(s) conform to the following:
- 2.2.5 Manhole castings shall be designed to withstand AASHTO H-20 loadings and manufactured of cast-iron conforming to ASTM A 48 Class 30.

3.0 PERFORMANCE

3.1 The SWTD shall be sized to either achieve an 80 percent average annual reduction in the total suspended solid load with a particle size distribution having a mean particle size (d_{50}) of 125 microns unless otherwise stated.

3.2 The SWTD shall be capable of capturing and retaining 100 percent of pollutants greater than or equal to 2.4 millimeters (mm) regardless of the pollutant's specific gravity (i.e.: floatable and neutrally buoyant materials) for flows up to the device's rated-treatment capacity. The SWTD shall be designed to retain all previously captured pollutants addressed by this

subsection under all flow conditions. The SWTD shall be capable of capturing and retaining total petroleum hydrocarbons. The SWTD shall be capable of achieving a removal efficiency of 92 and 78 percent when the device is operating at 25 and 50 percent of its rated-treatment capacity. These removal efficiencies shall be based on independent third-party research for influent oil concentrations representative of storm water runoff (20 ± 5 mg/L). The SWTD shall be greater than 99 percent effective in controlling dry-weather accidental oil spills.

3.3 The SWTD shall be designed with a sump chamber for the storage of captured sediments and other negatively buoyant pollutants in between maintenance cycles. The minimum storage capacity provided by the sump chamber shall be in accordance with the volume listed in Table 1. The boundaries of the sump chamber shall be limited to that which do not degrade the SWTD's treatment efficiency as captured pollutants accumulate. The sump chamber shall be separate from the treatment processing portion(s) of the SWTD to minimize the probability of fine particle re-suspension. In order to not restrict the Owner's ability to maintain the SWTD, the minimum dimension providing access from the ground surface to the sump chamber shall be 16 inches in diameter.

3.4 The SWTD shall be designed to capture and retain Total Petroleum Hydrocarbons generated by wet-weather flow and dry-weather gross spills and have a capacity listed in Table 1 of the required unit.

3.5 The SWTD shall convey the flow from the peak storm event of the drainage network, in accordance with required hydraulic upstream conditions as defined by the Engineer. If a substitute SWTD is proposed, supporting documentation shall be submitted that demonstrates equal or better upstream hydraulic conditions compared to that specified herein. This documentation shall be signed and sealed by a Professional Engineer registered in the State of the work. All costs associated with preparing and certifying this documentation shall be born solely by the Contractor.

3.6 The SWTD shall have completed field tested following TARP Tier II protocol requirements

4.0 EXECUTION

4.1 The contractor shall exercise care in the storage and handling of the SWTD components prior to and during installation. Any repair or replacement costs associated with events occurring after delivery is accepted and unloading has commenced shall be borne by the contractor.

4.2 The SWTD shall be installed in accordance with the manufacturer's recommendations and related sections of the contract documents. The manufacturer shall provide the contractor installation instructions and offer on-site guidance during the important stages of the installation as identified by the manufacturer at no additional expense. A minimum of 72 hours notice shall be provided to the manufacturer prior to their performance of the services included under this subsection.

4.3 The contractor shall fill all voids associated with lifting provisions provided by the manufacturer. These voids shall be filled with non-shrinking grout providing a finished surface consistent with adjacent surfaces. The contractor shall trim all protruding lifting provisions flush with the adjacent concrete surface in a manner, which leaves no sharp points or edges.

4.4 The contractor shall removal all loose material and pooling water from the SWTD prior to the transfer of operational responsibility to the Owner.

TABLE 1
Storm Water Treatment Device
Storage Capacities

CDS Model	Minimum Sump Storage Capacity $(yd^3)/(m^3)$	Minimum Oil Storage Capacity (gal)/(L)
CDS2015-4	0.9(0.7)	61(232)
CDS2015-5	1.5(1.1)	83(313)
CDS2020-5	1.5(1.1)	99(376)
CDS2025-5	1.5(1.1)	116(439)
CDS3020-6	2.1 (1.6)	184(696)
CDS3025-6	2.1(1.6)	210(795)
CDS3030-6	2.1 (1.6)	236(895)
CDS3035-6	2.1 (1.6)	263(994)
CDS3535-7	2.9(2.2)	377(1426)
CDS4030-8	5.6(4.3)	426(1612)
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CDS7070-DV	3.6(2.8)	914 (3459)
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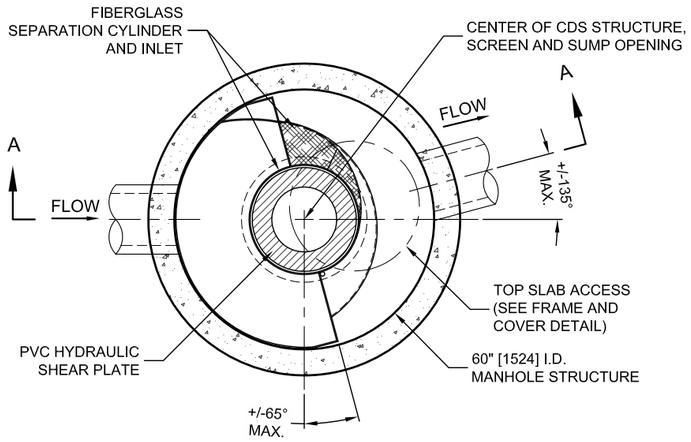
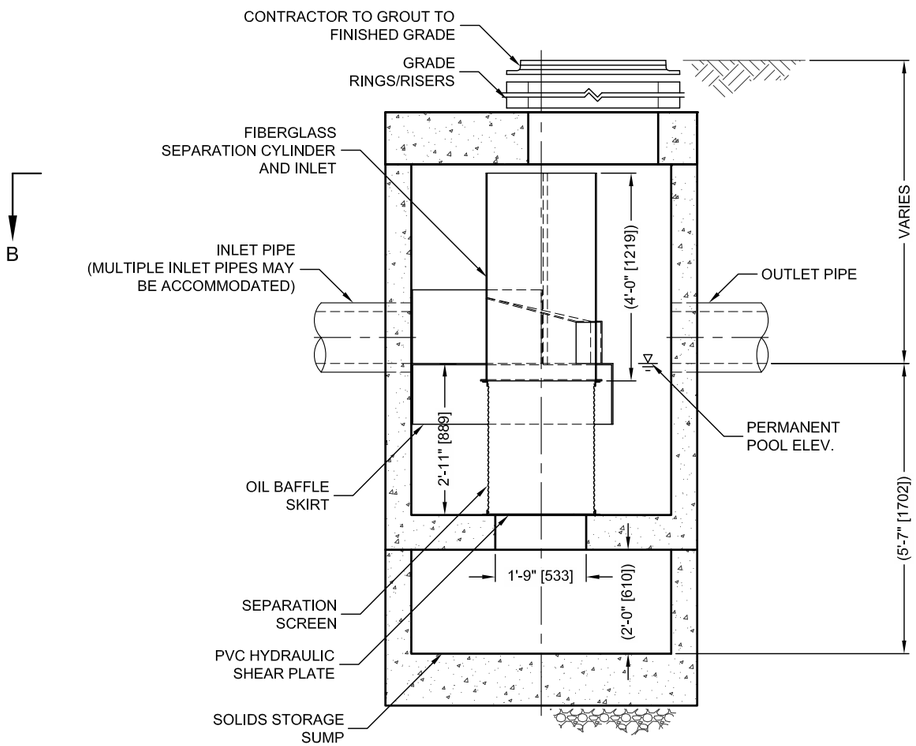
CDS10080-DV	5.0 (3.8)	1057 (4000)
CDS100100-DV	5.0 (3.8)	1320 (4996)

END OF SECTION



PLAN VIEW B-B
N.T.S.

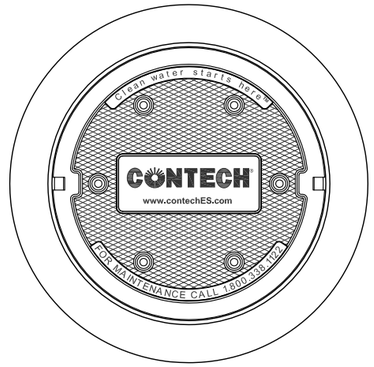


ELEVATION A-A
N.T.S.

CDS2025-5-C DESIGN NOTES

THE STANDARD CDS2025-5-C CONFIGURATION IS SHOWN. ALTERNATE CONFIGURATIONS ARE AVAILABLE AND ARE LISTED BELOW. SOME CONFIGURATIONS MAY BE COMBINED TO SUIT SITE REQUIREMENTS.

CONFIGURATION DESCRIPTION
GRATED INLET ONLY (NO INLET PIPE)
GRATED INLET WITH INLET PIPE OR PIPES
CURB INLET ONLY (NO INLET PIPE)
CURB INLET WITH INLET PIPE OR PIPES
SEPARATE OIL BAFFLE (SINGLE INLET PIPE REQUIRED FOR THIS CONFIGURATION)
SEDIMENT WEIR FOR NJDEP / NJCAT CONFORMING UNITS



FRAME AND COVER
(DIAMETER VARIES)
N.T.S.

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID	
WATER QUALITY FLOW RATE (CFS OR L/s)	*
PEAK FLOW RATE (CFS OR L/s)	*
RETURN PERIOD OF PEAK FLOW (YRS)	*
SCREEN APERTURE (2400 OR 4700)	*

PIPE DATA:	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	*	*	*
INLET PIPE 2	*	*	*
OUTLET PIPE	*	*	*

RIM ELEVATION	*

ANTI-FLOTATION BALLAST	WIDTH	HEIGHT
	*	*

NOTES/SPECIAL REQUIREMENTS:

* PER ENGINEER OF RECORD

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3. FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.contechES.com
4. CDS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
5. STRUCTURE SHALL MEET AASHTO HS20 AND CASTINGS SHALL MEET HS20 (AASHTO M 306) LOAD RATING, ASSUMING GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION.
6. PVC HYDRAULIC SHEAR PLATE IS PLACED ON SHELF AT BOTTOM OF SCREEN CYLINDER. REMOVE AND REPLACE AS NECESSARY DURING MAINTENANCE CLEANING.

INSTALLATION NOTES
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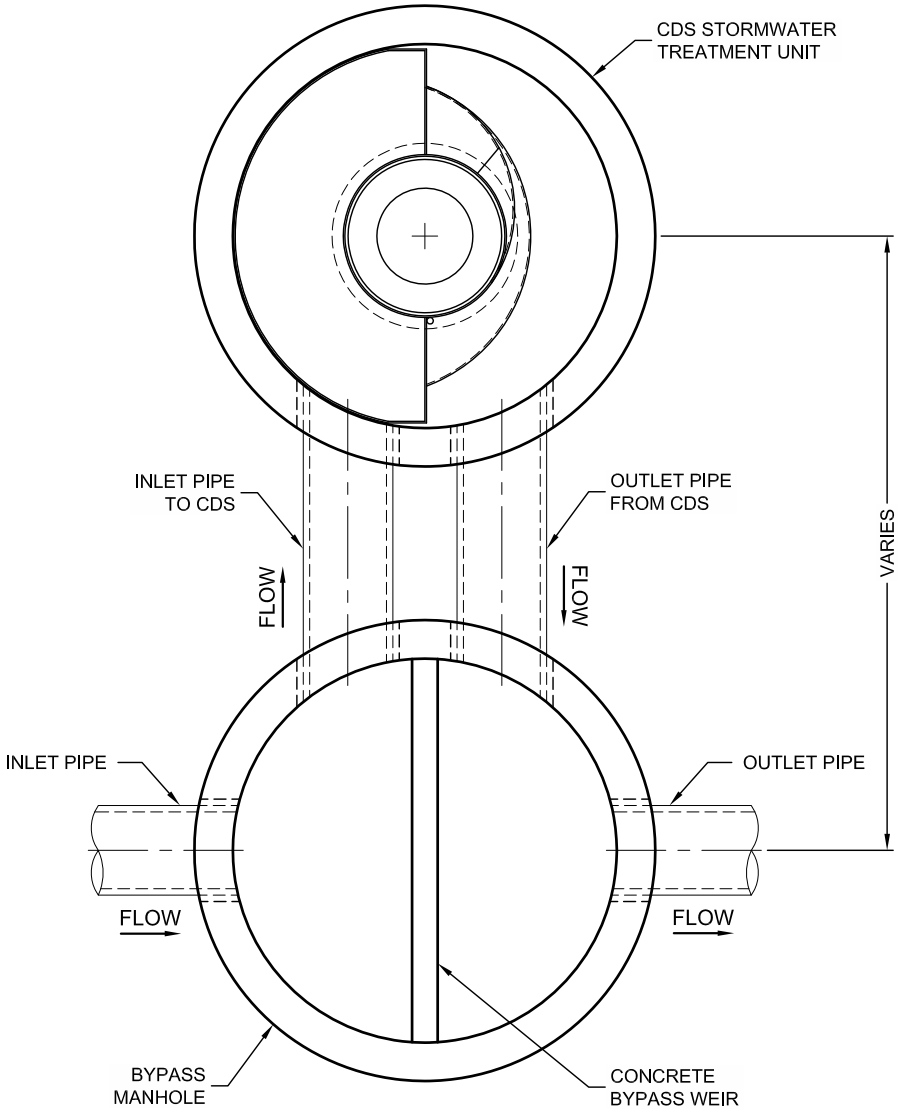
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CDS MANHOLE STRUCTURE (LIFTING CLUTCHES PROVIDED).
C. CONTRACTOR TO ADD JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS, AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH PIPE INVERTS WITH ELEVATIONS SHOWN.
E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

CONTECH ENGINEERED SOLUTIONS LLC
www.contechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CDS2025-5-C
INLINE CDS
STANDARD DETAIL



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9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CDS STORMWATER TREATMENT SYSTEM
TYPICAL OFFLINE LAYOUT
WITH BYPASS MANHOLE STRUCTURE

DATE:03/12/13	SCALE: NONE	PROJECT No.: N/A	SEQ. No.: N/A	DRAWN: N/A	CHECKED: N/A

Hydrodynamic Separation Product Calculator

King Street Commons

Treatment #2

CDS 2015-4

Project Information					
Project Name	King Street Commons			**Option #**	A
Country	UNITED_STATES	**State**	Massachusetts	**City**	Littleton

Contact Information			
First Name	Matt	**Last Name**	Perry
Company	TEC, Inc.	**Phone #**	603-601-8154
Email	mperry@theengineeringcorp.com		

Design Criteria					
Site Designation	Treatment #2			**Sizing Method**	Net Annual
Screening Required?	Yes	**Drainage Area (ac)**	0.79	**Peak Flow (cfs)**	2.84
Groundwater Depth (ft)	10 - 15	**Pipe Invert Depth (ft)**	5 - 10	**Bedrock Depth (ft)**	>15
Multiple Inlets?	No	**Grate Inlet Required?**	No	**Pipe Size (in)**	12.00
Required Particle Size Distribution?	No	**90° between two inlets?**	N/A	**180° between inlet and outlet?**	No
Runoff Coefficient	0.90	**Rainfall Station**	69 - Boston Airport, MA	**TC (Min)**	10

Treatment Selection					
Treatment Unit	CDS	**System Model**	2015-4		
Target Removal	80%	**Particle Size Distribution (PSD)**	125	**Predicted Net Annual Removal**	90.51%

CONTECH ENGINEERED SOLUTIONS

Hydrodynamic Separation Product Calculator

King Street Commons

Treatment #2

CDS 2015-4

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION BASED ON THE RATIONAL RAINFALL METHOD								
Rainfall Intensity[1] (in/hr)	% Rainfall Volume[1]	Cumulative Rainfall Volume	Rainfall Volume Treated	Total Flowrate (cfs)	Treated Flowrate (cfs)	Operating Rate (%)	Removal Efficiency (%)	Incremental Removal (%)
0.0200	10.17%	10.17%	10.17%	0.0142	0.0142	2.03%	100.00%	10.17%
0.0400	9.65%	19.82%	9.65%	0.0284	0.0284	4.06%	100.00%	9.65%
0.0600	9.45%	29.27%	9.45%	0.0427	0.0427	6.10%	100.00%	9.45%
0.0800	7.74%	37.01%	7.74%	0.0569	0.0569	8.13%	99.78%	7.72%
0.1000	8.57%	45.58%	8.57%	0.0711	0.0711	10.16%	99.38%	8.52%
0.1200	6.30%	51.88%	6.30%	0.0853	0.0853	12.19%	98.97%	6.24%
0.1400	4.66%	56.54%	4.66%	0.0995	0.0995	14.21%	98.57%	4.59%
0.1600	4.64%	61.18%	4.64%	0.1138	0.1138	16.26%	98.16%	4.55%
0.1800	3.54%	64.72%	3.54%	0.1280	0.1280	18.29%	97.75%	3.46%
0.2000	4.34%	69.06%	4.34%	0.1422	0.1422	20.31%	97.35%	4.22%
0.2500	8.00%	77.06%	8.00%	0.1778	0.1778	25.40%	96.33%	7.71%
0.3000	5.59%	82.65%	5.59%	0.2133	0.2133	30.47%	95.31%	5.33%
0.3500	4.37%	87.02%	4.37%	0.2489	0.2489	35.56%	94.29%	4.12%
0.4000	2.53%	89.55%	2.53%	0.2844	0.2844	40.63%	93.28%	2.36%
0.4500	2.53%	92.08%	2.53%	0.3200	0.3200	45.71%	92.26%	2.33%
0.5000	1.38%	93.46%	1.38%	0.3555	0.3555	50.79%	91.25%	1.26%
0.7500	5.04%	98.50%	5.04%	0.5333	0.5333	76.19%	86.16%	4.34%
1.0000	1.01%	99.51%	0.99%	0.7110	0.7000	100.00%	80.14%	0.81%
1.5000	0.00%	99.51%	0.00%	1.0665	0.7000	100.00%	53.43%	0.00%
2.0000	0.00%	99.51%	0.00%	1.4220	0.7000	100.00%	40.07%	0.00%
3.0000	0.48%	99.99%	0.16%	2.1330	0.7000	100.00%	26.71%	0.13%
								96.96%
							Removal Efficiency Adjustment[2] =	6.45%
							Predicted % Annual Rainfall Treated =	93.20%
							Predicted Net Annual Load Removal Efficiency =	90.51%

1 - Based on 10 years of hourly precipitation data from NCDC Station 770, Boston WSFO AP, Suffolk County, MA

2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

SECTION (_____)
STORM WATER TREATMENT DEVICE

1.0 GENERAL

1.1 This item shall govern the furnishing and installation of the CDS® by Contech Engineered Solutions LLC, complete and operable as shown and as specified herein, in accordance with the requirements of the plans and contract documents.

1.2 The Contractor shall furnish all labor, equipment and materials necessary to install the storm water treatment device(s) (SWTD) and appurtenances specified in the Drawings and these specifications.

1.3 The manufacturer of the SWTD shall be one that is regularly engaged in the engineering design and production of systems deployed for the treatment of storm water runoff for at least five (5) years and which have a history of successful production, acceptable to the Engineer. In accordance with the Drawings, the SWTD(s) shall be a CDS® device manufactured by:

Contech Engineered Solutions LLC
9025 Centre Pointe Drive
West Chester, OH, 45069
Tel: 1 800 338 1122

1.4 Related Sections

1.4.1 Section 02240: Dewatering
1.4.2 Section 02260: Excavation Support and Protection
1.4.3 Section 02315: Excavation and Fill
1.4.4 Section 02340: Soil Stabilization

1.5 All components shall be subject to inspection by the engineer at the place of manufacture and/or installation. All components are subject to being rejected or identified for repair if the quality of materials and manufacturing do not comply with the requirements of this specification. Components which have been identified as defective may be subject for repair where final acceptance of the component is contingent on the discretion of the Engineer.

1.6 The manufacturer shall guarantee the SWTD components against all manufacturer originated defects in materials or workmanship for a period of twelve (12) months from the date the components are delivered to the owner for installation. The manufacturer shall upon its determination repair, correct or replace any manufacturer originated defects advised in writing to the manufacturer within the referenced warranty period. The use of SWTD components shall be limited to the application for which it was specifically designed.

1.7 The SWTD manufacturer shall submit to the Engineer of Record a “Manufacturer’s Performance Certification” certifying that each SWTD is capable of achieving the specified removal efficiencies listed in these specifications. The certification shall be supported by independent third-party research

1.8 No product substitutions shall be accepted unless submitted 10 days prior to project bid date, or as directed by the Engineer of Record. Submissions for substitutions require review and approval by the Engineer of Record, for hydraulic performance, impact to project designs, equivalent treatment performance, and any required project plan and report (hydrology/hydraulic, water quality, stormwater pollution) modifications that would be required by the approving jurisdictions/agencies. Contractor to coordinate with the Engineer of Record any applicable modifications to the project estimates of cost, bonding amount determinations, plan check fees for changes to approved documents, and/or any other regulatory requirements resulting from the product substitution.

2.0 MATERIALS

2.1 Housing unit of stormwater treatment device shall be constructed of pre-cast or cast-in-place concrete, no exceptions. Precast concrete components shall conform to applicable sections of ASTM C 478, ASTM C 857 and ASTM C 858 and the following:

- 2.1.1 Concrete shall achieve a minimum 28-day compressive strength of 4,000 pounds per square-inch (psi);
- 2.1.2 Unless otherwise noted, the precast concrete sections shall be designed to withstand lateral earth and AASHTO H-20 traffic loads;
- 2.1.3 Cement shall be Type III Portland Cement conforming to ASTM C 150;
- 2.1.4 Aggregates shall conform to ASTM C 33;
- 2.1.5 Reinforcing steel shall be deformed billet-steel bars, welded steel wire or deformed welded steel wire conforming to ASTM A 615, A 185, or A 497.
- 2.1.6 Joints shall be sealed with preformed joint sealing compound conforming to ASTM C 990.
- 2.1.7 Shipping of components shall not be initiated until a minimum compressive strength of 4,000 psi is attained or five (5) calendar days after fabrication has expired, whichever occurs first.

2.2 Internal Components and appurtenances shall conform to the following:

- 2.2.1 Screen and support structure shall be manufactured of Type 316 and 316L stainless steel conforming to ASTM F 1267-01;
- 2.2.2 Hardware shall be manufactured of Type 316 stainless steel conforming to ASTM A 320;
- 2.2.3 Fiberglass components shall conform to applicable sections of ASTM D-4097
- 2.2.4 Access system(s) conform to the following:
- 2.2.5 Manhole castings shall be designed to withstand AASHTO H-20 loadings and manufactured of cast-iron conforming to ASTM A 48 Class 30.

3.0 PERFORMANCE

3.1 The SWTD shall be sized to either achieve an 80 percent average annual reduction in the total suspended solid load with a particle size distribution having a mean particle size (d_{50}) of 125 microns unless otherwise stated.

3.2 The SWTD shall be capable of capturing and retaining 100 percent of pollutants greater than or equal to 2.4 millimeters (mm) regardless of the pollutant's specific gravity (i.e.: floatable and neutrally buoyant materials) for flows up to the device's rated-treatment capacity. The SWTD shall be designed to retain all previously captured pollutants addressed by this

subsection under all flow conditions. The SWTD shall be capable of capturing and retaining total petroleum hydrocarbons. The SWTD shall be capable of achieving a removal efficiency of 92 and 78 percent when the device is operating at 25 and 50 percent of its rated-treatment capacity. These removal efficiencies shall be based on independent third-party research for influent oil concentrations representative of storm water runoff (20 ± 5 mg/L). The SWTD shall be greater than 99 percent effective in controlling dry-weather accidental oil spills.

3.3 The SWTD shall be designed with a sump chamber for the storage of captured sediments and other negatively buoyant pollutants in between maintenance cycles. The minimum storage capacity provided by the sump chamber shall be in accordance with the volume listed in Table 1. The boundaries of the sump chamber shall be limited to that which do not degrade the SWTD's treatment efficiency as captured pollutants accumulate. The sump chamber shall be separate from the treatment processing portion(s) of the SWTD to minimize the probability of fine particle re-suspension. In order to not restrict the Owner's ability to maintain the SWTD, the minimum dimension providing access from the ground surface to the sump chamber shall be 16 inches in diameter.

3.4 The SWTD shall be designed to capture and retain Total Petroleum Hydrocarbons generated by wet-weather flow and dry-weather gross spills and have a capacity listed in Table 1 of the required unit.

3.5 The SWTD shall convey the flow from the peak storm event of the drainage network, in accordance with required hydraulic upstream conditions as defined by the Engineer. If a substitute SWTD is proposed, supporting documentation shall be submitted that demonstrates equal or better upstream hydraulic conditions compared to that specified herein. This documentation shall be signed and sealed by a Professional Engineer registered in the State of the work. All costs associated with preparing and certifying this documentation shall be born solely by the Contractor.

3.6 The SWTD shall have completed field tested following TARP Tier II protocol requirements

4.0 EXECUTION

4.1 The contractor shall exercise care in the storage and handling of the SWTD components prior to and during installation. Any repair or replacement costs associated with events occurring after delivery is accepted and unloading has commenced shall be borne by the contractor.

4.2 The SWTD shall be installed in accordance with the manufacturer's recommendations and related sections of the contract documents. The manufacturer shall provide the contractor installation instructions and offer on-site guidance during the important stages of the installation as identified by the manufacturer at no additional expense. A minimum of 72 hours notice shall be provided to the manufacturer prior to their performance of the services included under this subsection.

4.3 The contractor shall fill all voids associated with lifting provisions provided by the manufacturer. These voids shall be filled with non-shrinking grout providing a finished surface consistent with adjacent surfaces. The contractor shall trim all protruding lifting provisions flush with the adjacent concrete surface in a manner, which leaves no sharp points or edges.

4.4 The contractor shall removal all loose material and pooling water from the SWTD prior to the transfer of operational responsibility to the Owner.

TABLE 1
Storm Water Treatment Device
Storage Capacities

CDS Model	Minimum Sump Storage Capacity $(yd^3)/(m^3)$	Minimum Oil Storage Capacity (gal)/(L)
CDS2015-4	0.9(0.7)	61(232)
CDS2015-5	1.5(1.1)	83(313)
CDS2020-5	1.5(1.1)	99(376)
CDS2025-5	1.5(1.1)	116(439)
CDS3020-6	2.1 (1.6)	184(696)
CDS3025-6	2.1(1.6)	210(795)
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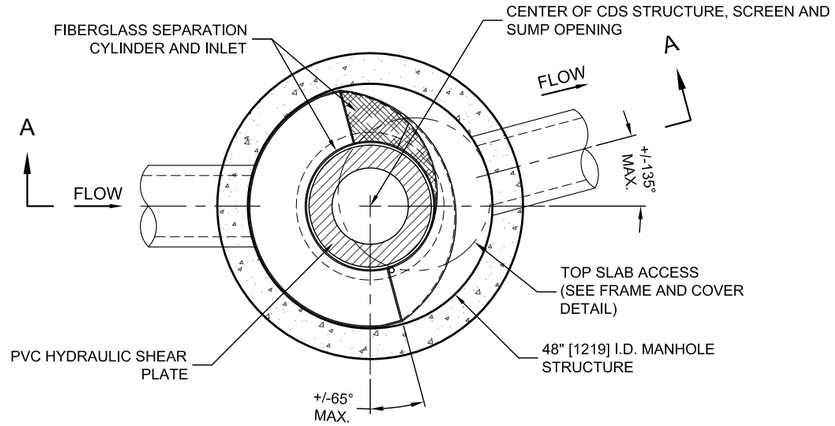

PLAN VIEW B-B
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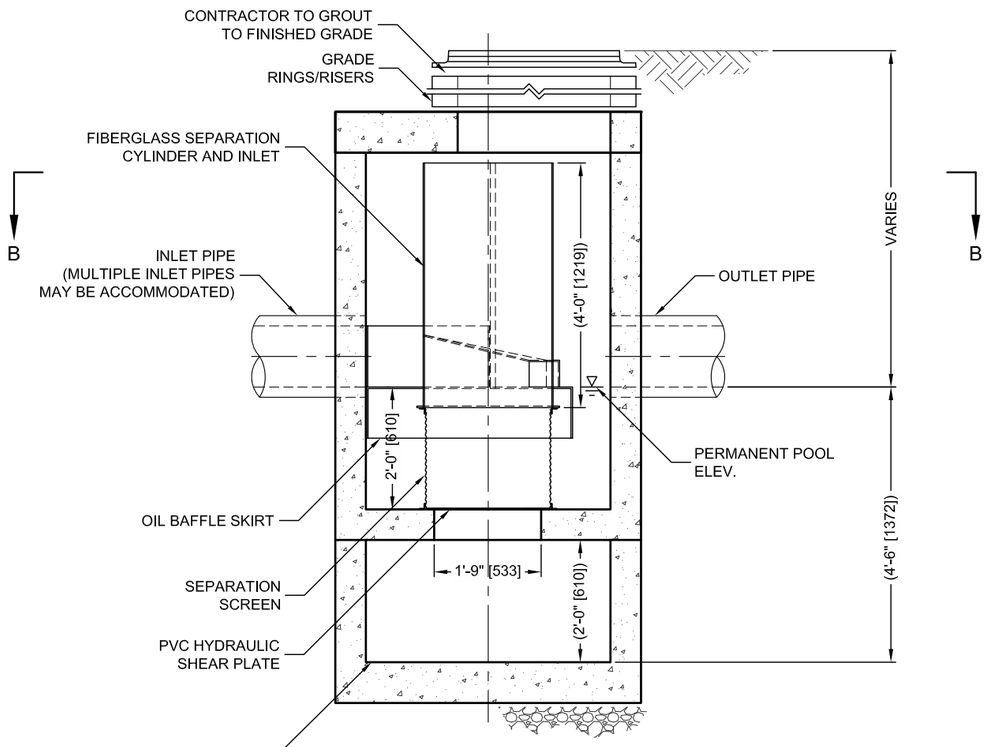

ELEVATION A-A
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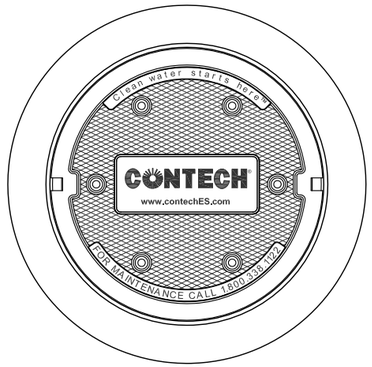

FRAME AND COVER
(DIAMETER VARIES)
N.T.S.

CDS2015-4-C DESIGN NOTES

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CURB INLET WITH INLET PIPE OR PIPES
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SEDIMENT WEIR FOR NJDEP / NJCAT CONFORMING UNITS

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PEAK FLOW RATE (CFS OR L/s)	*
RETURN PERIOD OF PEAK FLOW (YRS)	*
SCREEN APERTURE (2400 OR 4700)	*

PIPE DATA:	I.E.	MATERIAL	DIAMETER
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INLET PIPE 2	*	*	*
OUTLET PIPE	*	*	*

RIM ELEVATION	*

ANTI-FLOTATION BALLAST	WIDTH	HEIGHT
	*	*

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CDS2015-4-C
INLINE CDS
STANDARD DETAIL

CONTECH®
ENGINEERED SOLUTIONS

Hydrodynamic Separation

The experts you need to solve your stormwater challenges

Contech is the leader in stormwater solutions, helping engineers, contractors and owners with infrastructure and land development projects throughout North America.

With our responsive team of stormwater experts, local regulatory expertise and flexible solutions, Contech is the trusted partner you can count on for stormwater management solutions.

Your Contech Team

STORMWATER CONSULTANT

It's my job to recommend the best solution to meet permitting requirements.

STORMWATER DESIGN ENGINEER

I work with consultants to design the best approved solution to meet your project's needs.

REGULATORY MANAGER

I understand the local stormwater regulations and what solutions will be approved.

SALES ENGINEER

I make sure our solutions meet the needs of the contractor during construction.

Contech is your partner in stormwater management solutions

Removing Pollutants using Hydrodynamic Separation

Utilize high-performance hydrodynamic separation to effectively remove finer sediment, oil and grease, and floating and sinking debris.

CASCADE separator™

CDS®

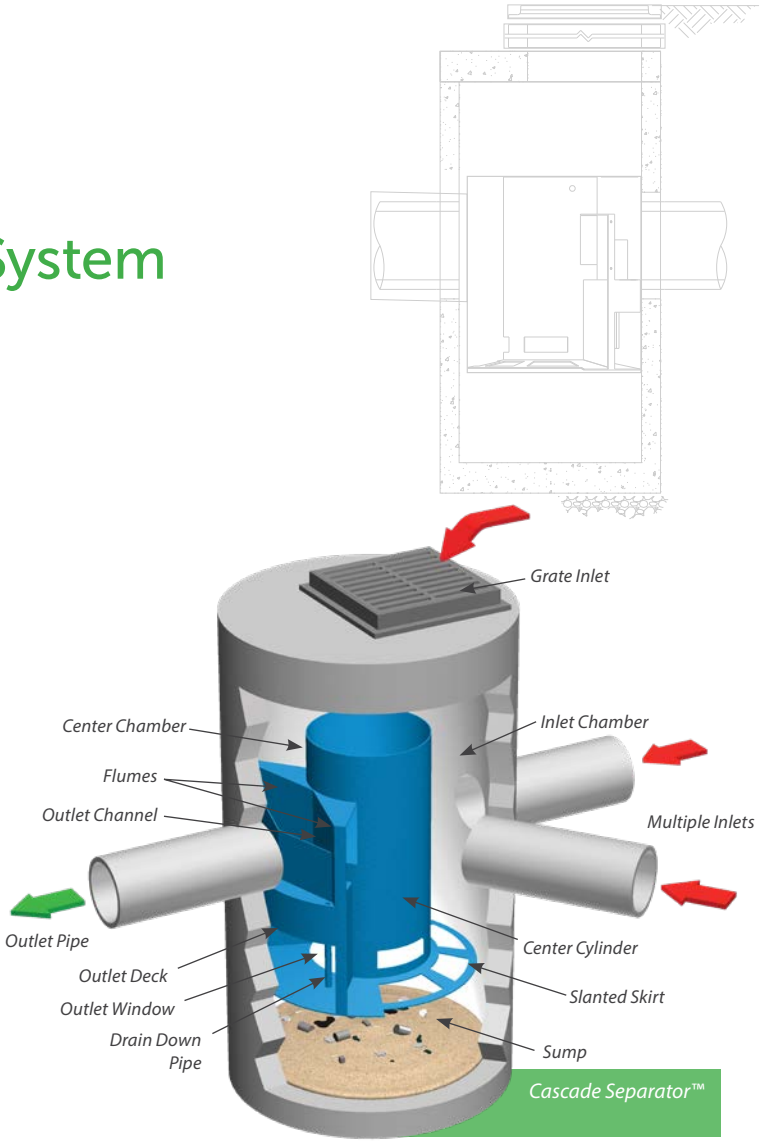
Vortechs®

HDS systems play a vital role in protecting our waterways by removing high levels of sediment, trash, debris, and hydrocarbons from stormwater runoff.

Frequently used as end-of-pipe solutions, they are also used to provide stormwater quality treatment in places where space is limited.

HDS systems capture and retain a variety of stormwater pollutants and are very easy to maintain. These two key benefits have resulted in new uses for HDS technologies, such as pretreating detention, Low Impact Development, and green infrastructure practices, as well as other land-based stormwater treatment systems.

The Cascade Separator™ System



Advanced Sediment Capture Technology ...

The Cascade Separator™ is the newest innovation in stormwater treatment from Contech. The Cascade Separator was developed by Contech's stormwater experts using advanced modeling tools and Contech's industry leading stormwater laboratory.

This innovative hydrodynamic separator excels at sediment capture and retention while also removing hydrocarbons, trash, and debris from stormwater runoff. What makes the Cascade Separator unique is the use of opposing vortices that enhance particle settling and a unique skirt design that allows for sediment transport into the sump while reducing turbulence and resuspension of previously captured material. These two factors allow the Cascade Separator to treat high flow rates in a small footprint, resulting in an efficient and economical solution for any site.

FEATURE	BENEFIT
Unique skirt design & opposing vortices	Superior TSS removal; reduced system size and costs
Inlet area accepts wide range of inlet pipe angles	Design and installation flexibility
Accepts multiple inlet pipes	Eliminates the need for separate junction structure
Grate inlet option	Eliminates the need for a separate grate inlet structure
Internal bypass	Eliminates the need for a separate bypass structure
Clear access to sump and stored pollutants	Fast, easy maintenance

Learn More:
www.ContechES.com/cascade

SELECT CASCADE APPROVALS

- New Jersey Department of Environmental Protection Certification (NJDEP)

CASCADE MAINTENANCE

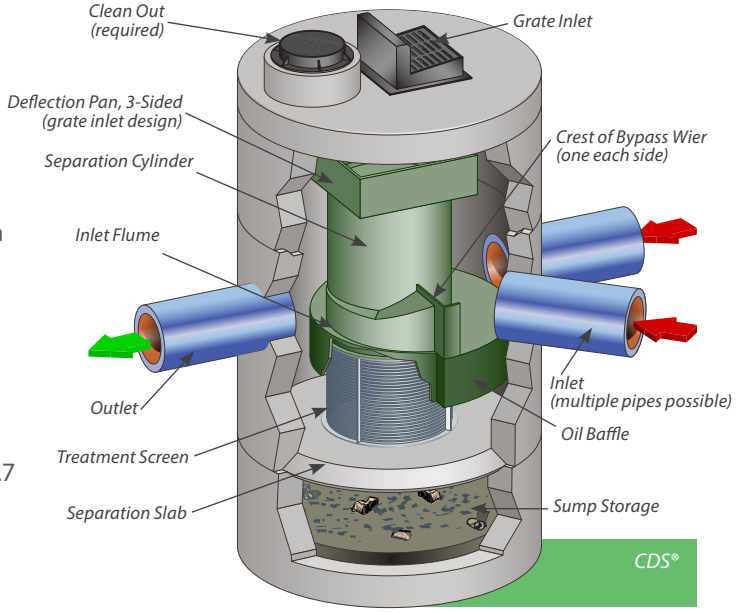
Cascade provides unobstructed access to stored pollutants, making it easy to maintain using a vacuum truck, with no requirement to enter the unit.

The CDS® System

Superior Trash Removal ...

The CDS is a hybrid technology that uses a combination of swirl concentration and indirect screening to separate and trap trash, debris, sediment, and hydrocarbons from stormwater runoff.

At the heart of the CDS system is a unique screening technology used to capture and retain trash and debris. The screen face is louvered so that it is smooth in the downstream direction. The effect created is called "Continuous Deflective Separation." The power of the incoming flow is harnessed to continually shear debris off the screen and to direct trash and sediment toward the center of the separation cylinder. This results in a screen that is self-cleaning and provides 100% removal of floatables and neutrally buoyant material debris 4.7 mm or larger, without blinding.



FEATURE	BENEFIT
Captures and retains 100% of floatables and neutrally buoyant debris 4.7 mm or larger	Superior trash removal
Self-cleaning screen	Ease of maintenance
Isolated storage sump eliminates scour potential	Excellent pollutant retention
Internal bypass	Eliminates the need for additional structures
Multiple pipe inlets and 90-180° angles	Design flexibility
Clear access to sump and stored pollutants	Fast, easy maintenance

Learn More:
www.ContechES.com/cds

SELECT CDS APPROVALS

- Washington Department of Ecology (GULD) – Pretreatment
- New Jersey Department of Environmental Protection Certification (NJDEP)
- Canadian Environmental Technology Verification (ETV)
- California Statewide Trash Amendments Full Capture System Certified*

** The CDS System has been certified by the California State Water Resources Control Board as a Full Capture System provided that it is sized to treat the peak flow rate from the region specific 1-year, 1-hour design storm, or the peak flow capacity of the corresponding storm drain, whichever is less.*

The Vortechs® System

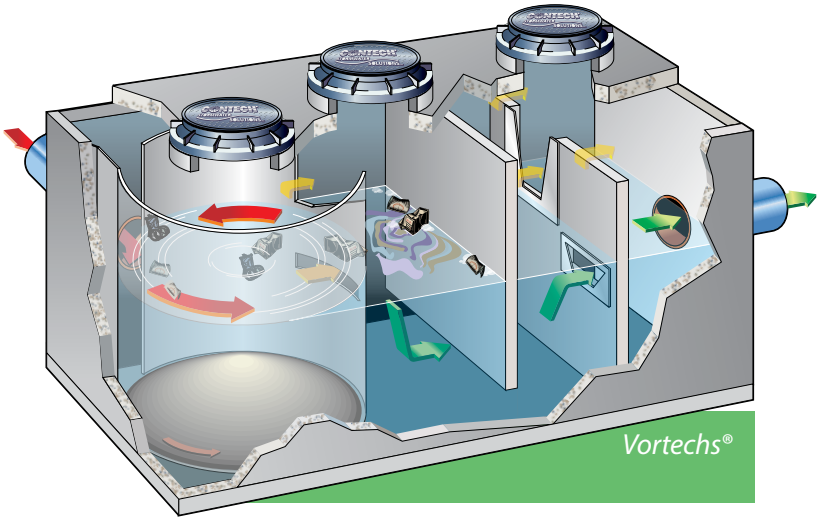
Stormwater Treatment in a Shallow Footprint ....

Vortechs combines swirl concentration and flow controls into a single treatment unit that captures and retains trash, debris, sediment, and hydrocarbons from stormwater runoff.

The Vortechs system's large swirl chamber and flow controls work together to create a low energy environment, ideal for capturing and retaining particles down to 50 microns.

Vortechs is the ideal solution for sites with high groundwater, bedrock, utility conflicts, or sites with a large volume runoff.

The Vortechs System is approved by the Washington Department of Ecology (GULD) - Pretreatment.



SELECT VORTECHS APPROVALS

- Washington Department of Ecology (GULD) – Pretreatment

Learn More:
www.ContechES.com/vortechs

FEATURE	BENEFIT
Large swirl chamber	Fine particle removal down to 50 microns
Shallow profile – Typical depth below pipe invert is only 3 feet.	Can be used on sites with high groundwater, bedrock, or utility conflicts
Unobstructed access to stored pollutants	Fast, easy maintenance

The ideal solution for sites with high groundwater

Design Your Own Hydrodynamic Separator (DYOHDS™)

Learn More:
www.ContechES.com/dyohds

Quickly prepare designs for estimates and project meetings ...

Engineers are always looking for new ways to quickly prepare designs for estimates and project meetings. Contech has developed an online tool to help with the hydrodynamic separation product selection process… the Design Your Own Hydrodynamic Separator (DYOHDS™) tool.

This free, online tool fully automates the layout process for identifying the proper hydrodynamic separator for your site. You can create multiple systems for each project while saving all project information for future use.

- Multiple sizing methods available.
- Site-specific questions ensure the selected unit will comply with site constraints.
- Multiple treatment options may be available based on regulations and site parameters.
- Follow up reports contain a site-specific design, sizing summary, standard detail, and specification.

A free, online tool to aid in the selection of a hydrodynamic separation solution.

A partner you can rely on

STORMWATER SOLUTIONS

PIPE SOLUTIONS

STRUCTURES SOLUTIONS

Few companies offer the wide range of high-quality stormwater resources you can find with us — state-of-the-art products, decades of expertise, and all the maintenance support you need to operate your system cost-effectively.

THE CONTECH WAY

Contech® Engineered Solutions provides innovative, cost-effective site solutions to engineers, contractors, and developers on projects across North America. Our portfolio includes bridges, drainage, erosion control, retaining wall, sanitary sewer and stormwater management products.

TAKE THE NEXT STEP

For more information: www.ContechES.com

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Riprap Sizing Computations for King Street Commons

Taken from:

- *FHWA Hydraulic Design of Energy Dissipators for Culverts and Channels (Chapter 10) FHWA-NHI-06-086 July 2006*
- *NRCS Rock Outlet Protection 2012 Fact Sheet (attached)*

By: M. Perry - TEC, Inc. 8/22/2023

Checked By: C. Raymond - TEC, Inc. 8/22/2023

$$D_{50} = 0.2D\left(\frac{Q}{\sqrt{gD^{2.5}}}\right)^{4/3}\left(\frac{D}{TW}\right)$$

$$D_{50} = riprap\ size\ (ft)$$

$$Q = design\ discharge\ \left(\frac{ft^3}{s}\right)$$

Used 10-year storm peak flow from drainage calculations

$$D = culvert\ diameter\ (ft)$$

$$TW = tailwater\ depth\ (ft)$$

Use 0.4D as minimum

$$g = acceleration\ due\ to\ gravity\ \left(32.2\ \frac{ft}{s^2}\right)$$

Table 10.1. Example Riprap Classes and Apron Dimensions

Class	D_{50} (mm)	D_{50} (in)	Apron Length[1]	Apron Depth
1	125	5	4D	$3.5D_{50}$
2	150	6	4D	$3.3D_{50}$
3	250	10	5D	$2.4D_{50}$
4	350	14	6D	$2.2D_{50}$
5	500	20	7D	$2.0D_{50}$
6	550	22	8D	$2.0D_{50}$

[1]D is the culvert rise.

$$W_U = 3D$$

$$W_D = D + Length$$

$$W_U = upstream\ width\ (ft)$$

$$W_D = downstream\ width\ (ft)$$

Proposed Outfall #1 – Existing Stormwater Pond

$$D_{50} = 0.2(2.0\ ft)\left(\frac{20.64\ \frac{ft^3}{s}}{\sqrt{(32.2\ \frac{ft}{s^2})(2.0ft)^{2.5}}}\right)^{4/3}\left(\frac{2.0ft}{0.8ft}\right) = 1.76\ feet = 21.1\ inches$$

$21.1\ inches = Class\ 6\ (Table\ 10.1)$ *-> Class 6 min. = 22 inches*

$Length = 8D = 8(2.0\ ft) = 16\ feet$

$Depth = 2.0(D_{50}) = 2.0(22\ in) = 44\ inches = 3.7\ feet$

$W_U = 3(2.0\ ft) = 6\ feet$

$W_D = 2.0\ ft + 16\ ft = 18\ feet$

TEC recommends the rip-rap apron be 16 feet long by 3.7 feet deep with an upstream width of 6 feet and a downstream width of 18 feet.

Proposed Outfall #2 – Rain Garden

$$D_{50} = 0.2(1.0\ ft)\left(\frac{0.73\ \frac{ft^3}{s}}{\sqrt{(32.2\ \frac{ft}{s^2})(1.0ft)^{2.5}}}\right)^{4/3}\left(\frac{1.0ft}{0.4ft}\right) = 0.32\ feet = 0.40\ inches$$

$0.4\ inches = Class\ 1\ (Table\ 10.1)$ *-> Class 1 min. = 5 inches*

$Length = 4D = 4(1.0\ ft) = 4\ feet$

$Depth = 3.5(D_{50}) = 3.5(5\ in) = 17.5\ inches = 1.5\ feet$

$W_U = 3(1.0\ ft) = 3\ feet$

$W_D = 1.0\ ft + 4\ ft = 4\ feet$

TEC recommends the rip-rap apron be 4 feet long by 1.5 feet deep with an upstream width of 3 feet and a downstream width of 4 feet.

NRCS
Natural Resources
Conservation Service

Rock Outlet Protection

Denver Federal Center
Building 56, Room 2604
PO Box 25426
Denver, Co 80225-0426

720-544-2810 - office
www.co.nrcs.usda.gov

What is rock outlet protection?

A pad or apron of heavy rock placed at the outlet end of culverts or chutes.

When is rock outlet protection used?

Rock outlet protection is installed where the energy at the outlets of culverts or chutes are sufficient to erode the receiving channel or area. This fact sheet does not apply to continuous rock linings of channels or streams. Pipes that dump water at the top of a slope, or down slopes steeper than 10 percent, or flow at rates greater than 10 feet per second require a site specific design that is beyond the scope of this fact sheet.

How is rock outlet protection installed?

Apron length: Apron length ***(La)*** shall be determined from Table 1.

Apron width: The apron width is based on the diameter of the discharge pipe, ***(D)***. The apron width will be ***3D*** at the upstream end ***(Wu),*** and the downstream width ***(Wd)*** will be equal to ***(D + La)***. The apron shall extend across the channel bottom and up side slopes for a minimum height equal to the diameter of the pipe, ***(D)***.

Alignment: The apron shall be located so that there are no bends in the horizontal alignment. The apron should be level over its length, and the elevation of the downstream end of the apron must be the same as the elevation of the receiving channel or adjacent ground.

Thickness: The required apron thickness is shown in Table 1.

Gabions: When a gabion mattress is used it shall be made of double twisted galvanized steel wire. Gabions shall be fabricated in such a manner that the sides, ends, and lid can be assembled at the construction site into mats a minimum of 12 inches thick.

Materials: Outlet protection may be done using rock riprap or gabion mattresses to construct the apron. The rock shall consist of field stone or rough unhewn quarry stone. The stone shall be hard and angular and of a quality that will not disintegrate on exposure to water or weathering. Broken concrete may be used provided it does not have any exposed steel or reinforcing bars, and that it is broken into blocky pieces such that the largest dimension of each piece is no more than 3 times the smallest dimension. The required rock size is shown in Tables 1 and 2. In all cases a geotextile (filter fabric) shall be placed between the apron and the underlying soil to prevent soil movement into and through the riprap.

When type of maintenance is required?

Inspect rock outlet structures after heavy rains to see if any erosion around or below the riprap has taken place or if stones have been dislodged. Immediately make all needed repairs to prevent further damage. Remove any debris that has collected on the outlet pad.

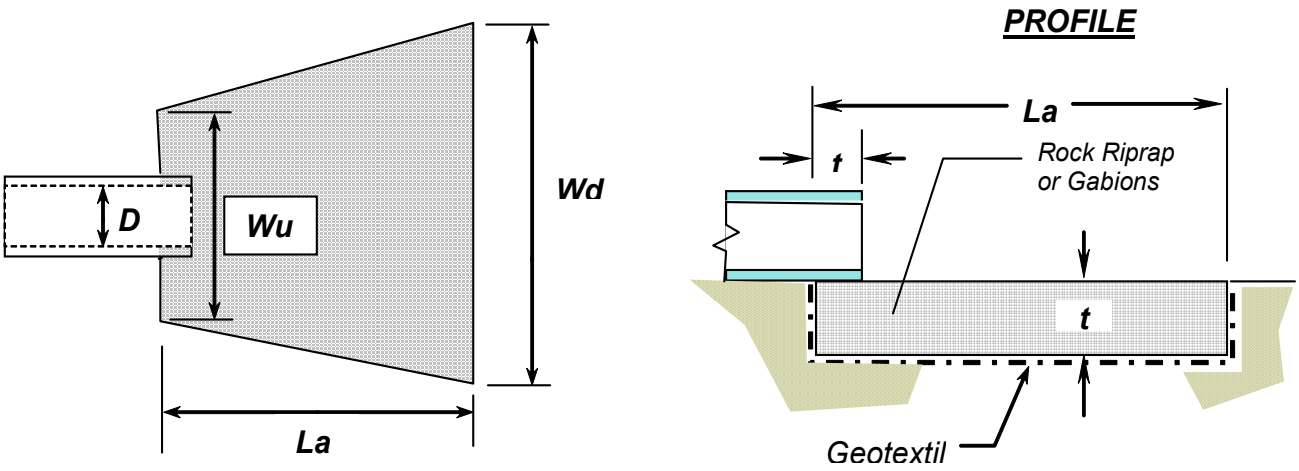


Figure 1 - Typical detail for rock outlet protection below a culvert

Culvert Size D, (inches)	Rock Size d_{50} (inches)	Apron Legnth La, (feet)	Upstream Width Wu, (feet)	Downstream Width Wd, (feet)	Thickness *t*, (inches)	Quantity (tons)
12	6	12	3	13	18	15
18	9	16	4.5	18	24	20
21	9	18	5	20	24	35
24	9	20	6	22	24	60
30	9	22	7.5	24	24	75
36	12	24	9	27	30	120
42	18	26	10.5	30	36	180
48	18	28	12	32	36	215

TABLE 1 - Rock outlet protection apron dimensions

Smallest Dimension in Inches					% of rocks small than size shown
Gadion Rock	6"d_{50}	9"d_{50}	12"d_{50}	18"d_{50}	
8	12	15	21	30	100
6	9	12	18	24	50-70
4	6	9	12	18	35-50
3	2	3	4	6	2-10

TABLE 2 - Required rock gradation

NOTE: After a fire many trees are weakened from burning around the base of the trunk. The trees can fall over or blow down without warning. Shallow rooted trees can also fall. Therefore be extremely alert when around burned trees.

C

NRCS Soil Resource Report

United States Department of Agriculture

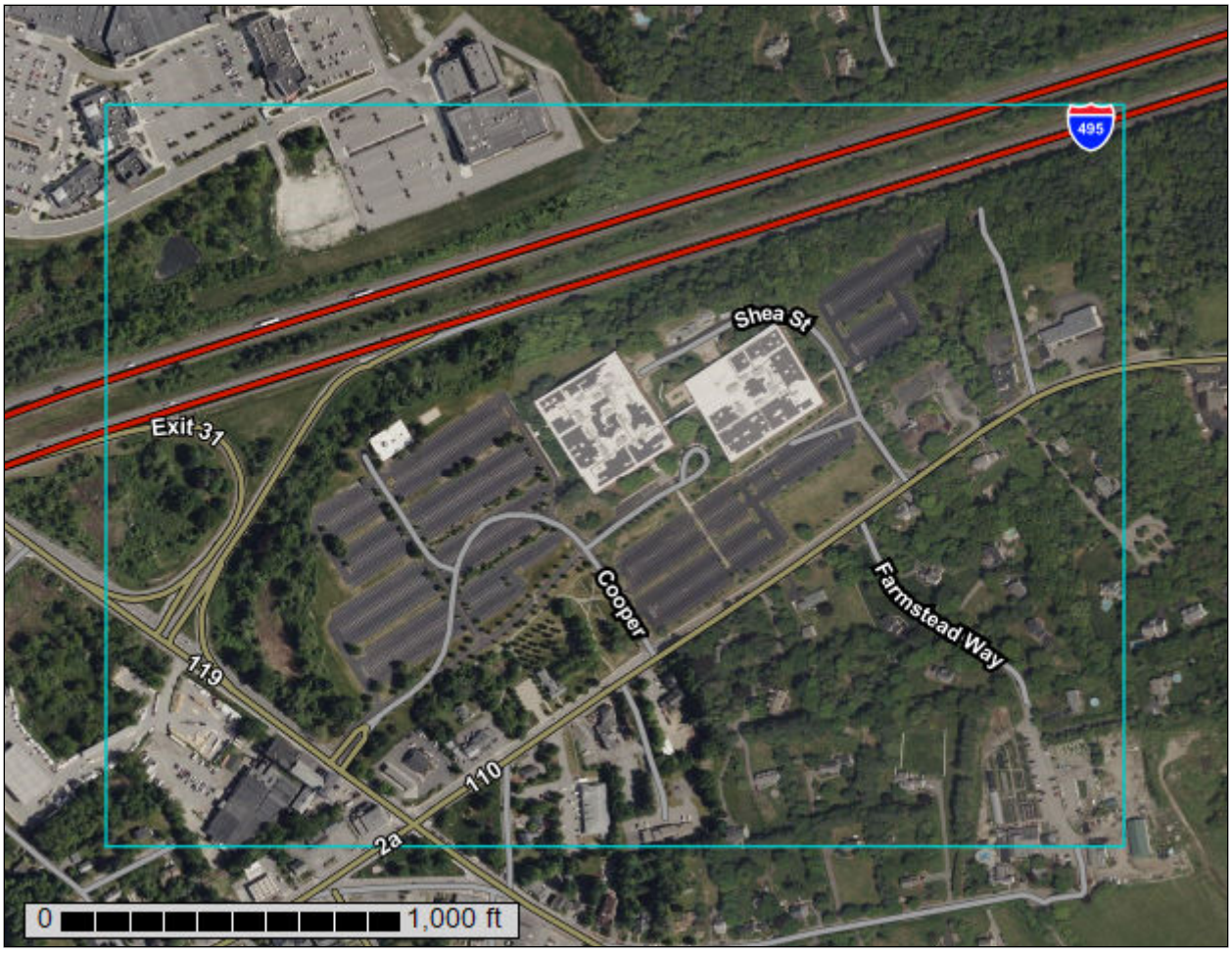
NRCS

Natural Resources Conservation Service

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

Custom Soil Resource Report for Middlesex County, Massachusetts

550 King Street



August 15, 2023

Preface

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

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

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

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

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

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

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

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Contents

How Soil Surveys Are Made

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

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

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

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

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

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

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

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

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

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

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

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

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

Soil Map

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

Custom Soil Resource Report
Soil Map

Map Scale: 1:5,620 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 50 100 200 300

Feet
0 250 500 1000 1500

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

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 22, Sep 9, 2022

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

Date(s) aerial images were photographed: May 22, 2022—Jun 5, 2022

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
6A	Scarboro mucky fine sandy loam, 0 to 3 percent slopes	3.5	2.3%
103C	Charlton-Hollis-Rock outcrop complex, 8 to 15 percent slopes	0.2	0.1%
307B	Paxton fine sandy loam, 0 to 8 percent slopes, extremely stony	2.9	2.0%
307E	Paxton fine sandy loam, 25 to 35 percent slopes, extremely stony	4.1	2.7%
310B	Woodbridge fine sandy loam, 3 to 8 percent slopes	30.2	20.1%
310C	Woodbridge fine sandy loam, 8 to 15 percent slopes	8.8	5.8%
311B	Woodbridge fine sandy loam, 0 to 8 percent slopes, very stony	3.5	2.3%
422B	Canton fine sandy loam, 0 to 8 percent slopes, extremely stony	7.3	4.8%
422C	Canton fine sandy loam, 8 to 15 percent slopes, extremely stony	0.1	0.1%
622C	Paxton-Urban land complex, 3 to 15 percent slopes	10.3	6.9%
623C	Woodbridge-Urban land complex, 3 to 15 percent slopes	0.3	0.2%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	12.6	8.4%
654	Udorthents, loamy	3.2	2.1%
655	Udorthents, wet substratum	7.3	4.9%
656	Udorthents-Urban land complex	56.1	37.3%
Totals for Area of Interest		**150.3**	**100.0%**

Map Unit Descriptions

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

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named

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

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

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

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

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

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

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

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

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

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

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

Middlesex County, Massachusetts

6A—Scarboro mucky fine sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2svky
Elevation: 0 to 1,320 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 250 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Scarboro

Setting

Landform: Drainageways, outwash deltas, outwash terraces, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Sandy glaciofluvial deposits derived from schist and/or sandy glaciofluvial deposits derived from gneiss and/or sandy glaciofluvial deposits derived from granite

Typical profile

Oe - 0 to 3 inches: mucky peat
A - 3 to 11 inches: mucky fine sandy loam
Cg1 - 11 to 21 inches: sand
Cg2 - 21 to 65 inches: gravelly coarse sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (1.42 to 14.17 in/hr)
Depth to water table: About 0 to 2 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: A/D
Ecological site: F144AY031MA - Very Wet Outwash
Hydric soil rating: Yes

Minor Components

Swansea

Percent of map unit: 10 percent
Landform: Bogs, swamps
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Wareham

Percent of map unit: 5 percent
Landform: Depressions
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Walpole

Percent of map unit: 5 percent
Landform: Deltas, depressions, outwash terraces, depressions, outwash plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, talf, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

103C—Charlton-Hollis-Rock outcrop complex, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2wzp1
Elevation: 0 to 1,390 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Charlton, extremely stony, and similar soils: 50 percent
Hollis, extremely stony, and similar soils: 20 percent
Rock outcrop: 10 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Charlton, Extremely Stony

Setting

Landform: Ridges, hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear

Across-slope shape: Convex
Parent material: Coarse-loamy melt-out till derived from granite, gneiss, and/or schist

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 4 inches: fine sandy loam
Bw - 4 to 27 inches: gravelly fine sandy loam
C - 27 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 8 to 15 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 8.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: B
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Description of Hollis, Extremely Stony

Setting

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

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
A - 2 to 7 inches: gravelly fine sandy loam
Bw - 7 to 16 inches: gravelly fine sandy loam
2R - 16 to 26 inches: bedrock

Properties and qualities

Slope: 8 to 15 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 8 to 23 inches to lithic bedrock
Drainage class: Somewhat excessively drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Depth to water table: More than 80 inches

Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: F144AY033MA - Shallow Dry Till Uplands
Hydric soil rating: No

Description of Rock Outcrop

Setting

Landform: Ridges, hills
Parent material: Igneous and metamorphic rock

Typical profile

R - 0 to 79 inches: bedrock

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 0 inches to lithic bedrock
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Available water supply, 0 to 60 inches: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Woodbridge, extremely stony

Percent of map unit: 8 percent
Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Canton, extremely stony

Percent of map unit: 5 percent
Landform: Moraines, hills, ridges
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Chatfield, extremely stony

Percent of map unit: 5 percent
Landform: Ridges, hills

Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest
Down-slope shape: Convex
Across-slope shape: Linear, convex
Hydric soil rating: No

Ridgebury, extremely stony

Percent of map unit: 2 percent
Landform: Hills, drainageways, drumlins, depressions, ground moraines
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

307B—Paxton fine sandy loam, 0 to 8 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 2w675
Elevation: 0 to 1,580 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Paxton, Extremely Stony

Setting

Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Linear, convex
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 10 inches: fine sandy loam
Bw1 - 10 to 17 inches: fine sandy loam
Bw2 - 17 to 28 inches: fine sandy loam
Cd - 28 to 67 inches: gravelly fine sandy loam

Properties and qualities

Slope: 0 to 8 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 20 to 43 inches to densic material
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Ecological site: F144AY007CT - Well Drained Dense Till Uplands
Hydric soil rating: No

Minor Components

Woodbridge, extremely stony

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

Charlton, extremely stony

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

Ridgebury, extremely stony

Percent of map unit: 4 percent
Landform: Drumlins, drainageways, depressions, ground moraines, hills
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Whitman, extremely stony

Percent of map unit: 1 percent
Landform: Depressions
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

307E—Paxton fine sandy loam, 25 to 35 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 2w67q
Elevation: 0 to 1,400 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Paxton, extremely stony, and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Paxton, Extremely Stony

Setting

Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Linear, convex
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 10 inches: fine sandy loam
Bw1 - 10 to 17 inches: fine sandy loam
Bw2 - 17 to 28 inches: fine sandy loam
Cd - 28 to 67 inches: gravelly fine sandy loam

Properties and qualities

Slope: 25 to 35 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 20 to 43 inches to densic material
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s

Hydrologic Soil Group: C
Ecological site: F144AY007CT - Well Drained Dense Till Uplands
Hydric soil rating: No

Minor Components

Charlton, extremely stony
Percent of map unit: 8 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Woodbridge, extremely stony
Percent of map unit: 1 percent
Landform: Hills, drumlins, ground moraines
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Chatfield, extremely stony
Percent of map unit: 1 percent
Landform: Ridges, hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

310B—Woodbridge fine sandy loam, 3 to 8 percent slopes

Map Unit Setting
National map unit symbol: 2t2ql
Elevation: 0 to 1,470 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition
Woodbridge, fine sandy loam, and similar soils: 82 percent
Minor components: 18 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Woodbridge, Fine Sandy Loam

Setting

Landform: Ground moraines, drumlins, hills
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Ap - 0 to 7 inches: fine sandy loam
Bw1 - 7 to 18 inches: fine sandy loam
Bw2 - 18 to 30 inches: fine sandy loam
Cd - 30 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 20 to 39 inches to densic material
Drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C/D
Ecological site: F144AY037MA - Moist Dense Till Uplands
Hydric soil rating: No

Minor Components

Paxton

Percent of map unit: 10 percent
Landform: Drumlins, ground moraines, hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Ridgebury

Percent of map unit: 8 percent
Landform: Depressions, ground moraines, hills, drainageways
Landform position (two-dimensional): Toeslope, backslope, footslope
Landform position (three-dimensional): Base slope, head slope, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

310C—Woodbridge fine sandy loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2w689
Elevation: 0 to 1,370 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

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

Description of Woodbridge

Setting

Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Ap - 0 to 7 inches: fine sandy loam
Bw1 - 7 to 18 inches: fine sandy loam
Bw2 - 18 to 30 inches: fine sandy loam
Cd - 30 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 20 to 39 inches to densic material
Drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C/D
Ecological site: F144AY037MA - Moist Dense Till Uplands

Hydric soil rating: No

Minor Components

Paxton

Percent of map unit: 10 percent
Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Ridgebury

Percent of map unit: 4 percent
Landform: Depressions, ground moraines, hills, drainageways, drumlins
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Sutton

Percent of map unit: 1 percent
Landform: Ground moraines, hills
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

311B—Woodbridge fine sandy loam, 0 to 8 percent slopes, very stony

Map Unit Setting

National map unit symbol: 2t2qr
Elevation: 0 to 1,440 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Woodbridge, very stony, and similar soils: 82 percent
Minor components: 18 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Woodbridge, Very Stony

Setting

Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Summit, backslope, footslope

Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 9 inches: fine sandy loam
Bw1 - 9 to 20 inches: fine sandy loam
Bw2 - 20 to 32 inches: fine sandy loam
Cd - 32 to 67 inches: gravelly fine sandy loam

Properties and qualities

Slope: 0 to 8 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 20 to 43 inches to densic material
Drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 19 to 27 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: C/D
Ecological site: F144AY037MA - Moist Dense Till Uplands
Hydric soil rating: No

Minor Components

Paxton, very stony

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

Ridgebury, very stony

Percent of map unit: 8 percent
Landform: Hills, drainageways, drumlins, depressions, ground moraines
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

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

Map Unit Setting

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

Map Unit Composition

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

Description of Canton, Extremely Stony

Setting

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

Typical profile

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

Properties and qualities

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

Interpretive groups

Land capability classification (irrigated): None specified

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

Minor Components

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

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

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

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

422C—Canton fine sandy loam, 8 to 15 percent slopes, extremely stony

Map Unit Setting
National map unit symbol: 2w815
Elevation: 0 to 1,310 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Canton, Extremely Stony

Setting

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

Typical profile

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

Properties and qualities

Slope: 8 to 15 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 19 to 39 inches to strongly contrasting textural stratification
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: B
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Scituate, extremely stony

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

Montauk, extremely stony

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

Charlton, extremely stony

Percent of map unit: 5 percent
Landform: Ridges, ground moraines, hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Hollis, extremely stony

Percent of map unit: 4 percent
Landform: Ridges, hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest
Down-slope shape: Convex
Across-slope shape: Linear, convex
Hydric soil rating: No

622C—Paxton-Urban land complex, 3 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2w67k
Elevation: 0 to 930 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Paxton and similar soils: 45 percent
Urban land: 35 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Paxton

Setting

Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear

Across-slope shape: Convex
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile
Ap - 0 to 8 inches: fine sandy loam
Bw1 - 8 to 15 inches: fine sandy loam
Bw2 - 15 to 26 inches: fine sandy loam
Cd - 26 to 65 inches: gravelly fine sandy loam

Properties and qualities
Slope: 3 to 15 percent
Depth to restrictive feature: 20 to 39 inches to densic material
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.1 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: F144AY007CT - Well Drained Dense Till Uplands
Hydric soil rating: No

Description of Urban Land

Typical profile
M - 0 to 10 inches: cemented material

Properties and qualities
Slope: 3 to 15 percent
Depth to restrictive feature: 0 inches to manufactured layer
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Available water supply, 0 to 60 inches: Very low (about 0.0 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: Unranked

Minor Components

Woodbridge
Percent of map unit: 9 percent
Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Concave
Across-slope shape: Linear

Hydric soil rating: No

Charlton

Percent of map unit: 6 percent
Landform: Hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Udorthents

Percent of map unit: 4 percent
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Ridgebury

Percent of map unit: 1 percent
Landform: Drumlins, depressions, ground moraines, hills, drainageways
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Hydric soil rating: Yes

623C—Woodbridge-Urban land complex, 3 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2w68b
Elevation: 0 to 550 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Woodbridge and similar soils: 58 percent
Urban land: 28 percent
Minor components: 14 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Woodbridge

Setting

Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex
Across-slope shape: Linear

Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Ap - 0 to 7 inches: fine sandy loam
Bw1 - 7 to 18 inches: fine sandy loam
Bw2 - 18 to 30 inches: fine sandy loam
Cd - 30 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 3 to 15 percent
Depth to restrictive feature: 20 to 39 inches to densic material
Drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C/D
Ecological site: F144AY037MA - Moist Dense Till Uplands
Hydric soil rating: No

Description of Urban Land

Typical profile

M - 0 to 10 inches: cemented material

Properties and qualities

Slope: 3 to 15 percent
Depth to restrictive feature: 0 inches to manufactured layer
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Available water supply, 0 to 60 inches: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: Unranked

Minor Components

Paxton

Percent of map unit: 9 percent
Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Ridgebury

Percent of map unit: 5 percent
Landform: Hills, drainageways, drumlins, depressions, ground moraines
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Hydric soil rating: Yes

626B—Merrimac-Urban land complex, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2tyr9
Elevation: 0 to 820 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 250 days
Farmland classification: Not prime farmland

Map Unit Composition

Merrimac and similar soils: 45 percent
Urban land: 40 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Merrimac

Setting

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

Typical profile

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

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low

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

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Description of Urban Land

Typical profile
M - 0 to 10 inches: cemented material

Properties and qualities
Slope: 0 to 8 percent
Depth to restrictive feature: 0 inches to manufactured layer
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Available water supply, 0 to 60 inches: Very low (about 0.0 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: Unranked

Minor Components

Windsor
Percent of map unit: 5 percent
Landform: Outwash terraces, dunes, outwash plains, deltas
Landform position (three-dimensional): Tread, riser
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Hydric soil rating: No

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

Hinckley
Percent of map unit: 5 percent
Landform: Deltas, kames, eskers, outwash plains

Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Head slope, nose slope, crest, side slope, rise
Down-slope shape: Convex
Across-slope shape: Convex, linear
Hydric soil rating: No

654—Udorthents, loamy

Map Unit Setting

National map unit symbol: vr1l
Elevation: 0 to 3,000 feet
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 110 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Udorthents, Loamy

Setting

Parent material: Loamy alluvium and/or sandy glaciofluvial deposits and/or loamy glaciolacustrine deposits and/or loamy marine deposits and/or loamy basal till and/or loamy lodgment till

Properties and qualities

Depth to restrictive feature: More than 80 inches
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Minor Components

Udorthents, sandy

Percent of map unit: 10 percent
Hydric soil rating: No

Urban land

Percent of map unit: 5 percent
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear

Udorthents, wet substratum

Percent of map unit: 5 percent

Hydric soil rating: Yes

655—Udorthents, wet substratum

Map Unit Setting

National map unit symbol: vr1n
Elevation: 0 to 3,000 feet
Mean annual precipitation: 32 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 110 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Udorthents, Wet Substratum

Setting

Parent material: Loamy alluvium and/or sandy glaciofluvial deposits and/or loamy glaciolacustrine deposits and/or loamy marine deposits and/or loamy basal till and/or loamy lodgment till

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Minor Components

Urban land

Percent of map unit: 8 percent
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear

Freetown

Percent of map unit: 4 percent
Landform: Depressions, bogs
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Swansea

Percent of map unit: 3 percent

Landform: Depressions, bogs
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

656—Udorthents-Urban land complex

Map Unit Setting

National map unit symbol: 995k
Elevation: 0 to 3,000 feet
Mean annual precipitation: 32 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 110 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Udorthents and similar soils: 45 percent
Urban land: 35 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents

Setting

Parent material: Loamy alluvium and/or sandy glaciofluvial deposits and/or loamy glaciolacustrine deposits and/or loamy marine deposits and/or loamy basal till and/or loamy lodgment till

Properties and qualities

Slope: 0 to 15 percent
Depth to restrictive feature: More than 80 inches
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Description of Urban Land

Setting

Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Excavated and filled land

Minor Components

Canton

Percent of map unit: 10 percent
Landform: Hills

Landform position (two-dimensional): Backslope, toeslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Linear
Across-slope shape: Convex
Hydric soil rating: No

Merrimac

Percent of map unit: 5 percent
Landform: Terraces, plains
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Tread, rise
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Paxton

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Summit, backslope
Landform position (three-dimensional): Head slope, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

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D

Operation & Maintenance Plan

Stormwater Management Operations and Maintenance Plan

KING STREET COMMONS MIXED-USE SUBDIVISION

ASSESSORS MAP U08, LOT 10-0
550 KING STREET
LITTLETON, MASSACHUSETTS

Prepared for:

550 King Street, LLC
280 Merrimack Street
Lawrence, MA 01843

Prepared by:

TEC, Inc.
282 Merrimack Street
Lawrence, MA 01843

August 22, 2023

Stormwater Management Operation and Maintenance Plan
August 22, 2023

Name of Owner: **550 King Street, LLC**
Name of Facility: **King Street Commons**
Location: **550 King Street, Littleton, MA**

A detailed, written log of all scheduled preventative and corrective maintenance performed for the stormwater management measures must be kept by the Applicant, including a record of all inspections and copies of maintenance-related work orders. An "Inspection and Maintenance Check List" shall be maintained as a record of regularly scheduled inspection and maintenance items as outlined below for every year. Maintenance required and actions taken shall be recorded in an "Inspection and Maintenance Log". The funding, operation, and maintenance of all stormwater management Best Management Practices (BMPs) shall be provided by the Owners, or their appointee.

Maintenance routine and schedule: Routine inspections will be conducted on a monthly basis and thorough investigations will be conducted twice a year. Tasks that are common to all systems include regular removal of accumulated sediments, floatables and debris. Inspections will be conducted by a qualified person experienced in drainage design and stormwater management systems.

Subsurface systems have access points located within the parking lots and roadways for ease of access by both personnel and vehicles necessary for maintenance. The BMP locations allow for safe vehicle and pedestrian travel across the site during maintenance activities. Please see Figure 1 for the BMP locations and maintenance areas. The routine inspection and maintenance of BMPs will ensure public safety by preventing clogging and failure of the system.

Annual reports will be prepared detailing the status of the stormwater system and the maintenance performed. A copy of the annual report will be sent to the City of Haverhill Conservation Commission, if requested. Please refer to the Site Plans submitted to the City of Haverhill Conservation Commission for BMP locations.

The Owner agrees to comply with a minimum maintenance schedule as follows:

1. **Inspection and cleaning of catch basins**
   Catch basin grates shall be inspected monthly and cleared of debris to maintain inlet capacity. Sumps and inlets shall be cleaned four (4) times per year and inspected monthly. All sediments shall be properly handled and disposed of in accordance with local, state, and federal guidelines and regulations.

2. **Annual cleaning of outlet control structure.**
   Sumps and inlets shall be cleaned once per year and inspected on a monthly basis. All sediments shall be properly handled and disposed of in accordance with local, state, and federal guidelines and regulations.

3. Quarterly street sweeping of all parking lots and roadways

The parking lots and roadways shall be swept on a quarterly basis. Sweepings shall be concentrated in the late spring after winter sanding and late fall after the leaves have fallen.

4. Semi-annual inspection and maintenance of Contech CDS® water quality units

The water quality units shall be inspected every six months (spring and fall) for the first year to determine oil and sediment accumulation rates. Subsequent inspections will be planned based on the first year's inspection observations, and after any oil or chemical spill. All maintenance including removal and disposal of sediments shall be performed at the time of inspection. All sediments shall be properly handled and disposed of in accordance with local, state, and federal guidelines and regulations. Please see the attached CDS® Inspection and Maintenance Guide provided by Contech.

5. Inspection and cleaning of drainage pipes and manholes

All retained and proposed drainage pipes and manhole structures shall be inspected and cleaned of sediment at least every five (5) years or as required to maintain adequate functionality of the stormwater conveyance system. All sediments shall be properly handled and disposed of in accordance with local, state, and federal guidelines and regulations.

6. Landscaping

Landscaping will be inspected after every major storm event for two (2) months after seeding to ensure functionality. Thereafter, inspections should take place every six (6) months in the spring and fall and after severe storm events. Grass and mulched landscaping showing signs of wear and erosion will be re-loamed/re-seeded or re-mulched as necessary to prevent further erosion from taking place.

7. Snow Removal

Snow will be stored within the landscape islands onsite. Snow will not be stored within or directly adjacent to bordering vegetated wetlands. Salting and/or sanding will be performed as necessary to promote the public's safety.

Public Safety Features

The stormwater infrastructure has been designed to collect and treat surface runoff from the development to prevent negative impacts to the resource area on site and groundwater. Measures shall be taken to prevent surface flooding and erosion as outlined in the Stormwater Operation and Maintenance Plan and the Site Plans.

The Long-Term Pollution Prevention Plan

The Owner agrees to comply with the following Long-Term Pollution Prevention Plan to ensure long-term stormwater quality discharge from the site:

- Good housekeeping practices: The site will be maintained by the owners, including snow removal, de-icing, street sweeping and BMP inspection/maintenance.

- Provisions for storing materials and solid waste products inside or under cover: Residential, retail, and restaurant produced waste will be stored in dumpsters onsite prior to regularly scheduled removal. Hazardous wastes are not anticipated to be produced on this site.

- Vehicle washing controls: Vehicle washing is not anticipated as a reasonably foreseeable use of the site.

- Requirements for routine inspections and maintenance of stormwater BMPs: BMPs will be inspected and maintained by qualified personnel as described in the Stormwater Management Operation and Maintenance Plan.

- Spill prevention and response plans: There are no proposed uses at the site that would provide an opportunity for a spill of oil or hazardous materials, other than a sudden, catastrophic, vehicle failure. If a vehicle release is the result of an accident, the police and fire department will respond and address any release.

- Provisions for maintenance of lawns, gardens, and other landscaped areas: The owner will provide long-term maintenance for the landscaped areas and stormwater BMPs.

- Requirements for storage and use of fertilizers, herbicides, and pesticides: At this time there would be no foreseeable need for the storage of fertilizers, herbicides, and pesticides.

- Pet waste management provisions: Pet waste will be removed by individual dog owners. The site is not anticipated to host a large number of pets.

- Provisions for operation and management of septic systems: Not Applicable.

- Provisions for solid waste management: Solid waste will be stored in dumpsters onsite prior to regularly scheduled removal.

- Snow disposal and plowing plans relative to Wetland Resource Areas: No snow will be stored or disposed of in surrounding resource areas.

- Street sweeping schedules: The owner will be responsible for quarterly street sweeping with sweepings concentrated in the Spring and Fall as stated in the Operations and Maintenance Plan.

- Winter road salt and/or sand use and storage restrictions: Road salt and/or sand will be stored under cover in a subcatchment area that receives TSS treatment prior to drainage to the bordering vegetated wetlands.

- Street sweeping schedule: The owner will perform street sweeping that is consistent with the City of Haverhill's current scheduled sweeping.

- Provisions for prevention of illicit discharges to the stormwater management system: Only stormwater is proposed to be conveyed through the stormwater

management system. No illicit materials will be permitted. The owners will be responsible to maintain this 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: The project location is not considered a LUHPPL.

- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan: Prior to implementation of the LTPPP, the owners shall provide an on-site meeting with the maintenance personnel to present the contents and requirements of the Stormwater Operation and Maintenance Plan and the LTPPP.

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

  550 King Street, LLC
  280 Merrimack Street
  Littleton, Massachusetts 01460

INSPECTION AND MAINTENANCE CHECK LIST –
King Street Commons at 550 King Street, Littleton, MA 01460

For Year: _____

	Inspection Item	Inspection Frequency* Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
1	Catch Basin Inlet												
2	Outlet Control Structure	at least 1 time per year											
3	Contech CDS® Water Quality Units												
4	Drainage Pipes and Manholes	at least every 5 years											
5	Landscaping												
	Maintenance Item	Maintenance Frequency* Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
1	Catch Basin Cleaning	at least 4 times per year											
2	Street Sweeping	at least 4 times per year											
4	Contech CDS® Water Quality Units												
5	Drainage Pipes and Manholes	at least every 5 years											
6	Landscaping	as needed, at least once a year											
7	Snow Removal												

* Actual time of inspecting and maintaining items may vary. Chart shall be used to indicate frequency of events.

** This chart shall be used in conjunction with the attached "Stormwater Management Operation and Maintenance Plan", dated August 22, 2023.

Name of Applicant: 550 King Street, LLC

Name of Project: King Street Commons

Location: 550 King Street, Littleton, MA 01460

Inspection and Maintenance Log

Inspection No.	Date	Inspections Performed	Maintenance Actions Taken
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			

Additional Sheets shall be added as needed

E

CPPP and Erosion Prevention & Sedimentation Control Plan

CONSTRUCTION PERIOD POLLUTION PREVENTION AND EROSION AND SEDIMENTATION CONTROL PLAN
August 22, 2023

Name of Owner: **550 King Street, LLC**
Name of Facility: **King Street Commons**
Location: **550 King Street**
Littleton, MA

This plan presents the minimum measures for the contractor to utilize in preparation of the Stormwater Pollution Prevention Plan (SWPPP) as required by the EPA National Pollutant Discharge Elimination System (NPDES) Construction General Permit. Contractor to provide SWPPP to the Conservation Commission and EPA at least fourteen (14) days prior to start of construction.

Good Housekeeping BMPs

Goals

Minimize the potential for contaminants to enter or runoff the site during construction activities. Fuel and other equipment related fluids will be properly stored. The Contractor shall establish secure storage areas that collect any spillage to meet requirements of the City of Haverhill Fire Department regarding the storage of flammable materials. The Contractor shall complete and submit the plans to the Engineer.

General Requirements

The following presents a proactive approach to all of the best management practices, erosion and sedimentation controls, mitigation measures, and monitoring activities for this Project.

Compost Filter Sock

A compost filter sock is a type of contained compost filter berm. It is a mesh tube filled with composted material that is placed perpendicular to sheet-flow runoff to control erosion and retain sediment in disturbed areas. The filter sock can be used in place of a traditional sediment and erosion control tool such as a silt fence or straw bale barrier.

Compost filter socks are flexible and can be placed along the perimeter of a site, or at intervals along a slope, to capture and treat stormwater that runs off as sheet flow. Filter socks can also be used on pavement as inlet protection for storm drains and to slow water flow in small ditches. Filter socks used for erosion control are usually 12 inches in diameter, although 8 inch, 18 inch, and 24 inch– diameter socks are used in some applications. The smaller, 8 inch–diameter filter socks are commonly used for stormwater inlet protection. The outer shell of a compost filter sock is typically biodegradable and can remain on pervious surfaces post construction versus having to be removed as construction waste.

Pavement Sweeping
Paved areas within the active construction site can be swept on a regular basis to remove larger sediment particles from construction activities. Pavement areas adjacent to the Site will be swept if dirt and debris is tracked from the construction site.

General Maintenance
Refer to the Inspection and Maintenance Checklist (at the end of this section) identifying inspection and maintenance measures for each specific practice.

The contractor or subcontractor will be responsible for implementing each control shown on the Plan. In accordance with EPA regulations, the contractor must sign a copy of a certification to verify that a plan has been prepared and that permit regulations are understood.

The onsite contractor will inspect all sediment and erosion control structures weekly and after each rainfall event meeting the minimum requirements as defined in the Plan. Records of the inspections will be prepared and maintained onsite by the contractor as required by the Plan.

- Silt shall be removed from behind barriers if greater than 6-inches deep, 2/3rds the height of the erosion control barrier, or as needed.
- Damaged or deteriorated items will be repaired immediately after identification.
- The underside of the compost filter sock should be kept in close contact with the earth and reset as necessary.
- Contractor to use rip-rap stone when necessary to manage stormwater during construction.
- Contractor to use erosion control blankets (ECBs) to stabilize sloped areas as necessary to minimize erosion during construction.
- Soil stockpiles in grass areas shall be enclosed by a silt fence and soil stockpiles in paved areas shall be enclosed by compost filter sock or straw bales. All soil stockpiles are to be covered with tarps.
- At a minimum establish good housekeeping BMPs for:
    - Material handling and waste management
    - Staging areas
    - Designate washout areas
    - Equipment vehicle fueling and maintenance
    - Spill prevention and control

Erosion control structures shall remain in place until all disturbed earth has been securely stabilized. After removal of structures, disturbed areas shall be regraded and stabilized as necessary.

Spill Prevention and Control

The Contractor will actively maintain and manage the site activities with the procedures outlined in this Plan. In the event of petroleum or other deleterious substance spill, action will be taken by the Contractor to contain and remove the spill. The Contractor will comply with the relevant section(s) of the Oil Pollution Prevention Act, 40 CFR 112.7.

Responsibility

All project personnel share the responsibility for the initial control and reporting of the oil and other substance spill, especially the personnel that first discover the spill. The Site Safety and Health Officer (SSHO) will be responsible for determining the necessary safety equipment and for establishing safety practices to be followed by the Contractor during the clean-up operations. All personnel will be trained in the use of and location of this equipment, prior to the commencement of the construction.

The Contractor's goal is to provide effective, efficient and coordinated action to minimize or mitigate damages to the environment and public health and welfare from oil or other substance discharges, conforming to applicable federal, state, and local regulations, as well as other provisions and restrictions. In the event of spills or releases that may occur during the Project, a representative on-site qualified by OSHA training requirements (29 CFR 1910.120) for a Level 3 Hazmat Technician will be provided and will have the responsibility and authority for supervising the cleanup. If the representative determines that the clean-up operations are beyond the capacity of the Contractor, assistance shall be requested from its Subcontractor.

In the event of an emergency spill, the Contractor will be responsible for retaining the environmental Subcontractor. The selected environmental subcontractor will develop a Hazardous Materials Health and Safety Plan, which will be referenced when a spill or release is discovered, and the control of the spill or release is beyond the scope of the Spill Prevention Control and Countermeasure plan. The Contractor's Project Manager is responsible for giving the SSHO directions for initiating the Hazardous Materials Health and Safety Plan.

Alert and reporting procedures will become effective immediately upon observance and indication of a spill or discharge of oil or other substances on the project.

Reportable observations are:

1. Leaks or spills
2. Soils which are discolored or have an odor
3. Discharge of oil or other similar substances from drain pipes

The Engineer will be informed immediately of all substantial spills, releases, or other substance discharges. All telephone numbers for the Emergency Response agencies will

be posted on site. The Contractor or its Subcontractors will implement control and countermeasures immediately.

Fuel and Oil Delivery Trucks

The equipment superintendent or designee will monitor all truck unloading procedures to verify all hoses are tight and do not leak, and if necessary, will tighten, adjust, or replace them to prevent a release of any kind. In the event of a major spill, alert and initial report procedures will be implemented, and an emergency response contractor will be called in to perform the cleanup.

Equipment

Motorized equipment that require fuel and oil to operate will be inspected prior to the start of each work shift by the operator (in the field) to ensure there is no leakage of oil, fuel, or other material. Trucks will be inspected prior to use for potential leaks or drips. If a leak is found, repairs will be made immediately, and spillage will be cleaned up manually using sorbent material. Vehicles that are found to be leaking will be immediately taken out of service until repairs can be made.

Drum Storage

Drum storage, if any, will be located in a secure area within the Project limits away from environmental areas of concern. Petroleum liquids and other substances stored in drums will be kept in a drum container that consists of a drum rack and drip containment pan that is capable of containing 110% of the stored volume should the drum rupture.

Lubrication / Oil Maintenance

Replacement lubrication will be directly deposited from the lubrication truck to the equipment lubrication reservoir. No other container system will be used to transport oil to the equipment. Mobile equipment will be serviced off site or in the lay-down area. Equipment that cannot be moved will be serviced in the field. The Contractor will place a containment pan or absorbent below the service area prior to initiating service activities in the field. Waste disposal will be completed by the Contractor or by a waste disposal firm. Miscellaneous lubricants for operating equipment will be limited to daily quantities.

Spent Oil

Oil that has already been used on the job will be disposed of via a certified waste disposal firm. Spent oil will be stored in a labeled (hazardous waste signs) and vented fuel storage cell located at the staging area awaiting disposal by a certified waste disposal firm (i.e. Enpro, Inc.). The staging area will be located within the boundary of the project and inspected daily for leaks or spills. The storage cell will be bermed to contain 110% of the largest container or 10% of the total volume in storage, whichever is greater.

Special Oil Spill Equipment

Sorbent Pads

Sorbent pads will be available to absorb oil and petroleum compounds. If necessary, the pads will be used to absorb oil spills or leaks by placing them on the oil and giving

them antiquated time to absorb it. The sorbent pads will be stored in equipment box located in the maintenance area. The pads shall float and be water repellent, so they can absorb oil on water. Saturated/contaminated pads will be placed in an appropriate container and stored within the maintenance area. A certified waste disposal firm will dispose of the approved containers.

Sorbent Compound

The compound will be used for contaminants spilled on decks or hard surfaces. In most cases, it can be applied directly to spills, but if the spill is large, it can be used to form a dike around the spill to prevent further migration.

Construction and Erosion Control Sequencing Plan

1. Selectively remove vegetation for compost filter tube installation;
2. Install compost filter tube;
3. Install construction fencing at limits of work, and no-disturb/tree save areas, if any;
4. Stabilize construction entrances;
5. Prepare construction trailer/staging location;
6. Strip and stockpile topsoil and pavement;
7. Temporarily stabilize topsoil stockpiles (seed and silt fence (grassed area) or compost filter tube or straw bales (pavement area) around toe of slope);
8. Conduct earthwork cuts and fills to bring site to grade;
9. Construct utilities (water, sewer, storm drain, etc.);
10. Construct roadway/parking/sidewalk pavement areas through binder course;
11. Finish grade landscaping area;
12. Permanently stabilize landscaping areas with seed/landscaping;
13. Construct roadway/parking areas through top course; and
14. Remove all temporary soil erosion and sediment control measures upon permanent site stabilization and approval by the engineer and City of Haverhill.

Best Management Practices – Maintenance/Evaluation Checklist
Construction Practices

Best Management Practice	Inspection Frequency	Date Inspected	Inspector	Minimum Maintenance and Key Items to Check	Cleaning/Repair Needed ☐yes ☐no (List Items)	Date of Cleaning/Repair	Performed by
Compost Filter Sock	Inspect at least once per week and after each rainstorm of 0.25 inch or greater.			• Ensure that compost filter sock is intact and the area behind the sock is not filled with sediment. If there is excessive ponding behind the filter sock or accumulated sediments reach the top of the sock, an additional sock should be added on top or in front of the existing filter sock in these areas, without disturbing the soil or accumulated sediment. • If the filter sock was overtopped during a storm event, the operator should consider installing an additional filter sock on top of the original, placing an additional filter sock further up the slope.			
Catch Basin Silt Sack	Inspect at least once per week and after each rainstorm of 0.25 inch or greater.			• Ensure that silt sack is intact. The silt sack should be removed, emptied, and replaced into the catch basin as needed for proper functioning.			
Pavement Sweeping	To be monitored as needed.			• Paved areas within the active construction site can be swept on a regular basis to remove larger sediment particles from construction activities. Pavement areas adjacent to the Site will be swept if dirt and debris is tracked from the construction site.			

Stormwater Supervisor Contact Information:

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Illicit Discharge Compliance Statement

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Name of Owner: **550 King Street, LLC**
Name of Facility: **King Street Commons Mixed-Use Development**
Location: **550 King Street, Littleton, MA 01460**

The Subdivision Plans and Drainage Report for the Proposed Site Development, located at 550 King Street, Littleton, MA, meets the requirements of Standard 10 of the Massachusetts Stormwater Handbook.

The Site Plans were prepared by qualified personnel at the direction of 550 King Street, LLC. The Site Plans identify the location of stormwater management and utility systems. As designed, the systems do not allow for any connections between stormwater management and sanitary sewer utilities.

Signature: _____
(To be signed prior to occupancy)