Stormwater Report

for

Site Plan Modification
124-126 Grove Street
Franklin, MA

Date: November 5, 2024
Revised: 3/27/2025

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

COMMONWEALTH OF MASSACHUSETTS
DALE
MACKINNON
CIVIL
No. [illegible]575
REGISTERED
PROFESSIONAL ENGINEER

3-28-2025

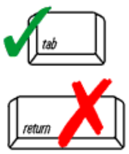
Prepared for:
Key Boston, Inc.
126 Grove Street
Franklin, MA 02038

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.

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.

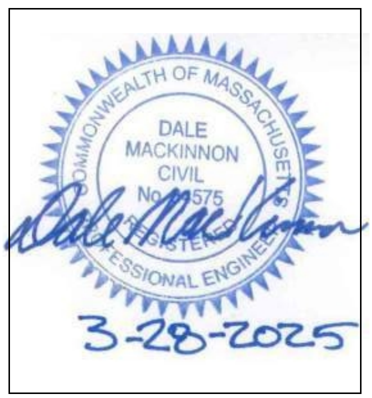
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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

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 (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 (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 (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 (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 (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

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

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

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

Standard 10: Prohibition of Illicit Discharges

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

☒ An Illicit Discharge Compliance Statement is attached;

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

Stormwater Report
126 Grove Street Site Plan Building Expansion
Franklin, MA 02038

Table of Contents

NARRATIVE

This report was prepared on behalf of the applicant, Key Boston, Inc. The project site encompasses an area of 1,086,116 +/- sf. (24.93 +/-Ac.) owned by NEAG Real Estate, LLC and to be developed by the applicant. The property is bordered by commercial properties to the north and east, wetlands and an industrial building to the south, and a single family home with associated agricultural land use to the west. The site is located within the Industrial zoning district and has primary site access from Grove Street from two existing driveways. Portions of the site contain bordering vegetated wetlands and their associated jurisdictional buffers, and portions of the site are located within the Franklin water resource district. The site is not located within a FEMA flood zone. The existing site is presently developed with a 269,105 +/-sf (6.18+/- AC) Warehouse building, with associated parking, utilities, drainage, and landscaping.

PROJECT DESCRIPTION

The Applicant is proposing to construct a 85,150sf +/- addition on the north side of the existing building. The existing northern site entrance will service new loading docks on the west face of the proposed addition, and a new site entrance from Prime Park east of the proposed addition (a private shared driveway located on 124 Grove Street, in common ownership with the project property) is proposed east of the existing building. The project will also expand the southeast truck, loading, parking and maneuvering area, and expand passenger vehicle parking areas near the main entrance. To support the proposed development, the applicant also proposed to construct associated utilities, drainage, grading, and landscaping, as well as modifications to existing site features and infrastructure. The topography consists of natural and constructed slopes ranging from 0% to 50% grade. Portions of existing basins #2 and #3 contain isolated vegetated wetlands as delineated by the ORAD issued 2/13/2024, MassDEP file# 159-1274.

DESCRIPTION OF EXISTING DRAINAGE

The existing developed site drains principally from north to south via a conventional catch basin and manhole system, with captured runoff routed to three existing stormwater basins for treatment, detention, and infiltration, prior to excess flows being discharged to the existing wetlands located on the southern portion of the site. The pre-development drainage area is modeled as nine hydrologic areas. These hydrologic areas are shown on the Pre-Development Watershed Plan attached to this report and are denoted as EX-1 through EX-9.

EX-1, located north of the existing building, contains approximately 123,165 square feet of contributing area, and includes all land which drains directly to the existing basin #3, excluding roof runoff from the existing building. Pavement and other impervious areas are captured by a conventional catch basin and manhole system. Excess runoff from this basin is conveyed by pipe to basin #2 for additional detention and infiltration prior to discharge to the southern bordering vegetated wetlands, AP-1.

EX-2, located west of the existing building, contains approximately 49,694 square feet of contributing area, and includes land which drains overland to existing basin #1 from the western parking area via existing paved & unpaved swales. Excess runoff from this basin is conveyed by pipe to basin #2 for additional detention, treatment and infiltration prior to discharge to the southern bordering vegetated wetlands, AP-1.

EX-3, located south of the existing building, contains approximately 81,237 square feet of contributing area, and includes all land which drains directly to the western forebay of existing basin #2. Pavement and other impervious areas are captured by a conventional catch basin and manhole system, merging with excess runoff from basin #1.

Basin #2 provides detention, treatment, and infiltration prior to discharge to the southern bordering vegetated wetlands, AP-1.

EX-4, located east and southeast of the existing building, contains approximately 38,175 square feet of contributing area, and includes all land which drains directly to the eastern forebay of existing basin #2. Pavement and other impervious areas are captured by a conventional catch basin and manhole system, merging with excess runoff from basin #3. Basin #2 provides detention, treatment, and infiltration prior to discharge to the southern bordering vegetated wetlands, AP-1.

EX-5, located at the southern edge of the developed site, contains approximately 121,653 square feet of contributing area, consists primarily of wooded slopes, and contains all land within the project area not captured by existing drainage infrastructure. Runoff from this hydrologic area flows overland to the bordering vegetated wetlands, AP-1.

EX-6, located south of watershed EX-4, contains approximately 68,451 square feet of contributing area, and includes all land which drains overland directly to existing basin #2. Basin #2 provides detention, treatment, and infiltration prior to discharge to the southern bordering vegetated wetlands, AP-1.

EX-7 contains approximately 269,289 square feet of contributing area and consists of the existing building’s roof area. Runoff from the existing roof is conveyed by pipe to existing basin #3. Excess runoff from this basin is conveyed by pipe to basin #2 for additional detention and infiltration prior to discharge to the southern bordering vegetated wetlands, AP-1.

EX-8, located south of basin #1, contains approximately 23,544 square feet of contributing area, and includes land captured by existing catch basins within the southwest parking area and conveyed by pipe to existing basin #1. Pavement and other impervious areas are captured by a conventional catch basin and manhole system. Excess runoff from this basin is conveyed by pipe to basin #2 for additional detention and infiltration prior to discharge to the southern bordering vegetated wetlands, AP-1.

EX-9, located south of the existing building, contains approximately 11,537 square feet of contributing area, and includes land which drains overland to the existing headwall connected to DMH #6, collecting runoff from the wooded area south of the primary building entrance. This headwall and associated topography has been modelled as a stormwater basin to assess any detention this area may provide. Excess runoff from this basin is conveyed by pipe to basin #2 for additional detention, treatment and infiltration prior to discharge to the southern bordering vegetated wetlands, AP-1.

DESCRIPTION OF PROPOSED DRAINAGE FACILITIES

The proposed drainage system to manage stormwater from the propose development consists of Deep Sump Hooded Catch Basins, Contech CS-4 and CS-8 Cascade Hydrodynamic Separators, Infiltration Basins, and a Cultec subsurface infiltration system. Stormwater from sidewalks, driveways, and parking areas are collected and conveyed by a conventional catch basin and drain manhole system to the infiltration basins and subsurface infiltration system for treatment, detention, and infiltration. Stormwater from the roof of the proposed building is directed to the proposed CS-8 Cascade Hydrodynamic Separator prior to being conveyed to infiltration basin #2 for infiltration. Existing basin #3 and part of existing basin #2 are to be filled during construction.

In the Post-Development condition, eleven hydrologic areas were considered. These watershed areas consider the pavement, lawns, sidewalks, roofs, and drainage facilities proposed to be constructed. These hydrologic areas are shown on the Post-Development Watershed Plan attached to this report and are denoted as PR-1 through PR-11.

PR-1 contains approximately 4,586.9 square feet of contributing area and includes the narrow strip of land north of the proposed addition which is captured by existing catch basins located in Prime Park. Runoff is conveyed by pipe to the East and then discharged to the existing drainage system at 124 Grove Street, which discharges to the bordering vegetated wetland, AP-1.

PR-2, located west of the existing building, contains approximately 49,958 square feet of contributing area, and includes land which drains overland to one of two proposed catch basins from the existing and proposed western parking areas. Pretreatment is provided by a proposed Contech CS-4 Hydrodynamic Separator. Excess runoff from this basin is conveyed by pipe to the proposed subsurface infiltration system and basin #2 for additional detention, treatment and infiltration prior to discharge to the southern bordering vegetated wetlands, AP-1.

PR-3, located south of the existing building, contains approximately 87,670 square feet of contributing area, and includes all land which drains directly to the western side of the Cultec Subsurface Infiltration Chambers. Pavement and other impervious areas are captured by a conventional catch basin and manhole system, merge with excess runoff from basin #1 and discharges to the proposed Cultec system and basin #2 for detention, treatment, and infiltration prior to discharge to the bordering vegetated wetlands, AP-1.

PR-4, located southeast of the existing building, contains approximately 56,112 square feet of contributing area, and includes all land which drains directly to the eastern side of the Cultec Subsurface Infiltration Chambers. Pavement and other impervious areas are captured by a conventional catch basin and manhole system and discharges to the proposed Cultec system and basin #2 for detention, treatment, and infiltration prior to discharge to the bordering vegetated wetlands, AP-1.

PR-5, located at the southern edge of the developed site, contains approximately 89,348 square feet of contributing area, consists primarily of wooded slopes, and contains all land within the project area not captured by existing drainage infrastructure. Runoff from this hydrologic area flows overland to the bordering vegetated wetlands, AP-1.

PR-6, located south of watershed PR-4, contains approximately 44,275 square feet of contributing area, and includes all land which drains overland directly to existing basin #2. Basin #2 provides detention, treatment, and infiltration prior to discharge to the southern bordering vegetated wetlands, AP-1.

PR-7 contains approximately 356,043 square feet of contributing area consist of the existing and proposed roof area. Runoff is conveyed by pipe, merges with runoff from PR-9, receives pretreatment by the proposed Cultec CS-8 Hydrodynamic Separator, and is conveyed to basin #2 for detention, treatment, and infiltration prior to discharge to the bordering vegetated wetlands, AP-1.

PR-8, located south of basin #1, contains approximately 26,155 square feet of contributing area, and includes land captured by existing catch basins within the southwest parking area and conveyed by pipe to existing basin #1. Pavement and other impervious areas are captured by a conventional catch basin and manhole system. Excess runoff from this basin is conveyed by pipe to the proposed Cultec system and basin #2 for additional detention and infiltration prior to discharge to the southern bordering vegetated wetlands, AP-1.

PR-9, located west of the proposed addition, contains approximately 33,014 square feet of contributing area, and includes all land which drains to the proposed catch basins in the proposed loading dock area. Pavement and other impervious areas are captured by a conventional catch basin and manhole system, merges with runoff from PR-7, receives pretreatment by the proposed Cultec CS-8 Hydrodynamic Separator, and is conveyed to basin #2 for detention, treatment, and infiltration prior to discharge to the bordering vegetated wetlands, AP-1.

PR-10, located south of PR-8, contains approximately 14,533 square feet of contributing area and includes all land which drains to proposed catch basin CB 24-1. runoff is conveyed by pipe to the east and merges with flows from PR-3 and basin #1, discharging to the proposed subsurface detention system and basin #2 for detention, treatment, and infiltration prior to discharge to the bordering vegetated wetlands, AP-1.

PR-11, located northeast of the building, contains approximately 13,864 square feet of contributing area and includes all land which drains to proposed catch basin CB 24-3, 4, & 5. runoff is conveyed by pipe to the south and merges with flows from PR-3, PR-7, and PR-9, receives pretreatment by the proposed Cultec CS-8 Hydrodynamic Separator, and is conveyed to basin #2 for detention, treatment, and infiltration prior to discharge to the bordering vegetated wetlands, AP-1.

This report documents design compliance with the applicable sections of the Massachusetts Stormwater Management Standards 1-10.

Stormwater Design Parameters:

The stormwater management system was designed to control the post-development rate of peak rainfall runoff from the site by keeping it below the post-development peak rate of rainfall runoff as stated as the objective in the Massachusetts Stormwater Handbook. The calculations were performed using the HydroCAD hydraulic program, developed by applied Microcomputer System. The HydroCAD software is based upon the Soil Conservation Service, "Technical Release 55 – Urban Hydrology for Small Watersheds" and is generally accepted industry methodology.

The analysis was performed for the 2-year, 10-year, 25-year, and 100-year 24-hour storm events.

The following data was required for input:

- Watershed Area: Areas of each watershed were calculated and expressed in square feet for these calculations.
- SCS Curve Number (Cn): Based on the cover type and hydrologic soil group, a weighted curve number (CN) was determined for each of the existing watersheds utilizing Table 2-2a- *Runoff Curve Numbers For Urban Areas* and *Worksheet 2, Runoff Curve Number and Runoff* from the Soil Conservation Service Technical Release 55 – Urban Hydrology for Small Watersheds.
- Time of Concentration, Tc (Minutes): The time of concentration for each watershed was determined by finding the time necessary for runoff to travel from the hydraulically most distant point in the watershed to the point of analysis. This was calculated by using a minimum time of 6 minutes for runoff to reach the most distant catch basin.
- SCS 24-Hour Storm Type: For the greater New England region, a Type III storm rainfall distribution is recommended for drainage calculations and was used for this project.
- Rainfall Precipitation: Rainfall precipitations used the Atlas-14 Volume 10, Version 3 rainfall estimates for the site, obtained from the NOAA Precipitation Frequency Data Server (PFDS) for the 2, 10, 25, and 100 year storm events and are as follows:

2-year storm event:	3.36 inches
10-year storm event:	5.22 inches
25-year storm event:	6.39 inches
100-year storm event:	8.18 inches

An on-site conventional storm drainage collection system is designed based on the "Rational Method" using Manning's equation to carry a minimum 25-year storm event and underground culverts to carry a minimum 50-year storm event through the site (See Pipe Sizing Attachments). The proposed drainage pipes will be Reinforced Concrete Pipe (RCP), unless otherwise noted on the plans.

Standard 1: No new stormwater conveyances (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.

All runoff from impervious areas will sheet flow across the pavement areas, accumulate into hooded catch basins, connect with drain pipe to a chamber system with separator row or sediment forebay, and discharge to the infiltration basins. No new untreated stormwater discharges are proposed.

Standard 2: Stormwater management systems shall be designed so that the post-development peak discharge rates do not exceed pre-development peak discharge rates.

To meet Standard 2, the post-development peak discharge rate must be equal to or less than pre-development rates to prevent storm damage and downstream and offsite flooding from the 2-year,10-year, and 100 year 24-hour storm events.

Peak discharge rates volumes were calculated and evaluated at one analysis point. The point of evaluation is shown on the accompanying watershed plans. The projects discharges to Grove Street or abutting properties are de minimis in both the existing and proposed conditions and were not included as separate analysis points in the stormwater analysis.

In summary of the attached drainage analysis (HydroCAD), the peak discharge rates at the point of evaluation in cubic feet per second (cfs) are as follows;

	Storm Events	Run off Pre-dev. (cfs)[af]	Run off Proposed (cfs)[af]	Run off Change (cfs)[af]
Analysis Point 1 (AP-1)	2-year	(0.01)[0.004]	(0.02)[0.011]	(0.01)[0.007]
	10-year	(0.76)[0.639]	(0.50)[0.297]	(-0.26)[-0.342]
	25-year	(2.38)[1.743]	(1.58)[1.186]	(-0.80)[-0.557]
	100-year	(4.87)[3.628]	(4.55)[2.766]	(-0.32)[-0.862]

G&H considers the minor increases in peak rate and volume during the two year storm de minimis, noting that the 0.01cfs and 0.007af increases occur over the approximately 1,100’ +/- of wetland boundary that is AP-1, and these increases are anticipated to have no discernable impact on the analysis point or downgradient sites, consistent with the goals and objectives of standard 2.

Standard 3: Loss of annual recharge to ground water shall be eliminated or minimized through the use of environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type. This standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook.

Soil Evaluation

Soil evaluation is broken down into two stages. Stage 1 identifies the underlying soils just beneath the surface that contribute to how much runoff is generated as stormwater falls and moves across the surface. Stage 2 evaluates the soils in direct contact with the proposed infiltration BMPs. The attachments section includes the NRCS Soil Survey used for Stage 1 while the site plan set and Geotechnical Reports prepared by Northeast Geotechnical include the on-site soil textural analysis and in-situ permeability testing results in the specific locations that infiltration is proposed. The information from the NRCS Soil Survey is included on the Pre and Post Development Watershed Plans.

Recharge Volume

Soils underlying the site are defined as map unit 10 Scarboro and Birdsall soils, 0 to 3 percent slopes, 71B Ridgebury fine sandy loam, 3 to 8 percent slopes – extremely stony, 103B Charlton-Hollis-Rock Outcrop complex, 3 to 8 percent slopes, 245B Hinckley Loamy Sand, 3 to 8 percent slopes, 253D Hinckley Loamy Sand, 15 to 35 percent slopes, 254B Merrimac Fine Sandy Loam, 3 to 8 percent slopes, 255C Windsor Loamy Sand, 8 to 15 percent slopes, and map unit 653 Udorthents, sandy. Map unit 1 – Water is also present on the USGS soil map, however it is located largely within the footprint of the existing building and no surface water was observed in this location. Soil borings in this location identify an approximately 10' thick layer of sandy fill over a 13' layer of natural sand. We have estimated the soil as a mix of hydrologic group "A" for the majority of the upland portion of the site and "D" for the remaining portion of the site underlain by map unit 10 Scarboro and Birdsall soils, based on Web Soil Survey USDA/NRCS Soil Map. A geotechnical report, prepared by Northeast Geotechnical, Inc, has been included, and provides boring and test pit data within the proposed work areas for the project. The infiltration design is based on a Type A Soil "1982 Rawls Rates" of 2.41 in/hr for the existing and proposed Infiltration Basins, and 1.02 in/hr for the proposed 40B Infiltration Basins. See attached Geotechnical Engineering Report.

Table 2: Basin #1 Required Recharge Volume Calculation

Hydrologic Group	**Recharge** (in/sqft)	**Impervious** (sqft)	**Volume** (cf)
A - *sand*	0.60	559,049.0	27,952.5
B - *loam*	0.35	40,554.4	0
C - *silty loam*	0.25	75,968.6	0
D - *clay*	0.10	5,009.4	41.74
		Required Recharge Volume Total	**27,994.2 cf**

Stormwater Basin Sizing

There are three ways of determining the recharge volume provided by a storm water basin (Static, Simple Dynamic, and Dynamic Field). The Static Method, used here, includes the volume of water that can be stored beneath the lowest outlet of the basin. This, the most conservative method of determining the recharge volume, doesn't account for any infiltration that takes place while the basin is filling with water and is less dependent on maintenance of the basin since the only way for the water below the lowest invert can leave the basin is though infiltration. The following table summarizes the recharge volume provided by the infiltration chambers. Detailed volume calculations for the basin are included in the attachments.

Table 3: Basin Recharge Volumes

	Recharge Volume
Basin 1 @ 275.0	9,136 cf
Basin 2 @ 256.2	122,035 cf
Total	131,171 cf

72-hour Drawdown

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

A Massachusetts Certified Soil Evaluator performed an evaluation of the soil at the proposed infiltration BMP. Soil testing and borings within the footprint of existing stormwater basin #2 determined the underlying parent material soil to include layers of Sand and Loamy Sand. The soil textural analysis for the infiltration BMPs are listed below with the associated hydraulic conductivity rates used in the HydroCAD calculations. Where textural analysis varied within any single BMP, the most restrictive textural evaluation and Rawls Rate were used. Soil logs of the in situ soil evaluation and permeability testing are included within the Site Plan set and Geotechnical Reports.

Table 4: Rawls Rate

	Basis for determination of infiltration rate:	**Permeability Testing Results:**	**Most Restrictive Soil Texture**	**Assumed Hydraulic Conductivity Rate (in/hour)**
Infiltration Basin 1	In-situ testing	None (TP-102), 2.1 in/hr (TP-103)	Loam (TP-101 & 102)	none
Infiltration Basin 2	In-situ testing	1.8 in/hr (TP-104) 30.3 in/hr (TP-105)	Silt Loam (TP 104) Sand (TP 105)	1.02 in/hr
Cultec R902HD Chambers	Rawls Rate	N/A	Loamy Sand	2.41 in/hr

Drawdown time for the Infiltration Basin #2 and chamber system is modeled by HydroCAD and included in the attachments. The following table summarizes the drawdown time for the basin to show it will drawdown within the 72-hour maximum.

Table 5: Basin Drawdown

	Time for Drawdown
Infiltration Basin 1	not modeled
Infiltration Basin 2	70 hours
Cultec System	34 hours

Existing Infiltration Basin #1 could not be modeled due to the in-situ permeability testing for TP-102 resulting in no observed infiltration over 30 minutes. The testing at TP-103, also within the limits of Basin #1, yielded a infiltration rate of 2.1 in/hr, a relatively fast rate, and a sand parent material also indicates a strong potential for recharge. The full soil boundaries within the basin cannot be determined without significant disturbance of the existing basin, and accordingly, the basins infiltration performance cannot be accurately modelled. However, Basin #1 has been consistently de-watering after rain events during its operation. The watershed characteristics, impervious contributing areas, and pond outlet device are not proposed to be significantly altered as a result of this project. This results in the volume requiring recharge after a storm within this basin to remain unchanged, as will the ponds infiltration performance. Accordingly, it is our opinion that Basin #1 will dewater in a manner consistent with its pre-development performance.

The infiltration performance within Basin #2 is impacted by the presence of wetlands within the western portion of the basin. To account for this, the storage volume associated with the wetlands portion of basin #2 has been excluded from the exfiltration model in HydroCAD.

Standard 4: Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This standard is met when:

a) Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan, and thereafter are implemented and maintained;

b) Structural stormwater best management practices are sized to capture the required water quality volume as determined in accordance with the Massachusetts Stormwater Handbook; and

c) Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.

The Water Quality Volume requiring 80% TSS removal, is calculated as follows:

The required water quality volume is based on 1.0” as the soil recharge rate is 2.41 in/hr for portions of the site, meeting the threshold rate of 2.4 in/hr or greater. In addition, portions of the site lie within the Franklin Watershed Protection District (WPRD) Zone II. The water quality volume equals 1.0 inches of runoff times the increased impervious area of the post-development site.

Basin #1 Required Water Quality Volume:

Proposed Site Impervious Area = 32,931.4 sf
Impervious area to be treated = **32,931.4 sf**

Total volume to be treated:
1.0” x 1’/12” x 32,931 sf = 2,744 **cf Water Quality Volume Required**

Basin #1 Provided Water Quality Volume:

Infiltration Basin 1 Treatment volume:

(Storage below lowest invert @ 274.00) = 2,125 cf

Additional water quality volume is provided within the Cultec Subsurface Chamber System

Cultec System Required Water Quality Volume:

Proposed contributing area Impervious Area = 184,607 sf
Impervious area to be treated = **184,607 sf**

Total volume to be treated:
1.0” x 1’/12” x 184,607 sf = 15,384 **cf Water Quality Volume Required**

Cultec System Provided Water Quality Volume:

Cultec System Treatment volume:

(Storage below lowest invert @ 269.50) = 41,507 cf

Basin #2 Required Water Quality Volume:

Proposed Site Impervious Area = 564,798.9 sf
(Includes all impervious area from Basin #1 and Cultec System Contributing areas)

Impervious area to be treated = **564,798.9 sf**

Total volume to be treated:
1.0” x 1’/12” x 564,798.9sf = 47,066.6 **cf Water Quality Volume Required**

Basin #2 Provided Water Quality Volume:

Infiltration Basin 2 Treatment volume:

(Storage below lowest invert @ 355.75) = 67,224 cf

Water Quality Unit Sizing

All the stormwater from impervious areas is collected and discharged to one of two Contech Cascade Hydrodynamic Separators. Water Quality Flow Rates were calculated in accordance with the procedures outlined within the Massachusetts Stormwater Management Handbook. Detailed calculations from the manufacturer for the two Contech units are included in Appendix 5.

Water Quality Flow Rate = (qu)(A)(WQV)

DMH 24-20:

qu = 774 csm/in
A = 0.299 acres = 0.0004664 sq.mi.
WQV = 1"

DMH 24-20 required WQFR = 0.36 cfs
Cascade CS-4 maximum rated treatment capacity = 1.8 cfs

DMH 24-18:

qu = 774 csm/in
A = 8.724 acres = 0.013631 sq.mi.
WQV = 1"

DMH 24-5 required WQFR = 10.55 cfs
Cascade CS-8 maximum rated treatment capacity = 12.0 cfs (off-line configuration)

See TSS Removal Calculations in Attachment Section.

Separator Row Sizing

The proposed Cultec Separator Row was sized by calculating an equivalent water quality flow rate in accordance with the MassDEP Wetlands Program "Standard Method to Convert Required Water Quality Volume to a Discharge Rate for Sizing Flow Based Manufactured Proprietary Stormwater Treatment Practices" and Rhode Island Department of Environmental Management's Alternative Stormwater Technology Certification issued April 9, 2024 for the Cultec Separator Row (see supplemental attachments).

Chamber System:
Water Quality Flow Rate=(qu)(A)(WQV)
Qu = 774 csm/in (6 min Tc, 1.0" WQV)
A = 3.48 Ac = 0.005442 sq. mi.
WQV = 1.0"
Water Quality Flow Rate = 4.2cfs

The RIDEM certification specifies a maximum treatment flow rate for the Cultech Recharger 902HD of 0.11cfs per chamber in Table 1. The separator rows for the chamber system are designed as an offline pretreatment BMP as required by the manufacturer specifications.

Chamber System #1 Maximum Treatment Flow Rate provided:
0.11 cfs/chamber x 46 chambers = 5.06 cfs

MS4 Bylaw Compliance:

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

The total impervious area, including roofs, is 564,799 square feet. The equivalent 1" of runoff from these surfaces is 47,067 cubic feet. The total storage provided below the lowest inverts out are as follows. See Appendix 5 – Stage -Area-Storage calculations.

Basin 1 @ Elev. 274.00 = 2,125 cf
Basin 2 @ Elev. 255.75 = 99,575 cf
Cultec Chambers @ Elev. 269.50 = 41,507cf

Total Storage Volume Required = 47,067 cf
Total Storage Volume Provided = 143,207 cf

Standard 4: requires the development and implementation of suitable practices for source control and pollution prevention. These measures must be identified in a long-term pollution prevention plan.

The long-term pollution prevention plan is incorporated into the Operation and Maintenance Plan required by Standard 9.

Standard 5: For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable.

The proposed project is not a use with higher potential pollutant loads.

Standard 6: Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply and stormwater discharges near or to any other critical area require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas, as provided in the Massachusetts Stormwater Handbook.

The subject property discharges stormwater within the Franklin Water Resource District. In addition, soils with rapid recharge rates in the area of the infiltration basin are present on site. Accordingly the Water Quality Volume is calculated using the required 1.0" rule, and 44% TSS removal is achieved prior to discharge to the infiltration basin. See Standard 4 for computations. The design utilizes stormwater BMPs designated as suitable for critical areas within the Massachusetts Stormwater Handbook. No metal roof is proposed.

Standard 7: A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable:

This project is a mix of redevelopment and new development. The project has been designed to meet all applicable stormwater standards where possible. 80% TSS removal is achieved for the net increase in impervious area prior to discharge to the IVW within Basin #2, and a hydrodynamic separator has been provided to treat the remainder of impervious contributing areas associated with the redevelopment portion of the project to at least 65% TSS removal prior to discharge to Basin #2, an improvement over the pre-development treatment of 44%.

Prior to discharge to the BVW identified on the Watershed Plans as AP-1, 80% TSS removal or greater is achieved for the entire water quality volume associated with the total site impervious area (see Standard 4 documentation above).

The pre-existing non-conforming setbacks to BVW and IVW for Basin #2 will not be increased or expanded upon, and the project will result in an overall increase to the protection of these wetland resource areas.

Standard 8: A plan to control construction-related impacts, including erosion, sedimentation, and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented.

During land disturbance and construction activities, project proponents must implement controls that prevent erosion, control sediment movement, and stabilize exposed soils to prevent pollutants from moving offsite or entering wetlands or waters. Land disturbance activities include demolition, construction, clearing, excavation, grading, filling, and reconstruction.

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

A. Names of Persons or Entities Responsible for Plan Compliance

Key Boston, Inc.
126 Grove Street
Franklin, MA 02038
Tel: 508-298-7402 Owner Signature____

B. Construction Period Pollution Prevention Measures

1. Inventory materials to be present on-site during construction.
2. Train employees and subcontractors in prevention and clean up procedures.
3. All materials stored on site will be stored in their appropriate containers and if possible, under a roof or covered.
4. Follow manufacturer's recommendation for disposal of used containers.
5. Store only enough product on site to do the job.
6. On site equipment, fueling and maintenance measures:
    a. Inspect on-site vehicles and equipment daily for leaks.
    b. Conduct all vehicle and equipment maintenance and refueling in front of building, away from storm drains.
    c. Perform major repairs and maintenance off site.
    d. Use drip pans, drip cloths or absorbent pads when replacing spent fuels.
    e. Collect spent fuels and remove from site, per Local and State regulations.
    f. Maintain a clean construction entrance where truck traffic is frequent to reduce soil compaction constant sweeping is required and limit tracking of sediment into streets, sweeping street when silt is observed on street.
7. Stockpile materials and maintain Erosion Control around the materials where it can easily be accessed. Maintain easy access to clean up materials to include brooms, mops, rags gloves, goggles, sand, sawdust, plastic and metal trash containers. Locate stockpile locations outside the 100' wetland buffers identified on the site plans.
8. Stabilize areas of temporary or permanent disturbance within 7 days of completion, or, if work remains, if these areas are expected to remain open for greater than 14 days. Utilize New England Erosion Control/Restoration seed mix unless otherwise identified on site plans or within wetland replication plan.
9. Stabilize soil stockpiles with hydroseeding if expected to remain unused for greater than 14 days. Use New England Erosion Control/Restoration seed mix or approved equivalent.
10. Clean up spills.
    a. Never hose down "dirty" pavement or impermeable surfaces where fluids have spilled. Use dry clean up methods (sawdust, cat litter and/or rags and absorbent pads).

b. Sweep up dry materials immediately. Never wash them away or bury them.
c. Clean up spills on dirt areas by digging up and properly disposing of contaminated soil in a certified container and notify a certified hauler for removal.
d. Report significant spills to the Fire Department.

11. It is the responsibility of the site superintendent or employees designated by the Applicant to inspect erosion control and repair as needed, also to inspect all on site vehicles for leaks and check all containers on site that may contain hazardous materials daily.

C. <u>Construction Erosion and Sedimentation Control Plan.</u>
See “Site Plan Modification, 124/126 Grove Street, Franklin, Massachusetts” prepared by Guerriere & Halnon, Inc. Dated 11/05/24 and revised 3/27/2025

D. <u>Site Development Plans</u>.
See “Site Plan Modification, 124/126 Grove Street, Franklin, Massachusetts” prepared by Guerriere & Halnon, Inc. Dated 11/05/24 and revised 3/27/2025

E. <u>Construction Sequencing Plan</u>

a. A NPDES NOI shall be filed with the EPA.
b. Record Order of Conditions - The site superintendent shall be aware of all the Conditions contained within the Order including inspection schedules
c. Install DEP File # Sign prior to commencement of work.
d. Prior to any work on the site including tree/brush clearing, the approved limit of clearing as well as the location of the proposed erosion control devices (such as mulch socks) must be staked on the ground under the direction of a Massachusetts registered Professional Land Surveyor.
e. Install erosion control barriers and temporary construction entrances at locations depicted on the plans.
f. Erosion control to be inspected by either the design engineer (or agent) or an erosion control monitor appointed by the Town of Franklin.
g. Perform tree/brush removal.
h. Construct temporary wetland replication access path. Adjust path in field to avoid damage to trees greater than 2” caliper.
i. Begin construction of wetland replication when appropriate. Follow Construction and Installation instructions outline in “Isolated Vegetated Wetland Replication Plan” prepared by Goddard Consulting, dated October 31, 2024. Wetland replication plantings should take place in the spring or fall growing seasons.
j. Strip off top and subsoil. Stockpile material to be reused away from the wetland, remove excess material from the site. Install and maintain erosion control barrier around stockpile.
k. Rough grade site, maintaining temporary low areas/sediment traps for sediment accumulation and away from the wetlands and prevent sedimentation from migrating from the site.
l. Construct retaining wall, drainage outfalls, underdrains, modifications to stormwater basins #1 & #2, and Subsurface Chamber System. Protect all stormwater inlets, basins, and chambers with additional erosion control as necessary to prevent siltation during construction. Stabilize side slopes with loam, seed and mulch.
m. Install underground utilities, including manholes and catch basins; protect all open drainage structures with erosion/siltation control devices.
n. Begin construction of building foundation.
o. Install binder course of bituminous asphalt.

p. Begin landscaping work for completed areas and installation of proposed plantings.
q. Complete construction of building.
r. Install wearing course of asphalt, and striping (where required).
s. Complete landscaping work and required plantings.
t. Maintain all erosion control devices until site is stabilized and a Certificate of Compliance is issued by the Conservation Commission.
u. The Contractor shall be responsible to schedule any required inspections of his/her work.

F. Construction Waste Management Plan

a. Dumpster for trash and bulk waste collection shall be provided separately for construction.
b. Recycle materials whenever possible (paper, plaster cardboard, metal cans). Separate containers for material are recommended.
c. Segregate and provide containers for disposal options for waste.
d. Do not bury waste and debris on site.
e. A Concrete Truck wash-out station must be installed. Locate wash-out station outside the 100' wetland buffers identified on the plans.
f. Certified haulers will be hired to remove the dumpster container waste as needed. Recycling products will also be removed off site weekly.
g. The sewer system is only for disposal of human waste, and substances permitted for disposal in the site sewer permit with the Town B.O.H.

G. Operation and Maintenance of Erosion and Sedimentation Controls

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

H. Inspection and Maintenance Schedules

1. Inspection must be conducted at least once every 7 days and within 24 hours of the end of a storm event 0.5 inches or greater.
2. Inspection frequency can be reduced to once a month if:
   a. The site is temporarily stabilized.
   b. Runoff is unlikely due to winter conditions when site is covered with snow or ice.
3. Inspections must be conducted by qualified personnel, "qualified personnel" means a person knowledgeable in the principles and practice of erosion and sediment controls and who possess the skills to assess the conditions and take measures to maintain and ensure proper operation, also to conclude if the erosion control methods selected are effective.
4. For each inspection, the inspection report must include: (See attached inspection and maintenance log)
   a. The inspection date.
   b. Names, titles of personnel making the inspection.
   c. Weather information for the period since the last inspection.
   d. Weather information at the time of the inspection.
   e. Locations of discharges of sediment from the site, if any.
   f. Locations of BMP's that need to be maintained.

g. Locations of Erosion Control Measures that need to be maintained
h. Locations where additional BMP’s may be required.
i. Corrective action required or any changes to the SWPPP that may be necessary.

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

Inspection Schedule:	
Erosion Control	Weekly
Catch Basins	Weekly
Temporary Sedimentation Traps/Basins	Weekly
Street Sweeping	Weekly

Maintenance Schedule	
Erosion Control Devices Failure	Immediately
Catch Basins	Sump 1/4 full of sediment
Temporary Sedimentation Trap/Basin	As needed
Street Sweeping	14 days minimum and prior to any significant rain event.

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

The individual responsible for plan compliance shall keep a log of the inspections and maintenance, and the report shall be submitted to the conservation office on a weekly basis detailing the state of the erosion control and any steps taken to address any issues with failure of the barriers.

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

Standard 9: A Long –Term Operation and Maintenance (O&M) Plan shall be developed and implemented to ensure that storm water management systems function as designed.

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

A. Names of Persons or Entities Responsible for Plan Compliance;

Key Boston, Inc.
126 Grove Street
Franklin, MA 02038
Tel: 508-298-7402 Signature____

Amendments to the maintenance schedule must be made by Mutual Agreement of the Franklin DPW Director and the responsible parties.

B. Stormwater Management System Owner

Key Boston, Inc.
126 Grove Street
Franklin, MA 02038
Tel: 508-298-7402 Owner Signature____

The property owner must notify the Franklin DPW Director of any changes in ownership or assignment of financial responsibility to a new entity. Notification must be provided to future property owners of the presence of the stormwater management system, as well as its Operation and Maintenance requirements. A copy of this Long Term O&M Plan must be provided to new owners, and a disclosure notice included within the Deed notifying the new owner of their responsibility for the Stormwater Management System and the requirements of this O&M Plan.

C. Good housekeeping practices

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

D. Requirements for routine inspections and maintenance of stormwater BMPs

1. Plans: The stormwater Operation and Maintenance Plan shall consist of all Plans, documents and all local state and federal approvals as required for the subject property.
2. Record Keeping:
    a. Maintain a log of all operation and maintenance activities for at least three years following construction, including inspections, repairs, replacement and disposal (for disposal, the log shall indicate the type of material and the disposal location).
    b. Make this log available to MassDEP and the Conservation Commission upon request; and
    c. Allow MassDEP and the Conservation Commission to inspect each BMP to determine whether the responsible party is implementing the Operation and Maintenance Plan.
3. Descriptions and Designs: The Best Management Practices (BMP) incorporated into the design include the following.

a. Street Sweeping – Stipulated within the Construction Period Pollution Prevention Plan, the Long-Term Pollution Prevention Plan, and the Operation and Maintenance Plan. As the amount of TSS removal is discretionary, no credit was taken within the calculations for this BMP.
b. Deep Sump Catch Basins with Hoods - Installed to promote TSS Removal of solids and control floatable pollutants. This BMP has a design rate of 25% TSS Removal.
c. Contech Cascade Hydrodynamic Separators - installed to promote TSS Removal of solids. These proprietary BMPs have a variable rate of TSS removal, see manufacturer calculations in attachment section of this report. For purposes of documentation of meeting required removal rates, these BMPs have an assigned removal rate of 50%.
d. Cultec Subsurface Infiltration System – the subsurface detention BMP provides additional detention, treatment, and infiltration for the purpose of mitigating offsite stormwater impacts. This BMP has an assigned TSS Removal Rate of 80% Refer to TSS Removal Worksheet included in the Attachments.
e. Infiltration Basin - provided to promote groundwater recharge, detention, and the required 80% TSS Removal. Refer to TSS Removal Worksheet in Standard 4 for treatment train.
f. Safety Fencing - Provide 6-FT high chain link fence with lockable gates around detention basin for public safety.
g. Spill Containment Kit to contain and clean-up spills that could occur on site.

4. BMP Maintenance: After construction it is the responsibility of the owner to perform maintenance. The cleaning of the components of the stormwater management system shall generally be as follows:
a. Roadway: The owner shall keep the roadway swept with a mechanical sweeper or hand swept semi-annually at a minimum.
b. Catch Basins: Shall be cleaned by excavating, pumping or vacuuming four times per year and at the end of foliage and snow removal seasons. The sediment shall be disposed of off-site by the Owner. Inspect quarterly, remove silt when ¼ full.
c. Water Quality Manholes: Inspect twice a year. Clean structure when sediment accumulation reaches a depth of 2.0ft. Cleaning is generally done with the combination of a high pressure spray jet and vacuum truck and is the most effective and convenient method. A maintenance log shall be kept for all maintenance activities
d. Cultec Subsurface Infiltration System: Inspect after 1 years of commission using the inspection port or manhole via a CCTV and inspect every year thereafter or as needed depending on rainfall and site conditions. Cleaning with high pressure water through culvert cleaning nozzle when sediment accumulation reaches a depth of 3 inches or more. A maintenance log shall be kept for all maintenance activities. Follow manufacturer maintenance guide included in appendix of this report.
e. Infiltration Basins: Preventative maintenance shall be performed at least twice per year. Inspection shall be performed after every major storm for the first three months and twice a year thereafter and when there are discharges through the high outlet orifice. Mowing of the buffer area, and bottom of basin; removal of trash and debris; removal of grass clippings and organic matter to be performed at least twice per year. Pretreatment devices shall be inspected every other month and a least twice a year and after every major storm event.
f. Rip-rap Aprons/Outfalls: Preventative maintenance shall be performed at least twice per year, in concurrence with the inspection of the corresponding Infiltration Basin. Inspection shall be performed after every major storm for the first three months and twice a year thereafter and when there are discharges through the high outlet orifice. Remove debris, leaf litter, and any accumulated sediment. Remove this material from the site, do not dispose adjacent to the outlets or within wetland resource areas and their associated buffers.

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

E. Spill prevention and response plans

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

F. Provisions for maintenance of lawns, gardens, and other landscaped areas

Use only organic fertilizer. Dispose of clippings outside of the 100-foot buffer zone to the adjacent wetland.

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

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

H. Provisions for operation and management of septic system

Site to be serviced by town sewer.

I. Requirements for handling of pet waste

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

J. Provisions for washing of vehicles

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

K. Provisions for solid waste management

1. Waste Management Plan
   a. Recycle materials whenever possible (paper, plaster cardboard, metal cans). Separate containers for material are recommended.
   b. Do not bury waste and debris on site.

c. Certified haulers will be hired to remove the dumpster container waste as needed. Recycling products will also be removed off site weekly.

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

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

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

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

N. Street sweeping schedules

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

O. Easements

Existing utility and other easements are identified on the Site Plans: “Site Plan Modification, 124/126 Grove Street, Franklin, Massachusetts” prepared by Guerriere & Halnon, Inc. Dated 11/05/24 and revised 3/27/2025

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

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

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

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

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

Key Boston, Inc.
126 Grove Street
Franklin, MA 02038
Tel: 508-298-7402 Owner Signature____

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

S. Estimated BMP Maintenance Costs

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

BMP	Estimated Maintenance Cost
Pavement sweeping	$ 400 per year
Catch basin & WQMH cleaning	$ 200 per catch basin per cleaning
Subsurface Infiltration System	$ 1,000 per cleaning
Infiltration Basin	$ 200 per cleaning
Spill Containment Kit	$ 750 purchase price

Standard 10: All illicit discharges to the stormwater management system are prohibited.

Standard 10 prohibits illicit discharges to stormwater management systems. The stormwater management system is the system for conveying, treating, and infiltrating stormwater on site, including stormwater best management practices and any pipes intended to transport stormwater to the ground water, a surface water, or municipal separate storm sewer system. Illicit discharges to the stormwater management system are discharges that are not entirely comprised of stormwater. Notwithstanding the foregoing, an illicit discharge does not include discharges from the following activities or facilities: firefighting, water line flushing, landscape irrigation, uncontaminated ground water, potable water sources, foundation drains, air conditioning condensation, footing drains, individual resident car washing, flows from riparian habitats and wetlands, dechlorinated water from swimming pools, water used for street washing and water used to clean residential buildings without detergents.

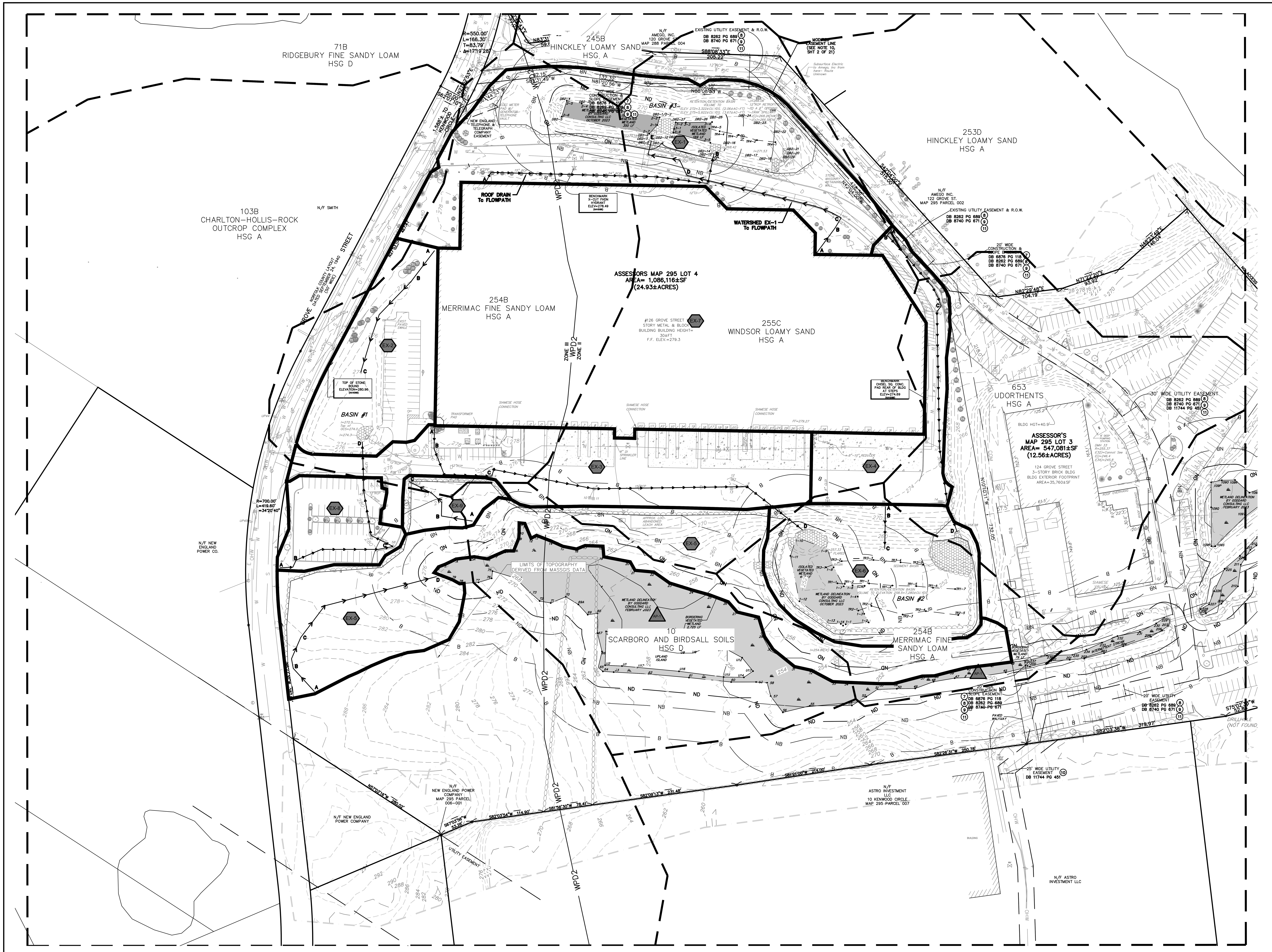
Illicit Discharge Compliance Statement

It is the intent of the Applicant, Key Boston, Inc., 126 Grove Street, Franklin, MA 02038 to prevent illicit discharges to the stormwater management system, including wastewater discharges and discharges of stormwater contaminated by contact with process wastes, raw materials, toxic pollutants, hazardous substances, oil, or grease. There will be no connection to the storm water system to inadvertently direct other types of liquids, chemicals or solids into the storm drainage system. The Owner will also promote a clean Green Environment by mitigating spills onto pavements; oils, soda, chemicals, pet waste, debris and litter.

Respectfully Acknowledged,

ATTACHMENTS

Pre- Post Drainage Plans



F4593

APPROVED DATE:

FRANKLIN PLANNING BOARD

BEING A MAJORITY

LEGAL NOTES

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

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

OWNER

A.M. 295 LOT 003
NEAG REAL ESTATE LLC
126 GROVE ST
FRANKLIN, MA
DEED BOOK 41715 PAGE 121
PLAN No. 253 OF 1989 PLAN Bk. 379

APPLICANT

A.M. 295 LOT 4
KEY BOSTON, INC.
126 GROVE STREET
FRANKLIN, MA 02038
DEED BOOK 6353 PAGE 200
DEED BOOK 6876 PAGE 112
PLAN No. 238 OF 1984 PLAN Bk. 309
PLAN No. 1655 OF 1985 PLAN Bk. 330

SITE PLAN
BUILDING EXPANSION
124 / 126 GROVE ST.
FRANKLIN MASSACHUSETTS

EXISTING CONDITIONS

OCTOBER 29, 2024

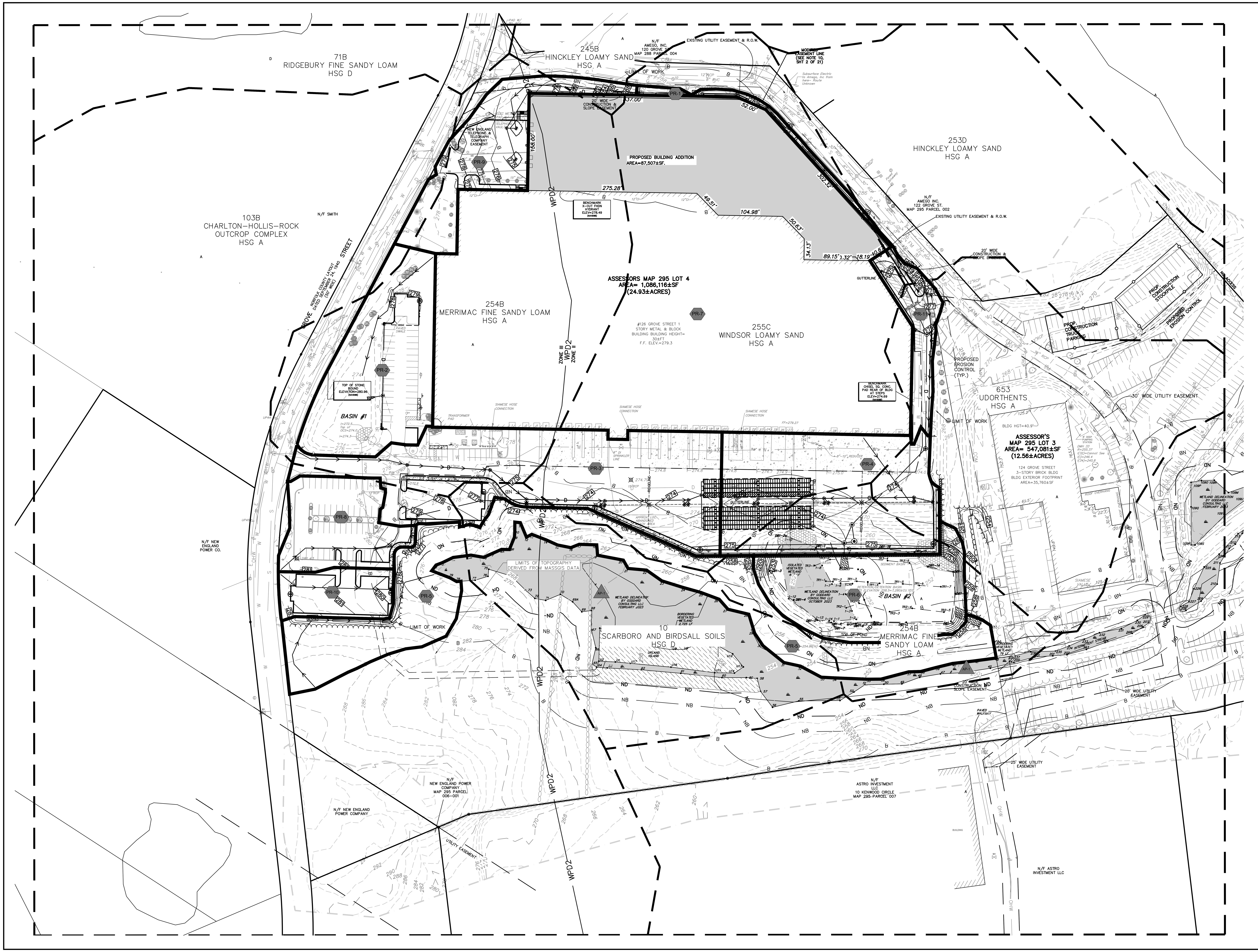
DATE	REVISION DESCRIPTION
3/27/25	PER TOWN AND CONSULTANT COMMENTS

GRAPHIC SCALE: 1"=50'

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

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

SHEET 1 OF 2
JOB NO. F4593



APPROVED DATE:

FRANKLIN PLANNING BOARD

BEING A MAJORITY

LEGAL NOTES

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

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

OWNER

A.M. 295 LOT 003
NEAG REAL ESTATE LLC
126 GROVE ST
FRANKLIN, MA
DEED BOOK 41715 PAGE 121
PLAN No. 253 OF 1989 PLAN Bk. 379

APPLICANT

A.M. 295 LOT 4
KEY BOSTON, INC.
126 GROVE STREET
FRANKLIN, MA 02038
DEED BOOK 6353 PAGE 200
DEED BOOK 6876 PAGE 112
PLAN No. 238 OF 1984 PLAN Bk. 309
PLAN No. 1655 OF 1985 PLAN Bk. 330

SITE PLAN BUILDING EXPANSION 124 / 126 GROVE ST. FRANKLIN MASSACHUSETTS

POST–DEVELOPMENT WATERSHED PLAN

OCTOBER 29, 2024

DATE	REVISION DESCRIPTION
3/27/25	PER TOWN AND CONSULTANT COMMENTS

GRAPHIC SCALE: 1"=50'

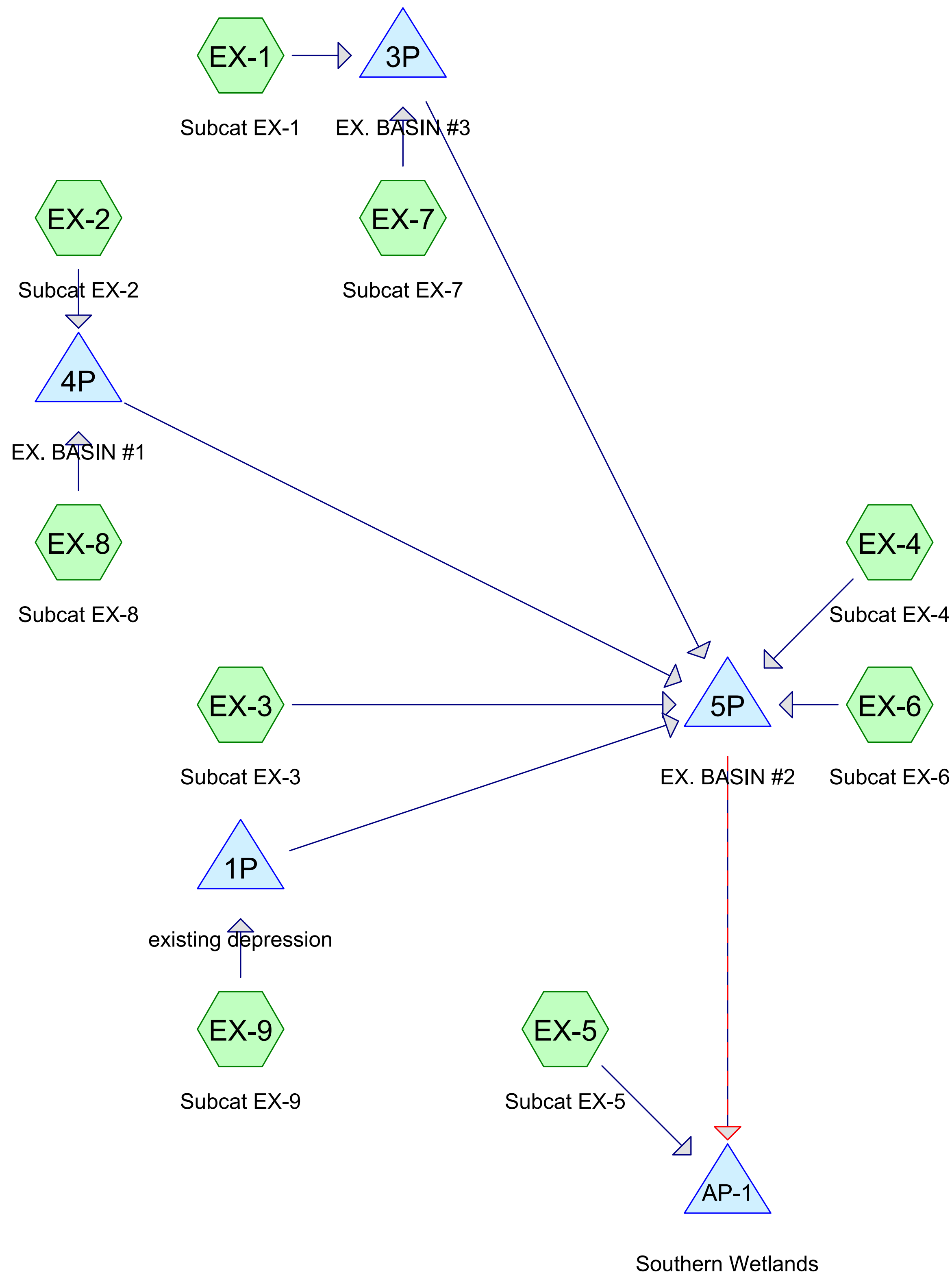
Guerriere & Halnon, Inc.
ENGINEERING & LAND SURVEYING
55 WEST CENTRAL ST. FRANKLIN, MA 02038
PH. (508) 528–3221
FX. (508) 528–7921
www.gandhengineering.com

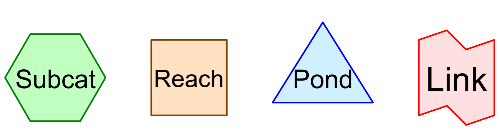
SHEET 2 OF 2

JOB NO. F4593

Hydro CAD Calculations

TABLE OF CONTENTS





Routing Diagram for F4593 PRE-Development 2-7
Prepared by Guerriere & Halnon Inc, Printed 3/27/2025
HydroCAD® 10.20-5c s/n 00417 © 2023 HydroCAD Software Solutions LLC

Project Notes

Rainfall events imported from "NRCS2-Rain.txt" for 6681 MA Franklin Norfolk Co
Defined 4 rainfall events from MA-126 Grove PFD IDF

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-yr	NOAA10 24-hr	D	Default	24.00	1	3.36	2
2	10-yr	NOAA10 24-hr	D	Default	24.00	1	5.22	2
3	25-yr	NOAA10 24-hr	D	Default	24.00	1	6.39	2
4	100-yr	NOAA10 24-hr	D	Default	24.00	1	8.18	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
2.776	39	>75% Grass cover, Good, HSG A (EX-1, EX-2, EX-3, EX-4, EX-5, EX-6, EX-7, EX-8, EX-9)
0.031	80	>75% Grass cover, Good, HSG D (EX-3, EX-5, EX-9)
3.561	98	Paved parking, HSG A (EX-1, EX-2, EX-3, EX-4, EX-8)
0.039	98	Paved parking, HSG D (EX-3)
6.182	98	Roofs, HSG A (EX-7)
0.018	98	Unconnected pavement, HSG A (EX-1, EX-2, EX-3, EX-7)
1.493	98	Water Surface, HSG A (EX-1, EX-2, EX-6)
3.284	30	Woods, Good, HSG A (EX-1, EX-5, EX-6, EX-9)
0.677	77	Woods, Good, HSG D (EX-5, EX-9)
18.062	**76**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
17.314	HSG A	EX-1, EX-2, EX-3, EX-4, EX-5, EX-6, EX-7, EX-8, EX-9
0.000	HSG B	
0.000	HSG C	
0.748	HSG D	EX-3, EX-5, EX-9
0.000	Other	
18.062		**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
2.776	0.000	0.000	0.031	0.000	2.807	>75% Grass cover, Good	EX-1, EX-2, EX-3, EX-4, EX-5, EX-6, EX-7, EX-8, EX-9
3.561	0.000	0.000	0.039	0.000	3.601	Paved parking	EX-1, EX-2, EX-3, EX-4, EX-8
6.182	0.000	0.000	0.000	0.000	6.182	Roofs	EX-7
0.018	0.000	0.000	0.000	0.000	0.018	Unconnected pavement	EX-1, EX-2, EX-3, EX-7
1.493	0.000	0.000	0.000	0.000	1.493	Water Surface	EX-1, EX-2, EX-6
3.284	0.000	0.000	0.677	0.000	3.961	Woods, Good	EX-1, EX-5, EX-6, EX-9
17.314	**0.000**	**0.000**	**0.748**	**0.000**	**18.062**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)	Node Name
1	EX-1	0.00	0.00	100.0	0.0080	0.013	0.0	12.0	0.0	
2	EX-3	0.00	0.00	528.0	0.0220	0.013	0.0	15.0	0.0	
3	EX-4	0.00	0.00	365.0	0.0350	0.013	0.0	30.0	0.0	
4	EX-8	0.00	0.00	189.0	0.0120	0.013	0.0	12.0	0.0	
5	1P	272.90	271.90	24.3	0.0412	0.013	0.0	12.0	0.0	
6	3P	265.60	264.50	223.3	0.0049	0.013	0.0	24.0	0.0	
7	3P	266.06	265.90	8.4	0.0190	0.013	0.0	12.0	0.0	
8	3P	266.58	265.80	12.3	0.0634	0.013	0.0	12.0	0.0	
9	4P	272.50	271.90	75.9	0.0079	0.013	0.0	12.0	0.0	
10	5P	254.94	254.86	12.0	0.0067	0.013	0.0	12.0	0.0	

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 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

SubcatchmentEX-1: Subcat EX-1 Runoff Area=2.827 ac 27.56% Impervious Runoff Depth=0.21"
Flow Length=424' Tc=8.1 min CN=52 Runoff=0.10 cfs 0.050 af

SubcatchmentEX-2: Subcat EX-2 Runoff Area=1.141 ac 44.71% Impervious Runoff Depth=0.68"
Flow Length=231' Tc=11.0 min CN=65 Runoff=0.65 cfs 0.065 af

SubcatchmentEX-3: Subcat EX-3 Runoff Area=1.865 ac 89.47% Impervious Runoff Depth=2.50"
Flow Length=682' Tc=6.4 min CN=92 Runoff=5.50 cfs 0.389 af

SubcatchmentEX-4: Subcat EX-4 Runoff Area=0.877 ac 88.00% Impervious Runoff Depth=2.41"
Flow Length=524' Tc=6.0 min CN=91 Runoff=2.55 cfs 0.176 af

SubcatchmentEX-5: Subcat EX-5 Runoff Area=2.793 ac 0.00% Impervious Runoff Depth=0.02"
Flow Length=349' Tc=16.9 min CN=41 Runoff=0.01 cfs 0.004 af

SubcatchmentEX-6: Subcat EX-6 Runoff Area=68,451 sf 61.12% Impervious Runoff Depth=1.14"
Tc=6.0 min CN=74 Runoff=2.21 cfs 0.150 af

SubcatchmentEX-7: Subcat EX-7 Runoff Area=6.182 ac 99.99% Impervious Runoff Depth=3.13"
Tc=6.0 min CN=98 Runoff=20.97 cfs 1.611 af

SubcatchmentEX-8: Subcat EX-8 Runoff Area=0.540 ac 77.97% Impervious Runoff Depth=1.89"
Flow Length=382' Tc=7.0 min CN=85 Runoff=1.22 cfs 0.085 af

SubcatchmentEX-9: Subcat EX-9 Runoff Area=0.265 ac 0.00% Impervious Runoff Depth=0.08"
Flow Length=134' Tc=10.0 min CN=46 Runoff=0.00 cfs 0.002 af

Pond 1P: existing depression Peak Elev=274.00' Storage=0 cf Inflow=0.00 cfs 0.002 af
12.0" Round Culvert n=0.013 L=24.3' S=0.0412 '/' Outflow=0.00 cfs 0.002 af

Pond 3P: EX. BASIN #3 Peak Elev=268.36' Storage=33,180 cf Inflow=20.98 cfs 1.661 af
Outflow=4.25 cfs 1.485 af

Pond 4P: EX. BASIN #1 Peak Elev=274.05' Storage=2,386 cf Inflow=1.78 cfs 0.150 af
Outflow=0.35 cfs 0.101 af

Pond 5P: EX. BASIN #2 Peak Elev=254.23' Storage=55,310 cf Inflow=11.48 cfs 2.303 af
Discarded=0.80 cfs 2.303 af Primary=0.00 cfs 0.000 af Secondary=0.00 cfs 0.000 af Outflow=0.80 cfs 2.303 af

Pond AP-1: Southern Wetlands Inflow=0.01 cfs 0.004 af
Primary=0.01 cfs 0.004 af

Total Runoff Area = 18.062 ac Runoff Volume = 2.531 af Average Runoff Depth = 1.68"
37.47% Pervious = 6.769 ac 62.53% Impervious = 11.293 ac

Summary for Subcatchment EX-1: Subcat EX-1

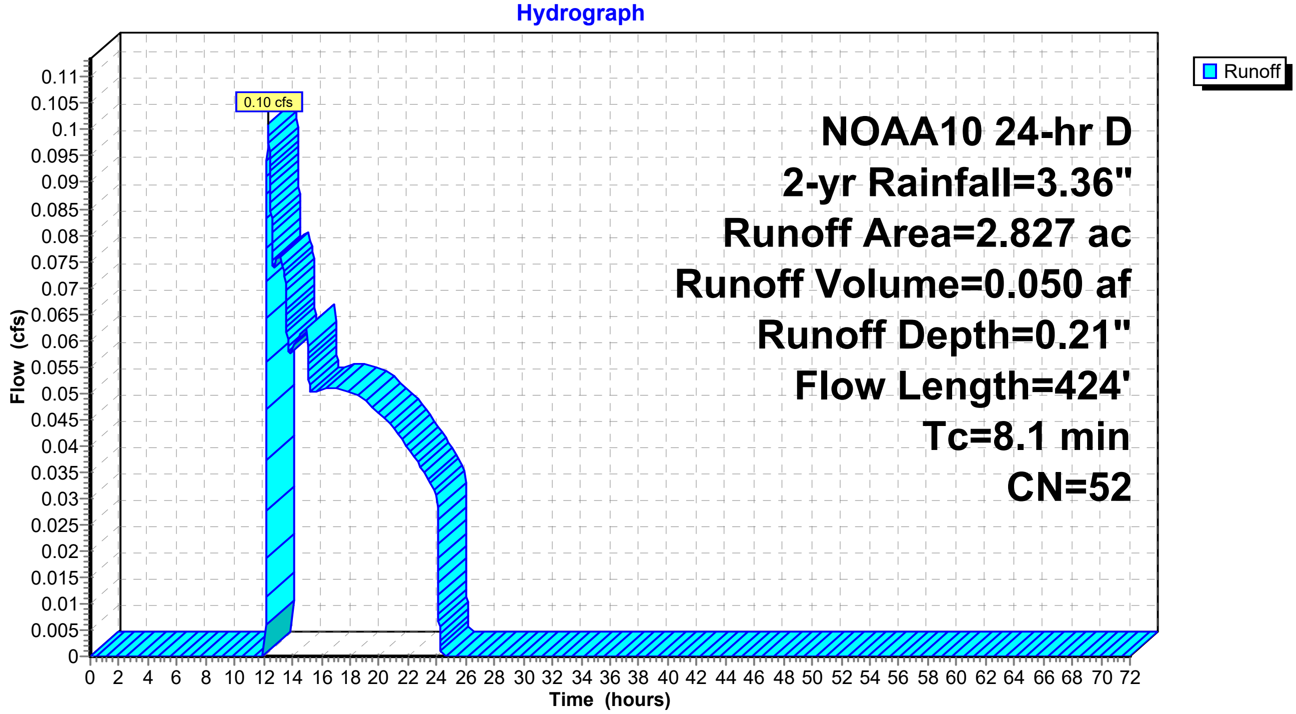
Runoff = 0.10 cfs @ 12.34 hrs, Volume= 0.050 af, Depth= 0.21"
Routed to Pond 3P : EX. BASIN #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-yr Rainfall=3.36"

Area (ac)	CN	Description
1.115	39	>75% Grass cover, Good, HSG A
0.505	98	Paved parking, HSG A
0.003	98	Unconnected pavement, HSG A
0.271	98	Water Surface, HSG A
0.933	30	Woods, Good, HSG A
2.827	52	Weighted Average
2.048		72.44% Pervious Area
0.779		27.56% Impervious Area
0.003		0.37% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	50	0.0250	0.17		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.36"
0.4	19	0.0110	0.73		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
2.3	255	0.0080	1.82		**Shallow Concentrated Flow, C-D** Paved Kv= 20.3 fps
0.4	100	0.0080	4.06	3.19	**Pipe Channel, D-E** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Concrete pipe, bends & connections
8.1	424	Total			

Subcatchment EX-1: Subcat EX-1



Summary for Subcatchment EX-2: Subcat EX-2

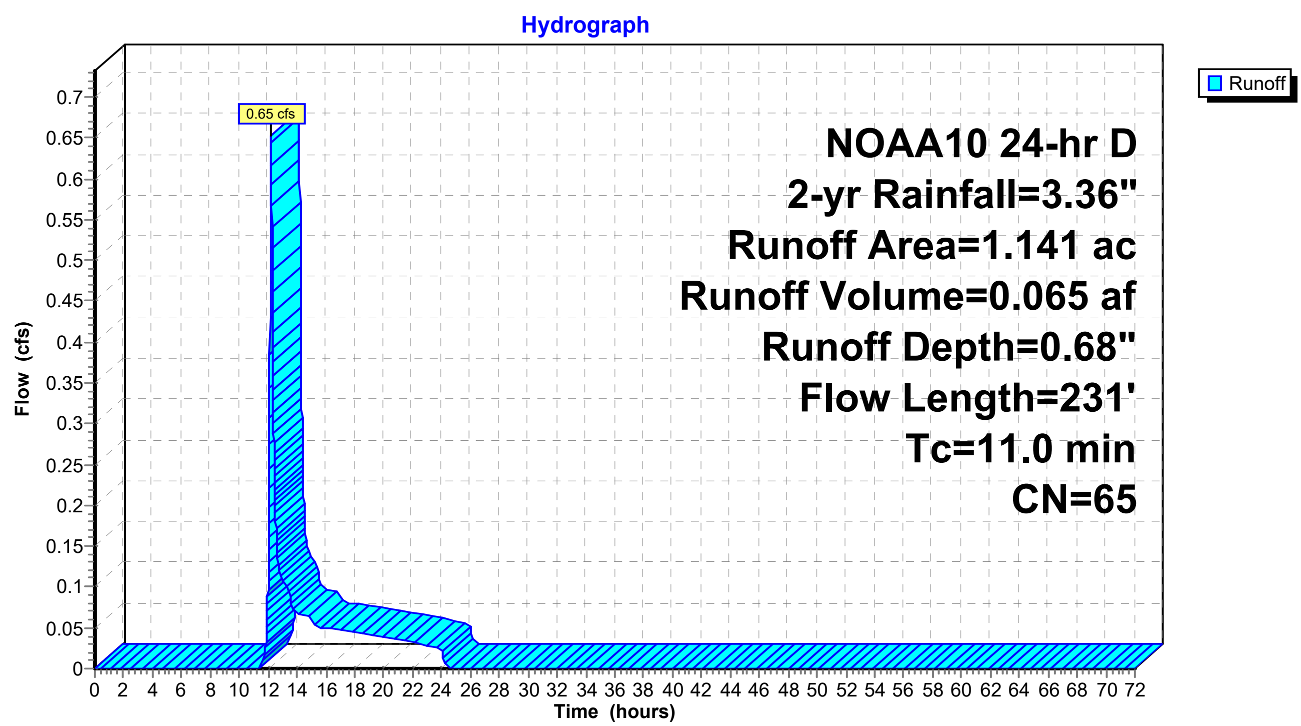
Runoff = 0.65 cfs @ 12.20 hrs, Volume= 0.065 af, Depth= 0.68"
Routed to Pond 4P : EX. BASIN #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-yr Rainfall=3.36"

Area (ac)	CN	Description
0.631	39	>75% Grass cover, Good, HSG A
0.239	98	Paved parking, HSG A
0.009	98	Unconnected pavement, HSG A
0.261	98	Water Surface, HSG A
1.141	65	Weighted Average
0.631		55.29% Pervious Area
0.510		44.71% Impervious Area
0.009		1.84% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	50	0.0050	0.09		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.36"
1.4	181	0.0220	2.22		**Shallow Concentrated Flow, B-C** Grassed Waterway Kv= 15.0 fps
11.0	231	Total			

Subcatchment EX-2: Subcat EX-2



Summary for Subcatchment EX-3: Subcat EX-3

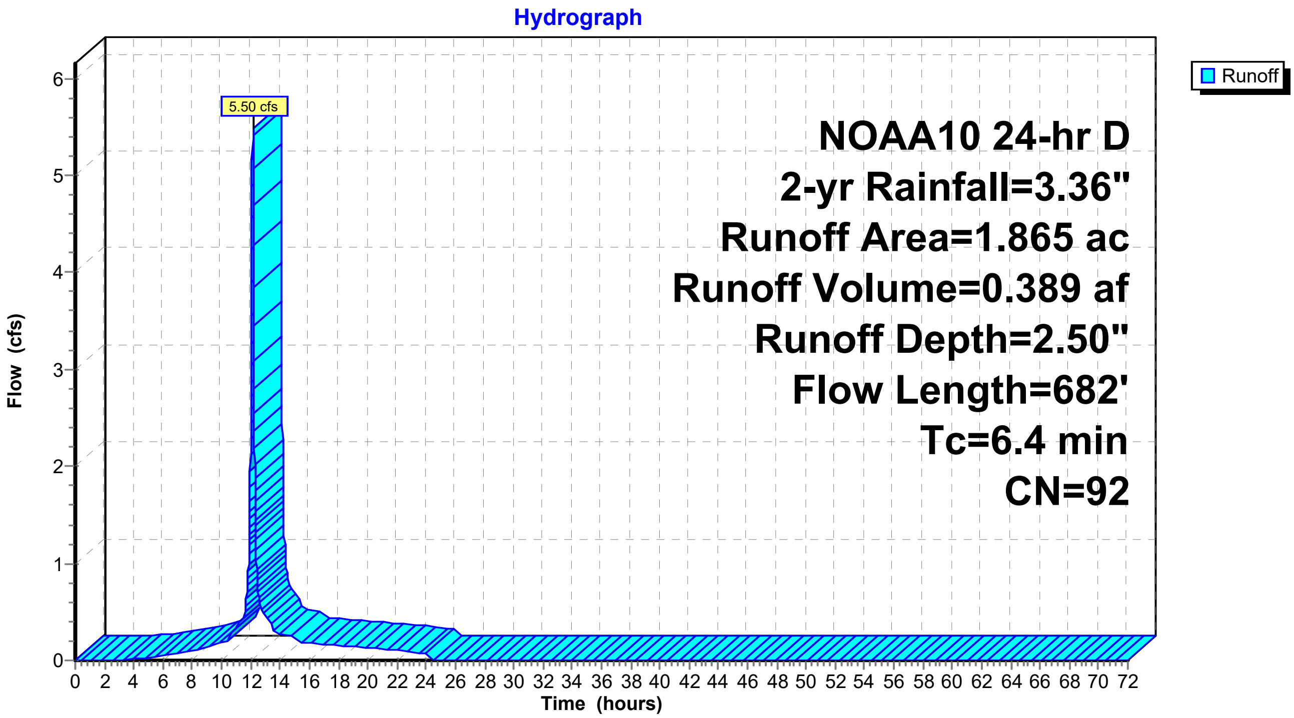
Runoff = 5.50 cfs @ 12.13 hrs, Volume= 0.389 af, Depth= 2.50"
Routed to Pond 5P : EX. BASIN #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-yr Rainfall=3.36"

Area (ac)	CN	Description
0.188	39	>75% Grass cover, Good, HSG A
0.008	80	>75% Grass cover, Good, HSG D
1.623	98	Paved parking, HSG A
0.039	98	Paved parking, HSG D
0.006	98	Unconnected pavement, HSG A
1.865	92	Weighted Average
0.196		10.53% Pervious Area
1.669		89.47% Impervious Area
0.006		0.35% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	35	0.0150	0.13		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.36"
0.7	119	0.0200	2.87		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
1.1	528	0.0220	7.81	9.58	**Pipe Channel, C-D** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013 Concrete pipe, bends & connections
6.4	682	Total			

Subcatchment EX-3: Subcat EX-3



Summary for Subcatchment EX-4: Subcat EX-4

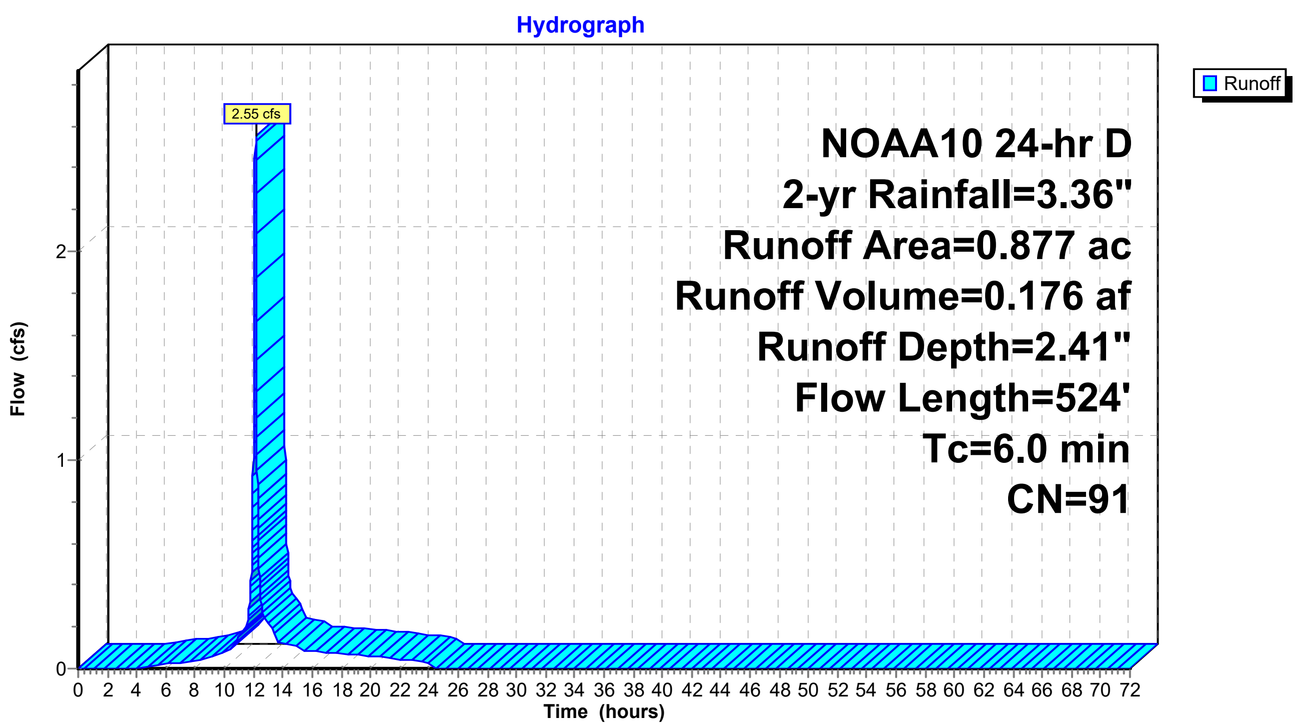
Runoff = 2.55 cfs @ 12.13 hrs, Volume= 0.176 af, Depth= 2.41"
Routed to Pond 5P : EX. BASIN #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-yr Rainfall=3.36"

Area (ac)	CN	Description
0.105	39	>75% Grass cover, Good, HSG A
0.772	98	Paved parking, HSG A
0.877	91	Weighted Average
0.105		12.00% Pervious Area
0.772		88.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	17	0.0100	0.06		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.36"
1.1	142	0.0120	2.22		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
0.4	365	0.0350	15.63	76.74	**Pipe Channel, C-D** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013 Concrete pipe, bends & connections
6.0	524	Total			

Subcatchment EX-4: Subcat EX-4



Summary for Subcatchment EX-5: Subcat EX-5

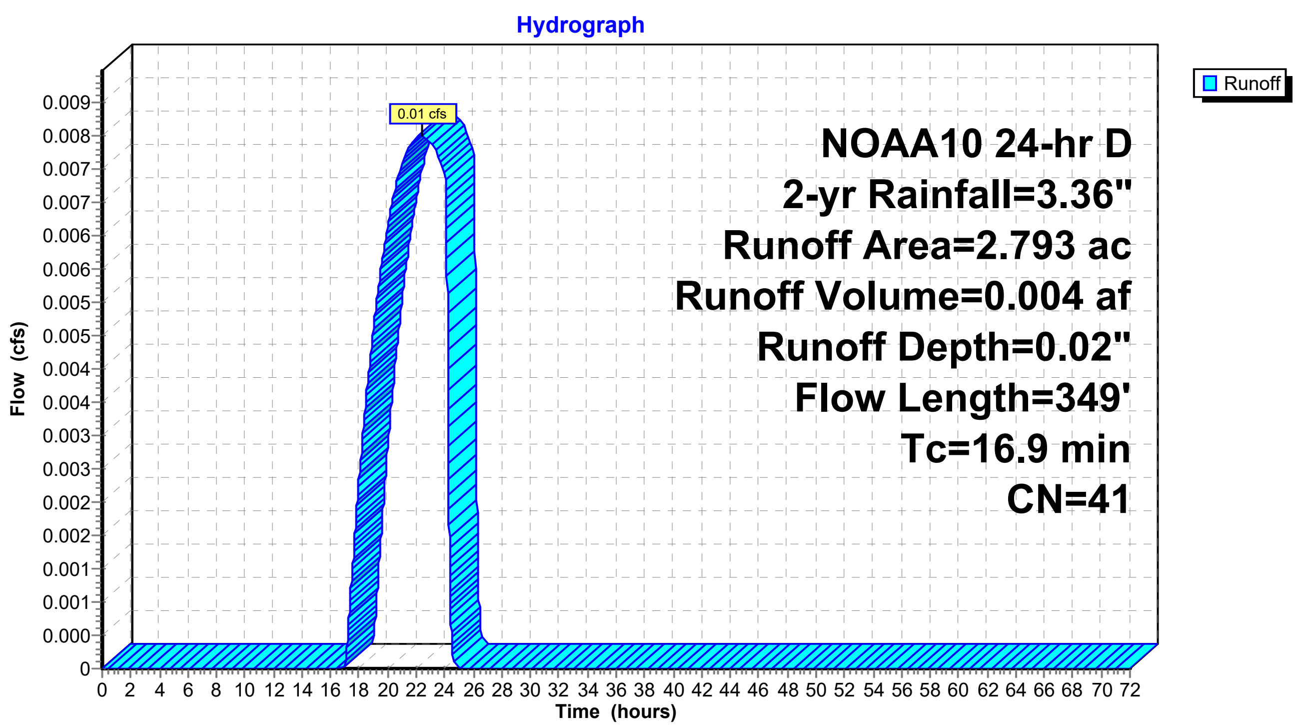
Runoff = 0.01 cfs @ 22.44 hrs, Volume= 0.004 af, Depth= 0.02"
Routed to Pond AP-1 : Southern Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-yr Rainfall=3.36"

Area (ac)	CN	Description
0.176	39	>75% Grass cover, Good, HSG A
0.016	80	>75% Grass cover, Good, HSG D
1.994	30	Woods, Good, HSG A
0.606	77	Woods, Good, HSG D
2.793	41	Weighted Average
2.793		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0190	0.07		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.36"
0.7	58	0.0780	1.40		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
3.9	241	0.0420	1.02		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
16.9	349	Total			

Subcatchment EX-5: Subcat EX-5



Summary for Subcatchment EX-6: Subcat EX-6

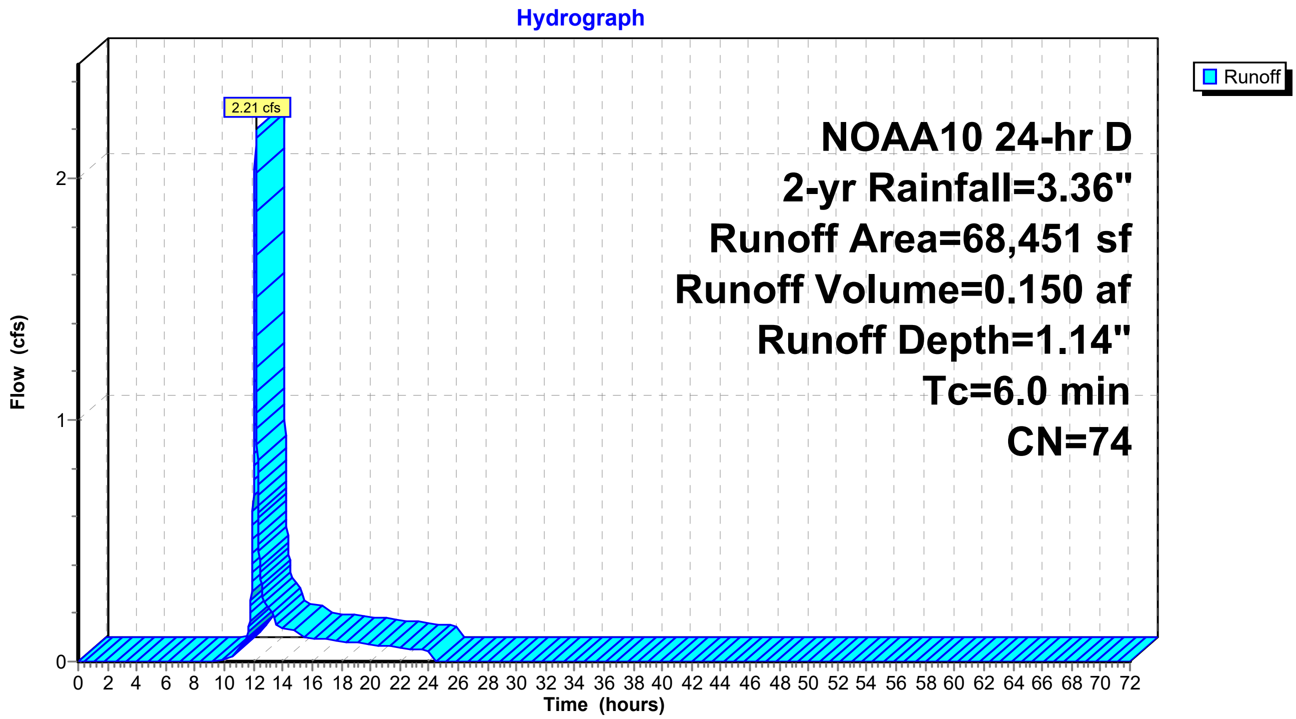
Runoff = 2.21 cfs @ 12.14 hrs, Volume= 0.150 af, Depth= 1.14"
Routed to Pond 5P : EX. BASIN #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-yr Rainfall=3.36"

Area (sf)	CN	Description
17,052	39	>75% Grass cover, Good, HSG A
41,839	98	Water Surface, HSG A
9,559	30	Woods, Good, HSG A
68,451	74	Weighted Average
26,612		38.88% Pervious Area
41,839		61.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, A-B-C: CALCULATED BELOW MINIMUM**

Subcatchment EX-6: Subcat EX-6



Summary for Subcatchment EX-7: Subcat EX-7

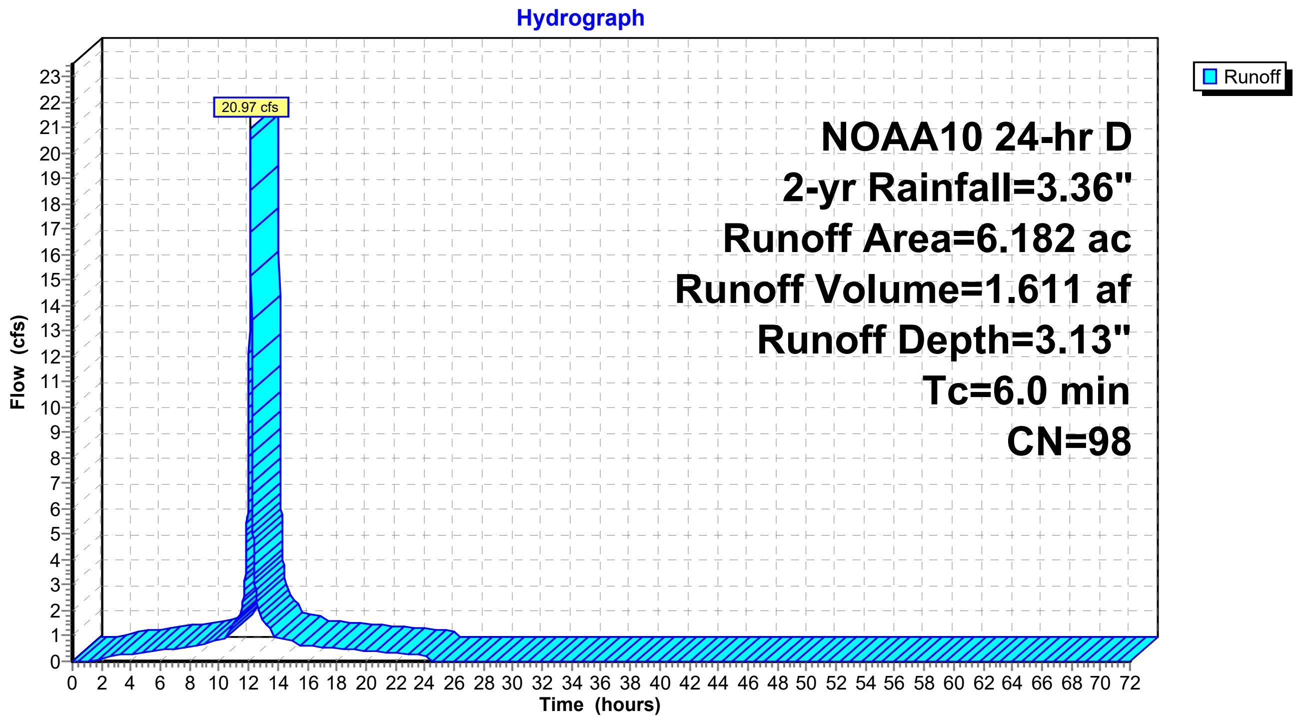
Runoff = 20.97 cfs @ 12.13 hrs, Volume= 1.611 af, Depth= 3.13"
Routed to Pond 3P : EX. BASIN #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-yr Rainfall=3.36"

Area (ac)	CN	Description
0.000	39	>75% Grass cover, Good, HSG A
6.182	98	Roofs, HSG A
0.000	98	Unconnected pavement, HSG A
6.182	98	Weighted Average
0.000		0.01% Pervious Area
6.182		99.99% Impervious Area
0.000		0.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, A-B: CALCULATED BELOW MINIMUM**

Subcatchment EX-7: Subcat EX-7



Summary for Subcatchment EX-8: Subcat EX-8

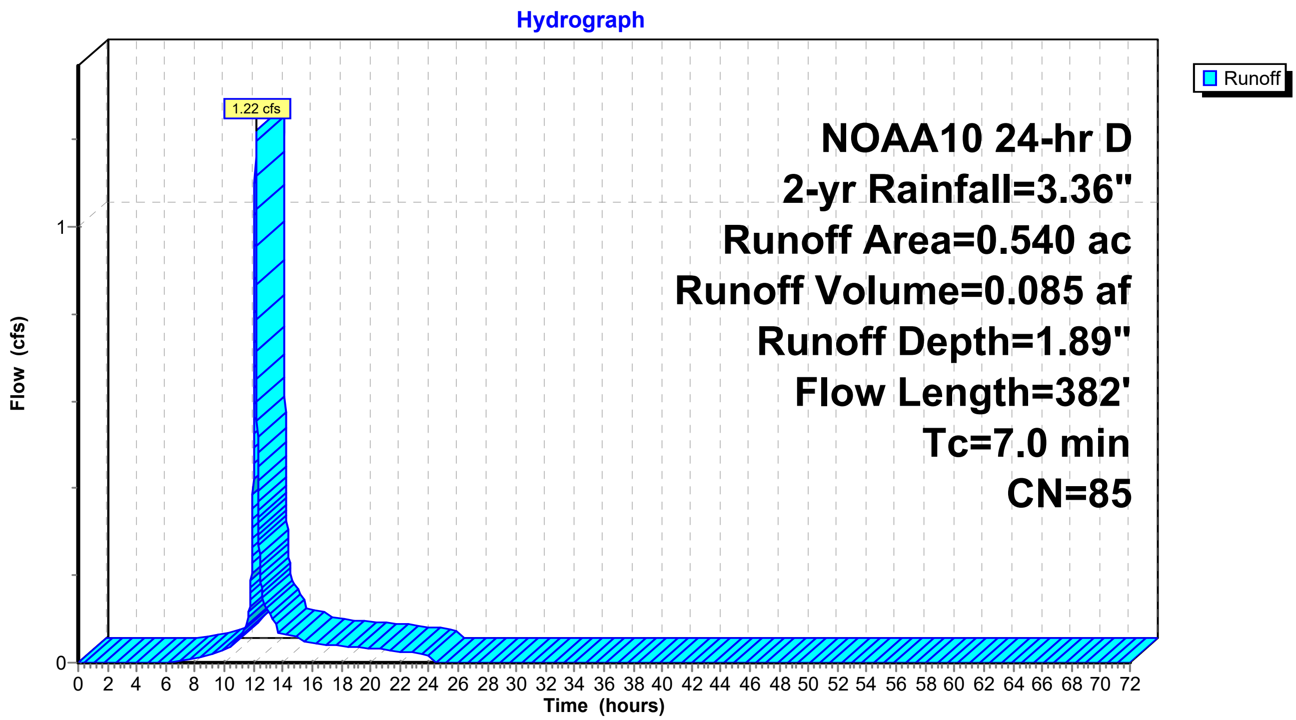
Runoff = 1.22 cfs @ 12.14 hrs, Volume= 0.085 af, Depth= 1.89"
Routed to Pond 4P : EX. BASIN #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-yr Rainfall=3.36"

Area (ac)	CN	Description
0.119	39	>75% Grass cover, Good, HSG A
0.421	98	Paved parking, HSG A
0.540	85	Weighted Average
0.119		22.03% Pervious Area
0.421		77.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	35	0.0300	0.11		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.36"
1.3	158	0.0100	2.03		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
0.6	189	0.0120	4.97	3.90	**Pipe Channel, C-D** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Concrete pipe, bends & connections
7.0	382	Total			

Subcatchment EX-8: Subcat EX-8



Summary for Subcatchment EX-9: Subcat EX-9

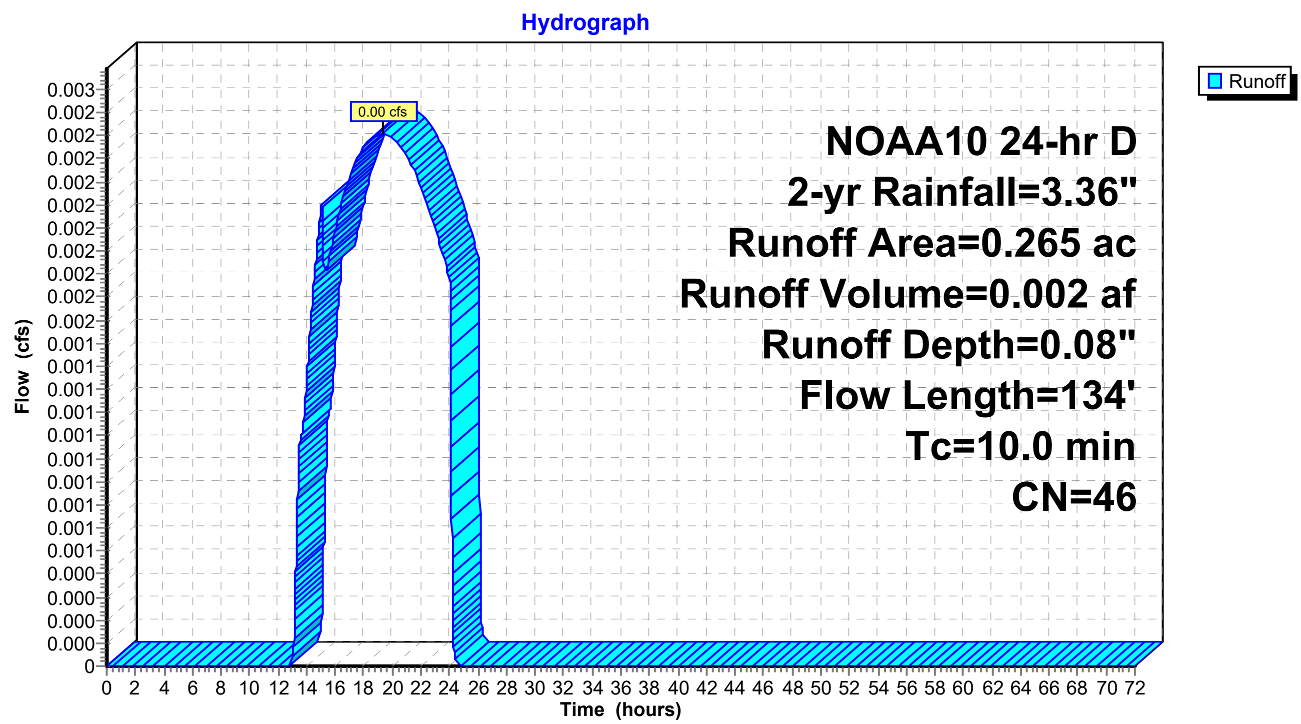
Runoff = 0.00 cfs @ 19.28 hrs, Volume= 0.002 af, Depth= 0.08"
Routed to Pond 1P : existing depression

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-yr Rainfall=3.36"

Area (ac)	CN	Description
0.050	39	>75% Grass cover, Good, HSG A
0.006	80	>75% Grass cover, Good, HSG D
0.137	30	Woods, Good, HSG A
0.071	77	Woods, Good, HSG D
0.265	46	Weighted Average
0.265		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.8	50	0.0440	0.09		**Sheet Flow, A-B**
					Woods: Light underbrush n= 0.400 P2= 3.36"
1.2	84	0.0520	1.14		**Shallow Concentrated Flow, B-C**
					Woodland Kv= 5.0 fps
10.0	134	Total			

Subcatchment EX-9: Subcat EX-9



Summary for Pond 1P: existing depression

[44] Hint: Outlet device #1 is below defined storage

Inflow Area = 0.265 ac, 0.00% Impervious, Inflow Depth = 0.08" for 2-yr event
Inflow = 0.00 cfs @ 19.28 hrs, Volume= 0.002 af
Outflow = 0.00 cfs @ 19.28 hrs, Volume= 0.002 af, Atten= 0%, Lag= 0.0 min
Primary = 0.00 cfs @ 19.28 hrs, Volume= 0.002 af
Routed to Pond 5P : EX. BASIN #2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 274.00' @ 0.00 hrs Surf.Area= 528 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.0 min (1,137.3 - 1,137.3)

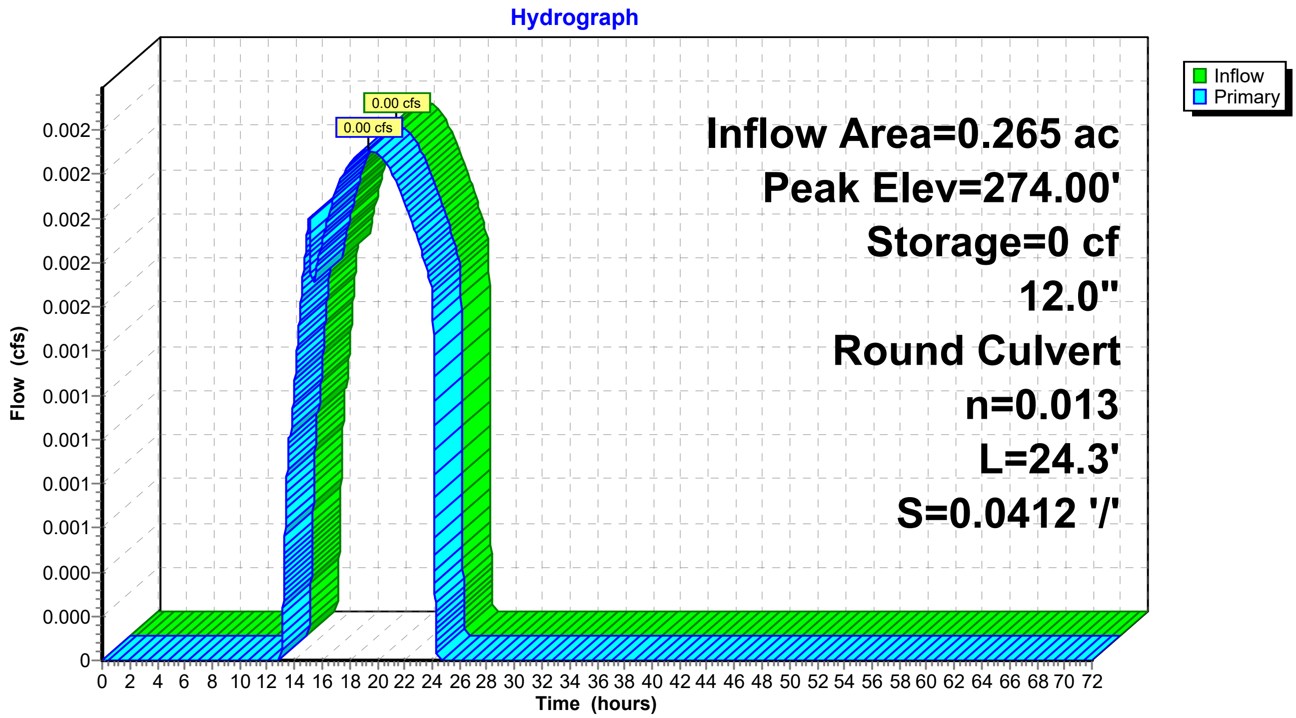
Volume	Invert	Avail.Storage	Storage Description
#1	274.00'	2,821 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
274.00	528	0	0
275.00	1,358	943	943
276.00	2,397	1,878	2,821

Device	Routing	Invert	Outlet Devices
#1	Primary	272.90'	**12.0" Round Culvert** L= 24.3' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 272.90' / 271.90' S= 0.0412 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 19.28 hrs HW=274.00' TW=254.05' (Dynamic Tailwater)
1=Culvert (Passes 0.00 cfs of 2.93 cfs potential flow)

Pond 1P: existing depression



Summary for Pond 3P: EX. BASIN #3

Inflow Area = 9.009 ac, 77.26% Impervious, Inflow Depth = 2.21" for 2-yr event
Inflow = 20.98 cfs @ 12.13 hrs, Volume= 1.661 af
Outflow = 4.25 cfs @ 12.36 hrs, Volume= 1.485 af, Atten= 80%, Lag= 13.7 min
Primary = 4.25 cfs @ 12.36 hrs, Volume= 1.485 af
Routed to Pond 5P : EX. BASIN #2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 268.36' @ 12.36 hrs Surf.Area= 16,160 sf Storage= 33,180 cf

Plug-Flow detention time= 326.0 min calculated for 1.485 af (89% of inflow)
Center-of-Mass det. time= 266.3 min (1,034.3 - 768.0)

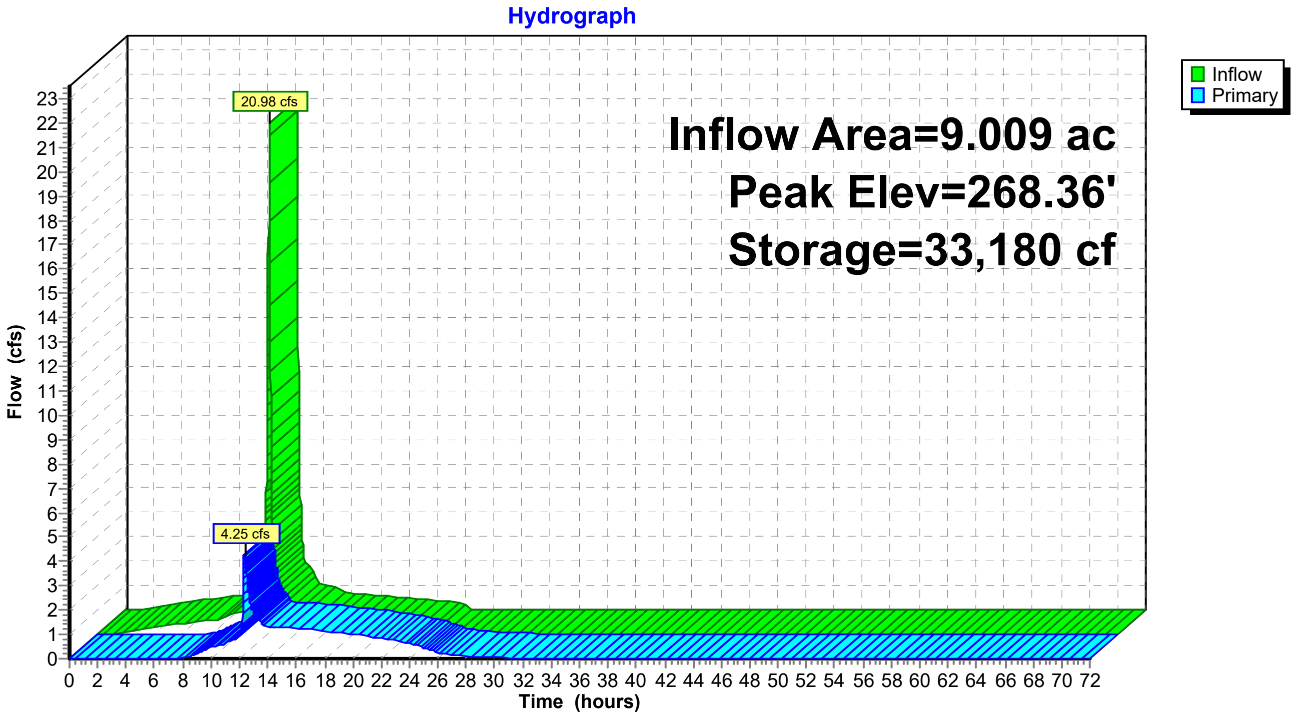
Volume	Invert	Avail.Storage	Storage Description
#1	265.00'	188,837 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
265.00	6,581	0	0
266.00	7,637	7,109	7,109
267.00	8,818	8,228	15,337
268.00	15,371	12,095	27,431
269.00	17,536	16,454	43,885
270.00	19,637	18,587	62,471
271.00	21,748	20,693	83,164
272.00	23,983	22,866	106,029
273.00	26,245	25,114	131,143
274.00	28,727	27,486	158,629
275.00	31,688	30,208	188,837

Device	Routing	Invert	Outlet Devices
#1	Primary	265.60'	**24.0" Round Culvert** L= 223.3' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 265.60' / 264.50' S= 0.0049 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 3.14 sf
#2	Device 1	266.06'	**12.0" Round Culvert** L= 8.4' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 266.06' / 265.90' S= 0.0190 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf
#3	Device 2	266.06'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 1	266.58'	**12.0" Round Culvert** L= 12.3' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 266.58' / 265.80' S= 0.0634 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf
#5	Device 4	268.26'	**57.0" x 100.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=4.25 cfs @ 12.36 hrs HW=268.36' TW=253.05' (Dynamic Tailwater)
└─**1=Culvert** (Passes 4.25 cfs of 16.63 cfs potential flow)
  ├─**2=Culvert** (Passes 1.36 cfs of 5.08 cfs potential flow)
  │ └─**3=Orifice/Grate** (Orifice Controls 1.36 cfs @ 6.90 fps)
  └─**4=Culvert** (Passes 2.90 cfs of 4.29 cfs potential flow)
    └─**5=Orifice/Grate** (Weir Controls 2.90 cfs @ 1.06 fps)

Pond 3P: EX. BASIN #3



Summary for Pond 4P: EX. BASIN #1

Inflow Area = 1.681 ac, 55.40% Impervious, Inflow Depth = 1.07" for 2-yr event
Inflow = 1.78 cfs @ 12.16 hrs, Volume= 0.150 af
Outflow = 0.35 cfs @ 12.54 hrs, Volume= 0.101 af, Atten= 81%, Lag= 22.8 min
Primary = 0.35 cfs @ 12.54 hrs, Volume= 0.101 af
Routed to Pond 5P : EX. BASIN #2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 274.05' @ 12.54 hrs Surf.Area= 5,512 sf Storage= 2,386 cf

Plug-Flow detention time= 244.0 min calculated for 0.101 af (67% of inflow)
Center-of-Mass det. time= 111.1 min (1,002.7 - 891.6)

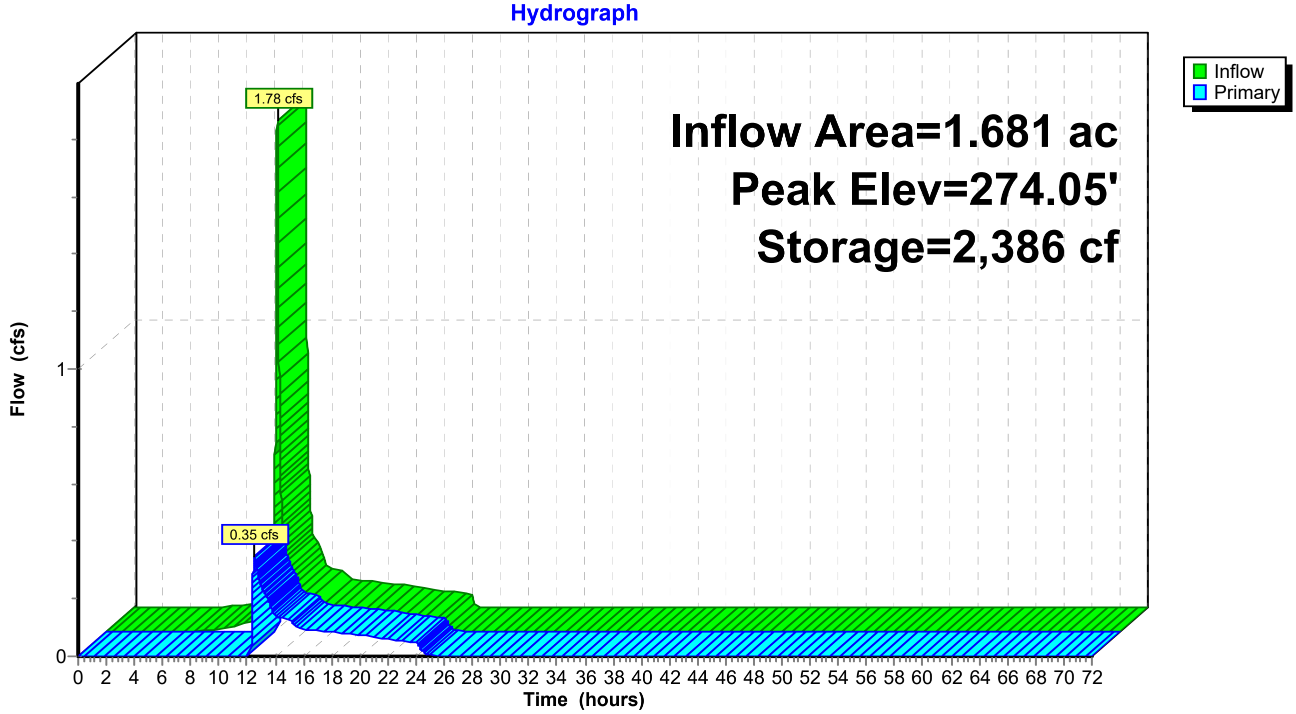
Volume	Invert	Avail.Storage	Storage Description
#1	273.40'	31,754 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
273.40	1,731	0	0
274.00	5,352	2,125	2,125
275.00	8,670	7,011	9,136
276.00	11,387	10,029	19,164
277.00	13,793	12,590	31,754

Device	Routing	Invert	Outlet Devices
#1	Primary	272.50'	**12.0" Round Culvert** L= 75.9' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 272.50' / 271.90' S= 0.0079 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf
#2	Device 1	274.00'	**24.0" x 36.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.35 cfs @ 12.54 hrs HW=274.05' TW=253.15' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.35 cfs of 3.43 cfs potential flow)
  └─**2=Orifice/Grate** (Weir Controls 0.35 cfs @ 0.72 fps)

Pond 4P: EX. BASIN #1



Summary for Pond 5P: EX. BASIN #2

Inflow Area = 15.269 ac, 73.96% Impervious, Inflow Depth = 1.81" for 2-yr event
Inflow = 11.48 cfs @ 12.13 hrs, Volume= 2.303 af
Outflow = 0.80 cfs @ 24.06 hrs, Volume= 2.303 af, Atten= 93%, Lag= 715.6 min
Discarded = 0.80 cfs @ 24.06 hrs, Volume= 2.303 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond AP-1 : Southern Wetlands
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond AP-1 : Southern Wetlands

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 254.23' @ 24.06 hrs Surf.Area= 25,210 sf Storage= 55,310 cf

Plug-Flow detention time= 739.8 min calculated for 2.303 af (100% of inflow)
Center-of-Mass det. time= 739.8 min (1,710.1 - 970.3)

Volume	Invert	Avail.Storage	Storage Description
#1	252.50'	198,113 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	252.50'	50,451 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) -Impervious
		248,564 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
252.50	21,111	0	0
253.00	22,353	10,866	10,866
254.00	24,697	23,525	34,391
255.00	26,888	25,793	60,184
256.00	30,430	28,659	88,843
257.00	33,434	31,932	120,775
258.00	36,584	35,009	155,784
259.00	48,075	42,330	198,113

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
252.50	8,488	0	0
253.00	8,672	4,290	4,290
254.00	8,778	8,725	13,015
255.00	9,174	8,976	21,991
256.00	9,483	9,329	31,320
257.00	9,587	9,535	40,855
258.00	9,606	9,597	50,451

Device	Routing	Invert	Outlet Devices
#1	Secondary	257.70'	**9.0' long x 15.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Primary	254.94'	**12.0" Round Culvert** L= 12.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 254.94' / 254.86' S= 0.0067 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

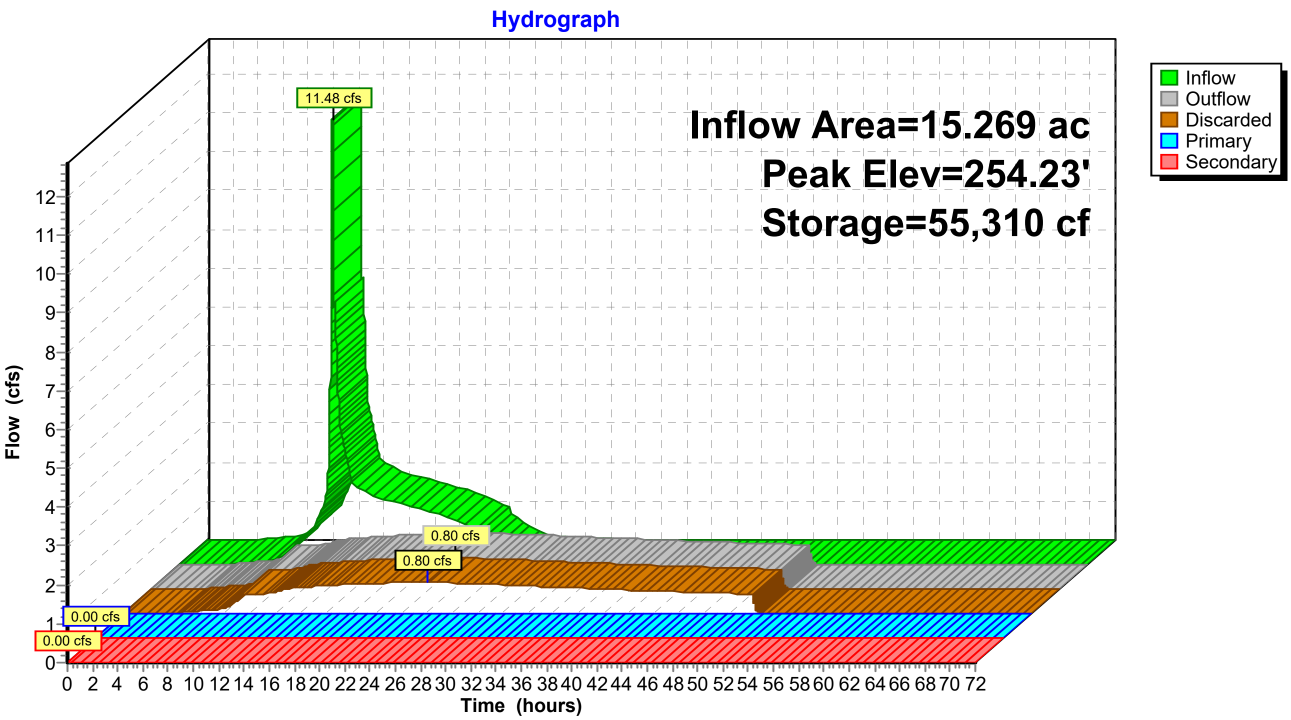
#3 Discarded 252.50' **1.020 in/hr Exfiltration over Surface area**
Conductivity to Groundwater Elevation = 248.00' Phase-In= 0.01'

Discarded OutFlow Max=0.80 cfs @ 24.06 hrs HW=254.23' (Free Discharge)
└─**3=Exfiltration** (Controls 0.80 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=252.50' TW=0.00' (Dynamic Tailwater)
└─**2=Culvert** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=252.50' TW=0.00' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 5P: EX. BASIN #2

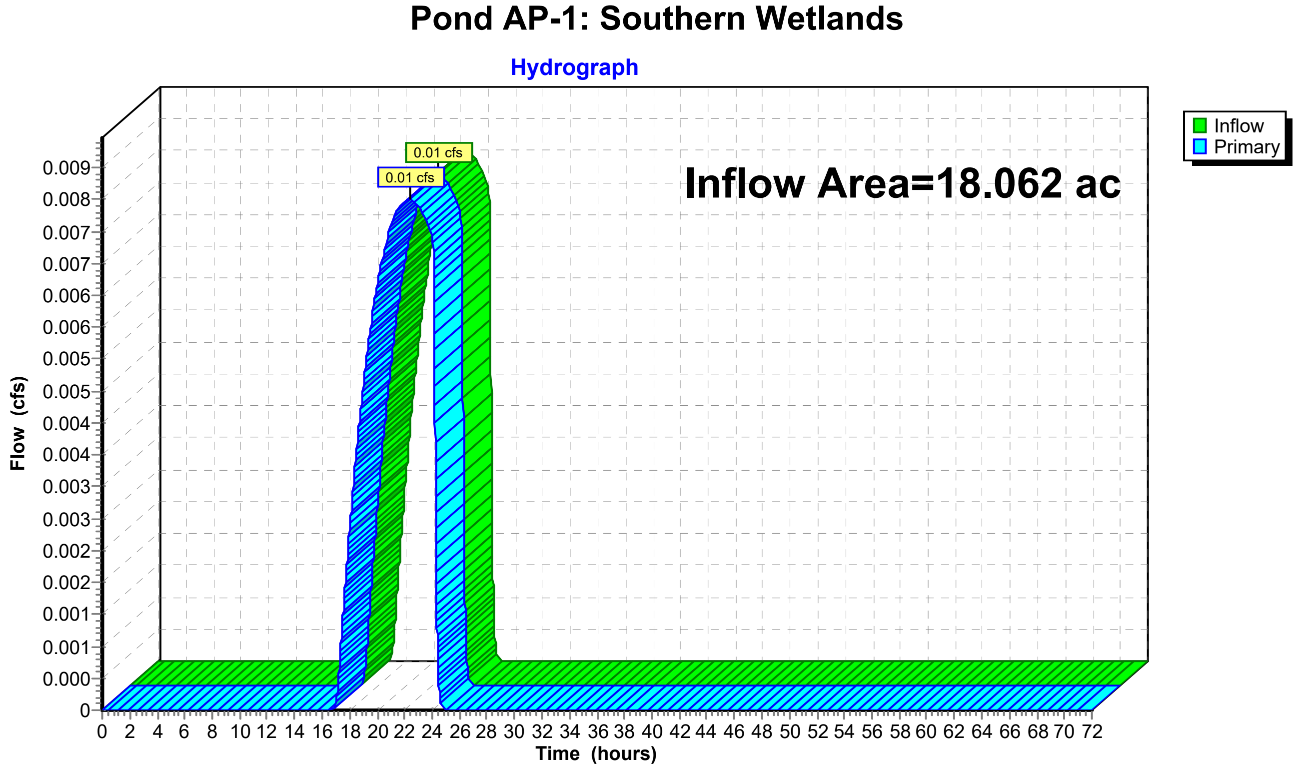


Summary for Pond AP-1: Southern Wetlands

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

Inflow Area =	18.062 ac, 62.53% Impervious, Inflow Depth = 0.00" for 2-yr event		
Inflow =	0.01 cfs @ 22.44 hrs, Volume=	0.004 af	
Primary =	0.01 cfs @ 22.44 hrs, Volume=	0.004 af,	Atten= 0%, Lag= 0.0 min

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



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 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 EX-1: Subcat EX-1 Runoff Area=2.827 ac 27.56% Impervious Runoff Depth=0.90"
Flow Length=424' Tc=8.1 min CN=52 Runoff=2.28 cfs 0.213 af

Subcatchment EX-2: Subcat EX-2 Runoff Area=1.141 ac 44.71% Impervious Runoff Depth=1.80"
Flow Length=231' Tc=11.0 min CN=65 Runoff=2.02 cfs 0.171 af

Subcatchment EX-3: Subcat EX-3 Runoff Area=1.865 ac 89.47% Impervious Runoff Depth=4.30"
Flow Length=682' Tc=6.4 min CN=92 Runoff=9.14 cfs 0.669 af

Subcatchment EX-4: Subcat EX-4 Runoff Area=0.877 ac 88.00% Impervious Runoff Depth=4.20"
Flow Length=524' Tc=6.0 min CN=91 Runoff=4.30 cfs 0.307 af

Subcatchment EX-5: Subcat EX-5 Runoff Area=2.793 ac 0.00% Impervious Runoff Depth=0.33"
Flow Length=349' Tc=16.9 min CN=41 Runoff=0.13 cfs 0.076 af

Subcatchment EX-6: Subcat EX-6 Runoff Area=68,451 sf 61.12% Impervious Runoff Depth=2.54"
Tc=6.0 min CN=74 Runoff=5.01 cfs 0.333 af

Subcatchment EX-7: Subcat EX-7 Runoff Area=6.182 ac 99.99% Impervious Runoff Depth=4.98"
Tc=6.0 min CN=98 Runoff=32.80 cfs 2.567 af

Subcatchment EX-8: Subcat EX-8 Runoff Area=0.540 ac 77.97% Impervious Runoff Depth=3.57"
Flow Length=382' Tc=7.0 min CN=85 Runoff=2.26 cfs 0.161 af

Subcatchment EX-9: Subcat EX-9 Runoff Area=0.265 ac 0.00% Impervious Runoff Depth=0.56"
Flow Length=134' Tc=10.0 min CN=46 Runoff=0.08 cfs 0.012 af

Pond 1P: existing depression Peak Elev=274.00' Storage=0 cf Inflow=0.08 cfs 0.012 af
12.0" Round Culvert n=0.013 L=24.3' S=0.0412 '/' Outflow=0.08 cfs 0.012 af

Pond 3P: EX. BASIN #3 Peak Elev=269.24' Storage=48,237 cf Inflow=34.77 cfs 2.780 af
Outflow=7.18 cfs 2.603 af

Pond 4P: EX. BASIN #1 Peak Elev=274.21' Storage=3,350 cf Inflow=4.07 cfs 0.332 af
Outflow=3.25 cfs 0.283 af

Pond 5P: EX. BASIN #2 Peak Elev=255.44' Storage=98,346 cf Inflow=27.27 cfs 4.208 af
Discarded=1.04 cfs 3.645 af Primary=0.69 cfs 0.562 af Secondary=0.00 cfs 0.000 af Outflow=1.73 cfs 4.208 af

Pond AP-1: Southern Wetlands Inflow=0.76 cfs 0.639 af
Primary=0.76 cfs 0.639 af

Total Runoff Area = 18.062 ac Runoff Volume = 4.509 af Average Runoff Depth = 3.00"
37.47% Pervious = 6.769 ac 62.53% Impervious = 11.293 ac

Summary for Subcatchment EX-1: Subcat EX-1

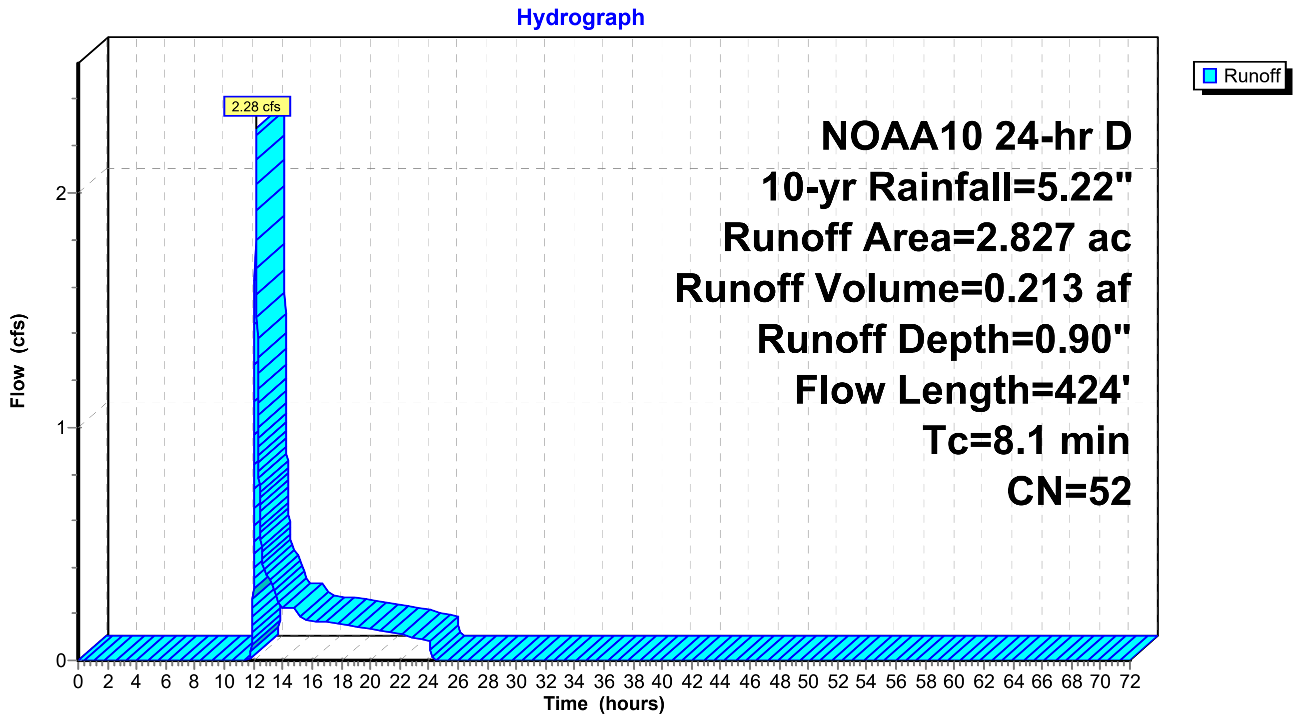
Runoff = 2.28 cfs @ 12.16 hrs, Volume= 0.213 af, Depth= 0.90"
Routed to Pond 3P : EX. BASIN #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-yr Rainfall=5.22"

Area (ac)	CN	Description
1.115	39	>75% Grass cover, Good, HSG A
0.505	98	Paved parking, HSG A
0.003	98	Unconnected pavement, HSG A
0.271	98	Water Surface, HSG A
0.933	30	Woods, Good, HSG A
2.827	52	Weighted Average
2.048		72.44% Pervious Area
0.779		27.56% Impervious Area
0.003		0.37% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	50	0.0250	0.17		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.36"
0.4	19	0.0110	0.73		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
2.3	255	0.0080	1.82		**Shallow Concentrated Flow, C-D** Paved Kv= 20.3 fps
0.4	100	0.0080	4.06	3.19	**Pipe Channel, D-E** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Concrete pipe, bends & connections
8.1	424	Total			

Subcatchment EX-1: Subcat EX-1



Summary for Subcatchment EX-2: Subcat EX-2

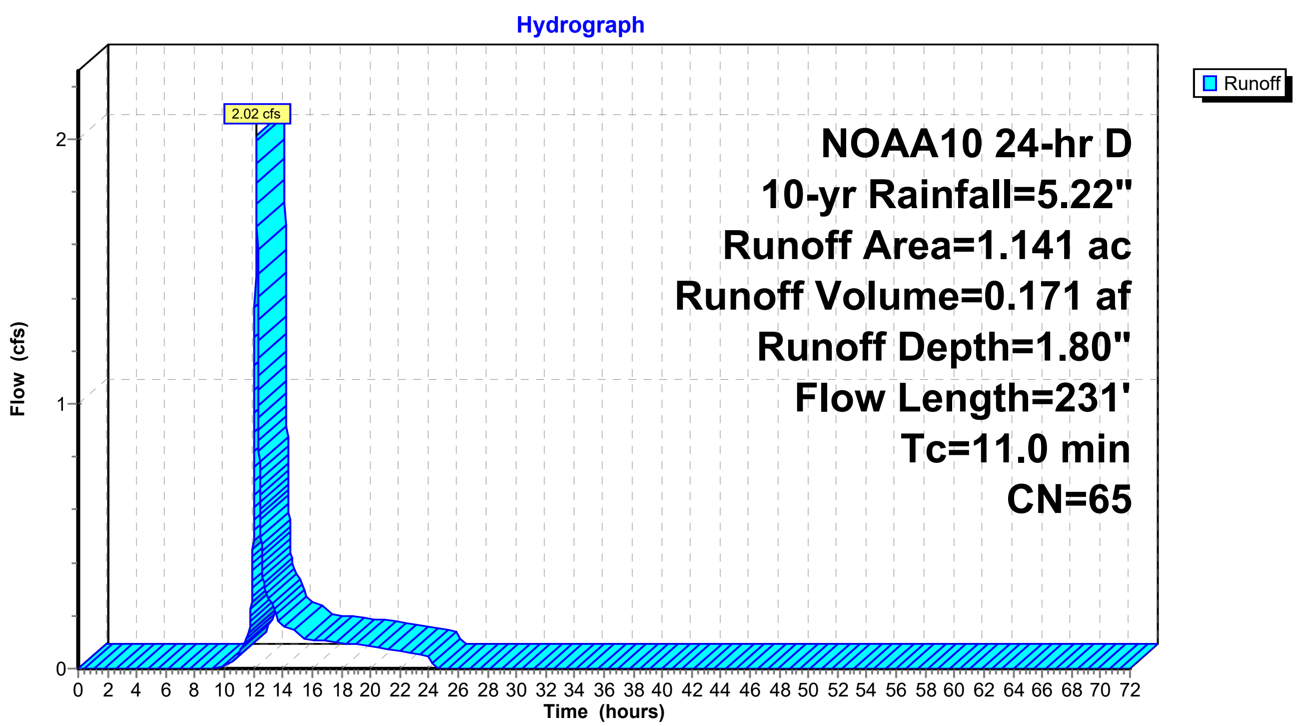
Runoff = 2.02 cfs @ 12.19 hrs, Volume= 0.171 af, Depth= 1.80"
Routed to Pond 4P : EX. BASIN #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-yr Rainfall=5.22"

Area (ac)	CN	Description
0.631	39	>75% Grass cover, Good, HSG A
0.239	98	Paved parking, HSG A
0.009	98	Unconnected pavement, HSG A
0.261	98	Water Surface, HSG A
1.141	65	Weighted Average
0.631		55.29% Pervious Area
0.510		44.71% Impervious Area
0.009		1.84% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	50	0.0050	0.09		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.36"
1.4	181	0.0220	2.22		**Shallow Concentrated Flow, B-C** Grassed Waterway Kv= 15.0 fps
11.0	231	Total			

Subcatchment EX-2: Subcat EX-2



Summary for Subcatchment EX-3: Subcat EX-3

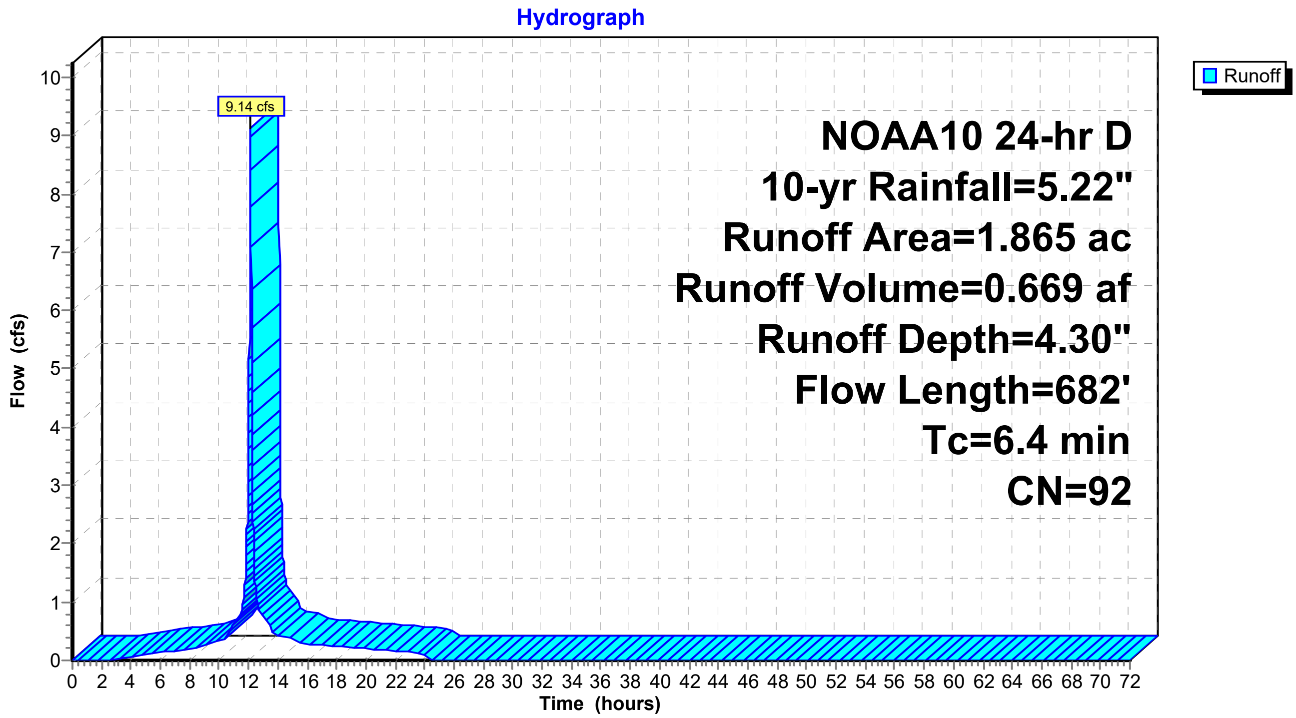
Runoff = 9.14 cfs @ 12.13 hrs, Volume= 0.669 af, Depth= 4.30"
Routed to Pond 5P : EX. BASIN #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-yr Rainfall=5.22"

Area (ac)	CN	Description
0.188	39	>75% Grass cover, Good, HSG A
0.008	80	>75% Grass cover, Good, HSG D
1.623	98	Paved parking, HSG A
0.039	98	Paved parking, HSG D
0.006	98	Unconnected pavement, HSG A
1.865	92	Weighted Average
0.196		10.53% Pervious Area
1.669		89.47% Impervious Area
0.006		0.35% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	35	0.0150	0.13		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.36"
0.7	119	0.0200	2.87		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
1.1	528	0.0220	7.81	9.58	**Pipe Channel, C-D** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013 Concrete pipe, bends & connections
6.4	682	Total			

Subcatchment EX-3: Subcat EX-3



Summary for Subcatchment EX-4: Subcat EX-4

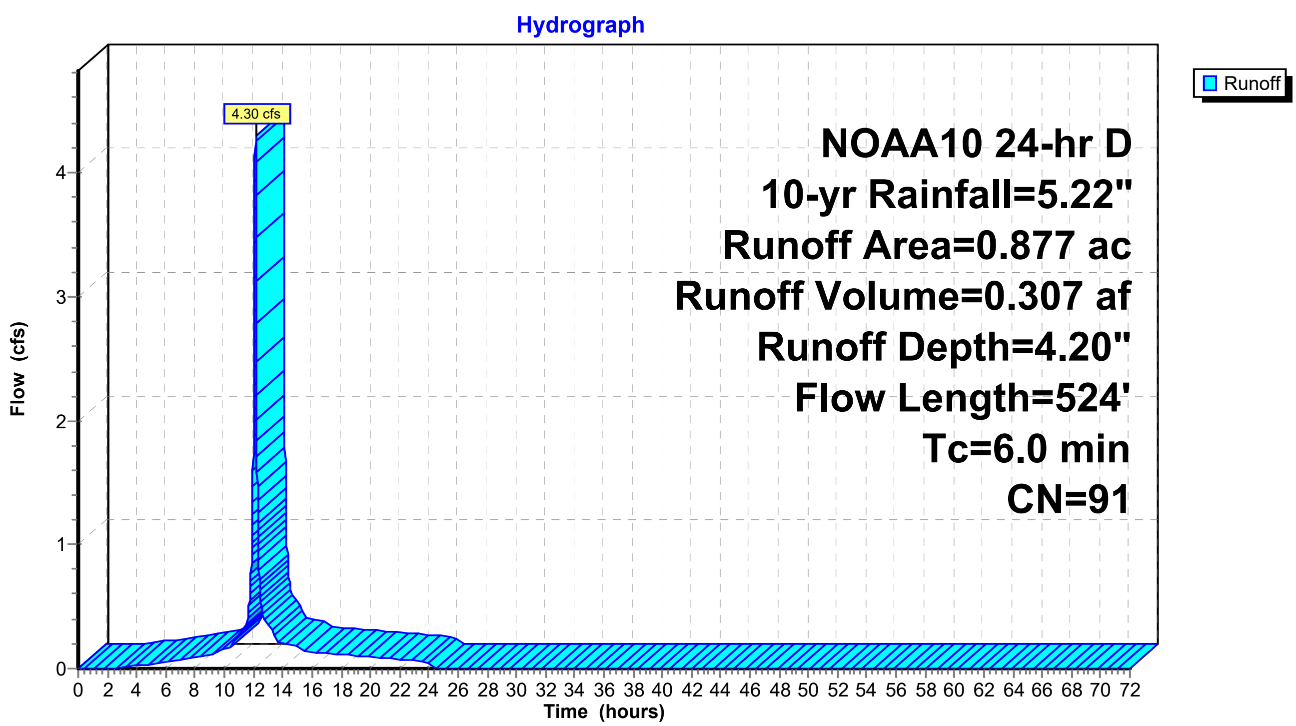
Runoff = 4.30 cfs @ 12.13 hrs, Volume= 0.307 af, Depth= 4.20"
Routed to Pond 5P : EX. BASIN #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-yr Rainfall=5.22"

Area (ac)	CN	Description
0.105	39	>75% Grass cover, Good, HSG A
0.772	98	Paved parking, HSG A
0.877	91	Weighted Average
0.105		12.00% Pervious Area
0.772		88.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	17	0.0100	0.06		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.36"
1.1	142	0.0120	2.22		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
0.4	365	0.0350	15.63	76.74	**Pipe Channel, C-D** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013 Concrete pipe, bends & connections
6.0	524	Total			

Subcatchment EX-4: Subcat EX-4



Summary for Subcatchment EX-5: Subcat EX-5

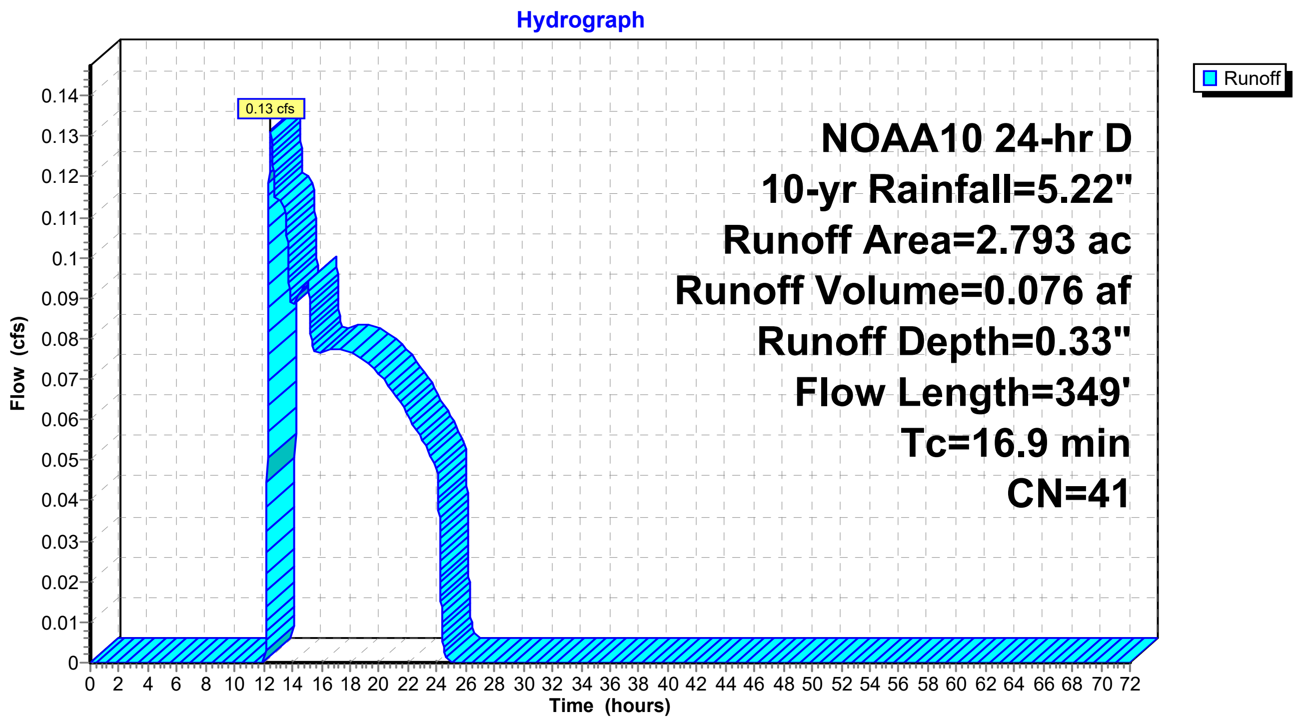
Runoff = 0.13 cfs @ 12.49 hrs, Volume= 0.076 af, Depth= 0.33"
Routed to Pond AP-1 : Southern Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-yr Rainfall=5.22"

Area (ac)	CN	Description
0.176	39	>75% Grass cover, Good, HSG A
0.016	80	>75% Grass cover, Good, HSG D
1.994	30	Woods, Good, HSG A
0.606	77	Woods, Good, HSG D
2.793	41	Weighted Average
2.793		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0190	0.07		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.36"
0.7	58	0.0780	1.40		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
3.9	241	0.0420	1.02		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
16.9	349	Total			

Subcatchment EX-5: Subcat EX-5



Summary for Subcatchment EX-6: Subcat EX-6

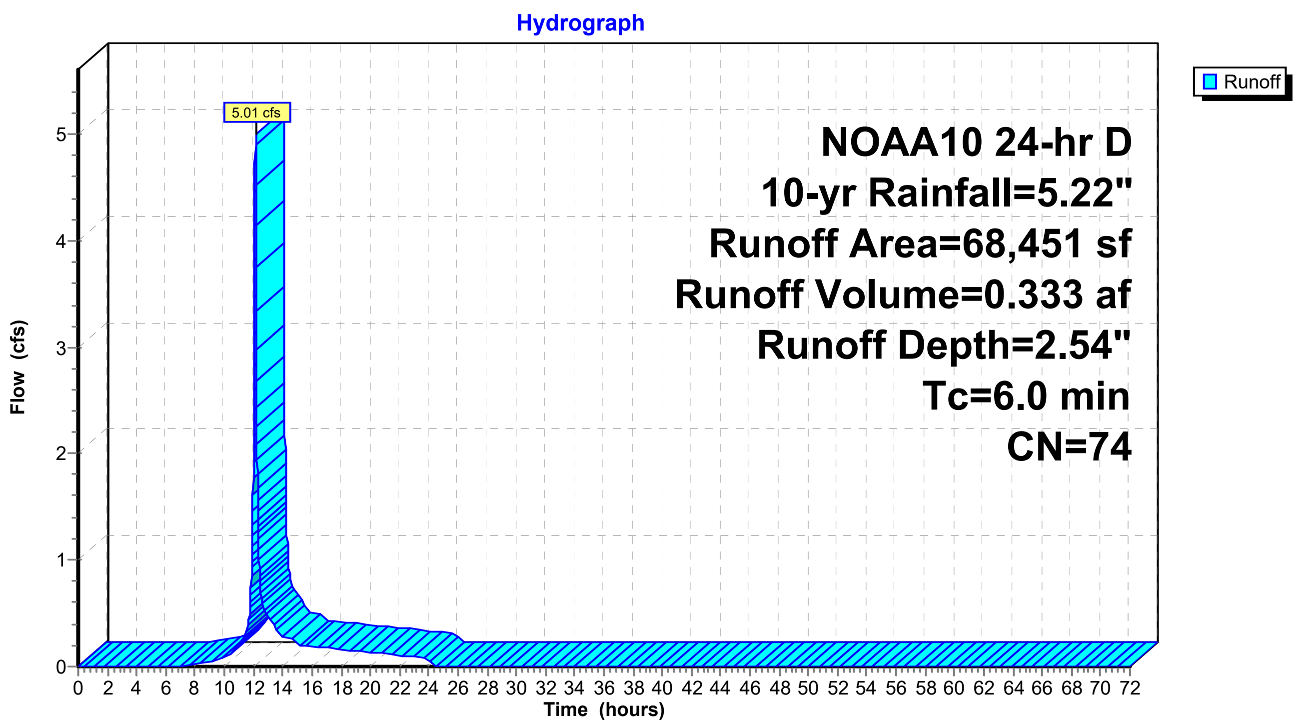
Runoff = 5.01 cfs @ 12.13 hrs, Volume= 0.333 af, Depth= 2.54"
Routed to Pond 5P : EX. BASIN #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-yr Rainfall=5.22"

Area (sf)	CN	Description
17,052	39	>75% Grass cover, Good, HSG A
41,839	98	Water Surface, HSG A
9,559	30	Woods, Good, HSG A
68,451	74	Weighted Average
26,612		38.88% Pervious Area
41,839		61.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, A-B-C: CALCULATED BELOW MINIMUM**

Subcatchment EX-6: Subcat EX-6



Summary for Subcatchment EX-7: Subcat EX-7

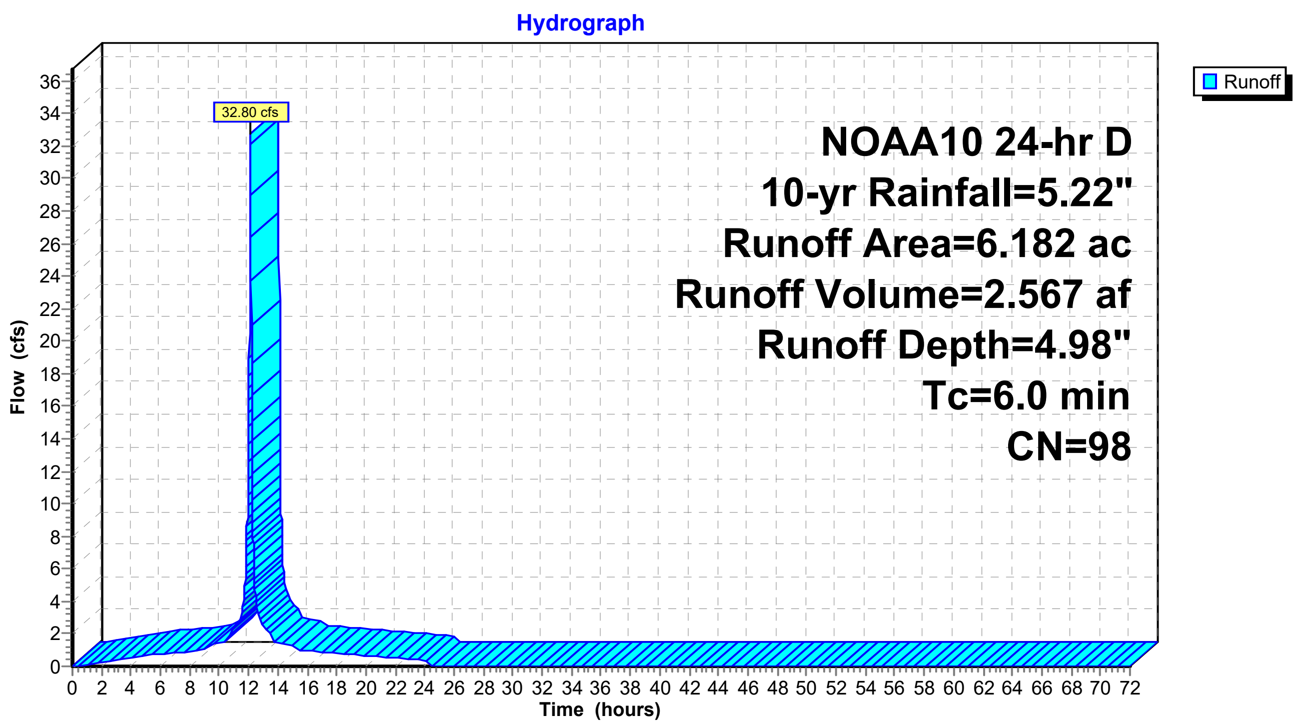
Runoff = 32.80 cfs @ 12.13 hrs, Volume= 2.567 af, Depth= 4.98"
Routed to Pond 3P : EX. BASIN #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-yr Rainfall=5.22"

Area (ac)	CN	Description
0.000	39	>75% Grass cover, Good, HSG A
6.182	98	Roofs, HSG A
0.000	98	Unconnected pavement, HSG A
6.182	98	Weighted Average
0.000		0.01% Pervious Area
6.182		99.99% Impervious Area
0.000		0.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, A-B: CALCULATED BELOW MINIMUM**

Subcatchment EX-7: Subcat EX-7



Summary for Subcatchment EX-8: Subcat EX-8

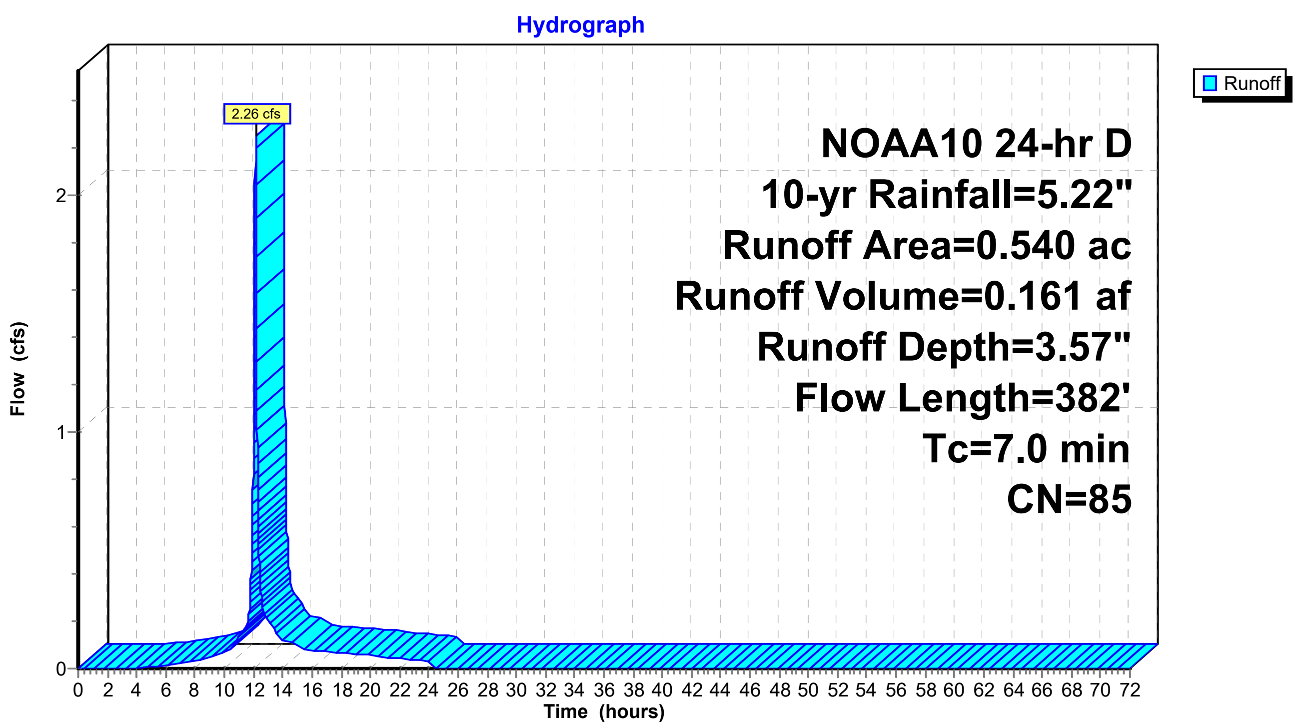
Runoff = 2.26 cfs @ 12.14 hrs, Volume= 0.161 af, Depth= 3.57"
Routed to Pond 4P : EX. BASIN #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-yr Rainfall=5.22"

Area (ac)	CN	Description
0.119	39	>75% Grass cover, Good, HSG A
0.421	98	Paved parking, HSG A
0.540	85	Weighted Average
0.119		22.03% Pervious Area
0.421		77.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	35	0.0300	0.11		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.36"
1.3	158	0.0100	2.03		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
0.6	189	0.0120	4.97	3.90	**Pipe Channel, C-D** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Concrete pipe, bends & connections
7.0	382	Total			

Subcatchment EX-8: Subcat EX-8



Summary for Subcatchment EX-9: Subcat EX-9

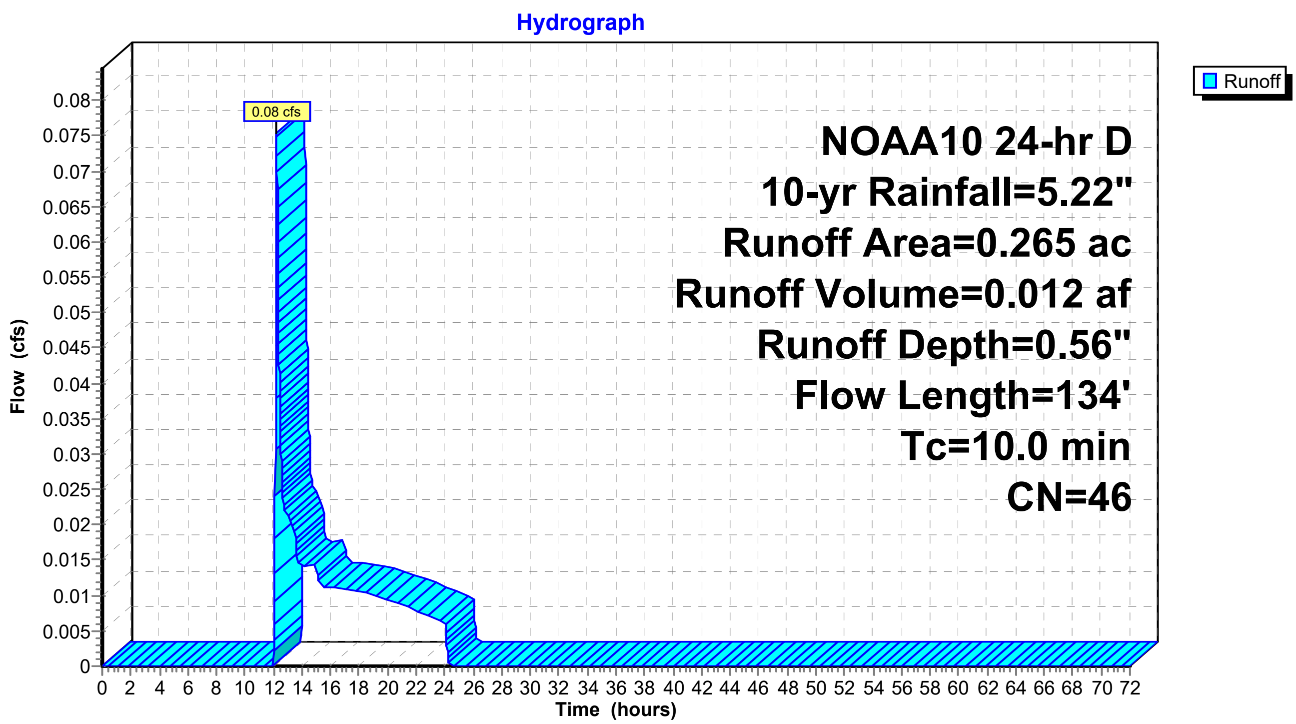
Runoff = 0.08 cfs @ 12.21 hrs, Volume= 0.012 af, Depth= 0.56"
Routed to Pond 1P : existing depression

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-yr Rainfall=5.22"

Area (ac)	CN	Description
0.050	39	>75% Grass cover, Good, HSG A
0.006	80	>75% Grass cover, Good, HSG D
0.137	30	Woods, Good, HSG A
0.071	77	Woods, Good, HSG D
0.265	46	Weighted Average
0.265		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.8	50	0.0440	0.09		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.36"
1.2	84	0.0520	1.14		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
10.0	134	Total			

Subcatchment EX-9: Subcat EX-9



Summary for Pond 1P: existing depression

[44] Hint: Outlet device #1 is below defined storage

Inflow Area = 0.265 ac, 0.00% Impervious, Inflow Depth = 0.56" for 10-yr event
Inflow = 0.08 cfs @ 12.21 hrs, Volume= 0.012 af
Outflow = 0.08 cfs @ 12.21 hrs, Volume= 0.012 af, Atten= 0%, Lag= 0.0 min
Primary = 0.08 cfs @ 12.21 hrs, Volume= 0.012 af
Routed to Pond 5P : EX. BASIN #2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 274.00' @ 0.00 hrs Surf.Area= 528 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.0 min (993.9 - 993.9)

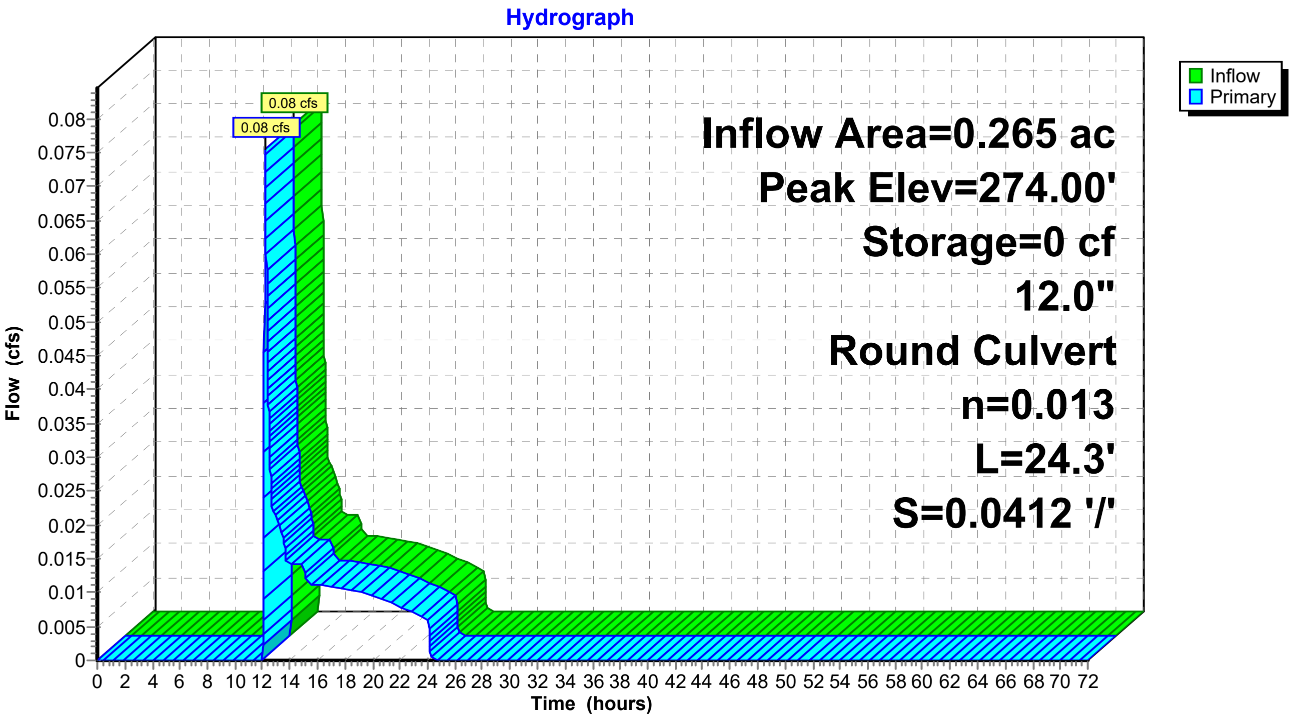
Volume	Invert	Avail.Storage	Storage Description
#1	274.00'	2,821 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
274.00	528	0	0
275.00	1,358	943	943
276.00	2,397	1,878	2,821

Device	Routing	Invert	Outlet Devices
#1	Primary	272.90'	**12.0" Round Culvert** L= 24.3' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 272.90' / 271.90' S= 0.0412 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 12.21 hrs HW=274.00' TW=253.60' (Dynamic Tailwater)
↑—**1=Culvert** (Passes 0.00 cfs of 2.93 cfs potential flow)

Pond 1P: existing depression



Summary for Pond 3P: EX. BASIN #3

Inflow Area = 9.009 ac, 77.26% Impervious, Inflow Depth = 3.70" for 10-yr event
Inflow = 34.77 cfs @ 12.13 hrs, Volume= 2.780 af
Outflow = 7.18 cfs @ 12.36 hrs, Volume= 2.603 af, Atten= 79%, Lag= 13.8 min
Primary = 7.18 cfs @ 12.36 hrs, Volume= 2.603 af
Routed to Pond 5P : EX. BASIN #2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 269.24' @ 12.36 hrs Surf.Area= 18,050 sf Storage= 48,237 cf

Plug-Flow detention time= 256.8 min calculated for 2.603 af (94% of inflow)
Center-of-Mass det. time= 218.6 min (984.0 - 765.4)

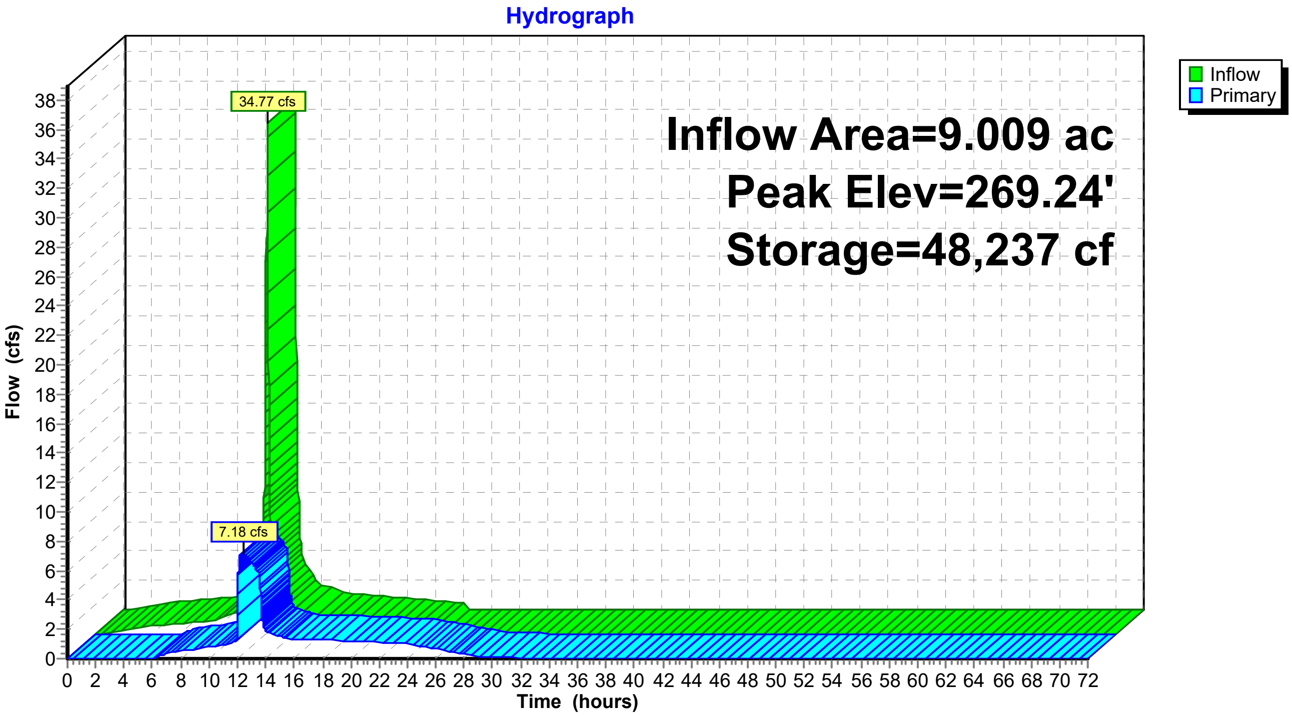
Volume	Invert	Avail.Storage	Storage Description
#1	265.00'	188,837 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
265.00	6,581	0	0
266.00	7,637	7,109	7,109
267.00	8,818	8,228	15,337
268.00	15,371	12,095	27,431
269.00	17,536	16,454	43,885
270.00	19,637	18,587	62,471
271.00	21,748	20,693	83,164
272.00	23,983	22,866	106,029
273.00	26,245	25,114	131,143
274.00	28,727	27,486	158,629
275.00	31,688	30,208	188,837

Device	Routing	Invert	Outlet Devices
#1	Primary	265.60'	**24.0" Round Culvert** L= 223.3' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 265.60' / 264.50' S= 0.0049 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 3.14 sf
#2	Device 1	266.06'	**12.0" Round Culvert** L= 8.4' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 266.06' / 265.90' S= 0.0190 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf
#3	Device 2	266.06'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 1	266.58'	**12.0" Round Culvert** L= 12.3' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 266.58' / 265.80' S= 0.0634 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf
#5	Device 4	268.26'	**57.0" x 100.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=7.18 cfs @ 12.36 hrs HW=269.24' TW=253.85' (Dynamic Tailwater)
1=Culvert (Passes 7.18 cfs of 20.18 cfs potential flow)
2=Culvert (Passes 1.62 cfs of 6.20 cfs potential flow)
3=Orifice/Grate (Orifice Controls 1.62 cfs @ 8.25 fps)
4=Culvert (Inlet Controls 5.56 cfs @ 7.08 fps)
5=Orifice/Grate (Passes 5.56 cfs of 83.59 cfs potential flow)

Pond 3P: EX. BASIN #3



Summary for Pond 4P: EX. BASIN #1

Inflow Area = 1.681 ac, 55.40% Impervious, Inflow Depth = 2.37" for 10-yr event
Inflow = 4.07 cfs @ 12.16 hrs, Volume= 0.332 af
Outflow = 3.25 cfs @ 12.22 hrs, Volume= 0.283 af, Atten= 20%, Lag= 3.6 min
Primary = 3.25 cfs @ 12.22 hrs, Volume= 0.283 af
Routed to Pond 5P : EX. BASIN #2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 274.21' @ 12.22 hrs Surf.Area= 6,064 sf Storage= 3,350 cf

Plug-Flow detention time= 124.8 min calculated for 0.283 af (85% of inflow)
Center-of-Mass det. time= 53.3 min (919.1 - 865.8)

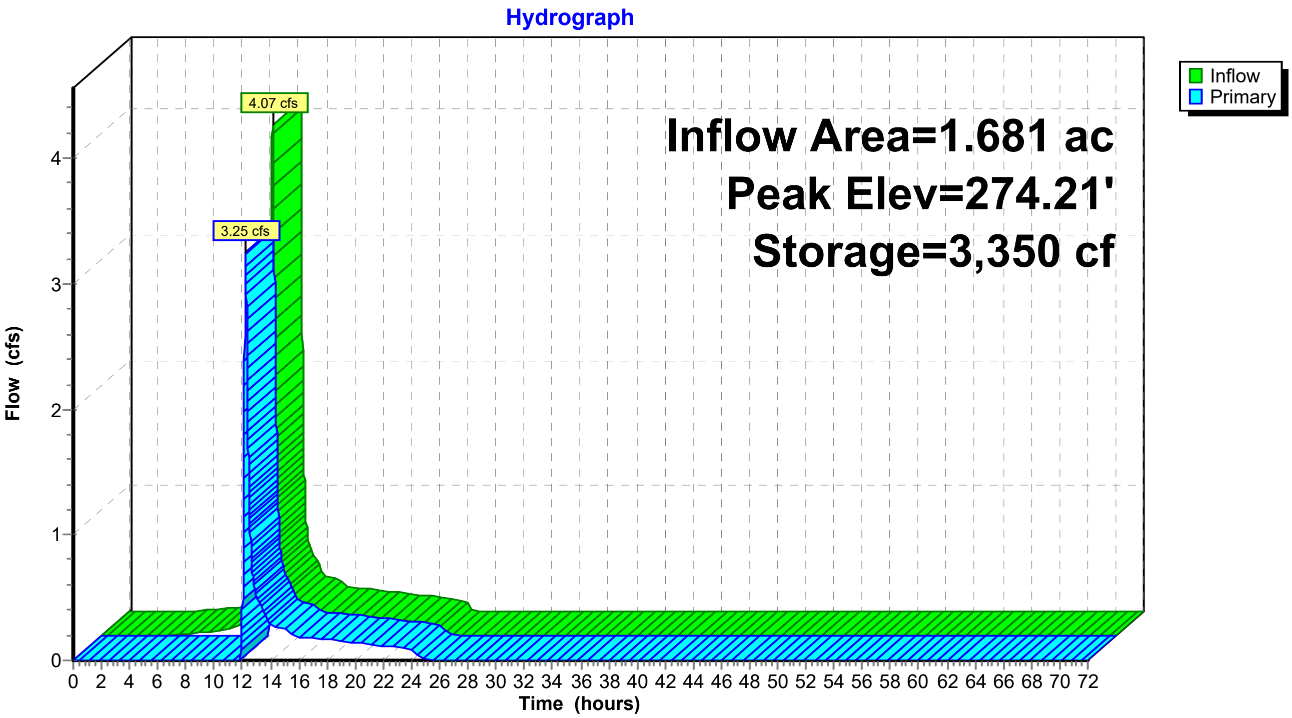
Volume	Invert	Avail.Storage	Storage Description
#1	273.40'	31,754 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
273.40	1,731	0	0
274.00	5,352	2,125	2,125
275.00	8,670	7,011	9,136
276.00	11,387	10,029	19,164
277.00	13,793	12,590	31,754

Device	Routing	Invert	Outlet Devices
#1	Primary	272.50'	**12.0" Round Culvert** L= 75.9' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 272.50' / 271.90' S= 0.0079 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf
#2	Device 1	274.00'	**24.0" x 36.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=3.25 cfs @ 12.22 hrs HW=274.21' TW=253.61' (Dynamic Tailwater)
↑—**1=Culvert** (Passes 3.25 cfs of 3.67 cfs potential flow)
  ↑—**2=Orifice/Grate** (Weir Controls 3.25 cfs @ 1.51 fps)

Pond 4P: EX. BASIN #1



Summary for Pond 5P: EX. BASIN #2

Inflow Area = 15.269 ac, 73.96% Impervious, Inflow Depth = 3.31" for 10-yr event
Inflow = 27.27 cfs @ 12.14 hrs, Volume= 4.208 af
Outflow = 1.73 cfs @ 20.75 hrs, Volume= 4.208 af, Atten= 94%, Lag= 516.6 min
Discarded = 1.04 cfs @ 20.75 hrs, Volume= 3.645 af
Primary = 0.69 cfs @ 20.75 hrs, Volume= 0.562 af
Routed to Pond AP-1 : Southern Wetlands
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond AP-1 : Southern Wetlands

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 255.44' @ 20.75 hrs Surf.Area= 28,440 sf Storage= 98,346 cf

Plug-Flow detention time= 931.1 min calculated for 4.208 af (100% of inflow)
Center-of-Mass det. time= 931.1 min (1,857.6 - 926.5)

Volume	Invert	Avail.Storage	Storage Description
#1	252.50'	198,113 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	252.50'	50,451 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) -Impervious
		248,564 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
252.50	21,111	0	0
253.00	22,353	10,866	10,866
254.00	24,697	23,525	34,391
255.00	26,888	25,793	60,184
256.00	30,430	28,659	88,843
257.00	33,434	31,932	120,775
258.00	36,584	35,009	155,784
259.00	48,075	42,330	198,113

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
252.50	8,488	0	0
253.00	8,672	4,290	4,290
254.00	8,778	8,725	13,015
255.00	9,174	8,976	21,991
256.00	9,483	9,329	31,320
257.00	9,587	9,535	40,855
258.00	9,606	9,597	50,451

Device	Routing	Invert	Outlet Devices
#1	Secondary	257.70'	**9.0' long x 15.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Primary	254.94'	**12.0" Round Culvert** L= 12.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 254.94' / 254.86' S= 0.0067 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

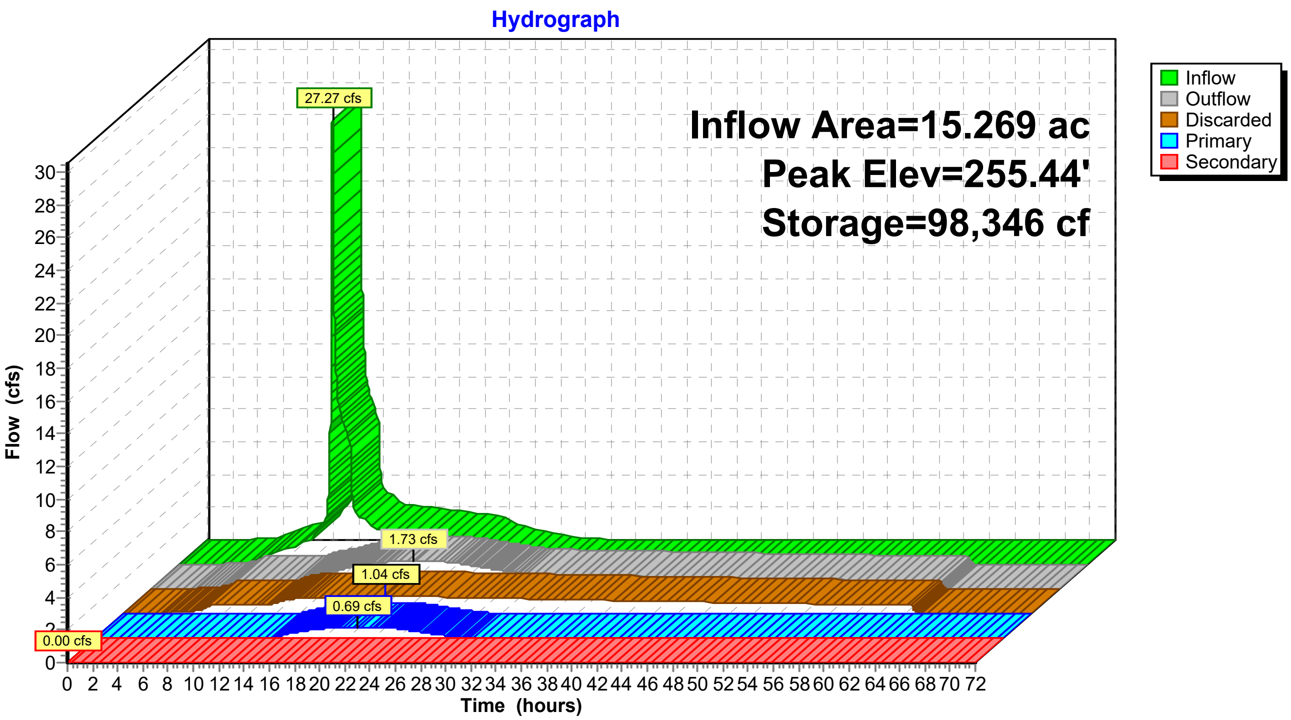
#3	Discarded	252.50'	**1.020 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 248.00' Phase-In= 0.01'

Discarded OutFlow Max=1.04 cfs @ 20.75 hrs HW=255.44' (Free Discharge)
└─**3=Exfiltration** (Controls 1.04 cfs)

Primary OutFlow Max=0.69 cfs @ 20.75 hrs HW=255.44' TW=0.00' (Dynamic Tailwater)
└─**2=Culvert** (Barrel Controls 0.69 cfs @ 2.57 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=252.50' TW=0.00' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 5P: EX. BASIN #2



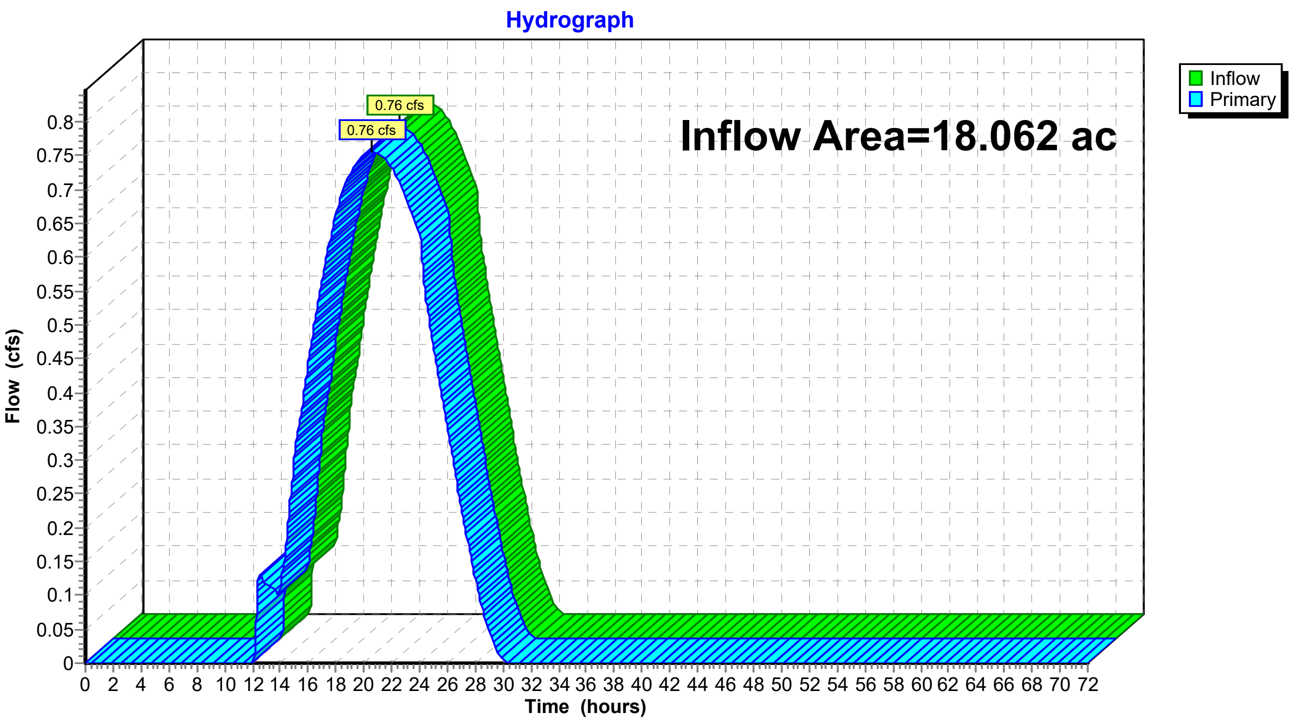
Summary for Pond AP-1: Southern Wetlands

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

Inflow Area = 18.062 ac, 62.53% Impervious, Inflow Depth = 0.42" for 10-yr event
Inflow = 0.76 cfs @ 20.56 hrs, Volume= 0.639 af
Primary = 0.76 cfs @ 20.56 hrs, Volume= 0.639 af, Atten= 0%, Lag= 0.0 min

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

Pond AP-1: Southern Wetlands



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 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

SubcatchmentEX-1: Subcat EX-1 Runoff Area=2.827 ac 27.56% Impervious Runoff Depth=1.50"
Flow Length=424' Tc=8.1 min CN=52 Runoff=4.33 cfs 0.353 af

SubcatchmentEX-2: Subcat EX-2 Runoff Area=1.141 ac 44.71% Impervious Runoff Depth=2.64"
Flow Length=231' Tc=11.0 min CN=65 Runoff=3.02 cfs 0.251 af

SubcatchmentEX-3: Subcat EX-3 Runoff Area=1.865 ac 89.47% Impervious Runoff Depth=5.45"
Flow Length=682' Tc=6.4 min CN=92 Runoff=11.41 cfs 0.847 af

SubcatchmentEX-4: Subcat EX-4 Runoff Area=0.877 ac 88.00% Impervious Runoff Depth=5.34"
Flow Length=524' Tc=6.0 min CN=91 Runoff=5.39 cfs 0.390 af

SubcatchmentEX-5: Subcat EX-5 Runoff Area=2.793 ac 0.00% Impervious Runoff Depth=0.69"
Flow Length=349' Tc=16.9 min CN=41 Runoff=0.73 cfs 0.160 af

SubcatchmentEX-6: Subcat EX-6 Runoff Area=68,451 sf 61.12% Impervious Runoff Depth=3.52"
Tc=6.0 min CN=74 Runoff=6.90 cfs 0.460 af

SubcatchmentEX-7: Subcat EX-7 Runoff Area=6.182 ac 99.99% Impervious Runoff Depth=6.15"
Tc=6.0 min CN=98 Runoff=40.21 cfs 3.169 af

SubcatchmentEX-8: Subcat EX-8 Runoff Area=0.540 ac 77.97% Impervious Runoff Depth=4.67"
Flow Length=382' Tc=7.0 min CN=85 Runoff=2.91 cfs 0.210 af

SubcatchmentEX-9: Subcat EX-9 Runoff Area=0.265 ac 0.00% Impervious Runoff Depth=1.04"
Flow Length=134' Tc=10.0 min CN=46 Runoff=0.21 cfs 0.023 af

Pond 1P: existing depression Peak Elev=274.00' Storage=0 cf Inflow=0.21 cfs 0.023 af
12.0" Round Culvert n=0.013 L=24.3' S=0.0412 '/' Outflow=0.21 cfs 0.023 af

Pond 3P: EX. BASIN #3 Peak Elev=269.85' Storage=59,473 cf Inflow=44.12 cfs 3.522 af
Outflow=8.07 cfs 3.346 af

Pond 4P: EX. BASIN #1 Peak Elev=274.31' Storage=3,953 cf Inflow=5.66 cfs 0.461 af
Outflow=3.80 cfs 0.412 af

Pond 5P: EX. BASIN #2 Peak Elev=255.95' Storage=118,035 cf Inflow=34.69 cfs 5.479 af
Discarded=1.16 cfs 3.897 af Primary=2.20 cfs 1.582 af Secondary=0.00 cfs 0.000 af Outflow=3.35 cfs 5.479 af

Pond AP-1: Southern Wetlands Inflow=2.38 cfs 1.743 af
Primary=2.38 cfs 1.743 af

Total Runoff Area = 18.062 ac Runoff Volume = 5.865 af Average Runoff Depth = 3.90"
37.47% Pervious = 6.769 ac 62.53% Impervious = 11.293 ac

Summary for Subcatchment EX-1: Subcat EX-1

[47] Hint: Peak is 136% of capacity of segment #4

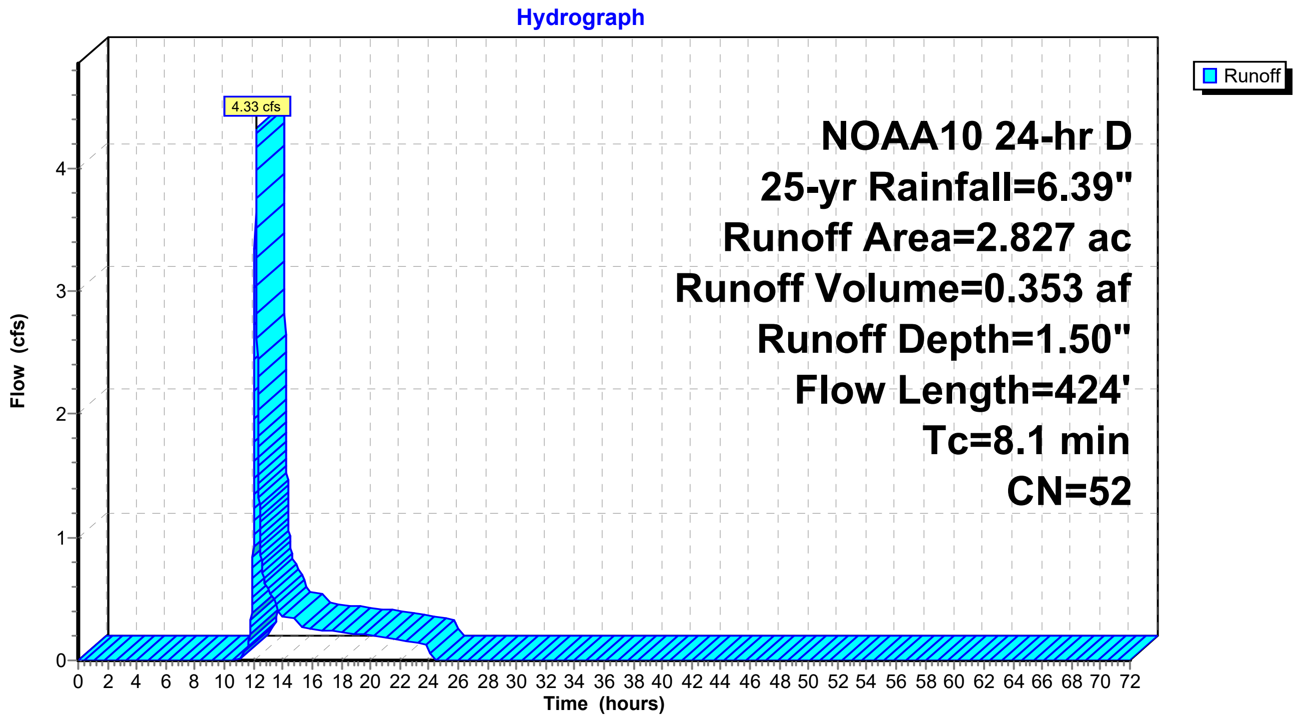
Runoff = 4.33 cfs @ 12.16 hrs, Volume= 0.353 af, Depth= 1.50"
Routed to Pond 3P : EX. BASIN #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-yr Rainfall=6.39"

Area (ac)	CN	Description
1.115	39	>75% Grass cover, Good, HSG A
0.505	98	Paved parking, HSG A
0.003	98	Unconnected pavement, HSG A
0.271	98	Water Surface, HSG A
0.933	30	Woods, Good, HSG A
2.827	52	Weighted Average
2.048		72.44% Pervious Area
0.779		27.56% Impervious Area
0.003		0.37% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	50	0.0250	0.17		**Sheet Flow, A-B**
					Grass: Short n= 0.150 P2= 3.36"
0.4	19	0.0110	0.73		**Shallow Concentrated Flow, B-C**
					Short Grass Pasture Kv= 7.0 fps
2.3	255	0.0080	1.82		**Shallow Concentrated Flow, C-D**
					Paved Kv= 20.3 fps
0.4	100	0.0080	4.06	3.19	**Pipe Channel, D-E**
					12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25'
					n= 0.013 Concrete pipe, bends & connections
8.1	424	Total			

Subcatchment EX-1: Subcat EX-1



Summary for Subcatchment EX-2: Subcat EX-2

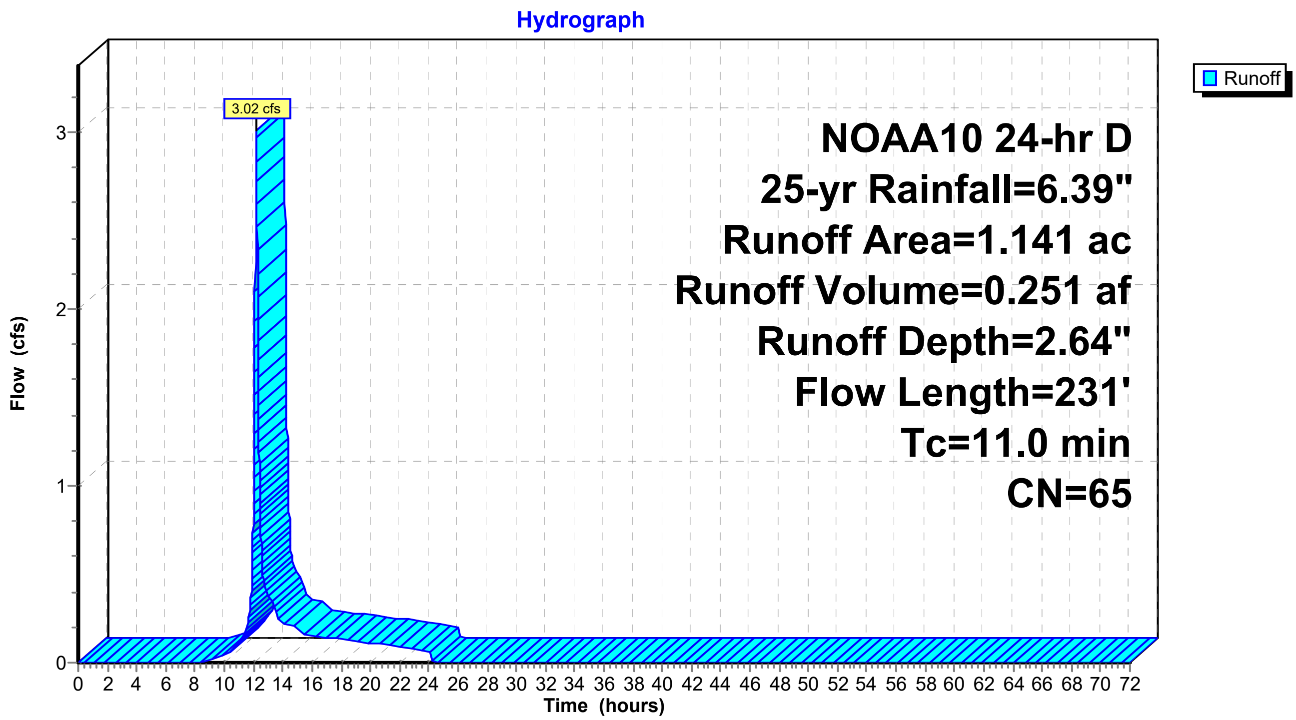
Runoff = 3.02 cfs @ 12.19 hrs, Volume= 0.251 af, Depth= 2.64"
Routed to Pond 4P : EX. BASIN #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-yr Rainfall=6.39"

Area (ac)	CN	Description
0.631	39	>75% Grass cover, Good, HSG A
0.239	98	Paved parking, HSG A
0.009	98	Unconnected pavement, HSG A
0.261	98	Water Surface, HSG A
1.141	65	Weighted Average
0.631		55.29% Pervious Area
0.510		44.71% Impervious Area
0.009		1.84% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	50	0.0050	0.09		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.36"
1.4	181	0.0220	2.22		**Shallow Concentrated Flow, B-C** Grassed Waterway Kv= 15.0 fps
11.0	231	Total			

Subcatchment EX-2: Subcat EX-2



Summary for Subcatchment EX-3: Subcat EX-3

[47] Hint: Peak is 119% of capacity of segment #3

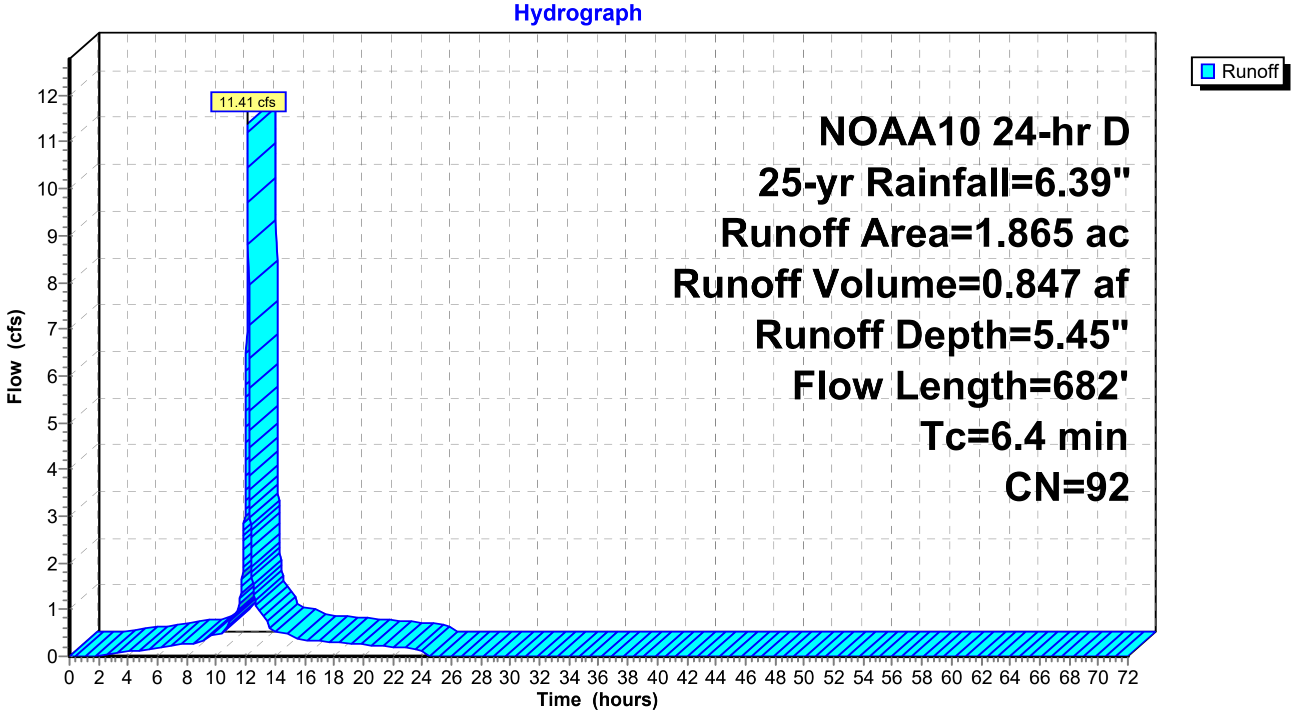
Runoff = 11.41 cfs @ 12.13 hrs, Volume= 0.847 af, Depth= 5.45"
Routed to Pond 5P : EX. BASIN #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-yr Rainfall=6.39"

Area (ac)	CN	Description
0.188	39	>75% Grass cover, Good, HSG A
0.008	80	>75% Grass cover, Good, HSG D
1.623	98	Paved parking, HSG A
0.039	98	Paved parking, HSG D
0.006	98	Unconnected pavement, HSG A
1.865	92	Weighted Average
0.196		10.53% Pervious Area
1.669		89.47% Impervious Area
0.006		0.35% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	35	0.0150	0.13		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.36"
0.7	119	0.0200	2.87		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
1.1	528	0.0220	7.81	9.58	**Pipe Channel, C-D** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013 Concrete pipe, bends & connections
6.4	682	Total			

Subcatchment EX-3: Subcat EX-3



Summary for Subcatchment EX-4: Subcat EX-4

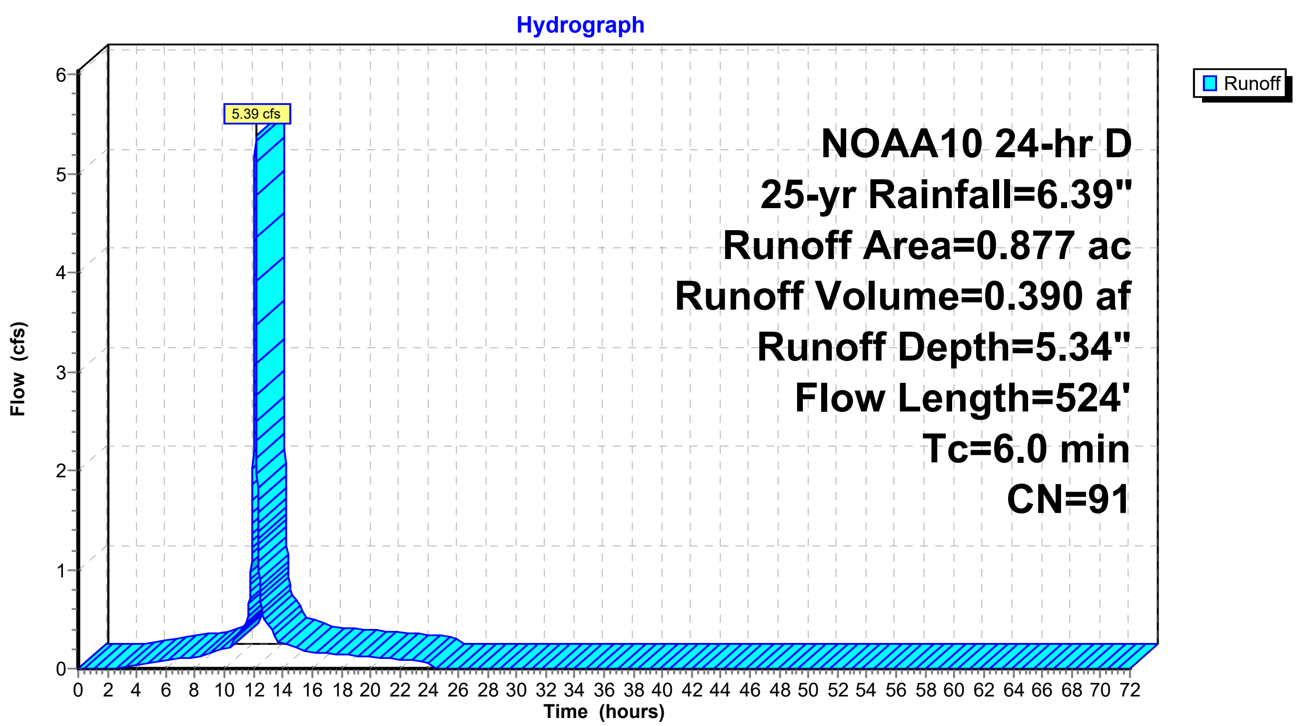
Runoff = 5.39 cfs @ 12.13 hrs, Volume= 0.390 af, Depth= 5.34"
Routed to Pond 5P : EX. BASIN #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-yr Rainfall=6.39"

Area (ac)	CN	Description
0.105	39	>75% Grass cover, Good, HSG A
0.772	98	Paved parking, HSG A
0.877	91	Weighted Average
0.105		12.00% Pervious Area
0.772		88.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	17	0.0100	0.06		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.36"
1.1	142	0.0120	2.22		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
0.4	365	0.0350	15.63	76.74	**Pipe Channel, C-D** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013 Concrete pipe, bends & connections
6.0	524	Total			

Subcatchment EX-4: Subcat EX-4



Summary for Subcatchment EX-5: Subcat EX-5

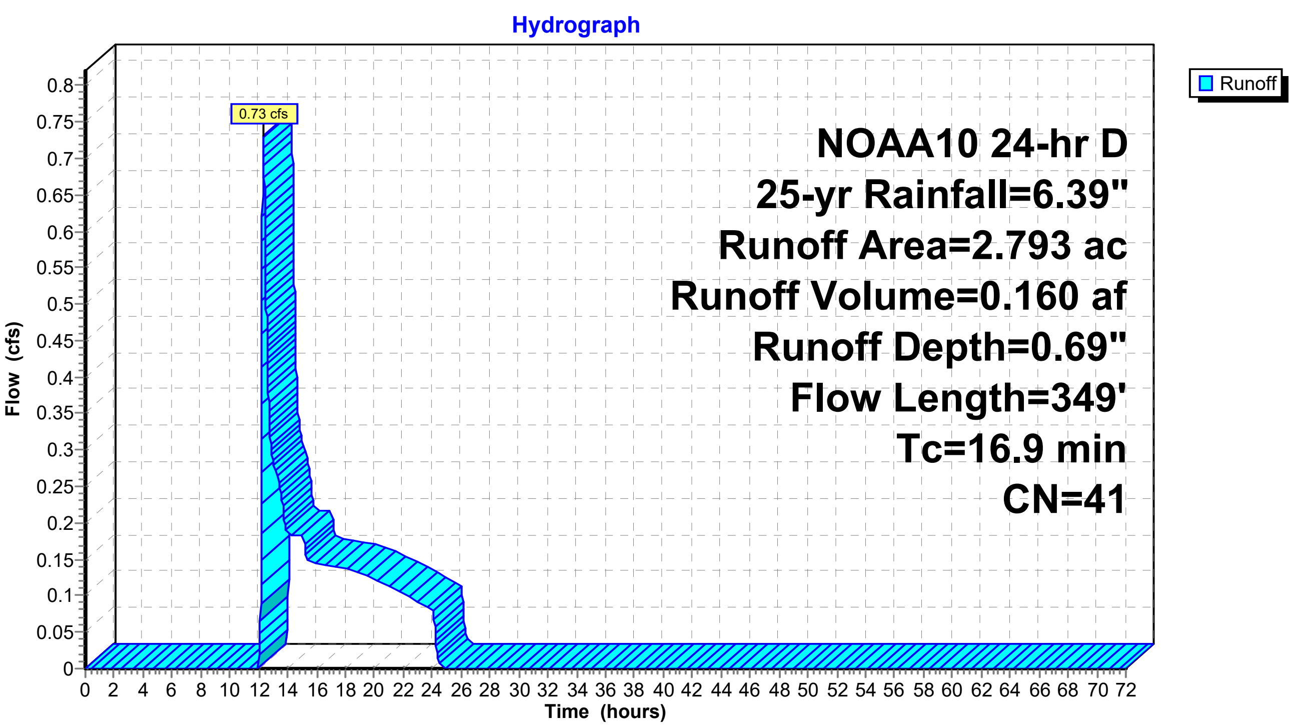
Runoff = 0.73 cfs @ 12.33 hrs, Volume= 0.160 af, Depth= 0.69"
Routed to Pond AP-1 : Southern Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-yr Rainfall=6.39"

Area (ac)	CN	Description
0.176	39	>75% Grass cover, Good, HSG A
0.016	80	>75% Grass cover, Good, HSG D
1.994	30	Woods, Good, HSG A
0.606	77	Woods, Good, HSG D
2.793	41	Weighted Average
2.793		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0190	0.07		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.36"
0.7	58	0.0780	1.40		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
3.9	241	0.0420	1.02		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
16.9	349	Total			

Subcatchment EX-5: Subcat EX-5



Summary for Subcatchment EX-6: Subcat EX-6

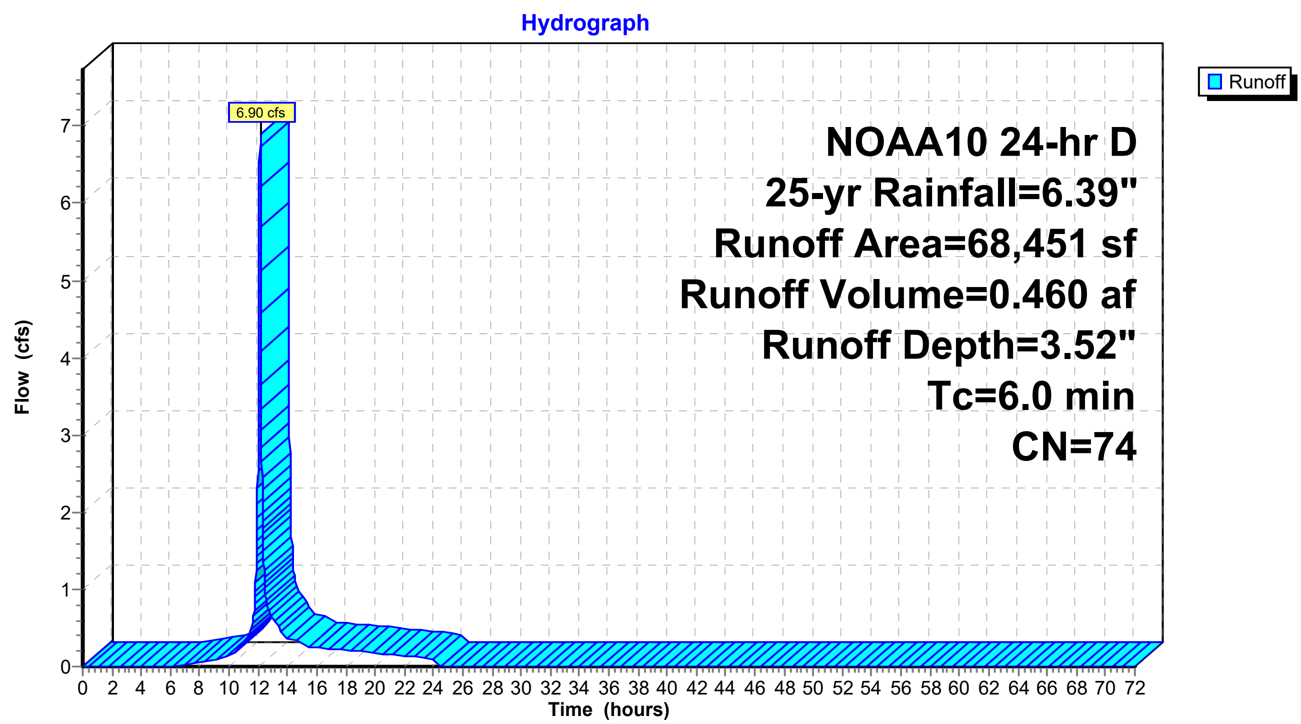
Runoff = 6.90 cfs @ 12.13 hrs, Volume= 0.460 af, Depth= 3.52"
Routed to Pond 5P : EX. BASIN #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-yr Rainfall=6.39"

Area (sf)	CN	Description
17,052	39	>75% Grass cover, Good, HSG A
41,839	98	Water Surface, HSG A
9,559	30	Woods, Good, HSG A
68,451	74	Weighted Average
26,612		38.88% Pervious Area
41,839		61.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, A-B-C: CALCULATED BELOW MINIMUM**

Subcatchment EX-6: Subcat EX-6



Summary for Subcatchment EX-7: Subcat EX-7

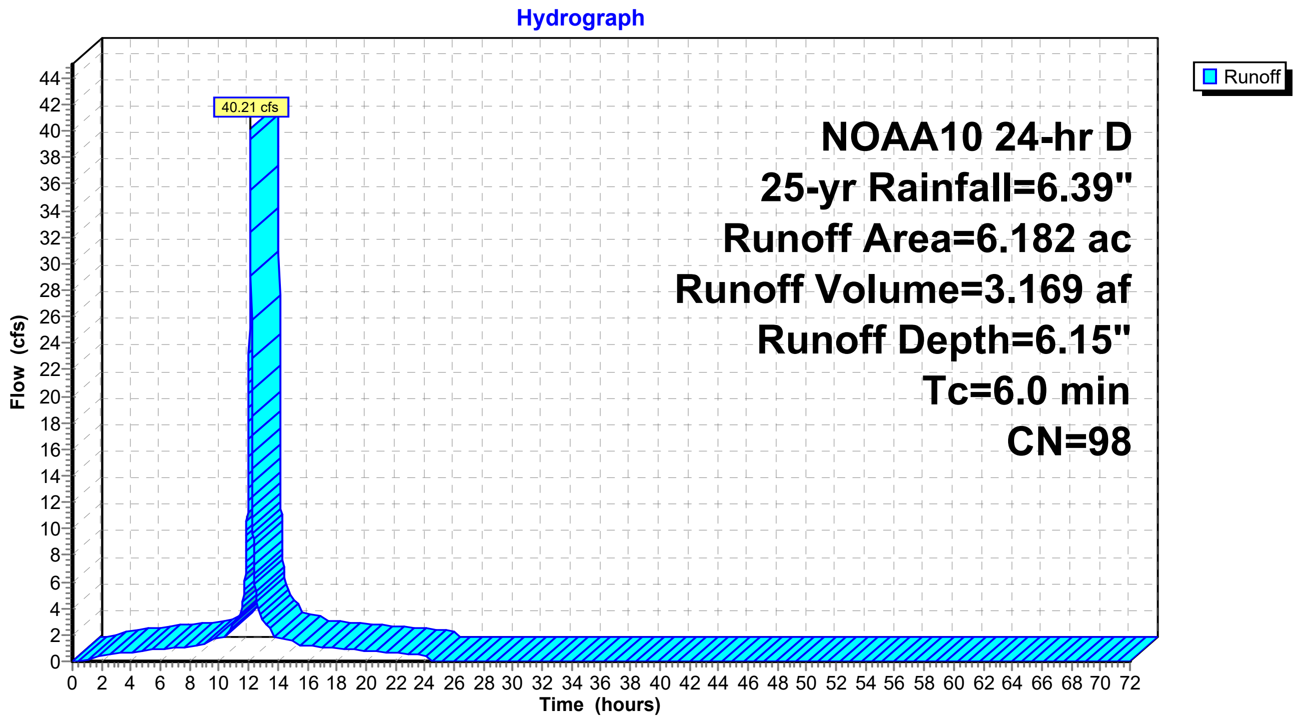
Runoff = 40.21 cfs @ 12.13 hrs, Volume= 3.169 af, Depth= 6.15"
Routed to Pond 3P : EX. BASIN #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-yr Rainfall=6.39"

Area (ac)	CN	Description
0.000	39	>75% Grass cover, Good, HSG A
6.182	98	Roofs, HSG A
0.000	98	Unconnected pavement, HSG A
6.182	98	Weighted Average
0.000		0.01% Pervious Area
6.182		99.99% Impervious Area
0.000		0.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, A-B: CALCULATED BELOW MINIMUM**

Subcatchment EX-7: Subcat EX-7



Summary for Subcatchment EX-8: Subcat EX-8

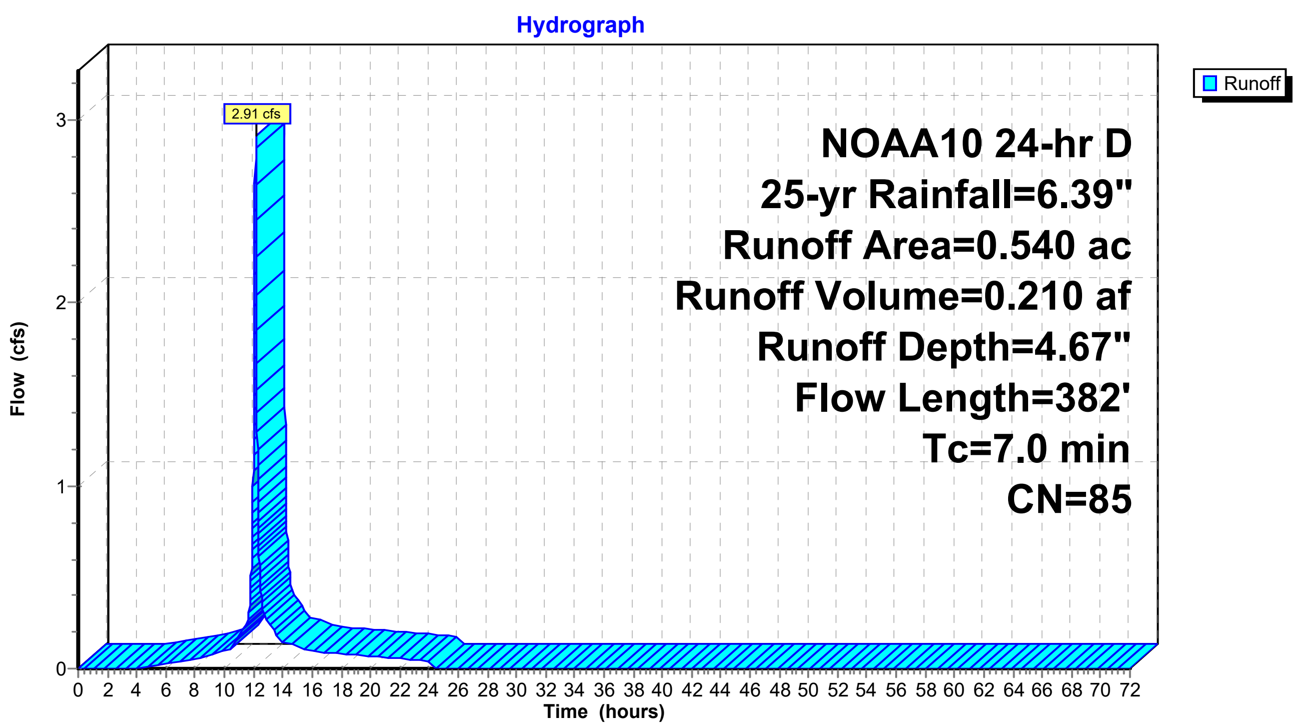
Runoff = 2.91 cfs @ 12.14 hrs, Volume= 0.210 af, Depth= 4.67"
Routed to Pond 4P : EX. BASIN #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-yr Rainfall=6.39"

Area (ac)	CN	Description
0.119	39	>75% Grass cover, Good, HSG A
0.421	98	Paved parking, HSG A
0.540	85	Weighted Average
0.119		22.03% Pervious Area
0.421		77.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	35	0.0300	0.11		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.36"
1.3	158	0.0100	2.03		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
0.6	189	0.0120	4.97	3.90	**Pipe Channel, C-D** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Concrete pipe, bends & connections
7.0	382	Total			

Subcatchment EX-8: Subcat EX-8



Summary for Subcatchment EX-9: Subcat EX-9

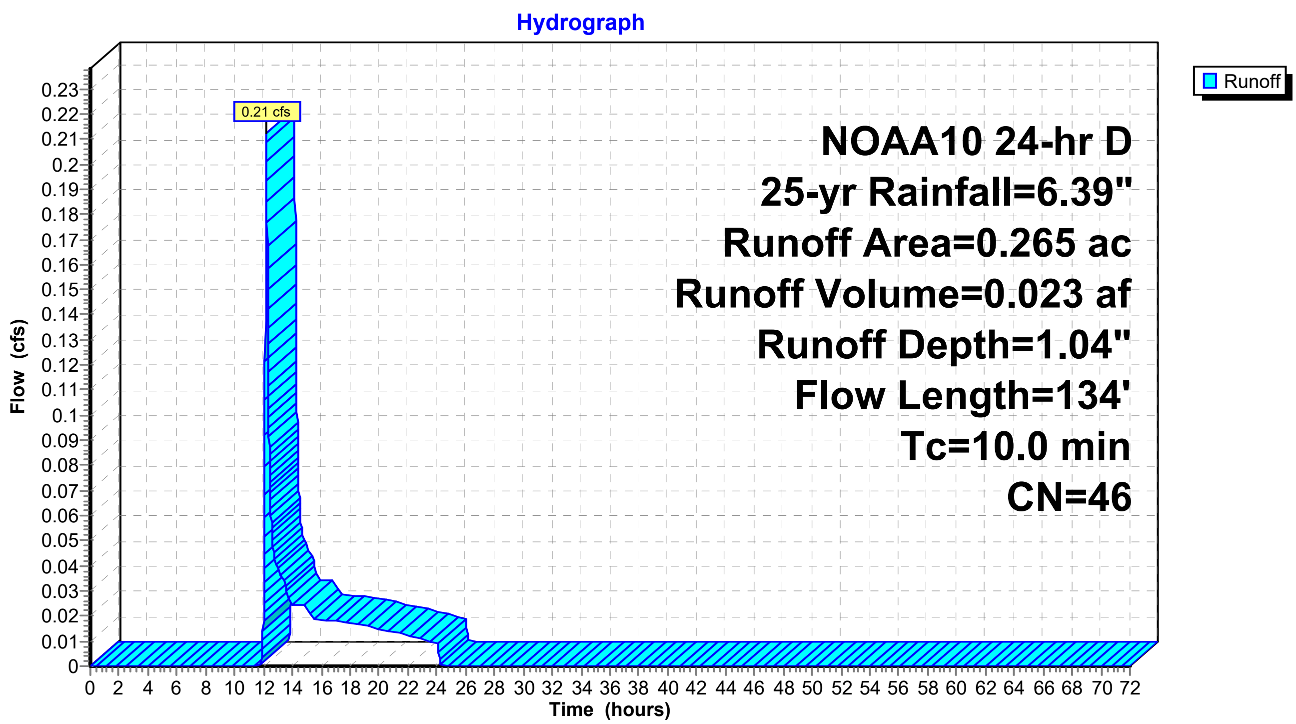
Runoff = 0.21 cfs @ 12.19 hrs, Volume= 0.023 af, Depth= 1.04"
Routed to Pond 1P : existing depression

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-yr Rainfall=6.39"

Area (ac)	CN	Description
0.050	39	>75% Grass cover, Good, HSG A
0.006	80	>75% Grass cover, Good, HSG D
0.137	30	Woods, Good, HSG A
0.071	77	Woods, Good, HSG D
0.265	46	Weighted Average
0.265		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.8	50	0.0440	0.09		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.36"
1.2	84	0.0520	1.14		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
10.0	134	Total			

Subcatchment EX-9: Subcat EX-9



Summary for Pond 1P: existing depression

[44] Hint: Outlet device #1 is below defined storage

Inflow Area = 0.265 ac, 0.00% Impervious, Inflow Depth = 1.04" for 25-yr event
Inflow = 0.21 cfs @ 12.19 hrs, Volume= 0.023 af
Outflow = 0.21 cfs @ 12.19 hrs, Volume= 0.023 af, Atten= 0%, Lag= 0.0 min
Primary = 0.21 cfs @ 12.19 hrs, Volume= 0.023 af
Routed to Pond 5P : EX. BASIN #2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 274.00' @ 0.00 hrs Surf.Area= 528 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.0 min (960.4 - 960.4)

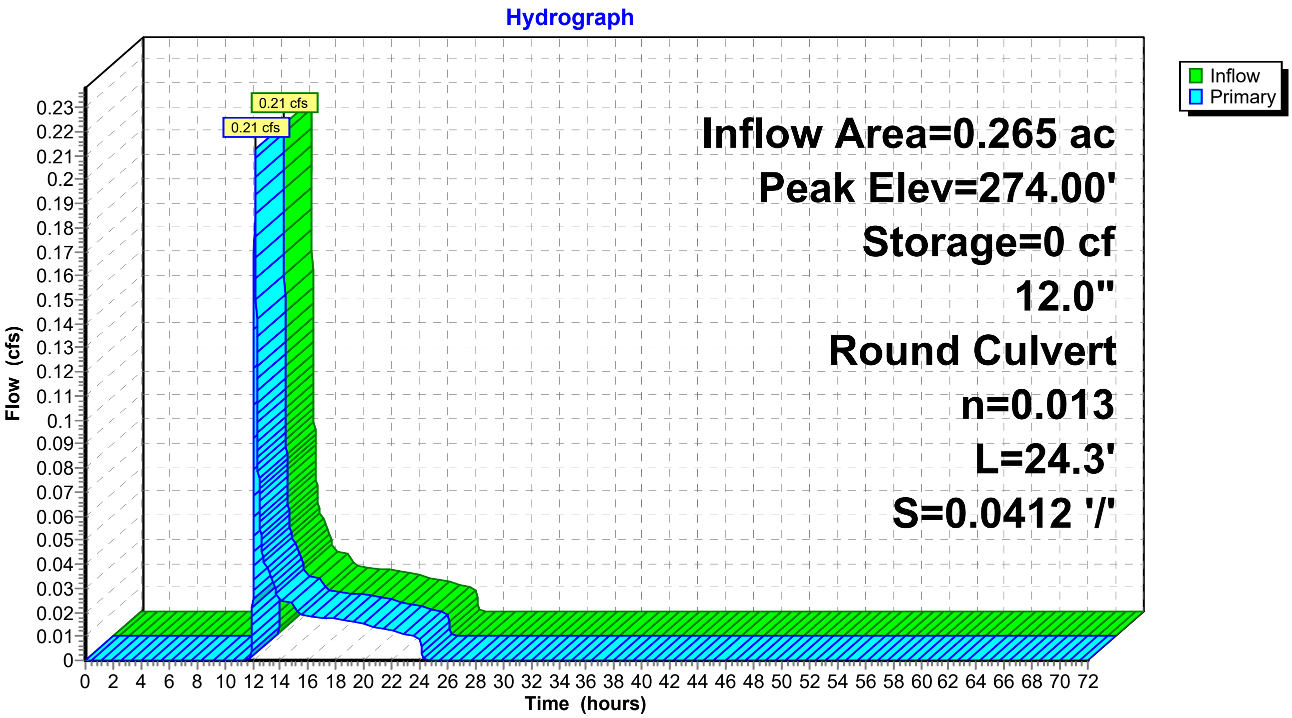
Volume	Invert	Avail.Storage	Storage Description
#1	274.00'	2,821 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
274.00	528	0	0
275.00	1,358	943	943
276.00	2,397	1,878	2,821

Device	Routing	Invert	Outlet Devices
#1	Primary	272.90'	**12.0" Round Culvert** L= 24.3' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 272.90' / 271.90' S= 0.0412 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 12.19 hrs HW=274.00' TW=254.02' (Dynamic Tailwater)
1=Culvert (Passes 0.00 cfs of 2.93 cfs potential flow)

Pond 1P: existing depression



Summary for Pond 3P: EX. BASIN #3

Inflow Area = 9.009 ac, 77.26% Impervious, Inflow Depth = 4.69" for 25-yr event
Inflow = 44.12 cfs @ 12.13 hrs, Volume= 3.522 af
Outflow = 8.07 cfs @ 12.39 hrs, Volume= 3.346 af, Atten= 82%, Lag= 15.5 min
Primary = 8.07 cfs @ 12.39 hrs, Volume= 3.346 af
Routed to Pond 5P : EX. BASIN #2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 269.85' @ 12.39 hrs Surf.Area= 19,314 sf Storage= 59,473 cf

Plug-Flow detention time= 235.3 min calculated for 3.345 af (95% of inflow)
Center-of-Mass det. time= 204.6 min (969.2 - 764.6)

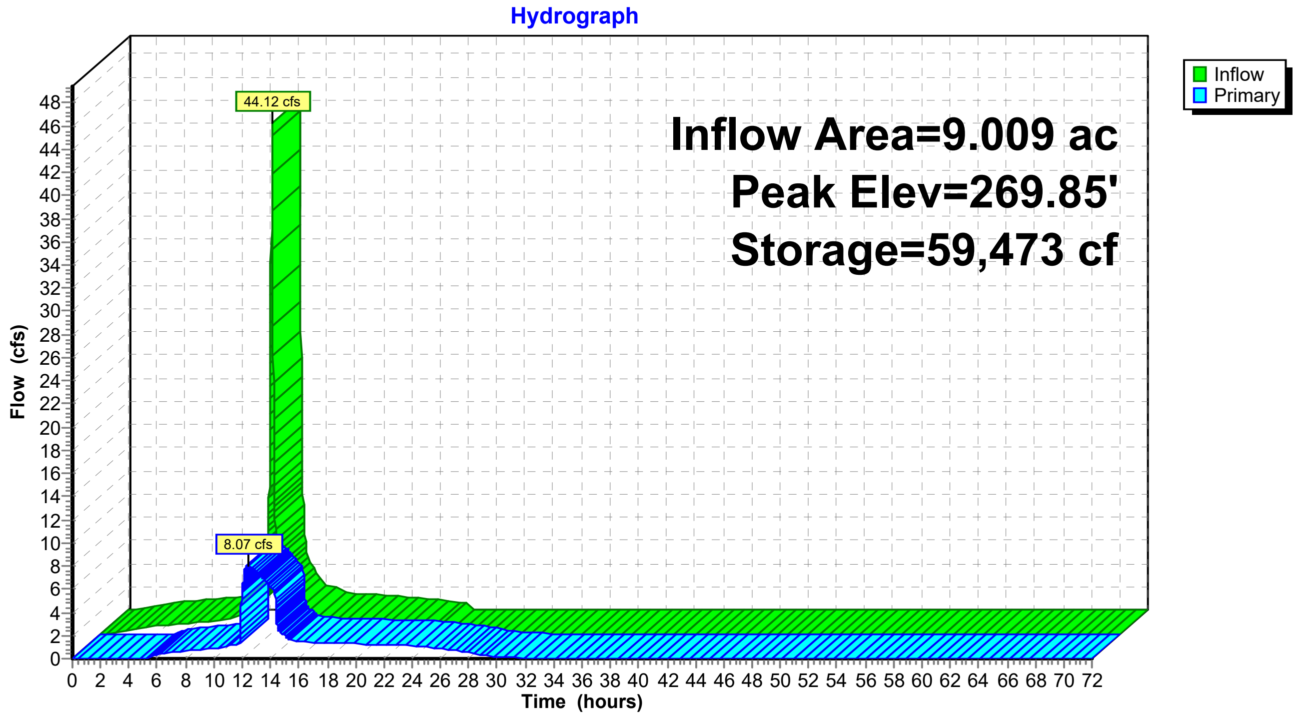
Volume	Invert	Avail.Storage	Storage Description
#1	265.00'	188,837 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
265.00	6,581	0	0
266.00	7,637	7,109	7,109
267.00	8,818	8,228	15,337
268.00	15,371	12,095	27,431
269.00	17,536	16,454	43,885
270.00	19,637	18,587	62,471
271.00	21,748	20,693	83,164
272.00	23,983	22,866	106,029
273.00	26,245	25,114	131,143
274.00	28,727	27,486	158,629
275.00	31,688	30,208	188,837

Device	Routing	Invert	Outlet Devices
#1	Primary	265.60'	**24.0" Round Culvert** L= 223.3' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 265.60' / 264.50' S= 0.0049 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 3.14 sf
#2	Device 1	266.06'	**12.0" Round Culvert** L= 8.4' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 266.06' / 265.90' S= 0.0190 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf
#3	Device 2	266.06'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 1	266.58'	**12.0" Round Culvert** L= 12.3' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 266.58' / 265.80' S= 0.0634 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf
#5	Device 4	268.26'	**57.0" x 100.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=8.07 cfs @ 12.39 hrs HW=269.85' TW=254.42' (Dynamic Tailwater)
└─**1=Culvert** (Passes 8.07 cfs of 22.28 cfs potential flow)
  ├─**2=Culvert** (Passes 1.78 cfs of 6.86 cfs potential flow)
  │ └─**3=Orifice/Grate** (Orifice Controls 1.78 cfs @ 9.05 fps)
  └─**4=Culvert** (Inlet Controls 6.29 cfs @ 8.01 fps)
    └─**5=Orifice/Grate** (Passes 6.29 cfs of 170.91 cfs potential flow)

Pond 3P: EX. BASIN #3



Summary for Pond 4P: EX. BASIN #1

Inflow Area = 1.681 ac, 55.40% Impervious, Inflow Depth = 3.29" for 25-yr event
Inflow = 5.66 cfs @ 12.16 hrs, Volume= 0.461 af
Outflow = 3.80 cfs @ 12.25 hrs, Volume= 0.412 af, Atten= 33%, Lag= 5.4 min
Primary = 3.80 cfs @ 12.25 hrs, Volume= 0.412 af
Routed to Pond 5P : EX. BASIN #2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 274.31' @ 12.25 hrs Surf.Area= 6,386 sf Storage= 3,953 cf

Plug-Flow detention time= 98.8 min calculated for 0.412 af (89% of inflow)
Center-of-Mass det. time= 44.5 min (899.3 - 854.8)

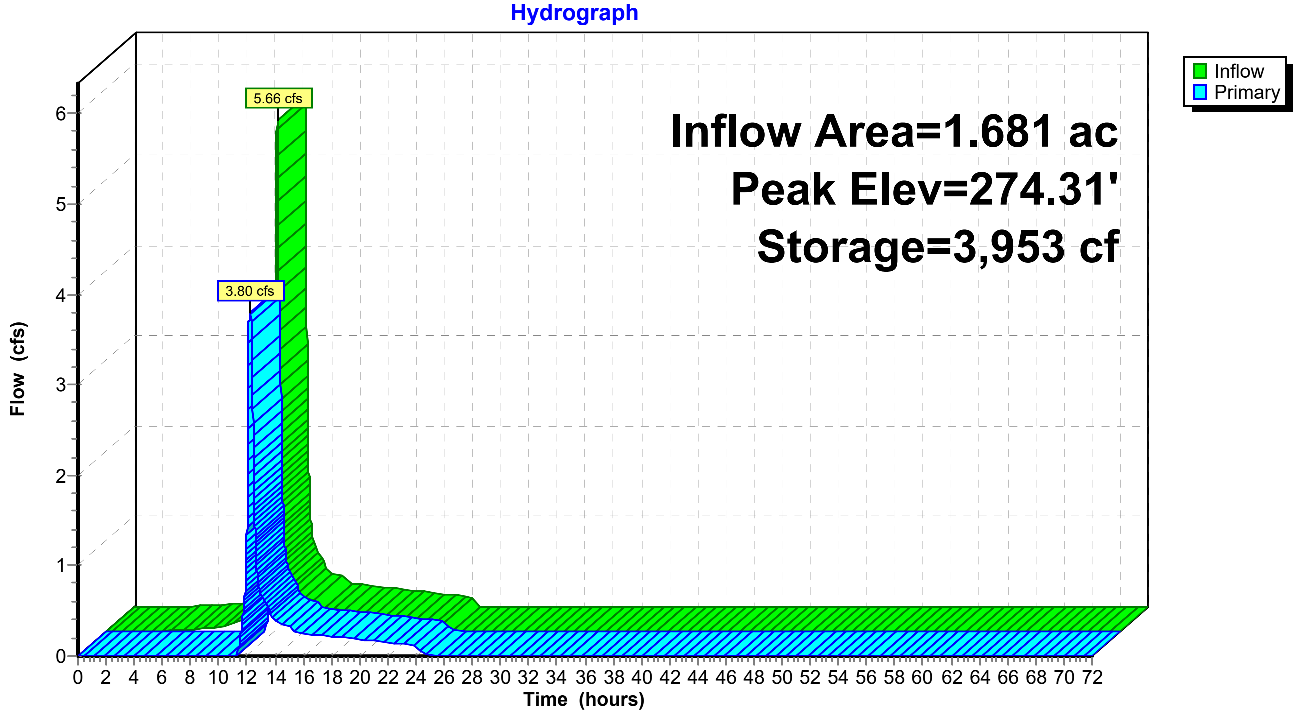
Volume	Invert	Avail.Storage	Storage Description
#1	273.40'	31,754 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
273.40	1,731	0	0
274.00	5,352	2,125	2,125
275.00	8,670	7,011	9,136
276.00	11,387	10,029	19,164
277.00	13,793	12,590	31,754

Device	Routing	Invert	Outlet Devices
#1	Primary	272.50'	**12.0" Round Culvert** L= 75.9' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 272.50' / 271.90' S= 0.0079 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf
#2	Device 1	274.00'	**24.0" x 36.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=3.80 cfs @ 12.25 hrs HW=274.31' TW=254.17' (Dynamic Tailwater)
└─**1=Culvert** (Barrel Controls 3.80 cfs @ 4.84 fps)
  └─**2=Orifice/Grate** (Passes 3.80 cfs of 5.68 cfs potential flow)

Pond 4P: EX. BASIN #1



Summary for Pond 5P: EX. BASIN #2

Inflow Area = 15.269 ac, 73.96% Impervious, Inflow Depth = 4.31" for 25-yr event
Inflow = 34.69 cfs @ 12.14 hrs, Volume= 5.479 af
Outflow = 3.35 cfs @ 15.06 hrs, Volume= 5.479 af, Atten= 90%, Lag= 175.3 min
Discarded = 1.16 cfs @ 15.06 hrs, Volume= 3.897 af
Primary = 2.20 cfs @ 15.06 hrs, Volume= 1.582 af
Routed to Pond AP-1 : Southern Wetlands
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond AP-1 : Southern Wetlands

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 255.95' @ 15.06 hrs Surf.Area= 30,241 sf Storage= 118,035 cf

Plug-Flow detention time= 801.2 min calculated for 5.479 af (100% of inflow)
Center-of-Mass det. time= 801.2 min (1,714.1 - 913.0)

Volume	Invert	Avail.Storage	Storage Description
#1	252.50'	198,113 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	252.50'	50,451 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) -Impervious
		248,564 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
252.50	21,111	0	0
253.00	22,353	10,866	10,866
254.00	24,697	23,525	34,391
255.00	26,888	25,793	60,184
256.00	30,430	28,659	88,843
257.00	33,434	31,932	120,775
258.00	36,584	35,009	155,784
259.00	48,075	42,330	198,113

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
252.50	8,488	0	0
253.00	8,672	4,290	4,290
254.00	8,778	8,725	13,015
255.00	9,174	8,976	21,991
256.00	9,483	9,329	31,320
257.00	9,587	9,535	40,855
258.00	9,606	9,597	50,451

Device	Routing	Invert	Outlet Devices
#1	Secondary	257.70'	**9.0' long x 15.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Primary	254.94'	**12.0" Round Culvert** L= 12.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 254.94' / 254.86' S= 0.0067 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

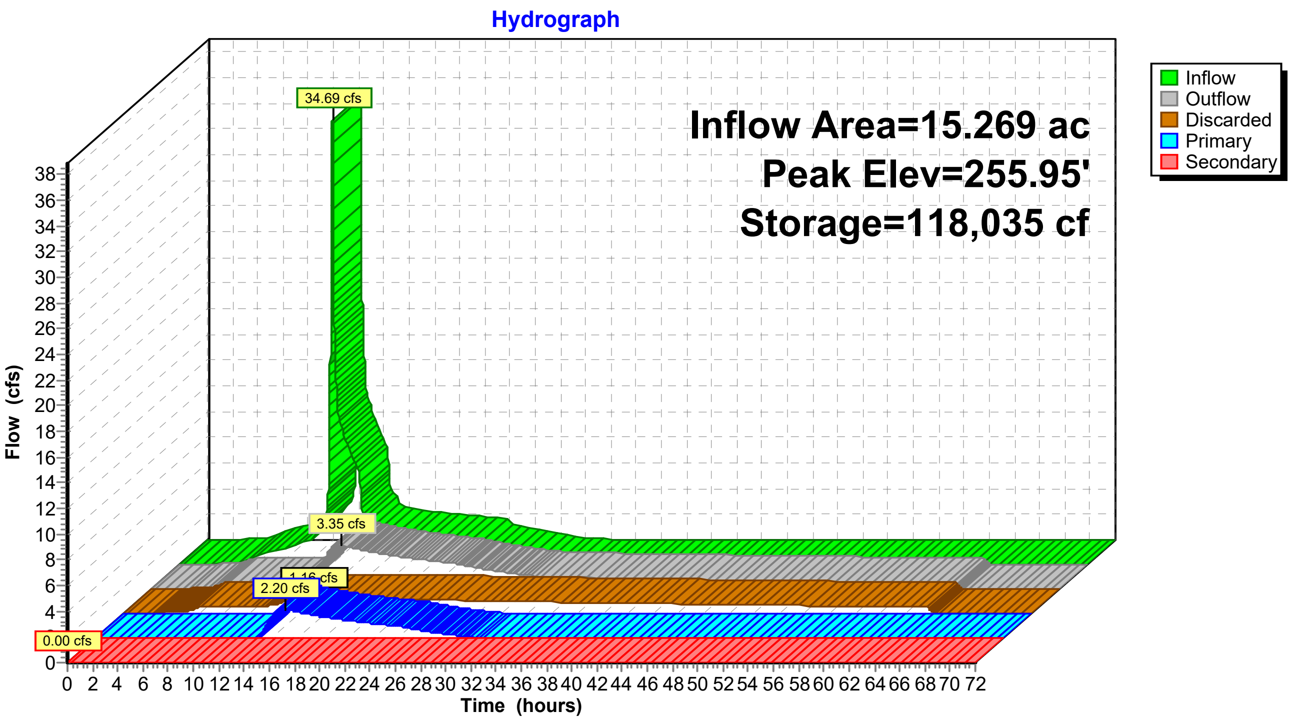
#3	Discarded	252.50'	**1.020 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 248.00' Phase-In= 0.01'

Discarded OutFlow Max=1.16 cfs @ 15.06 hrs HW=255.95' (Free Discharge)
└─**3=Exfiltration** (Controls 1.16 cfs)

Primary OutFlow Max=2.20 cfs @ 15.06 hrs HW=255.95' TW=0.00' (Dynamic Tailwater)
└─**2=Culvert** (Barrel Controls 2.20 cfs @ 3.45 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=252.50' TW=0.00' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 5P: EX. BASIN #2

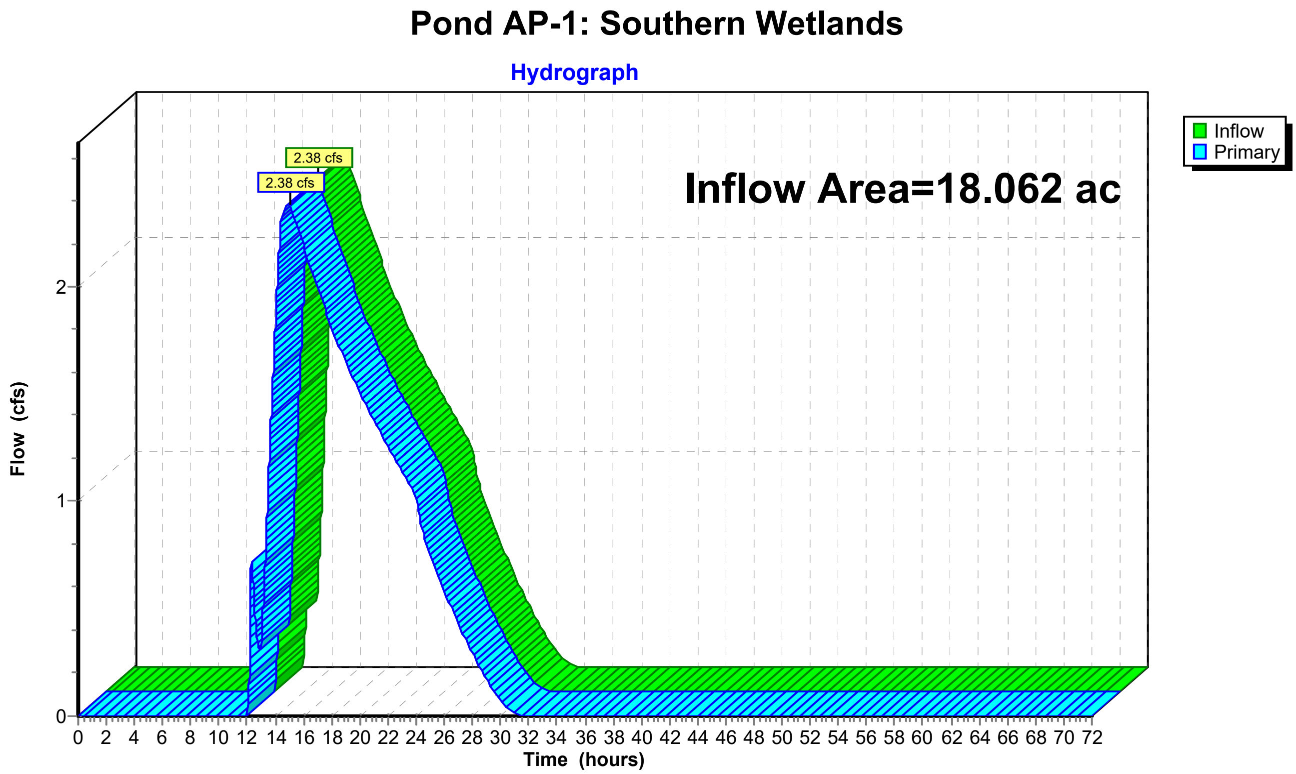


Summary for Pond AP-1: Southern Wetlands

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

Inflow Area = 18.062 ac, 62.53% Impervious, Inflow Depth = 1.16" for 25-yr event
Inflow = 2.38 cfs @ 15.04 hrs, Volume= 1.743 af
Primary = 2.38 cfs @ 15.04 hrs, Volume= 1.743 af, Atten= 0%, Lag= 0.0 min

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



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 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

SubcatchmentEX-1: Subcat EX-1 Runoff Area=2.827 ac 27.56% Impervious Runoff Depth=2.58"
Flow Length=424' Tc=8.1 min CN=52 Runoff=8.00 cfs 0.607 af

SubcatchmentEX-2: Subcat EX-2 Runoff Area=1.141 ac 44.71% Impervious Runoff Depth=4.04"
Flow Length=231' Tc=11.0 min CN=65 Runoff=4.67 cfs 0.384 af

SubcatchmentEX-3: Subcat EX-3 Runoff Area=1.865 ac 89.47% Impervious Runoff Depth=7.22"
Flow Length=682' Tc=6.4 min CN=92 Runoff=14.85 cfs 1.122 af

SubcatchmentEX-4: Subcat EX-4 Runoff Area=0.877 ac 88.00% Impervious Runoff Depth=7.10"
Flow Length=524' Tc=6.0 min CN=91 Runoff=7.05 cfs 0.519 af

SubcatchmentEX-5: Subcat EX-5 Runoff Area=2.793 ac 0.00% Impervious Runoff Depth=1.43"
Flow Length=349' Tc=16.9 min CN=41 Runoff=2.45 cfs 0.332 af

SubcatchmentEX-6: Subcat EX-6 Runoff Area=68,451 sf 61.12% Impervious Runoff Depth=5.09"
Tc=6.0 min CN=74 Runoff=9.89 cfs 0.666 af

SubcatchmentEX-7: Subcat EX-7 Runoff Area=6.182 ac 99.99% Impervious Runoff Depth=7.94"
Tc=6.0 min CN=98 Runoff=51.54 cfs 4.090 af

SubcatchmentEX-8: Subcat EX-8 Runoff Area=0.540 ac 77.97% Impervious Runoff Depth=6.39"
Flow Length=382' Tc=7.0 min CN=85 Runoff=3.91 cfs 0.288 af

SubcatchmentEX-9: Subcat EX-9 Runoff Area=0.265 ac 0.00% Impervious Runoff Depth=1.94"
Flow Length=134' Tc=10.0 min CN=46 Runoff=0.48 cfs 0.043 af

Pond 1P: existing depression Peak Elev=274.00' Storage=0 cf Inflow=0.48 cfs 0.043 af
12.0" Round Culvert n=0.013 L=24.3' S=0.0412 '/' Outflow=0.48 cfs 0.043 af

Pond 3P: EX. BASIN #3 Peak Elev=270.64' Storage=75,398 cf Inflow=58.94 cfs 4.698 af
Outflow=9.10 cfs 4.521 af

Pond 4P: EX. BASIN #1 Peak Elev=274.54' Storage=5,520 cf Inflow=8.20 cfs 0.672 af
Outflow=4.10 cfs 0.623 af

Pond 5P: EX. BASIN #2 Peak Elev=256.91' Storage=157,580 cf Inflow=43.98 cfs 7.495 af
Discarded=1.37 cfs 4.199 af Primary=4.58 cfs 3.296 af Secondary=0.00 cfs 0.000 af Outflow=5.95 cfs 7.495 af

Pond AP-1: Southern Wetlands Inflow=4.87 cfs 3.628 af
Primary=4.87 cfs 3.628 af

Total Runoff Area = 18.062 ac Runoff Volume = 8.052 af Average Runoff Depth = 5.35"
37.47% Pervious = 6.769 ac 62.53% Impervious = 11.293 ac

Summary for Subcatchment EX-1: Subcat EX-1

[47] Hint: Peak is 251% of capacity of segment #4

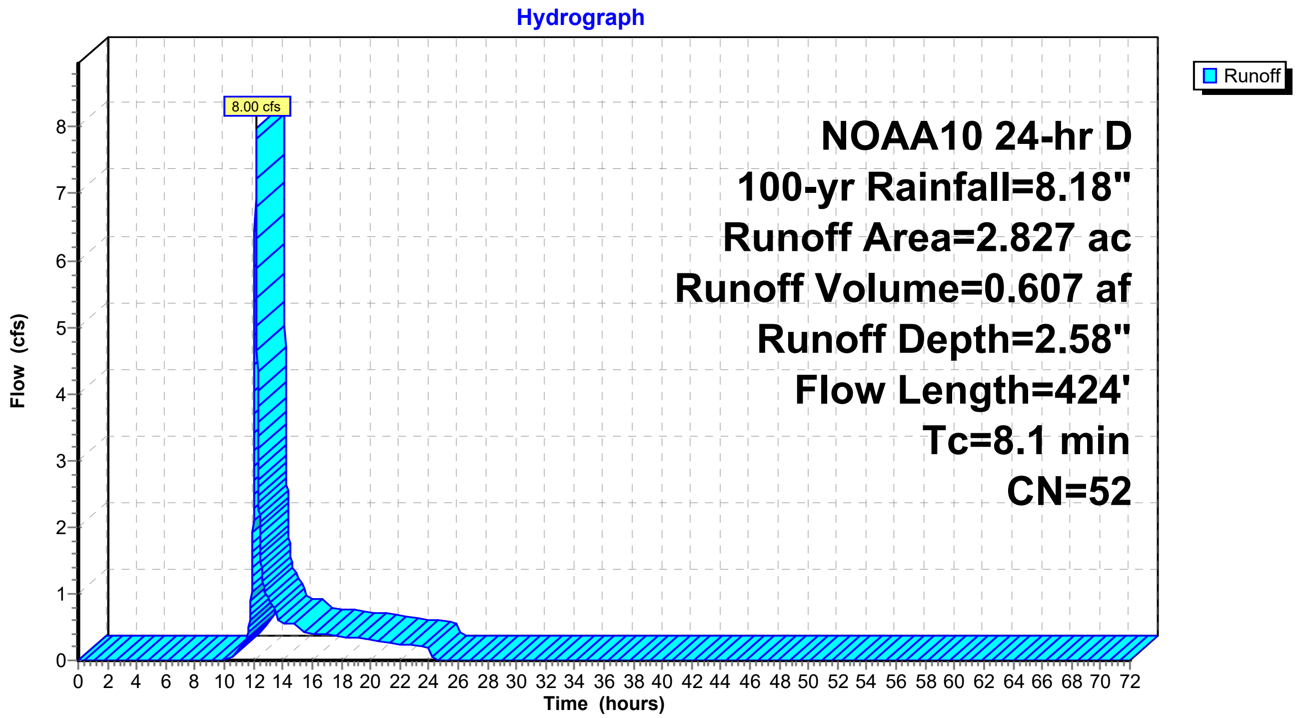
Runoff = 8.00 cfs @ 12.16 hrs, Volume= 0.607 af, Depth= 2.58"
Routed to Pond 3P : EX. BASIN #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-yr Rainfall=8.18"

Area (ac)	CN	Description
1.115	39	>75% Grass cover, Good, HSG A
0.505	98	Paved parking, HSG A
0.003	98	Unconnected pavement, HSG A
0.271	98	Water Surface, HSG A
0.933	30	Woods, Good, HSG A
2.827	52	Weighted Average
2.048		72.44% Pervious Area
0.779		27.56% Impervious Area
0.003		0.37% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	50	0.0250	0.17		**Sheet Flow, A-B**
					Grass: Short n= 0.150 P2= 3.36"
0.4	19	0.0110	0.73		**Shallow Concentrated Flow, B-C**
					Short Grass Pasture Kv= 7.0 fps
2.3	255	0.0080	1.82		**Shallow Concentrated Flow, C-D**
					Paved Kv= 20.3 fps
0.4	100	0.0080	4.06	3.19	**Pipe Channel, D-E**
					12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25'
					n= 0.013 Concrete pipe, bends & connections
8.1	424	Total			

Subcatchment EX-1: Subcat EX-1



Summary for Subcatchment EX-2: Subcat EX-2

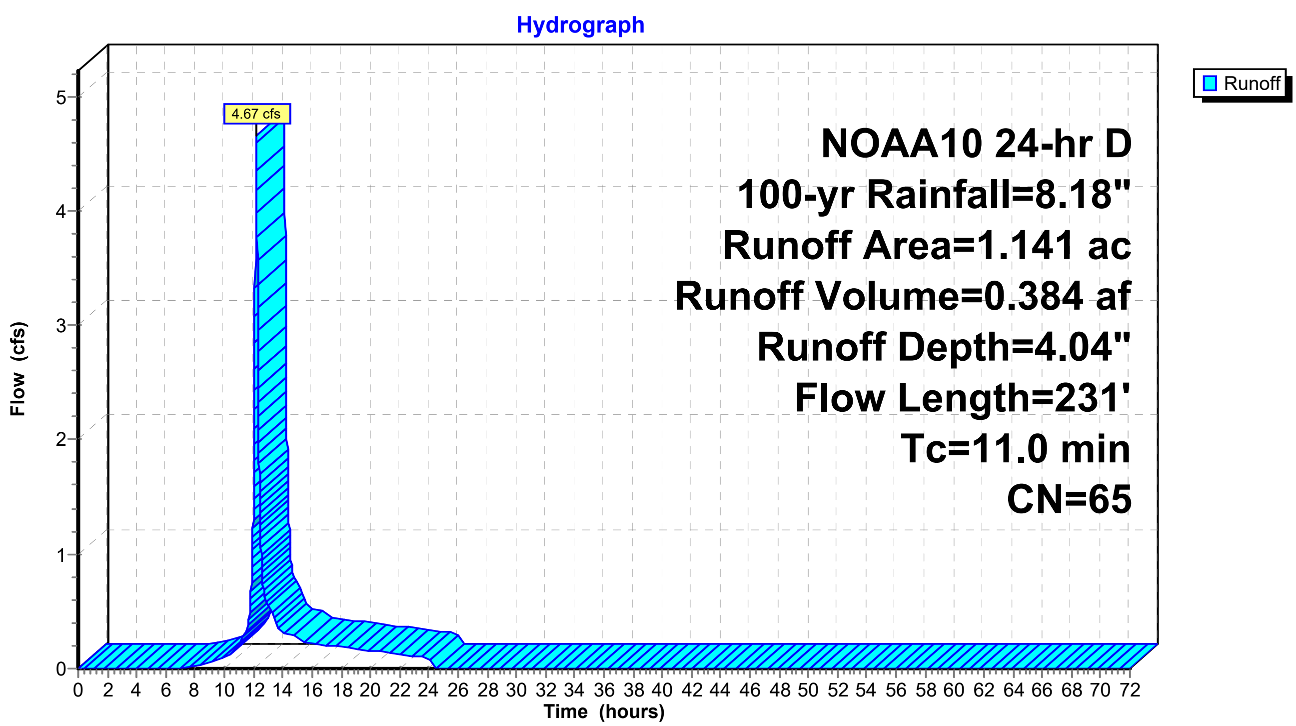
Runoff = 4.67 cfs @ 12.19 hrs, Volume= 0.384 af, Depth= 4.04"
Routed to Pond 4P : EX. BASIN #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-yr Rainfall=8.18"

Area (ac)	CN	Description
0.631	39	>75% Grass cover, Good, HSG A
0.239	98	Paved parking, HSG A
0.009	98	Unconnected pavement, HSG A
0.261	98	Water Surface, HSG A
1.141	65	Weighted Average
0.631		55.29% Pervious Area
0.510		44.71% Impervious Area
0.009		1.84% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	50	0.0050	0.09		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.36"
1.4	181	0.0220	2.22		**Shallow Concentrated Flow, B-C** Grassed Waterway Kv= 15.0 fps
11.0	231	Total			

Subcatchment EX-2: Subcat EX-2



Summary for Subcatchment EX-3: Subcat EX-3

[47] Hint: Peak is 155% of capacity of segment #3

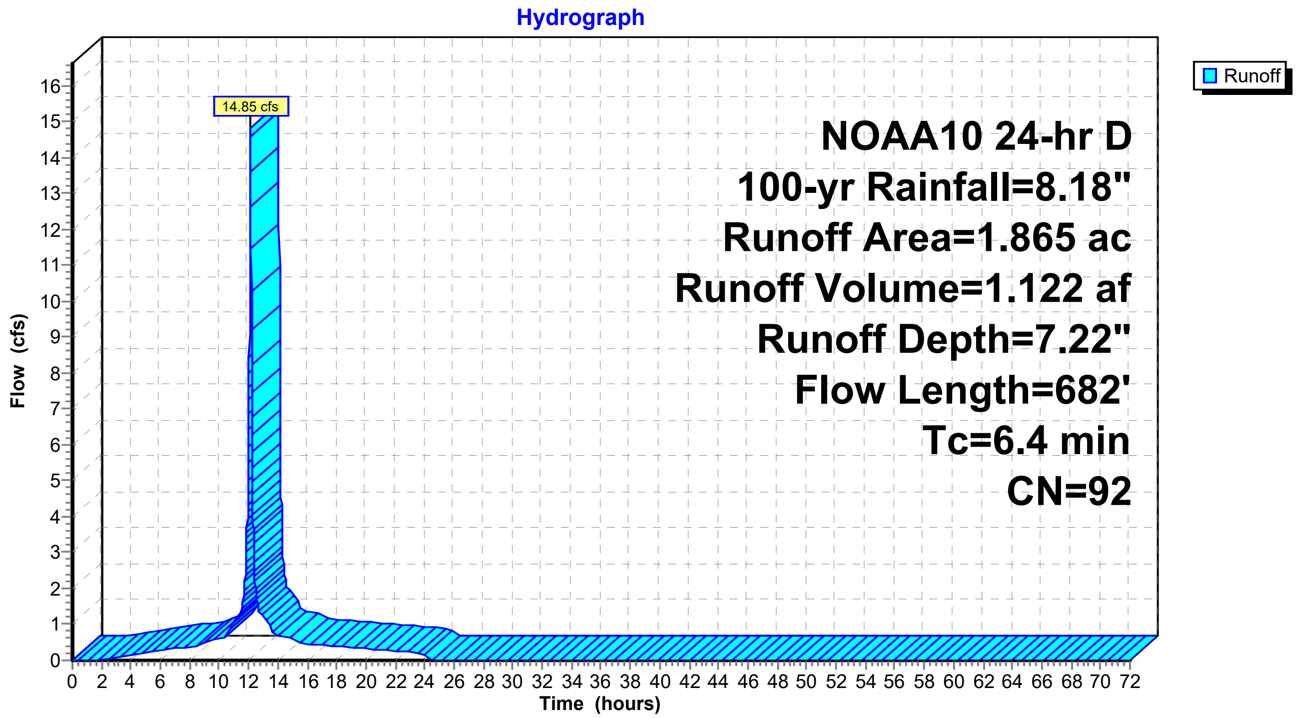
Runoff = 14.85 cfs @ 12.13 hrs, Volume= 1.122 af, Depth= 7.22"
Routed to Pond 5P : EX. BASIN #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-yr Rainfall=8.18"

Area (ac)	CN	Description
0.188	39	>75% Grass cover, Good, HSG A
0.008	80	>75% Grass cover, Good, HSG D
1.623	98	Paved parking, HSG A
0.039	98	Paved parking, HSG D
0.006	98	Unconnected pavement, HSG A
1.865	92	Weighted Average
0.196		10.53% Pervious Area
1.669		89.47% Impervious Area
0.006		0.35% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	35	0.0150	0.13		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.36"
0.7	119	0.0200	2.87		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
1.1	528	0.0220	7.81	9.58	**Pipe Channel, C-D** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013 Concrete pipe, bends & connections
6.4	682	Total			

Subcatchment EX-3: Subcat EX-3



Summary for Subcatchment EX-4: Subcat EX-4

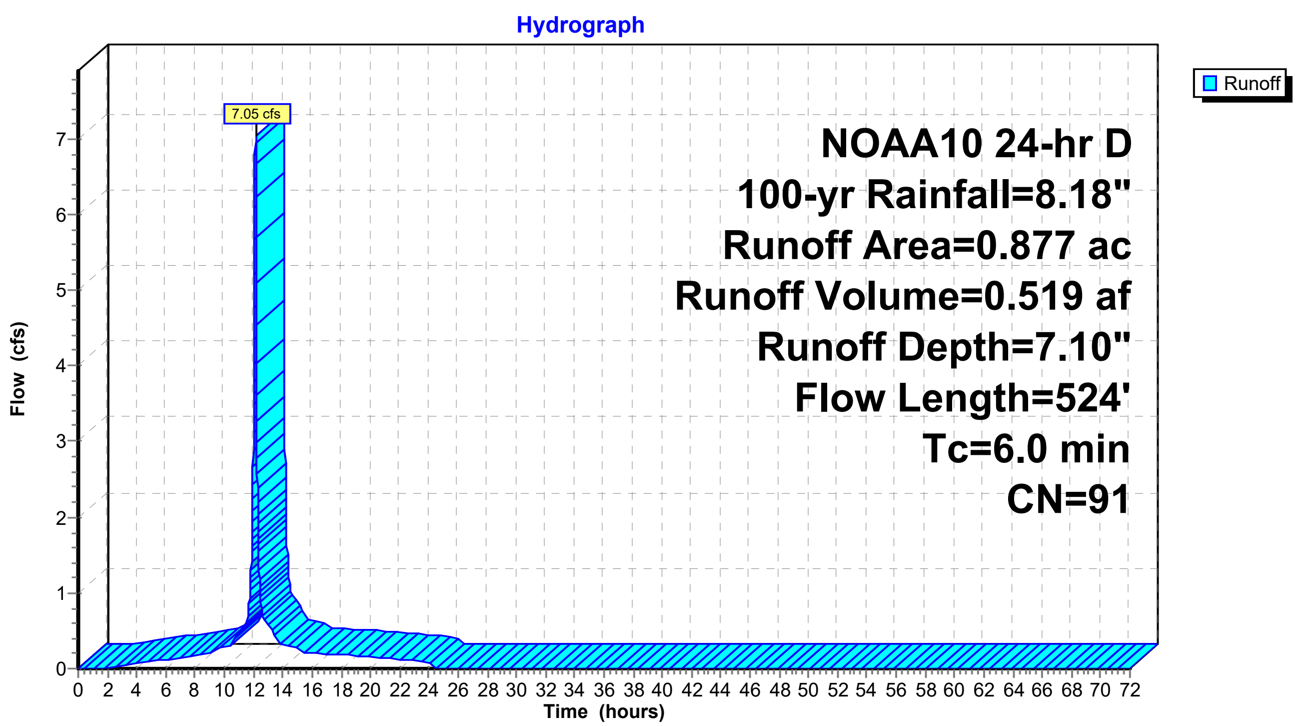
Runoff = 7.05 cfs @ 12.13 hrs, Volume= 0.519 af, Depth= 7.10"
Routed to Pond 5P : EX. BASIN #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-yr Rainfall=8.18"

Area (ac)	CN	Description
0.105	39	>75% Grass cover, Good, HSG A
0.772	98	Paved parking, HSG A
0.877	91	Weighted Average
0.105		12.00% Pervious Area
0.772		88.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	17	0.0100	0.06		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.36"
1.1	142	0.0120	2.22		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
0.4	365	0.0350	15.63	76.74	**Pipe Channel, C-D** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013 Concrete pipe, bends & connections
6.0	524	Total			

Subcatchment EX-4: Subcat EX-4



Summary for Subcatchment EX-5: Subcat EX-5

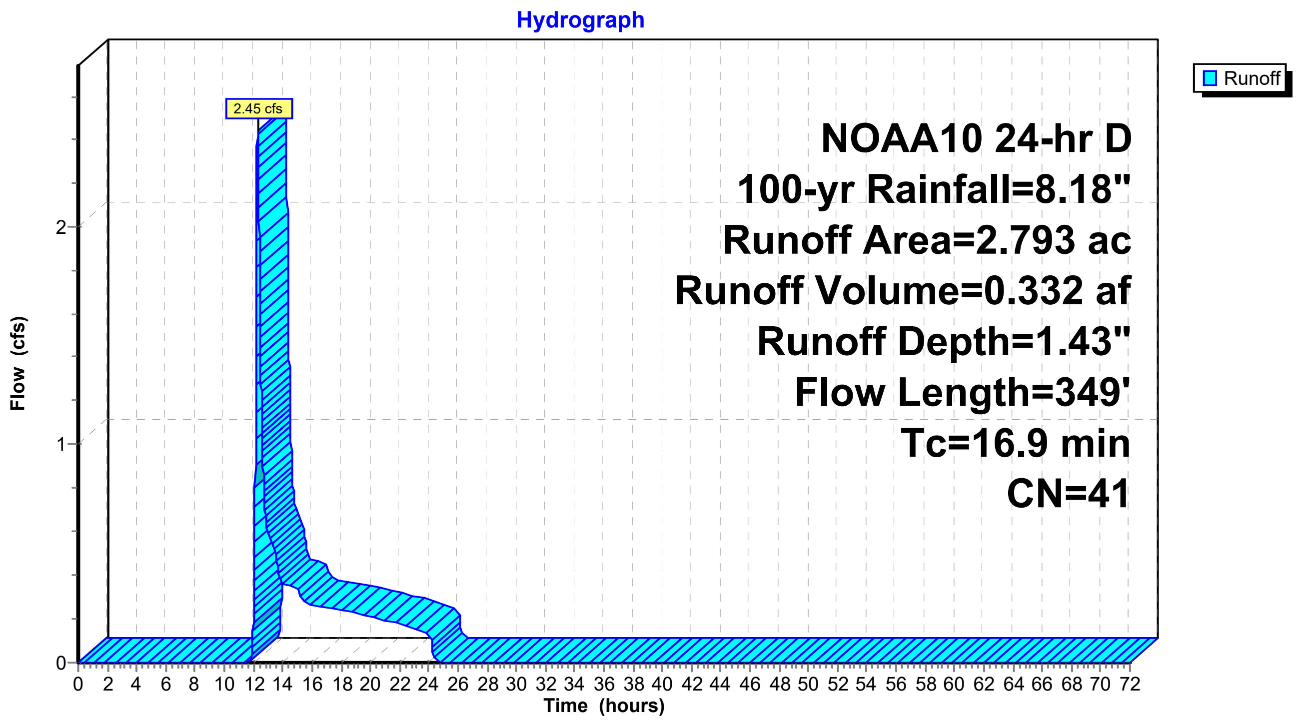
Runoff = 2.45 cfs @ 12.28 hrs, Volume= 0.332 af, Depth= 1.43"
Routed to Pond AP-1 : Southern Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-yr Rainfall=8.18"

Area (ac)	CN	Description
0.176	39	>75% Grass cover, Good, HSG A
0.016	80	>75% Grass cover, Good, HSG D
1.994	30	Woods, Good, HSG A
0.606	77	Woods, Good, HSG D
2.793	41	Weighted Average
2.793		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0190	0.07		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.36"
0.7	58	0.0780	1.40		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
3.9	241	0.0420	1.02		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
16.9	349	Total			

Subcatchment EX-5: Subcat EX-5



Summary for Subcatchment EX-6: Subcat EX-6

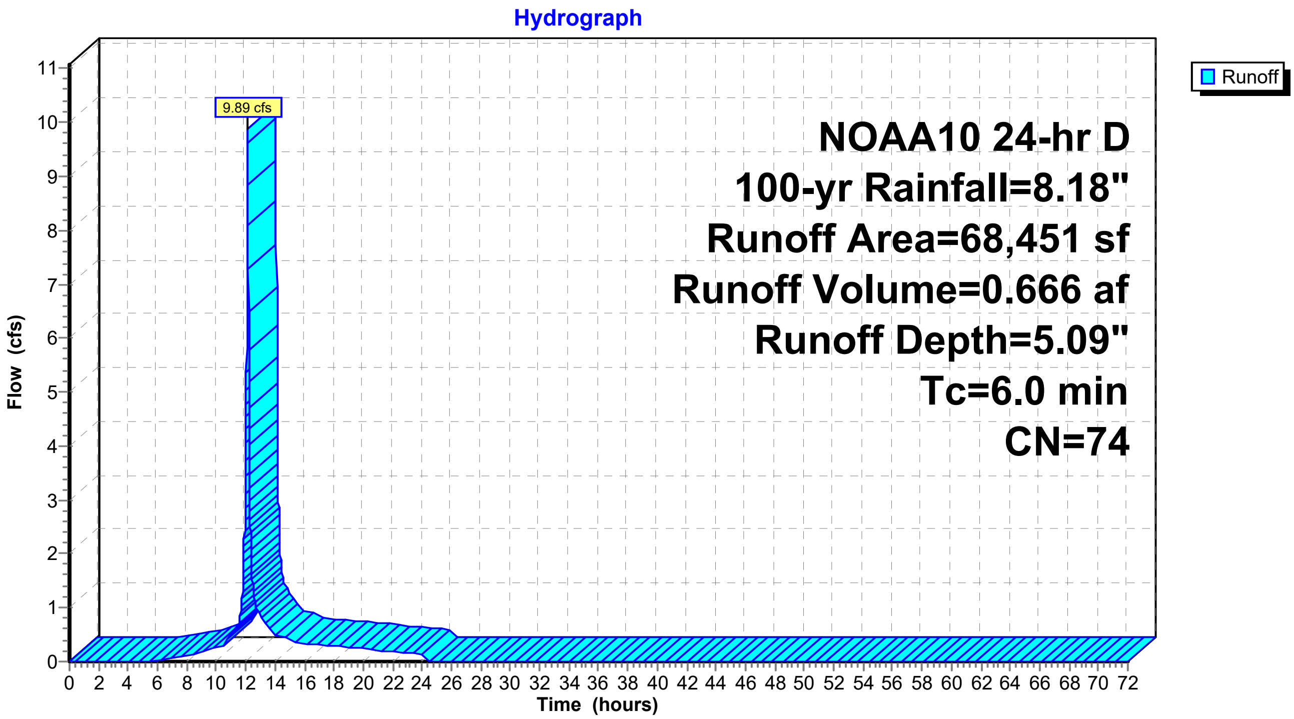
Runoff = 9.89 cfs @ 12.13 hrs, Volume= 0.666 af, Depth= 5.09"
Routed to Pond 5P : EX. BASIN #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-yr Rainfall=8.18"

Area (sf)	CN	Description
17,052	39	>75% Grass cover, Good, HSG A
41,839	98	Water Surface, HSG A
9,559	30	Woods, Good, HSG A
68,451	74	Weighted Average
26,612		38.88% Pervious Area
41,839		61.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, A-B-C: CALCULATED BELOW MINIMUM**

Subcatchment EX-6: Subcat EX-6



Summary for Subcatchment EX-7: Subcat EX-7

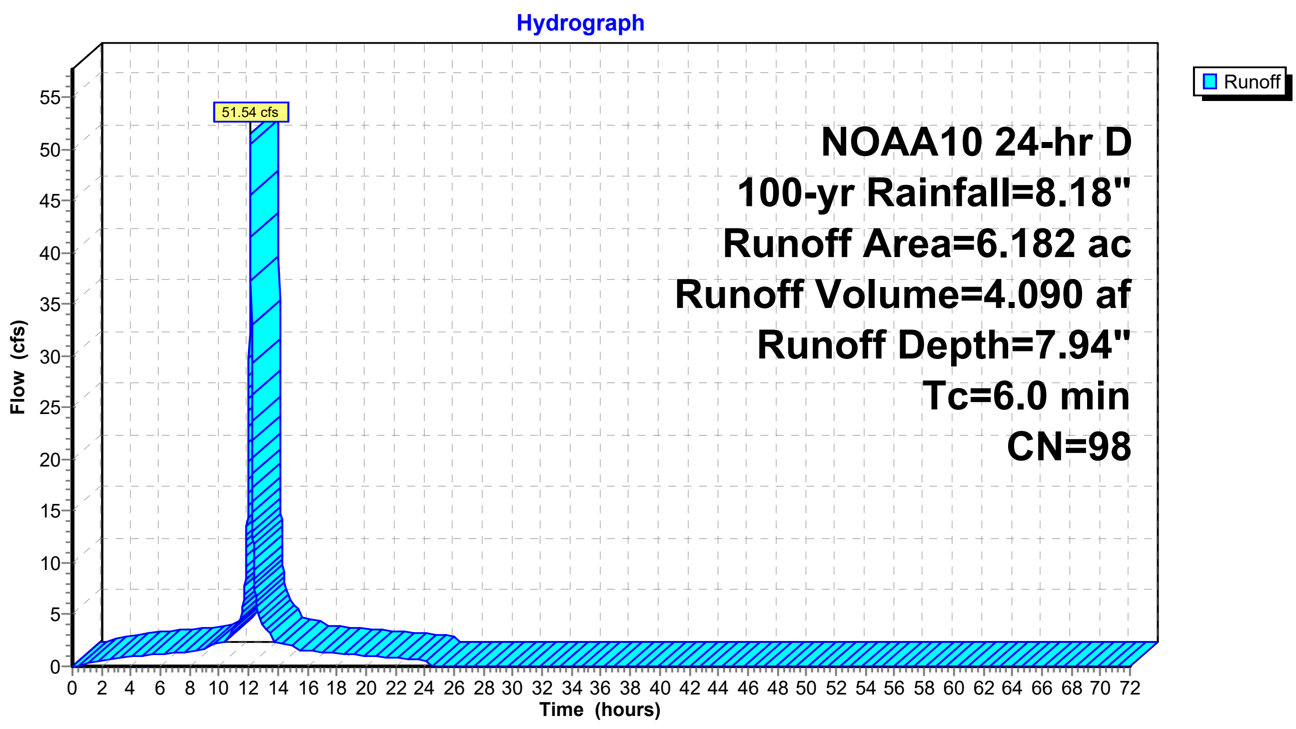
Runoff = 51.54 cfs @ 12.13 hrs, Volume= 4.090 af, Depth= 7.94"
Routed to Pond 3P : EX. BASIN #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-yr Rainfall=8.18"

Area (ac)	CN	Description
0.000	39	>75% Grass cover, Good, HSG A
6.182	98	Roofs, HSG A
0.000	98	Unconnected pavement, HSG A
6.182	98	Weighted Average
0.000		0.01% Pervious Area
6.182		99.99% Impervious Area
0.000		0.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, A-B: CALCULATED BELOW MINIMUM**

Subcatchment EX-7: Subcat EX-7



Summary for Subcatchment EX-8: Subcat EX-8

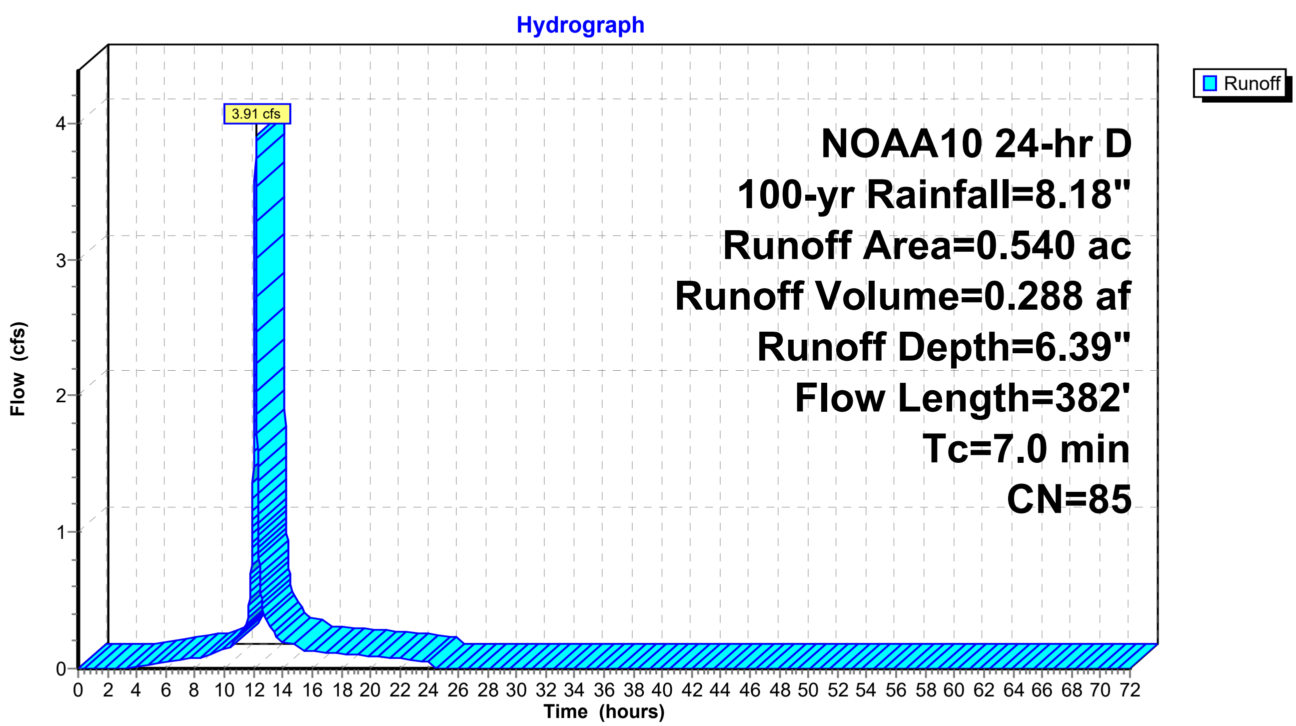
Runoff = 3.91 cfs @ 12.14 hrs, Volume= 0.288 af, Depth= 6.39"
Routed to Pond 4P : EX. BASIN #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-yr Rainfall=8.18"

Area (ac)	CN	Description
0.119	39	>75% Grass cover, Good, HSG A
0.421	98	Paved parking, HSG A
0.540	85	Weighted Average
0.119		22.03% Pervious Area
0.421		77.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	35	0.0300	0.11		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.36"
1.3	158	0.0100	2.03		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
0.6	189	0.0120	4.97	3.90	**Pipe Channel, C-D** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Concrete pipe, bends & connections
7.0	382	Total			

Subcatchment EX-8: Subcat EX-8



Summary for Subcatchment EX-9: Subcat EX-9

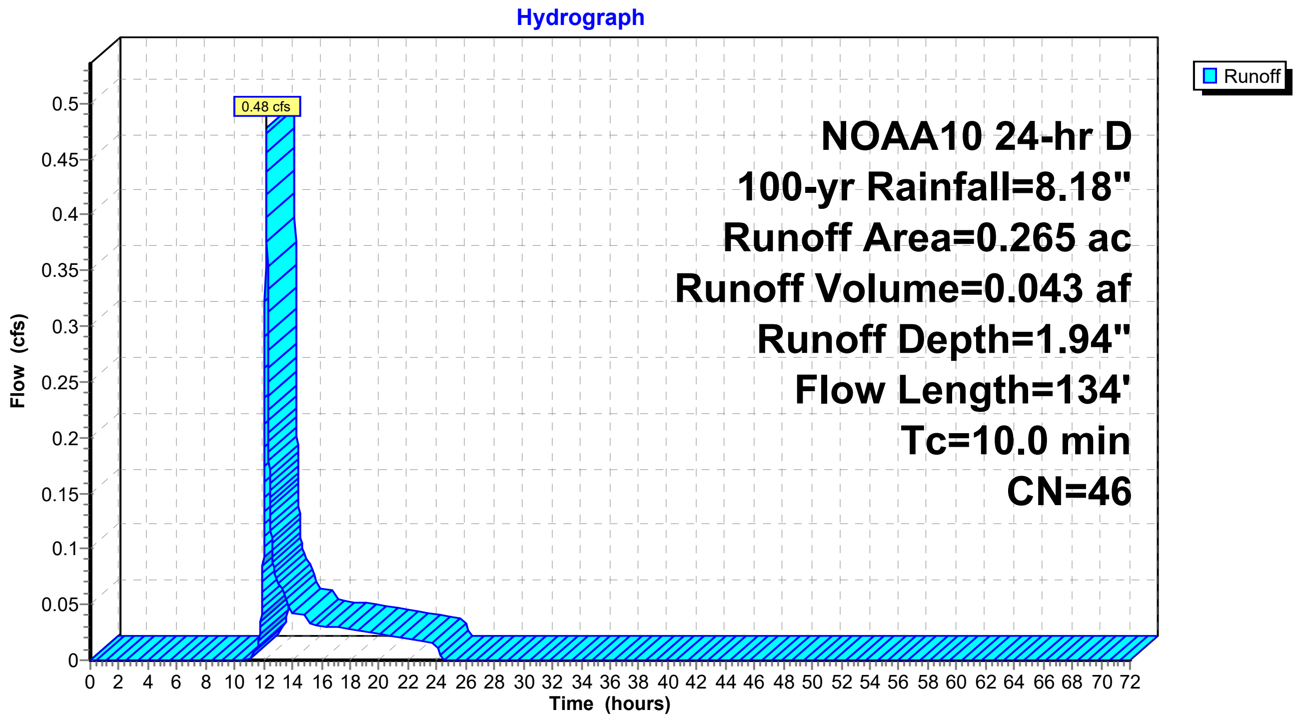
Runoff = 0.48 cfs @ 12.18 hrs, Volume= 0.043 af, Depth= 1.94"
Routed to Pond 1P : existing depression

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-yr Rainfall=8.18"

Area (ac)	CN	Description
0.050	39	>75% Grass cover, Good, HSG A
0.006	80	>75% Grass cover, Good, HSG D
0.137	30	Woods, Good, HSG A
0.071	77	Woods, Good, HSG D
0.265	46	Weighted Average
0.265		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.8	50	0.0440	0.09		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.36"
1.2	84	0.0520	1.14		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
10.0	134	Total			

Subcatchment EX-9: Subcat EX-9



Summary for Pond 1P: existing depression

[44] Hint: Outlet device #1 is below defined storage

Inflow Area = 0.265 ac, 0.00% Impervious, Inflow Depth = 1.94" for 100-yr event
Inflow = 0.48 cfs @ 12.18 hrs, Volume= 0.043 af
Outflow = 0.48 cfs @ 12.18 hrs, Volume= 0.043 af, Atten= 0%, Lag= 0.0 min
Primary = 0.48 cfs @ 12.18 hrs, Volume= 0.043 af
Routed to Pond 5P : EX. BASIN #2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 274.00' @ 0.00 hrs Surf.Area= 528 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.0 min (930.9 - 930.9)

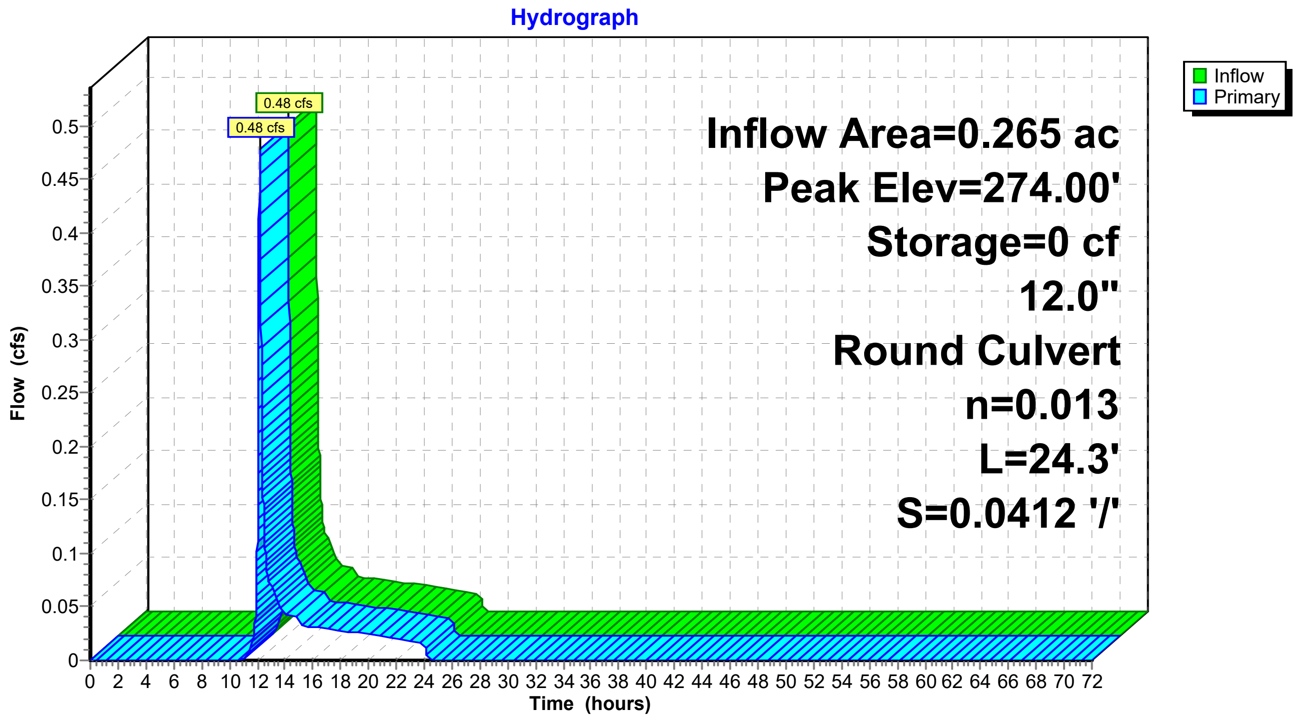
Volume	Invert	Avail.Storage	Storage Description
#1	274.00'	2,821 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
274.00	528	0	0
275.00	1,358	943	943
276.00	2,397	1,878	2,821

Device	Routing	Invert	Outlet Devices
#1	Primary	272.90'	**12.0" Round Culvert** L= 24.3' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 272.90' / 271.90' S= 0.0412 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 12.18 hrs HW=274.00' TW=254.81' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.00 cfs of 2.93 cfs potential flow)

Pond 1P: existing depression



Summary for Pond 3P: EX. BASIN #3

Inflow Area = 9.009 ac, 77.26% Impervious, Inflow Depth = 6.26" for 100-yr event
Inflow = 58.94 cfs @ 12.13 hrs, Volume= 4.698 af
Outflow = 9.10 cfs @ 12.44 hrs, Volume= 4.521 af, Atten= 85%, Lag= 18.7 min
Primary = 9.10 cfs @ 12.44 hrs, Volume= 4.521 af
Routed to Pond 5P : EX. BASIN #2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 270.64' @ 12.44 hrs Surf.Area= 20,981 sf Storage= 75,398 cf

Plug-Flow detention time= 208.9 min calculated for 4.521 af (96% of inflow)
Center-of-Mass det. time= 185.3 min (949.0 - 763.7)

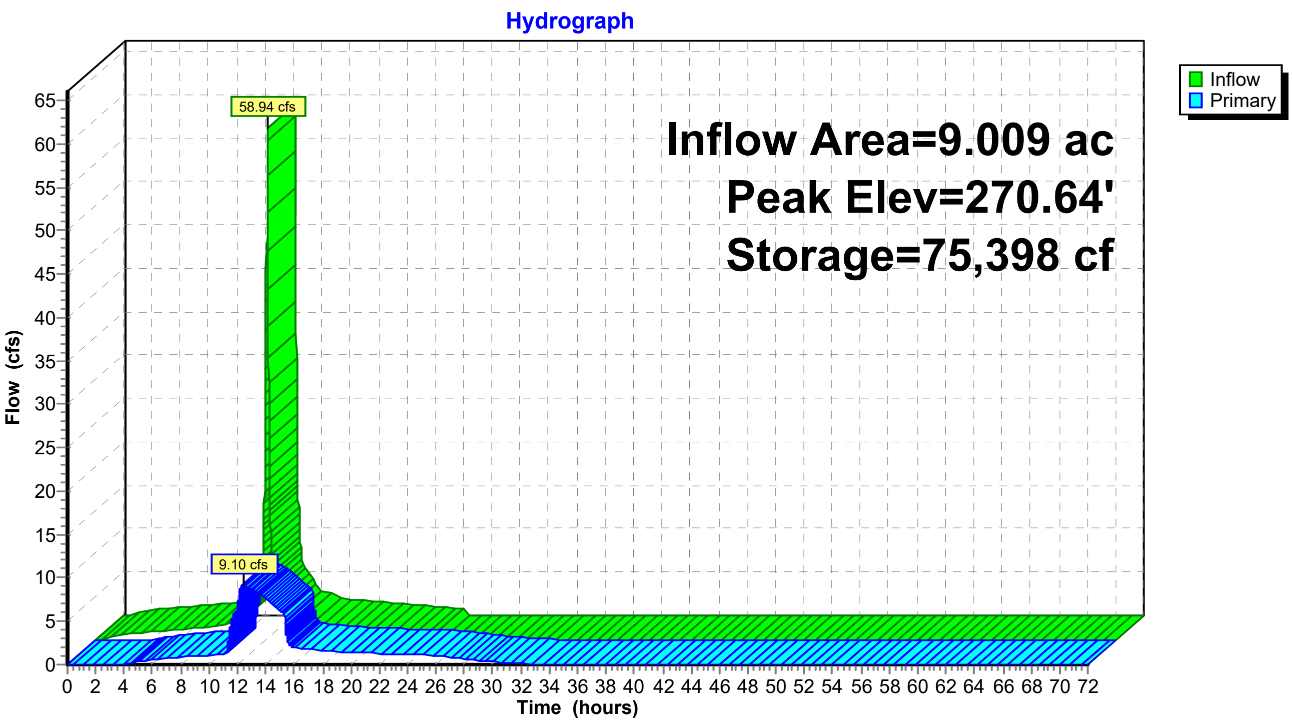
Volume	Invert	Avail.Storage	Storage Description
#1	265.00'	188,837 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
265.00	6,581	0	0
266.00	7,637	7,109	7,109
267.00	8,818	8,228	15,337
268.00	15,371	12,095	27,431
269.00	17,536	16,454	43,885
270.00	19,637	18,587	62,471
271.00	21,748	20,693	83,164
272.00	23,983	22,866	106,029
273.00	26,245	25,114	131,143
274.00	28,727	27,486	158,629
275.00	31,688	30,208	188,837

Device	Routing	Invert	Outlet Devices
#1	Primary	265.60'	**24.0" Round Culvert** L= 223.3' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 265.60' / 264.50' S= 0.0049 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 3.14 sf
#2	Device 1	266.06'	**12.0" Round Culvert** L= 8.4' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 266.06' / 265.90' S= 0.0190 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf
#3	Device 2	266.06'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 1	266.58'	**12.0" Round Culvert** L= 12.3' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 266.58' / 265.80' S= 0.0634 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf
#5	Device 4	268.26'	**57.0" x 100.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=9.10 cfs @ 12.44 hrs HW=270.64' TW=255.37' (Dynamic Tailwater)
└─**1=Culvert** (Passes 9.10 cfs of 24.78 cfs potential flow)
  ├─**2=Culvert** (Passes 1.97 cfs of 7.64 cfs potential flow)
  │ └─**3=Orifice/Grate** (Orifice Controls 1.97 cfs @ 10.02 fps)
  └─**4=Culvert** (Inlet Controls 7.13 cfs @ 9.08 fps)
    └─**5=Orifice/Grate** (Passes 7.13 cfs of 293.81 cfs potential flow)

Pond 3P: EX. BASIN #3



Summary for Pond 4P: EX. BASIN #1

Inflow Area = 1.681 ac, 55.40% Impervious, Inflow Depth = 4.79" for 100-yr event
Inflow = 8.20 cfs @ 12.16 hrs, Volume= 0.672 af
Outflow = 4.10 cfs @ 12.30 hrs, Volume= 0.623 af, Atten= 50%, Lag= 8.2 min
Primary = 4.10 cfs @ 12.30 hrs, Volume= 0.623 af
Routed to Pond 5P : EX. BASIN #2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 274.54' @ 12.30 hrs Surf.Area= 7,154 sf Storage= 5,520 cf

Plug-Flow detention time= 77.7 min calculated for 0.623 af (93% of inflow)
Center-of-Mass det. time= 38.2 min (880.3 - 842.1)

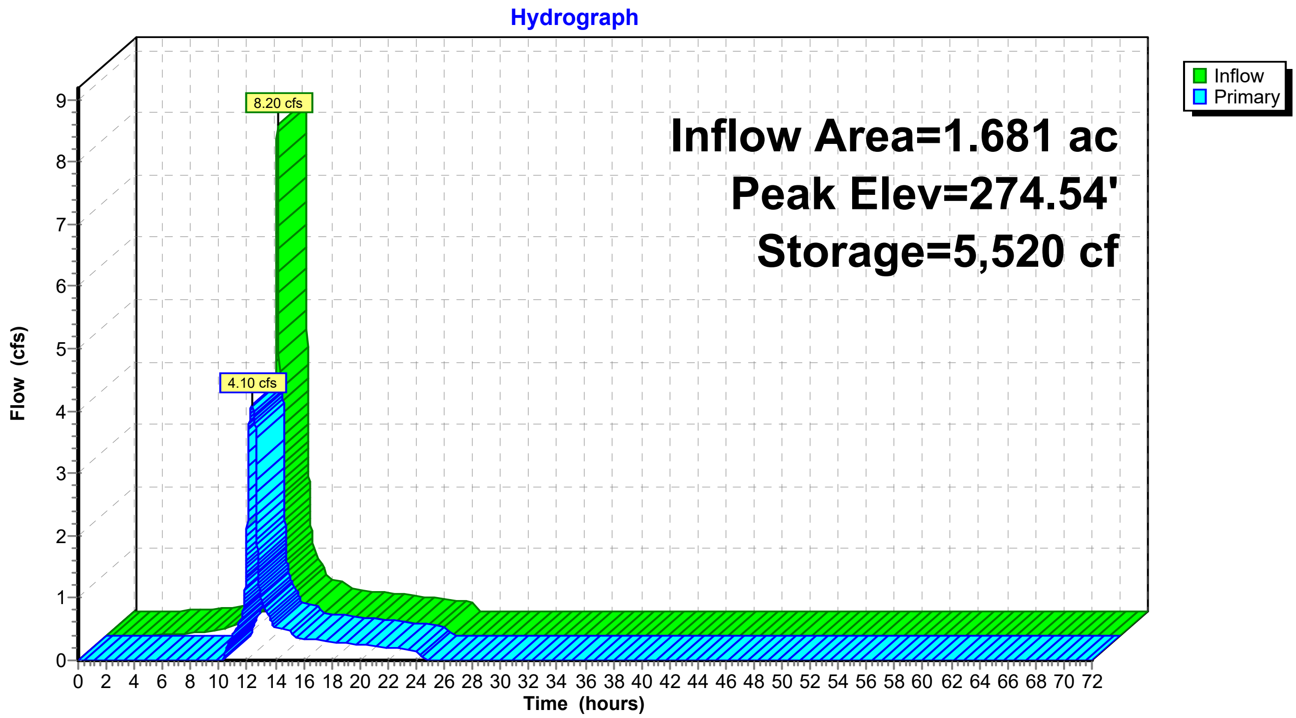
Volume	Invert	Avail.Storage	Storage Description
#1	273.40'	31,754 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
273.40	1,731	0	0
274.00	5,352	2,125	2,125
275.00	8,670	7,011	9,136
276.00	11,387	10,029	19,164
277.00	13,793	12,590	31,754

Device	Routing	Invert	Outlet Devices
#1	Primary	272.50'	**12.0" Round Culvert** L= 75.9' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 272.50' / 271.90' S= 0.0079 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf
#2	Device 1	274.00'	**24.0" x 36.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=4.10 cfs @ 12.30 hrs HW=274.54' TW=255.10' (Dynamic Tailwater)
└─**1=Culvert** (Barrel Controls 4.10 cfs @ 5.22 fps)
  └─**2=Orifice/Grate** (Passes 4.10 cfs of 13.08 cfs potential flow)

Pond 4P: EX. BASIN #1



Summary for Pond 5P: EX. BASIN #2

Inflow Area = 15.269 ac, 73.96% Impervious, Inflow Depth = 5.89" for 100-yr event
Inflow = 43.98 cfs @ 12.13 hrs, Volume= 7.495 af
Outflow = 5.95 cfs @ 15.39 hrs, Volume= 7.495 af, Atten= 86%, Lag= 195.4 min
Discarded = 1.37 cfs @ 15.39 hrs, Volume= 4.199 af
Primary = 4.58 cfs @ 15.39 hrs, Volume= 3.296 af
Routed to Pond AP-1 : Southern Wetlands
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond AP-1 : Southern Wetlands

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 256.91' @ 15.39 hrs Surf.Area= 33,150 sf Storage= 157,580 cf

Plug-Flow detention time= 671.3 min calculated for 7.493 af (100% of inflow)
Center-of-Mass det. time= 671.3 min (1,567.2 - 895.9)

Volume	Invert	Avail.Storage	Storage Description
#1	252.50'	198,113 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	252.50'	50,451 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) -Impervious
		248,564 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
252.50	21,111	0	0
253.00	22,353	10,866	10,866
254.00	24,697	23,525	34,391
255.00	26,888	25,793	60,184
256.00	30,430	28,659	88,843
257.00	33,434	31,932	120,775
258.00	36,584	35,009	155,784
259.00	48,075	42,330	198,113

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
252.50	8,488	0	0
253.00	8,672	4,290	4,290
254.00	8,778	8,725	13,015
255.00	9,174	8,976	21,991
256.00	9,483	9,329	31,320
257.00	9,587	9,535	40,855
258.00	9,606	9,597	50,451

Device	Routing	Invert	Outlet Devices
#1	Secondary	257.70'	**9.0' long x 15.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Primary	254.94'	**12.0" Round Culvert** L= 12.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 254.94' / 254.86' S= 0.0067 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

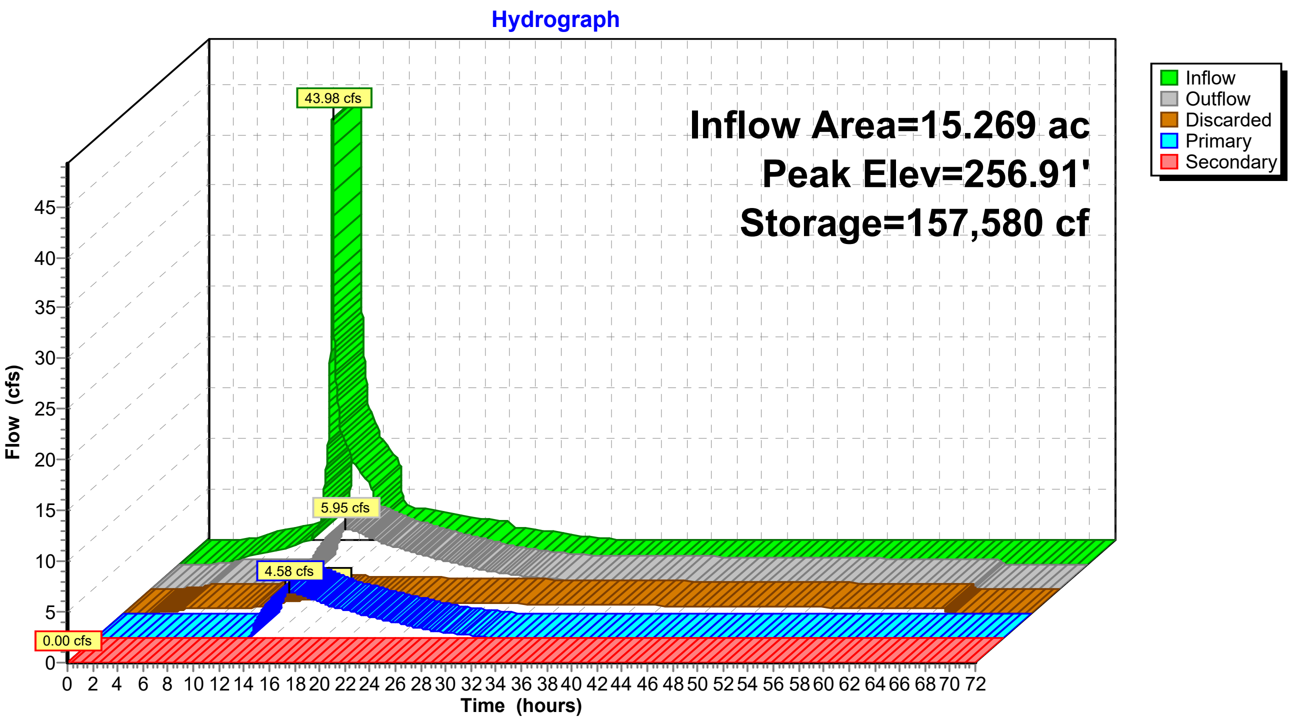
#3 Discarded 252.50' **1.020 in/hr Exfiltration over Surface area**
Conductivity to Groundwater Elevation = 248.00' Phase-In= 0.01'

Discarded OutFlow Max=1.37 cfs @ 15.39 hrs HW=256.91' (Free Discharge)
↑—**3=Exfiltration** (Controls 1.37 cfs)

Primary OutFlow Max=4.58 cfs @ 15.39 hrs HW=256.91' TW=0.00' (Dynamic Tailwater)
↑—**2=Culvert** (Inlet Controls 4.58 cfs @ 5.83 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=252.50' TW=0.00' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 5P: EX. BASIN #2



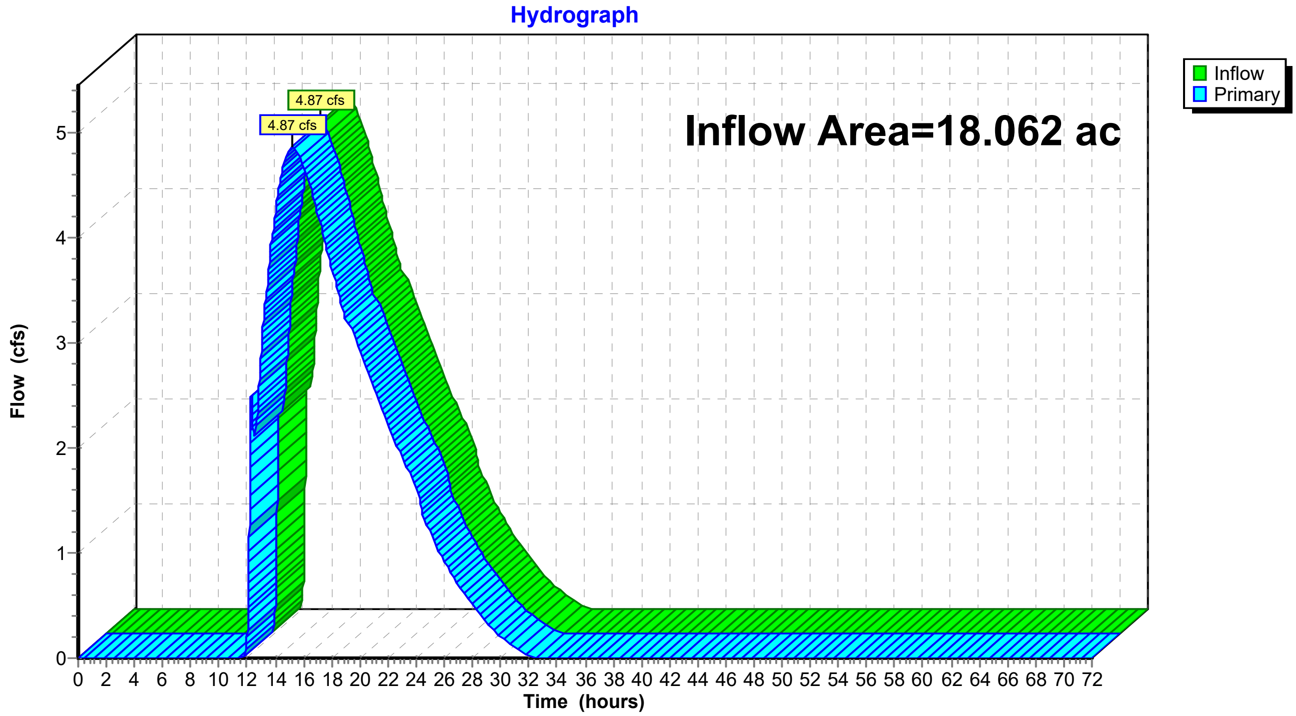
Summary for Pond AP-1: Southern Wetlands

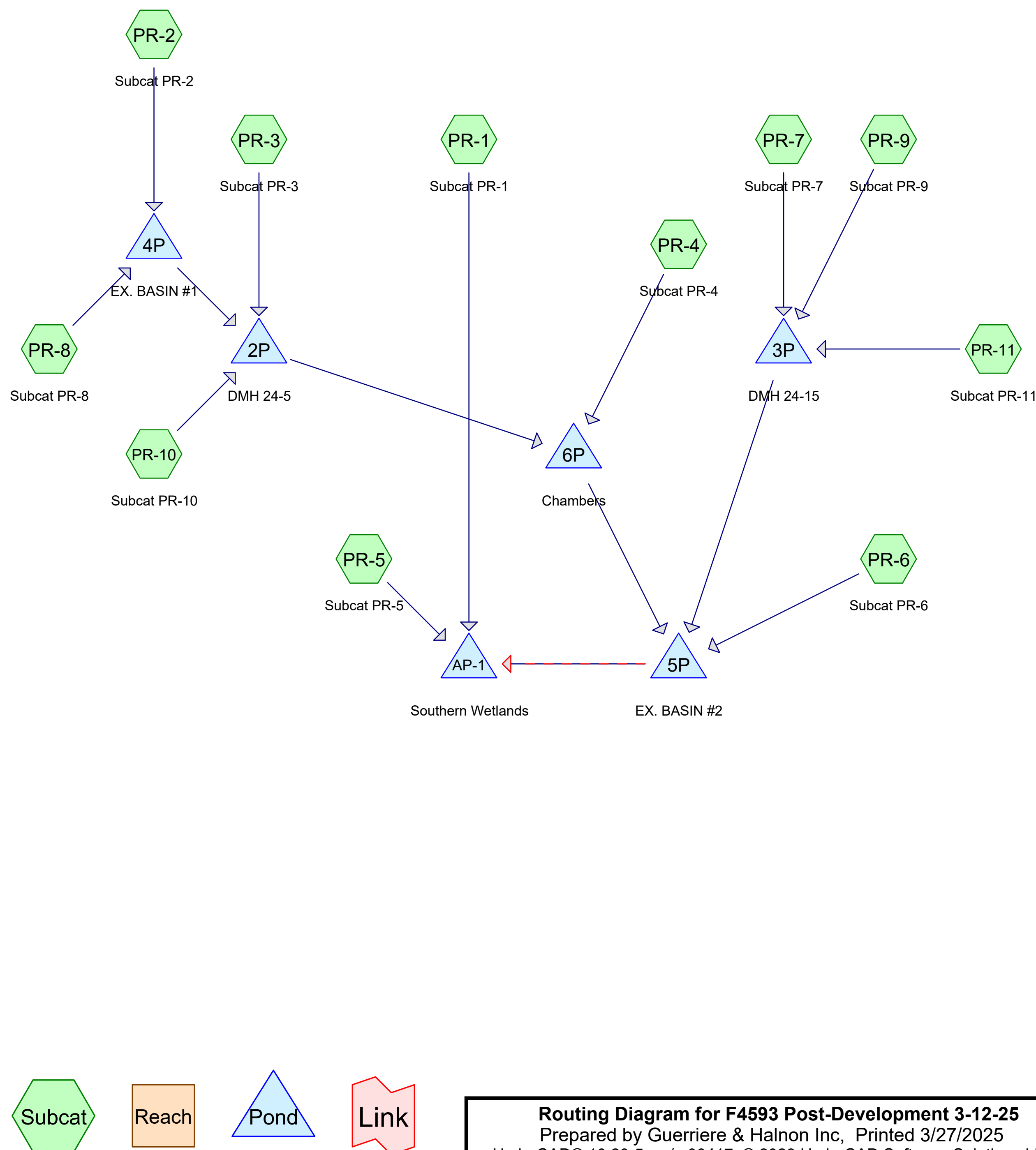
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 18.062 ac, 62.53% Impervious, Inflow Depth = 2.41" for 100-yr event
Inflow = 4.87 cfs @ 15.15 hrs, Volume= 3.628 af
Primary = 4.87 cfs @ 15.15 hrs, Volume= 3.628 af, Atten= 0%, Lag= 0.0 min

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

Pond AP-1: Southern Wetlands





Routing Diagram for F4593 Post-Development 3-12-25
Prepared by Guerriere & Halnon Inc, Printed 3/27/2025
HydroCAD® 10.20-5c s/n 00417 © 2023 HydroCAD Software Solutions LLC

Project Notes

Rainfall events imported from "NRCS2-Rain.txt" for 6681 MA Franklin Norfolk Co
Defined 4 rainfall events from MA-126 Grove PFD IDF

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-yr	NOAA10 24-hr	D	Default	24.00	1	3.36	2
2	10-yr	NOAA10 24-hr	D	Default	24.00	1	5.22	2
3	25-yr	NOAA10 24-hr	D	Default	24.00	1	6.39	2
4	100-yr	NOAA10 24-hr	D	Default	24.00	1	8.18	2

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
2.023	39	>75% Grass cover, Good, HSG A (PR-1, PR-10, PR-11, PR-2, PR-3, PR-4, PR-5, PR-6, PR-7, PR-8, PR-9)
0.051	80	>75% Grass cover, Good, HSG D (PR-3, PR-5)
4.629	98	Paved parking, HSG A (PR-10, PR-11, PR-2, PR-3, PR-4, PR-8, PR-9)
0.102	98	Paved parking, HSG D (PR-3)
8.137	98	Roofs, HSG A (PR-1, PR-7, PR-9)
0.085	98	Unconnected pavement, HSG A (PR-10, PR-2, PR-3, PR-8, PR-9)
0.013	98	Unconnected pavement, HSG D (PR-3)
1.067	98	Water Surface, HSG A (PR-2, PR-6)
1.400	30	Woods, Good, HSG A (PR-5, PR-6)
0.582	77	Woods, Good, HSG D (PR-5)
18.089	**85**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
17.341	HSG A	PR-1, PR-10, PR-11, PR-2, PR-3, PR-4, PR-5, PR-6, PR-7, PR-8, PR-9
0.000	HSG B	
0.000	HSG C	
0.748	HSG D	PR-3, PR-5
0.000	Other	
18.089		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
2.023	0.000	0.000	0.051	0.000	2.074	>75% Grass cover, Good	PR-1, PR-10, PR-11, PR-2, PR-3, PR-4, PR-5, PR-6, PR-7, PR-8, PR-9
4.629	0.000	0.000	0.102	0.000	4.730	Paved parking	PR-10, PR-11, PR-2, PR-3, PR-4, PR-8, PR-9
8.137	0.000	0.000	0.000	0.000	8.137	Roofs	PR-1, PR-7, PR-9
0.085	0.000	0.000	0.013	0.000	0.098	Unconnected pavement	PR-10, PR-2, PR-3, PR-8, PR-9
1.067	0.000	0.000	0.000	0.000	1.067	Water Surface	PR-2, PR-6
1.400	0.000	0.000	0.582	0.000	1.982	Woods, Good	PR-5, PR-6
17.341	**0.000**	**0.000**	**0.748**	**0.000**	**18.089**	**TOTAL AREA**	

Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)	Node Name
1	4P	272.50	271.90	75.9	0.0079	0.013	0.0	12.0	0.0	
2	5P	254.94	254.86	28.9	0.0028	0.013	0.0	12.0	0.0	

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 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

SubcatchmentPR-1: Subcat PR-1 Runoff Area=0.105 ac 3.65% Impervious Runoff Depth=0.02"
Tc=0.0 min CN=41 Runoff=0.00 cfs 0.000 af

SubcatchmentPR-10: Subcat PR-10 Runoff Area=0.334 ac 69.45% Impervious Runoff Depth=1.53"
Tc=6.0 min CN=80 Runoff=0.64 cfs 0.042 af

SubcatchmentPR-11: Subcat PR-11 Runoff Area=0.318 ac 77.70% Impervious Runoff Depth=1.89"
Tc=6.0 min CN=85 Runoff=0.75 cfs 0.050 af

SubcatchmentPR-2: Subcat PR-2 Runoff Area=49,958 sf 48.82% Impervious Runoff Depth=0.82"
Tc=6.0 min CN=68 Runoff=1.09 cfs 0.078 af

SubcatchmentPR-3: Subcat PR-3 Runoff Area=2.013 ac 88.34% Impervious Runoff Depth=2.50"
Tc=6.0 min CN=92 Runoff=6.03 cfs 0.420 af

SubcatchmentPR-4: Subcat PR-4 Runoff Area=1.573 ac 93.61% Impervious Runoff Depth=2.70"
Tc=6.0 min CN=94 Runoff=4.97 cfs 0.354 af

SubcatchmentPR-5: Subcat PR-5 Runoff Area=89,348 sf 0.00% Impervious Runoff Depth=0.06"
Flow Length=378' Tc=15.5 min CN=45 Runoff=0.02 cfs 0.011 af

SubcatchmentPR-6: Subcat PR-6 Runoff Area=44,275 sf 79.27% Impervious Runoff Depth=1.82"
Tc=6.0 min CN=84 Runoff=2.31 cfs 0.154 af

SubcatchmentPR-7: Subcat PR-7 Runoff Area=8.174 ac 99.51% Impervious Runoff Depth=3.13"
Tc=6.0 min CN=98 Runoff=27.73 cfs 2.130 af

SubcatchmentPR-8: Subcat PR-8 Runoff Area=26,155 sf 76.06% Impervious Runoff Depth=1.82"
Tc=6.0 min CN=84 Runoff=1.36 cfs 0.091 af

SubcatchmentPR-9: Subcat PR-9 Runoff Area=0.758 ac 45.36% Impervious Runoff Depth=0.73"
Tc=0.0 min CN=66 Runoff=0.83 cfs 0.046 af

Pond 2P: DMH 24-5 Inflow=6.67 cfs 0.583 af
Primary=6.67 cfs 0.583 af

Pond 3P: DMH 24-15 Inflow=28.71 cfs 2.226 af
Primary=28.71 cfs 2.226 af

Pond 4P: EX. BASIN #1 Peak Elev=274.06' Storage=2,448 cf Inflow=2.45 cfs 0.169 af
Outflow=0.66 cfs 0.121 af

Pond 5P: EX. BASIN #2 Peak Elev=254.47' Storage=58,528 cf Inflow=31.01 cfs 2.380 af
Discarded=0.76 cfs 2.380 af Primary=0.00 cfs 0.000 af Secondary=0.00 cfs 0.000 af Outflow=0.76 cfs 2.380 af

Pond 6P: Chambers Peak Elev=265.63' Storage=12,366 cf Inflow=11.64 cfs 0.937 af
Discarded=0.92 cfs 0.937 af Primary=0.00 cfs 0.000 af Outflow=0.92 cfs 0.937 af

Pond AP-1: Southern Wetlands Inflow=0.02 cfs 0.011 af
Primary=0.02 cfs 0.011 af

Total Runoff Area = 18.089 ac Runoff Volume = 3.376 af Average Runoff Depth = 2.24"
22.42% Pervious = 4.056 ac 77.58% Impervious = 14.033 ac

Summary for Subcatchment PR-1: Subcat PR-1

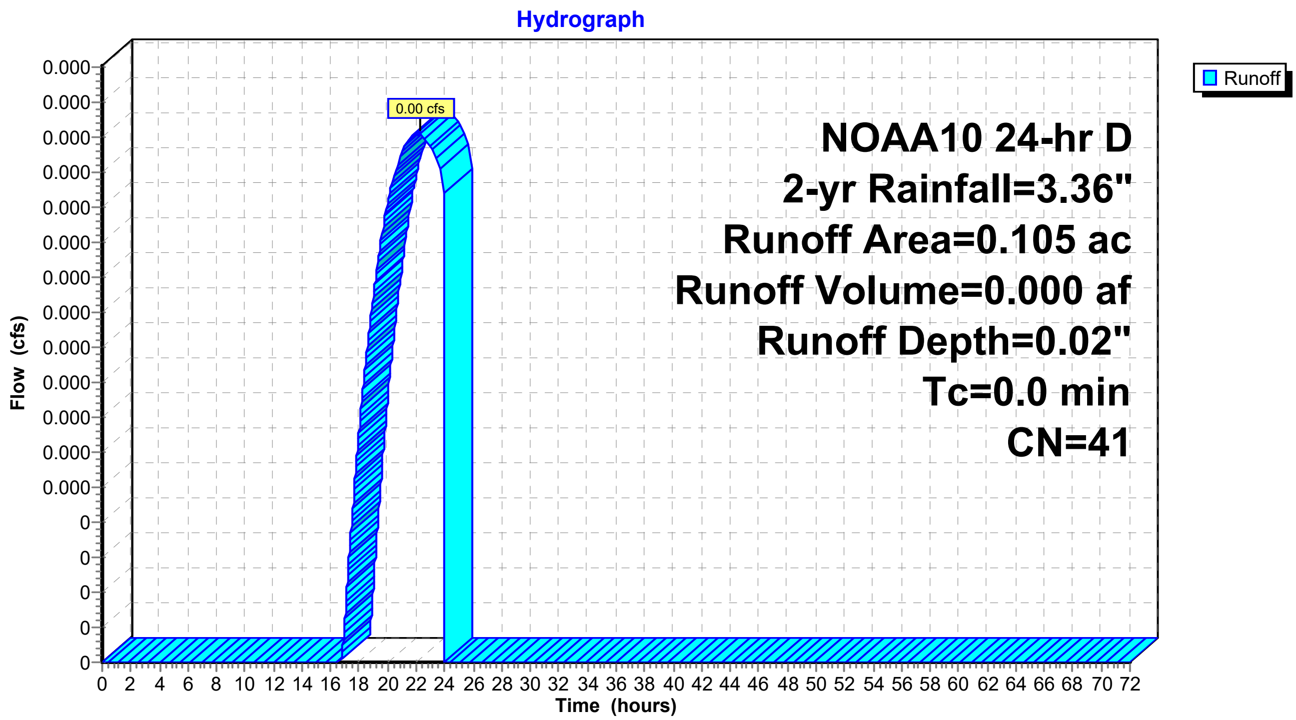
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.00 cfs @ 22.29 hrs, Volume= 0.000 af, Depth= 0.02"
Routed to Pond AP-1 : Southern Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-yr Rainfall=3.36"

Area (ac)	CN	Description
0.101	39	>75% Grass cover, Good, HSG A
0.004	98	Roofs, HSG A
0.105	41	Weighted Average
0.101		96.35% Pervious Area
0.004		3.65% Impervious Area

Subcatchment PR-1: Subcat PR-1



Summary for Subcatchment PR-10: Subcat PR-10

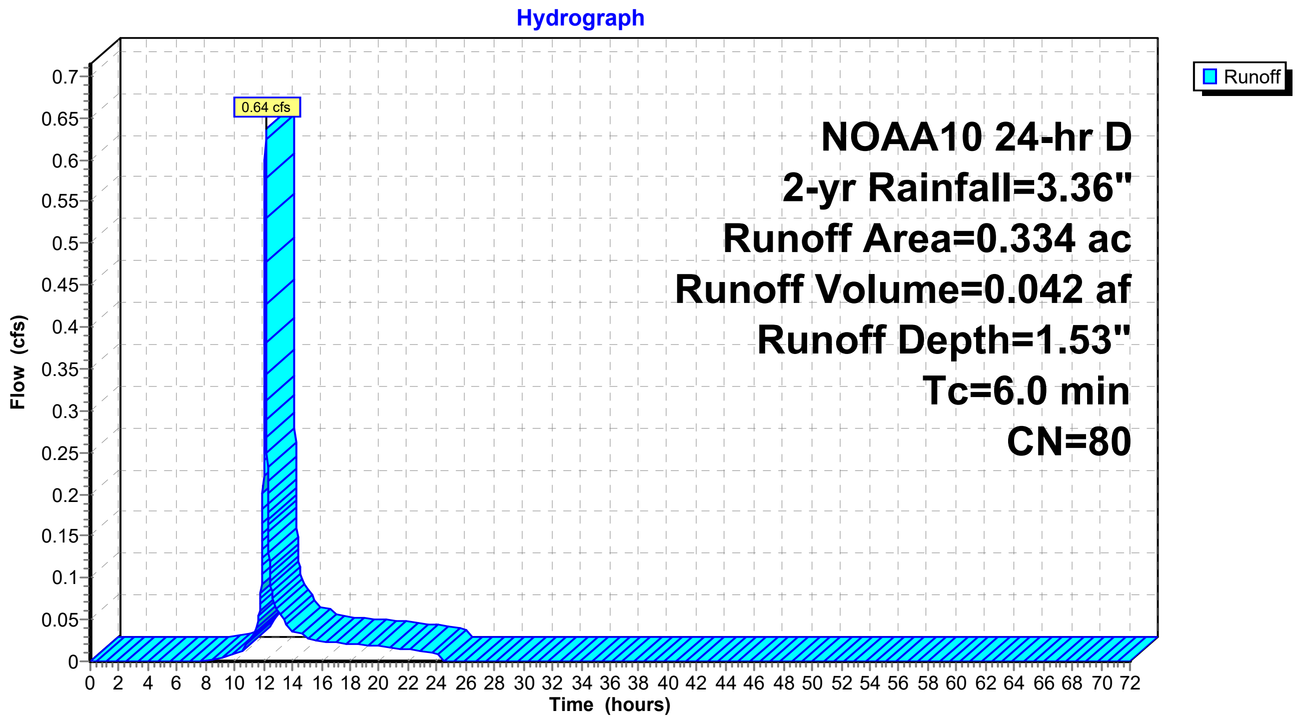
Runoff = 0.64 cfs @ 12.13 hrs, Volume= 0.042 af, Depth= 1.53"
Routed to Pond 2P : DMH 24-5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-yr Rainfall=3.36"

Area (ac)	CN	Description
0.102	39	>75% Grass cover, Good, HSG A
0.228	98	Paved parking, HSG A
0.004	98	Unconnected pavement, HSG A
0.334	80	Weighted Average
0.102		30.55% Pervious Area
0.232		69.45% Impervious Area
0.004		1.57% Unconnected

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

Subcatchment PR-10: Subcat PR-10



Summary for Subcatchment PR-11: Subcat PR-11

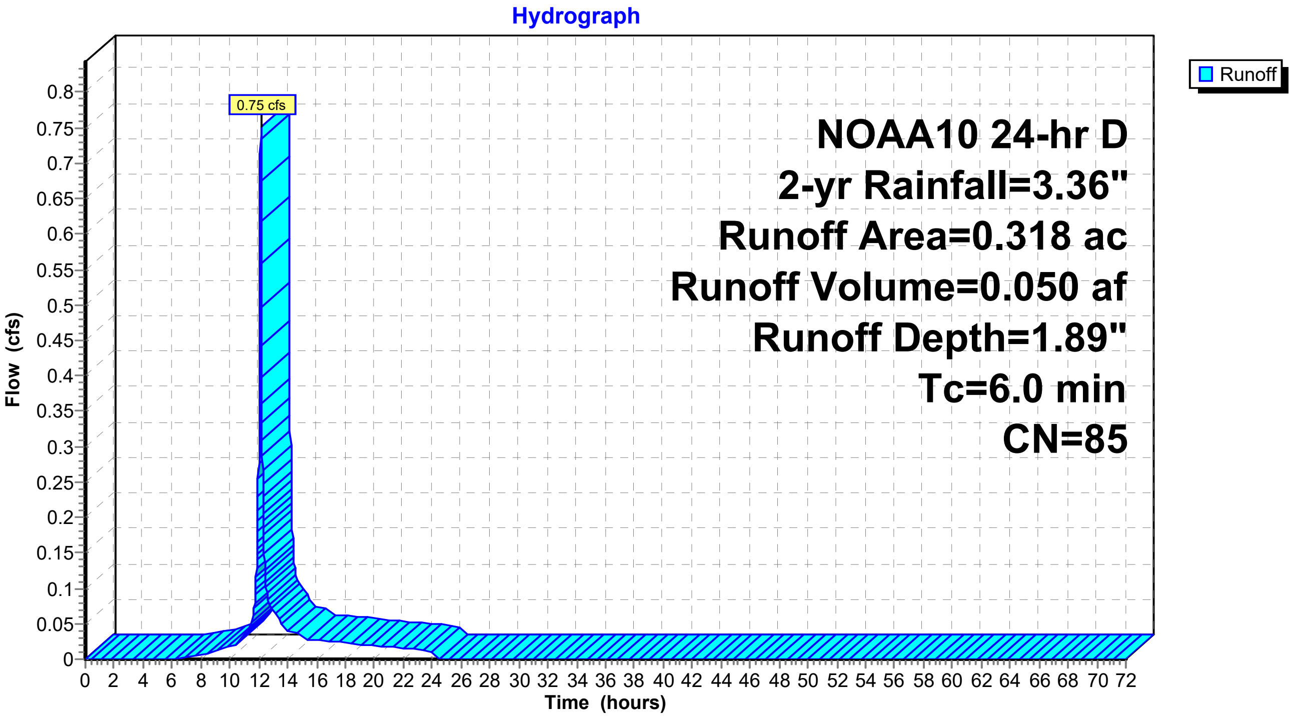
Runoff = 0.75 cfs @ 12.13 hrs, Volume= 0.050 af, Depth= 1.89"
Routed to Pond 3P : DMH 24-15

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-yr Rainfall=3.36"

Area (ac)	CN	Description
0.071	39	>75% Grass cover, Good, HSG A
0.247	98	Paved parking, HSG A
0.318	85	Weighted Average
0.071		22.30% Pervious Area
0.247		77.70% Impervious Area

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

Subcatchment PR-11: Subcat PR-11



Summary for Subcatchment PR-2: Subcat PR-2

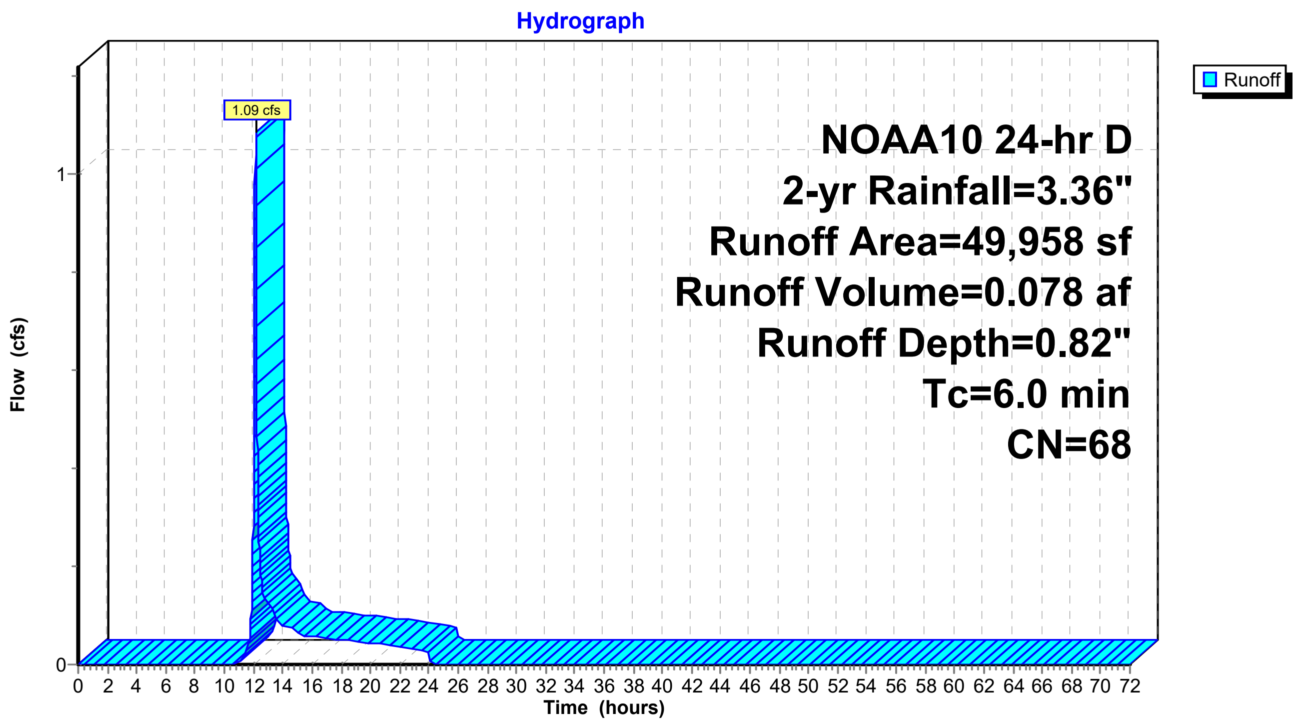
Runoff = 1.09 cfs @ 12.14 hrs, Volume= 0.078 af, Depth= 0.82"
Routed to Pond 4P : EX. BASIN #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-yr Rainfall=3.36"

Area (sf)	CN	Description
25,568	39	>75% Grass cover, Good, HSG A
12,594	98	Paved parking, HSG A
409	98	Unconnected pavement, HSG A
11,387	98	Water Surface, HSG A
49,958	68	Weighted Average
25,568		51.18% Pervious Area
24,390		48.82% Impervious Area
409		1.68% Unconnected

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

Subcatchment PR-2: Subcat PR-2



Summary for Subcatchment PR-3: Subcat PR-3

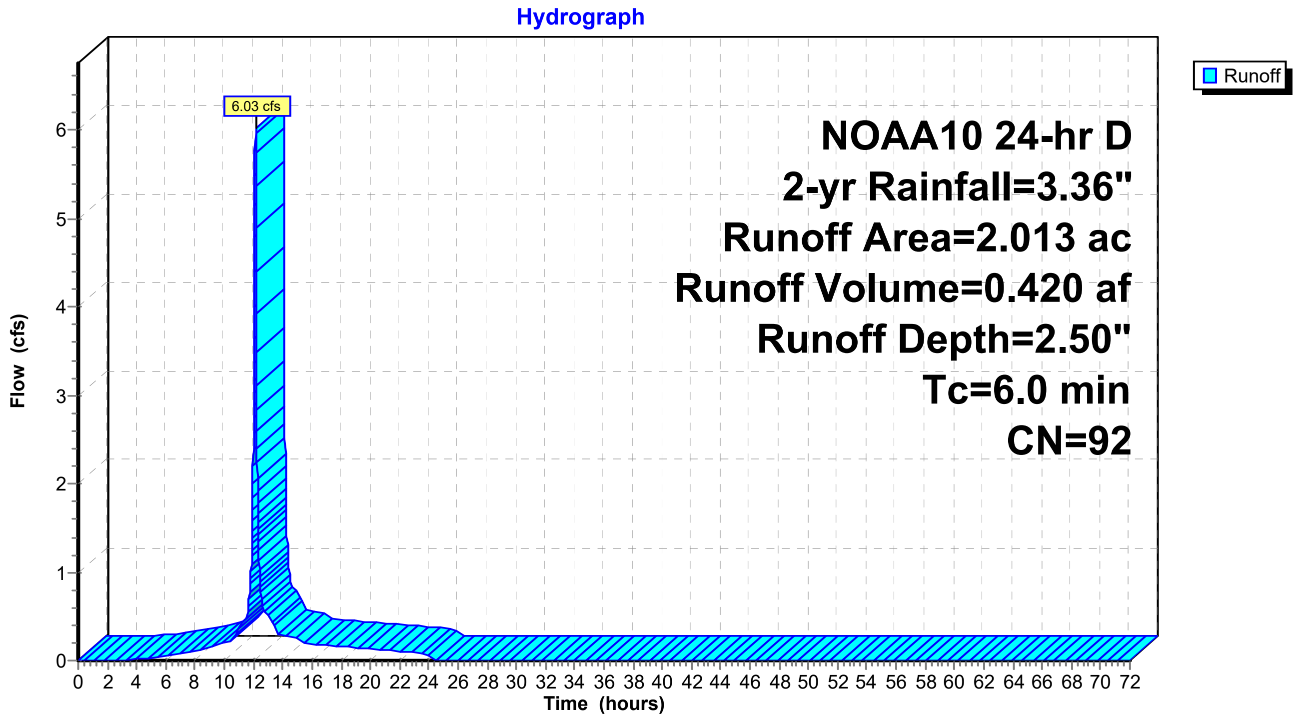
Runoff = 6.03 cfs @ 12.13 hrs, Volume= 0.420 af, Depth= 2.50"
Routed to Pond 2P : DMH 24-5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-yr Rainfall=3.36"

Area (ac)	CN	Description
0.205	39	>75% Grass cover, Good, HSG A
0.030	80	>75% Grass cover, Good, HSG D
1.603	98	Paved parking, HSG A
0.102	98	Paved parking, HSG D
0.060	98	Unconnected pavement, HSG A
0.013	98	Unconnected pavement, HSG D
2.013	92	Weighted Average
0.235		11.66% Pervious Area
1.778		88.34% Impervious Area
0.073		4.12% Unconnected

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

Subcatchment PR-3: Subcat PR-3



Summary for Subcatchment PR-4: Subcat PR-4

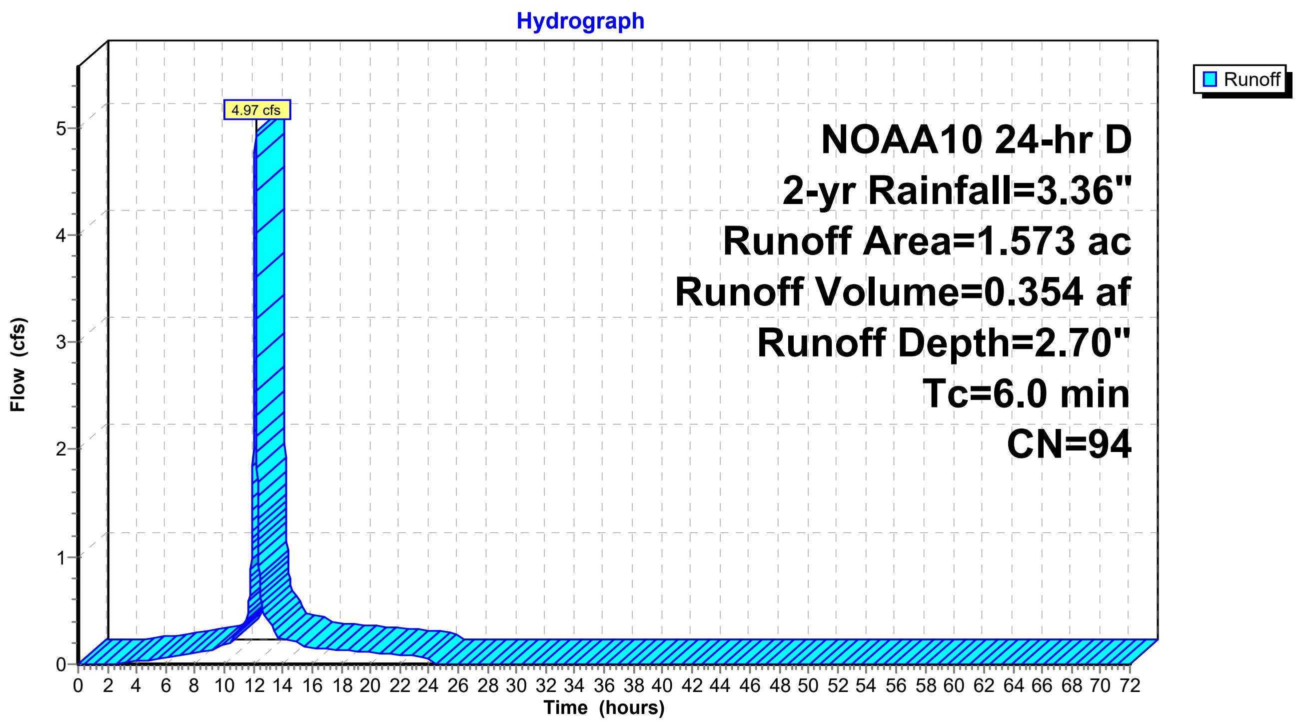
Runoff = 4.97 cfs @ 12.13 hrs, Volume= 0.354 af, Depth= 2.70"
Routed to Pond 6P : Chambers

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-yr Rainfall=3.36"

Area (ac)	CN	Description
0.101	39	>75% Grass cover, Good, HSG A
1.473	98	Paved parking, HSG A
1.573	94	Weighted Average
0.101		6.39% Pervious Area
1.473		93.61% Impervious Area

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

Subcatchment PR-4: Subcat PR-4



Summary for Subcatchment PR-5: Subcat PR-5

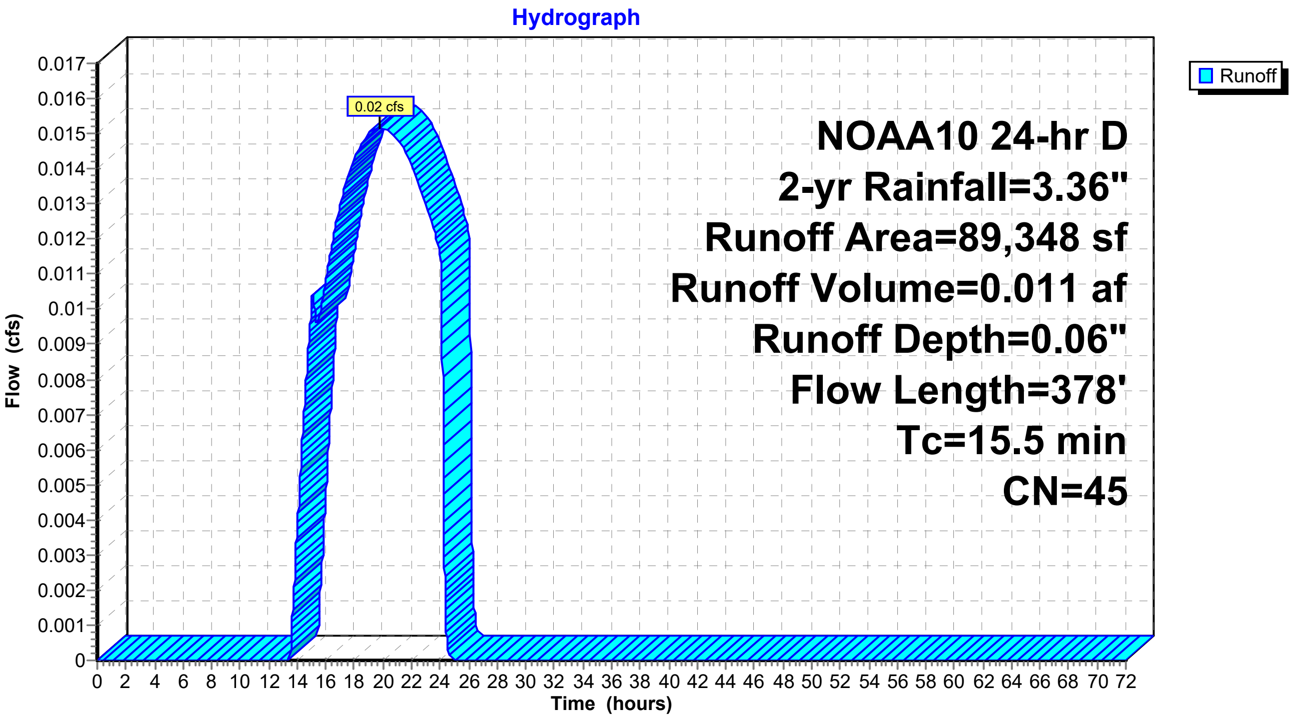
Runoff = 0.02 cfs @ 19.72 hrs, Volume= 0.011 af, Depth= 0.06"
Routed to Pond AP-1 : Southern Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-yr Rainfall=3.36"

Area (sf)	CN	Description
9,611	39	>75% Grass cover, Good, HSG A
954	80	>75% Grass cover, Good, HSG D
53,433	30	Woods, Good, HSG A
25,349	77	Woods, Good, HSG D
89,348	45	Weighted Average
89,348		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0190	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.36"
0.8	67	0.0780	1.40		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.0	14	0.3300	8.62		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
1.5	148	0.0125	1.68		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.2	46	0.0550	3.52		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.7	53	0.0700	1.32		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
15.5	378	Total			

Subcatchment PR-5: Subcat PR-5



Summary for Subcatchment PR-6: Subcat PR-6

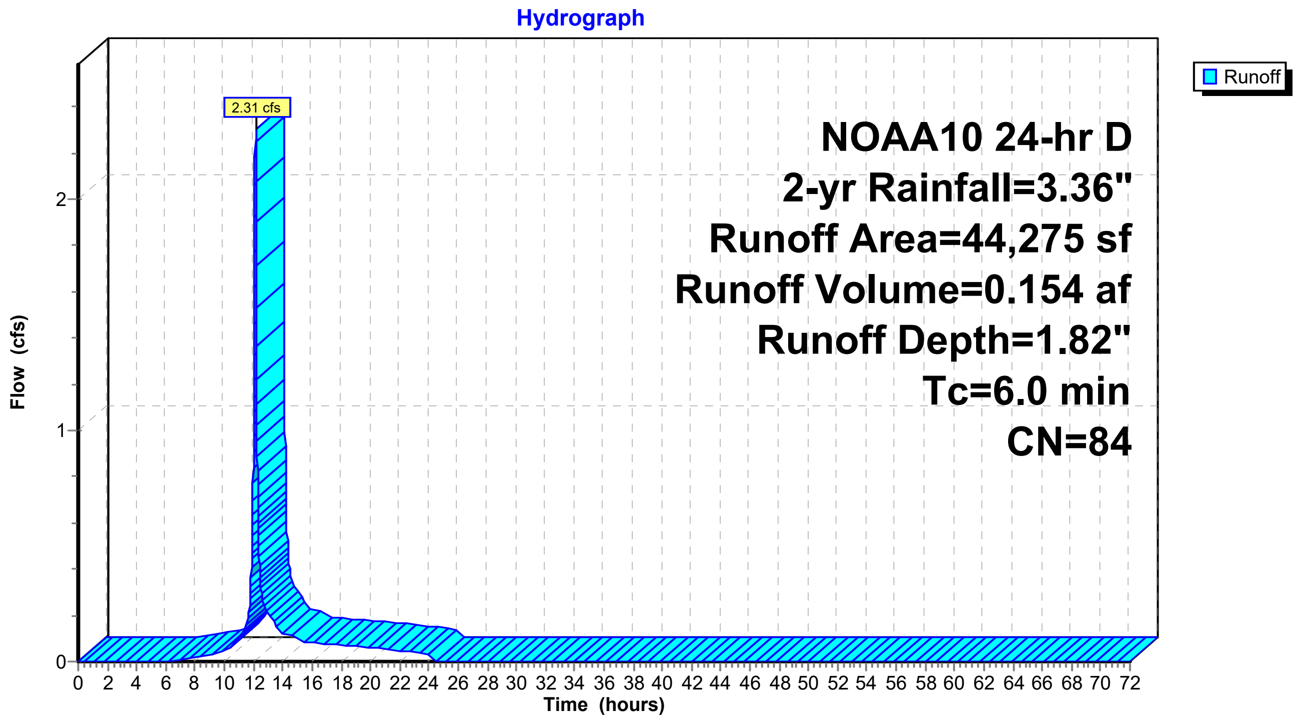
Runoff = 2.31 cfs @ 12.13 hrs, Volume= 0.154 af, Depth= 1.82"
Routed to Pond 5P : EX. BASIN #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-yr Rainfall=3.36"

Area (sf)	CN	Description
1,625	39	>75% Grass cover, Good, HSG A
35,096	98	Water Surface, HSG A
7,554	30	Woods, Good, HSG A
44,275	84	Weighted Average
9,179		20.73% Pervious Area
35,096		79.27% Impervious Area

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

Subcatchment PR-6: Subcat PR-6



Summary for Subcatchment PR-7: Subcat PR-7

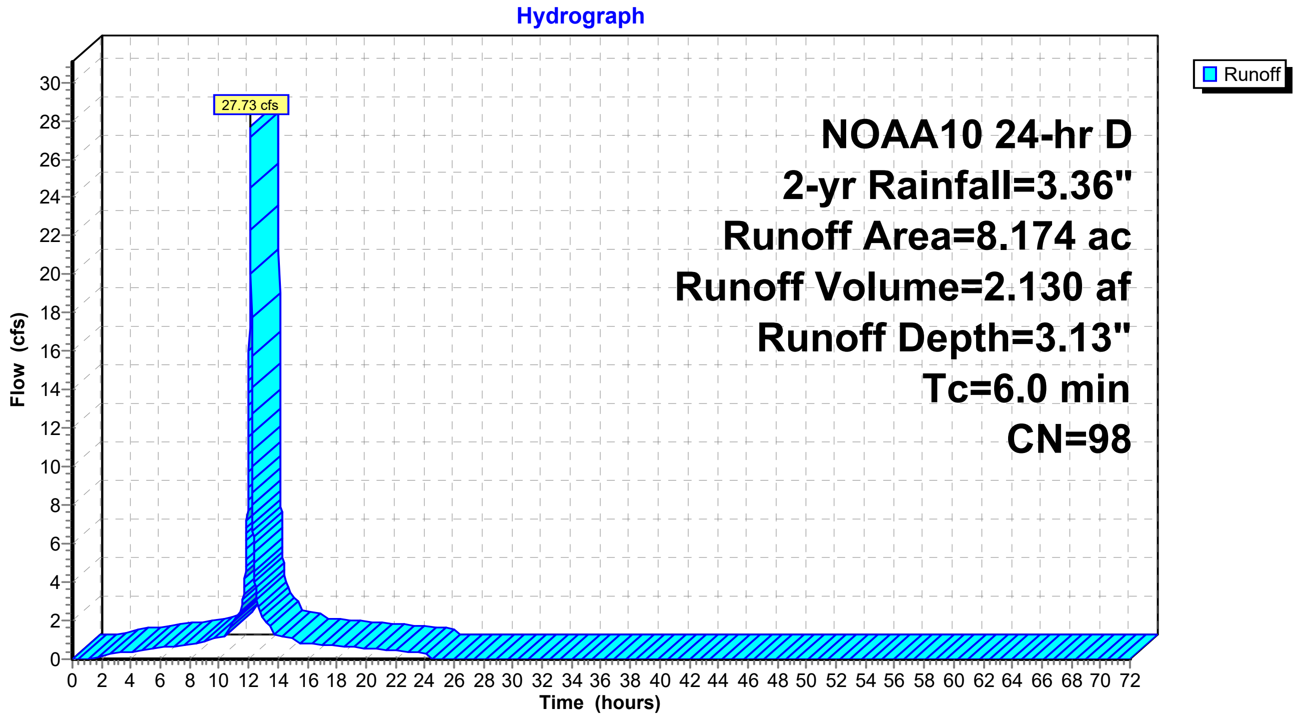
Runoff = 27.73 cfs @ 12.13 hrs, Volume= 2.130 af, Depth= 3.13"
Routed to Pond 3P : DMH 24-15

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-yr Rainfall=3.36"

Area (ac)	CN	Description
0.040	39	>75% Grass cover, Good, HSG A
8.133	98	Roofs, HSG A
8.174	98	Weighted Average
0.040		0.49% Pervious Area
8.133		99.51% Impervious Area

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

Subcatchment PR-7: Subcat PR-7



Summary for Subcatchment PR-8: Subcat PR-8

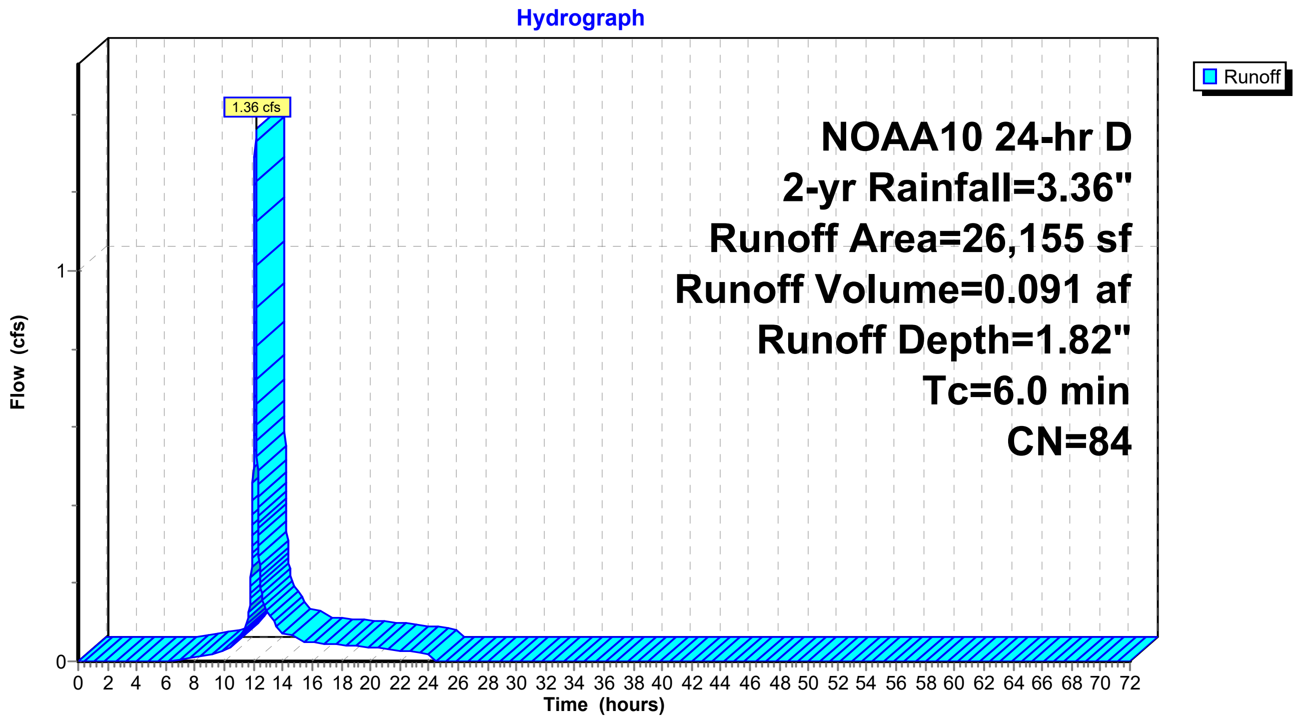
Runoff = 1.36 cfs @ 12.13 hrs, Volume= 0.091 af, Depth= 1.82"
Routed to Pond 4P : EX. BASIN #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-yr Rainfall=3.36"

Area (sf)	CN	Description
6,261	39	>75% Grass cover, Good, HSG A
19,408	98	Paved parking, HSG A
486	98	Unconnected pavement, HSG A
26,155	84	Weighted Average
6,261		23.94% Pervious Area
19,894		76.06% Impervious Area
486		2.44% Unconnected

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

Subcatchment PR-8: Subcat PR-8



Summary for Subcatchment PR-9: Subcat PR-9

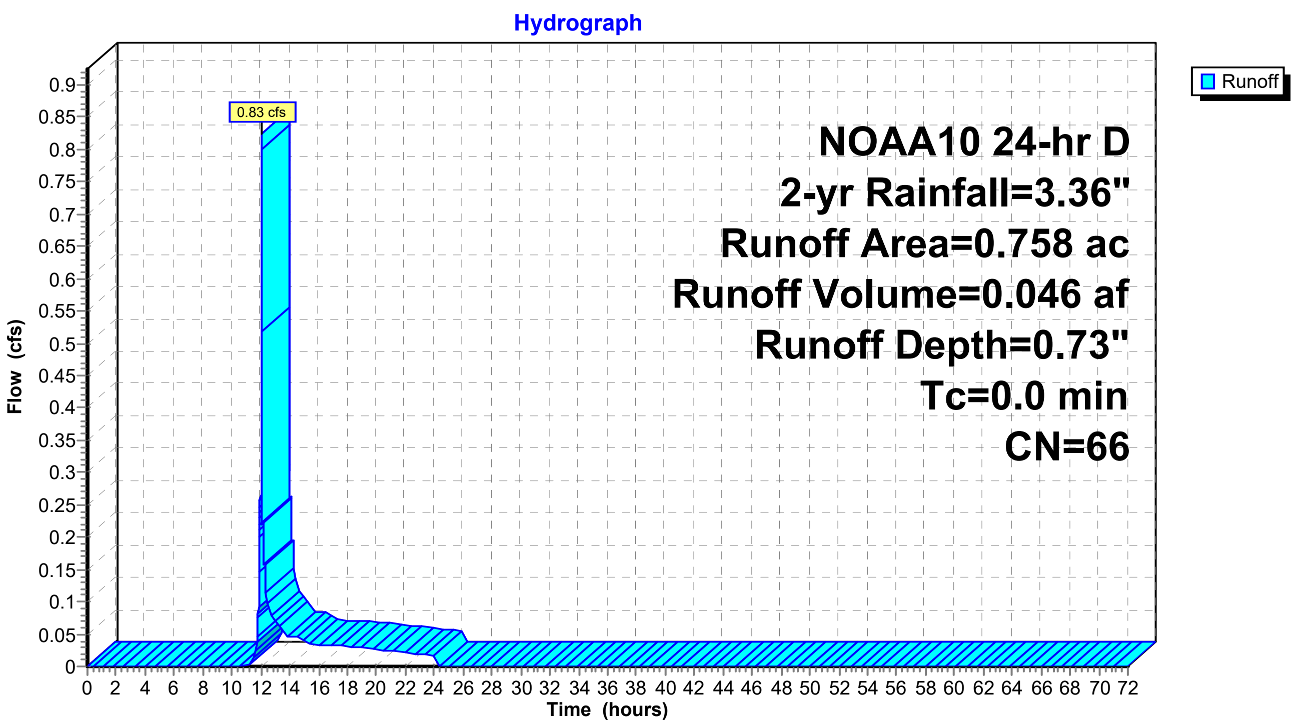
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.83 cfs @ 12.09 hrs, Volume= 0.046 af, Depth= 0.73"
Routed to Pond 3P : DMH 24-15

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-yr Rainfall=3.36"

Area (ac)	CN	Description
0.414	39	>75% Grass cover, Good, HSG A
0.343	98	Paved parking, HSG A
0.000	98	Roofs, HSG A
0.001	98	Unconnected pavement, HSG A
0.758	66	Weighted Average
0.414		54.64% Pervious Area
0.344		45.36% Impervious Area
0.001		0.15% Unconnected

Subcatchment PR-9: Subcat PR-9

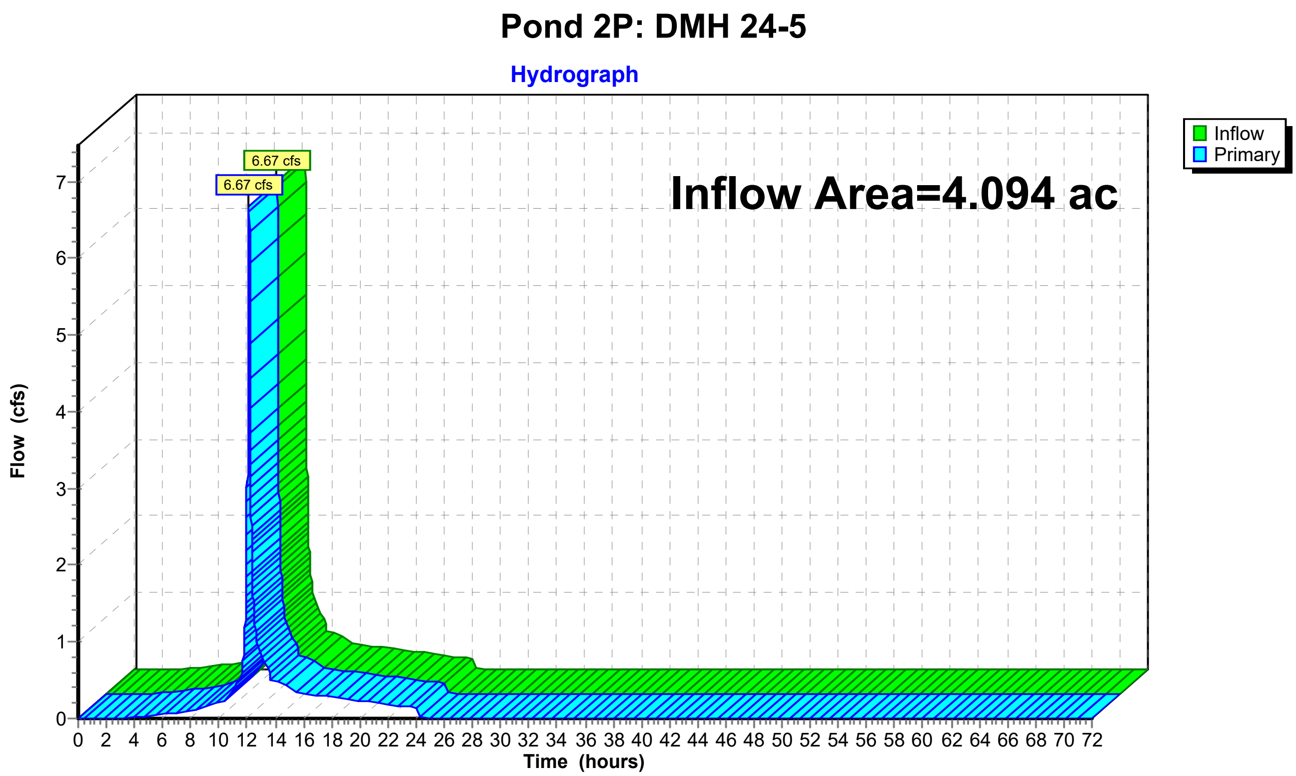


Summary for Pond 2P: DMH 24-5

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

Inflow Area = 4.094 ac, 73.93% Impervious, Inflow Depth = 1.71" for 2-yr event
Inflow = 6.67 cfs @ 12.13 hrs, Volume= 0.583 af
Primary = 6.67 cfs @ 12.13 hrs, Volume= 0.583 af, Atten= 0%, Lag= 0.0 min
Routed to Pond 6P : Chambers

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

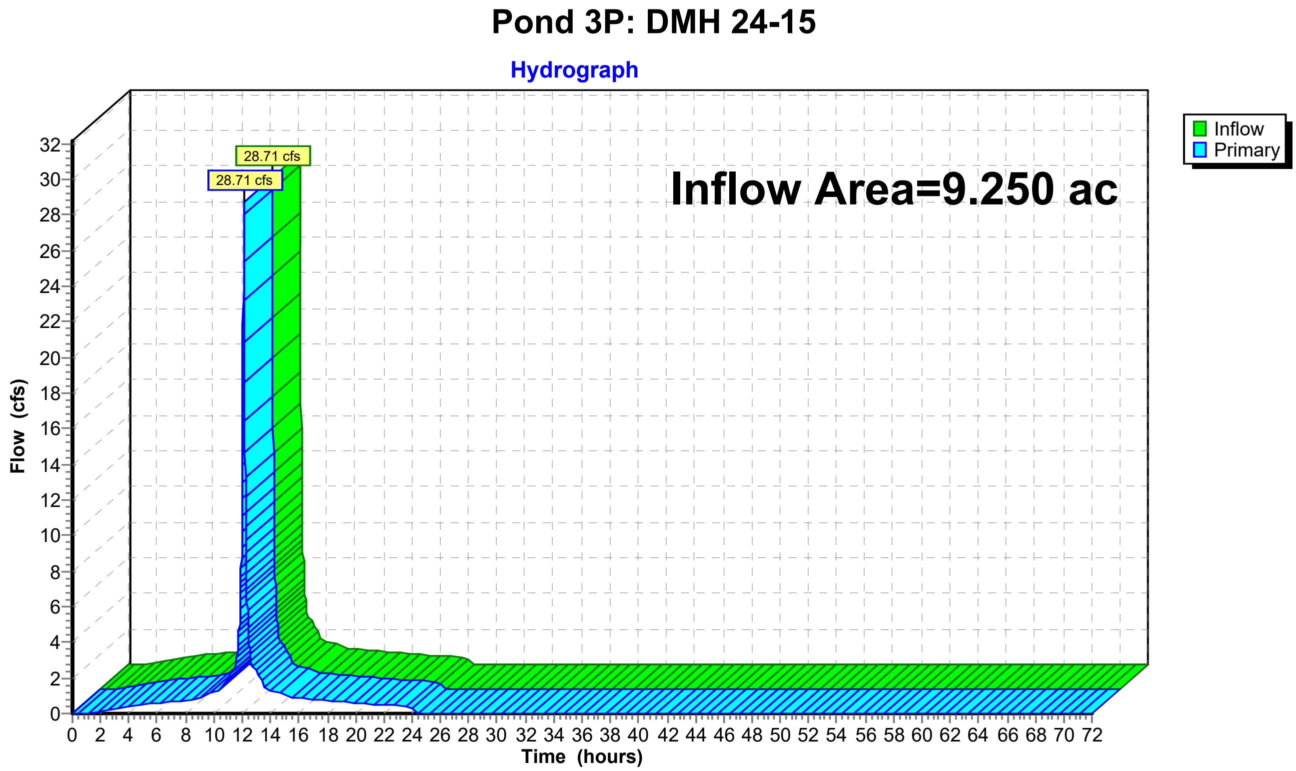


Summary for Pond 3P: DMH 24-15

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

Inflow Area = 9.250 ac, 94.32% Impervious, Inflow Depth = 2.89" for 2-yr event
Inflow = 28.71 cfs @ 12.13 hrs, Volume= 2.226 af
Primary = 28.71 cfs @ 12.13 hrs, Volume= 2.226 af, Atten= 0%, Lag= 0.0 min
Routed to Pond 5P : EX. BASIN #2

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



Summary for Pond 4P: EX. BASIN #1

Inflow Area = 1.747 ac, 58.18% Impervious, Inflow Depth = 1.16" for 2-yr event
Inflow = 2.45 cfs @ 12.14 hrs, Volume= 0.169 af
Outflow = 0.66 cfs @ 12.32 hrs, Volume= 0.121 af, Atten= 73%, Lag= 11.0 min
Primary = 0.66 cfs @ 12.32 hrs, Volume= 0.121 af
Routed to Pond 2P : DMH 24-5

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 274.06' @ 12.32 hrs Surf.Area= 5,549 sf Storage= 2,448 cf

Plug-Flow detention time= 211.4 min calculated for 0.121 af (71% of inflow)
Center-of-Mass det. time= 90.7 min (978.4 - 887.7)

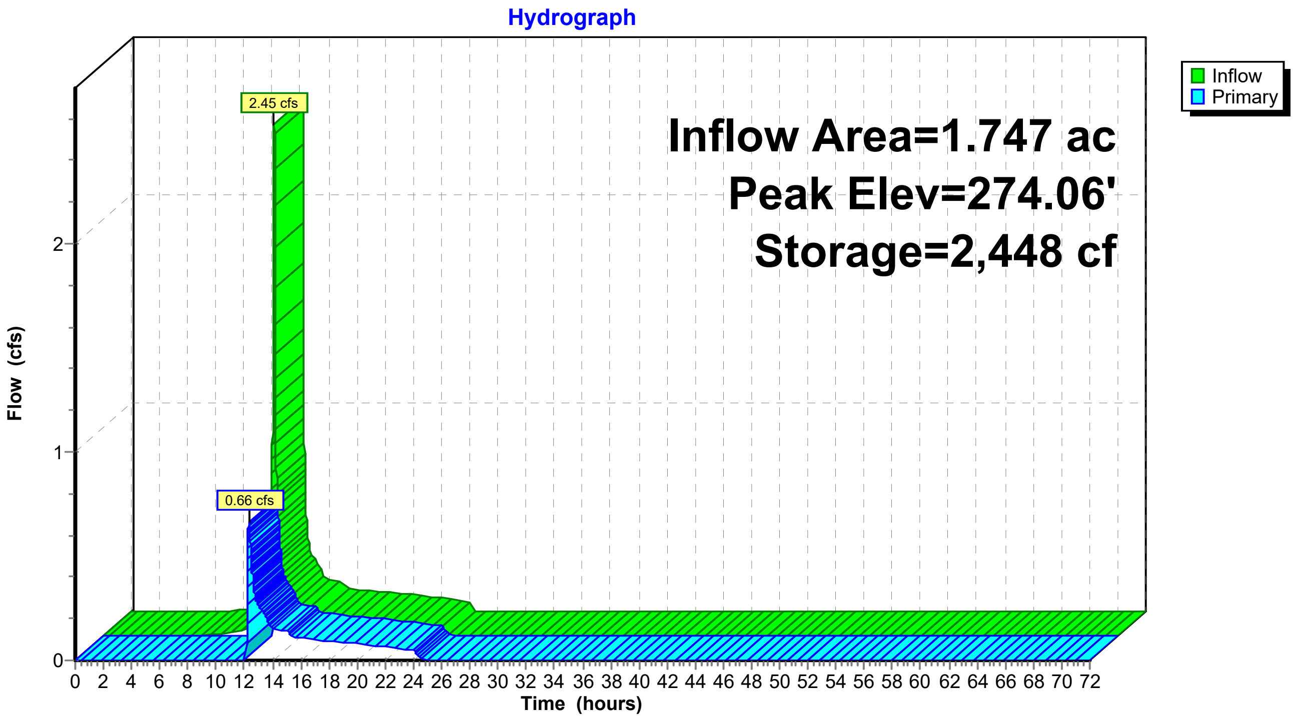
Volume	Invert	Avail.Storage	Storage Description
#1	273.40'	31,754 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
273.40	1,731	0	0
274.00	5,352	2,125	2,125
275.00	8,670	7,011	9,136
276.00	11,387	10,029	19,164
277.00	13,793	12,590	31,754

Device	Routing	Invert	Outlet Devices
#1	Primary	272.50'	**12.0" Round Culvert** L= 75.9' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 272.50' / 271.90' S= 0.0079 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf
#2	Device 1	274.00'	**34.0" x 50.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.66 cfs @ 12.32 hrs HW=274.06' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.66 cfs of 3.44 cfs potential flow)
  └─**2=Orifice/Grate** (Weir Controls 0.66 cfs @ 0.80 fps)

Pond 4P: EX. BASIN #1



Summary for Pond 5P: EX. BASIN #2

Inflow Area = 15.933 ac, 88.05% Impervious, Inflow Depth = 1.79" for 2-yr event
Inflow = 31.01 cfs @ 12.13 hrs, Volume= 2.380 af
Outflow = 0.76 cfs @ 18.88 hrs, Volume= 2.380 af, Atten= 98%, Lag= 405.1 min
Discarded = 0.76 cfs @ 18.88 hrs, Volume= 2.380 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond AP-1 : Southern Wetlands
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond AP-1 : Southern Wetlands

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 254.47' @ 18.88 hrs Surf.Area= 23,061 sf Storage= 58,528 cf

Plug-Flow detention time= 784.6 min calculated for 2.380 af (100% of inflow)
Center-of-Mass det. time= 784.6 min (1,555.5 - 770.9)

Volume	Invert	Avail.Storage	Storage Description
#1	252.50'	161,924 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	252.50'	52,984 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) -Impervious
		214,908 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
252.50	19,110	0	0
253.00	20,997	10,027	10,027
254.00	22,390	21,694	31,720
255.00	23,808	23,099	54,819
256.00	25,235	24,522	79,341
257.00	26,725	25,980	105,321
258.00	28,276	27,501	132,821
259.00	29,930	29,103	161,924

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
252.50	8,115	0	0
253.00	8,115	4,058	4,058
254.00	8,158	8,137	12,194
255.00	8,158	8,158	20,352
256.00	8,158	8,158	28,510
257.00	8,158	8,158	36,668
258.00	8,158	8,158	44,826
259.00	8,158	8,158	52,984

Device	Routing	Invert	Outlet Devices
#1	Secondary	258.00'	**15.0' long x 15.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Primary	254.94'	**12.0" Round Culvert** L= 28.9' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 254.94' / 254.86' S= 0.0028 '/' Cc= 0.900

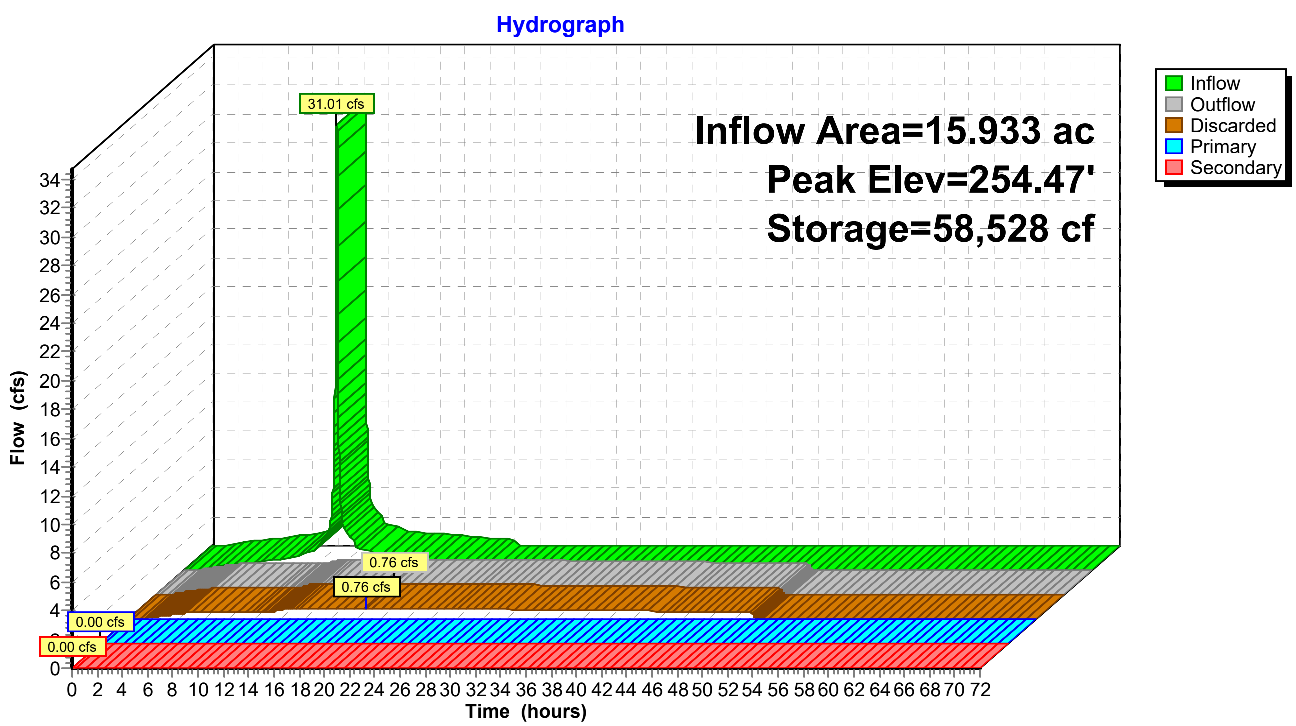
			n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf
#3	Device 2	255.75'	**8.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Discarded	252.50'	**1.020 in/hr Exfiltration over Surface area**
			Conductivity to Groundwater Elevation = 248.00' Phase-In= 0.01'

Discarded OutFlow Max=0.76 cfs @ 18.88 hrs HW=254.47' (Free Discharge)
└─**4=Exfiltration** (Controls 0.76 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=252.50' TW=0.00' (Dynamic Tailwater)
└─**2=Culvert** (Controls 0.00 cfs)
  └─**3=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=252.50' TW=0.00' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 5P: EX. BASIN #2



Summary for Pond 6P: Chambers

Inflow Area = 5.667 ac, 79.39% Impervious, Inflow Depth = 1.98" for 2-yr event
Inflow = 11.64 cfs @ 12.13 hrs, Volume= 0.937 af
Outflow = 0.92 cfs @ 13.54 hrs, Volume= 0.937 af, Atten= 92%, Lag= 84.8 min
Discarded = 0.92 cfs @ 13.54 hrs, Volume= 0.937 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond 5P : EX. BASIN #2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 265.63' @ 13.54 hrs Surf.Area= 11,965 sf Storage= 12,366 cf

Plug-Flow detention time= 113.1 min calculated for 0.937 af (100% of inflow)
Center-of-Mass det. time= 113.1 min (944.4 - 831.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	264.00'	16,883 cf	**68.50'W x 174.67'L x 5.75'H Field A**
			68,797 cf Overall - 26,590 cf Embedded = 42,207 cf x 40.0% Voids
#2A	264.75'	26,590 cf	**Cultec R-902HD v2** x 414 Inside #1
			Effective Size= 69.1"W x 48.0"H => 17.30 sf x 3.67'L = 63.4 cf
			Overall Size= 78.0"W x 48.0"H x 4.10'L with 0.44' Overlap
			414 Chambers in 9 Rows
			Cap Storage= 18.0 cf x 2 x 9 rows = 324.4 cf
		43,472 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	264.00'	**2.410 in/hr Exfiltration over Surface area**
			Conductivity to Groundwater Elevation = 259.70' Phase-In= 0.01'
#2	Primary	269.50'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.92 cfs @ 13.54 hrs HW=265.63' (Free Discharge)
└─**1=Exfiltration** (Controls 0.92 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=264.00' TW=252.50' (Dynamic Tailwater)
└─**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 6P: Chambers - Chamber Wizard Field A

Chamber Model = Cultec R-902HD v2 (Cultec Recharger®902HD v2)
Effective Size= 69.1"W x 48.0"H => 17.30 sf x 3.67'L = 63.4 cf
Overall Size= 78.0"W x 48.0"H x 4.10'L with 0.44' Overlap
Cap Storage= 18.0 cf x 2 x 9 rows = 324.4 cf

78.0" Wide + 9.0" Spacing = 87.0" C-C Row Spacing

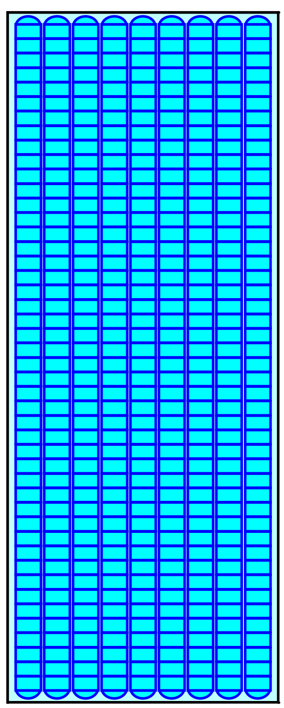
46 Chambers/Row x 3.67' Long +2.00' Cap Length x 2 = 172.67' Row Length +12.0" End Stone x 2 = 174.67' Base Length
9 Rows x 78.0" Wide + 9.0" Spacing x 8 + 24.0" Side Stone x 2 = 68.50' Base Width
9.0" Stone Base + 48.0" Chamber Height + 12.0" Stone Cover = 5.75' Field Height

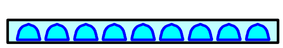
414 Chambers x 63.4 cf + 18.0 cf Cap Volume x 2 x 9 Rows = 26,589.6 cf Chamber Storage

68,796.8 cf Field - 26,589.6 cf Chambers = 42,207.3 cf Stone x 40.0% Voids = 16,882.9 cf Stone Storage

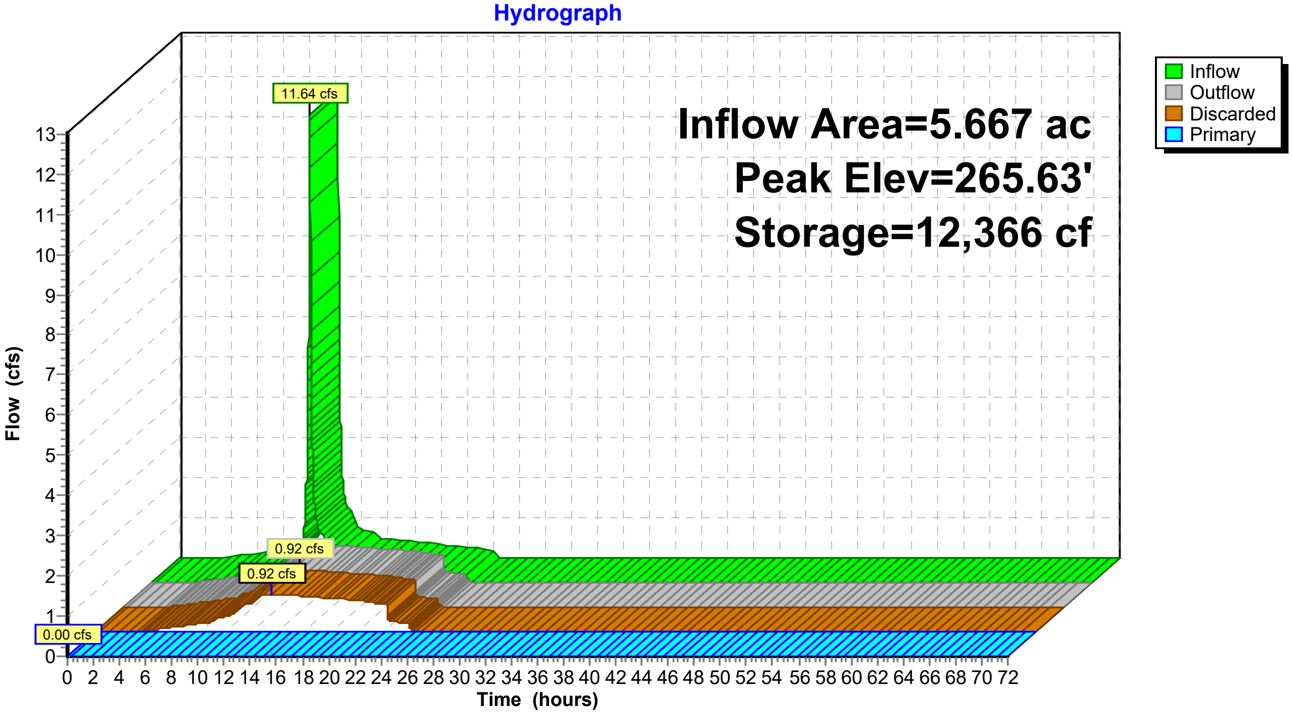
Chamber Storage + Stone Storage = 43,472.5 cf = 0.998 af
Overall Storage Efficiency = 63.2%
Overall System Size = 174.67' x 68.50' x 5.75'

414 Chambers
2,548.0 cy Field
1,563.2 cy Stone





Pond 6P: Chambers



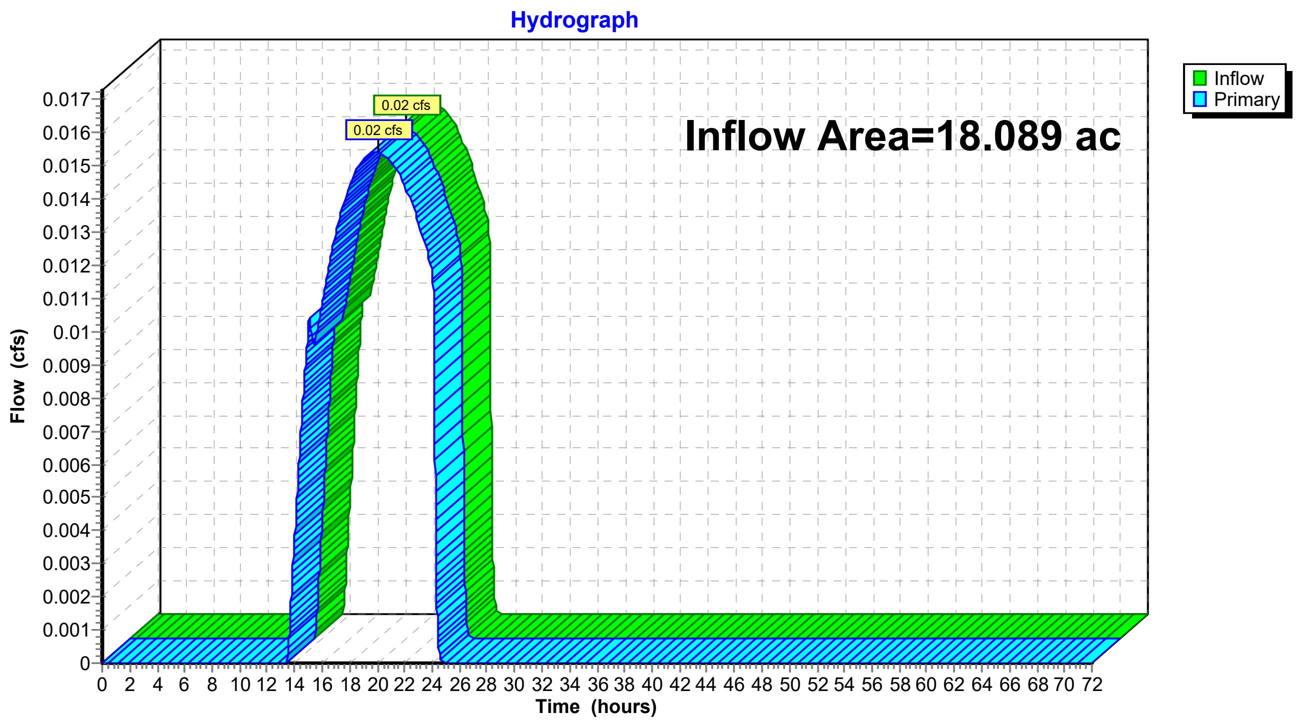
Summary for Pond AP-1: Southern Wetlands

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

Inflow Area =	18.089 ac,	77.58% Impervious,	Inflow Depth = 0.01"	for 2-yr event
Inflow =	0.02 cfs @	20.03 hrs, Volume=	0.011 af	
Primary =	0.02 cfs @	20.03 hrs, Volume=	0.011 af,	Atten= 0%, Lag= 0.0 min

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

Pond AP-1: Southern Wetlands



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 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

SubcatchmentPR-1: Subcat PR-1 Runoff Area=0.105 ac 3.65% Impervious Runoff Depth=0.33"
Tc=0.0 min CN=41 Runoff=0.01 cfs 0.003 af

SubcatchmentPR-10: Subcat PR-10 Runoff Area=0.334 ac 69.45% Impervious Runoff Depth=3.09"
Tc=6.0 min CN=80 Runoff=1.28 cfs 0.086 af

SubcatchmentPR-11: Subcat PR-11 Runoff Area=0.318 ac 77.70% Impervious Runoff Depth=3.57"
Tc=6.0 min CN=85 Runoff=1.39 cfs 0.095 af

SubcatchmentPR-2: Subcat PR-2 Runoff Area=49,958 sf 48.82% Impervious Runoff Depth=2.04"
Tc=6.0 min CN=68 Runoff=2.91 cfs 0.195 af

SubcatchmentPR-3: Subcat PR-3 Runoff Area=2.013 ac 88.34% Impervious Runoff Depth=4.30"
Tc=6.0 min CN=92 Runoff=10.03 cfs 0.722 af

SubcatchmentPR-4: Subcat PR-4 Runoff Area=1.573 ac 93.61% Impervious Runoff Depth=4.53"
Tc=6.0 min CN=94 Runoff=8.06 cfs 0.593 af

SubcatchmentPR-5: Subcat PR-5 Runoff Area=89,348 sf 0.00% Impervious Runoff Depth=0.51"
Flow Length=378' Tc=15.5 min CN=45 Runoff=0.37 cfs 0.088 af

SubcatchmentPR-6: Subcat PR-6 Runoff Area=44,275 sf 79.27% Impervious Runoff Depth=3.47"
Tc=6.0 min CN=84 Runoff=4.33 cfs 0.294 af

SubcatchmentPR-7: Subcat PR-7 Runoff Area=8.174 ac 99.51% Impervious Runoff Depth=4.98"
Tc=6.0 min CN=98 Runoff=43.36 cfs 3.394 af

SubcatchmentPR-8: Subcat PR-8 Runoff Area=26,155 sf 76.06% Impervious Runoff Depth=3.47"
Tc=6.0 min CN=84 Runoff=2.56 cfs 0.174 af

SubcatchmentPR-9: Subcat PR-9 Runoff Area=0.758 ac 45.36% Impervious Runoff Depth=1.88"
Tc=0.0 min CN=66 Runoff=2.23 cfs 0.119 af

Pond 2P: DMH 24-5 Inflow=14.96 cfs 1.127 af
Primary=14.96 cfs 1.127 af

Pond 3P: DMH 24-15 Inflow=45.33 cfs 3.607 af
Primary=45.33 cfs 3.607 af

Pond 4P: EX. BASIN #1 Peak Elev=274.24' Storage=3,501 cf Inflow=5.46 cfs 0.368 af
Outflow=3.70 cfs 0.320 af

Pond 5P: EX. BASIN #2 Peak Elev=255.90' Storage=104,659 cf Inflow=49.66 cfs 3.902 af
Discarded=0.99 cfs 3.695 af Primary=0.41 cfs 0.207 af Secondary=0.00 cfs 0.000 af Outflow=1.40 cfs 3.902 af

Pond 6P: Chambers Peak Elev=267.46' Storage=29,445 cf Inflow=23.02 cfs 1.721 af
Discarded=1.20 cfs 1.721 af Primary=0.00 cfs 0.000 af Outflow=1.20 cfs 1.721 af

Pond AP-1: Southern Wetlands

Inflow=0.50 cfs 0.297 af
Primary=0.50 cfs 0.297 af

Total Runoff Area = 18.089 ac Runoff Volume = 5.762 af Average Runoff Depth = 3.82"
22.42% Pervious = 4.056 ac 77.58% Impervious = 14.033 ac

Summary for Subcatchment PR-1: Subcat PR-1

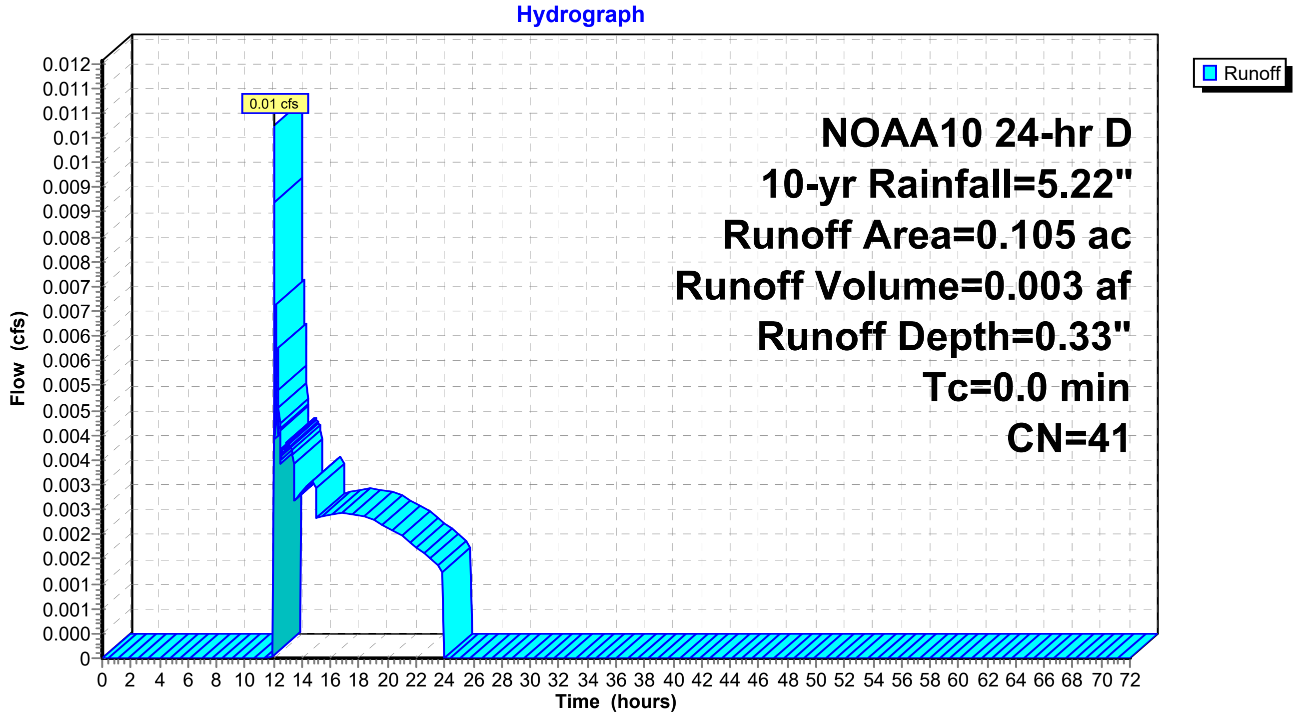
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.01 cfs @ 12.09 hrs, Volume= 0.003 af, Depth= 0.33"
Routed to Pond AP-1 : Southern Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-yr Rainfall=5.22"

Area (ac)	CN	Description
0.101	39	>75% Grass cover, Good, HSG A
0.004	98	Roofs, HSG A
0.105	41	Weighted Average
0.101		96.35% Pervious Area
0.004		3.65% Impervious Area

Subcatchment PR-1: Subcat PR-1



Summary for Subcatchment PR-10: Subcat PR-10

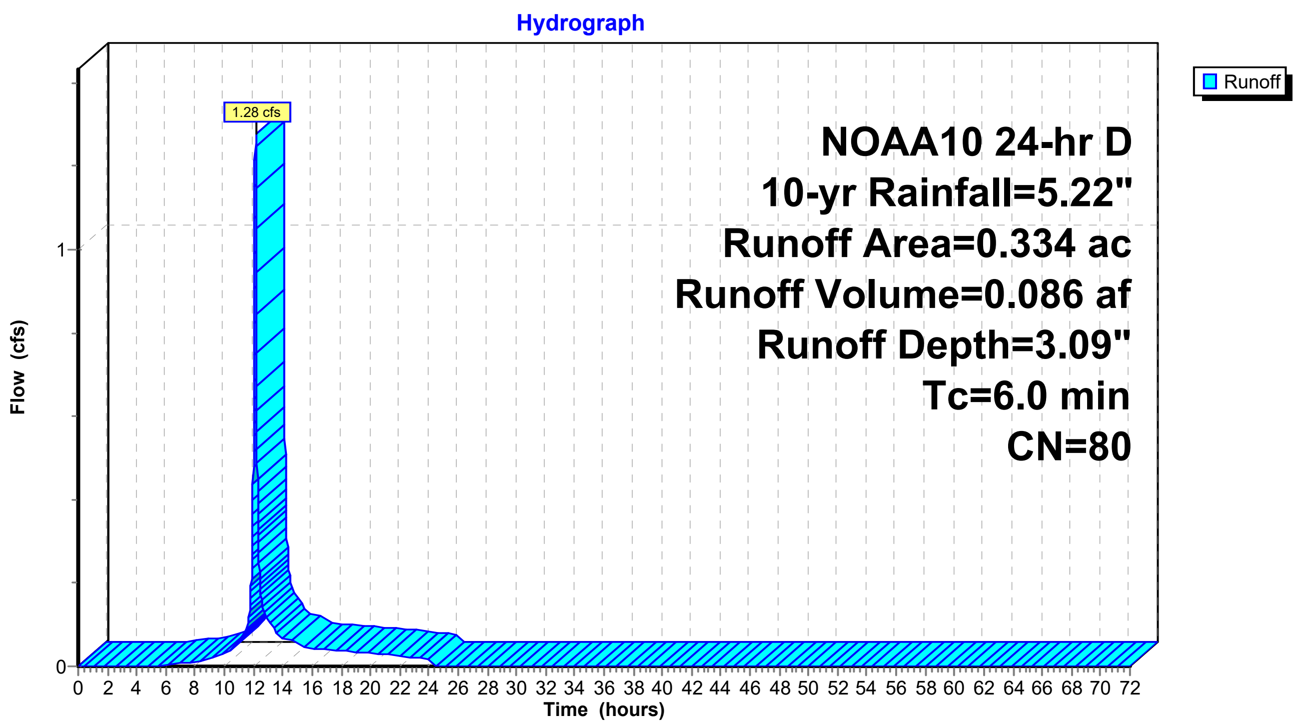
Runoff = 1.28 cfs @ 12.13 hrs, Volume= 0.086 af, Depth= 3.09"
Routed to Pond 2P : DMH 24-5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-yr Rainfall=5.22"

Area (ac)	CN	Description
0.102	39	>75% Grass cover, Good, HSG A
0.228	98	Paved parking, HSG A
0.004	98	Unconnected pavement, HSG A
0.334	80	Weighted Average
0.102		30.55% Pervious Area
0.232		69.45% Impervious Area
0.004		1.57% Unconnected

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

Subcatchment PR-10: Subcat PR-10



Summary for Subcatchment PR-11: Subcat PR-11

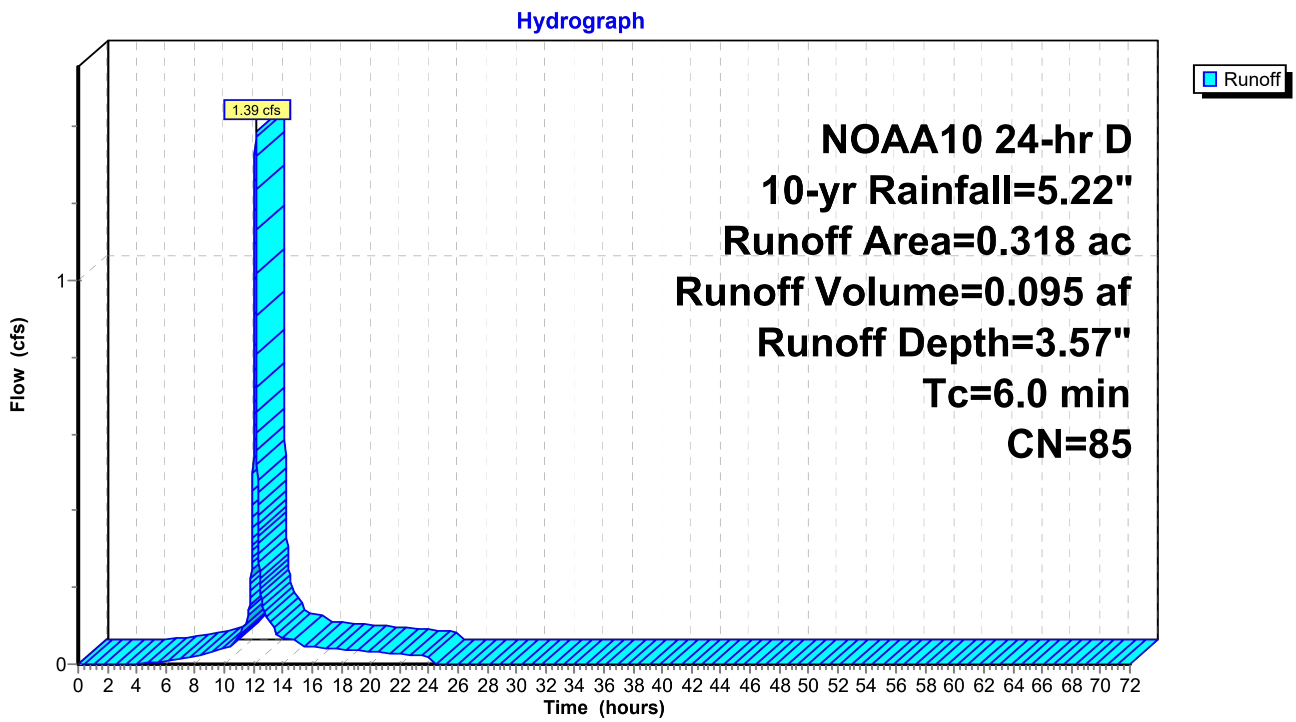
Runoff = 1.39 cfs @ 12.13 hrs, Volume= 0.095 af, Depth= 3.57"
Routed to Pond 3P : DMH 24-15

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-yr Rainfall=5.22"

Area (ac)	CN	Description
0.071	39	>75% Grass cover, Good, HSG A
0.247	98	Paved parking, HSG A
0.318	85	Weighted Average
0.071		22.30% Pervious Area
0.247		77.70% Impervious Area

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

Subcatchment PR-11: Subcat PR-11



Summary for Subcatchment PR-2: Subcat PR-2

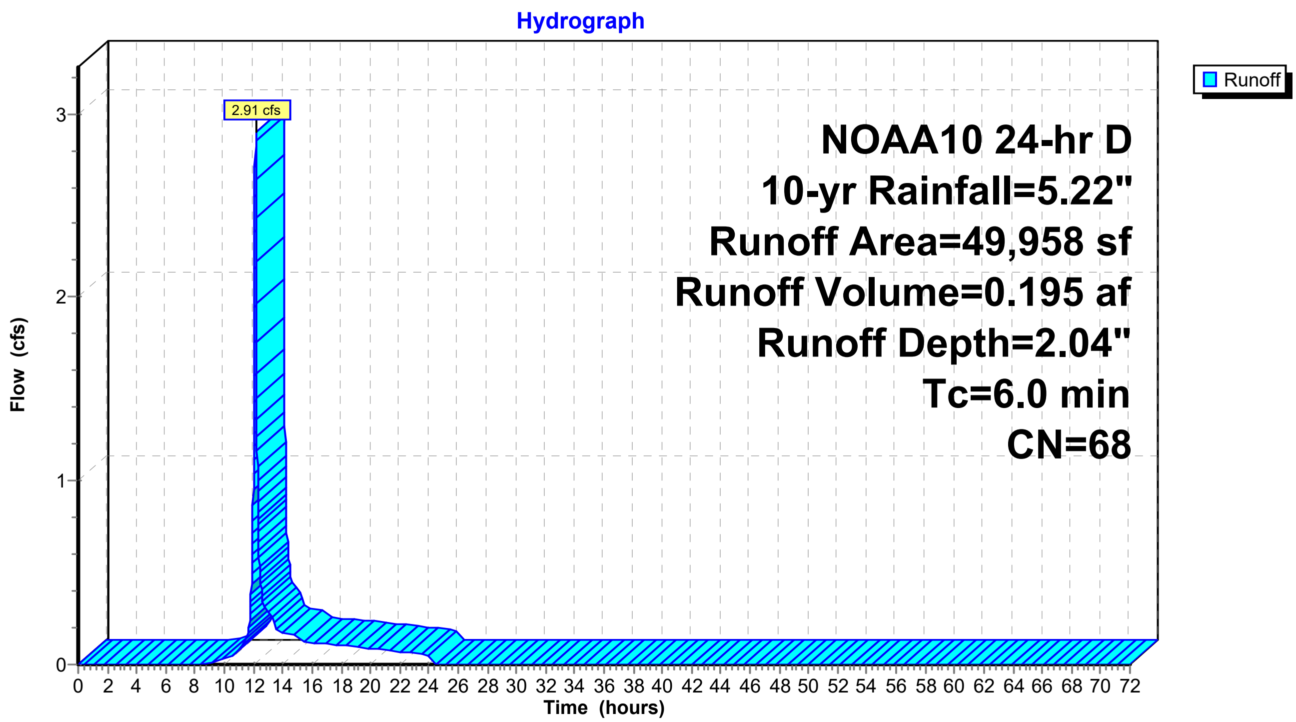
Runoff = 2.91 cfs @ 12.13 hrs, Volume= 0.195 af, Depth= 2.04"
Routed to Pond 4P : EX. BASIN #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-yr Rainfall=5.22"

Area (sf)	CN	Description
25,568	39	>75% Grass cover, Good, HSG A
12,594	98	Paved parking, HSG A
409	98	Unconnected pavement, HSG A
11,387	98	Water Surface, HSG A
49,958	68	Weighted Average
25,568		51.18% Pervious Area
24,390		48.82% Impervious Area
409		1.68% Unconnected

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

Subcatchment PR-2: Subcat PR-2



Summary for Subcatchment PR-3: Subcat PR-3

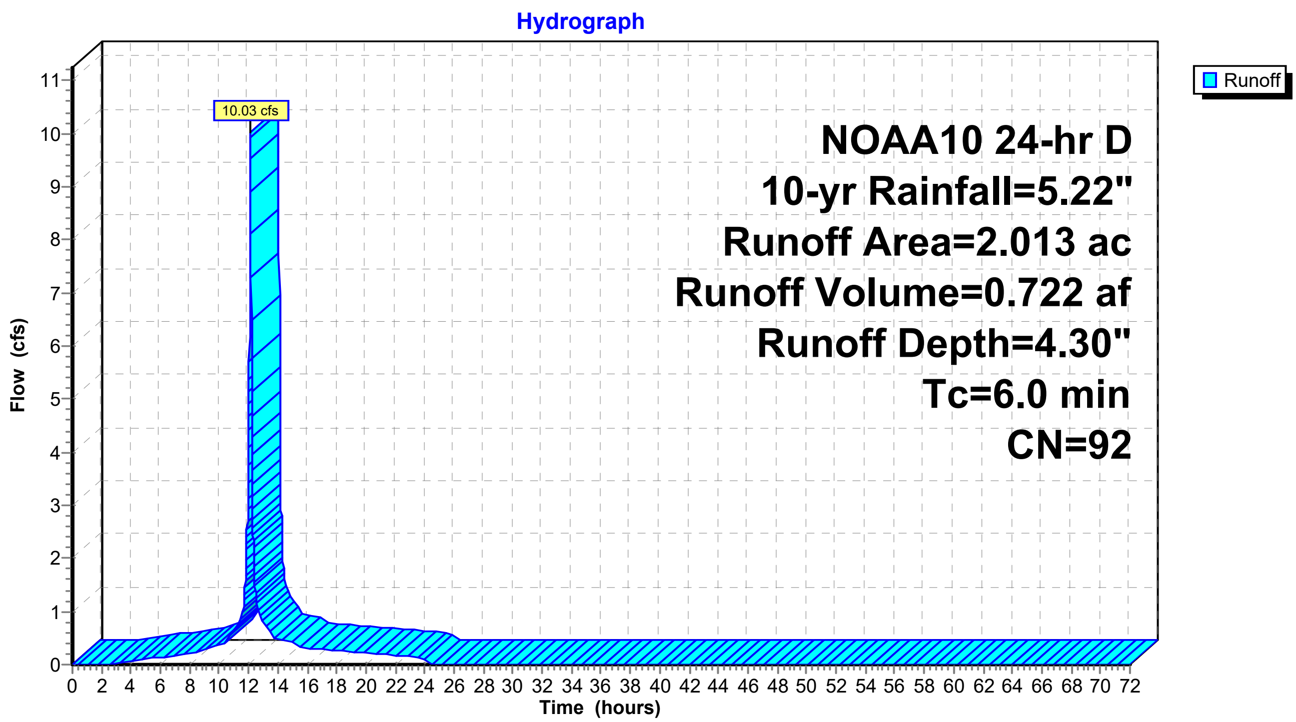
Runoff = 10.03 cfs @ 12.13 hrs, Volume= 0.722 af, Depth= 4.30"
Routed to Pond 2P : DMH 24-5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-yr Rainfall=5.22"

Area (ac)	CN	Description
0.205	39	>75% Grass cover, Good, HSG A
0.030	80	>75% Grass cover, Good, HSG D
1.603	98	Paved parking, HSG A
0.102	98	Paved parking, HSG D
0.060	98	Unconnected pavement, HSG A
0.013	98	Unconnected pavement, HSG D
2.013	92	Weighted Average
0.235		11.66% Pervious Area
1.778		88.34% Impervious Area
0.073		4.12% Unconnected

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

Subcatchment PR-3: Subcat PR-3



Summary for Subcatchment PR-4: Subcat PR-4

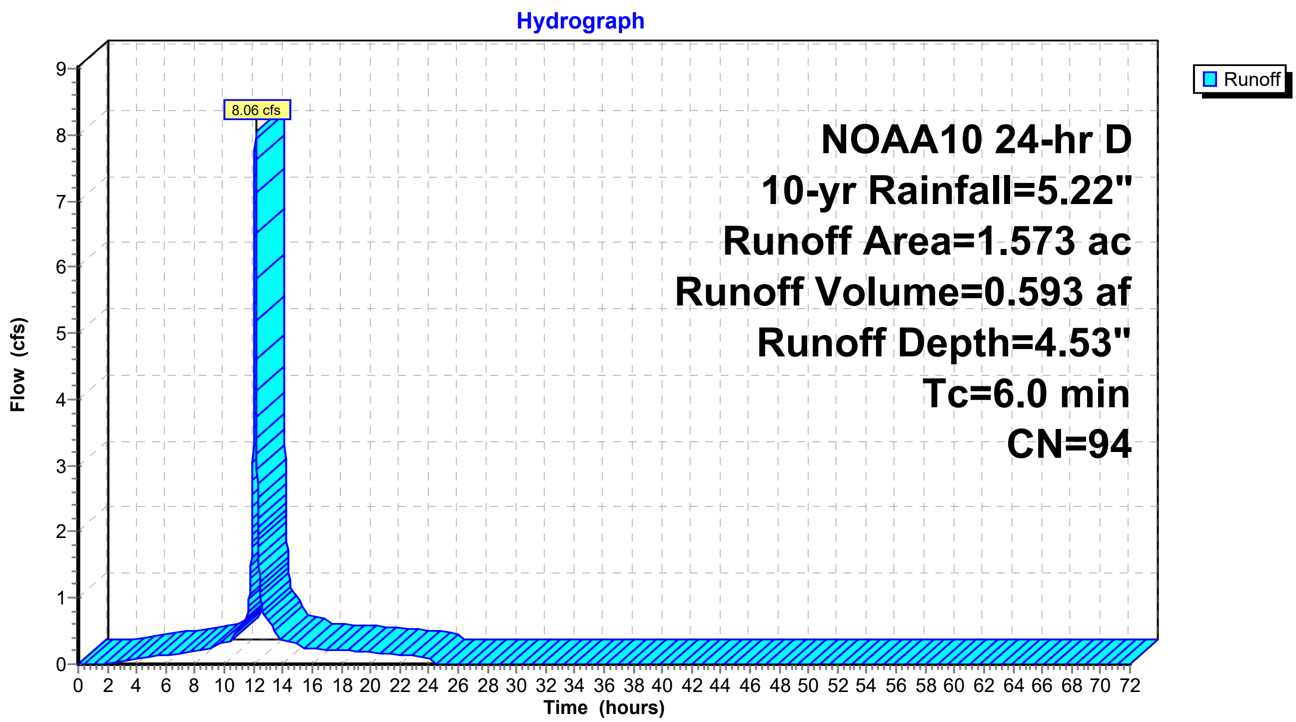
Runoff = 8.06 cfs @ 12.13 hrs, Volume= 0.593 af, Depth= 4.53"
Routed to Pond 6P : Chambers

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-yr Rainfall=5.22"

Area (ac)	CN	Description
0.101	39	>75% Grass cover, Good, HSG A
1.473	98	Paved parking, HSG A
1.573	94	Weighted Average
0.101		6.39% Pervious Area
1.473		93.61% Impervious Area

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

Subcatchment PR-4: Subcat PR-4



Summary for Subcatchment PR-5: Subcat PR-5

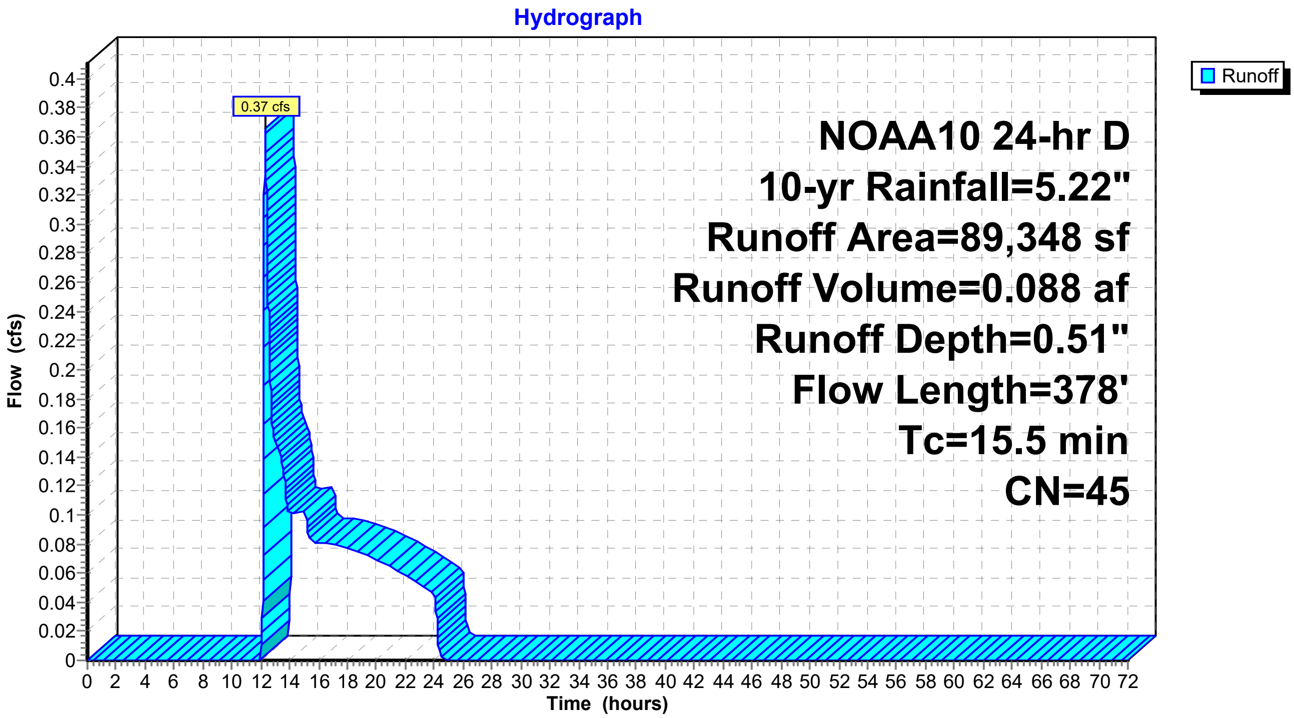
Runoff = 0.37 cfs @ 12.31 hrs, Volume= 0.088 af, Depth= 0.51"
Routed to Pond AP-1 : Southern Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-yr Rainfall=5.22"

Area (sf)	CN	Description
9,611	39	>75% Grass cover, Good, HSG A
954	80	>75% Grass cover, Good, HSG D
53,433	30	Woods, Good, HSG A
25,349	77	Woods, Good, HSG D
89,348	45	Weighted Average
89,348		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0190	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.36"
0.8	67	0.0780	1.40		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.0	14	0.3300	8.62		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
1.5	148	0.0125	1.68		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.2	46	0.0550	3.52		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.7	53	0.0700	1.32		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
15.5	378	Total			

Subcatchment PR-5: Subcat PR-5



Summary for Subcatchment PR-6: Subcat PR-6

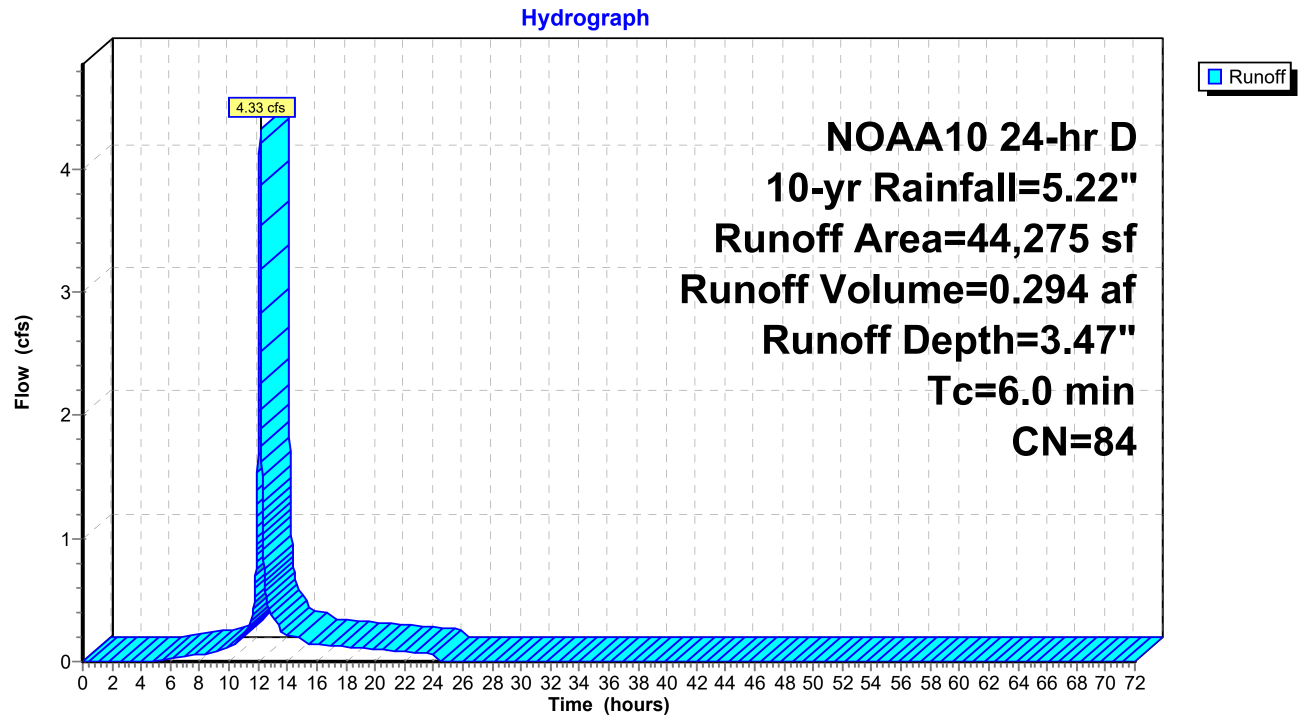
Runoff = 4.33 cfs @ 12.13 hrs, Volume= 0.294 af, Depth= 3.47"
Routed to Pond 5P : EX. BASIN #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-yr Rainfall=5.22"

Area (sf)	CN	Description
1,625	39	>75% Grass cover, Good, HSG A
35,096	98	Water Surface, HSG A
7,554	30	Woods, Good, HSG A
44,275	84	Weighted Average
9,179		20.73% Pervious Area
35,096		79.27% Impervious Area

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

Subcatchment PR-6: Subcat PR-6



Summary for Subcatchment PR-7: Subcat PR-7

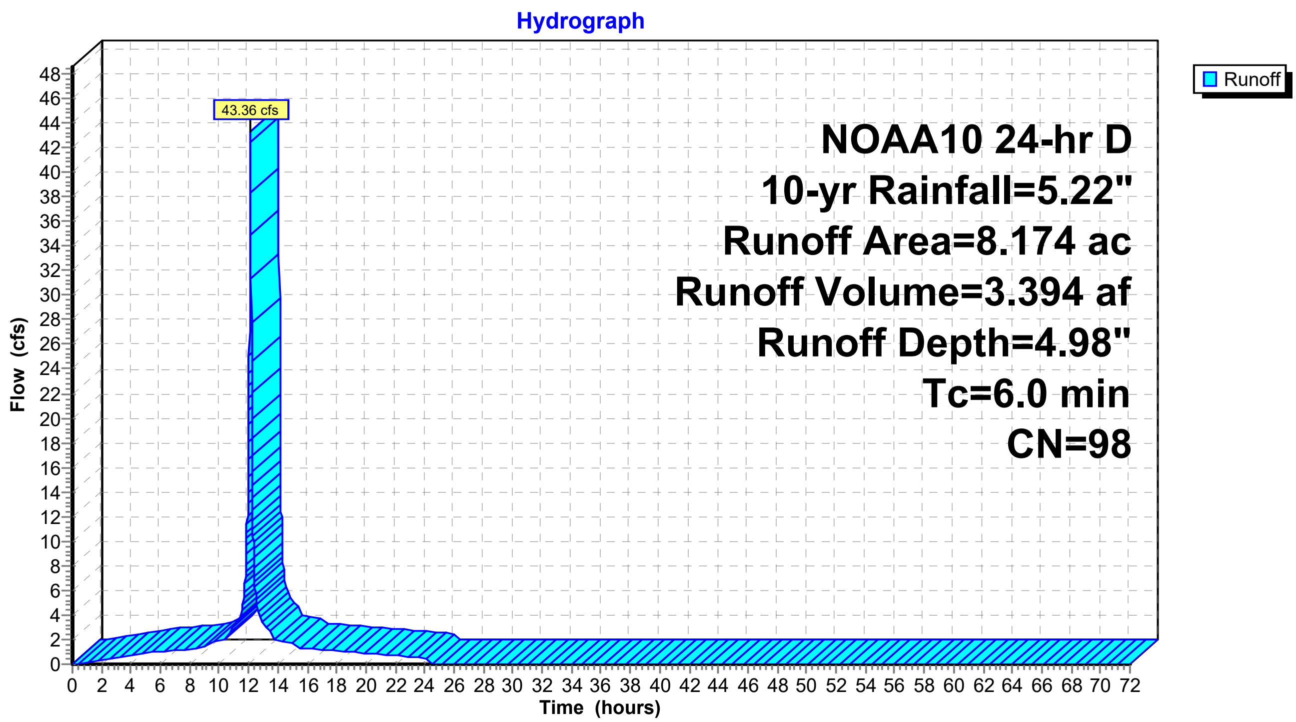
Runoff = 43.36 cfs @ 12.13 hrs, Volume= 3.394 af, Depth= 4.98"
Routed to Pond 3P : DMH 24-15

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-yr Rainfall=5.22"

Area (ac)	CN	Description
0.040	39	>75% Grass cover, Good, HSG A
8.133	98	Roofs, HSG A
8.174	98	Weighted Average
0.040		0.49% Pervious Area
8.133		99.51% Impervious Area

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

Subcatchment PR-7: Subcat PR-7



Summary for Subcatchment PR-8: Subcat PR-8

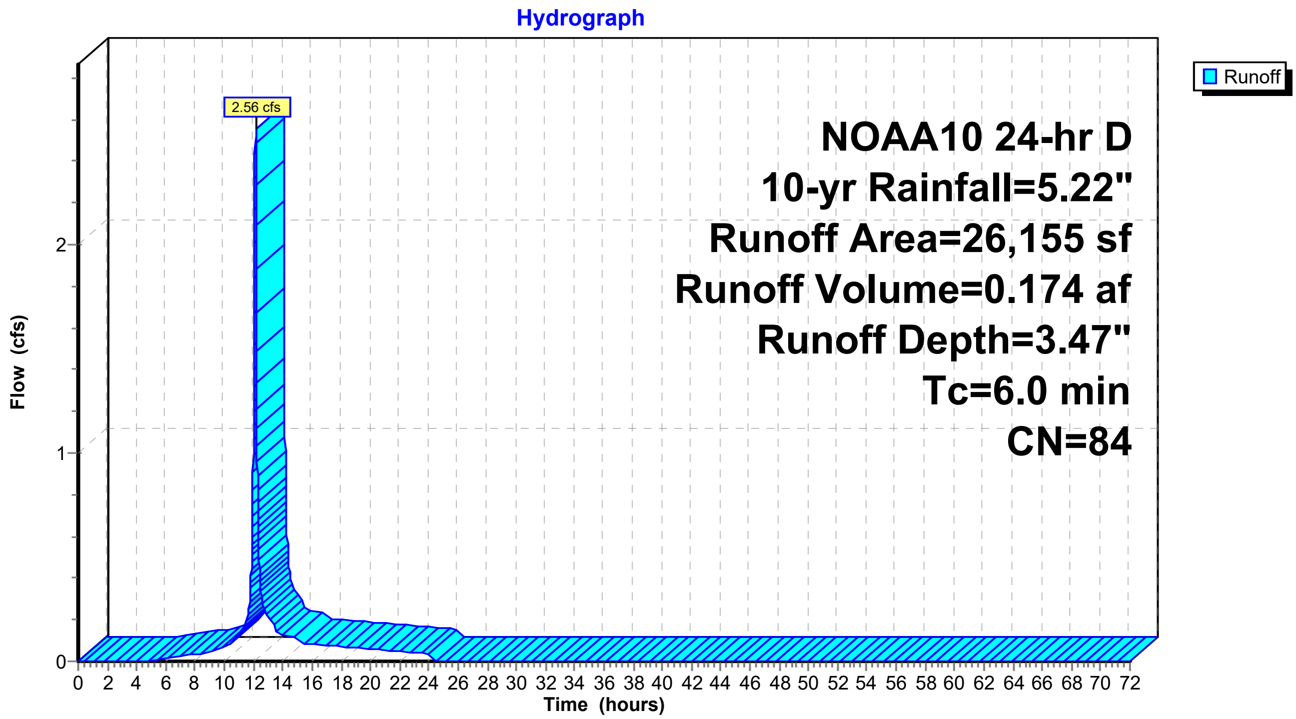
Runoff = 2.56 cfs @ 12.13 hrs, Volume= 0.174 af, Depth= 3.47"
Routed to Pond 4P : EX. BASIN #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-yr Rainfall=5.22"

Area (sf)	CN	Description
6,261	39	>75% Grass cover, Good, HSG A
19,408	98	Paved parking, HSG A
486	98	Unconnected pavement, HSG A
26,155	84	Weighted Average
6,261		23.94% Pervious Area
19,894		76.06% Impervious Area
486		2.44% Unconnected

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

Subcatchment PR-8: Subcat PR-8



Summary for Subcatchment PR-9: Subcat PR-9

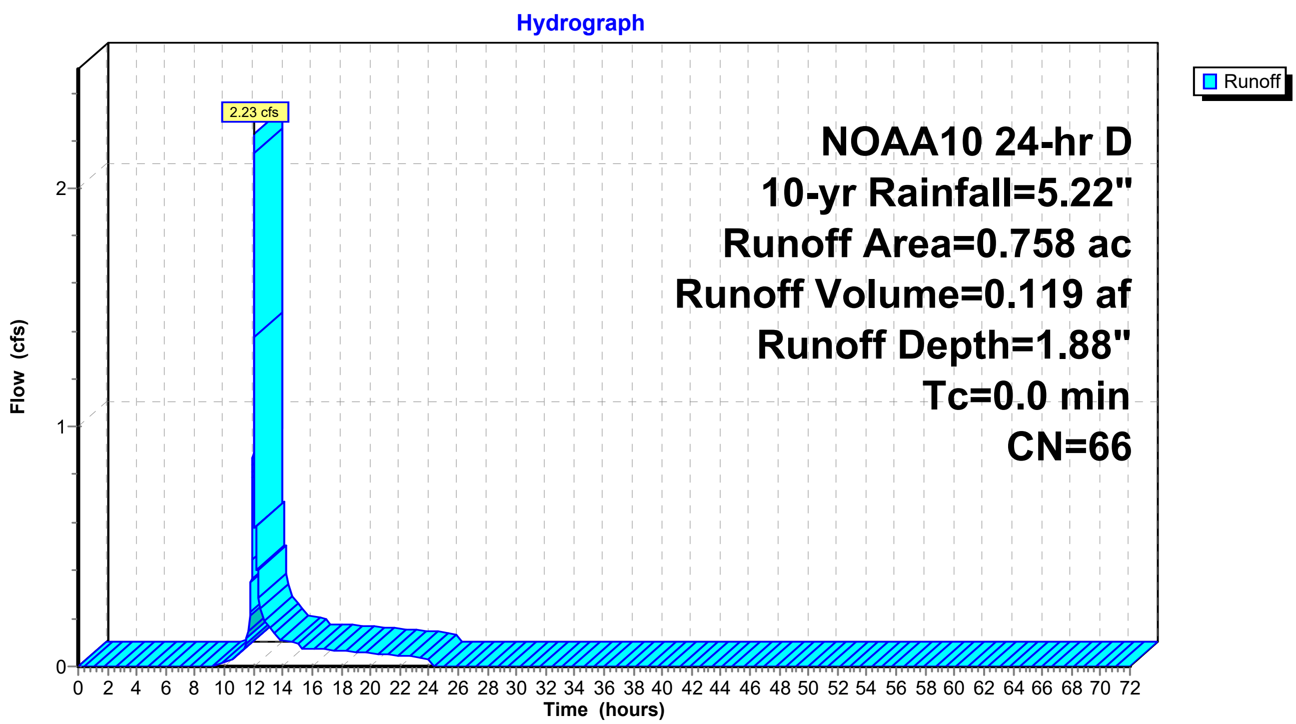
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 2.23 cfs @ 12.09 hrs, Volume= 0.119 af, Depth= 1.88"
Routed to Pond 3P : DMH 24-15

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-yr Rainfall=5.22"

Area (ac)	CN	Description
0.414	39	>75% Grass cover, Good, HSG A
0.343	98	Paved parking, HSG A
0.000	98	Roofs, HSG A
0.001	98	Unconnected pavement, HSG A
0.758	66	Weighted Average
0.414		54.64% Pervious Area
0.344		45.36% Impervious Area
0.001		0.15% Unconnected

Subcatchment PR-9: Subcat PR-9

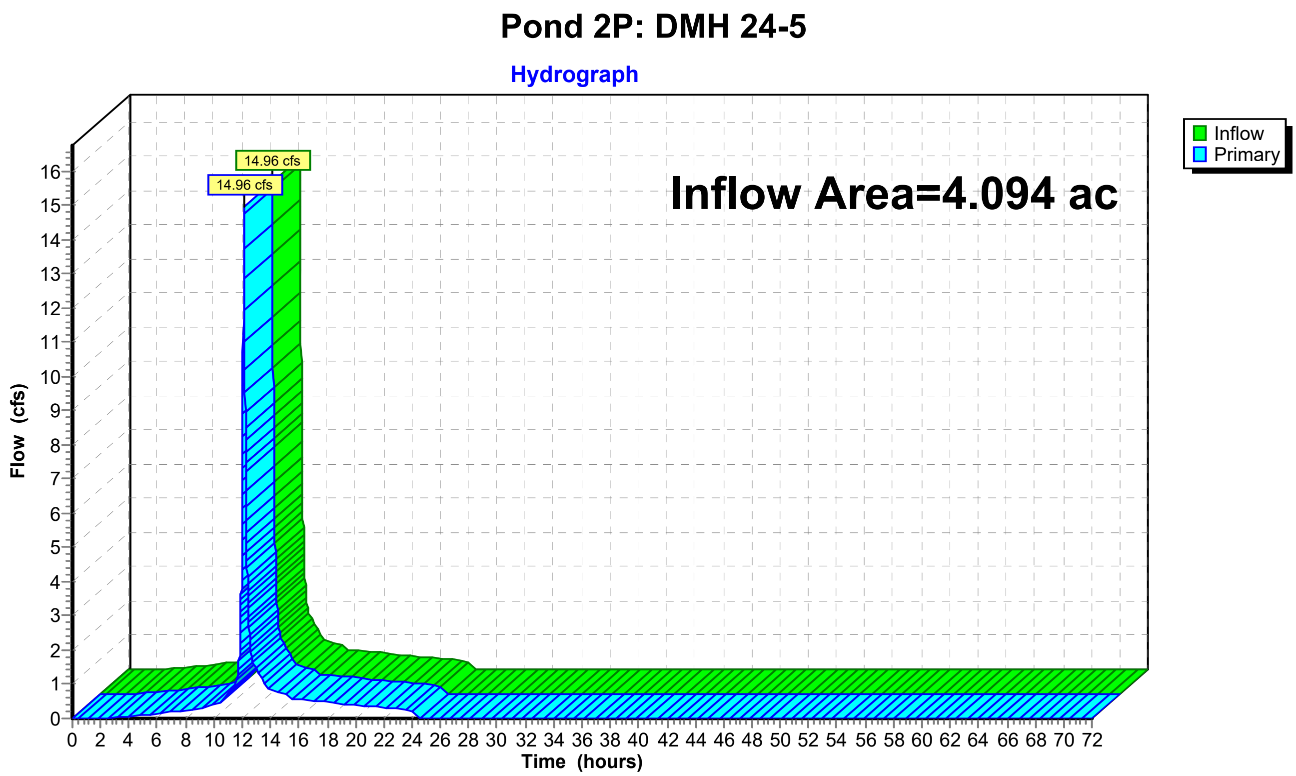


Summary for Pond 2P: DMH 24-5

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

Inflow Area = 4.094 ac, 73.93% Impervious, Inflow Depth = 3.30" for 10-yr event
Inflow = 14.96 cfs @ 12.13 hrs, Volume= 1.127 af
Primary = 14.96 cfs @ 12.13 hrs, Volume= 1.127 af, Atten= 0%, Lag= 0.0 min
Routed to Pond 6P : Chambers

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

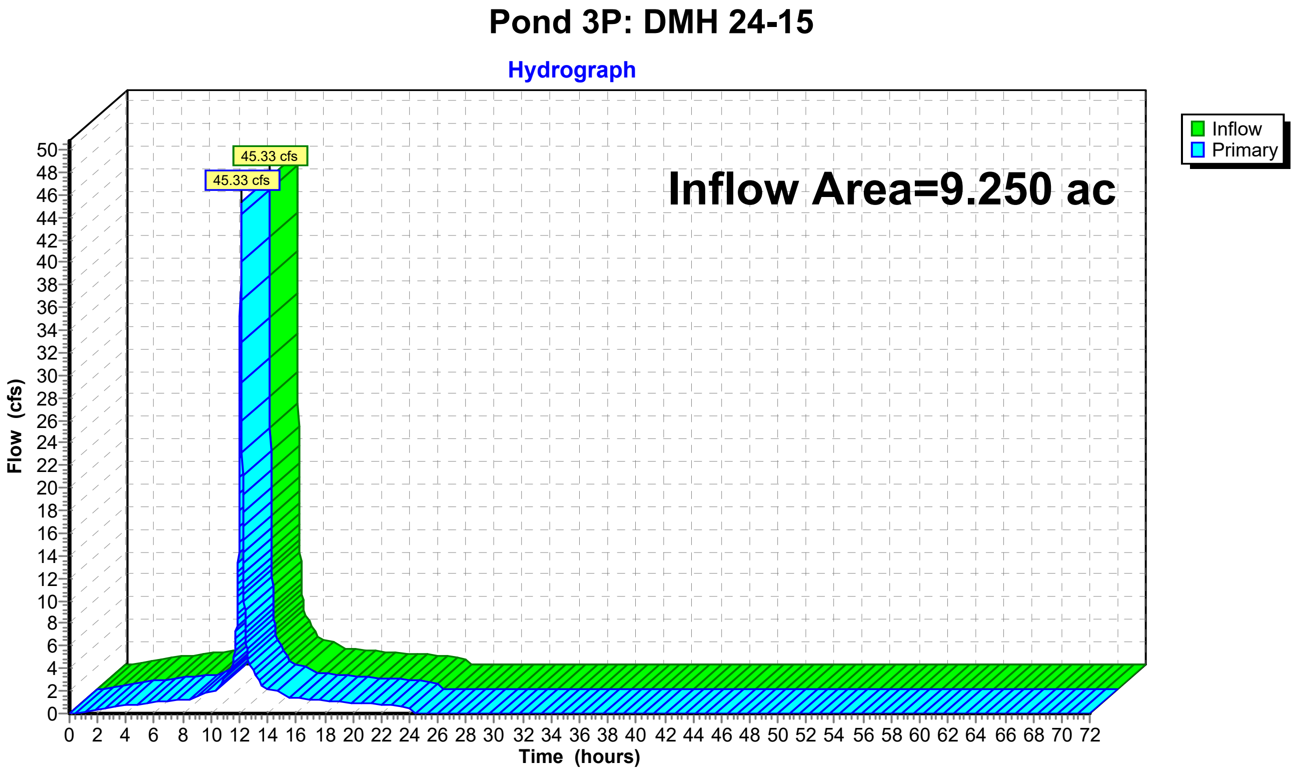


Summary for Pond 3P: DMH 24-15

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

Inflow Area = 9.250 ac, 94.32% Impervious, Inflow Depth = 4.68" for 10-yr event
Inflow = 45.33 cfs @ 12.13 hrs, Volume= 3.607 af
Primary = 45.33 cfs @ 12.13 hrs, Volume= 3.607 af, Atten= 0%, Lag= 0.0 min
Routed to Pond 5P : EX. BASIN #2

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



Summary for Pond 4P: EX. BASIN #1

Inflow Area = 1.747 ac, 58.18% Impervious, Inflow Depth = 2.53" for 10-yr event
Inflow = 5.46 cfs @ 12.13 hrs, Volume= 0.368 af
Outflow = 3.70 cfs @ 12.19 hrs, Volume= 0.320 af, Atten= 32%, Lag= 3.4 min
Primary = 3.70 cfs @ 12.19 hrs, Volume= 0.320 af
Routed to Pond 2P : DMH 24-5

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 274.24' @ 12.19 hrs Surf.Area= 6,146 sf Storage= 3,501 cf

Plug-Flow detention time= 111.7 min calculated for 0.320 af (87% of inflow)
Center-of-Mass det. time= 46.3 min (906.5 - 860.3)

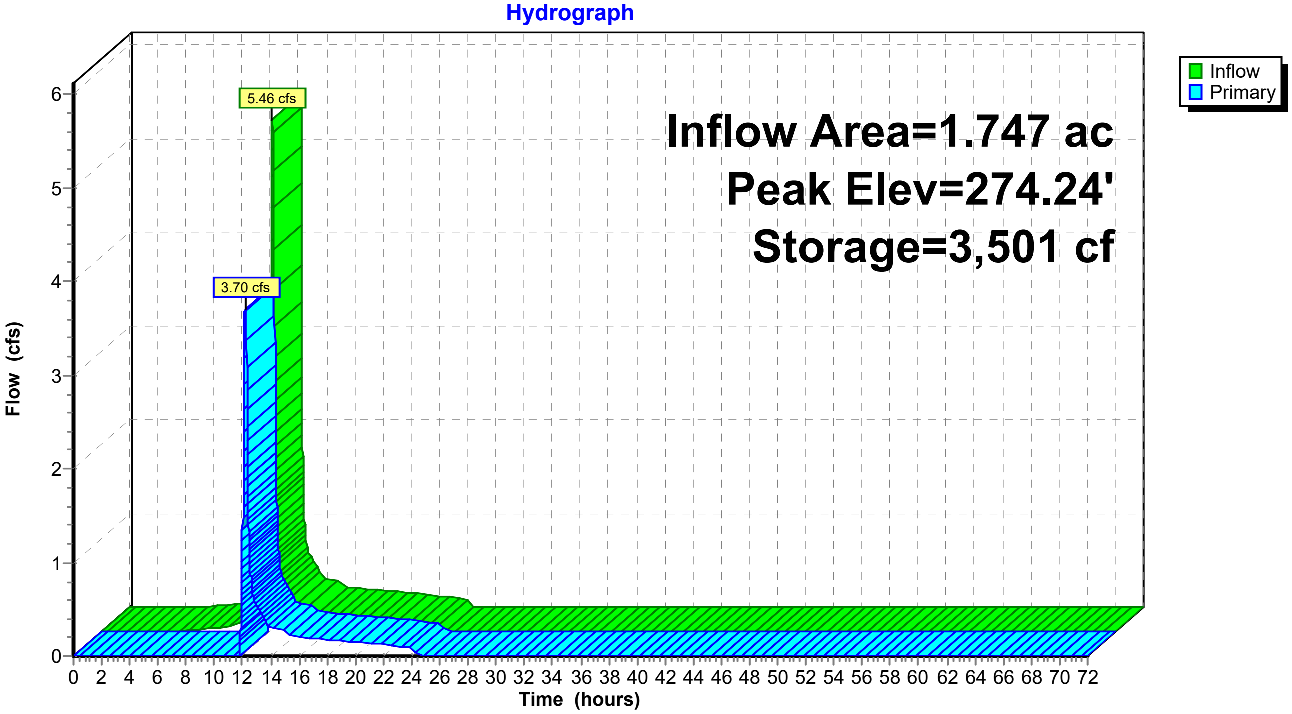
Volume	Invert	Avail.Storage	Storage Description
#1	273.40'	31,754 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
273.40	1,731	0	0
274.00	5,352	2,125	2,125
275.00	8,670	7,011	9,136
276.00	11,387	10,029	19,164
277.00	13,793	12,590	31,754

Device	Routing	Invert	Outlet Devices
#1	Primary	272.50'	**12.0" Round Culvert** L= 75.9' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 272.50' / 271.90' S= 0.0079 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf
#2	Device 1	274.00'	**34.0" x 50.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=3.70 cfs @ 12.19 hrs HW=274.24' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Barrel Controls 3.70 cfs @ 4.71 fps)
  └─**2=Orifice/Grate** (Passes 3.70 cfs of 5.36 cfs potential flow)

Pond 4P: EX. BASIN #1



Summary for Pond 5P: EX. BASIN #2

Inflow Area = 15.933 ac, 88.05% Impervious, Inflow Depth = 2.94" for 10-yr event
Inflow = 49.66 cfs @ 12.13 hrs, Volume= 3.902 af
Outflow = 1.40 cfs @ 17.27 hrs, Volume= 3.902 af, Atten= 97%, Lag= 308.2 min
Discarded = 0.99 cfs @ 17.27 hrs, Volume= 3.695 af
Primary = 0.41 cfs @ 17.27 hrs, Volume= 0.207 af
Routed to Pond AP-1 : Southern Wetlands
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond AP-1 : Southern Wetlands

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 255.90' @ 17.27 hrs Surf.Area= 25,098 sf Storage= 104,659 cf

Plug-Flow detention time= 1,084.9 min calculated for 3.901 af (100% of inflow)
Center-of-Mass det. time= 1,085.1 min (1,847.0 - 761.9)

Volume	Invert	Avail.Storage	Storage Description
#1	252.50'	161,924 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	252.50'	52,984 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) -Impervious
		214,908 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
252.50	19,110	0	0
253.00	20,997	10,027	10,027
254.00	22,390	21,694	31,720
255.00	23,808	23,099	54,819
256.00	25,235	24,522	79,341
257.00	26,725	25,980	105,321
258.00	28,276	27,501	132,821
259.00	29,930	29,103	161,924

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
252.50	8,115	0	0
253.00	8,115	4,058	4,058
254.00	8,158	8,137	12,194
255.00	8,158	8,158	20,352
256.00	8,158	8,158	28,510
257.00	8,158	8,158	36,668
258.00	8,158	8,158	44,826
259.00	8,158	8,158	52,984

Device	Routing	Invert	Outlet Devices
#1	Secondary	258.00'	**15.0' long x 15.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Primary	254.94'	**12.0" Round Culvert** L= 28.9' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 254.94' / 254.86' S= 0.0028 '/' Cc= 0.900

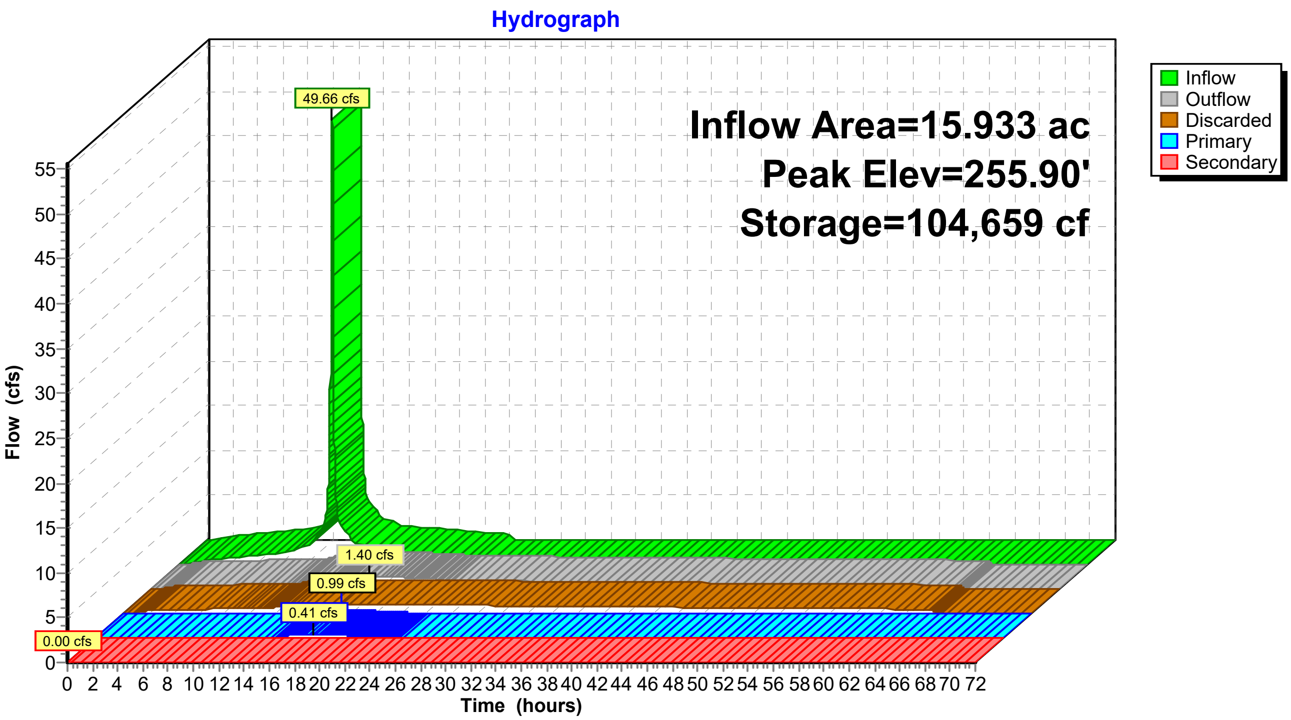
			n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf
#3	Device 2	255.75'	**8.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Discarded	252.50'	**1.020 in/hr Exfiltration over Surface area**
			Conductivity to Groundwater Elevation = 248.00' Phase-In= 0.01'

Discarded OutFlow Max=0.99 cfs @ 17.27 hrs HW=255.90' (Free Discharge)
└─**4=Exfiltration** (Controls 0.99 cfs)

Primary OutFlow Max=0.41 cfs @ 17.27 hrs HW=255.90' TW=0.00' (Dynamic Tailwater)
└─**2=Culvert** (Passes 0.41 cfs of 1.86 cfs potential flow)
  └─**3=Orifice/Grate** (Weir Controls 0.41 cfs @ 1.28 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=252.50' TW=0.00' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 5P: EX. BASIN #2



Summary for Pond 6P: Chambers

Inflow Area = 5.667 ac, 79.39% Impervious, Inflow Depth = 3.64" for 10-yr event
Inflow = 23.02 cfs @ 12.13 hrs, Volume= 1.721 af
Outflow = 1.20 cfs @ 13.91 hrs, Volume= 1.721 af, Atten= 95%, Lag= 106.8 min
Discarded = 1.20 cfs @ 13.91 hrs, Volume= 1.721 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond 5P : EX. BASIN #2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 267.46' @ 13.91 hrs Surf.Area= 11,965 sf Storage= 29,445 cf

Plug-Flow detention time= 252.3 min calculated for 1.720 af (100% of inflow)
Center-of-Mass det. time= 252.3 min (1,064.7 - 812.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	264.00'	16,883 cf	**68.50'W x 174.67'L x 5.75'H Field A** 68,797 cf Overall - 26,590 cf Embedded = 42,207 cf x 40.0% Voids
#2A	264.75'	26,590 cf	**Cultec R-902HD v2** x 414 Inside #1 Effective Size= 69.1"W x 48.0"H => 17.30 sf x 3.67'L = 63.4 cf Overall Size= 78.0"W x 48.0"H x 4.10'L with 0.44' Overlap 414 Chambers in 9 Rows Cap Storage= 18.0 cf x 2 x 9 rows = 324.4 cf
		43,472 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	264.00'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 259.70' Phase-In= 0.01'
#2	Primary	269.50'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=1.20 cfs @ 13.91 hrs HW=267.46' (Free Discharge)
└─**1=Exfiltration** (Controls 1.20 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=264.00' TW=252.50' (Dynamic Tailwater)
└─**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 6P: Chambers - Chamber Wizard Field A

Chamber Model = Cultec R-902HD v2 (Cultec Recharger® 902HD v2)
Effective Size= 69.1"W x 48.0"H => 17.30 sf x 3.67'L = 63.4 cf
Overall Size= 78.0"W x 48.0"H x 4.10'L with 0.44' Overlap
Cap Storage= 18.0 cf x 2 x 9 rows = 324.4 cf

78.0" Wide + 9.0" Spacing = 87.0" C-C Row Spacing

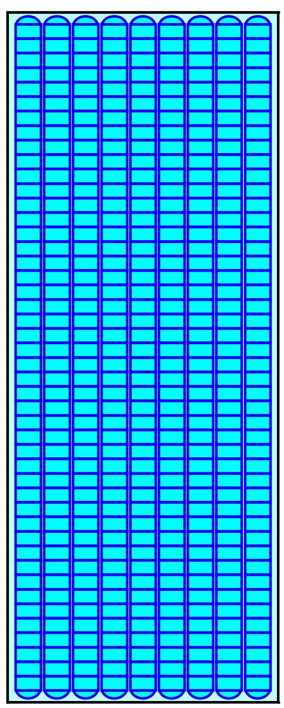
46 Chambers/Row x 3.67' Long +2.00' Cap Length x 2 = 172.67' Row Length +12.0" End Stone x 2 = 174.67' Base Length
9 Rows x 78.0" Wide + 9.0" Spacing x 8 + 24.0" Side Stone x 2 = 68.50' Base Width
9.0" Stone Base + 48.0" Chamber Height + 12.0" Stone Cover = 5.75' Field Height

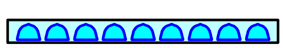
414 Chambers x 63.4 cf + 18.0 cf Cap Volume x 2 x 9 Rows = 26,589.6 cf Chamber Storage

68,796.8 cf Field - 26,589.6 cf Chambers = 42,207.3 cf Stone x 40.0% Voids = 16,882.9 cf Stone Storage

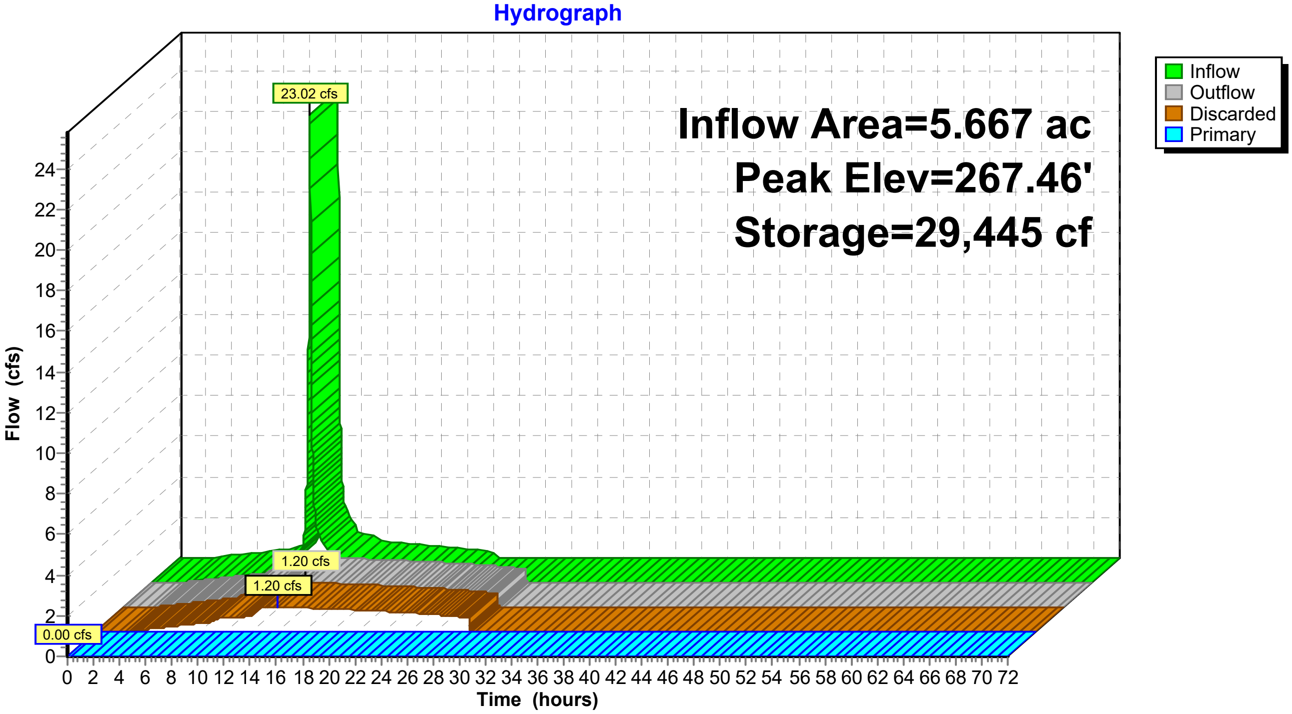
Chamber Storage + Stone Storage = 43,472.5 cf = 0.998 af
Overall Storage Efficiency = 63.2%
Overall System Size = 174.67' x 68.50' x 5.75'

414 Chambers
2,548.0 cy Field
1,563.2 cy Stone





Pond 6P: Chambers



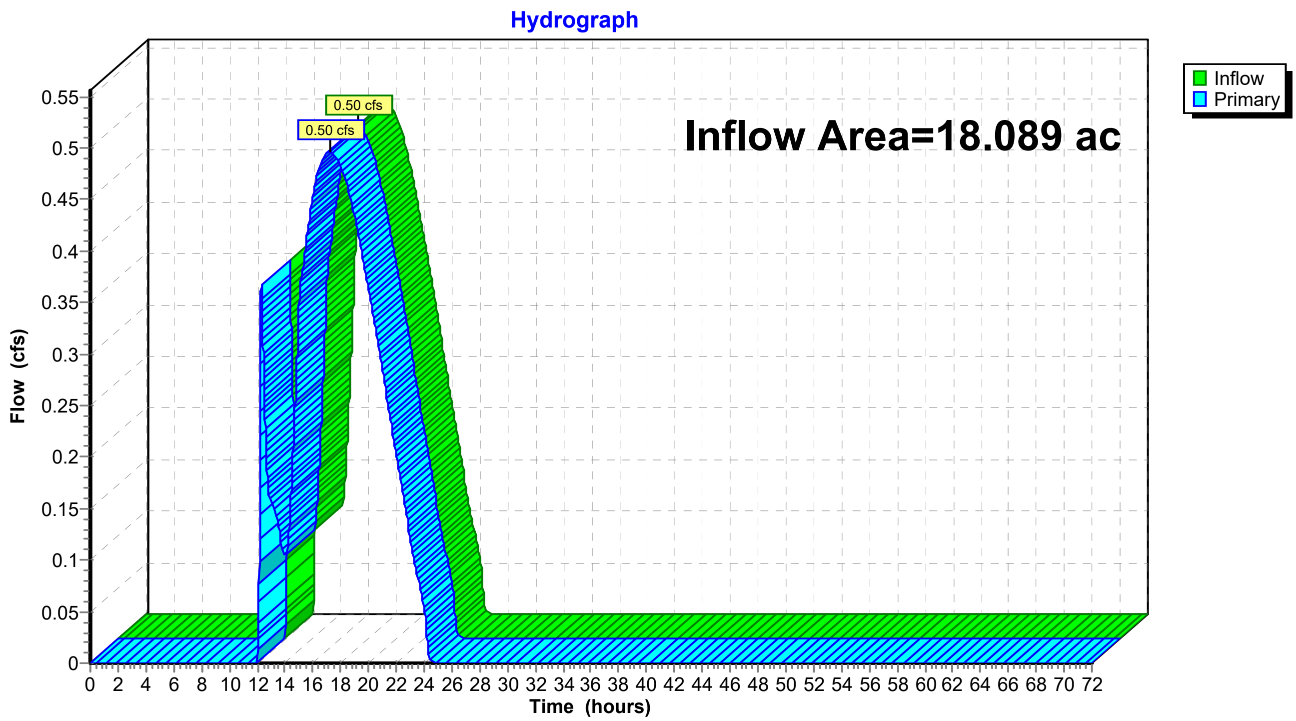
Summary for Pond AP-1: Southern Wetlands

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

Inflow Area =	18.089 ac,	77.58% Impervious,	Inflow Depth = 0.20"	for 10-yr event
Inflow =	0.50 cfs @	17.24 hrs, Volume=	0.297 af	
Primary =	0.50 cfs @	17.24 hrs, Volume=	0.297 af, Atten= 0%, Lag= 0.0 min	

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

Pond AP-1: Southern Wetlands



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 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

SubcatchmentPR-1: Subcat PR-1 Runoff Area=0.105 ac 3.65% Impervious Runoff Depth=0.69"
Tc=0.0 min CN=41 Runoff=0.08 cfs 0.006 af

SubcatchmentPR-10: Subcat PR-10 Runoff Area=0.334 ac 69.45% Impervious Runoff Depth=4.13"
Tc=6.0 min CN=80 Runoff=1.70 cfs 0.115 af

SubcatchmentPR-11: Subcat PR-11 Runoff Area=0.318 ac 77.70% Impervious Runoff Depth=4.67"
Tc=6.0 min CN=85 Runoff=1.79 cfs 0.124 af

SubcatchmentPR-2: Subcat PR-2 Runoff Area=49,958 sf 48.82% Impervious Runoff Depth=2.92"
Tc=6.0 min CN=68 Runoff=4.20 cfs 0.279 af

SubcatchmentPR-3: Subcat PR-3 Runoff Area=2.013 ac 88.34% Impervious Runoff Depth=5.45"
Tc=6.0 min CN=92 Runoff=12.52 cfs 0.915 af

SubcatchmentPR-4: Subcat PR-4 Runoff Area=1.573 ac 93.61% Impervious Runoff Depth=5.68"
Tc=6.0 min CN=94 Runoff=9.98 cfs 0.745 af

SubcatchmentPR-5: Subcat PR-5 Runoff Area=89,348 sf 0.00% Impervious Runoff Depth=0.96"
Flow Length=378' Tc=15.5 min CN=45 Runoff=1.14 cfs 0.165 af

SubcatchmentPR-6: Subcat PR-6 Runoff Area=44,275 sf 79.27% Impervious Runoff Depth=4.56"
Tc=6.0 min CN=84 Runoff=5.61 cfs 0.386 af

SubcatchmentPR-7: Subcat PR-7 Runoff Area=8.174 ac 99.51% Impervious Runoff Depth=6.15"
Tc=6.0 min CN=98 Runoff=53.17 cfs 4.190 af

SubcatchmentPR-8: Subcat PR-8 Runoff Area=26,155 sf 76.06% Impervious Runoff Depth=4.56"
Tc=6.0 min CN=84 Runoff=3.31 cfs 0.228 af

SubcatchmentPR-9: Subcat PR-9 Runoff Area=0.758 ac 45.36% Impervious Runoff Depth=2.73"
Tc=0.0 min CN=66 Runoff=3.11 cfs 0.173 af

Pond 2P: DMH 24-5 Inflow=17.98 cfs 1.489 af
Primary=17.98 cfs 1.489 af

Pond 3P: DMH 24-15 Inflow=55.80 cfs 4.486 af
Primary=55.80 cfs 4.486 af

Pond 4P: EX. BASIN #1 Peak Elev=274.38' Storage=4,421 cf Inflow=7.51 cfs 0.508 af
Outflow=3.90 cfs 0.459 af

Pond 5P: EX. BASIN #2 Peak Elev=256.43' Storage=122,270 cf Inflow=61.41 cfs 4.873 af
Discarded=1.07 cfs 3.857 af Primary=1.38 cfs 1.016 af Secondary=0.00 cfs 0.000 af Outflow=2.45 cfs 4.873 af

Pond 6P: Chambers Peak Elev=269.27' Storage=41,189 cf Inflow=27.96 cfs 2.233 af
Discarded=1.49 cfs 2.233 af Primary=0.00 cfs 0.000 af Outflow=1.49 cfs 2.233 af

Pond AP-1: Southern Wetlands

Inflow=1.58 cfs 1.186 af
Primary=1.58 cfs 1.186 af

Total Runoff Area = 18.089 ac Runoff Volume = 7.326 af Average Runoff Depth = 4.86"
22.42% Pervious = 4.056 ac 77.58% Impervious = 14.033 ac

Summary for Subcatchment PR-1: Subcat PR-1

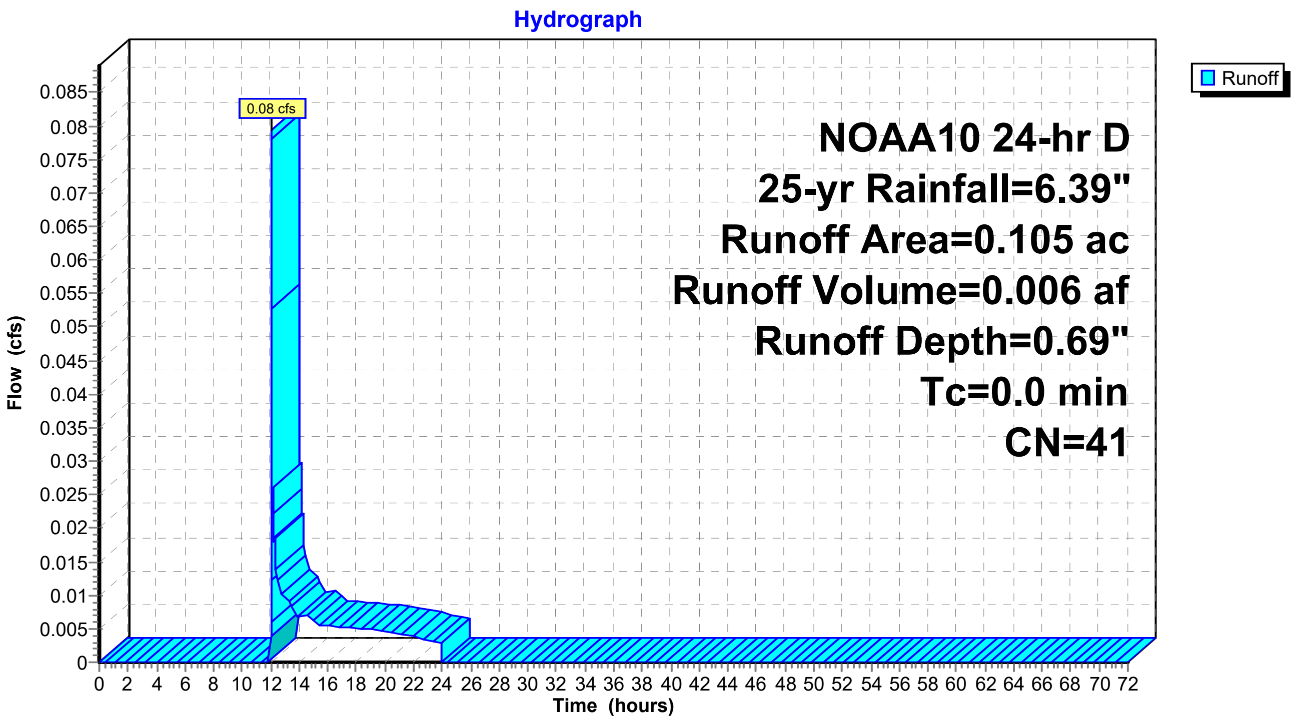
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.08 cfs @ 12.09 hrs, Volume= 0.006 af, Depth= 0.69"
Routed to Pond AP-1 : Southern Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-yr Rainfall=6.39"

Area (ac)	CN	Description
0.101	39	>75% Grass cover, Good, HSG A
0.004	98	Roofs, HSG A
0.105	41	Weighted Average
0.101		96.35% Pervious Area
0.004		3.65% Impervious Area

Subcatchment PR-1: Subcat PR-1



Summary for Subcatchment PR-10: Subcat PR-10

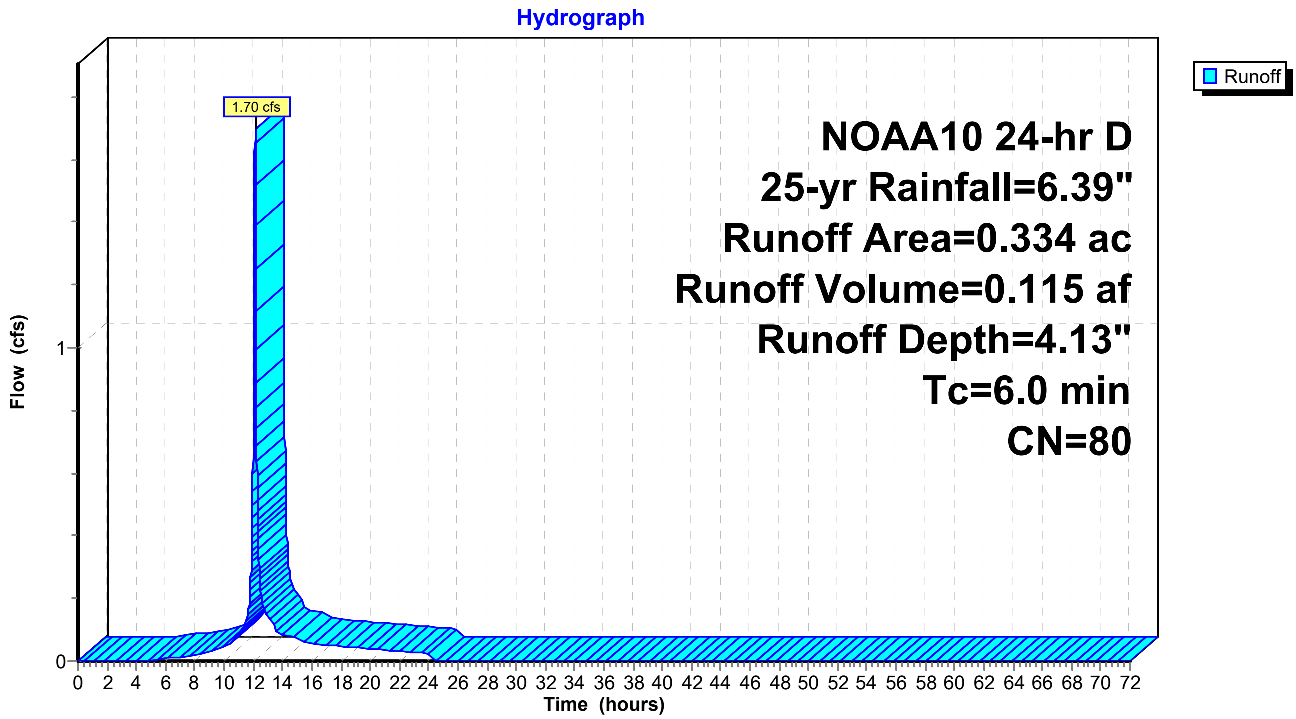
Runoff = 1.70 cfs @ 12.13 hrs, Volume= 0.115 af, Depth= 4.13"
Routed to Pond 2P : DMH 24-5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-yr Rainfall=6.39"

Area (ac)	CN	Description
0.102	39	>75% Grass cover, Good, HSG A
0.228	98	Paved parking, HSG A
0.004	98	Unconnected pavement, HSG A
0.334	80	Weighted Average
0.102		30.55% Pervious Area
0.232		69.45% Impervious Area
0.004		1.57% Unconnected

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

Subcatchment PR-10: Subcat PR-10



Summary for Subcatchment PR-11: Subcat PR-11

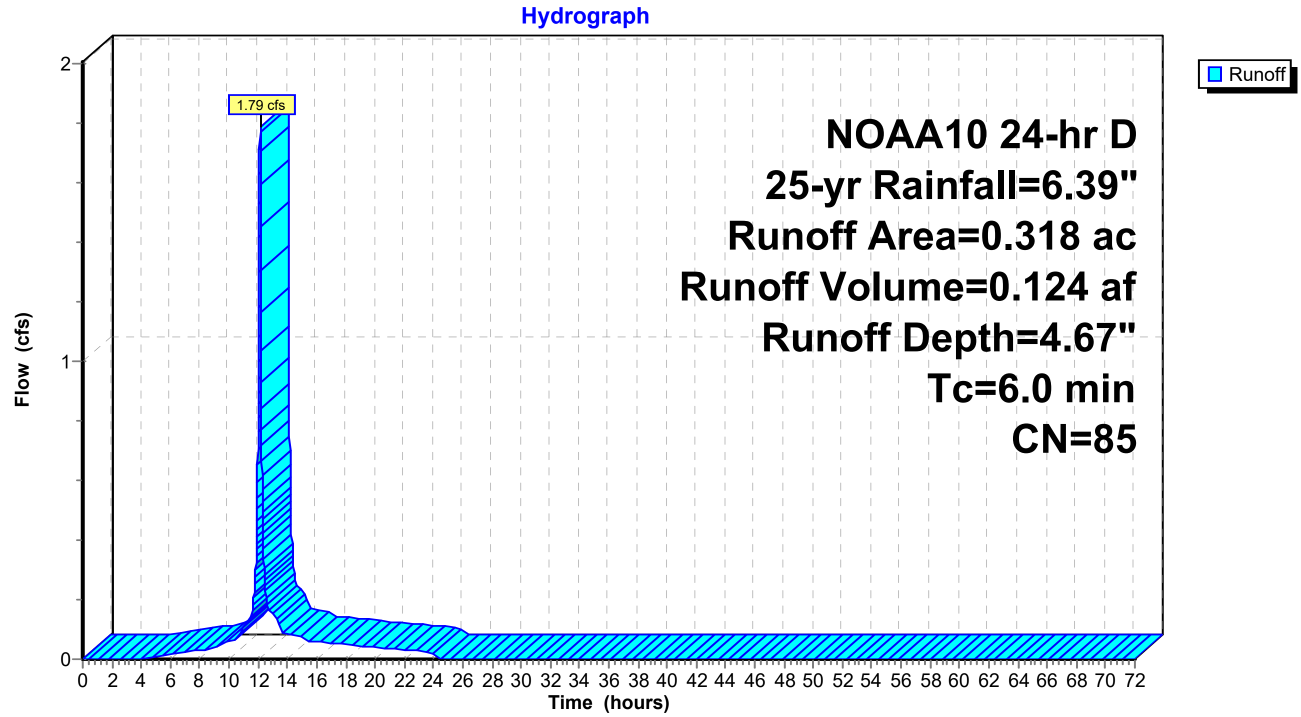
Runoff = 1.79 cfs @ 12.13 hrs, Volume= 0.124 af, Depth= 4.67"
Routed to Pond 3P : DMH 24-15

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-yr Rainfall=6.39"

Area (ac)	CN	Description
0.071	39	>75% Grass cover, Good, HSG A
0.247	98	Paved parking, HSG A
0.318	85	Weighted Average
0.071		22.30% Pervious Area
0.247		77.70% Impervious Area

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

Subcatchment PR-11: Subcat PR-11



Summary for Subcatchment PR-2: Subcat PR-2

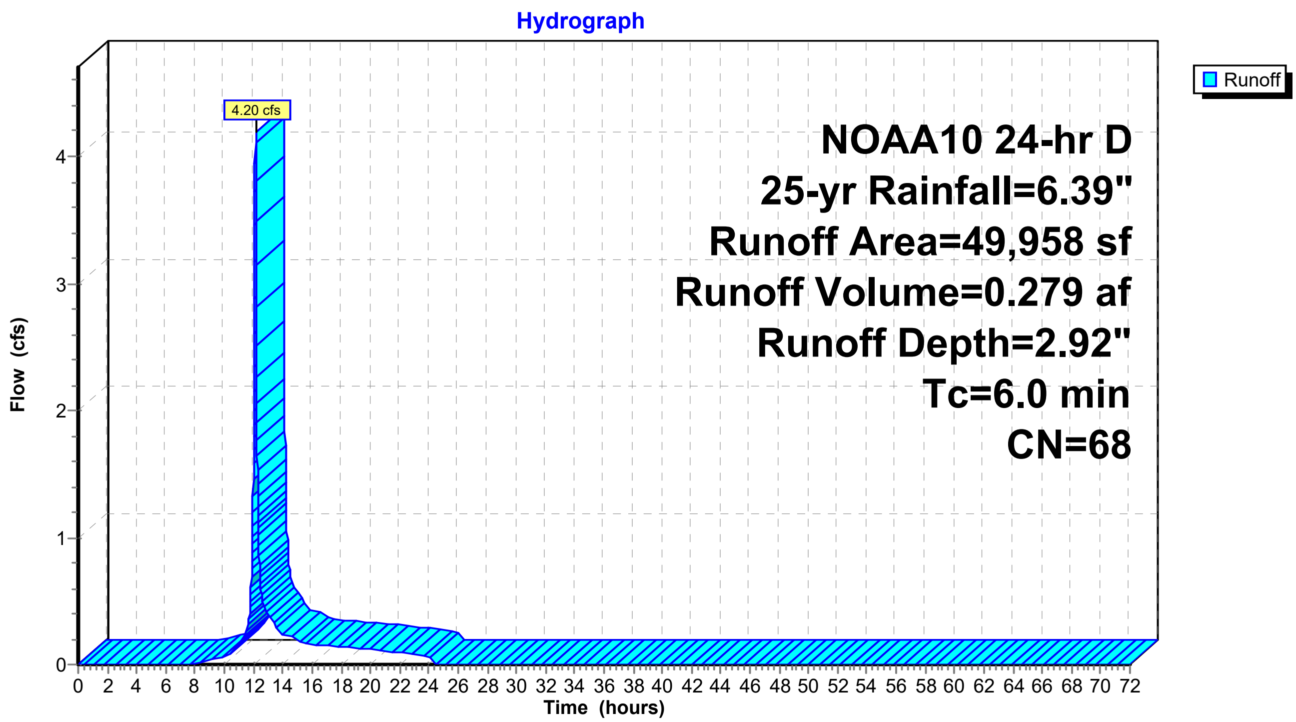
Runoff = 4.20 cfs @ 12.13 hrs, Volume= 0.279 af, Depth= 2.92"
Routed to Pond 4P : EX. BASIN #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-yr Rainfall=6.39"

Area (sf)	CN	Description
25,568	39	>75% Grass cover, Good, HSG A
12,594	98	Paved parking, HSG A
409	98	Unconnected pavement, HSG A
11,387	98	Water Surface, HSG A
49,958	68	Weighted Average
25,568		51.18% Pervious Area
24,390		48.82% Impervious Area
409		1.68% Unconnected

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

Subcatchment PR-2: Subcat PR-2



Summary for Subcatchment PR-3: Subcat PR-3

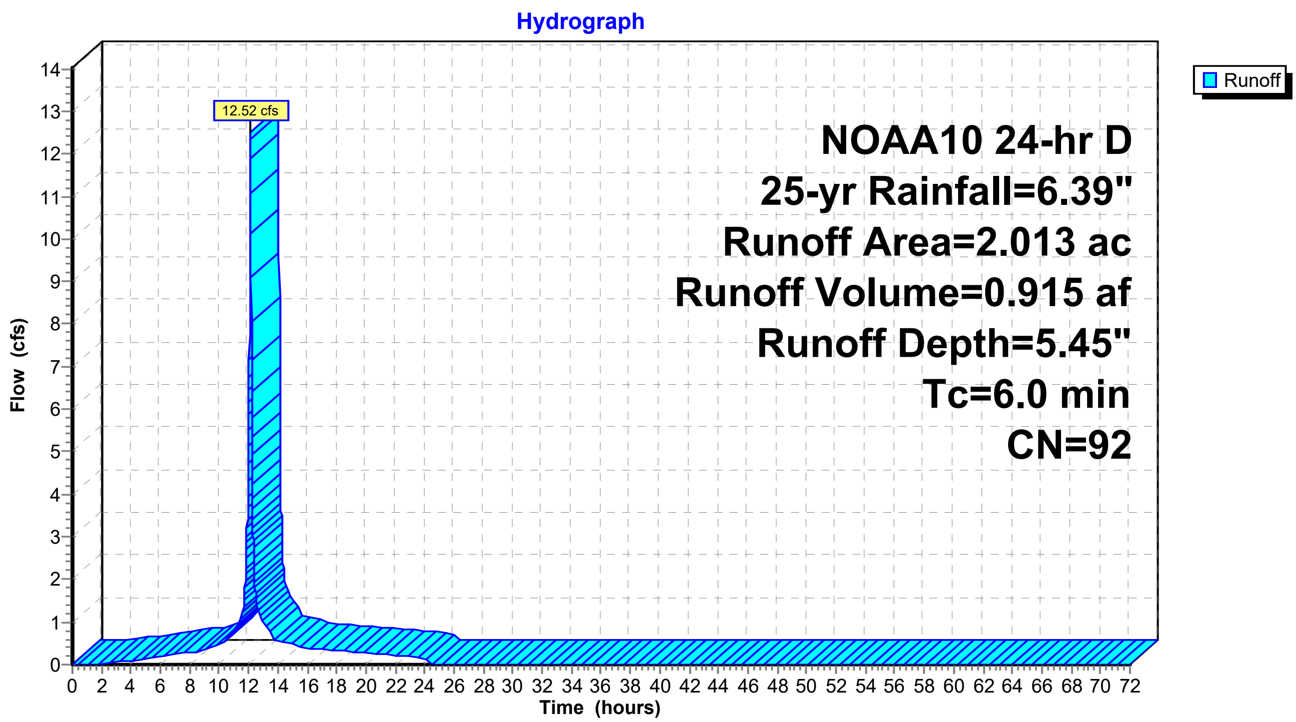
Runoff = 12.52 cfs @ 12.13 hrs, Volume= 0.915 af, Depth= 5.45"
Routed to Pond 2P : DMH 24-5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-yr Rainfall=6.39"

Area (ac)	CN	Description
0.205	39	>75% Grass cover, Good, HSG A
0.030	80	>75% Grass cover, Good, HSG D
1.603	98	Paved parking, HSG A
0.102	98	Paved parking, HSG D
0.060	98	Unconnected pavement, HSG A
0.013	98	Unconnected pavement, HSG D
2.013	92	Weighted Average
0.235		11.66% Pervious Area
1.778		88.34% Impervious Area
0.073		4.12% Unconnected

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

Subcatchment PR-3: Subcat PR-3



Summary for Subcatchment PR-4: Subcat PR-4

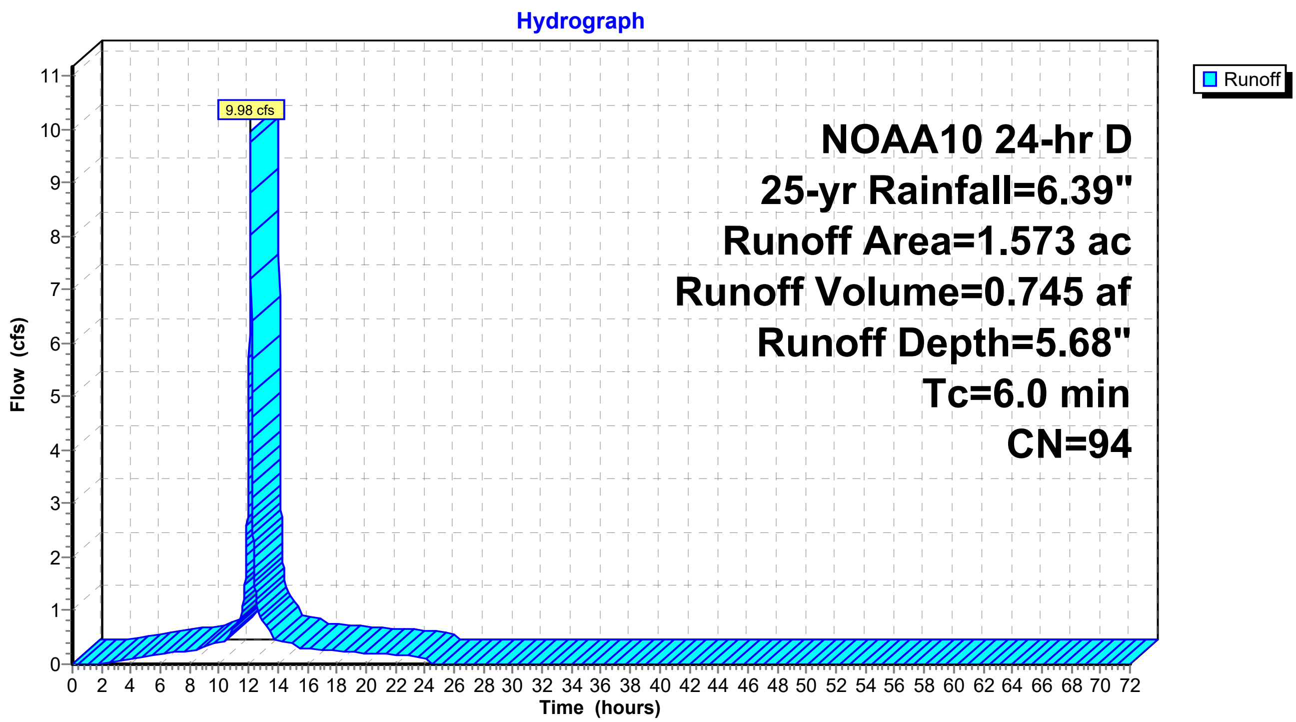
Runoff = 9.98 cfs @ 12.13 hrs, Volume= 0.745 af, Depth= 5.68"
Routed to Pond 6P : Chambers

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-yr Rainfall=6.39"

Area (ac)	CN	Description
0.101	39	>75% Grass cover, Good, HSG A
1.473	98	Paved parking, HSG A
1.573	94	Weighted Average
0.101		6.39% Pervious Area
1.473		93.61% Impervious Area

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

Subcatchment PR-4: Subcat PR-4



Summary for Subcatchment PR-5: Subcat PR-5

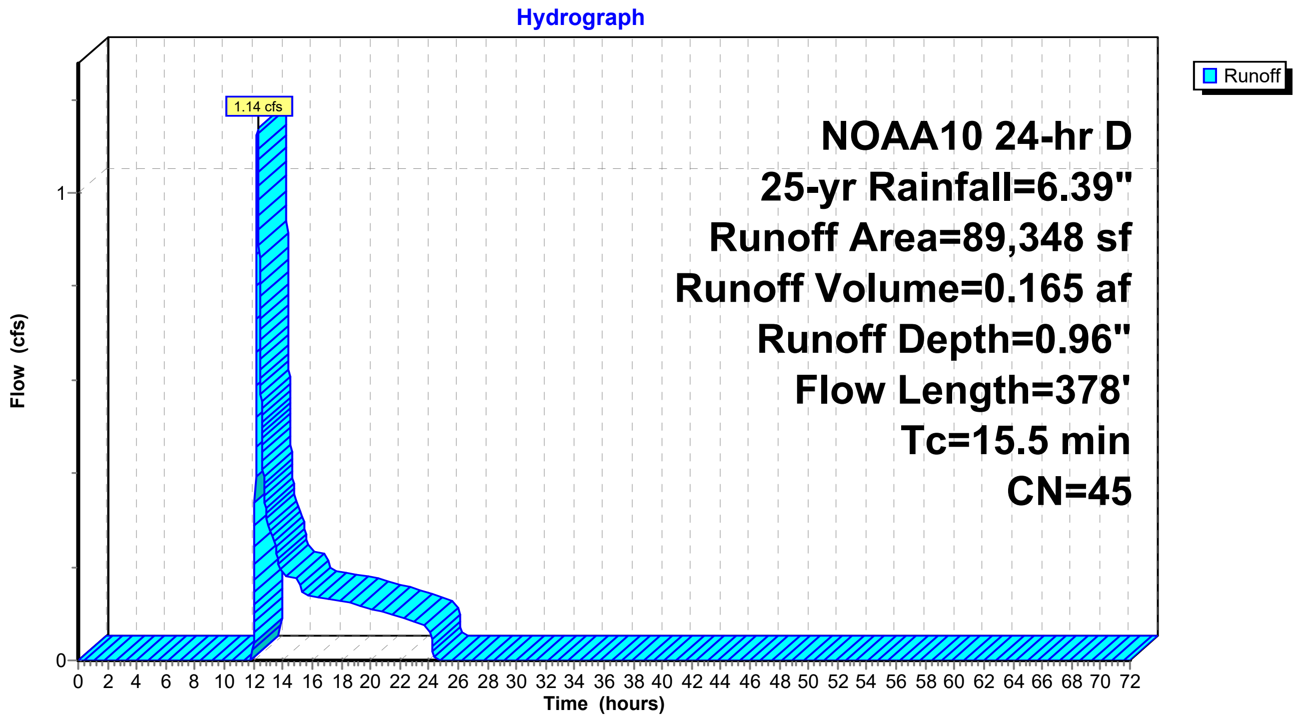
Runoff = 1.14 cfs @ 12.28 hrs, Volume= 0.165 af, Depth= 0.96"
Routed to Pond AP-1 : Southern Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-yr Rainfall=6.39"

Area (sf)	CN	Description
9,611	39	>75% Grass cover, Good, HSG A
954	80	>75% Grass cover, Good, HSG D
53,433	30	Woods, Good, HSG A
25,349	77	Woods, Good, HSG D
89,348	45	Weighted Average
89,348		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0190	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.36"
0.8	67	0.0780	1.40		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.0	14	0.3300	8.62		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
1.5	148	0.0125	1.68		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.2	46	0.0550	3.52		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.7	53	0.0700	1.32		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
15.5	378	Total			

Subcatchment PR-5: Subcat PR-5



Summary for Subcatchment PR-6: Subcat PR-6

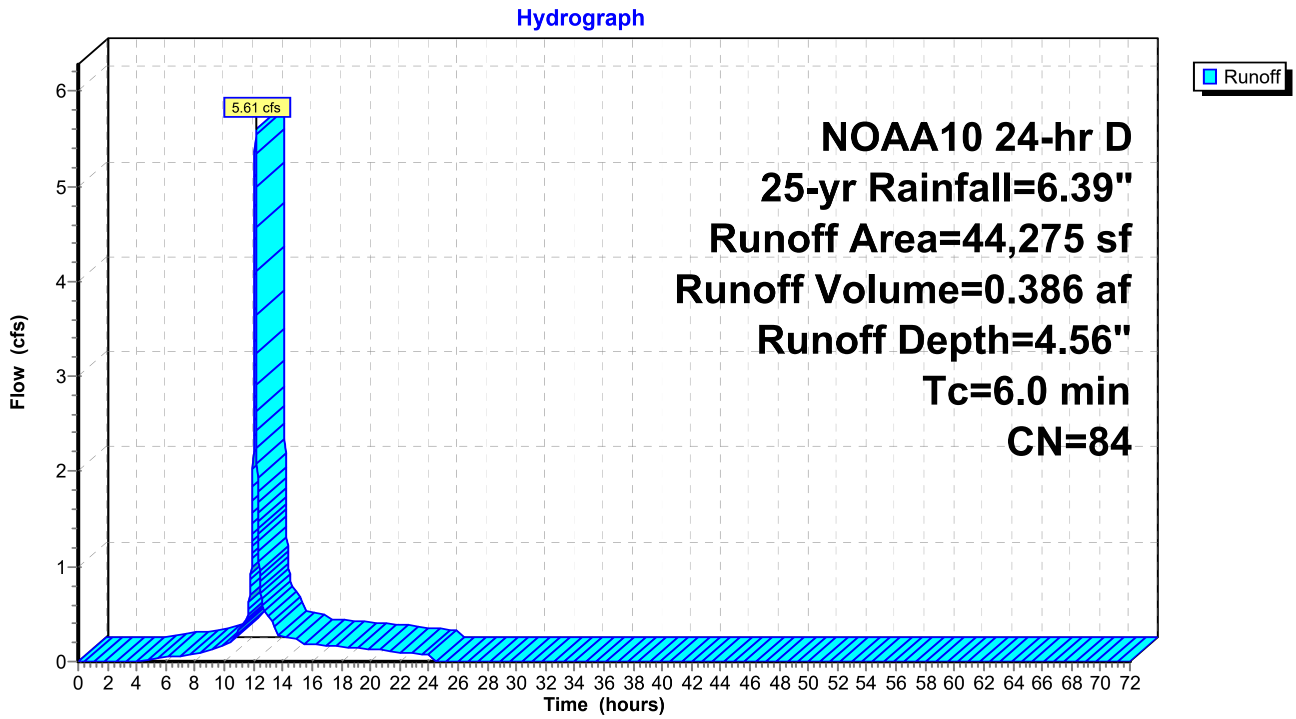
Runoff = 5.61 cfs @ 12.13 hrs, Volume= 0.386 af, Depth= 4.56"
Routed to Pond 5P : EX. BASIN #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-yr Rainfall=6.39"

Area (sf)	CN	Description
1,625	39	>75% Grass cover, Good, HSG A
35,096	98	Water Surface, HSG A
7,554	30	Woods, Good, HSG A
44,275	84	Weighted Average
9,179		20.73% Pervious Area
35,096		79.27% Impervious Area

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

Subcatchment PR-6: Subcat PR-6



Summary for Subcatchment PR-7: Subcat PR-7

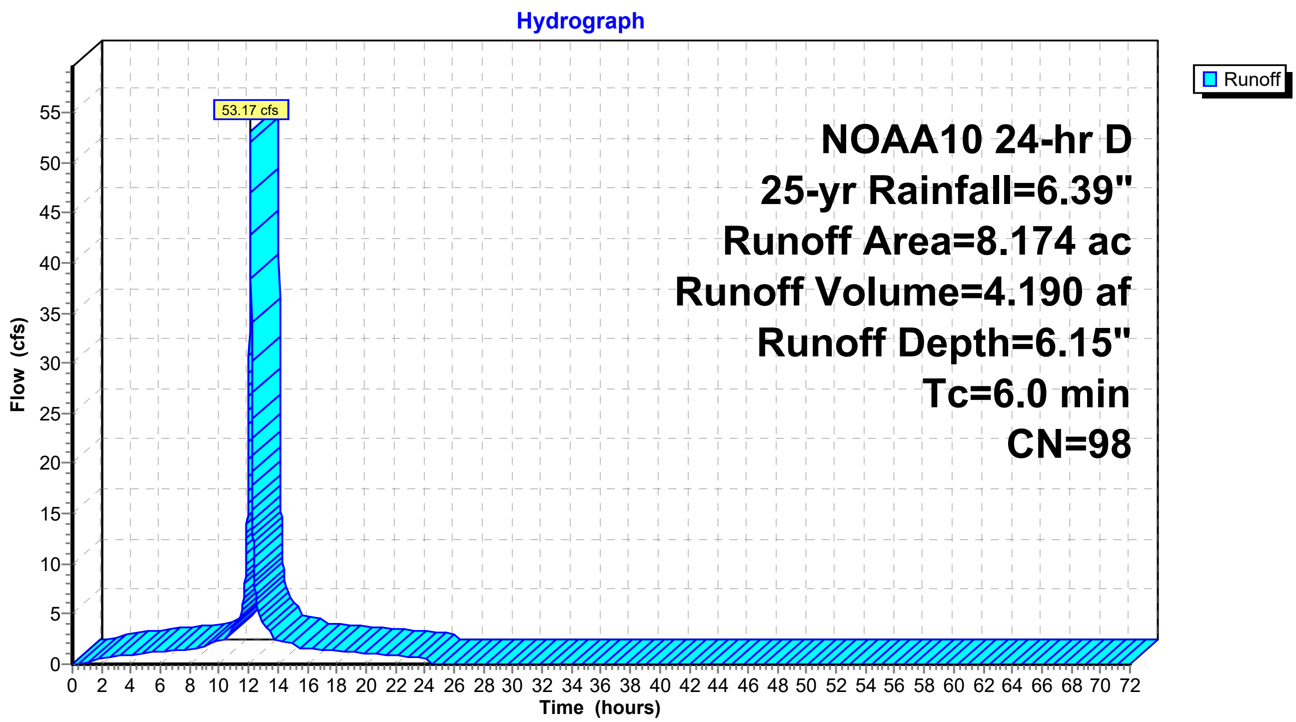
Runoff = 53.17 cfs @ 12.13 hrs, Volume= 4.190 af, Depth= 6.15"
Routed to Pond 3P : DMH 24-15

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-yr Rainfall=6.39"

Area (ac)	CN	Description
0.040	39	>75% Grass cover, Good, HSG A
8.133	98	Roofs, HSG A
8.174	98	Weighted Average
0.040		0.49% Pervious Area
8.133		99.51% Impervious Area

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

Subcatchment PR-7: Subcat PR-7



Summary for Subcatchment PR-8: Subcat PR-8

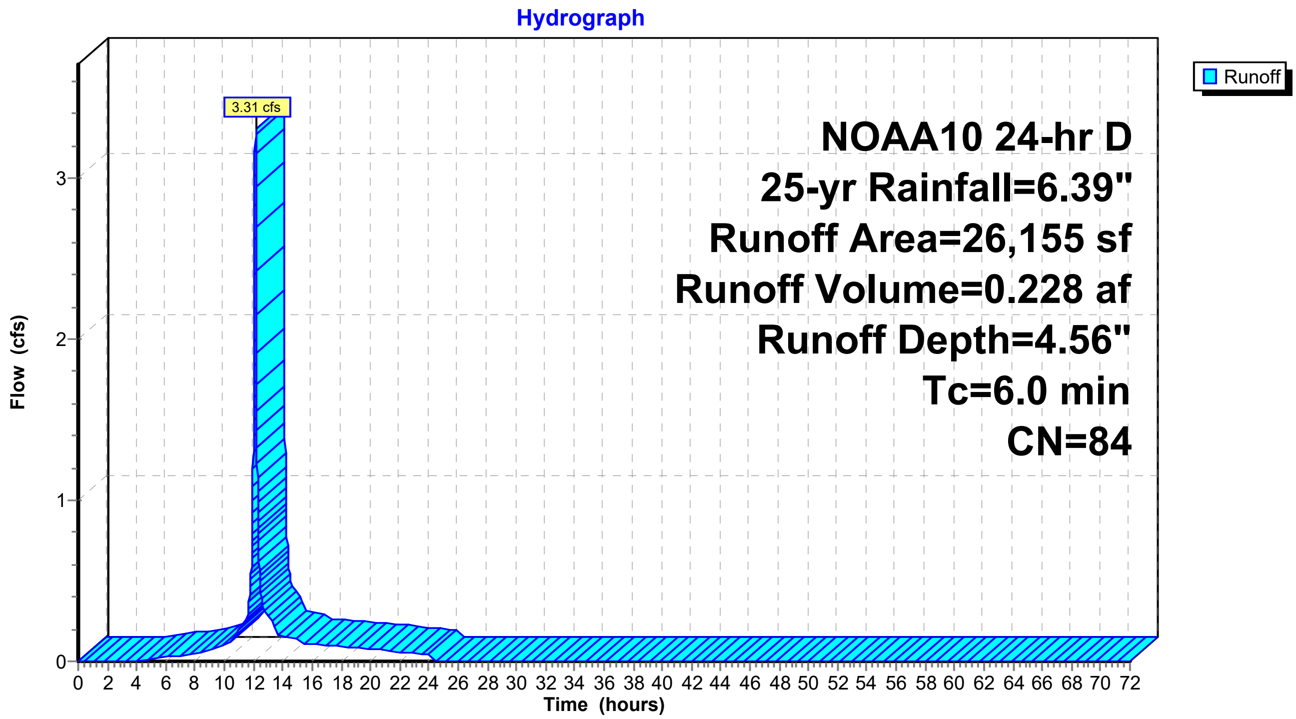
Runoff = 3.31 cfs @ 12.13 hrs, Volume= 0.228 af, Depth= 4.56"
Routed to Pond 4P : EX. BASIN #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-yr Rainfall=6.39"

Area (sf)	CN	Description
6,261	39	>75% Grass cover, Good, HSG A
19,408	98	Paved parking, HSG A
486	98	Unconnected pavement, HSG A
26,155	84	Weighted Average
6,261		23.94% Pervious Area
19,894		76.06% Impervious Area
486		2.44% Unconnected

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

Subcatchment PR-8: Subcat PR-8



Summary for Subcatchment PR-9: Subcat PR-9

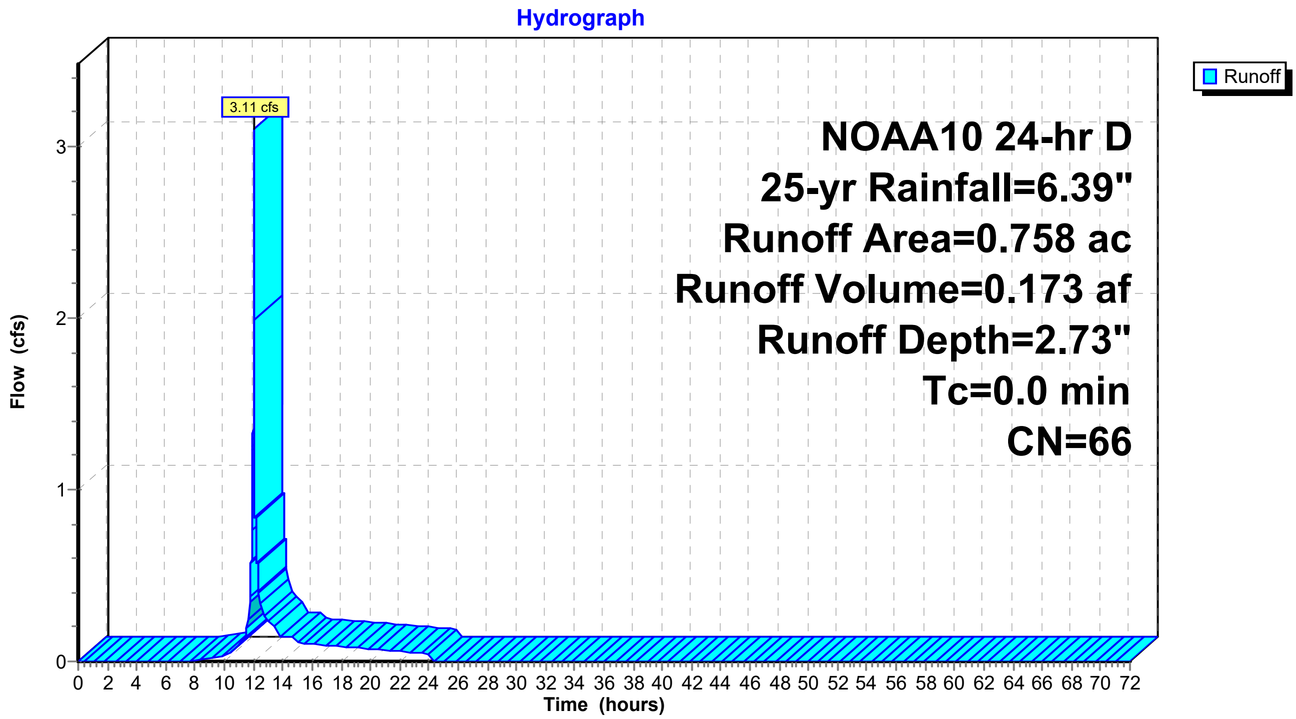
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 3.11 cfs @ 12.09 hrs, Volume= 0.173 af, Depth= 2.73"
Routed to Pond 3P : DMH 24-15

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-yr Rainfall=6.39"

Area (ac)	CN	Description
0.414	39	>75% Grass cover, Good, HSG A
0.343	98	Paved parking, HSG A
0.000	98	Roofs, HSG A
0.001	98	Unconnected pavement, HSG A
0.758	66	Weighted Average
0.414		54.64% Pervious Area
0.344		45.36% Impervious Area
0.001		0.15% Unconnected

Subcatchment PR-9: Subcat PR-9

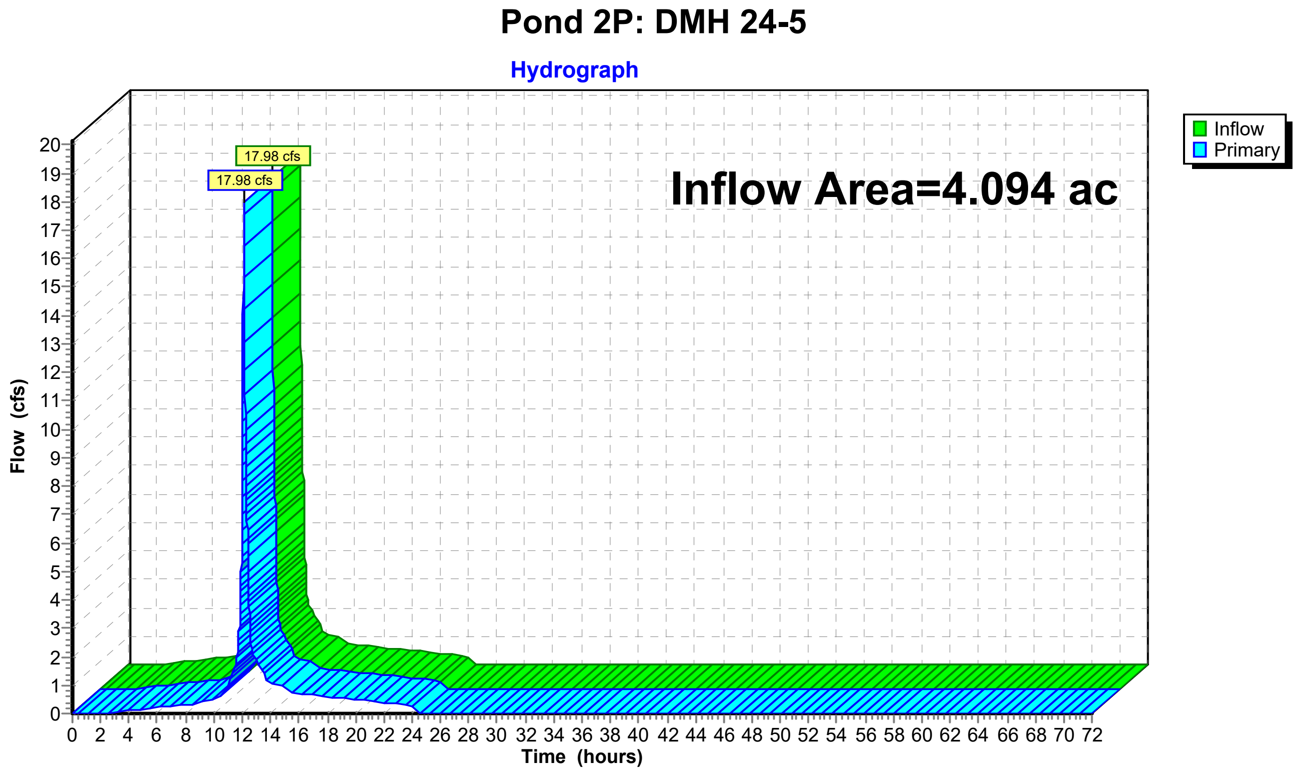


Summary for Pond 2P: DMH 24-5

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

Inflow Area = 4.094 ac, 73.93% Impervious, Inflow Depth = 4.36" for 25-yr event
Inflow = 17.98 cfs @ 12.13 hrs, Volume= 1.489 af
Primary = 17.98 cfs @ 12.13 hrs, Volume= 1.489 af, Atten= 0%, Lag= 0.0 min
Routed to Pond 6P : Chambers

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

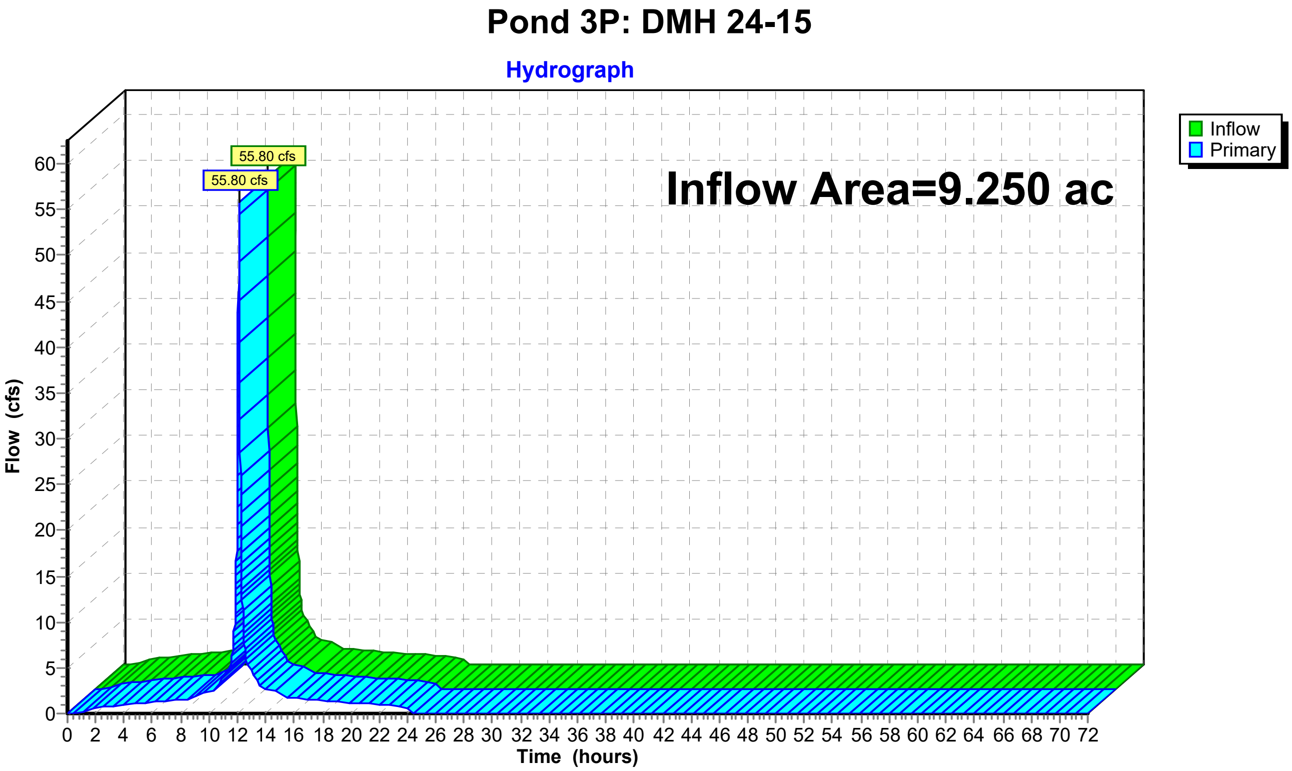


Summary for Pond 3P: DMH 24-15

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

Inflow Area = 9.250 ac, 94.32% Impervious, Inflow Depth = 5.82" for 25-yr event
Inflow = 55.80 cfs @ 12.13 hrs, Volume= 4.486 af
Primary = 55.80 cfs @ 12.13 hrs, Volume= 4.486 af, Atten= 0%, Lag= 0.0 min
Routed to Pond 5P : EX. BASIN #2

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



Summary for Pond 4P: EX. BASIN #1

Inflow Area = 1.747 ac, 58.18% Impervious, Inflow Depth = 3.49" for 25-yr event
Inflow = 7.51 cfs @ 12.13 hrs, Volume= 0.508 af
Outflow = 3.90 cfs @ 12.21 hrs, Volume= 0.459 af, Atten= 48%, Lag= 4.8 min
Primary = 3.90 cfs @ 12.21 hrs, Volume= 0.459 af
Routed to Pond 2P : DMH 24-5

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 274.38' @ 12.21 hrs Surf.Area= 6,624 sf Storage= 4,421 cf

Plug-Flow detention time= 89.7 min calculated for 0.459 af (90% of inflow)
Center-of-Mass det. time= 39.6 min (888.5 - 848.8)

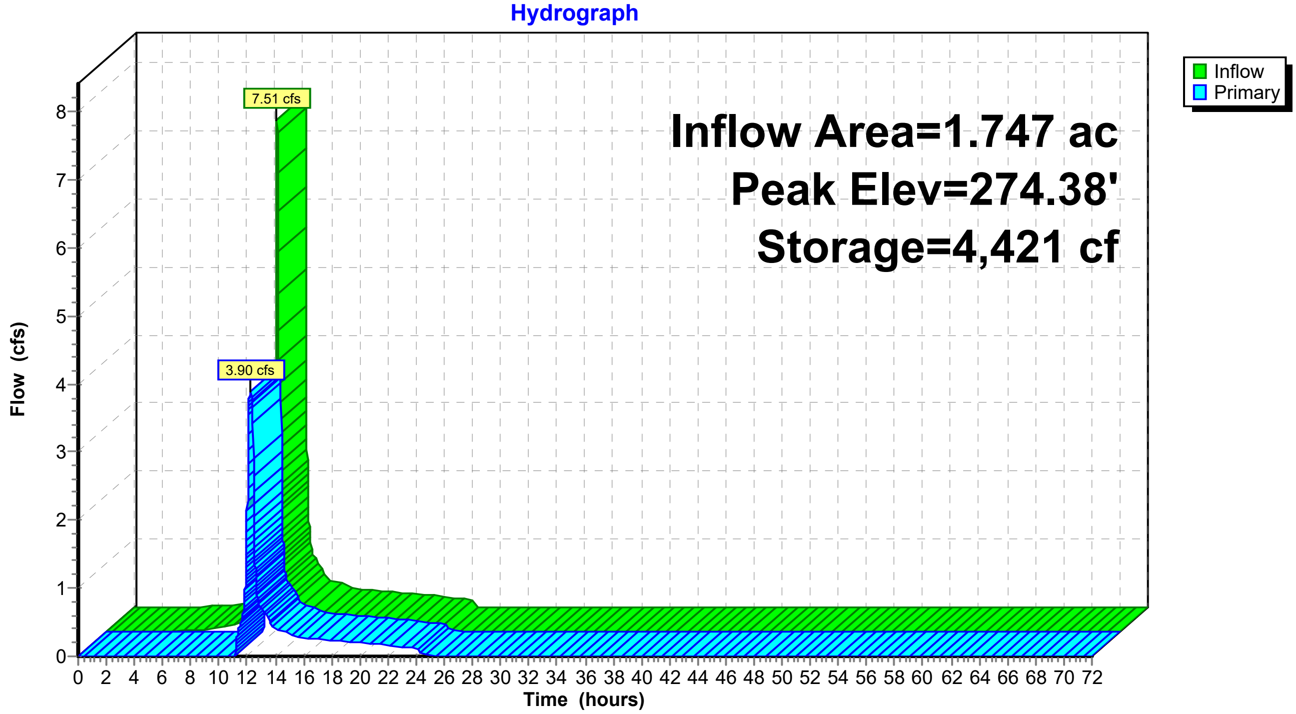
Volume	Invert	Avail.Storage	Storage Description
#1	273.40'	31,754 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
273.40	1,731	0	0
274.00	5,352	2,125	2,125
275.00	8,670	7,011	9,136
276.00	11,387	10,029	19,164
277.00	13,793	12,590	31,754

Device	Routing	Invert	Outlet Devices
#1	Primary	272.50'	**12.0" Round Culvert** L= 75.9' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 272.50' / 271.90' S= 0.0079 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf
#2	Device 1	274.00'	**34.0" x 50.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=3.90 cfs @ 12.21 hrs HW=274.38' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Barrel Controls 3.90 cfs @ 4.96 fps)
  └─**2=Orifice/Grate** (Passes 3.90 cfs of 10.86 cfs potential flow)

Pond 4P: EX. BASIN #1



Summary for Pond 5P: EX. BASIN #2

Inflow Area = 15.933 ac, 88.05% Impervious, Inflow Depth = 3.67" for 25-yr event
Inflow = 61.41 cfs @ 12.13 hrs, Volume= 4.873 af
Outflow = 2.45 cfs @ 15.06 hrs, Volume= 4.873 af, Atten= 96%, Lag= 175.8 min
Discarded = 1.07 cfs @ 15.06 hrs, Volume= 3.857 af
Primary = 1.38 cfs @ 15.06 hrs, Volume= 1.016 af
Routed to Pond AP-1 : Southern Wetlands
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond AP-1 : Southern Wetlands

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 256.43' @ 15.06 hrs Surf.Area= 25,872 sf Storage= 122,270 cf

Plug-Flow detention time= 949.4 min calculated for 4.872 af (100% of inflow)
Center-of-Mass det. time= 949.6 min (1,707.9 - 758.3)

Volume	Invert	Avail.Storage	Storage Description
#1	252.50'	161,924 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	252.50'	52,984 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) -Impervious
		214,908 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
252.50	19,110	0	0
253.00	20,997	10,027	10,027
254.00	22,390	21,694	31,720
255.00	23,808	23,099	54,819
256.00	25,235	24,522	79,341
257.00	26,725	25,980	105,321
258.00	28,276	27,501	132,821
259.00	29,930	29,103	161,924

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
252.50	8,115	0	0
253.00	8,115	4,058	4,058
254.00	8,158	8,137	12,194
255.00	8,158	8,158	20,352
256.00	8,158	8,158	28,510
257.00	8,158	8,158	36,668
258.00	8,158	8,158	44,826
259.00	8,158	8,158	52,984

Device	Routing	Invert	Outlet Devices
#1	Secondary	258.00'	**15.0' long x 15.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Primary	254.94'	**12.0" Round Culvert** L= 28.9' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 254.94' / 254.86' S= 0.0028 '/' Cc= 0.900

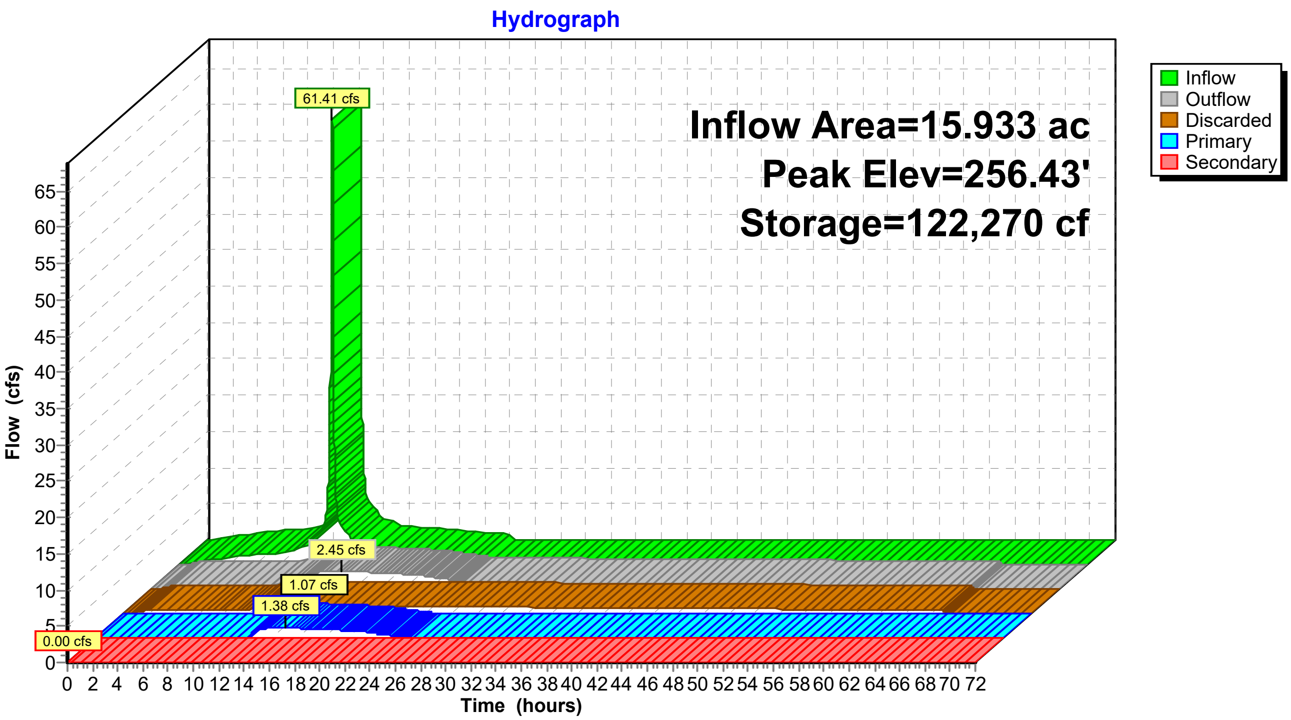
			n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf
#3	Device 2	255.75'	**8.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Discarded	252.50'	**1.020 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 248.00' Phase-In= 0.01'

Discarded OutFlow Max=1.07 cfs @ 15.06 hrs HW=256.43' (Free Discharge)
└─**4=Exfiltration** (Controls 1.07 cfs)

Primary OutFlow Max=1.38 cfs @ 15.06 hrs HW=256.43' TW=0.00' (Dynamic Tailwater)
└─**2=Culvert** (Passes 1.38 cfs of 3.06 cfs potential flow)
  └─**3=Orifice/Grate** (Orifice Controls 1.38 cfs @ 3.96 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=252.50' TW=0.00' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir**(Controls 0.00 cfs)

Pond 5P: EX. BASIN #2



Summary for Pond 6P: Chambers

Inflow Area = 5.667 ac, 79.39% Impervious, Inflow Depth = 4.73" for 25-yr event
Inflow = 27.96 cfs @ 12.13 hrs, Volume= 2.233 af
Outflow = 1.49 cfs @ 14.14 hrs, Volume= 2.233 af, Atten= 95%, Lag= 120.4 min
Discarded = 1.49 cfs @ 14.14 hrs, Volume= 2.233 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond 5P : EX. BASIN #2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 269.27' @ 14.14 hrs Surf.Area= 11,965 sf Storage= 41,189 cf

Plug-Flow detention time= 310.0 min calculated for 2.233 af (100% of inflow)
Center-of-Mass det. time= 310.1 min (1,115.0 - 805.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	264.00'	16,883 cf	**68.50'W x 174.67'L x 5.75'H Field A** 68,797 cf Overall - 26,590 cf Embedded = 42,207 cf x 40.0% Voids
#2A	264.75'	26,590 cf	**Cultec R-902HD v2** x 414 Inside #1 Effective Size= 69.1"W x 48.0"H => 17.30 sf x 3.67'L = 63.4 cf Overall Size= 78.0"W x 48.0"H x 4.10'L with 0.44' Overlap 414 Chambers in 9 Rows Cap Storage= 18.0 cf x 2 x 9 rows = 324.4 cf
		43,472 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	264.00'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 259.70' Phase-In= 0.01'
#2	Primary	269.50'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=1.49 cfs @ 14.14 hrs HW=269.27' (Free Discharge)
└─**1=Exfiltration** (Controls 1.49 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=264.00' TW=252.50' (Dynamic Tailwater)
└─**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 6P: Chambers - Chamber Wizard Field A

Chamber Model = Cultec R-902HD v2 (Cultec Recharger® 902HD v2)
Effective Size= 69.1"W x 48.0"H => 17.30 sf x 3.67'L = 63.4 cf
Overall Size= 78.0"W x 48.0"H x 4.10'L with 0.44' Overlap
Cap Storage= 18.0 cf x 2 x 9 rows = 324.4 cf

78.0" Wide + 9.0" Spacing = 87.0" C-C Row Spacing

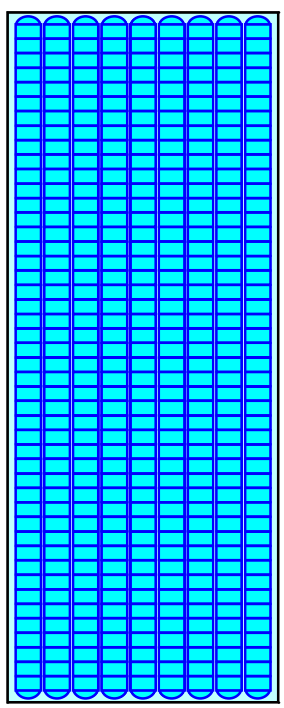
46 Chambers/Row x 3.67' Long +2.00' Cap Length x 2 = 172.67' Row Length +12.0" End Stone x 2 = 174.67' Base Length
9 Rows x 78.0" Wide + 9.0" Spacing x 8 + 24.0" Side Stone x 2 = 68.50' Base Width
9.0" Stone Base + 48.0" Chamber Height + 12.0" Stone Cover = 5.75' Field Height

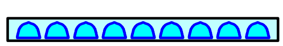
414 Chambers x 63.4 cf + 18.0 cf Cap Volume x 2 x 9 Rows = 26,589.6 cf Chamber Storage

68,796.8 cf Field - 26,589.6 cf Chambers = 42,207.3 cf Stone x 40.0% Voids = 16,882.9 cf Stone Storage

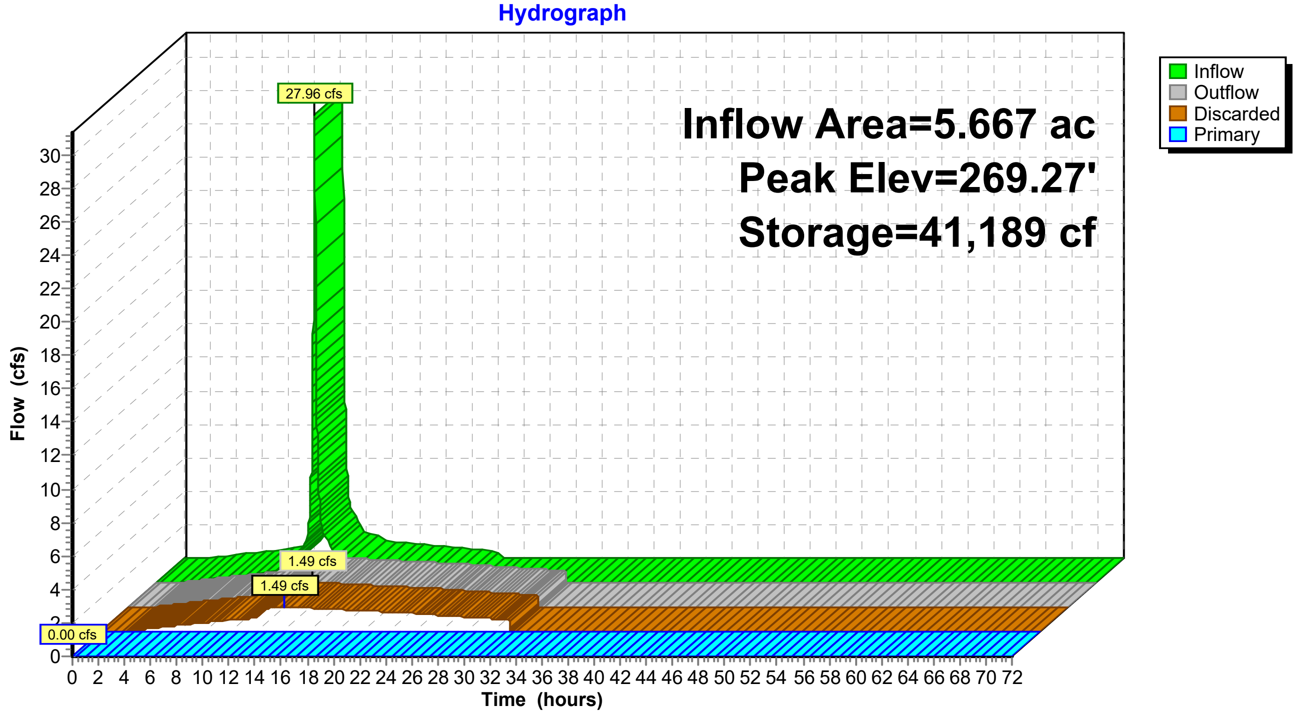
Chamber Storage + Stone Storage = 43,472.5 cf = 0.998 af
Overall Storage Efficiency = 63.2%
Overall System Size = 174.67' x 68.50' x 5.75'

414 Chambers
2,548.0 cy Field
1,563.2 cy Stone





Pond 6P: Chambers



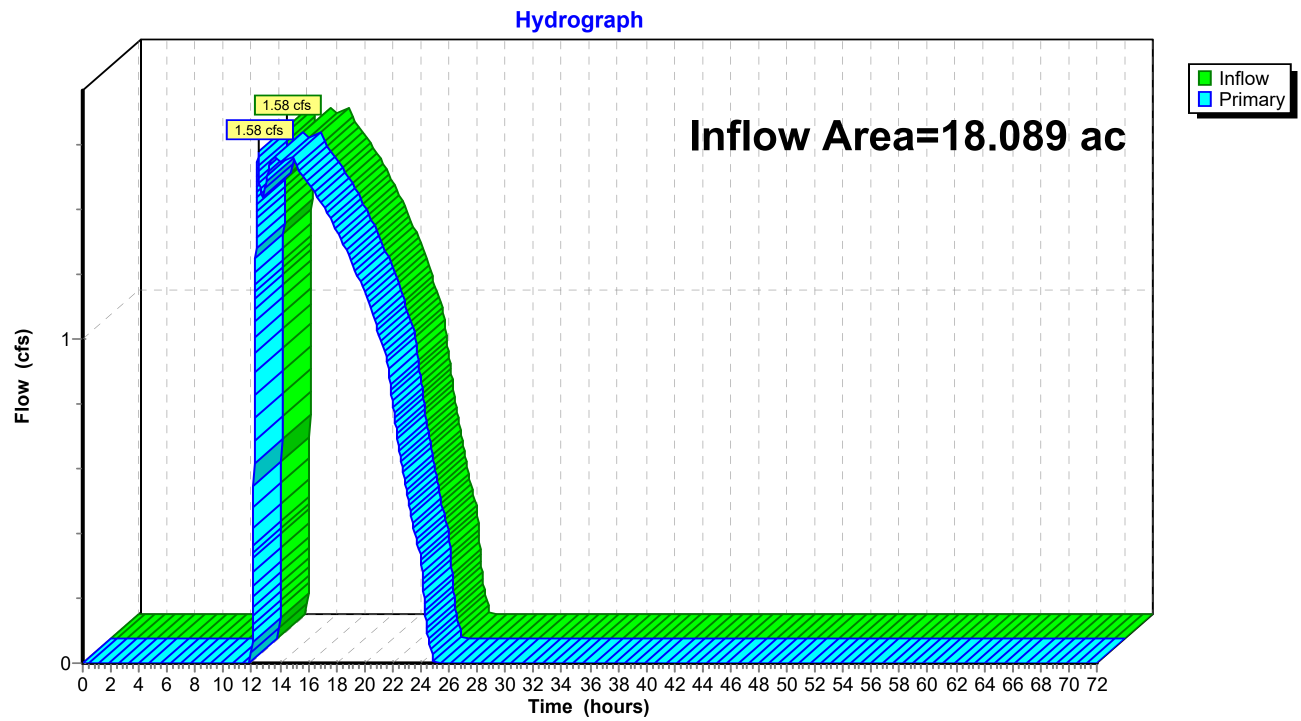
Summary for Pond AP-1: Southern Wetlands

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

Inflow Area = 18.089 ac, 77.58% Impervious, Inflow Depth = 0.79" for 25-yr event
Inflow = 1.58 cfs @ 12.44 hrs, Volume= 1.186 af
Primary = 1.58 cfs @ 12.44 hrs, Volume= 1.186 af, Atten= 0%, Lag= 0.0 min

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

Pond AP-1: Southern Wetlands



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 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

SubcatchmentPR-1: Subcat PR-1 Runoff Area=0.105 ac 3.65% Impervious Runoff Depth=1.43"
Tc=0.0 min CN=41 Runoff=0.21 cfs 0.013 af

SubcatchmentPR-10: Subcat PR-10 Runoff Area=0.334 ac 69.45% Impervious Runoff Depth=5.79"
Tc=6.0 min CN=80 Runoff=2.34 cfs 0.161 af

SubcatchmentPR-11: Subcat PR-11 Runoff Area=0.318 ac 77.70% Impervious Runoff Depth=6.39"
Tc=6.0 min CN=85 Runoff=2.40 cfs 0.169 af

SubcatchmentPR-2: Subcat PR-2 Runoff Area=49,958 sf 48.82% Impervious Runoff Depth=4.39"
Tc=6.0 min CN=68 Runoff=6.30 cfs 0.419 af

SubcatchmentPR-3: Subcat PR-3 Runoff Area=2.013 ac 88.34% Impervious Runoff Depth=7.22"
Tc=6.0 min CN=92 Runoff=16.30 cfs 1.211 af

SubcatchmentPR-4: Subcat PR-4 Runoff Area=1.573 ac 93.61% Impervious Runoff Depth=7.46"
Tc=6.0 min CN=94 Runoff=12.91 cfs 0.978 af

SubcatchmentPR-5: Subcat PR-5 Runoff Area=89,348 sf 0.00% Impervious Runoff Depth=1.83"
Flow Length=378' Tc=15.5 min CN=45 Runoff=2.75 cfs 0.313 af

SubcatchmentPR-6: Subcat PR-6 Runoff Area=44,275 sf 79.27% Impervious Runoff Depth=6.27"
Tc=6.0 min CN=84 Runoff=7.57 cfs 0.531 af

SubcatchmentPR-7: Subcat PR-7 Runoff Area=8.174 ac 99.51% Impervious Runoff Depth=7.94"
Tc=6.0 min CN=98 Runoff=68.15 cfs 5.408 af

SubcatchmentPR-8: Subcat PR-8 Runoff Area=26,155 sf 76.06% Impervious Runoff Depth=6.27"
Tc=6.0 min CN=84 Runoff=4.47 cfs 0.314 af

SubcatchmentPR-9: Subcat PR-9 Runoff Area=0.758 ac 45.36% Impervious Runoff Depth=4.16"
Tc=0.0 min CN=66 Runoff=4.65 cfs 0.262 af

Pond 2P: DMH 24-5 Inflow=22.62 cfs 2.056 af
Primary=22.62 cfs 2.056 af

Pond 3P: DMH 24-15 Inflow=71.80 cfs 5.840 af
Primary=71.80 cfs 5.840 af

Pond 4P: EX. BASIN #1 Peak Elev=274.64' Storage=6,261 cf Inflow=10.77 cfs 0.733 af
Outflow=4.22 cfs 0.684 af

Pond 5P: EX. BASIN #2 Peak Elev=257.99' Storage=177,268 cf Inflow=79.37 cfs 6.842 af
Discarded=1.33 cfs 4.401 af Primary=2.52 cfs 2.441 af Secondary=0.00 cfs 0.000 af Outflow=3.84 cfs 6.842 af

Pond 6P: Chambers Peak Elev=270.34' Storage=43,472 cf Inflow=35.53 cfs 3.034 af
Discarded=1.65 cfs 2.563 af Primary=14.63 cfs 0.471 af Outflow=16.28 cfs 3.034 af

Pond AP-1: Southern Wetlands

Inflow=4.55 cfs 2.766 af
Primary=4.55 cfs 2.766 af

Total Runoff Area = 18.089 ac Runoff Volume = 9.780 af Average Runoff Depth = 6.49"
22.42% Pervious = 4.056 ac 77.58% Impervious = 14.033 ac

Summary for Subcatchment PR-1: Subcat PR-1

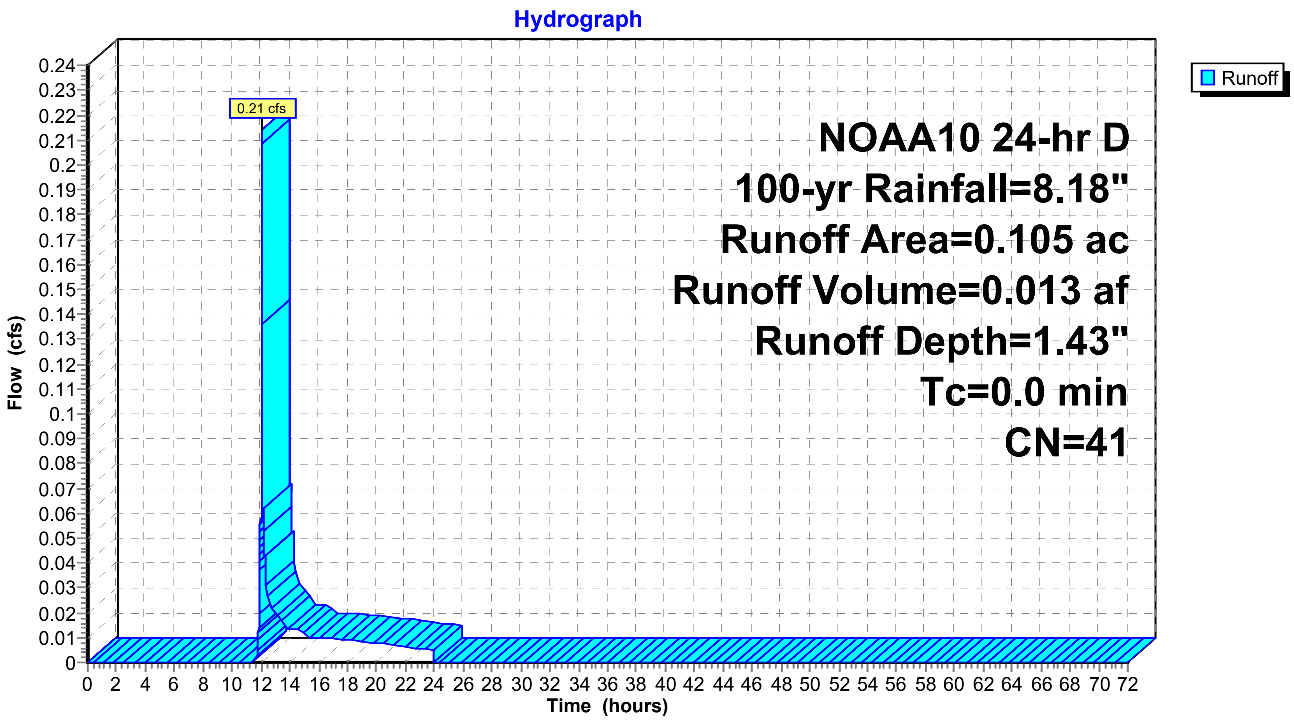
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.21 cfs @ 12.09 hrs, Volume= 0.013 af, Depth= 1.43"
Routed to Pond AP-1 : Southern Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-yr Rainfall=8.18"

Area (ac)	CN	Description
0.101	39	>75% Grass cover, Good, HSG A
0.004	98	Roofs, HSG A
0.105	41	Weighted Average
0.101		96.35% Pervious Area
0.004		3.65% Impervious Area

Subcatchment PR-1: Subcat PR-1



Summary for Subcatchment PR-10: Subcat PR-10

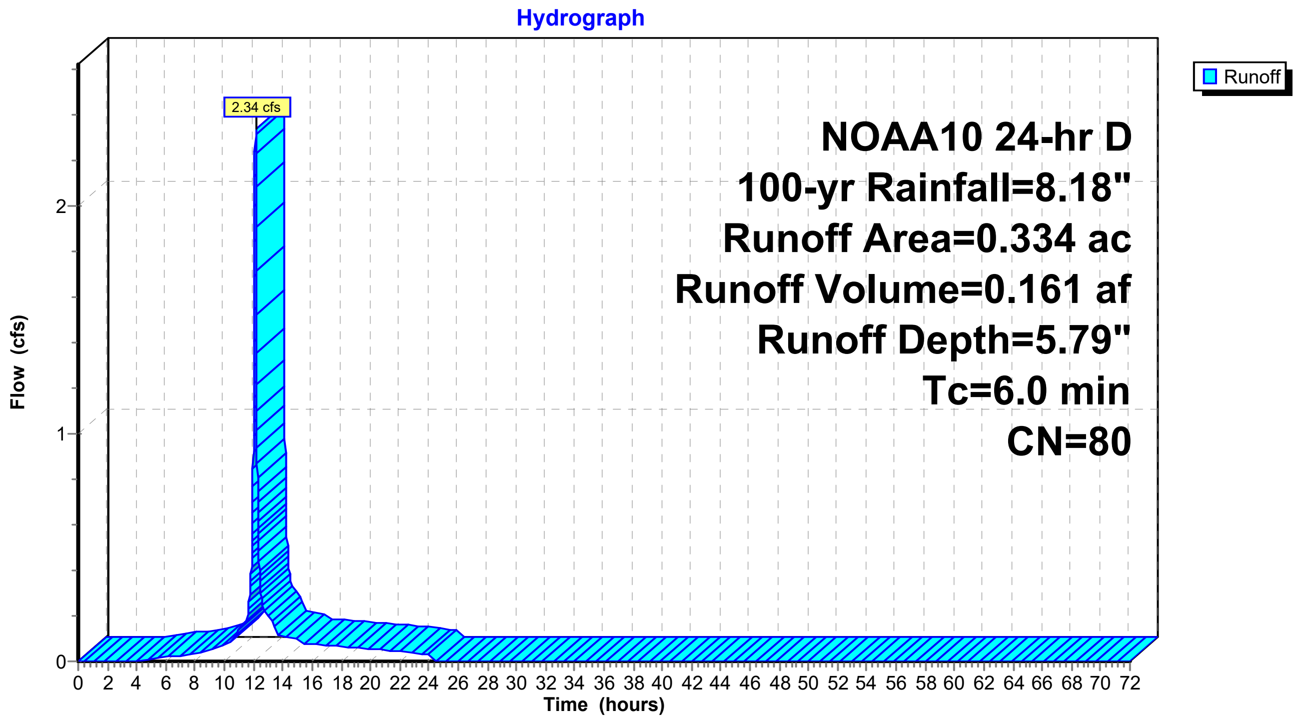
Runoff = 2.34 cfs @ 12.13 hrs, Volume= 0.161 af, Depth= 5.79"
Routed to Pond 2P : DMH 24-5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-yr Rainfall=8.18"

Area (ac)	CN	Description
0.102	39	>75% Grass cover, Good, HSG A
0.228	98	Paved parking, HSG A
0.004	98	Unconnected pavement, HSG A
0.334	80	Weighted Average
0.102		30.55% Pervious Area
0.232		69.45% Impervious Area
0.004		1.57% Unconnected

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

Subcatchment PR-10: Subcat PR-10



Summary for Subcatchment PR-11: Subcat PR-11

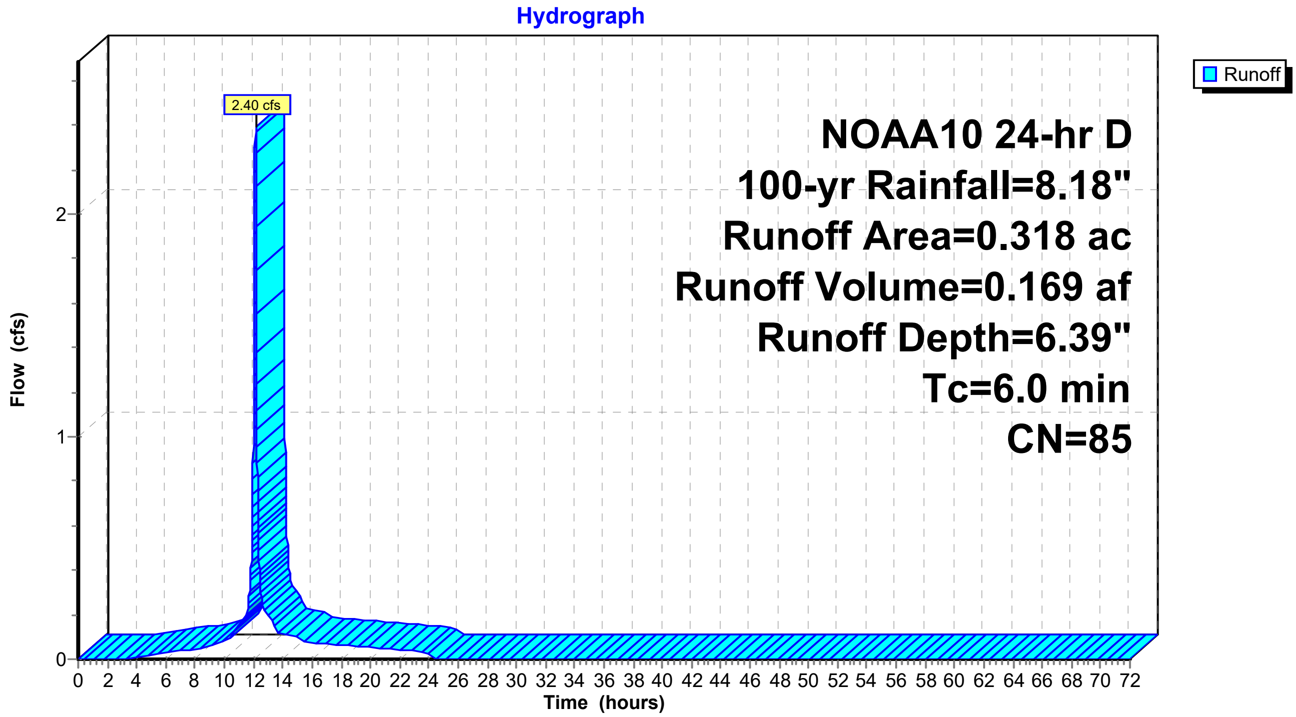
Runoff = 2.40 cfs @ 12.13 hrs, Volume= 0.169 af, Depth= 6.39"
Routed to Pond 3P : DMH 24-15

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-yr Rainfall=8.18"

Area (ac)	CN	Description
0.071	39	>75% Grass cover, Good, HSG A
0.247	98	Paved parking, HSG A
0.318	85	Weighted Average
0.071		22.30% Pervious Area
0.247		77.70% Impervious Area

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

Subcatchment PR-11: Subcat PR-11



Summary for Subcatchment PR-2: Subcat PR-2

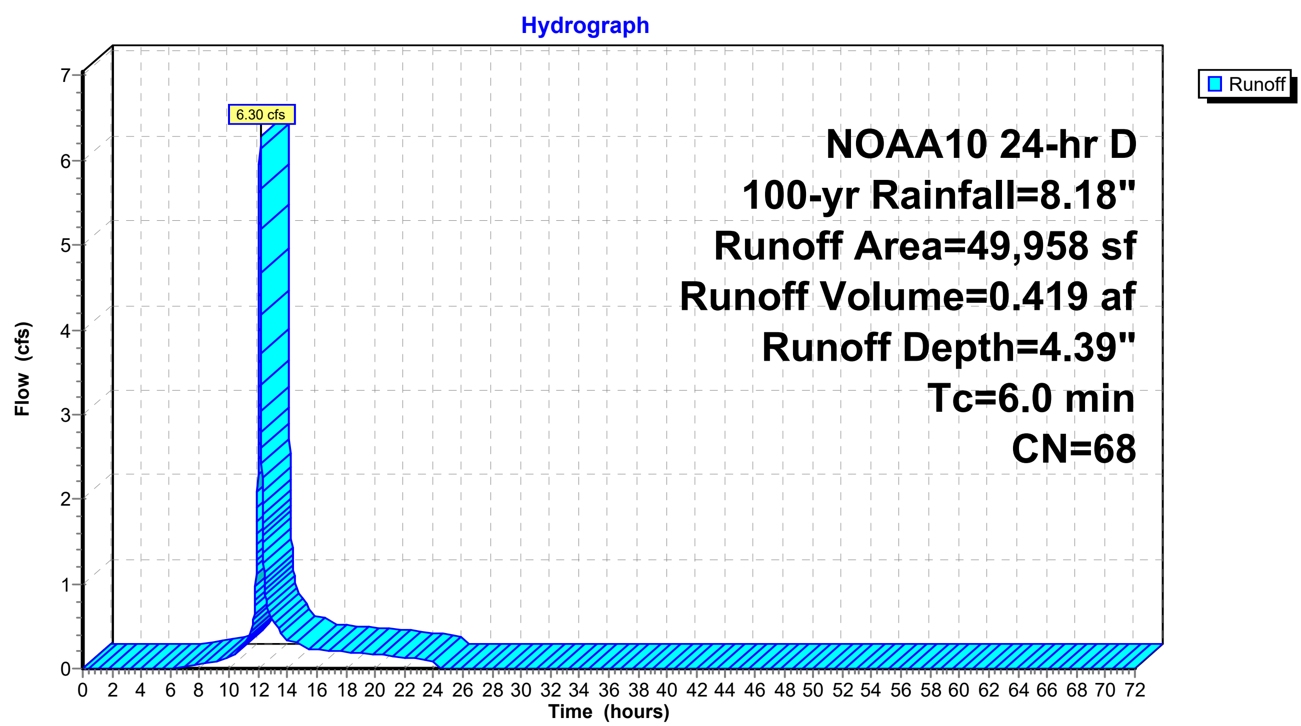
Runoff = 6.30 cfs @ 12.13 hrs, Volume= 0.419 af, Depth= 4.39"
Routed to Pond 4P : EX. BASIN #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-yr Rainfall=8.18"

Area (sf)	CN	Description
25,568	39	>75% Grass cover, Good, HSG A
12,594	98	Paved parking, HSG A
409	98	Unconnected pavement, HSG A
11,387	98	Water Surface, HSG A
49,958	68	Weighted Average
25,568		51.18% Pervious Area
24,390		48.82% Impervious Area
409		1.68% Unconnected

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

Subcatchment PR-2: Subcat PR-2



Summary for Subcatchment PR-3: Subcat PR-3

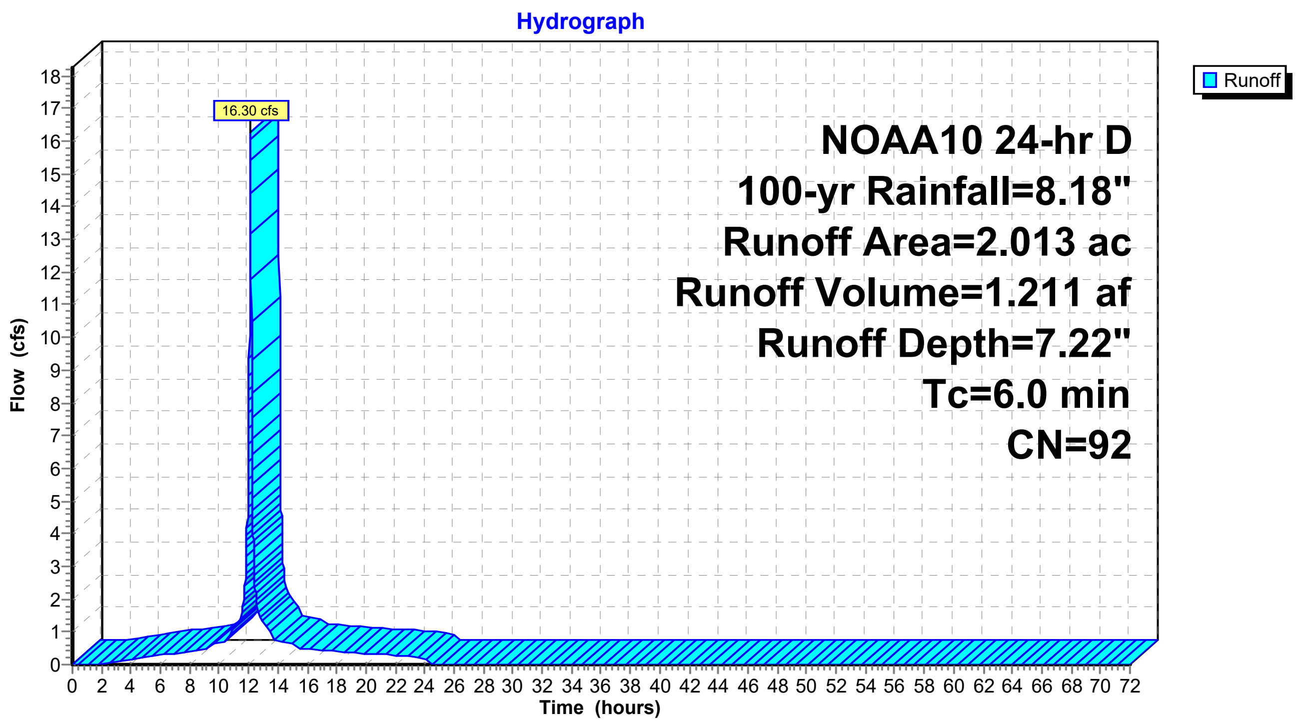
Runoff = 16.30 cfs @ 12.13 hrs, Volume= 1.211 af, Depth= 7.22"
Routed to Pond 2P : DMH 24-5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-yr Rainfall=8.18"

Area (ac)	CN	Description
0.205	39	>75% Grass cover, Good, HSG A
0.030	80	>75% Grass cover, Good, HSG D
1.603	98	Paved parking, HSG A
0.102	98	Paved parking, HSG D
0.060	98	Unconnected pavement, HSG A
0.013	98	Unconnected pavement, HSG D
2.013	92	Weighted Average
0.235		11.66% Pervious Area
1.778		88.34% Impervious Area
0.073		4.12% Unconnected

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

Subcatchment PR-3: Subcat PR-3



Summary for Subcatchment PR-4: Subcat PR-4

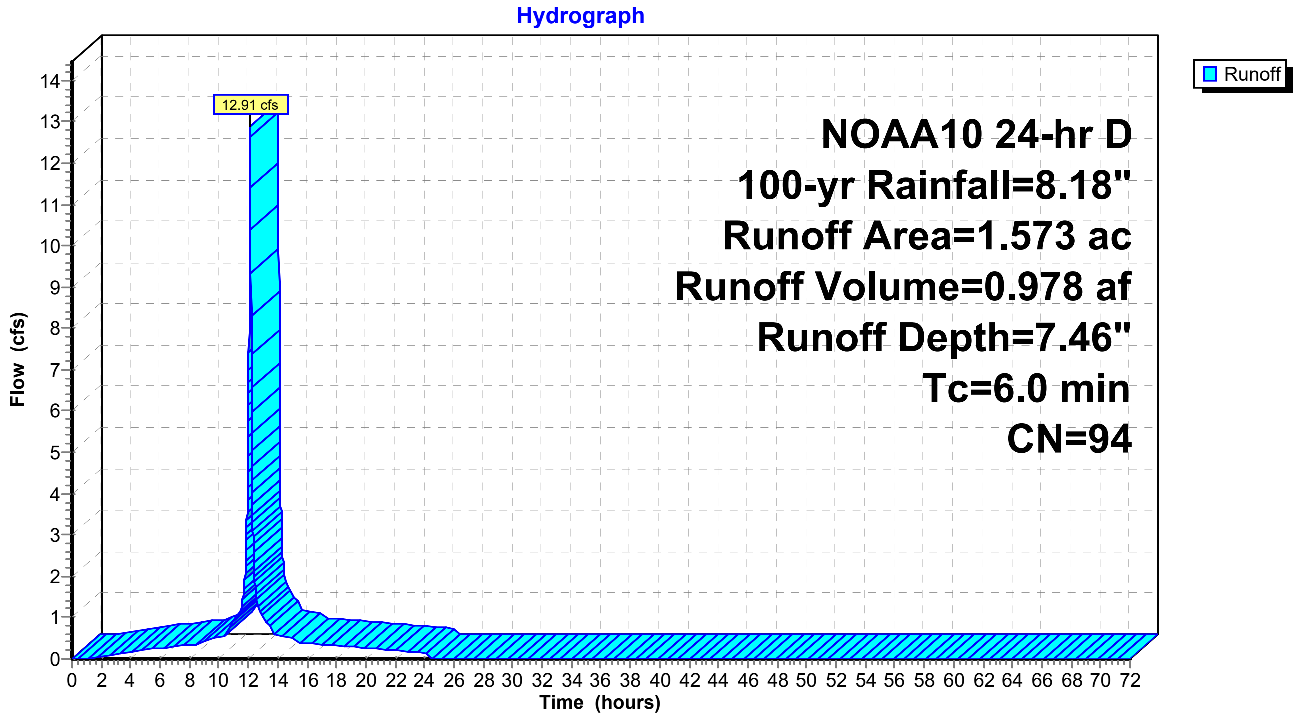
Runoff = 12.91 cfs @ 12.13 hrs, Volume= 0.978 af, Depth= 7.46"
Routed to Pond 6P : Chambers

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-yr Rainfall=8.18"

Area (ac)	CN	Description
0.101	39	>75% Grass cover, Good, HSG A
1.473	98	Paved parking, HSG A
1.573	94	Weighted Average
0.101		6.39% Pervious Area
1.473		93.61% Impervious Area

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

Subcatchment PR-4: Subcat PR-4



Summary for Subcatchment PR-5: Subcat PR-5

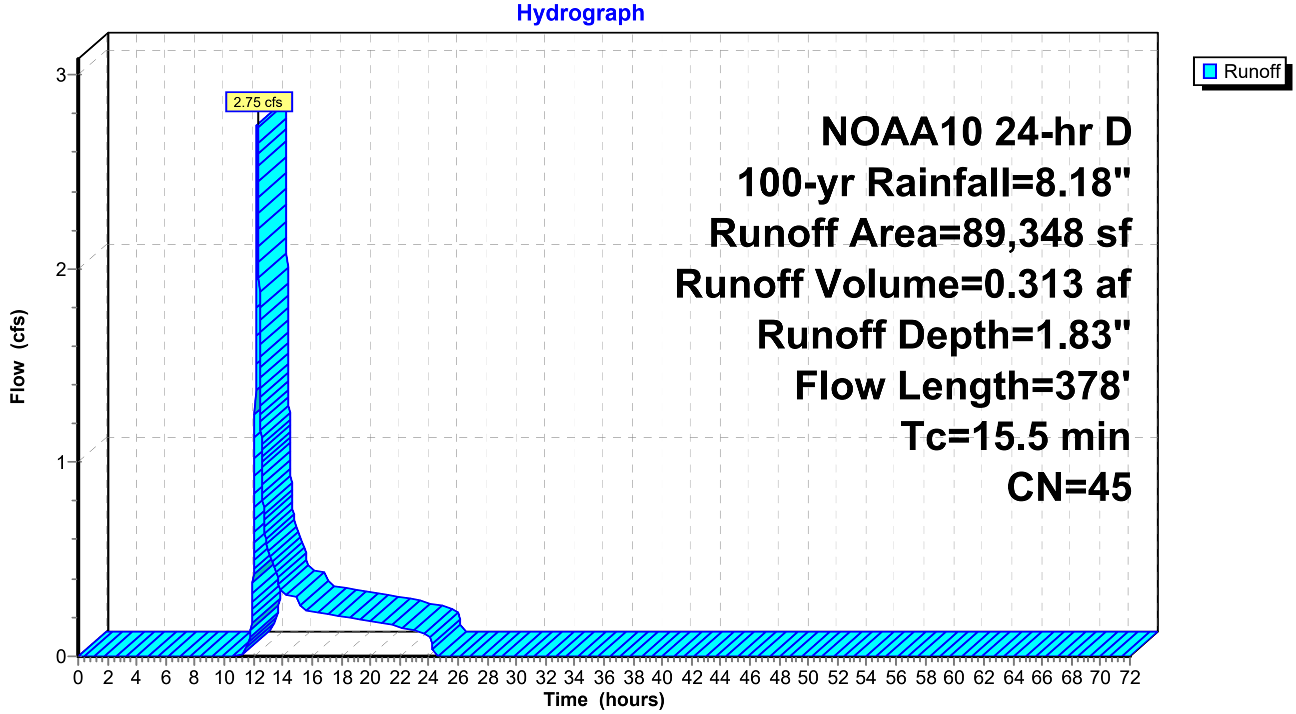
Runoff = 2.75 cfs @ 12.25 hrs, Volume= 0.313 af, Depth= 1.83"
Routed to Pond AP-1 : Southern Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-yr Rainfall=8.18"

Area (sf)	CN	Description
9,611	39	>75% Grass cover, Good, HSG A
954	80	>75% Grass cover, Good, HSG D
53,433	30	Woods, Good, HSG A
25,349	77	Woods, Good, HSG D
89,348	45	Weighted Average
89,348		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0190	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.36"
0.8	67	0.0780	1.40		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.0	14	0.3300	8.62		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
1.5	148	0.0125	1.68		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.2	46	0.0550	3.52		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.7	53	0.0700	1.32		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
15.5	378	Total			

Subcatchment PR-5: Subcat PR-5



Summary for Subcatchment PR-6: Subcat PR-6

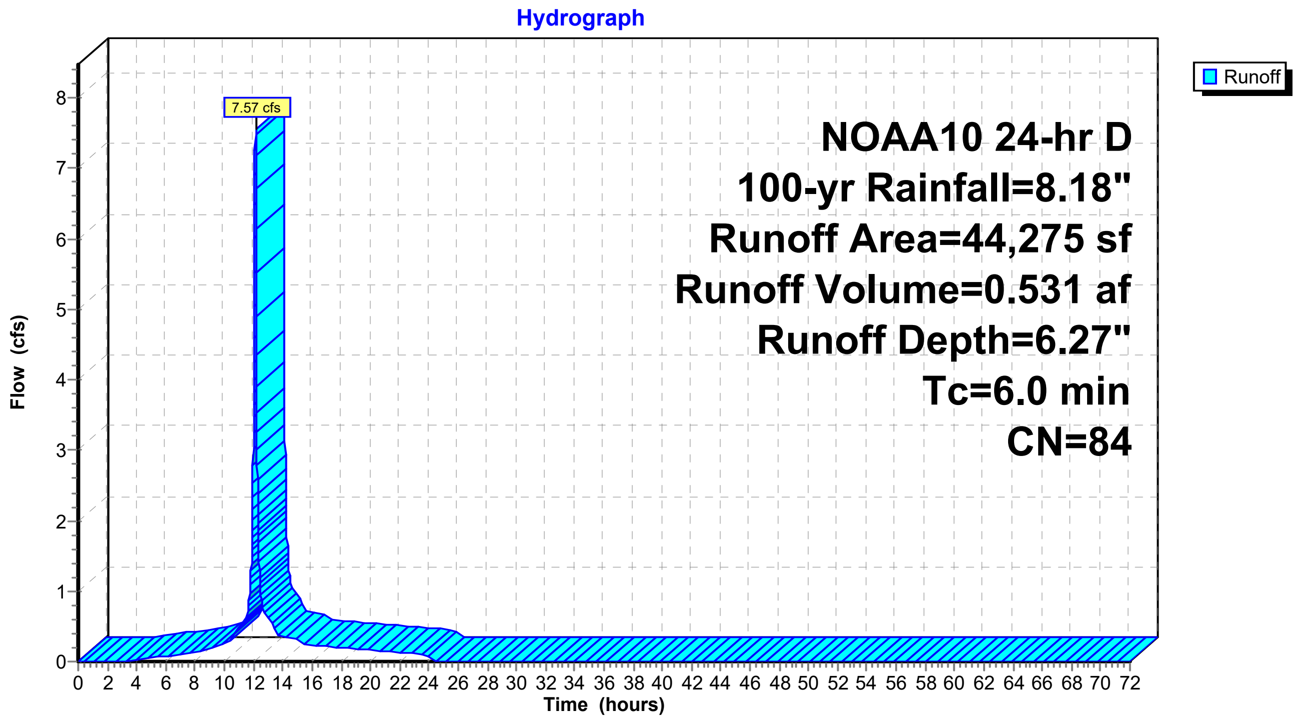
Runoff = 7.57 cfs @ 12.13 hrs, Volume= 0.531 af, Depth= 6.27"
Routed to Pond 5P : EX. BASIN #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-yr Rainfall=8.18"

Area (sf)	CN	Description
1,625	39	>75% Grass cover, Good, HSG A
35,096	98	Water Surface, HSG A
7,554	30	Woods, Good, HSG A
44,275	84	Weighted Average
9,179		20.73% Pervious Area
35,096		79.27% Impervious Area

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

Subcatchment PR-6: Subcat PR-6



Summary for Subcatchment PR-7: Subcat PR-7

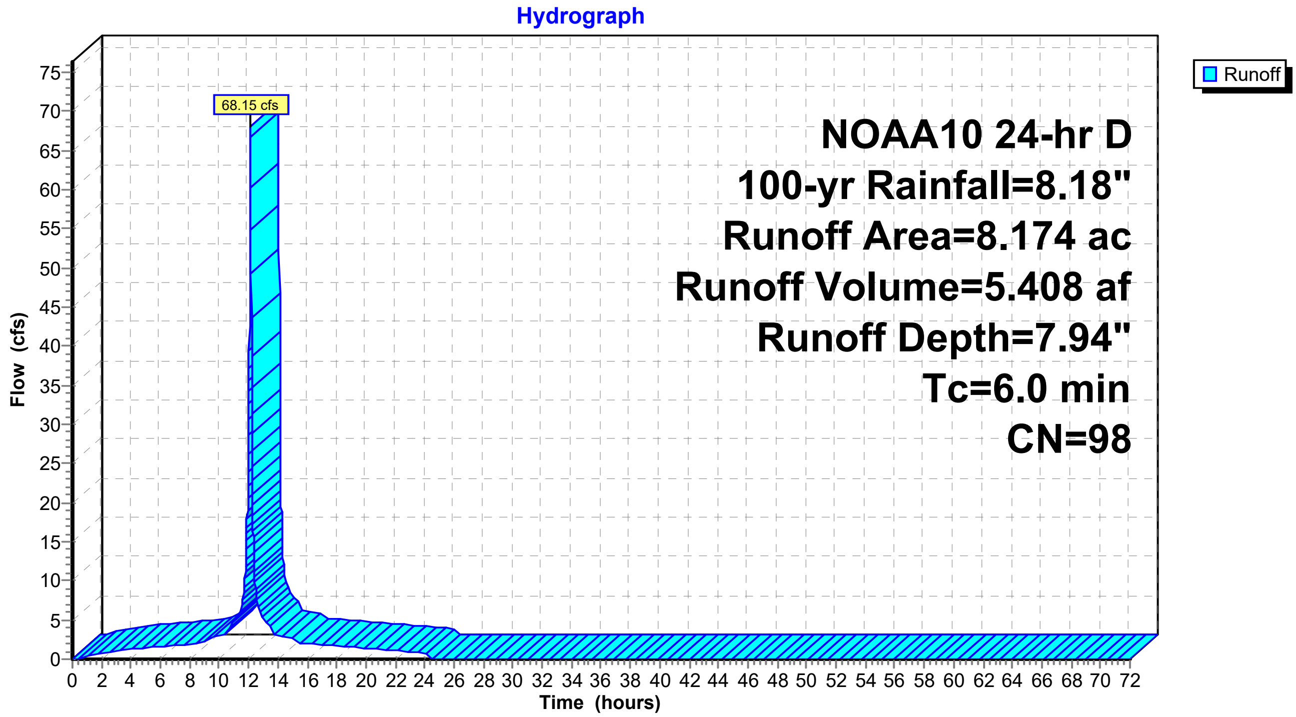
Runoff = 68.15 cfs @ 12.13 hrs, Volume= 5.408 af, Depth= 7.94"
Routed to Pond 3P : DMH 24-15

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-yr Rainfall=8.18"

Area (ac)	CN	Description
0.040	39	>75% Grass cover, Good, HSG A
8.133	98	Roofs, HSG A
8.174	98	Weighted Average
0.040		0.49% Pervious Area
8.133		99.51% Impervious Area

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

Subcatchment PR-7: Subcat PR-7



Summary for Subcatchment PR-8: Subcat PR-8

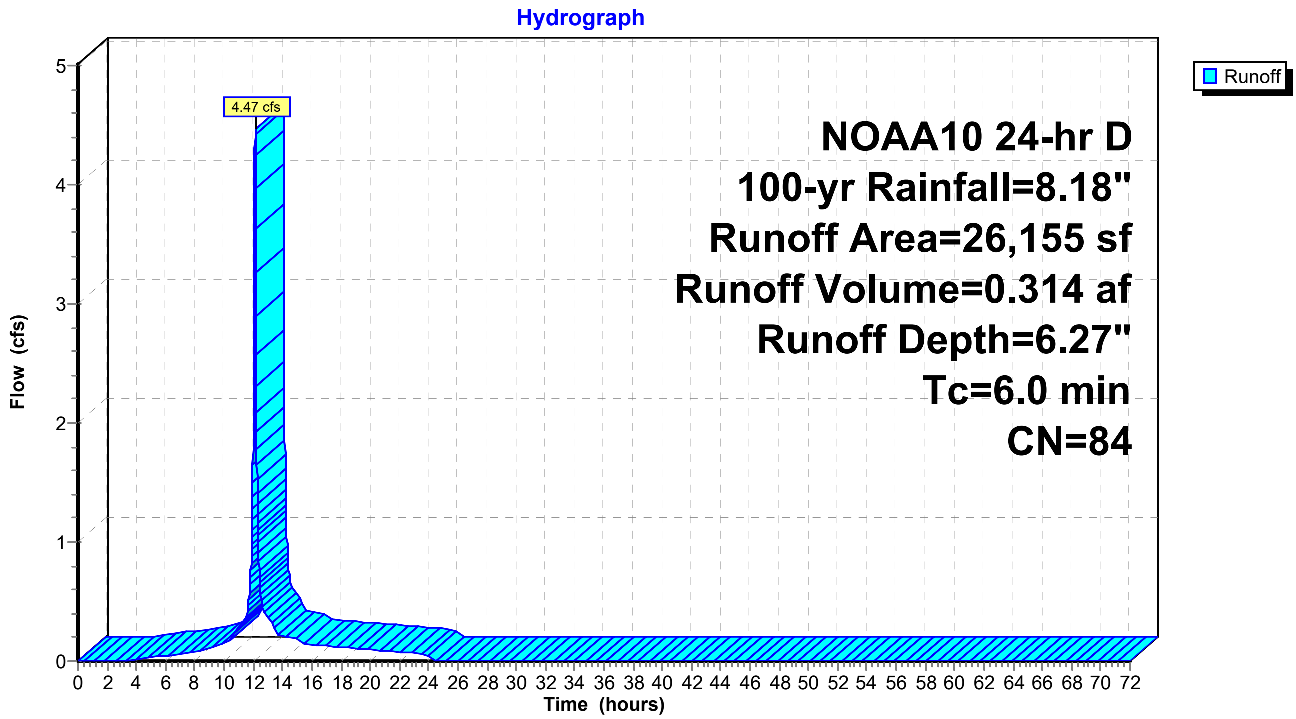
Runoff = 4.47 cfs @ 12.13 hrs, Volume= 0.314 af, Depth= 6.27"
Routed to Pond 4P : EX. BASIN #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-yr Rainfall=8.18"

Area (sf)	CN	Description
6,261	39	>75% Grass cover, Good, HSG A
19,408	98	Paved parking, HSG A
486	98	Unconnected pavement, HSG A
26,155	84	Weighted Average
6,261		23.94% Pervious Area
19,894		76.06% Impervious Area
486		2.44% Unconnected

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

Subcatchment PR-8: Subcat PR-8



Summary for Subcatchment PR-9: Subcat PR-9

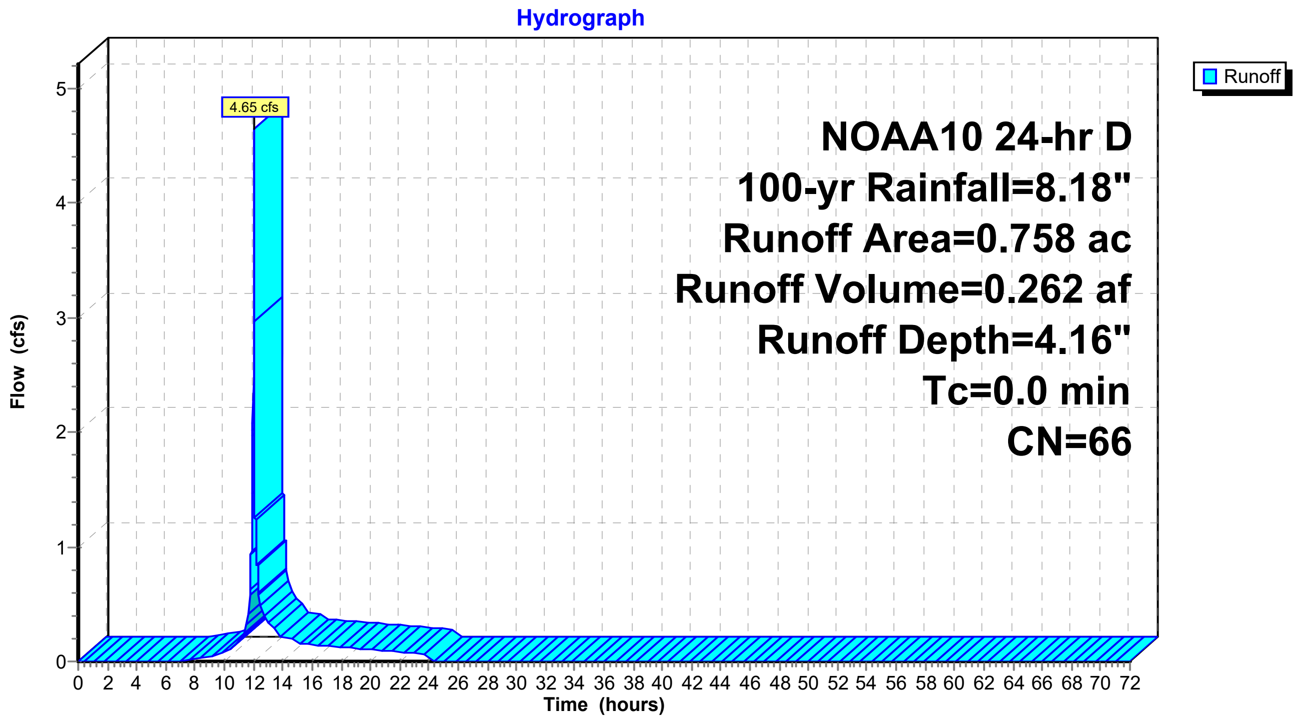
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 4.65 cfs @ 12.09 hrs, Volume= 0.262 af, Depth= 4.16"
Routed to Pond 3P : DMH 24-15

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-yr Rainfall=8.18"

Area (ac)	CN	Description
0.414	39	>75% Grass cover, Good, HSG A
0.343	98	Paved parking, HSG A
0.000	98	Roofs, HSG A
0.001	98	Unconnected pavement, HSG A
0.758	66	Weighted Average
0.414		54.64% Pervious Area
0.344		45.36% Impervious Area
0.001		0.15% Unconnected

Subcatchment PR-9: Subcat PR-9

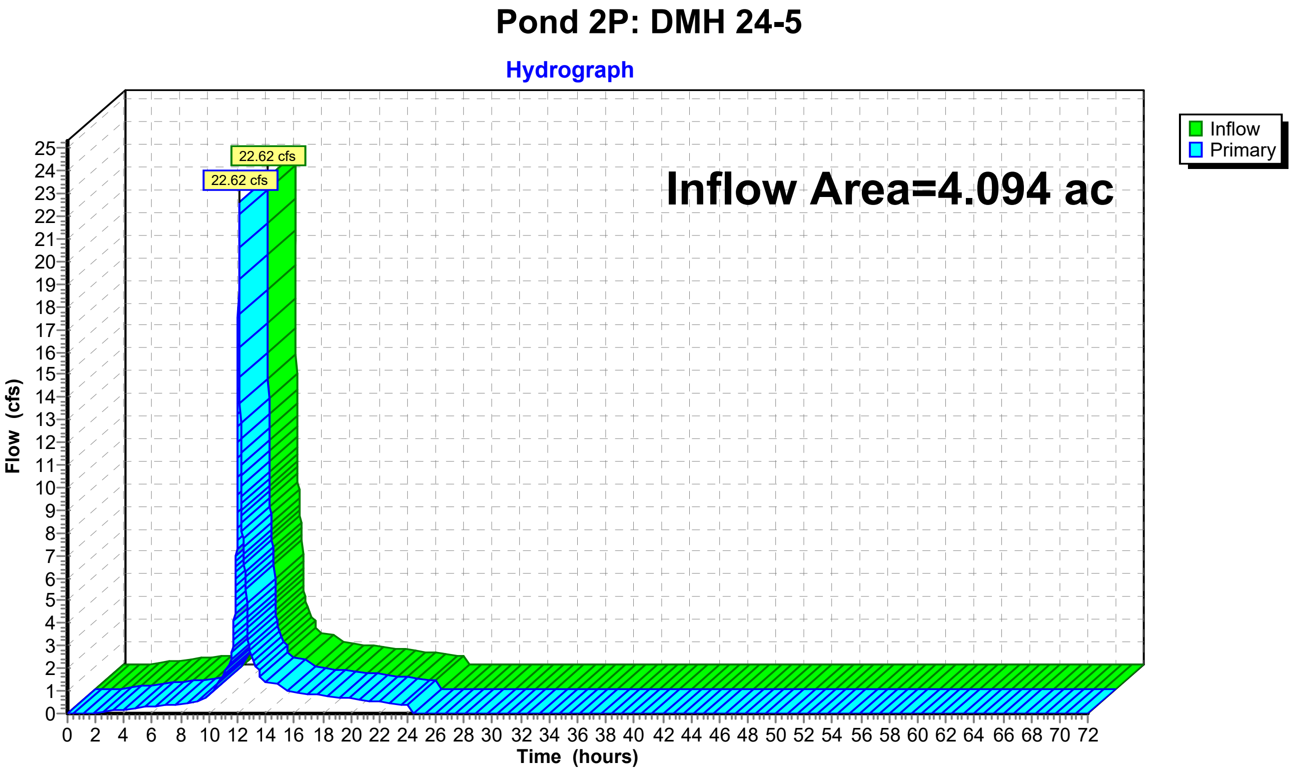


Summary for Pond 2P: DMH 24-5

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

Inflow Area = 4.094 ac, 73.93% Impervious, Inflow Depth = 6.03" for 100-yr event
Inflow = 22.62 cfs @ 12.13 hrs, Volume= 2.056 af
Primary = 22.62 cfs @ 12.13 hrs, Volume= 2.056 af, Atten= 0%, Lag= 0.0 min
Routed to Pond 6P : Chambers

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



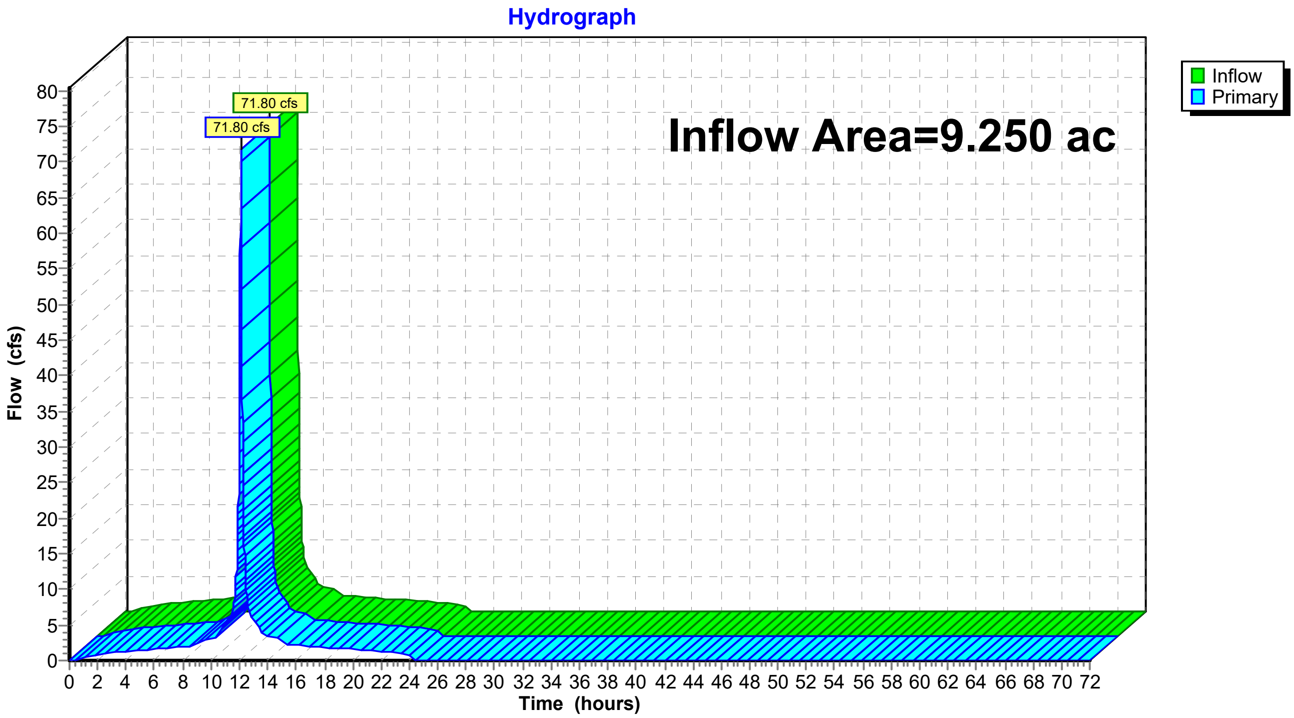
Summary for Pond 3P: DMH 24-15

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

Inflow Area = 9.250 ac, 94.32% Impervious, Inflow Depth = 7.58" for 100-yr event
Inflow = 71.80 cfs @ 12.13 hrs, Volume= 5.840 af
Primary = 71.80 cfs @ 12.13 hrs, Volume= 5.840 af, Atten= 0%, Lag= 0.0 min
Routed to Pond 5P : EX. BASIN #2

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

Pond 3P: DMH 24-15



Summary for Pond 4P: EX. BASIN #1

Inflow Area = 1.747 ac, 58.18% Impervious, Inflow Depth = 5.03" for 100-yr event
Inflow = 10.77 cfs @ 12.13 hrs, Volume= 0.733 af
Outflow = 4.22 cfs @ 12.24 hrs, Volume= 0.684 af, Atten= 61%, Lag= 6.8 min
Primary = 4.22 cfs @ 12.24 hrs, Volume= 0.684 af
Routed to Pond 2P : DMH 24-5

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 274.64' @ 12.24 hrs Surf.Area= 7,490 sf Storage= 6,261 cf

Plug-Flow detention time= 71.2 min calculated for 0.684 af (93% of inflow)
Center-of-Mass det. time= 34.8 min (870.4 - 835.6)

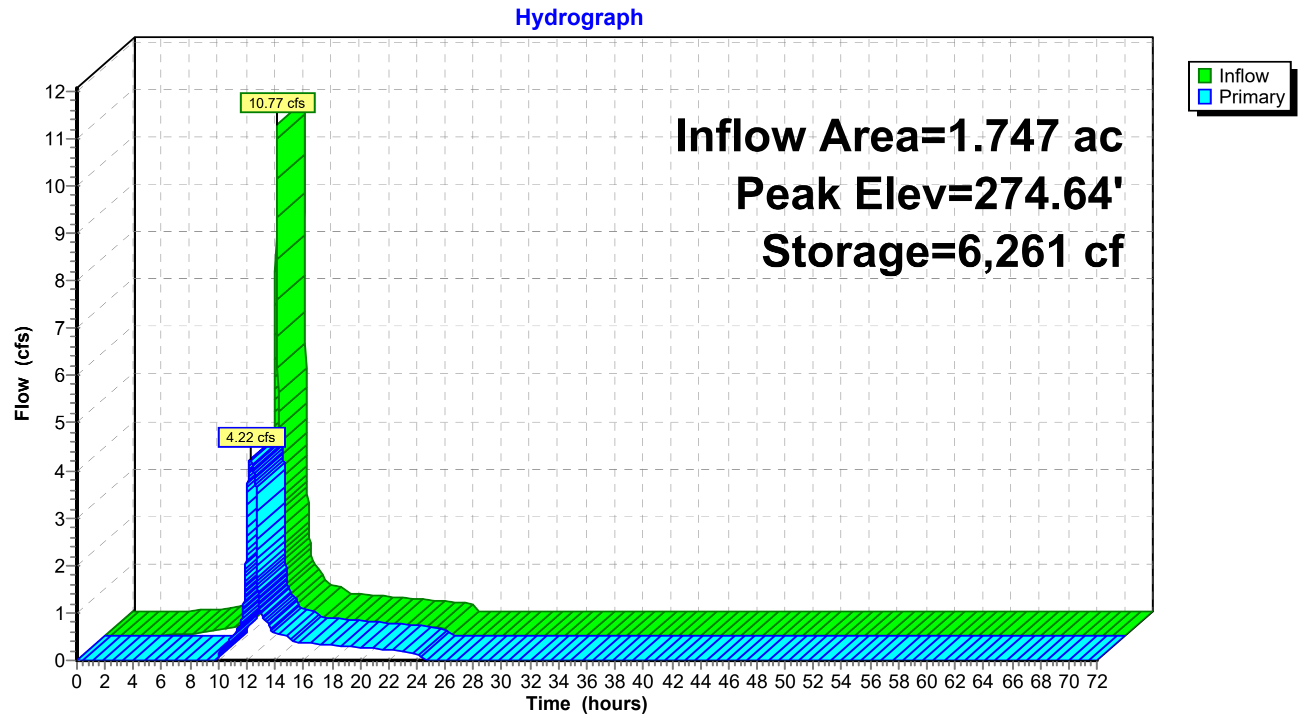
Volume	Invert	Avail.Storage	Storage Description
#1	273.40'	31,754 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
273.40	1,731	0	0
274.00	5,352	2,125	2,125
275.00	8,670	7,011	9,136
276.00	11,387	10,029	19,164
277.00	13,793	12,590	31,754

Device	Routing	Invert	Outlet Devices
#1	Primary	272.50'	**12.0" Round Culvert** L= 75.9' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 272.50' / 271.90' S= 0.0079 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf
#2	Device 1	274.00'	**34.0" x 50.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=4.22 cfs @ 12.24 hrs HW=274.64' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Barrel Controls 4.22 cfs @ 5.38 fps)
  └─**2=Orifice/Grate** (Passes 4.22 cfs of 23.66 cfs potential flow)

Pond 4P: EX. BASIN #1



Summary for Pond 5P: EX. BASIN #2

Inflow Area = 15.933 ac, 88.05% Impervious, Inflow Depth = 5.15" for 100-yr event
Inflow = 79.37 cfs @ 12.13 hrs, Volume= 6.842 af
Outflow = 3.84 cfs @ 14.68 hrs, Volume= 6.842 af, Atten= 95%, Lag= 152.9 min
Discarded = 1.33 cfs @ 14.68 hrs, Volume= 4.401 af
Primary = 2.52 cfs @ 14.68 hrs, Volume= 2.441 af
Routed to Pond AP-1 : Southern Wetlands
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond AP-1 : Southern Wetlands

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 257.99' @ 14.68 hrs Surf.Area= 28,260 sf Storage= 177,268 cf

Plug-Flow detention time= 877.0 min calculated for 6.842 af (100% of inflow)
Center-of-Mass det. time= 877.0 min (1,632.5 - 755.4)

Volume	Invert	Avail.Storage	Storage Description
#1	252.50'	161,924 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	252.50'	52,984 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) -Impervious
		214,908 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
252.50	19,110	0	0
253.00	20,997	10,027	10,027
254.00	22,390	21,694	31,720
255.00	23,808	23,099	54,819
256.00	25,235	24,522	79,341
257.00	26,725	25,980	105,321
258.00	28,276	27,501	132,821
259.00	29,930	29,103	161,924

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
252.50	8,115	0	0
253.00	8,115	4,058	4,058
254.00	8,158	8,137	12,194
255.00	8,158	8,158	20,352
256.00	8,158	8,158	28,510
257.00	8,158	8,158	36,668
258.00	8,158	8,158	44,826
259.00	8,158	8,158	52,984

Device	Routing	Invert	Outlet Devices
#1	Secondary	258.00'	**15.0' long x 15.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Primary	254.94'	**12.0" Round Culvert** L= 28.9' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 254.94' / 254.86' S= 0.0028 '/' Cc= 0.900

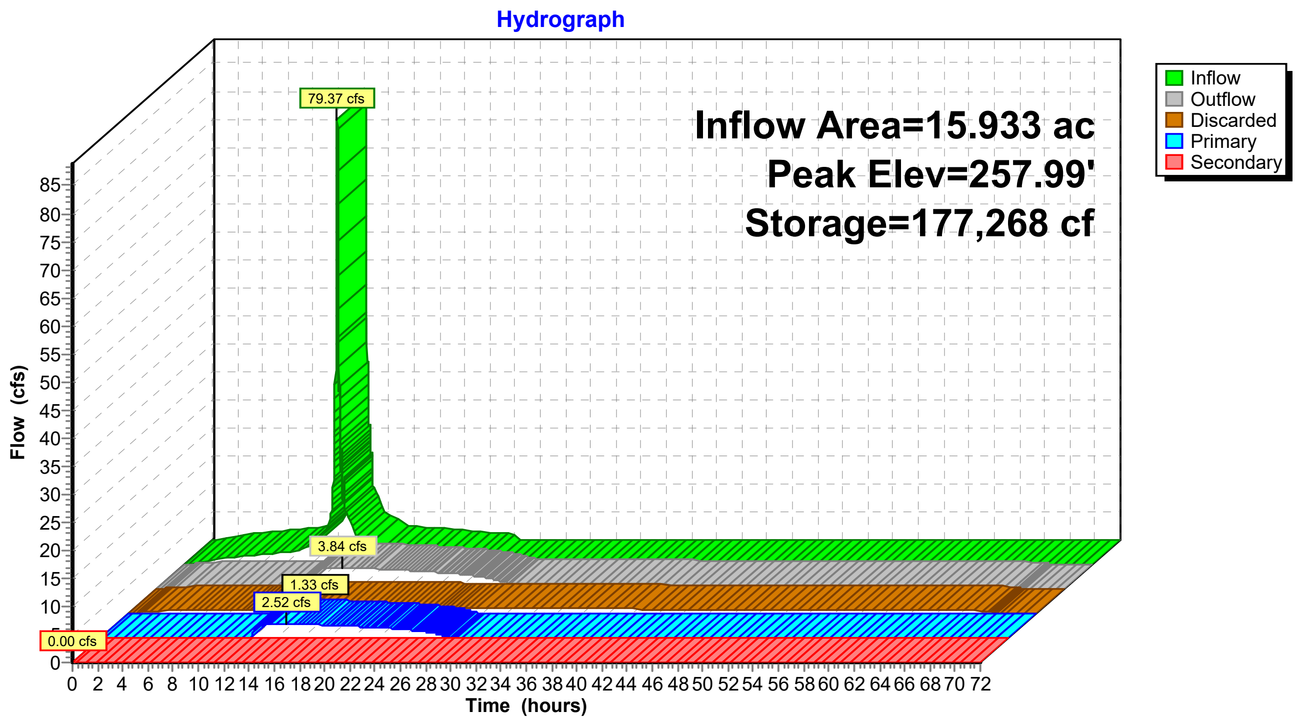
			n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf
#3	Device 2	255.75'	**8.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Discarded	252.50'	**1.020 in/hr Exfiltration over Surface area**
			Conductivity to Groundwater Elevation = 248.00' Phase-In= 0.01'

Discarded OutFlow Max=1.33 cfs @ 14.68 hrs HW=257.99' (Free Discharge)
└─**4=Exfiltration** (Controls 1.33 cfs)

Primary OutFlow Max=2.52 cfs @ 14.68 hrs HW=257.99' TW=0.00' (Dynamic Tailwater)
└─**2=Culvert** (Passes 2.52 cfs of 5.93 cfs potential flow)
  └─**3=Orifice/Grate** (Orifice Controls 2.52 cfs @ 7.21 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=252.50' TW=0.00' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir**(Controls 0.00 cfs)

Pond 5P: EX. BASIN #2



Summary for Pond 6P: Chambers

[93] Warning: Storage range exceeded by 0.59'
[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=25)

Inflow Area = 5.667 ac, 79.39% Impervious, Inflow Depth = 6.43" for 100-yr event
Inflow = 35.53 cfs @ 12.13 hrs, Volume= 3.034 af
Outflow = 16.28 cfs @ 12.27 hrs, Volume= 3.034 af, Atten= 54%, Lag= 8.4 min
Discarded = 1.65 cfs @ 12.27 hrs, Volume= 2.563 af
Primary = 14.63 cfs @ 12.27 hrs, Volume= 0.471 af
Routed to Pond 5P : EX. BASIN #2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 270.34' @ 12.27 hrs Surf.Area= 11,965 sf Storage= 43,472 cf

Plug-Flow detention time= 272.4 min calculated for 3.034 af (100% of inflow)
Center-of-Mass det. time= 272.4 min (1,068.9 - 796.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	264.00'	16,883 cf	**68.50'W x 174.67'L x 5.75'H Field A** 68,797 cf Overall - 26,590 cf Embedded = 42,207 cf x 40.0% Voids
#2A	264.75'	26,590 cf	**Cultec R-902HD v2** x 414 Inside #1 Effective Size= 69.1"W x 48.0"H => 17.30 sf x 3.67'L = 63.4 cf Overall Size= 78.0"W x 48.0"H x 4.10'L with 0.44' Overlap 414 Chambers in 9 Rows Cap Storage= 18.0 cf x 2 x 9 rows = 324.4 cf
		43,472 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	264.00'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 259.70' Phase-In= 0.01'
#2	Primary	269.50'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=1.65 cfs @ 12.27 hrs HW=270.32' (Free Discharge)
└─**1=Exfiltration** (Controls 1.65 cfs)

Primary OutFlow Max=14.28 cfs @ 12.27 hrs HW=270.32' TW=256.86' (Dynamic Tailwater)
└─**2=Sharp-Crested Rectangular Weir** (Weir Controls 14.28 cfs @ 2.97 fps)

Pond 6P: Chambers - Chamber Wizard Field A

Chamber Model = Cultec R-902HD v2 (Cultec Recharger® 902HD v2)
Effective Size= 69.1"W x 48.0"H => 17.30 sf x 3.67'L = 63.4 cf
Overall Size= 78.0"W x 48.0"H x 4.10'L with 0.44' Overlap
Cap Storage= 18.0 cf x 2 x 9 rows = 324.4 cf

78.0" Wide + 9.0" Spacing = 87.0" C-C Row Spacing

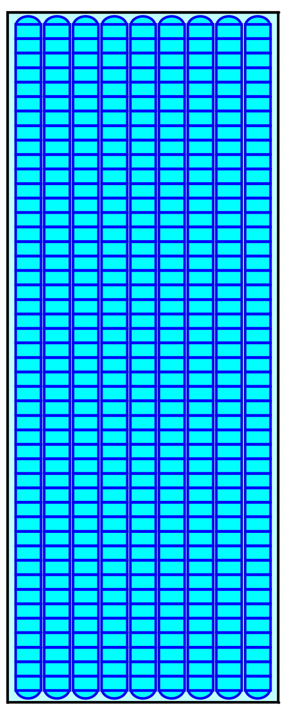
46 Chambers/Row x 3.67' Long +2.00' Cap Length x 2 = 172.67' Row Length +12.0" End Stone x 2 = 174.67' Base Length
9 Rows x 78.0" Wide + 9.0" Spacing x 8 + 24.0" Side Stone x 2 = 68.50' Base Width
9.0" Stone Base + 48.0" Chamber Height + 12.0" Stone Cover = 5.75' Field Height

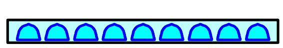
414 Chambers x 63.4 cf + 18.0 cf Cap Volume x 2 x 9 Rows = 26,589.6 cf Chamber Storage

68,796.8 cf Field - 26,589.6 cf Chambers = 42,207.3 cf Stone x 40.0% Voids = 16,882.9 cf Stone Storage

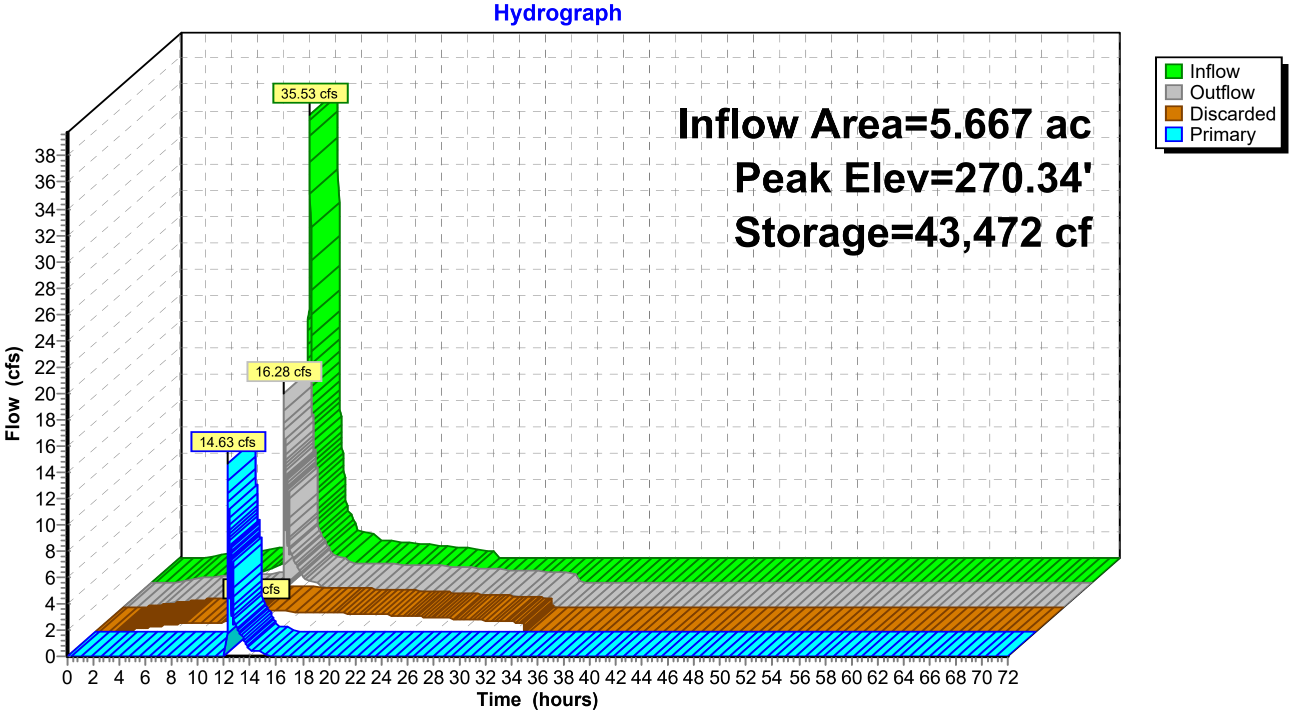
Chamber Storage + Stone Storage = 43,472.5 cf = 0.998 af
Overall Storage Efficiency = 63.2%
Overall System Size = 174.67' x 68.50' x 5.75'

414 Chambers
2,548.0 cy Field
1,563.2 cy Stone





Pond 6P: Chambers



Summary for Pond AP-1: Southern Wetlands

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

Inflow Area =	18.089 ac, 77.58% Impervious, Inflow Depth = 1.84"	for 100-yr event	
Inflow =	4.55 cfs @ 12.28 hrs, Volume=	2.766 af	
Primary =	4.55 cfs @ 12.28 hrs, Volume=	2.766 af,	Atten= 0%, Lag= 0.0 min

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

Pond AP-1: Southern Wetlands

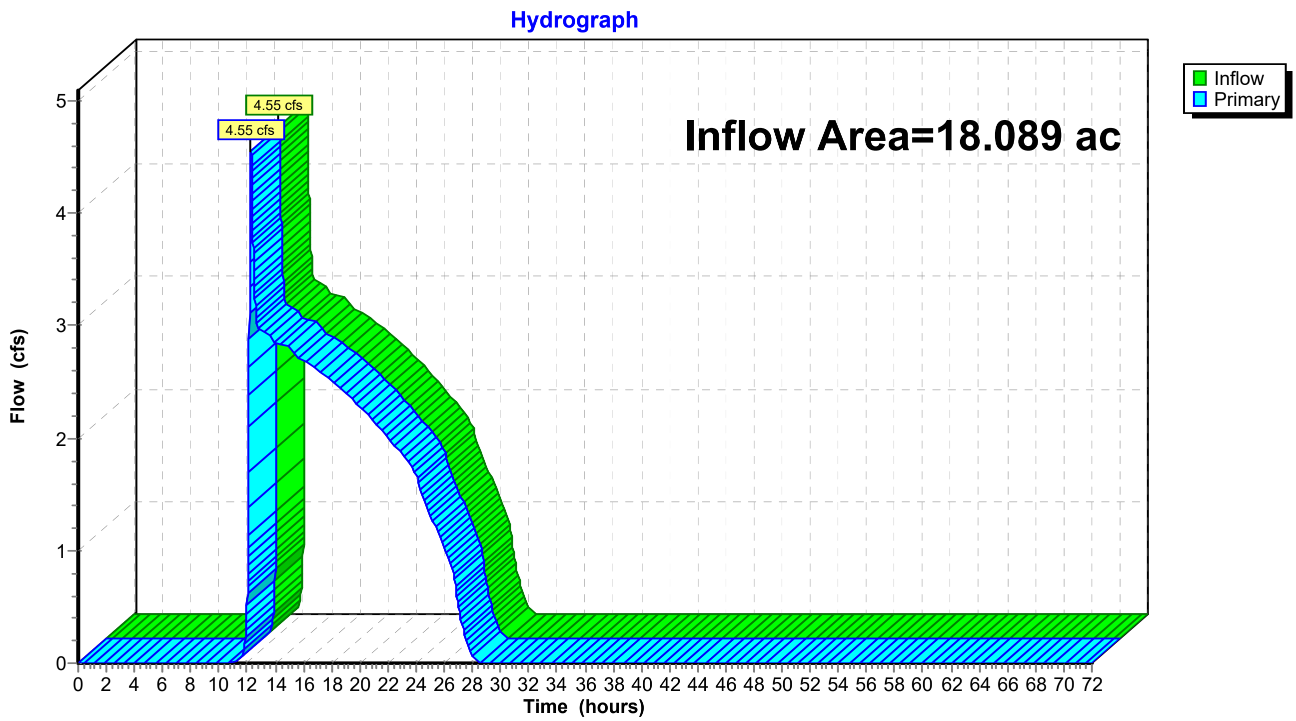


TABLE OF CONTENTS

25-yr Event

100-yr Event

Pipe Sizing Calculations

Land Use Coefficients "C"

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

Area	Land Use Area Impervious (acres)	Gravel (acres)	Wetland (acres)	Pervious (acres)	Woods (acres)	Roof (acres)	Total (acres)	Weighted "C"
CB 24-1	0.231			0.101		0.000	0.332	0.72
CB 24-2	0.185			0.034		0.000	0.219	0.81
CB 24-3, 4, &5	0.113			0.051		0.000	0.164	0.71
CB 24-6&7	0.343			0.313		0.000	0.656	0.61
CB 24-8	0.248			0.037		0.000	0.285	0.82
CB 24-9	0.246			0.002		0.000	0.248	0.90
CB 24-10	0.245			0.008		0.000	0.253	0.88
CB 24-11	0.248			0.007		0.000	0.255	0.88
CB 24-12	0.246			0.011		0.000	0.257	0.87
CB 24-13	0.250			0.012		0.000	0.262	0.87
CB 24-14	0.248			0.012		0.000	0.260	0.87
CB 24-15	0.248			0.012		0.000	0.260	0.87
CB 24-16	0.246			0.012		0.000	0.258	0.87
CB 24-17	0.237			0.013		0.000	0.250	0.87
CB 24-18	0.243			0.038		0.000	0.281	0.82
CB 7&8	0.112			0.024		0.000	0.136	0.79
CB 9	0.244			0.111		0.000	0.355	0.71
CB 15&16	0.118			0.018		0.000	0.136	0.82
CB 58&59	0.258			0.105		0.000	0.363	0.73
CB 60&61	0.200			0.040		0.000	0.240	0.80
ROOF	0.000			0.000		8.137	8.137	0.90
SUBTOTAL	4.509	0.000	0.000	0.961	0.000	8.137	13.607	
OVERALL TOTALS	4.509			0.961	0.000	8.137	13.607	

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

Project: 126 Grove Street, Franklin MA
Job No.: 4593

DESIGN COMPUTATIONS FOR STORM DRAINS

Prepared By MAH | Date 11/05/2024 | Revised March 23, 2025
Checked By | Date | Revised

Drainage Area	Upper Structure	Lower Structure	Sum of CA's (sf)	Time of Concentration (Tc) (min)	Rainfall Intensity (I) (in/hr)	Actual Peak Flow Rate (Q) (cfs)	Pipe Diameter (in)	Slope (ft/ft)	Roughness Coefficient (n)	Design Flow Full (Q) (cfs)	Velocity Flow Full (V) (fps)	Actual Velocity (V) (fps)	Length of Pipe (L)* (ft)	Time in pipe (min)	Total Fall (ft)	Invert Elevation Elev. Upper End	Invert Elevation Elev. Lower End	Rim Elev Elev. Upper End	Rim Elev Elev. Lower End	Destination
	CB 24-1	DMH 24-1	0.24	6.00	8.02	1.91	12	0.010	0.011	4.21	5.36	2.43	127.9	0.40	1.28	273.46	272.18	279.60	279.20	CULTEC RECHARGER R-902HD SYSTEM #1 WEST INLET
	CB 24-2	DMH 24-2	0.18	6.00	8.02	1.42	12	0.010	0.011	4.18	5.32	1.80	29.4	0.09	0.29	271.31	271.02	276.00	277.00	
	CB 24-3, 4, &5	DMH 24-13	0.12	6.00	8.02	0.94	12	0.013	0.011	4.73	6.02	1.19	19.9	0.05	0.25	267.11	266.86		275.70	BASIN #2
	CB 24-6&7	DMH 24-18	0.40	6.00	8.02	3.23	15	0.005	0.011	5.13	4.18	2.63	73.1	0.29	0.33	271.95	271.62	274.80	276.60	
	CB 24-8	DMH 24-3	0.23	6.00	8.02	1.88	12	0.017	0.011	5.44	6.92	2.39	6.0	0.01	0.10	270.38	270.28	274.30	274.40	CULTEC RECHARGER R-902HD SYSTEM #1 WEST INLET
	CB 24-9	DMH 24-4	0.22	6.00	8.02	1.78	12	0.010	0.011	4.22	5.37	2.27	10.0	0.03	0.10	269.64	269.54	273.40	273.50	
	CB 24-10	DMH 24-4	0.22	6.00	8.02	1.79	12	0.014	0.011	5.03	6.41	2.28	7.0	0.02	0.10	269.64	269.54	273.40	273.50	
	CB 24-11	DMH 24-5	0.23	6.00	8.02	1.81	12	0.010	0.011	4.23	5.39	2.30	9.9	0.03	0.10	268.86	268.76	273.50	273.70	
	CB 24-12	DMH 24-5	0.22	6.00	8.02	1.80	12	0.014	0.011	5.03	6.41	2.29	7.0	0.02	0.10	268.86	268.76	273.50	273.70	
	CB 24-13	DMH 24-22	0.23	6.00	8.02	1.83	12	0.010	0.011	4.15	5.28	2.33	10.3	0.03	0.10	268.78	268.68	273.50	273.70	CULTEC RECHARGER R-902HD SYSTEM #1 EAST INLET
	CB 24-14	DMH 24-22	0.23	6.00	8.02	1.82	12	0.013	0.011	4.86	6.19	2.32	7.5	0.02	0.10	268.78	268.68	273.50	273.70	
	CB 24-15	DMH 24-25	0.23	6.00	8.02	1.82	12	0.013	0.011	4.86	6.19	2.32	7.5	0.02	0.10	268.06	267.96	273.50	273.70	
	CB 24-16	DMH 24-25	0.23	6.00	8.02	1.80	12	0.010	0.011	4.15	5.28	2.30	10.3	0.03	0.10	268.06	267.96	273.50	273.70	
	CB 24-17	DMH 24-26	0.22	6.00	8.02	1.74	12	0.011	0.011	4.35	5.54	2.22	7.5	0.02	0.08	269.60	269.52	273.30	273.40	
	CB 24-18	DMH 24-26	0.23	6.00	8.02	1.85	12	0.010	0.011	4.20	5.35	2.35	31.1	0.10	0.31	269.83	269.52	273.00	273.40	
	CB 7&8	DMH 6	0.11	6.00	8.02	0.87	12	0.065	0.011	10.76	13.70	1.10	30.6	0.04	2.00	273.90	271.90	277.60	277.60	CULTEC RECHARGER R-902HD SYSTEM #1 WEST INLET
	CB 9	DMH 7	0.25	6.00	8.02	2.03	12	0.025	0.011	6.66	8.48	2.58	8.0	0.02	0.20	270.60	270.40	275.32	275.45	
	CB 15&16	DMH 24-14	0.11	6.00	8.02	0.90	12	0.017	0.011	5.44	6.92	1.14	18.0	0.04	0.30	270.40	270.10	274.50	274.30	BASIN #2
	CB 58&59	DMH 46	0.26	6.00	8.02	2.11	12	0.003	0.011	2.21	2.81	2.69	36.3	0.22	0.10	276.50	276.40	279.60		BASIN #1
	CB 60&61	DMH 45	0.19	6.00	8.02	1.54	12	0.034	0.011	7.76	9.89	1.96	23.5	0.04	0.80	275.90	275.10	278.92		
	ROOF	DMH 24-12	7.32	6.00	8.02	58.73	36	0.010	0.011	79.12	11.19	8.31	46.7	0.07	0.47	265.57	265.10			BASIN #2
	DMH 46	DMH 45	0.26	6.22	8.02	2.11	12	0.017	0.011	5.52	7.02	2.69	69.9	0.17	1.20	276.30	275.10	279.85	279.87	BASIN #1
	DMH 45	BASIN 1	0.46	6.38	8.02	3.65	12	0.009	0.011	3.95	5.03	4.65	79.6	0.26	0.70	275.00	274.30	279.87		
*	BASIN 1	DMH 6	0.46	6.64	8.02	3.65	12	0.008	0.011	3.74	4.77	4.65	75.9	0.27	0.60	272.50	271.90		277.60	CULTEC RECHARGER R-902HD SYSTEM #1 WEST INLET
	DMH 6	DMH 7	0.56	6.91	8.02	4.52	15	0.009	0.011	7.32	5.96	3.68	134.9	0.38	1.24	271.80	270.56	277.60	275.50	
	DMH 7	DMH 24-3	0.82	7.29	7.44	6.08	18	0.005	0.011	8.78	4.97	3.44	75.9	0.25	0.38	270.06	269.68	275.50	274.40	
	DMH 24-1	DMH 24-2	0.24	7.54	7.44	1.77	12	0.010	0.011	4.21	5.36	2.26	127.9	0.40	1.28	273.46	272.18	279.60	272.18	
	DMH 24-2	DMH 24-3	0.41	7.94	7.44	3.09	12	0.010	0.011	4.20	5.35	3.93	74.3	0.23	0.74	270.77	270.03	277.00	274.40	
	DMH 24-3	DMH 24-4	1.47	7.54	7.44	10.91	24	0.005	0.011	18.95	6.03	3.47	127.4	0.35	0.64	269.18	268.54	274.40	273.50	
	DMH 24-4	DMH 24-5	1.91	7.94	7.44	14.22	24	0.005	0.011	18.91	6.02	4.52	136.0	0.38	0.68	268.54	267.86	273.70	273.80	
	DMH 24-5	DMH 24-20	2.36	8.32	6.96	16.43	24	0.005	0.011	19.52	6.21	5.23	11.3	0.03	0.06	267.76	267.70	273.70	273.80	
	DMH 24-20	DMH 24-21	2.36	8.35	6.96	16.43	24	0.005	0.011	19.52	6.21	5.23	11.3	0.03	0.06	267.60	267.54	273.80	274.00	
	DMH 24-21`	CULTEC #1	2.36	8.38	6.96	16.43	24	0.010	0.011	26.74	8.51	5.23	4.0	0.01	0.04	265.00	264.96	274.00		
	DMH 24-26	DMH 24-25	0.45	6.00	8.02	3.59	12	0.010	0.011	4.21	5.36	4.57	146.1	0.45	1.46	269.42	267.96	273.40	273.70	
	DMH 24-25	DMH 24-23	0.90	6.45	8.02	7.21	15	0.010	0.011	7.73	6.30	5.88	17.6	0.05	0.18	267.61	267.43	273.70	273.90	

Drainage Area	Upper Structure	Lower Structure	Sum of CA's (sf)	Time of Concentration (Tc) (min)	Rainfall Intensity (I) (in/hr)	Actual Peak Flow Rate (Q) (cfs)	Pipe Diameter (in)	Slope (ft/ft)	Roughness Coefficient (n)	Design Flow Full (Q) (cfs)	Velocity Flow Full (V) (fps)	Actual Velocity (V) (fps)	Length of Pipe (L)* (ft)	Time in pipe (min)	Total Fall (ft)	Invert Elevation Elev. Upper End	Invert Elevation Elev. Lower End	Rim Elev Elev. Upper End	Rim Elev Elev. Lower End	Destination
	DMH 24-22	DMH 24-23	0.46	6.00	8.02	3.65	12	0.010	0.011	4.21	5.36	4.65	89.9	0.28	0.90	268.58	267.68	273.70	273.90	CULTEC RECHARGER R-902HD SYSTEM #1 EAST INLET
	DMH 24-23	DMH 24-24	1.35	6.50	8.02	10.86	18	0.014	0.011	14.58	8.25	6.15	7.3	0.01	0.10	266.00	265.90	273.90	274.00	
	DMH 24-24	CULTEC #1	1.35	6.52	8.02	10.86	24	0.010	0.011	26.74	8.51	3.46	4.0	0.01	0.04	265.00	264.96	274.00		
	DMH 24-6	DMH 24-11	0.40	6.29	8.02	3.23	18	0.005	0.011	9.19	5.20	1.83	701.3	2.25	3.84	270.76	266.92	276.50	284.80	BASIN #2
	DMH 24-11	DMH 24-12	7.73	6.07	8.02	61.96	36	0.009	0.011	73.94	10.46	8.77	46.7	0.07	0.47	265.57	265.10	284.80	277.00	
	DMH 24-12	DMH 24-13	7.73	6.14	8.02	61.96	36	0.010	0.011	78.75	11.14	8.77	104.2	0.16	1.04	265.00	263.96	277.00	275.70	
	DMH 24-13	DMH 24-14	7.84	6.30	8.02	62.90	36	0.010	0.011	78.89	11.16	8.90	185.7	0.28	1.86	263.86	262.00	275.70	274.30	
	DMH 24-14	DMH 24-15	7.95	6.58	8.02	63.80	36	0.014	0.011	93.28	13.20	9.03	172.1	0.22	2.41	261.90	259.49	274.30	273.80	
	DMH 24-15	DMH 24-16	7.95	6.79	8.02	63.80	36	0.065	0.011	201.05	28.44	9.03	32.3	0.02	2.10	259.38	257.28	273.80	273.50	
	DMH 24-16	BASIN 2	7.95	6.81	8.02	63.80	36	0.020	0.011	111.81	15.82	9.03	24.9	0.03	0.50	252.50	252.00	274.80		
**	DMH 24-15	DMH 24-19	1.32	6.00	8.02	10.59	18	0.010	0.011	12.35	6.99	5.99	27.3	0.07	0.27	257.28	257.01	274.05	274.80	
**	DMH 24-19	DMH 24-16	1.32	6.00	8.02	10.59	24	0.010	0.011	26.33	8.38	3.37	16.5	0.03	0.16	256.51	256.35	274.80	274.85	

Basin Drawdown Tabulation

Stage-Area-Storage for Pond 5P: EX. BASIN #2

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
252.50	19,110	0
252.60	19,487	2,741
252.70	19,865	5,520
252.80	20,242	8,337
252.90	20,620	11,192
253.00	20,997	14,084
253.10	21,136	17,003
253.20	21,276	19,935
253.30	21,415	22,882
253.40	21,554	25,844
253.50	21,694	28,820
253.60	21,833	31,810
253.70	21,972	34,814
253.80	22,111	37,833
253.90	22,251	40,867
254.00	22,390	43,914
254.10	22,532	46,976
254.20	22,674	50,052
254.30	22,815	53,142
254.40	22,957	56,247
254.50	23,099	59,366
254.60	23,241	62,498
254.70	23,383	65,645
254.80	23,524	68,806
254.90	23,666	71,982
255.00	23,808	75,171
255.10	23,951	78,375
255.20	24,093	81,593
255.30	24,236	84,825
255.40	24,379	88,072
255.50	24,522	91,333
255.60	24,664	94,608
255.70	24,807	97,897
255.80	24,950	101,201
255.90	25,092	104,519
256.00	25,235	107,851
256.10	25,384	111,198
256.20	25,533	114,559
256.30	25,682	117,936
256.40	25,831	121,327
256.50	25,980	124,734
256.60	26,129	128,155
256.70	26,278	131,591
256.80	26,427	135,042
256.90	26,576	138,508
257.00	26,725	141,989
257.10	26,880	145,485
257.20	27,035	148,996
257.30	27,190	152,523
257.40	27,345	156,066
257.50	27,501	159,624
257.60	27,656	163,198

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
257.70	27,811	166,787
257.80	27,966	170,391
257.90	28,121	174,012
258.00	28,276	177,647
258.10	28,441	181,299
258.20	28,607	184,967
258.30	28,772	188,652
258.40	28,938	192,353
258.50	29,103	196,071
258.60	29,268	199,805
258.70	29,434	203,556
258.80	29,599	207,324
258.90	29,765	211,108
259.00	**29,930**	**214,908**

Hydrograph for Pond 5P: EX. BASIN #2

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)	Secondary (cfs)
0.00	0.00	0	252.50	0.00	0.00	0.00	**0.00**
2.00	0.78	768	252.53	0.46	0.46	0.00	0.00
4.00	1.30	4,948	252.68	0.49	0.49	0.00	0.00
6.00	1.73	12,198	252.93	0.54	0.54	0.00	0.00
8.00	2.15	22,091	253.27	0.59	0.59	0.00	0.00
10.00	3.38	37,012	253.77	0.66	0.66	0.00	0.00
12.00	**40.30**	85,175	255.31	0.89	0.89	0.00	0.00
14.00	**4.22**	**176,827**	**257.98**	**3.84**	**1.33**	**2.51**	0.00
16.00	2.46	**173,106**	**257.88**	**3.76**	**1.31**	**2.45**	0.00
18.00	2.10	163,191	257.60	3.55	1.26	2.29	0.00
20.00	1.74	152,333	257.29	3.30	1.21	2.09	0.00
22.00	1.38	140,804	256.97	3.01	1.16	1.85	0.00
24.00	0.98	128,918	256.62	2.67	1.10	1.57	0.00
26.00	0.00	112,139	256.13	2.06	1.02	1.03	0.00
28.00	0.00	101,059	255.80	1.04	0.97	0.07	0.00
30.00	0.00	94,161	255.59	0.94	0.94	0.00	0.00
32.00	0.00	87,537	255.38	0.90	0.90	0.00	0.00
34.00	0.00	81,137	255.19	0.87	0.87	0.00	0.00
36.00	0.00	74,955	254.99	0.84	0.84	0.00	0.00
38.00	0.00	68,984	254.81	0.81	0.81	0.00	0.00
40.00	0.00	63,217	254.62	0.79	0.79	0.00	0.00
42.00	0.00	57,648	254.44	0.76	0.76	0.00	0.00
44.00	0.00	52,270	254.27	0.73	0.73	0.00	0.00
46.00	0.00	47,076	254.10	0.71	0.71	0.00	0.00
48.00	0.00	42,062	253.94	0.68	0.68	0.00	0.00
50.00	0.00	37,220	253.78	0.66	0.66	0.00	0.00
52.00	0.00	32,545	253.62	0.64	0.64	0.00	0.00
54.00	0.00	28,030	253.47	0.62	0.62	0.00	0.00
56.00	0.00	23,672	253.33	0.59	0.59	0.00	0.00
58.00	0.00	19,464	253.18	0.57	0.57	0.00	0.00
60.00	0.00	15,401	253.05	0.55	0.55	0.00	0.00
62.00	0.00	11,491	252.91	0.53	0.53	0.00	0.00
64.00	0.00	7,765	252.78	0.50	0.50	0.00	0.00
66.00	0.00	4,219	252.65	0.48	0.48	0.00	0.00
68.00	0.00	845	252.53	0.46	0.46	0.00	0.00
70.00	0.00	0	252.50	0.00	0.00	0.00	0.00
72.00	0.00	0	252.50	0.00	0.00	0.00	0.00

Stage-Area-Storage for Pond 6P: Chambers

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
264.00	**11,965**	0
264.10	11,965	479
264.20	11,965	957
264.30	11,965	1,436
264.40	11,965	1,914
264.50	11,965	2,393
264.60	11,965	2,872
264.70	11,965	3,350
264.80	11,965	4,094
264.90	11,965	5,104
265.00	11,965	6,114
265.10	11,965	7,120
265.20	11,965	8,120
265.30	11,965	9,113
265.40	11,965	10,101
265.50	11,965	11,088
265.60	11,965	12,073
265.70	11,965	13,050
265.80	11,965	14,027
265.90	11,965	15,002
266.00	11,965	15,971
266.10	11,965	16,933
266.20	11,965	17,888
266.30	11,965	18,837
266.40	11,965	19,781
266.50	11,965	20,722
266.60	11,965	21,656
266.70	11,965	22,588
266.80	11,965	23,515
266.90	11,965	24,435
267.00	11,965	25,348
267.10	11,965	26,255
267.20	11,965	27,151
267.30	11,965	28,033
267.40	11,965	28,904
267.50	11,965	29,768
267.60	11,965	30,621
267.70	11,965	31,457
267.80	11,965	32,274
267.90	11,965	33,075
268.00	11,965	33,859
268.10	11,965	34,627
268.20	11,965	35,366
268.30	11,965	36,075
268.40	11,965	36,743
268.50	11,965	37,356
268.60	11,965	37,917
268.70	11,965	38,440
268.80	11,965	38,926
268.90	11,965	39,404
269.00	11,965	39,883
269.10	11,965	40,362

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
269.20	11,965	40,840
269.30	11,965	41,319
269.40	11,965	41,797
269.50	11,965	42,276
269.60	11,965	42,755
269.70	11,965	**43,233**
269.80	11,965	**43,472**
269.90	11,965	43,472
270.00	11,965	43,472
270.10	11,965	43,472
270.20	11,965	43,472
270.30	11,965	43,472

Hydrograph for Pond 6P: Chambers

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)
0.00	0.00	0	264.00	0.00	0.00	0.00
2.00	0.08	5	264.00	0.07	0.07	0.00
4.00	0.33	24	264.00	0.33	0.33	0.00
6.00	0.56	40	264.01	0.56	0.56	0.00
8.00	0.77	224	264.05	0.67	0.67	0.00
10.00	1.35	2,325	264.49	0.74	0.74	0.00
12.00	**18.16**	**21,032**	**266.53**	**1.06**	**1.06**	**0.00**
14.00	**1.97**	**42,698**	**269.59**	**2.05**	**1.53**	**0.51**
16.00	1.31	41,940	269.43	1.51	1.51	0.00
18.00	1.13	40,059	269.04	1.45	1.45	0.00
20.00	0.94	37,349	268.50	1.37	1.37	0.00
22.00	0.74	33,846	268.00	1.29	1.29	0.00
24.00	0.55	29,517	267.47	1.21	1.21	0.00
26.00	0.00	21,623	266.60	1.07	1.07	0.00
28.00	0.00	14,356	265.83	0.95	0.95	0.00
30.00	0.00	7,878	265.18	0.85	0.85	0.00
32.00	0.00	2,110	264.44	0.74	0.74	0.00
34.00	0.00	0	264.00	0.00	0.00	0.00
36.00	0.00	0	264.00	0.00	0.00	0.00
38.00	0.00	0	264.00	0.00	0.00	0.00
40.00	0.00	0	264.00	0.00	0.00	0.00
42.00	0.00	0	264.00	0.00	0.00	0.00
44.00	0.00	0	264.00	0.00	0.00	0.00
46.00	0.00	0	264.00	0.00	0.00	0.00
48.00	0.00	0	264.00	0.00	0.00	0.00
50.00	0.00	0	264.00	0.00	0.00	0.00
52.00	0.00	0	264.00	0.00	0.00	0.00
54.00	0.00	0	264.00	0.00	0.00	0.00
56.00	0.00	0	264.00	0.00	0.00	0.00
58.00	0.00	0	264.00	0.00	0.00	0.00
60.00	0.00	0	264.00	0.00	0.00	0.00
62.00	0.00	0	264.00	0.00	0.00	0.00
64.00	0.00	0	264.00	0.00	0.00	0.00
66.00	0.00	0	264.00	0.00	0.00	0.00
68.00	0.00	0	264.00	0.00	0.00	0.00
70.00	0.00	0	264.00	0.00	0.00	0.00
72.00	0.00	0	264.00	0.00	0.00	0.00

NRCS Soils Report

United States Department of Agriculture

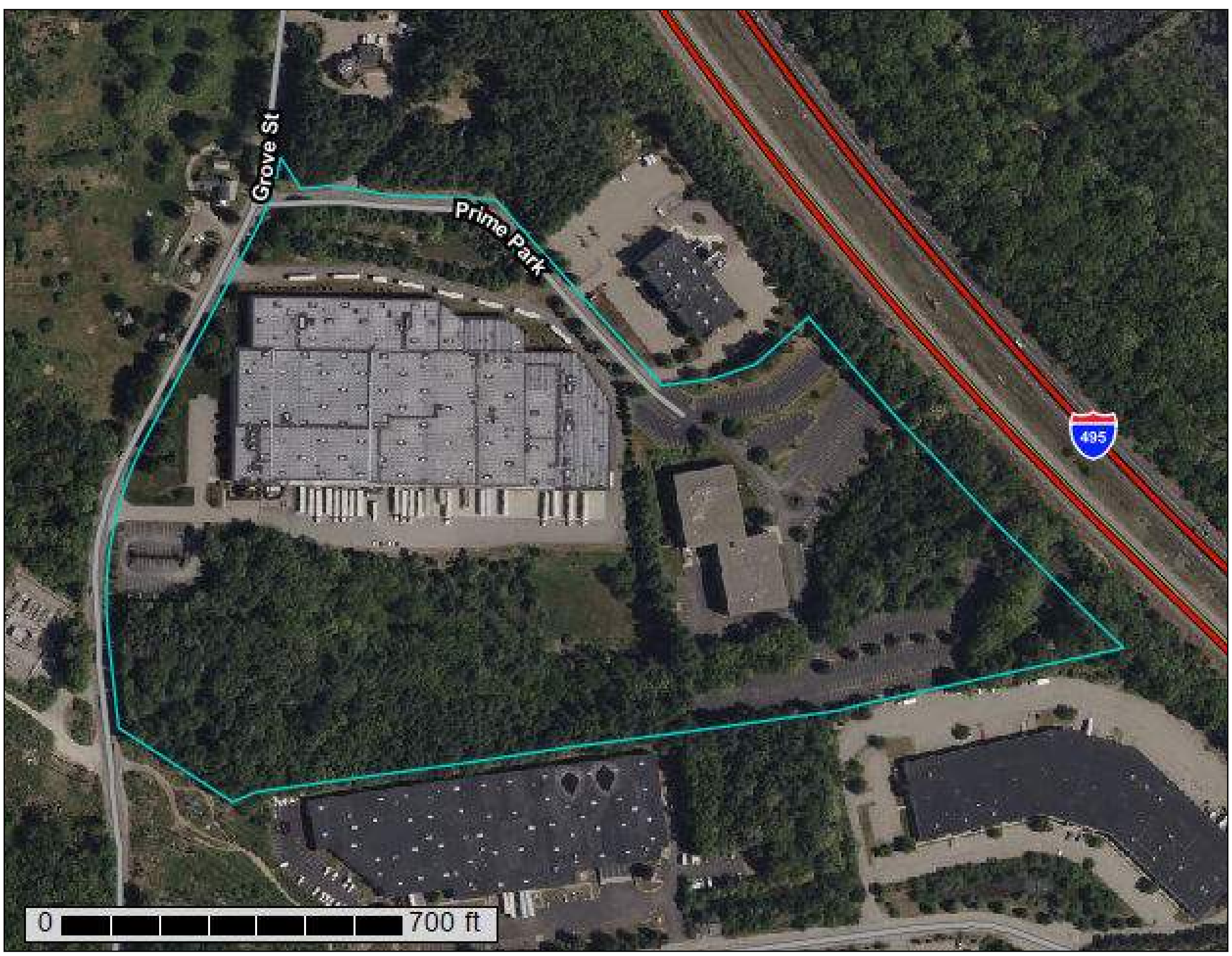
NRCS

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

Norfolk and Suffolk Counties, Massachusetts



October 18, 2024

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 alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

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.

Soil Map

Map Scale: 1:3,500 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0, 50, 100, 200, 300

Feet: 0, 150, 300, 600, 900

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Norfolk and Suffolk Counties, Massachusetts
Survey Area Data: Version 20, Aug 27, 2024

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
1	Water	0.9	2.4%
10	Scarboro and Birdsall soils, 0 to 3 percent slopes	3.3	8.7%
71B	Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony	0.0	0.1%
103B	Charlton-Hollis-Rock outcrop complex, 3 to 8 percent slopes	4.8	12.8%
245B	Hinckley loamy sand, 3 to 8 percent slopes	5.2	14.0%
253D	Hinckley loamy sand, 15 to 35 percent slopes	4.1	11.0%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	6.9	18.4%
255C	Windsor loamy sand, 8 to 15 percent slopes	7.6	20.3%
653	Udorthents, sandy	4.6	12.2%
Totals for Area of Interest		**37.5**	**100.0%**

Map Unit Descriptions

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

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

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

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

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

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

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

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

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

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

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

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

Norfolk and Suffolk Counties, Massachusetts

1—Water

Map Unit Setting

National map unit symbol: vkyp
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 120 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

10—Scarboro and Birdsall soils, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: vkxw
Elevation: 0 to 2,100 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Scarboro and similar soils: 65 percent
Birdsall and similar soils: 25 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Scarboro

Setting

Landform: Terraces
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Loose sandy glaciofluvial deposits

Typical profile

H1 - 0 to 9 inches: mucky fine sandy loam
H2 - 9 to 60 inches: stratified loamy fine sand to 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): High to very high (6.00 to 20.00 in/hr)

Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: Low (about 5.1 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

Description of Birdsall

Setting

Landform: Terraces
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Soft coarse-silty glaciolacustrine deposits

Typical profile

H1 - 0 to 8 inches: very fine sandy loam
H2 - 8 to 16 inches: very fine sandy loam
H3 - 16 to 60 inches: silt loam

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 low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: Very high (about 12.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: C/D
Ecological site: F144AY031MA - Very Wet Outwash
Hydric soil rating: Yes

Minor Components

Swansea

Percent of map unit: 5 percent
Landform: Bogs
Hydric soil rating: Yes

Raynham

Percent of map unit: 3 percent
Landform: Depressions
Hydric soil rating: Yes

Walpole

Percent of map unit: 2 percent
Landform: Terraces
Hydric soil rating: Yes

71B—Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 2w69c
Elevation: 0 to 1,290 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Ridgebury, Extremely Stony

Setting

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
Across-slope shape: Concave
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 6 inches: fine sandy loam
Bw - 6 to 10 inches: sandy loam
Bg - 10 to 19 inches: gravelly sandy loam
Cd - 19 to 66 inches: gravelly sandy loam

Properties and qualities

Slope: 3 to 8 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 15 to 35 inches to densic material
Drainage class: Poorly 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 0 to 6 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 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: F144AY009CT - Wet Till Depressions
Hydric soil rating: Yes

Minor Components

Woodbridge, extremely stony

Percent of map unit: 10 percent
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
Hydric soil rating: No

Whitman, extremely stony

Percent of map unit: 8 percent
Landform: Depressions
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Paxton, extremely stony

Percent of map unit: 2 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

103B—Charlton-Hollis-Rock outcrop complex, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: vktd
Elevation: 0 to 480 feet
Mean annual precipitation: 32 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 120 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Charlton and similar soils: 40 percent
Hollis and similar soils: 25 percent
Rock outcrop: 20 percent

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

Description of Charlton

Setting

Landform: Hills
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Friable coarse-loamy ablation till derived from granite

Typical profile

H1 - 0 to 6 inches: fine sandy loam
H2 - 6 to 36 inches: fine sandy loam
H3 - 36 to 60 inches: fine sandy loam

Properties and qualities

Slope: 3 to 8 percent
Surface area covered with cobbles, stones or boulders: 1.6 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 high to high (0.60 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Description of Hollis

Setting

Landform: Hills
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Shallow, friable loamy ablation till derived from igneous rock

Typical profile

H1 - 0 to 3 inches: fine sandy loam
H2 - 3 to 14 inches: gravelly fine sandy loam
H3 - 14 to 18 inches: unweathered bedrock

Properties and qualities

Slope: 3 to 8 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
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: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 1.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Ecological site: F144AY033MA - Shallow Dry Till Uplands
Hydric soil rating: No

Description of Rock Outcrop

Setting

Parent material: Igneous and metamorphic rock

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 0 inches to lithic bedrock

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: Unranked

Minor Components

Canton

Percent of map unit: 7 percent
Hydric soil rating: No

Chatfield

Percent of map unit: 5 percent
Hydric soil rating: No

Scituate

Percent of map unit: 2 percent
Hydric soil rating: No

Whitman

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

245B—Hinckley loamy sand, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2svm8
Elevation: 0 to 1,430 feet
Mean annual precipitation: 36 to 53 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 250 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

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

Description of Hinckley

Setting

Landform: Outwash deltas, outwash terraces, kames, kame terraces, moraines, eskers, outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope
Landform position (three-dimensional): Nose slope, side slope, base slope, crest, riser, tread
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Parent material: Sandy and gravelly glaciofluvial deposits derived from gneiss and/or granite and/or schist

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 8 inches: loamy sand
Bw1 - 8 to 11 inches: gravelly loamy sand
Bw2 - 11 to 16 inches: gravelly loamy sand
BC - 16 to 19 inches: very gravelly loamy sand
C - 19 to 65 inches: very gravelly sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: 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
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)

Available water supply, 0 to 60 inches: Very low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Minor Components

Windsor

Percent of map unit: 8 percent
Landform: Outwash deltas, outwash terraces, moraines, eskers, kames, outwash plains, kame terraces
Landform position (two-dimensional): Summit, shoulder, backslope, footslope
Landform position (three-dimensional): Nose slope, side slope, base slope, crest, riser, tread
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Hydric soil rating: No

Sudbury

Percent of map unit: 5 percent
Landform: Outwash deltas, outwash terraces, moraines, outwash plains, kame terraces
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Head slope, side slope, base slope, tread
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Hydric soil rating: No

Agawam

Percent of map unit: 2 percent
Landform: Outwash deltas, outwash terraces, moraines, eskers, kames, outwash plains, kame terraces
Landform position (two-dimensional): Summit, shoulder, backslope, footslope
Landform position (three-dimensional): Nose slope, side slope, base slope, crest, riser, tread
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Hydric soil rating: No

253D—Hinckley loamy sand, 15 to 35 percent slopes

Map Unit Setting

National map unit symbol: 2svmd
Elevation: 0 to 860 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

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

Description of Hinckley

Setting

Landform: Outwash deltas, outwash terraces, moraines, eskers, kames, outwash plains, kame terraces
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Head slope, nose slope, side slope, crest, riser
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Parent material: Sandy and gravelly glaciofluvial deposits derived from gneiss and/or granite and/or schist

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 8 inches: loamy sand
Bw1 - 8 to 11 inches: gravelly loamy sand
Bw2 - 11 to 16 inches: gravelly loamy sand
BC - 16 to 19 inches: very gravelly loamy sand
C - 19 to 65 inches: very gravelly sand

Properties and qualities

Slope: 15 to 35 percent
Depth to restrictive feature: More than 80 inches
Drainage class: 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
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Minor Components

Windsor

Percent of map unit: 10 percent
Landform: Moraines, eskers, kames, outwash deltas, outwash terraces, outwash plains, kame terraces
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Head slope, nose slope, side slope, crest, riser

Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Hydric soil rating: No

Merrimac

Percent of map unit: 3 percent
Landform: Kame terraces, outwash plains, outwash terraces, moraines, eskers, kames
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Head slope, nose slope, side slope, crest, riser
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Hydric soil rating: No

Sudbury

Percent of map unit: 2 percent
Landform: Outwash deltas, outwash plains, kame terraces, outwash terraces, moraines
Landform position (two-dimensional): Backslope, footslope, toeslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Hydric soil rating: No

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

Map Unit Setting

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

Map Unit Composition

Merrimac and similar soils: 86 percent
Minor components: 14 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): Side slope, crest, riser, tread
Down-slope shape: Convex
Across-slope shape: Convex

Parent material: Loamy glaciofluvial deposits derived from granite, schist, and gneiss over sandy and gravelly glaciofluvial deposits derived from granite, schist, and gneiss

Typical profile

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

Properties and qualities

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

Interpretive groups

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

Minor Components

Hinckley

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

Sudbury

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

Windsor

Percent of map unit: 3 percent
Landform: Dunes, deltas, outwash terraces, outwash plains
Landform position (two-dimensional): Summit

Landform position (three-dimensional): Tread, riser
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Hydric soil rating: No

Walpole

Percent of map unit: 1 percent
Landform: Depressions
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: F144AY028MA - Wet Outwash
Hydric soil rating: Yes

255C—Windsor loamy sand, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2svkq
Elevation: 0 to 1,260 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

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

Description of Windsor

Setting

Landform: — error in exists on —
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, riser
Down-slope shape: Convex
Across-slope shape: Convex, linear
Parent material: Loose sandy glaciofluvial deposits derived from granite and/or loose sandy glaciofluvial deposits derived from schist and/or loose sandy glaciofluvial deposits derived from gneiss

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
Ap - 1 to 11 inches: loamy sand
Bw - 11 to 31 inches: loamy sand
C - 31 to 65 inches: sand

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained

Runoff class: 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
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.2 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Minor Components

Hinckley
Percent of map unit: 10 percent
Landform: Deltas, kames, eskers, outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Head slope, nose slope, side slope, crest, rise
Down-slope shape: Convex
Across-slope shape: Convex, linear
Hydric soil rating: No

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

653—Udorthents, sandy

Map Unit Setting
National map unit symbol: vky8
Elevation: 0 to 3,000 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition
Udorthents and similar soils: 85 percent
Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents

Setting

Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Riser, tread
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Parent material: Excavated and filled sandy glaciofluvial deposits

Typical profile

H1 - 0 to 6 inches: variable
H2 - 6 to 60 inches: variable

Properties and qualities

Slope: 0 to 25 percent
Depth to restrictive feature: More than 80 inches
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to very high (0.06 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Hydric soil rating: Unranked

Minor Components

Udorthents

Percent of map unit: 8 percent
Hydric soil rating: Unranked

Urban land

Percent of map unit: 5 percent
Hydric soil rating: Unranked

Swansea

Percent of map unit: 2 percent
Landform: Bogs
Hydric soil rating: Yes

Soil Information for All Uses

Soil Properties and Qualities

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

Soil Qualities and Features

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

Hydrologic Soil Group

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

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

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

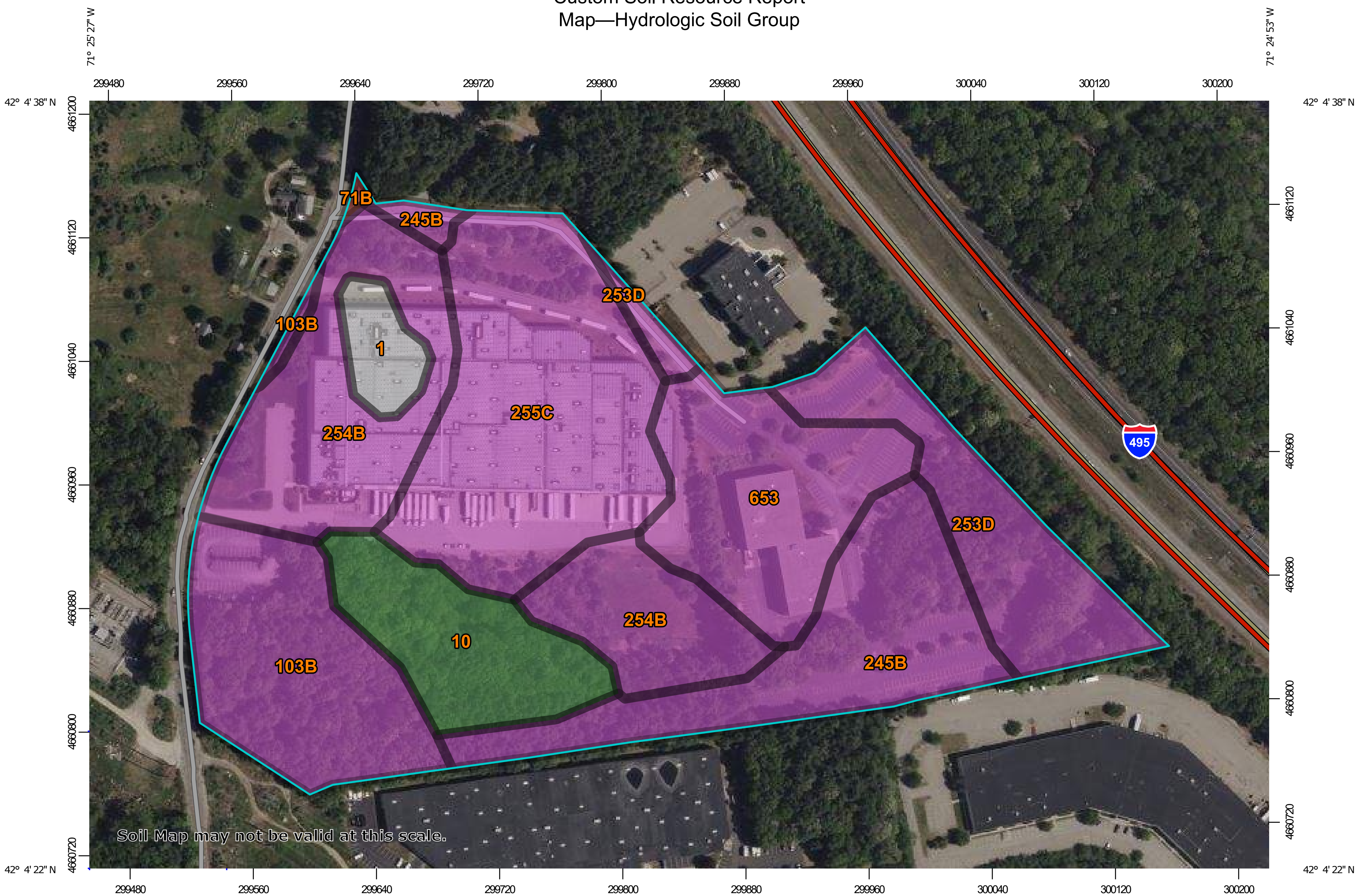
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

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

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

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

Map—Hydrologic Soil Group



Map Scale: 1:3,500 if printed on A landscape (11" x 8.5") sheet.

0 50 100 200 300 Meters

0 150 300 600 900 Feet

N

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 Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

Streams and Canals

Transportation

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

Background

Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Norfolk and Suffolk Counties, Massachusetts
Survey Area Data: Version 20, Aug 27, 2024

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.

Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
1	Water		0.9	2.4%
10	Scarboro and Birdsall soils, 0 to 3 percent slopes	A/D	3.3	8.7%
71B	Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony	D	0.0	0.1%
103B	Charlton-Hollis-Rock outcrop complex, 3 to 8 percent slopes	A	4.8	12.8%
245B	Hinckley loamy sand, 3 to 8 percent slopes	A	5.2	14.0%
253D	Hinckley loamy sand, 15 to 35 percent slopes	A	4.1	11.0%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	A	6.9	18.4%
255C	Windsor loamy sand, 8 to 15 percent slopes	A	7.6	20.3%
653	Udorthents, sandy	A	4.6	12.2%
Totals for Area of Interest			**37.5**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

References

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

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

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

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

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

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

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

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

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

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

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

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

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

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

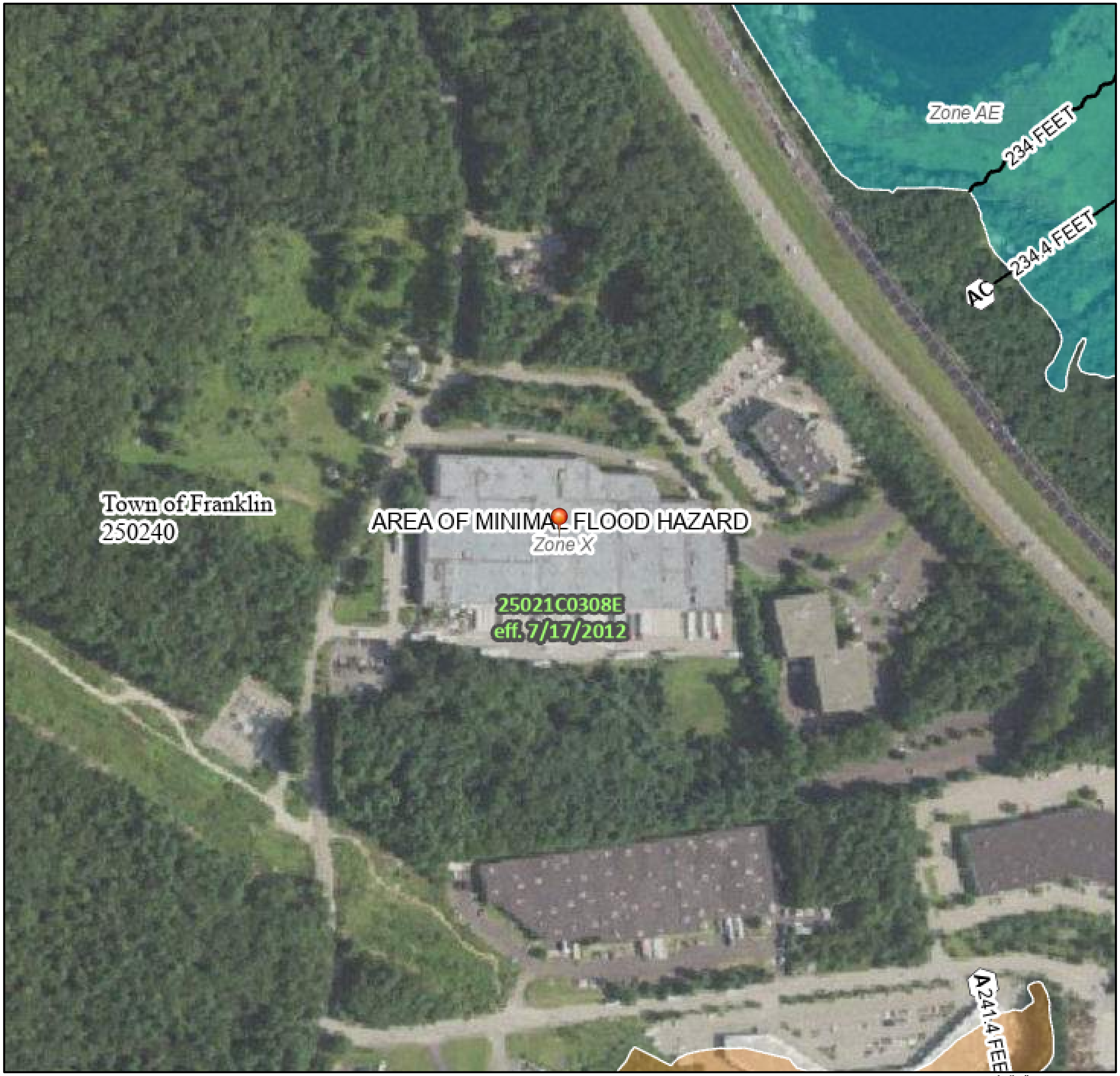
United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

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

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

1DWLRQDO)ORRG+D]DUG/D\HU)5,5PHWWH

FEMA



/HJHQG

%DVHPDS,PDJHU\6RXUFH 86*61DWLRQDO0DS

TSS Removal Worksheet

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

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

Location: 126 Grove Street - Infiltration Basin #2

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Infiltration Basin #2	80%	1.00	80%	20%

Total TSS Removal = 80%

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

Project: F-4593
Prepared By: Michael Hassett
Date: 2025-03-26

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

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

Mass. Dept. of Environmental Protection

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

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

TSS Removal Calculation Worksheet

Location: 126 Grove Street - Infiltration Basin #2

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump Hooded Catch Basin	0.25	1.00	0.25	0.75
Contech Hydrodynamic Separator	0.50	0.75	0.375	0.375

Pretreatment

Total TSS Removal = 62.5%

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

Project: F-4593

Prepared By: Michael Hassett

Date: 2025-03-26

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

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

1. From MassDEP Stormwater Handbook Vol. 1

Mass. Dept. of Environmental Protection

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

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

Location: 126 Grove Street - SUBSURFACE INFILTRATION SYSTEM

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Cultec Recharger 902HD Chambers	80%	1.00	80%	20%

Total TSS Removal = 80%

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

Project: F-4593
Prepared By: Michael Hassett
Date: 2025-03-26

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

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

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

Location: 126 Grove Street - SUBSURFACE INFILTRATION SYSTEM

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump Hooded Catch Basin	0.25	1.00	0.25	
SEPARATOR ROW	0.25	0.75	0.1875	0.56

Pretreatment

Total TSS Removal = 44%

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

Project: F-4593
Prepared By: Michael Hassett
Date: 2025-03-26

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

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

Mass. Dept. of Environmental Protection

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

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

TSS Removal Calculation Worksheet

Location: 126 Grove Street - Stormwater Basin #1

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Detention/Infiltration Basin #1	80%	1.00	80%	20%

Total TSS Removal = 80%

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

Project: F-4593
Prepared By: Michael Hassett
Date: 2025-03-26

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

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

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

Location: 126 Grove Street - Stormwater Basin #1

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump Hooded Catch Basin	0.25	**1.00**	0.25	0.75
Contech Hydrodynamic Separator	0.50	0.75	0.375	0.375

Pretreatment

Total TSS Removal = 62.5%

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

Project: F-4593

Prepared By: Michael Hassett

Date: 2025-03-26

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

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

1. From MassDEP Stormwater Handbook Vol. 1

Mass. Dept. of Environmental Protection

<u>Contech worksheet</u>

Estimated Net Annual Solids Load Reduction
Based on the Rational Rainfall Method

CONTECH ENGINEERED SOLUTIONS

CASCADE separator™

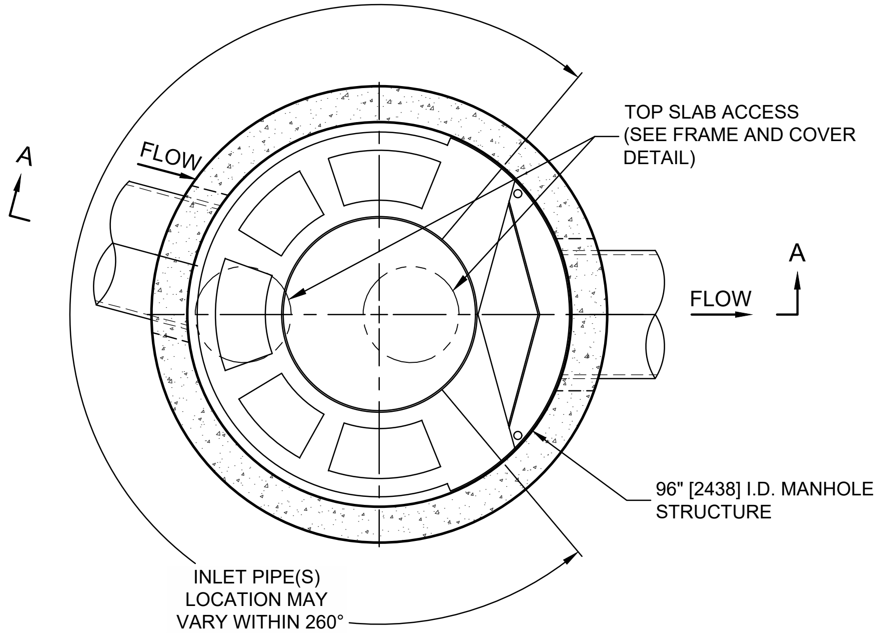
126 Grove Street
Franklin, MA
DMH 24-15

AREA	8.14	acres	CASCADE MODEL	CS-8	
WEIGHTED C	0.90		PARTICLE SIZE	110	microns
TC	6.00	minutes	RAINFALL STATION	68	

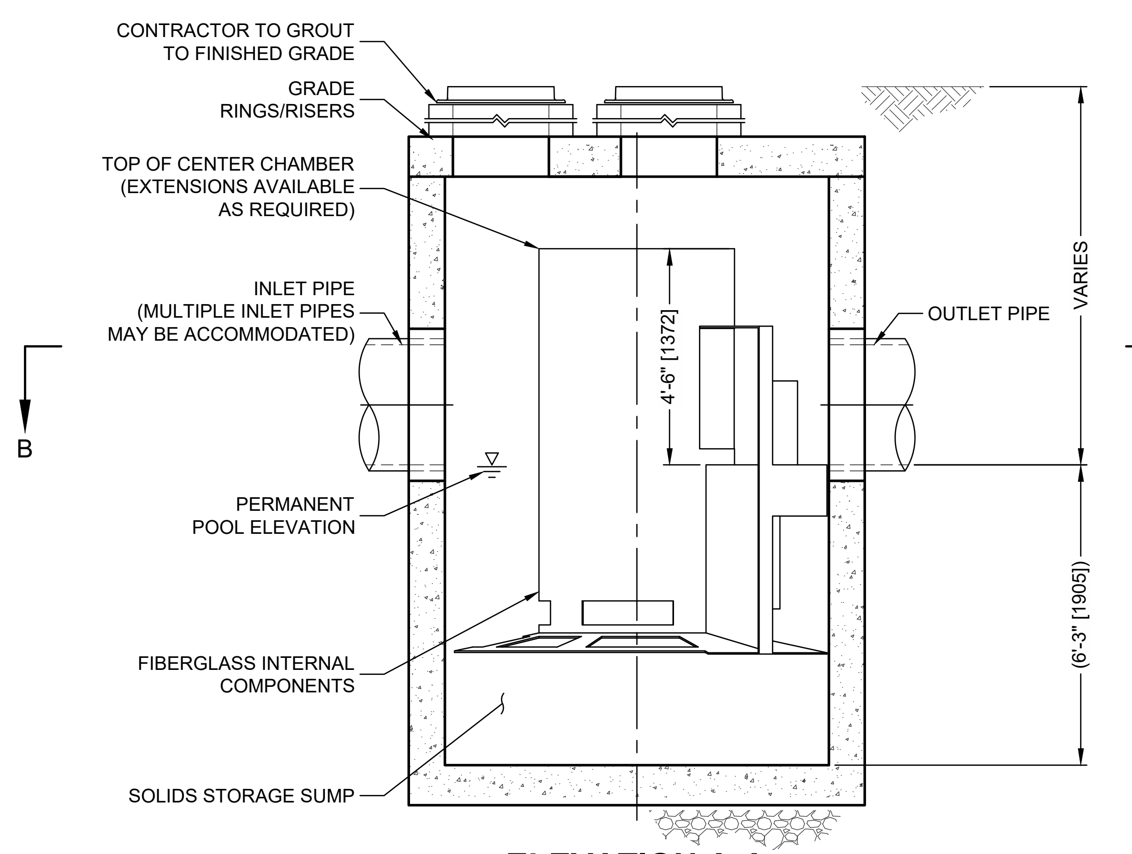
Rainfall Intensity[1] (in/hr)	Percent Rainfall Volume[1]	Hydraulic Loading Rate (gpm/ft2)	Removal Efficiency (%)	Incremental Removal (%)
0.02	9.3%	1.31	100.0	9.3
0.04	9.5%	2.62	100.0	9.5
0.06	8.7%	3.92	100.0	8.7
0.08	10.1%	5.23	100.0	10.1
0.10	7.2%	6.54	100.0	7.2
0.12	6.0%	7.85	100.0	6.0
0.14	6.3%	9.15	100.0	6.3
0.16	5.6%	10.46	100.0	5.6
0.18	4.7%	11.77	100.0	4.7
0.20	3.6%	13.08	99.6	3.6
0.25	8.2%	16.35	96.5	7.9
0.50	14.9%	32.70	81.2	12.1
0.75	3.2%	49.04	65.8	2.1
1.00	1.2%	65.39	50.4	0.6
1.50	0.7%	98.09	19.7	0.1
2.00	0.8%	130.78	0.0	0.0
				93.8
			Removal Efficiency Adjustment[2] =	6.5%
			Predicted % Annual Rainfall Treated =	93.5%
			Predicted Net Annual Load Removal Efficiency =	87.4%

1 - Based on 10 years of rainfall data from NCDC station 736, Blue Hill, Norfolk County, MA

2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.



PLAN VIEW B-B
NOT TO SCALE



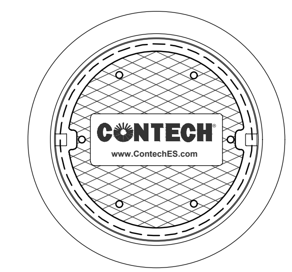
ELEVATION A-A
NOT TO SCALE

CASCADE
separator™

CASCADE SEPARATOR DESIGN NOTES

CS-8 RATED TREATMENT CAPACITY IS 12.00 CFS, OR PER LOCAL REGULATIONS.
THE STANDARD CS-8 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



FRAME AND COVER
(DIAMETER VARIES)
NOT TO SCALE

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID			
WATER QUALITY FLOW RATE (cfs [L/s])			
PEAK FLOW RATE (cfs [L/s])			
RETURN PERIOD OF PEAK FLOW (yrs)			
RIM ELEVATION			
PIPE DATA:	INVERT	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE			
NOTES / SPECIAL REQUIREMENTS:			

GENERAL NOTES
1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. FOR SITE SPECIFIC DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHT, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.ContechES.com
3. CASCADE SEPARATOR WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING. CONTRACTOR TO CONFIRM STRUCTURE MEETS REQUIREMENTS OF PROJECT.
4. CASCADE SEPARATOR STRUCTURE SHALL MEET AASHTO HS20 LOAD RATING, ASSUMING EARTH COVER OF 0' - 2' [610], AND GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET AASHTO M306 AND BE CAST WITH THE CONTECH LOGO.
5. CASCADE SEPARATOR STRUCTURE SHALL BE PRECAST CONCRETE CONFORMING TO ASTM C478 AND AASHTO LOAD FACTOR DESIGN METHOD.
6. ALTERNATE UNITS ARE SHOWN IN MILLIMETERS [mm].

INSTALLATION NOTES
A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CASCADE SEPARATOR MANHOLE STRUCTURE.
C. CONTRACTOR TO INSTALL JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT INLET AND OUTLET PIPE(S). MATCH PIPE INVERTS WITH ELEVATIONS SHOWN. ALL PIPE CENTERLINES TO MATCH PIPE OPENING CENTERLINES.
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

CS-8
CASCADE SEPARATOR
STANDARD DETAIL

I:\STORMWATER\JURISDICTIONS\USA\MA_SDE DESIGN TOOLS_STANDARD DETAILS\CASCADE\CS-8-DTL.DWG 4/16/2020 11:00 AM

SECTION (_____)
STORM WATER TREATMENT DEVICE

1.0 GENERAL

1.1 This item shall govern the furnishing and installation of the Cascade Separator® 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 Cascade Separator™ device manufactured by:

Contech Engineered Solutions LLC
9100 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 Hardware shall be manufactured of Type 316 stainless steel conforming to ASTM A 320;
- 2.2.2 Support brackets shall be manufactured of 5052 aluminum
- 2.2.3 Fiberglass components shall conform to applicable sections of ASTM D-4097
- 2.2.4 Polypropylene copolymer components shall conform to a tensile strength of 3,600 psi (ASTM D-638), and Izod impact value of “no break” (ASTM D-256).
- 2.2.5 Access system(s) conform to the following:
  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 or treat a flow rate designated by the jurisdiction in which the project is located. Both methods should be sized using the OK-110 particle distribution having particles ranging from 53 microns to 212 microns with a d50 of around 110 microns.

3.2 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. 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.

3.3 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.

3.4 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.

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

Cascade Model	Minimum Sump Storage Capacity (yd^3)	Minimum Oil Storage Capacity (gal)
CS-3	0.41	59.0
CS-4	0.70	141.0
CS-5	1.09	269.3
CS-6	1.57	475.9
CS-8	2.79	1128.0
CS-10	4.36	2203.2
CS-12	6.28	3807.1

END OF SECTION

Center for Environmental Systems

Stevens Institute of Technology

One Castle Point

Hoboken, NJ 07030-0000

November 6, 2018

Gabriel Mahon, Chief
NJDEP
Bureau of Non-Point Pollution Control
Bureau of Water Quality
401 E. State Street
Mail Code 401-02B, PO Box 420
Trenton, NJ 08625-0420

Dear Mr. Mahon,

Based on my review, evaluation and assessment of the testing conducted on a full-scale, commercially available Contech Cascade Separator (CS-4) at Contech's Portland, Oregon laboratory facility with Scott Wells, Ph.D., from Portland State University, and associates providing independent third-part oversight, the test protocol requirements contained in the "New Jersey Department of Environmental Protection Laboratory Protocol to Assess Total Suspended Solids Removal by a Hydrodynamic Sedimentation Manufactured Treatment Device" (NJDEP Filter Protocol, January 2013) were met consistent with the NJDEP Approval Process. Specifically:

Test Sediment Feed

The sediment used for removal efficiency tests was a ground and whole-grain silica blend with a specific gravity of 2.65. Twelve subsamples, taken from varying locations within the test sediment batch were composited. Three samples taken from the composite were pulled and analyzed for PSD and moisture content according to ASTM D422-63 (2007). The sampling and analysis were conducted in-house, under third party observation prior to testing. The sediment met the NJDEP Protocol specifications and the d_{50} of the sediment was 64 µm, significantly less than the NJDEP specification of <75 µm.

Scour Test Sediment

The test sediment used for the scour testing was a blend of whole-grain silica with a specific gravity of 2.65. Prior to testing, twelve subsamples were taken from three randomly chosen bags of the sediment batch and composited. Three samples taken from the composite were then analyzed for PSD according to ASTM D422-63 (2007). The sampling and analysis were conducted in-house, under third party observation prior to testing. The sediment met the NJDEP Protocol specifications.

Removal Efficiency Testing

Removal efficiency testing followed the effluent grab sampling test method outlined in Section 5 of the NJDEP Protocol. The weighted sediment removal efficiency of the Cascade Separator (CS-4) (MTFR 808 gpm, 1.80 cfs) was 50.0%.

Scour Testing

Scour testing of the Cascade Separator (CS-4) was conducted in accordance with Section 4 of the NJDEP Protocol at a target flow rate greater than 200% of the Cascade Separator MTFR to qualify the MTD for online installation. The average test flow rate was 3.99 cfs or 222% of the 1.80 cfs MTFR. The average adjusted effluent SSC for this test was 1.68 mg/L, well below the maximum allowable SSC of 20 mg/L, qualifying the Contech Cascade separator for online installation.

Sincerely,

Richard S Magee

Richard S. Magee, Sc.D., P.E., BCEE

CONTECH®
ENGINEERED SOLUTIONS

Cascade Separator® Inspection and Maintenance Guide

CASCADE
separator®

Maintenance

The Cascade Separator® system should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects sediment and debris will depend upon on-site activities and site pollutant characteristics. For example, unstable soils or heavy winter sanding will cause the sediment storage sump to fill more quickly but regular sweeping of paved surfaces will slow accumulation.

Inspection

Inspection is the key to effective maintenance and is easily performed. Pollutant transport and deposition may vary from year to year and regular inspections will help ensure that the system is cleaned out at the appropriate time. At a minimum, inspections should be performed twice per year (i.e. spring and fall). However, more frequent inspections may be necessary in climates where winter sanding operations may lead to rapid accumulations, or in equipment wash-down areas. Installations should also be inspected more frequently where excessive amounts of trash are expected.

A visual inspection should ascertain that the system components are in working order and that there are no blockages or obstructions in the inlet chamber, flumes or outlet channel. The inspection should also quantify the accumulation of hydrocarbons, trash and sediment in the system. Measuring pollutant accumulation can be done with a calibrated dipstick, tape measure or other measuring instrument. If absorbent material is used for enhanced removal of hydrocarbons, the level of discoloration of the sorbent material should also be identified during inspection. It is useful and often required as part of an operating permit to keep a record of each inspection. A simple form for doing so is provided in this Inspection and Maintenance Guide.

Access to the Cascade Separator unit is typically achieved through one manhole access cover. The opening allows for inspection and cleanout of the center chamber (cylinder) and sediment storage sump, as well as inspection of the inlet chamber and slanted skirt. For large units, multiple manhole covers allow access to the chambers and sump.

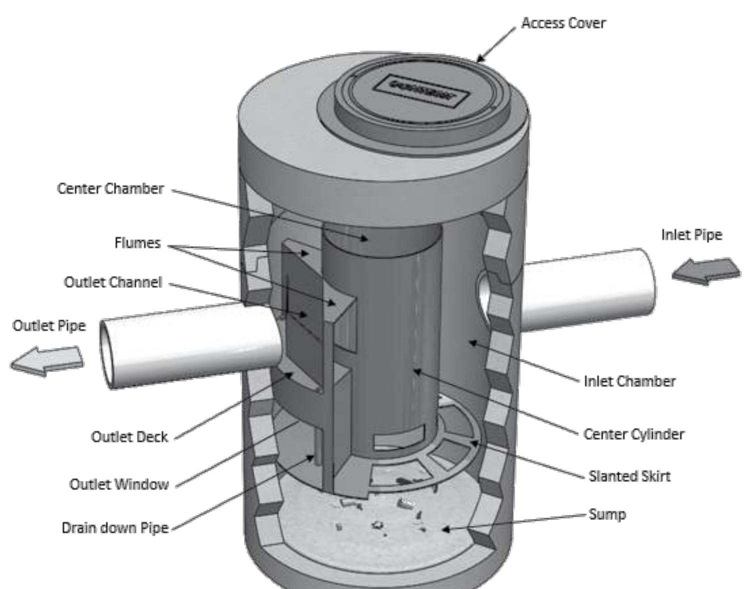
The Cascade Separator system should be cleaned before the level of sediment in the sump reaches the maximum sediment depth and/or when an appreciable level of hydrocarbons and trash has accumulated. If sorbent material is used, it must be replaced when significant discoloration has occurred. Performance may be impacted when maximum sediment storage capacity is exceeded. Contech recommends maintaining the system when sediment level reaches 50% of maximum storage volume. The level of sediment is easily determined by measuring the distance from the system outlet invert (standing water level) to the top of the sediment pile. To avoid underestimating the level of sediment in the chamber, the measuring device must be lowered to the top of the sediment pile carefully. Finer, silty particles at the top of the pile typically offer less resistance to the end of the rod than larger particles toward the bottom of the pile. Once this measurement is recorded, it should be compared to the chart in this document to determine if the height of the sediment pile off the bottom of the sump floor exceeds 50% of the maximum sediment storage.

Cleaning

Cleaning of a Cascade Separator system should be done during dry weather conditions when no flow is entering the system. The use of a vacuum truck is generally the most effective and convenient method of removing pollutants from the system. Simply remove the manhole cover and insert the vacuum tube down through the center chamber and into the sump. The system should be completely drained down and the sump fully evacuated of sediment. The areas outside the center chamber and the slanted skirt should also be washed off if pollutant build-up exists in these areas.

In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, the system should be cleaned out immediately in the event of an oil or gasoline spill. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use absorbent pads since they are usually less expensive to dispose than the oil/water emulsion that may be created by vacuuming the oily layer. Trash and debris can be netted out to separate it from the other pollutants. Then the system should be power washed to ensure it is free of trash and debris.

Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and to ensure proper safety precautions. Confined space entry procedures need to be followed if physical access is required. Disposal of all material removed from the Cascade Separator system must be done in accordance with local regulations. In many locations, disposal of evacuated sediments may be handled in the same manner as disposal of sediments removed from catch basins or deep sump manholes. Check your local regulations for specific requirements on disposal. If any components are damaged, replacement parts can be ordered from the manufacturer.



Cascade Separator® Maintenance Indicators and Sediment Storage Capacities

Model Number	Diameter		Distance from Water Surface to Top of Sediment Pile		Sediment Storage Capacity	
	ft	m	ft	m	y^3	m^3
CS-3	3	0.9	1.5	0.5	0.4	0.3
CS-4	4	1.2	2.5	0.8	0.7	0.5
CS-5	5	1.3	3	0.9	1.1	0.8
CS-6	6	1.8	3.5	1	1.6	1.2
CS-8	8	2.4	4.8	1.4	2.8	2.1
CS-10	10	3.0	6.2	1.9	4.4	3.3
CS-12	12	3.6	7.5	2.3	6.3	4.8

Note: The information in the chart is for standard units. Units may have been designed with non-standard sediment storage depth.

A Cascade Separator unit can be easily cleaned in less than 30 minutes.

A vacuum truck excavates pollutants from the systems.

Cascade Separator® Inspection & Maintenance Log

Cascade Model:		Location:			
Date	Depth Below Invert to Top of Sediment[1]	Floatable Layer Thickness[2]	Describe Maintenance Performed	Maintenance Personnel	Comments

1. The depth to sediment is determined by taking a measurement from the manhole outlet invert (standing water level) to the top of the sediment pile. Once this measurement is recorded, it should be compared to the chart in the maintenance guide to determine if the height of the sediment pile off the bottom of the sump floor exceeds 50% of the maximum sediment storage. Note: to avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile.
2. For optimum performance, the system should be cleaned out when the floating hydrocarbon layer accumulates to an appreciable thickness. In the event of an oil spill, the system should be cleaned immediately.

SUPPORT

- Drawings and specifications are available at www.ContechES.com.
- Site-specific design support is available from our engineers.

CONTECH ENGINEERED SOLUTIONS
800-925-5240
www.ContechES.com

Inspection Forms

Post Construction Inspection Report
126 Grove Street
Franklin, Massachusetts

INSPECTION DATE:						
Person Inspecting		Weather				Other Personnel Present
		Clear				
Item	**N/A***	**sat.****	**NMR*****	**CAM****	**MCA***	**Comments:**
Pavement Swept						
Catch Basins						
CB #24-1						
CB #24-2						
CB #24-3						
CB #24-4						
CB #24-5						
CB #24-6						
CB #24-7						
CB #24-8						
CB #24-9						
CB #24-10						
CB #24-11						
CB #24-12						
CB #24-13						
CB #24-14						
CB #24-15						
CB #24-16						
CB #24-17						
CB #24-18						
CB #24-19						
CB #24-20						
CB #7						
CB #15						
CB #16						
CB #59						
CB #60						
CB #61						
Water Quality Manholes						
DMH #24-19						
DMH #24-20						

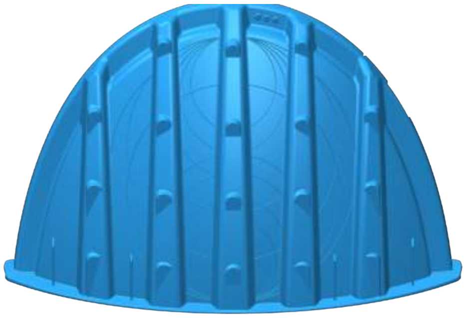
Post Construction Inspection Report
126 Grove Street
Franklin, Massachusetts

INSPECTION DATE:						
Person Inspecting		Weather				Other Personnel Present
		Clear				
Item	**N/A***	**sat.****	**NMR*****	**CAM****	**MCA***	**Comments:**
Infiltration Chambers #1						
(DMH 24-21 & 24-24)						
Inspection Ports						
Infiltration Basin #1						
Basin Inlet Flared End Section						
Basin Inlet Pipe						
Outlet Control Structure						
Infiltration Basin #2						
Basin Inlet						
Outlet Control Structure						
Basin Outlet Rip-Rap						
Emergency Spillway						
NMR* normal maintenance requested						
N/A* not applicable at the time of inspection						
CAM* corrective action - minor						
SAT* satisfactory conditions as compliant						
MCA* Major corrective action						

CULTEC RECHARGER® 902HD STORMWATER CHAMBER

The Recharger® 902HD is a 48" (1219 mm) tall, high capacity chamber. Typically when using this model, fewer chambers are required resulting in less labor and a smaller installation area. The Recharger® 902HD has the side portal internal manifold feature. HVLV® FC-48 Feed Connectors are inserted into the side portals to create the internal manifold.

Recharger 902HD Chamber



Recharger 902HD End Cap

Recharger 902HD Chamber	
Size (L x W x H)	4.25' x 78" x 48" 1.30 m x 1981 mm x 1219 mm
Installed Length	3.67' 1.12 m
Length Adjustment per Row - with two end caps installed	1.03' 0.31 m
Length Adjustment per Row - when not using end caps	0.58' 0.18 m
Chamber Storage	17.31 ft^3/ft 1.61 m^3/m 63.47 ft^3/unit 1.80 m^3/unit
Min. Installed Storage	27.06 ft^3/ft 2.53 m^3/m 99.28 ft^3/unit 2.81 m^3/unit
Min. Area Required	26.58 ft^2 2.47 m^2
Chamber Weight	83.0 lbs 37.65 kg
Shipping	15 chambers/skid 1,370 lbs/skid 14 skids/48' flatbed
Min. Center-to-Center Spacing	7.25' 2.21 m
Max. Allowable Cover	8.3' 2.53 m
Max. Allowable O.D. in Side Portal	10" HDPE, 12" PVC 250 mm HDPE, 300 mm PVC
Compatible Feed Connector	HVLV FC-48 Feed Connector

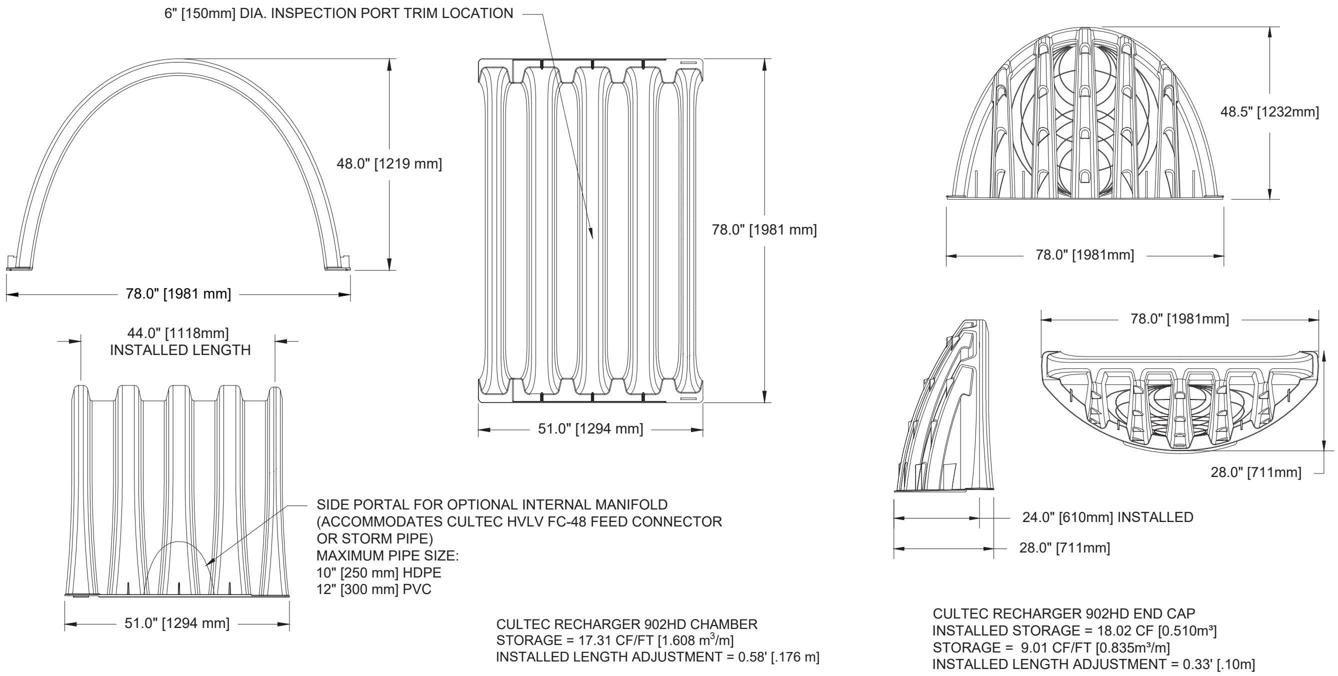
Calculations are based on installed chamber length.
All above values are nominal.
Includes 12" (305 mm) stone above crown of chamber and typical stone surround at 7.25' (2.21 m) center-to-center spacing and stone foundation depth as listed in table.
Stone void calculated at 40%.

	Stone Foundation Depth		
	9" 229 mm	12" 305 mm	18" 457 mm
Chamber and Stone Storage Per Chamber	99.28 ft^3 2.81 m^3	101.94 ft^3 2.89 m^3	107.26 ft^3 3.04 m^3
Min. Effective Depth	5.75' 1.75 m	6.00' 1.83 m	6.5' 1.98 m
Stone Required Per Chamber	3.32 yd^3 2.54 m^3	3.56 yd^3 2.72 m^3	4.05 yd^3 3.06 m^3

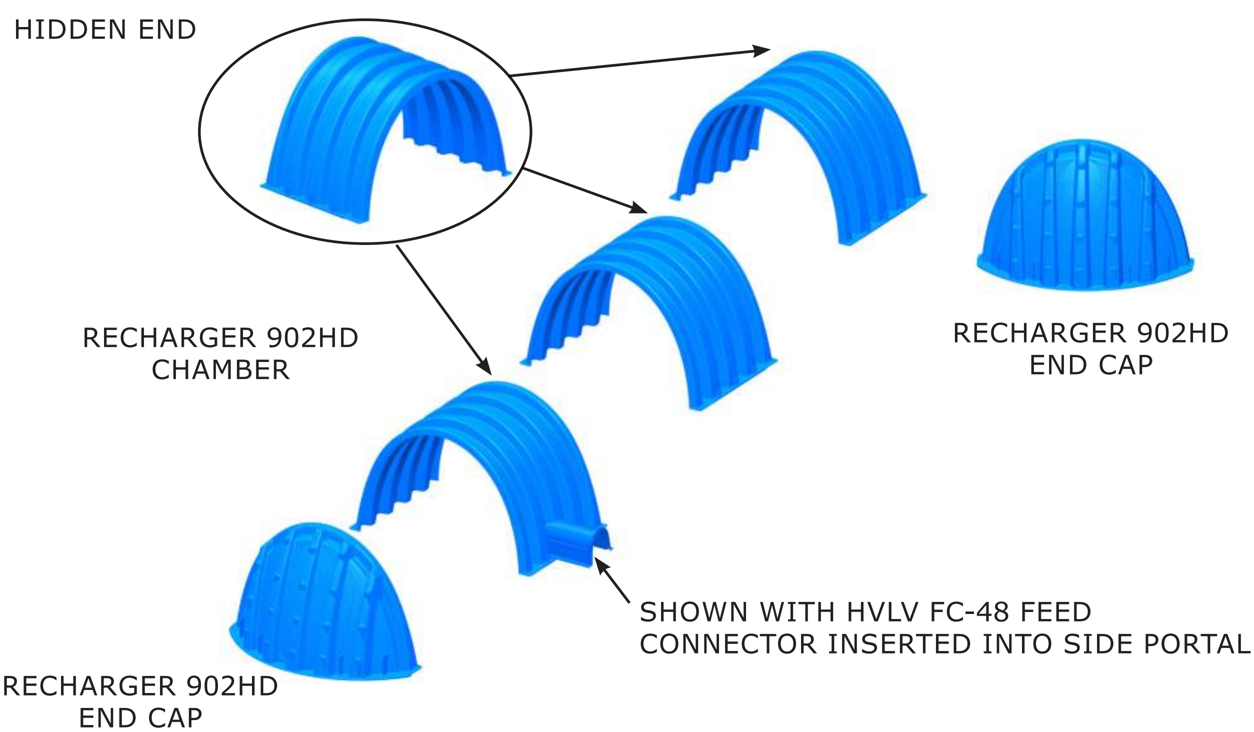
Recharger 902HD End Cap	
Size (L x W x H)	28.0" x 78.0" x 48.5" 711 mm x 1982 mm x 1231 mm
Installed Length	24.0" 610 mm
End Cap Storage	9.01 ft^3/ft 0.83 m^3/m 18.02 ft^3/unit 0.51 m^3/unit
Min. Installed Storage	22.08 ft^3/ft 2.05 m^3/m 44.16 ft^3/unit 1.25 m^3/unit
End Cap Weight	46.0 lbs 20.86 kg
Shipping	10 end caps/skid 540 lbs/skid 14 skids/48' flatbed
Max. Inlet Opening in End Cap	30" HDPE, 36" PVC 750 mm HDPE, 900 mm PVC

Calculations are based on installed chamber length.
All above values are nominal.
Min. installed storage includes 9" (229 mm) stone base, 12" (305 mm) stone above crown of chamber and typical stone surround at 7.25' (2.21 m) center-to-center spacing.

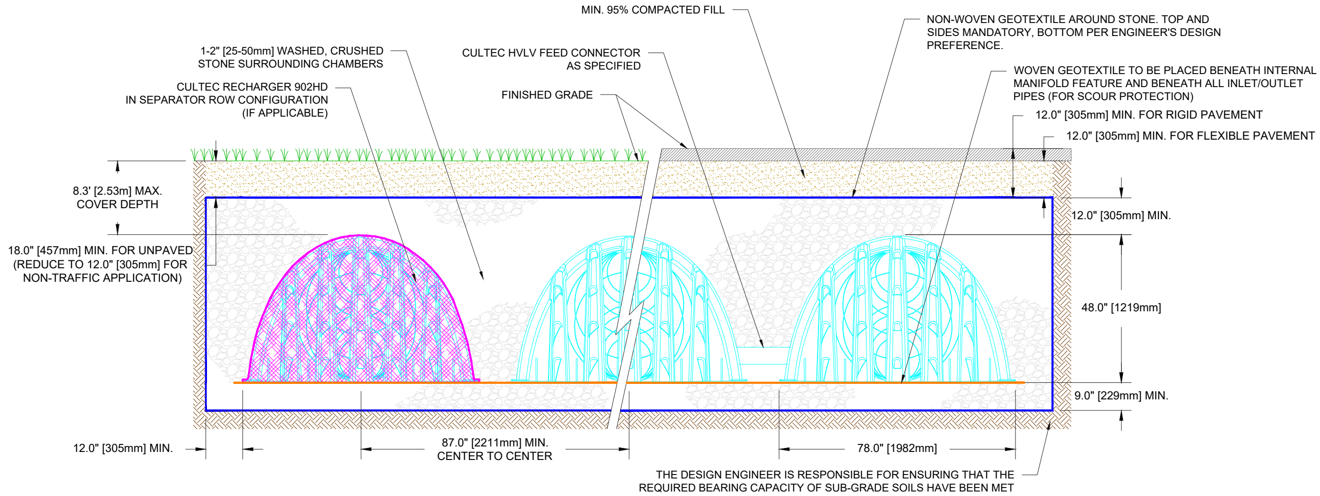
Three View Drawing



Typical Interlock Installation

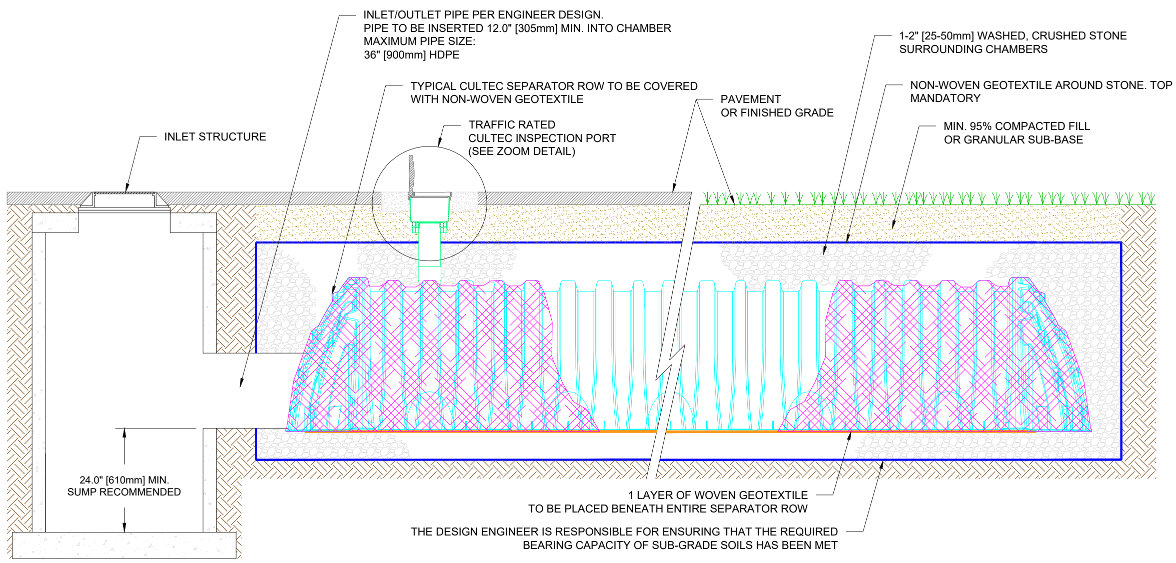


Typical Cross Section for Traffic Application



NOTES:
1. THE CHAMBERS SHALL BE DESIGNED AND TESTED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS." THE LOAD CONFIGURATION SHALL INCLUDE:
   1.a. INSTANTANEOUS AASHTO DESIGN TRUCK LIVE LOAD AT MINIMUM COVER
   1.b. MAXIMUM PERMANENT (50-YEAR) COVER LOAD
   1.c. 1-WEEK PARKED AASHTO DESIGN TRUCK LOAD
2. THE CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F3430-20 "STANDARD SPECIFICATION FOR CELLULAR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS"
3. THE INSTALLED CHAMBER SYSTEM SHALL PROVIDE RESISTANCE TO THE LOADS AND LOAD FACTORS AS DEFINED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS SECTION 12.12, WHEN INSTALLED ACCORDING TO CULTEC'S RECOMMENDED INSTALLATION INSTRUCTIONS. THE STRUCTURAL DESIGN OF THE CHAMBERS SHALL INCLUDE THE FOLLOWING:
   3.a. THE CREEP MODULUS SHALL BE 50-YEAR AS SPECIFIED IN ASTM F3430
   3.b. THE MINIMUM SAFETY FACTOR FOR LIVE LOADS SHALL BE 1.75
   3.c. THE MINIMUM SAFETY FACTOR FOR DEAD LOADS SHALL BE 1.95

Typical Profile View for Traffic Application



NOTES:
1. THE CHAMBERS SHALL BE DESIGNED AND TESTED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS." THE LOAD CONFIGURATION SHALL INCLUDE:
   1.a. INSTANTANEOUS AASHTO DESIGN TRUCK LIVE LOAD AT MINIMUM COVER
   1.b. MAXIMUM PERMANENT (50-YEAR) COVER LOAD
   1.c. 1-WEEK PARKED AASHTO DESIGN TRUCK LOAD
2. THE CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F3430-20 "STANDARD SPECIFICATION FOR CELLULAR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS"
3. THE INSTALLED CHAMBER SYSTEM SHALL PROVIDE RESISTANCE TO THE LOADS AND LOAD FACTORS AS DEFINED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS SECTION 12.12, WHEN INSTALLED ACCORDING TO CULTEC'S RECOMMENDED INSTALLATION INSTRUCTIONS. THE STRUCTURAL DESIGN OF THE CHAMBERS SHALL INCLUDE THE FOLLOWING:
   3.a. THE CREEP MODULUS SHALL BE 50-YEAR AS SPECIFIED IN ASTM F3430
   3.b. THE MINIMUM SAFETY FACTOR FOR LIVE LOADS SHALL BE 1.75
   3.c. THE MINIMUM SAFETY FACTOR FOR DEAD LOADS SHALL BE 1.95

Recharger® 902HD Bare Chamber Storage Volumes

Elevation		Incremental Storage Volume				Cumulative Storage	
in.	mm	ft³/ft	m³/m	ft³	m³	ft³	m³
48	1219	0.020	0.002	0.073	0.002	63.470	1.797
47	1194	0.050	0.005	0.183	0.005	63.397	1.795
46	1168	0.070	0.007	0.257	0.007	63.213	1.790
45	1143	0.120	0.011	0.440	0.012	62.957	1.783
44	1118	0.160	0.015	0.587	0.017	62.517	1.770
43	1092	0.200	0.019	0.733	0.021	61.930	1.754
42	1067	0.220	0.020	0.807	0.023	61.197	1.733
41	1041	0.240	0.022	0.880	0.025	60.390	1.710
40	1016	0.270	0.025	0.990	0.028	59.510	1.685
39	991	0.270	0.025	0.990	0.028	58.520	1.657
38	965	0.290	0.027	1.063	0.030	57.530	1.629
37	940	0.300	0.028	1.100	0.031	56.467	1.599
36	914	0.310	0.029	1.137	0.032	55.367	1.568
35	889	0.330	0.031	1.210	0.034	54.230	1.536
34	864	0.340	0.032	1.247	0.035	53.020	1.502
33	838	0.350	0.033	1.283	0.036	51.773	1.466
32	813	0.350	0.033	1.283	0.036	50.490	1.430
31	787	0.360	0.033	1.320	0.037	49.207	1.394
30	762	0.370	0.034	1.357	0.038	47.887	1.356
29	737	0.380	0.035	1.393	0.039	46.530	1.318
28	711	0.390	0.036	1.430	0.040	45.137	1.278
27	686	0.390	0.036	1.430	0.040	43.707	1.238
26	660	0.400	0.037	1.467	0.042	42.277	1.197
25	635	0.400	0.037	1.467	0.042	40.810	1.156
24	610	0.410	0.038	1.503	0.043	39.343	1.114
23	584	0.410	0.038	1.503	0.043	37.840	1.072
22	559	0.410	0.038	1.503	0.043	36.337	1.029
21	533	0.420	0.039	1.540	0.044	34.833	0.986
20	508	0.420	0.039	1.540	0.044	33.293	0.943
19	483	0.420	0.039	1.540	0.044	31.753	0.899
18	457	0.430	0.040	1.577	0.045	30.213	0.856
17	432	0.430	0.040	1.577	0.045	28.637	0.811
16	406	0.440	0.041	1.613	0.046	27.060	0.766
15	381	0.440	0.041	1.613	0.046	25.447	0.721
14	356	0.450	0.042	1.650	0.047	23.833	0.675
13	330	0.450	0.042	1.650	0.047	22.183	0.628
12	305	0.450	0.042	1.650	0.047	20.533	0.582
11	279	0.450	0.042	1.650	0.047	18.883	0.535
10	254	0.460	0.043	1.687	0.048	17.233	0.488
9	229	0.460	0.043	1.687	0.048	15.547	0.440
8	203	0.460	0.043	1.687	0.048	13.860	0.393
7	178	0.460	0.043	1.687	0.048	12.173	0.345
6	152	0.470	0.044	1.723	0.049	10.487	0.297
5	127	0.470	0.044	1.723	0.049	8.763	0.248
4	102	0.480	0.045	1.760	0.050	7.040	0.199
3	76	0.480	0.045	1.760	0.050	5.280	0.150
2	51	0.480	0.045	1.760	0.050	3.520	0.100
1	25	0.480	0.045	1.760	0.050	1.760	0.050
Total		**17.310**	**1.608**	**63.470**	**1.797**	**63.470**	**1.797**

Calculations are based on installed chamber length of 3.67' (1.12 m).

Recharger® 902HD Bare End Cap Storage Volumes

Elevation		Incremental Storage Volume				Cumulative Storage	
in.	mm	ft³/ft	m³/m	ft³	m³	ft³	m³
48	1219	0.010	0.001	0.020	0.0006	18.020	0.5103
47	1194	0.015	0.001	0.030	0.0008	18.000	0.5097
46	1168	0.020	0.002	0.040	0.0011	17.970	0.5088
45	1143	0.025	0.002	0.050	0.0014	17.930	0.5077
44	1118	0.030	0.003	0.060	0.0017	17.880	0.5063
43	1092	0.040	0.004	0.080	0.0023	17.820	0.5046
42	1067	0.050	0.005	0.100	0.0028	17.740	0.5023
41	1041	0.055	0.005	0.110	0.0031	17.640	0.4995
40	1016	0.065	0.006	0.130	0.0037	17.530	0.4964
39	991	0.070	0.007	0.140	0.0040	17.400	0.4927
38	965	0.080	0.007	0.160	0.0045	17.260	0.4887
37	940	0.085	0.008	0.170	0.0048	17.100	0.4842
36	914	0.095	0.009	0.190	0.0054	16.930	0.4794
35	889	0.105	0.010	0.210	0.0059	16.740	0.4740
34	864	0.115	0.011	0.230	0.0065	16.530	0.4681
33	838	0.130	0.012	0.260	0.0074	16.300	0.4615
32	813	0.140	0.013	0.280	0.0079	16.040	0.4542
31	787	0.150	0.014	0.300	0.0085	15.760	0.4463
30	762	0.155	0.014	0.310	0.0088	15.460	0.4378
29	737	0.165	0.015	0.330	0.0093	15.150	0.4290
28	711	0.175	0.016	0.350	0.0099	14.820	0.4196
27	686	0.180	0.017	0.360	0.0102	14.470	0.4097
26	660	0.190	0.018	0.380	0.0108	14.110	0.3995
25	635	0.195	0.018	0.390	0.0110	13.730	0.3888
24	610	0.200	0.019	0.400	0.0113	13.340	0.3777
23	584	0.210	0.020	0.420	0.0119	12.940	0.3664
22	559	0.215	0.020	0.430	0.0122	12.520	0.3545
21	533	0.225	0.021	0.450	0.0127	12.090	0.3423
20	508	0.230	0.021	0.460	0.0130	11.640	0.3296
19	483	0.240	0.022	0.480	0.0136	11.180	0.3166
18	457	0.245	0.023	0.490	0.0139	10.700	0.3030
17	432	0.250	0.023	0.500	0.0142	10.210	0.2891
16	406	0.255	0.024	0.510	0.0144	9.710	0.2749
15	381	0.265	0.025	0.530	0.0150	9.200	0.2605
14	356	0.270	0.025	0.540	0.0153	8.670	0.2455
13	330	0.275	0.026	0.550	0.0156	8.130	0.2302
12	305	0.280	0.026	0.560	0.0159	7.580	0.2146
11	279	0.285	0.026	0.570	0.0161	7.020	0.1988
10	254	0.295	0.027	0.590	0.0167	6.450	0.1826
9	229	0.300	0.028	0.600	0.0170	5.860	0.1659
8	203	0.310	0.029	0.620	0.0176	5.260	0.1489
7	178	0.315	0.029	0.630	0.0178	4.640	0.1314
6	152	0.320	0.030	0.640	0.0181	4.010	0.1135
5	127	0.325	0.030	0.650	0.0184	3.370	0.0954
4	102	0.325	0.030	0.650	0.0184	2.720	0.0770
3	76	0.330	0.031	0.660	0.0187	2.070	0.0586
2	51	0.335	0.031	0.670	0.0190	1.410	0.0399
1	25	0.370	0.034	0.740	0.0210	0.740	0.0210
Total		**9.010**	**0.837**	**18.020**	**0.510**	**18.020**	**0.5103**

Calculations are based on installed chamber length of 2' (0.61 m).

CULTEC Recharger® 902HD Specifications

GENERAL

CULTEC Recharger® 902HD chambers are designed for underground stormwater management. The chambers may be used for retention, recharging, detention or controlling the flow of on-site stormwater runoff.

CHAMBER PARAMETERS

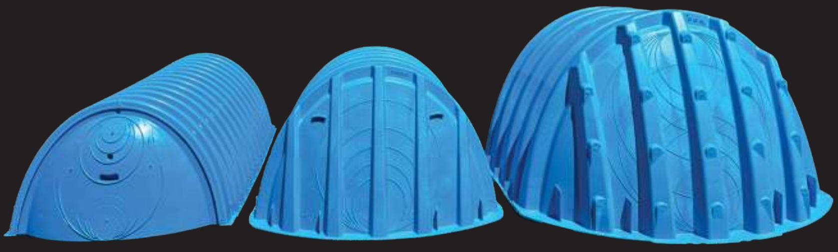
1. The chambers shall be manufactured in the U.S.A. by CULTEC of Brookfield, CT (cultec.com, 203-775-4416).
2. The chambers shall be designed and tested in accordance with ASTM F2787 "Standard Practice for Structural Design of Thermoplastic Corrugated Wall Stormwater Collection Chambers". The load configuration shall include:
    a. Instantaneous AASHTO Design Truck live load at minimum cover
    b. Maximum permanent (50-year) cover load
    c. 1-week parked AASHTO design truck load
3. The chambers shall meet the requirements of ASTM F3430-20 "Standard Specification for Cellular Polypropylene (PP) Corrugated Wall Stormwater Collection Chambers".
4. The installed chamber system shall provide resistance to the loads and load factors as defined in the AASHTO LRFD Bridge Design Specifications Section 12.12, when installed according to CULTEC's recommended installation instructions. The structural design of the chambers shall include the following:
    a. The Creep Modulus shall be 50-year as specified in ASTM F3430
    b. The minimum safety factor for live loads shall be 1.75
    c. The minimum safety factor for dead loads shall be 1.95
5. The chamber shall be structural foam injection molded of blue virgin high molecular weight impact-modified polypropylene.
6. The chamber shall be arched in shape.
7. The chamber shall be open-bottomed.
8. The chamber shall be joined using an interlocking overlapping rib method. Connections must be fully shouldered overlapping ribs, having no separate couplings.
9. The nominal chamber dimensions of the CULTEC Recharger® 902HD shall be 48 inches (1219 mm) tall, 78 inches (1981 mm) wide and 4.25 feet (1.30 m) long. The installed length of a joined Recharger 902HD shall be 3.67 feet (1.12 m).
10. Multiple chambers may be connected to form different length rows. Each row shall begin and end with a separately formed CULTEC Recharger® 902HD End Cap. Maximum inlet opening on the end cap is 30 inches (750 mm) HDPE or 36 inches (900 mm) PVC.
11. The chamber shall have two side portals to accept CULTEC HVLV™ FC-48 Feed Connectors to create an internal manifold. Maximum allowable pipe size in the side portal is 10 inches (250 mm) HDPE and 12 inches (300 mm) PVC.
12. The nominal chamber dimensions of the CULTEC HVLV™ FC-48 Feed Connector shall be 12 inches (305 mm) tall, 16 inches (406 mm) wide and 49 inches (1245 mm) long.
13. The nominal storage volume of the Recharger 902HD chamber shall be 17.31 ft^3 / ft (1.61 m^3 / m) - without stone. The nominal storage volume of a joined Recharger 902HD shall be 63.47 ft^3 / unit (1.80 m^3 / unit) - without stone.
14. The nominal storage volume of the HVLV™ FC-48 Feed Connector shall be 0.913 ft^3 / ft (0.085 m^3 / m) - without stone.
15. The Recharger 902HD chamber shall have 5 corrugations.
16. The chamber shall be capable of accepting a 6 inch (150 mm) inspection port opening at the top center of each chamber, centered on the corrugation crest.
17. The chamber shall be manufactured in a facility employing CULTEC's Quality Control and Assurance Procedures.
18. Maximum allowable cover over the top of the chamber shall be 8.3 feet (2.53 m).
19. The installed chamber system shall be structurally designed to provide resistance to live loads as defined by the AASHTO H-20/HL-93 specification when installed according to CULTEC's recommended installation instructions.

END CAP PARAMETERS

1. The CULTEC Recharger® 902HD End Cap (referred to as 'end cap') shall be manufactured in the U.S.A. by CULTEC of Brookfield, CT (cultec.com, 203-775-4416).
2. The end cap shall be structural foam injection molded of blue virgin high molecular weight impact-modified polypropylene.
3. The end cap shall be arched in shape.
4. The end cap shall be joined at the beginning and end of each row of chambers using an interlocking overlapping rib method. Connections must be fully shouldered overlapping ribs, having no separate couplings.
5. The end cap shall have 5 corrugations.
6. The nominal dimensions of the end cap shall be 48.5 inches (1231 mm) tall, 78 inches (1982 mm) wide and 28.0 inches (711 mm) long. When joined with a Recharger 902HD Chamber, the installed length of the end cap shall be 24.0 inches (610 mm).
7. The nominal storage volume of the end cap shall be 9.01 ft^3 / ft (0.83 m^3 / m) - without stone. The nominal storage volume of an interlocked end cap shall be 18.02 ft^3 / unit (0.51 m^3 / unit) - without stone.
8. Maximum inlet opening on the end cap is 30 inches (750 mm) HDPE or 36 inches (900 mm) PVC.
9. The end cap shall provide resistance to the loads and load factors as defined in the AASHTO LRFD Bridge Design Specifications Section 12.12.

RECHARGER® 300HD, 360HD, & 902HD
STORMWATER MANAGEMENT SOLUTIONS

INSTALLATION INSTRUCTIONS



RETENTION • DETENTION • INFILTRATION • WATER QUALITY

CULTEC®

Published by
CULTEC
P.O. Box 280
878 Federal Road
Brookfield, Connecticut 06804 USA
www.cultec.com

Disclaimers:
The drawings, photographs and illustrations shown in this document are for illustrative purposes only and are not necessarily to scale.
Actual designs may vary.
More information at https://cultec.com/legal/

CULTEC reserves the right to make design and/or specification changes at any time without notice at CULTEC's sole discretion.

Contact Information:
For general information on our other products and services, please contact our offices within the United States at 1-(800)428-5832, (203)775-4416 ext. 202, or e-mail us at CT-CustomerService@cultec.com.

For technical support, please call (203)775-4416 ext. 203 or e-mail CT-Tech@cultec.com.

Visit www.cultec.com/downloads.html for Product Downloads and CAD details.

Doc ID: CLT009 08-24
August 2024
You are using version CLT009 08-24 of our CULTEC Installation Instructions for Recharger® 300HD, 360HD, and 902HD Stormwater Systems.

These instructions are for single-layer traffic applications only. For multi-layer applications, contact CULTEC.
All illustrations and photos shown herein are examples of typical situations. Be sure to follow the engineer's drawings.
Actual designs may vary.

Required Materials and Equipment

- Proper geotechnical soil evaluation by a qualified engineer or soil scientist to determine suitability of structural installation
- OSHA compliance
- CULTEC warning tape, or equivalent
- Assurances from local utilities that no underground gas, electrical or other potentially dangerous pipelines or conduits are already buried at the site
- Acceptable 1– 2 inch washed, crushed stone as shown in Table 3, page 18. Cleanliness of stone to be verified by engineer.
- Acceptable fill material
- CULTEC No. 410™ non-woven geotextile or equivalent
- CULTEC AFAB-HPF woven geotextile or equivalent, as required
- All CULTEC chambers and accessories as specified in the engineer's plans including CULTEC No. 410™ non-woven geotextile, CULTEC StormFilter® and CULTEC AFAB-HPF woven geotextile, where applicable. Check CULTEC chambers for damage prior to installation. Do not use damaged CULTEC chambers. Contact your supplier immediately to report damage or packing list discrepancies.
- Reciprocating saw or router
- Stone bucket
- Stone conveyor and/or tracked excavator
- Transit or laser level measuring device
- Compaction equipment

Requirements for CULTEC Chamber System Installations

- CULTEC systems must be designed and installed in accordance with CULTEC's minimum requirements. Failure to do so will void the limited warranty. To request a copy and submit the CULTEC limited warranty, call CULTEC at 203-775-4416 or visit www.cultec.com.
- Installing contractors are expected to comprehend and use the most current installation instructions prior to beginning a system installation. If there is any question as to whether these are the most current instructions, contact CULTEC at (203)775-4416 or visit www.cultec.com.
- Contact CULTEC at least thirty days prior to system installation to arrange a pre-construction meeting.
- All CULTEC system designs must be certified by a registered professional engineer.
- Use these installation instructions as a guideline only. Actual design may vary. Refer to approved construction drawings for job-specific details. Be sure to follow the engineer's drawings as your primary guide.
- System cover/backfill requirements will vary based on installation type.
- Any discrepancies with the system sub-grade soil's bearing capacity must be reported to the design engineer.
- Non-woven geotextile must be used as specified in the engineer's drawings.
- Erosion and sediment-control measures must meet local codes and the design engineer's specifications throughout the entire site construction process.
- Responsibility for preventing vehicles that exceed CULTEC's requirements from traveling across or parking over the chamber system lies solely with the contractor throughout the entire site construction process. The placement of warning tape, temporary fencing, and/or appropriately located signs is highly recommended. Imprinted warning tape is available from CULTEC. For Acceptable Vehicle Load information, refer to Table 1 on page 16.

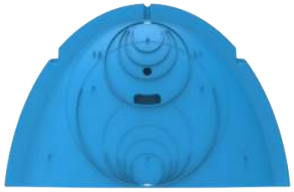
Chamber Specification Information

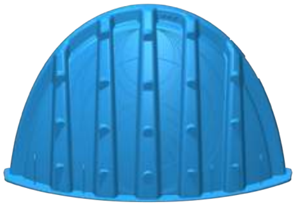
	Recharger 300HD Chamber	Recharger 360HD Chamber	Recharger 902HD Chamber
Size (L x W x H)	7.54′ x 51″ x 30″	4.17′ x 60″ x 36″	4.25' x 78" x 48"
Installed Length	7.08′	3.67′	3.67'
Length Adjustment per Row with two end caps installed	0.89′	2.50′	1.03'
when not using end caps	0.46′	0.50′	0.58'
Chamber Storage	6.53 ft³/ft 46.27 ft³/unit	10.00 ft³/ft 36.66 ft³/unit	17.31 ft³/ft 63.47 ft³/unit
Minimum Installed Storage	10.57 ft³/ft 74.44 ft³/unit	15.20 ft³/ft 55.73 ft³/unit	27.06 ft³/ft 99.28 ft³/unit
Minimum Area Required	33.65 ft²	21.08 ft²	26.58 ft²
Minimum Center-to-Center Spacing	4.75′	5.75′	7.25'
Minimum Spacing Between Chambers	6″	9″	9″
Minimum Cover Requirements	18″ (Paved) 24″ (Unpaved)	18″ (Paved) 24″ (Unpaved)	24″ (Paved) 30″ (Unpaved)
Maximum Allowable Cover	12′	12′	8.3'
Maximum Allowable O.D. in Side Portal	10″ HDPE, 12″ PVC	10″ HDPE, 12″ PVC	10″ HDPE, 12″ PVC
Compatible Feed Connector	HVLV FC-24 Feed Connector	HVLV FC-48 Feed Connector	HVLV FC-48 Feed Connector



End Cap Specification Information

	Recharger 300HD End Cap	Recharger 360HD End Cap	Recharger 902HD End Cap
Size (L x W x H)	12.2″ x 45.9″ x 29.3″	18″ x 60″ x 36.5″	28.0″ x 78.0″ x 48.5″
Installed Length	9.6″	15″	24"
End Cap Storage	3.32 ft³/ft 2.66 ft³/unit (interlocked)	5.17 ft³/ft 6.46 ft³/unit (interlocked)	9.01 ft³/ft 18.02 ft³/unit (interlocked)
Minimum Installed Storage	16.95 ft³/ft 13.56 ft³/unit	12.40 ft³/ft 15.50 ft³/unit	22.08 ft³/ft 44.16 ft³/unit
Maximum Inlet Opening in End Cap	24″ HDPE, 24″ PVC	24″ HDPE, 30″ PVC	30" HDPE, 36″ PVC





All dimensions are nominal. Actual dimensions may vary on-site due to shipping and temperature.

CULTEC HVLV Feed Connector Specification Information

	HVLV FC-24 Feed Connector	HVLV® FC-48 Feed Connector
Length	24.2”	49"
Installed Length (exposed)	6”	9" min.
Width	16”	16"
Height	12”	12"
Chamber Storage Capacity	0.91 ft^3/ft	0.91 ft^3/ft
Pipe Comparison	Greater flow capacity than 12” pipe	Greater flow capacity than 12" pipe
Compatible Models	Recharger 300HD	Recharger 360HD, Recharger 902HD

Site Preparation and Excavation

- Excavate and level the area per engineer’s drawings. Refer to plan view and cross-section details and excavate bed to accommodate chambers and manifold system. Be sure to allow for a minimum 12 inch stone border around the perimeter of the system and unforeseen overages in your excavation calculations.

- Remove any standing water and maintain positive drainage of the site throughout the installation. Dewatering procedures must be used, if necessary.

- Prepare the sub-grade soil for the chamber bed as specified by the engineer’s drawings.

- Place CULTEC No. 410™ non-woven geotextile (or equivalent) on the excavated bed bottom and perimeter sidewalls as specified by the engineer’s drawings. CULTEC No. 410™ non-woven geotextile is required on the sides and over the top of the system. It is also recommended on the system bottom. Overlap the geotextile by at least 24 inches where the fabric edges meet.

- Disperse a level base of 1 to 2 inch diameter washed, crushed stone over the entire area of the bed bottom. Refer to the engineer’s drawings for sub-grade soil preparation and required stone foundation thickness.

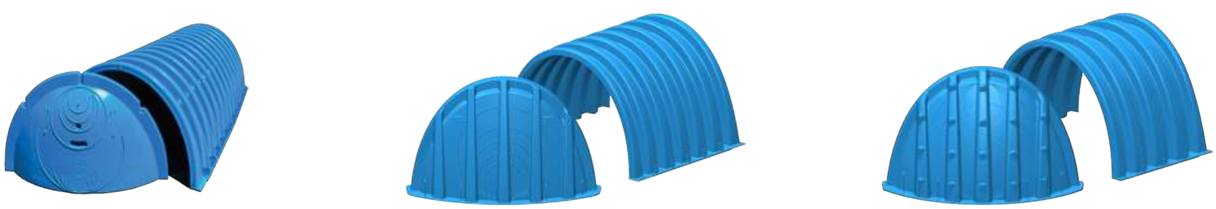
- Compact the stone base to achieve a flat, level unyielding surface. For vibratory roller use, refer to Table 1 on page 16 for recommended guidelines.

Chamber Information for Recharger® Models 300HD, 360HD, & 902HD

Directional arrows located on the top of the chamber point towards the Small Rib End.

CULTEC Recharger® 300HD, 360HD, & 902HD Chambers

The Recharger models 300HD, 360HD, & 902HD chambers come in only one model type which is fully open on both ends. The chamber requires the coordinating End Cap (*sold separately*) to cap rows of chambers or to create single stand alone units. One rib is dimensionally smaller to be able to interlock with additional units. A directional arrow points towards the small rib end. Typically, the build of the row begins with the large rib end facing you.



Shown: Recharger 300HD, 360HD, & Recharger 902HD Chambers with End Caps.

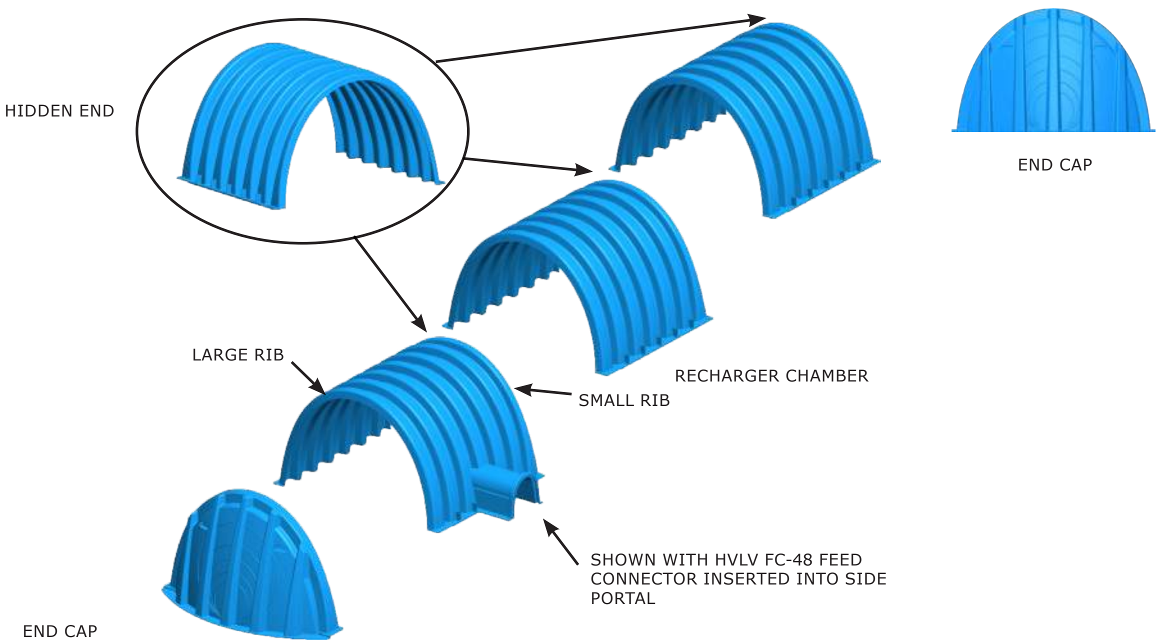
CULTEC Recharger® 300HD, 360HD, & 902HD End Caps

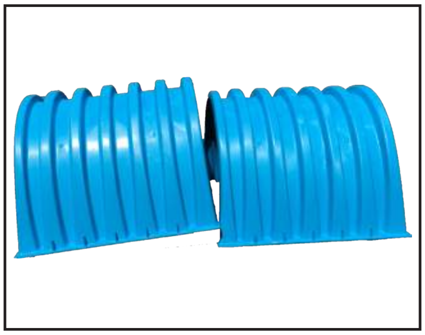
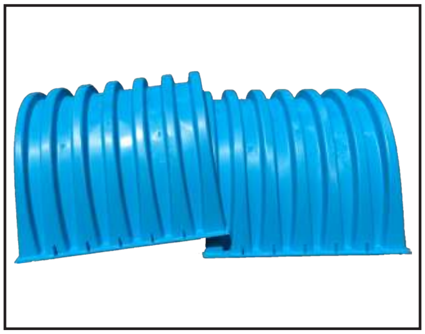
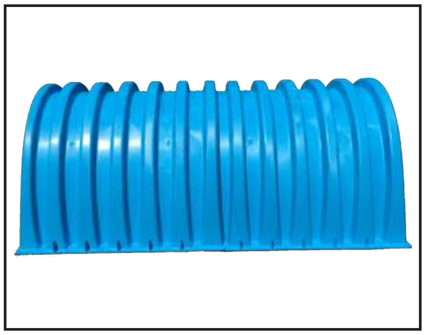
The End Cap is used in conjunction with the chamber to cap rows of chambers or to create single stand alone units.

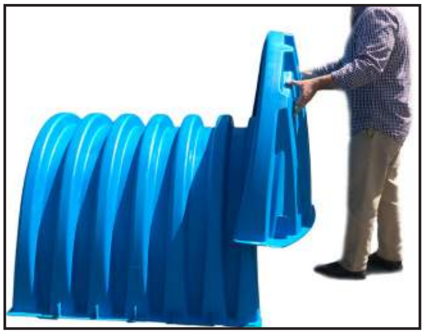
Shown: Recharger 300HD End Cap, 360HD End Cap & Recharger 902HD End Cap

Typical Installation Method

Interlock Recharger chambers using the overlapping rib connection.
Cap the ends of the lines using the Recharger End Cap.





Chamber Preparation and Installation

CULTEC Recharger® 300HD, 360HD, & 902HD chambers have the distinctive features of being fully open on both ends and utilize an overlapping rib connection. CULTEC chamber ribs are dimensionally sized with a large rib and a smaller rib to allow for an easy interlocking rib connection. The chambers require a separate end cap to cap off lines.

- Identify and group the chambers and end caps to ensure proper quantity and usage.
- Trim all side portals, end caps and inspection ports prior to installation for easier handling during trimming.
- Place one Recharger chamber for each row of units to be installed. Directional arrows point towards the small rib end of the chamber.
- If using the side portal internal manifold feature, trim the side portal(s) according to guidelines located on the sidewall of the chamber, as required. Insert one end of the HVLV Feed Connector into the trimmed portal to create the internal manifold. Refer to Installation of Manifold section on page 9.
- Place the next Recharger chamber so the directional arrow located in the center of the unit points downstream towards the end of the line. Overlap the large rib over the small rib of the preceding chamber's end wall, interlocking the chambers together. When placing chambers take care to maintain separation requirements, measuring from the base of the chamber.
- To ease backfilling requirements, only install as many chambers as the stone-laying bucket or conveyor can reach.
- Place stone taking care not to drop stone over the last rib to be overlapped.
- Continue chamber and stone placement to extend the length of the row.
- Use the Recharger End Caps to cap off chamber rows. To install the end cap, lift the end cap above the chamber and slide down the chamber rib.
- Prior to the placement of the next line of chambers, check and correct the level and alignment of the chamber units, where needed.

Installation of Manifold

Utilize the side portals located on the chamber as an internal manifold in locations where indicated on the engineer's drawings. HVLV® Feed Connectors are inserted into the portals to promote flow. An additional external manifold is not required unless specified by the engineer's design.

- CULTEC AFAB-HPF woven geotextile is to be placed under all chambers utilizing the internal manifold feature and under all chambers accepting inlet/outlet pipe connections per engineer's drawings. If inserting a pipe 18" diameter or larger into the CULTEC chamber, the use of CULTEC AFAB-HPF woven geotextile is recommended to prevent washout of the bedding stone.

- Most installations are designed with the internal manifold located at the ends of the chamber bed. However, the side portal internal manifold feature allows for the manifold to be located at any point within the chamber run. Refer to system design for manifold location(s).

- Using a reciprocating saw or router, trim the sidewall portals of the units that are to receive the HVLV Feed Connectors. Feed connectors may be placed on any chamber requiring a manifold, as indicated by the engineer's drawings.

- Place the HVLV Feed Connector into the side portal of the chambers per engineer's drawings. Maintain the required minimum separation between chamber rows.

- Check for correct center-to-center spacing of chamber runs according to engineer's drawings before proceeding to next row.

- Insert inflow/outflow pipe(s) into end cap or side portal as detailed on engineer's drawings. Maximum inlet sizes for the end caps are:
  - Recharger 300HD: 24" HDPE, 24" PVC
  - Recharger 360HD: 24" HDPE, 30" PVC
  - Recharger 902HD: 30" HDPE, 36" PVC

- Maximum pipe sizes for the side portals are: 10" HDPE, 12" PVC. There is no need to feed every row if utilizing the internal manifold feature.

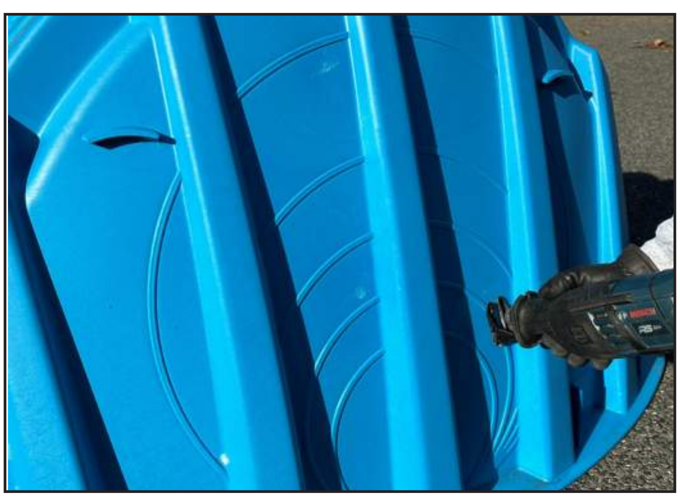
If the manifold installation detail does not include CULTEC's side portal internal manifold, proceed according to the engineer's drawings for pipe manifold installation.

How to Trim CULTEC Chamber to Accommodate Pipe on End Cap

When using a conventional pipe manifold or inlet / outlet pipes, the contractor is required to trim the CULTEC Recharger End Cap on-site. Here are some quick steps to ensure a successful outcome:

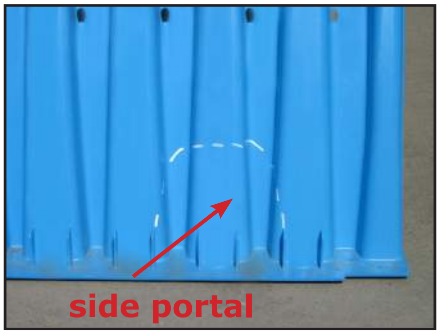
- Lay out chambers according to engineered plans.
- Directional arrows located at the top of the chamber point towards the small rib end.
- Install end caps on the chambers as detailed on the engineer's drawing.
- Locate the proper diameter pipe outline on the end cap to accommodate the designed pipe size and invert elevation.
- Drill a hole on the chamber end wall large enough to accommodate a saw blade.
- Following the etched outline, use a reciprocating saw to trim out the opening to accommodate the pipe. Trimming should be within 1/4" tolerance of pipe O.D. to prevent stone intrusion.
- Insert the pipe or fitting a minimum of 8" into the chamber. This is not required to be a watertight connection. Maximum inlet pipe sizes:
    - Recharger 300HD: 24" HDPE, 24" PVC
    - Recharger 360HD: 24" HDPE, 30" PVC
    - Recharger 902HD: 30" HDPE, 36" PVC
- Backfill as noted in the installation instructions and engineering details.

Trimming may only be performed on end caps or within side portal areas.
Pipe may not be inserted into the sidewall of the chamber unless it is within the side portal trim lines.



How to Trim Side Portal to Accommodate HVLV Feed Connector for Internal Manifold

When using the side portal internal manifold feature, the contractor is required to trim the side portal of the CULTEC Recharger chamber on site.



- Following the guides on the side portal, use a reciprocating saw to trim out the opening to accommodate the HVLV Feed Connector. Trimming should be within 1/4" tolerance of HVLV Feed Connector to prevent soil intrusion.

Trimming may only be performed on the side portal area. Side entry in any other location is unacceptable.

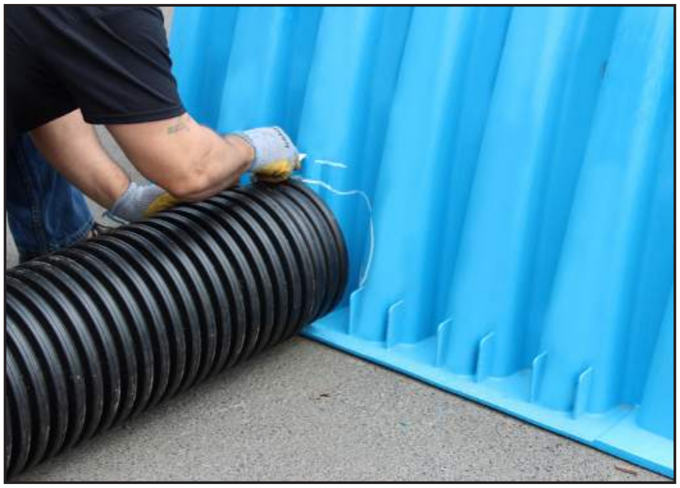
- Insert the HVLV Feed Connector a minimum of 8" into the sidewall of the chamber. This is not required to be a watertight connection.

- Maintain proper minimum separation between chamber rows.

How to Trim Side Portal to Accommodate Pipe for Side Entry

When using the side portal feature as an inlet /outlet location, the contractor is required to trim the side portal of the CULTEC Chamber on site.

- Line up the pipe on the chamber side portal to the designated pipe elevation as detailed on the engineer's drawing. The side portal may accommodate 10" HDPE or 12" PVC pipe.
- Using a grease pen, outline the pipe on the side portal of the CULTEC chamber. See Fig. 1 for acceptable trim area. Do not cut outside the side portal area guides.
- Drill a hole on the chamber side portal large enough to accommodate a saw blade.
- Following the grease pen outline, use a reciprocating saw to trim out the opening to accommodate the pipe. Trimming should be within 1/4" tolerance of pipe O.D. to prevent soil intrusion.
- Insert the pipe or fitting a minimum of 8" into the chamber. This is not required to be a watertight connection.



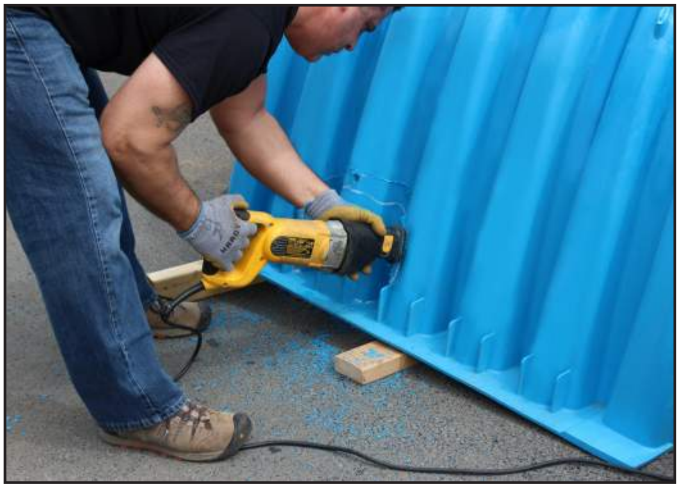


Fig. 1 - Acceptable Trim Area

Trimming may only be performed on the side portal area. Side entry in any other location is unacceptable.

Embedment Stone Backfill

Backfill using washed, crushed stone. To maintain row separation distance and prevent chamber displacement, slowly distribute stone on top of the center of the chamber crown so that stone trickles down and builds between chamber rows as required. Stone column differential should not exceed 12” between adjacent chamber rows or between chamber rows and perimeter.

Place the stone carefully over the centerline of the chamber crown. Embedment stone must only be placed by an excavator or telescoping conveyor boom. Placement of embedment stone with a bulldozer is not an acceptable method of installation and may cause damage to the chambers. Any chambers damaged using an unacceptable method of backfill are not covered under the CULTEC limited warranty.

Excavator-Placed Stone

Typically the most common method, excavator-placed stone is limited by the reach of the arm. To accommodate this issue with larger beds, it is common to prepare a bed by joining just a few chamber units at a time, then placing the stone and fabric before installing the next few units.

The excavator is usually operated within the excavation area. The excavator may work at grade level over recently placed chambers, provided coverage between the chambers and the excavator tracks meets the minimum requirements.

Telescoping Conveyor Boom Placement

With booms as much as 120-140 feet long, telescoping aggregate conveyors can greatly aid the process of stone placement.

With both stone-placement methods, ladling the stone carefully over the chambers’ centers will secure them in place. Evenly distributing the stones will help prevent chamber movement and maintain row separation.

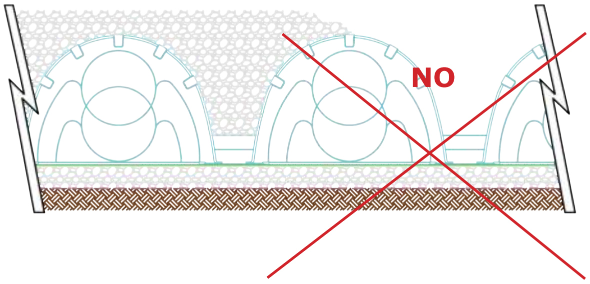
Once secured, stone may be placed to surround the chambers and fill the perimeter areas. Be sure to adhere to manufacturer recommendations and engineer’s drawings for system cover/backfill requirements.

Do not allow equipment to drive over the chambers unless the minimum cover is in place. Use a warning tape (available from CULTEC) to restrict access.

Repeat steps until all of the last chamber units are in place. Be certain to use the Recharger End Caps to end the line of chambers as specified by the drawings.

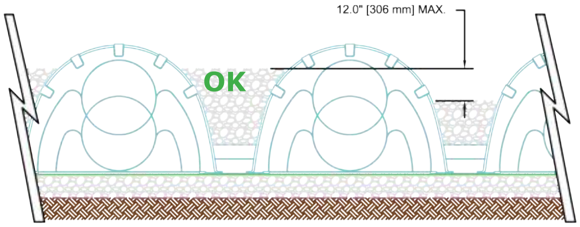
If a manifold system is designed on the back end of the chamber bed, follow manifold installation instructions as described previously.

Stone column height differential should never exceed 12 inches with adjacent chambers or between chamber rows and perimeter. Minimum depth of cover of properly compacted material must be met before allowing vehicles to drive over the bed. Avoid using large rocks and/or organic matter as backfill material. Refer to "Acceptable Fill Materials" or contact the design engineer for approved fill types.



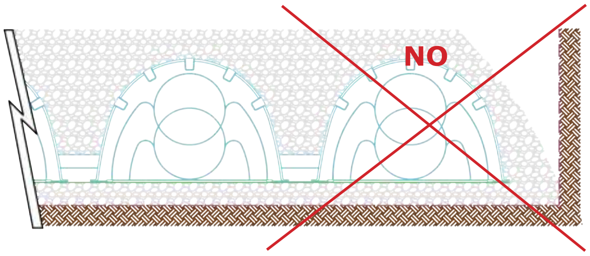
NOTE: CHAMBERS MUST BE BACKFILLED EVENLY.

UNEVEN BACKFILL - INCORRECT INSTALLATION



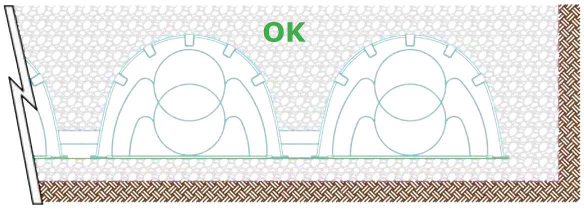
NOTE: STONE HEIGHT IN BETWEEN ROWS AND PERIMETER SHOULD NOT DIFFER BY MORE THAN 12" (300 MM)

EVEN BACKFILL - CORRECT INSTALLATION



NOTE: WHEN FILLING IN PERIMETER, STONE MUST BE FILLED IN EVENLY WITH CHAMBER ROWS.

PERIMETER NOT FULLY BACKFILLED
INCORRECT INSTALLATION



NOTE: PERIMETER STONE MUST BE FULLY BACKFILLED WITH STONE AND EXTEND TO THE EXCAVATION WALL.

PERIMETER FULLY BACKFILLED
CORRECT INSTALLATION

Placement of Top Fabric Layer & System Backfill Process

- Place the stone over the entire bed area as described in previous section.
- Cover the entire installation area with CULTEC No. 410 non-woven geotextile starting from the perimeter and laying it on top of the stone. The geotextile must overlap at least 24 inches at the edges.
- Fill the first 12 inches with enough material (See 3 in Fig. 1, page 18) to meet the requirements as shown in Table 3, page 18. Backfill over the top of the geotextile (See 3 in Fig. 1, page 18) in lifts that do not exceed 6 inches, and disperse the fill with a vehicle that meets the maximum wheel loads or ground pressure limits as specified on specified in Table 1 on page 16.

- Compact each lift of backfill as specified in the engineer's drawings. CULTEC specifies compacting to a minimum of 95% of the standard proctor density using compaction equipment Refer to Table 1, page 16 for acceptable equipment.
- Backfill over the chamber bed (See 4 in Fig. 1, page 18) in 12-inch maximum lifts until the specified grade is achieved. For pavement sub-base or special fill requirements, see engineer's drawings.

NOTE:
Excavation alongside already installed chamber rows backfilled with stone is not acceptable.
No chambers may be added or subtracted from previously installed systems.

Table 1: Maximum Allowable Construction Loads

Material Location See Fig. 1, p. 18	Cumulative Cover Depth over Chambers (in)	Maximum Allowable Wheel Loads Max Axle Load for Trucks (lbs)	Maximum Allowable Wheel Loads Max Axle Load for Loaders (lbs)	Maximum Allowable Track Loads Track Shoe Width (in)	Maximum Allowable Track Loads Max Ground Pressure (psi)	Maximum Allowable Compaction Loads Maximum Centrifugal Force (lbs)	Maximum Allowable Compaction Loads Max Gross Vehicle Weight (lbs)
4 Final Fill Material	36 Compacted	32,000	16,000	12	23.8	38,000	16,000
				18	16.3		
				24	12.8		
				30	10.6		
				36	9.1		
	30 Compacted	32,000	16,000	12	20.5	24,000	12,000
				18	14.3		
				24	11.4		
				30	9.5		
				36	8.3		
3 Initial Fill Material	24 Compacted	32,000	16,000	12	17.2	20,000	12,000
				18	12.3		
				24	9.9		
				30	8.4		
				36	7.4		
	24 Loose/Dumped	300HD: 32,000 360HD: 32,000 902HD: 24,000	300HD: 16,000 360HD: 16,000 902HD: 12,000	12	15.6	20,000	12,000
				18	11.3		
				24	9.2		
				30	7.9		
				36	7.0		
	18 Compacted	300HD: 32,000 360HD: 32,000 902HD: 24,000	300HD: 16,000 360HD: 16,000 902HD: 12,000	12	14.0	300HD: 20,000 360HD: 20,000 902HD: NOT ALLOWED	300HD: 12,000 360HD: 12,000 902HD: 5,000
				18	10.3		
				24	8.5		
				30	7.4		
				36	6.6		
	18 Loose/Dumped	300HD: 16,000 360HD: 16,000 902HD: NOT ALLOWED	NOT ALLOWED	12	12.6	NOT ALLOWED	300HD: 12,000 360HD: 12,000 902HD: NOT ALLOWED
				18	9.3		
				24	7.7		
				30	6.7		
				36	6.0		
2 Embedment Stone	12	NOT ALLOWED	NOT ALLOWED	12	10.7	NOT ALLOWED	NOT ALLOWED
				18	8.3		
				24	7.0		
				30	6.3		
				36	5.8		
	6	NOT ALLOWED	NOT ALLOWED	NOT ALLOWED FOR RECHARGER 902HD. 6” FILL DEPTH TRACK LOAD DATA APPLIES TO RECHARGER 360HD ONLY		NOT ALLOWED	NOT ALLOWED
				12	7.4		
				18	6.3		
				24	5.6		
				30	5.3		
				36	5.0		

The use of wheeled equipment without proper cover is strictly prohibited.
For Tracked Vehicles: Ground pressure is vehicle operating weight divided by total truck contact area for both tracks. Turning should be kept to a minimum.
No wheeled vehicles are allowed prior to compacted fill placement

Table 2: Placement Methods and Descriptions

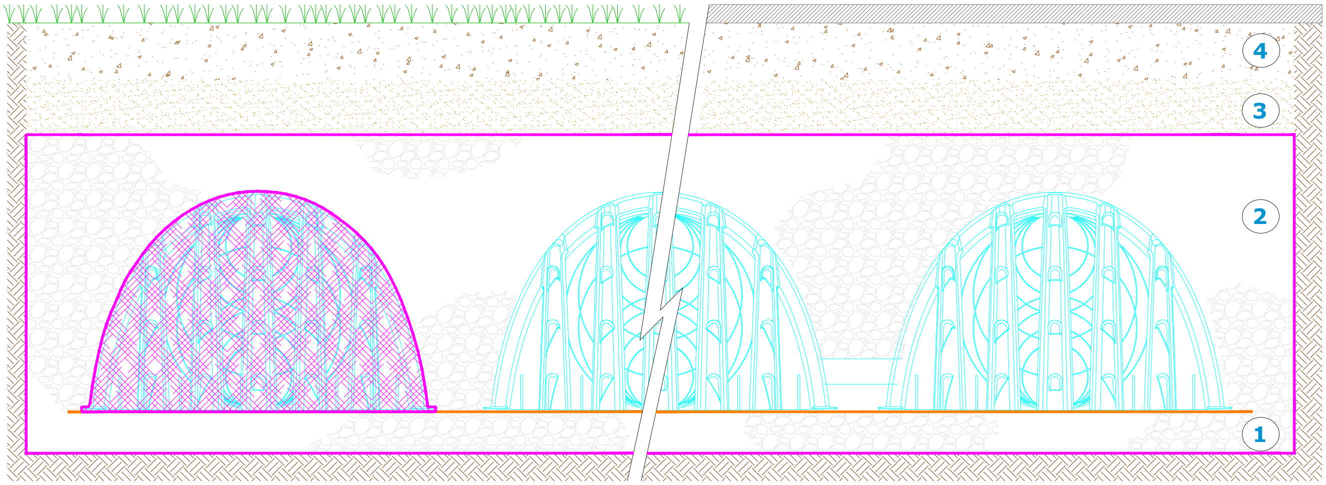
Material Location **See Fig. 1, p.18**	**Placement Method/ Restrictions**	**Wheel Load Restrictions**	**Track Load Restrictions**	**Compaction Restrictions**
	See Table 1, p. 16 for Maximum Construction Loads			
4 Final Fill Material	A variety of placement methods may be used. All construction loads shall not exceed the maximum values listed in Table 1.	902HD: 36″ minimum cover for dump truck and wheel loader travel 300HD, 360HD: 24″ minimum cover for dump truck and wheel loader travel	Dozers shall push parallel to rows only.	902HD: Roller travel shall be parallel to rows only until 36″ of cover is reached 300HD, 360HD: Roller travel shall be parallel to rows only until 24″ of cover is reached
3 Initial Fill Material	Excavator positioned off of bed or on foundation stone. Small LGP track dozer, track skid steer loaders may be used. Must maintain 12″ minimum fill below tracks at all times.	902HD: Asphalt can be dumped into paver machine when total cumulative fill depth over chambers reaches 24″ 300HD, 360HD: Asphalt can be dumped into paver machine when total cumulative fill depth over chambers reaches 18″	Equipment direction of travel shall be parallel to rows at all times. Equipment shall not be permitted to turn direction over chambers**.**	Roller travel shall be parallel to rows only. 902HD: Dynamic roller mode shall be used only when total cumulative fill depth over chambers reaches 24″ 300HD, 360HD: Dynamic roller mode shall be used only when total cumulative fill depth over chambers reaches 18″
2 Embedment Stone	No equipment shall be permitted to contact the chambers. Stone conveyor positioned off of bed or on foundation stone. Excavator positioned off of bed or on foundation stone. Stone column height differential between chamber rows shall never exceed 12″. Stone to be placed at the crown of the chamber. No stone shall be pushed over chambers.	No wheel loads allowed. No wheel loaders permitted to dump stone directly onto chambers.	No tracked equipment is allowed on chambers until 12″ of embedment stone is in place.	No rollers allowed.
1 Foundation	A variety of placement methods may be used including but not limited to excavator placement, stone conveyor placement or dozer placement. Plate compact or roll to achieve a flat, unyielding surface. Contractor is responsible for any conditions or requirements relating to subgrade bearing capacity, dewatering or protection of subgrade infiltrative capacity.			

Table 3: Acceptable Fill Materials

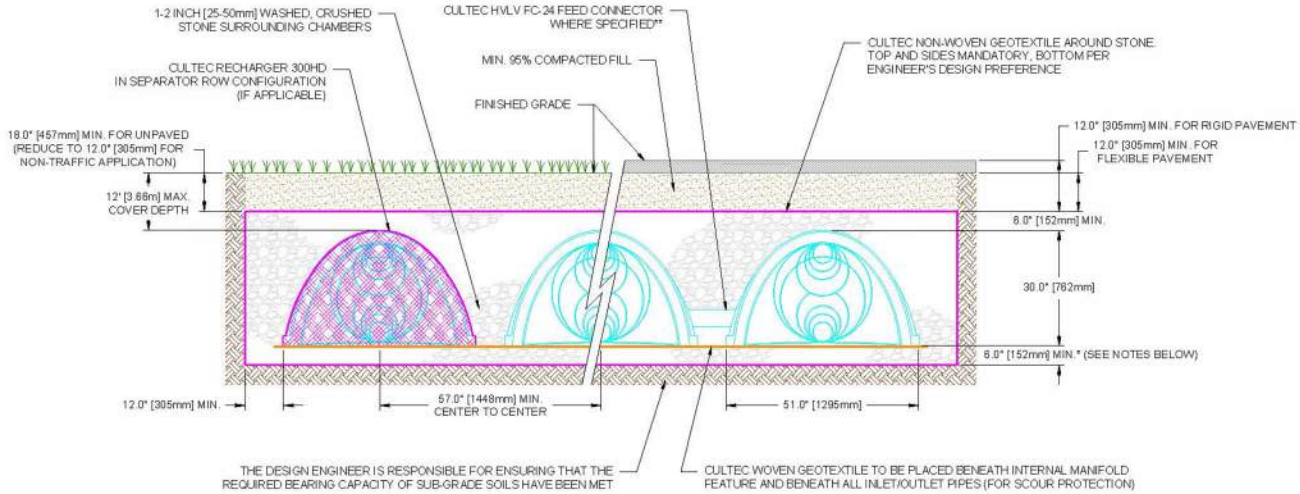
	Material Location	Description	AASHTO M43 Classification	Compaction/ Density Requirement
4	Fill Material for Layer 4 starts from the top of Layer 3 to the bottom of pavement or unpaved finished grade above. Refer to cross section, page 19 for proper minimum fill requirements.	Any soil/rock materials, native soils or per engineer's plans. Check plans for pavement subgrade requirements.	Per engineer's drawings	Prepare per engineer's drawing. Paved installations may have strict material and preparation requirements.
3	Fill Material for Layer 3 starts from top of embedment stone (Layer 2) to minimum required depth above top of chamber. Refer to cross section, page 19 for proper minimum fill requirements.	Granular well-graded soil/aggregate mixtures, <35% fines	3, 4, 5, 6, 7, 8, 9, 10, 56, 57, 67, 68, 78, 89, 467	Compact in 6" lifts to a minimum 95% Standard Proctor density. Refer to Table 1 for acceptable gross vehicle weights.
2	Embedment Stone surrounding chambers and to a minimum elevation above chamber crown. 300HD: 6" min. required 360HD: 6" min. required 902HD: 12" min. required.	Washed, crushed stone with the majority of particles between 1" - 2"	Recharger 300HD: 3, 4, 467, 57 Recharger 360HD: 3, 4, 467, 57 Recharger 902HD: 3, 4	No compaction required.
1	Foundation Stone below chambers per engineer's drawing 300HD: 6" min. required 360HD: 6" min. required 902HD: 9" min. required.	Washed, crushed stone with the majority of particles between 1" - 2"	Recharger 300HD: 3, 4, 467, 57 Recharger 360HD: 3, 4, 467, 57 Recharger 902HD: 3, 4	Plate compact or roll to achieve a flat, unyielding surface.

The listed AASHTO classifications are for gradations. The stone must be washed, crushed and angular. See Table 5, page 20.
For example, the stone must be specified as washed, crushed No. 4 stone. Fill materials shall be free of debris, trash, frozen lumps and other deleterious matter.
Contact CULTEC for gradation requirements for specific projects that do not fall within the above specifications.

Fig. 1. Fill Material Locations - refer to Tables 1-3



Recharger 300HD Typical Cross Section for Traffic Applications

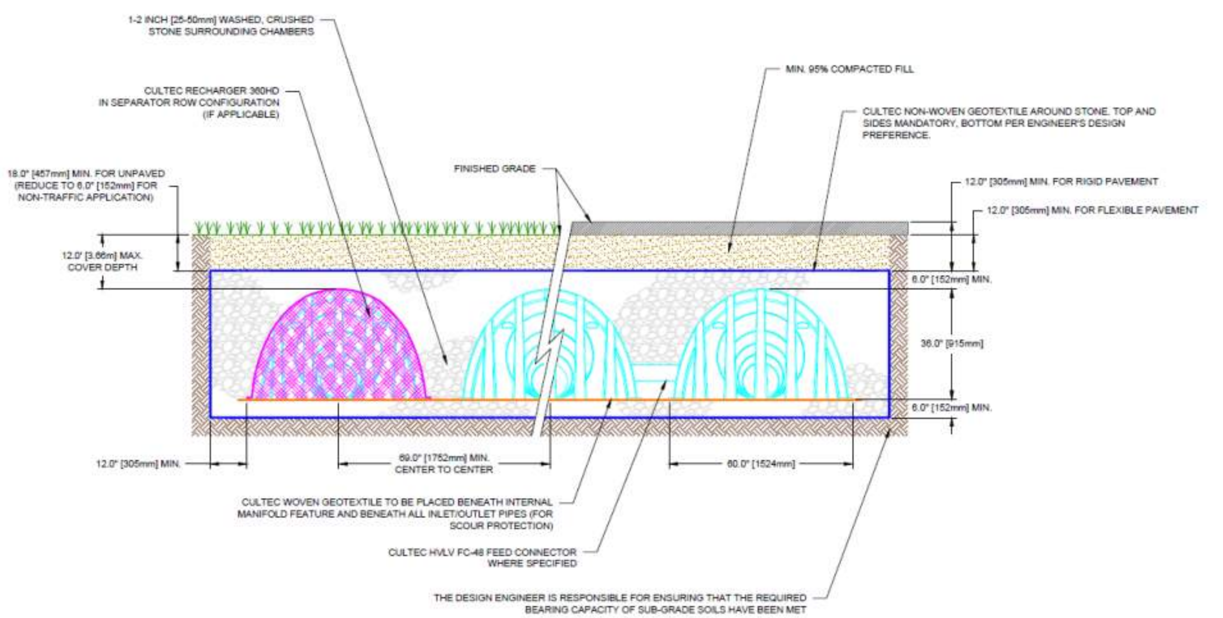


NOTES:

*FOR COVER DEPTHS FROM 18.0" - 8.0' (457mm - 2.44m). INCREASE DEPTH OF BEDDING STONE TO 9.0" (229mm) MIN. FOR COVER DEPTHS GREATER THAN 8.0' (2.44m)
**UTILIZE HVLV FC-24 FEED CONNECTOR FOR 6" (152mm) ROW SPACING. UTILIZE HVLV FC-48 FEED CONNECTOR FOR ROW SPACING GREATER THAN 6" (152mm)

1. THE CHAMBERS SHALL BE DESIGNED AND TESTED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS." THE LOAD CONFIGURATION SHALL INCLUDE:
   - 1.a. INSTANTANEOUS AASHTO DESIGN TRUCK LIVE LOAD AT MINIMUM COVER
   - 1.b. MAXIMUM PERMANENT (50-YEAR) COVER LOAD
   - 1.c. 1-WEEK PARKED AASHTO DESIGN TRUCK LOAD
2. THE CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418 "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS"
3. THE INSTALLED CHAMBER SYSTEM SHALL PROVIDE RESISTANCE TO THE LOADS AND LOAD FACTORS AS DEFINED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS SECTION 12.12, WHEN INSTALLED ACCORDING TO CULTEC'S RECOMMENDED INSTALLATION INSTRUCTIONS. THE STRUCTURAL DESIGN OF THE CHAMBERS SHALL INCLUDE THE FOLLOWING:
   - 3.a. THE CREEP MODULUS SHALL BE 50-YEAR AS SPECIFIED IN ASTM F2418
   - 3.b. THE MINIMUM SAFETY FACTOR FOR LIVE LOADS SHALL BE 1.75
   - 3.c. THE MINIMUM SAFETY FACTOR FOR DEAD LOADS SHALL BE 1.95

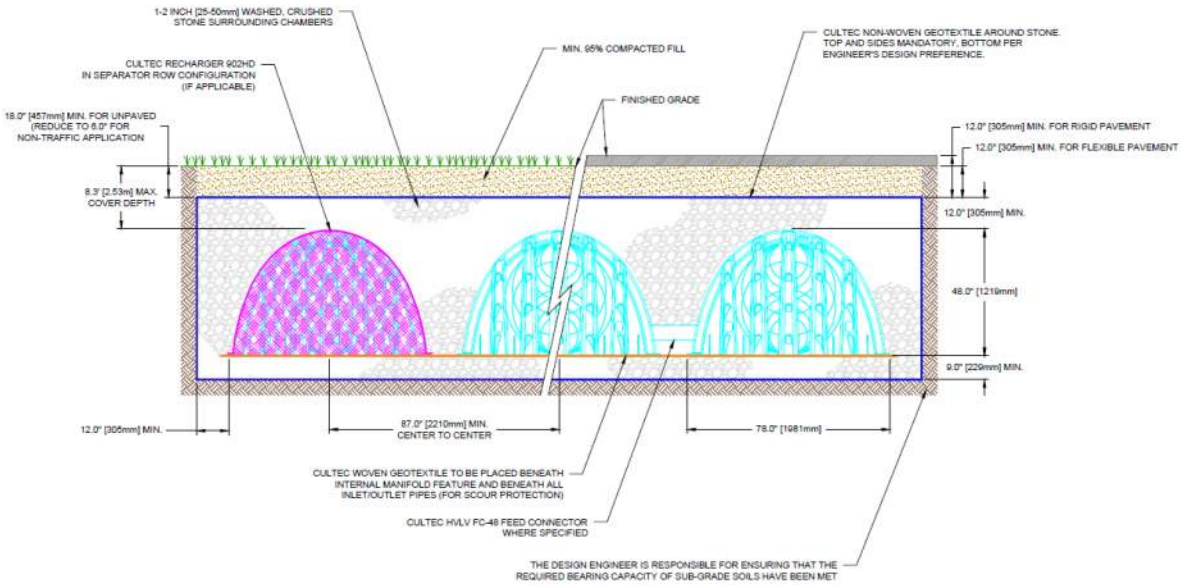
Recharger 360HD Typical Cross Section for Traffic Applications



NOTES:

1. THE CHAMBERS SHALL BE DESIGNED AND TESTED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS." THE LOAD CONFIGURATION SHALL INCLUDE:
   - 1.a. INSTANTANEOUS AASHTO DESIGN TRUCK LIVE LOAD AT MINIMUM COVER
   - 1.b. MAXIMUM PERMANENT (50-YEAR) COVER LOAD
   - 1.c. 1-WEEK PARKED AASHTO DESIGN TRUCK LOAD
2. THE CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F3430-20 "STANDARD SPECIFICATION FOR CELLULAR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS"
3. THE INSTALLED CHAMBER SYSTEM SHALL PROVIDE RESISTANCE TO THE LOADS AND LOAD FACTORS AS DEFINED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS SECTION 12.12, WHEN INSTALLED ACCORDING TO CULTEC'S RECOMMENDED INSTALLATION INSTRUCTIONS. THE STRUCTURAL DESIGN OF THE CHAMBERS SHALL INCLUDE THE FOLLOWING:
   - 3.a. THE CREEP MODULUS SHALL BE 50-YEAR AS SPECIFIED IN ASTM F3430
   - 3.b. THE MINIMUM SAFETY FACTOR FOR LIVE LOADS SHALL BE 1.75
   - 3.c. THE MINIMUM SAFETY FACTOR FOR DEAD LOADS SHALL BE 1.95

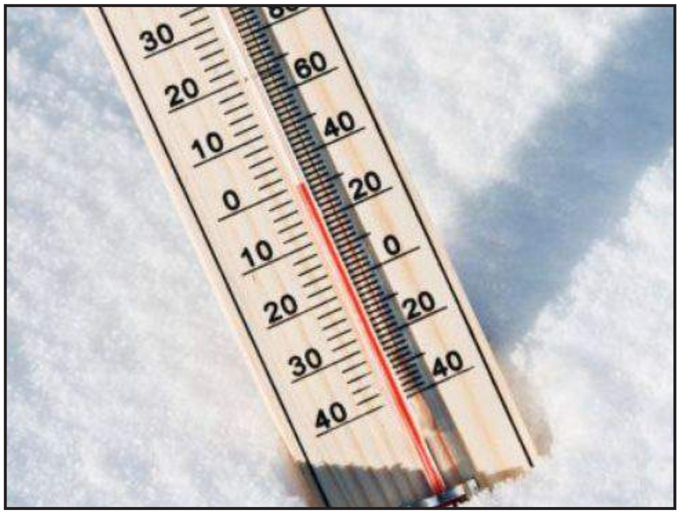
Recharger 902HD Typical Cross Section for Traffic Applications



NOTES:

1. THE CHAMBERS SHALL BE DESIGNED AND TESTED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS." THE LOAD CONFIGURATION SHALL INCLUDE:
   - 1.a. INSTANTANEOUS AASHTO DESIGN TRUCK LIVE LOAD AT MINIMUM COVER
   - 1.b. MAXIMUM PERMANENT (50-YEAR) COVER LOAD
   - 1.c. 1-WEEK PARKED AASHTO DESIGN TRUCK LOAD
2. THE CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F3430-20 "STANDARD SPECIFICATION FOR CELLULAR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS"
3. THE INSTALLED CHAMBER SYSTEM SHALL PROVIDE RESISTANCE TO THE LOADS AND LOAD FACTORS AS DEFINED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS SECTION 12.12, WHEN INSTALLED ACCORDING TO CULTEC'S RECOMMENDED INSTALLATION INSTRUCTIONS. THE STRUCTURAL DESIGN OF THE CHAMBERS SHALL INCLUDE THE FOLLOWING:
   - 3.a. THE CREEP MODULUS SHALL BE 50-YEAR AS SPECIFIED IN ASTM F3430
   - 3.b. THE MINIMUM SAFETY FACTOR FOR LIVE LOADS SHALL BE 1.75
   - 3.c. THE MINIMUM SAFETY FACTOR FOR DEAD LOADS SHALL BE 1.95

Special Handling Instructions for Polypropylene, Chambers in Colder Temperatures



CULTEC chambers are manufactured of impact-modified polypropylene, which is inherently resistant to corrosion and chemical breakdown and cold weather impact. Additional UV inhibitors and antioxidants increase the chambers' resistance to sunlight degradation. However, CULTEC recommends that, when installed in cold temperatures below 32° F, the installer take special care when removing the chambers from the stacks, not allowing the chambers to fall from height. Avoid using machinery to handle the chambers. When possible, CULTEC recommends that the stone backfill be placed in temperatures above 32° F to minimize depressions or deflections.

For more information, contact CULTEC at (203) 775-4416 or visit www.cultec.com.


DEERE
544J


CAT

Table 3: CULTEC No. 410™ Non-Woven Geotextile Specification Information

Properties	ASTM Test Method	Test Results
Appearance		Black
Weight - Typical	D 5261	4.5 oz/sy
Tensile Strength	D 4632	120 lbs
Elongation @ Break	D 4632	50%
Mullen Burst*	D 3786*	225 psi
Puncture Strength*	D 4833*	65 lbs
CBR Puncture	D 6241	340 lbs
Trapezoid Tear	D 4533	50 lbs
AOS	D 4751	70 US Sieve
Permittivity	D 4491	1.70 Sec^{-1}
Water Flow Rate	D 4491	135 gal/min/sf
UV Resistance @ 500 Hours	D 4355	70%

** Historical averages (current values not available): Mullen Burst Strength ASTM D3786 is no longer recognized by ASTM D-35 on Geosynthetics as an acceptable test method. Puncture Strength ASTM D4833 is not recognized by AASHTO M288 and has been replaced with CBR Puncture ASTM D6241.*
Substitutions must meet or exceed these minimums. Non-woven geotextile placement is mandatory over top and sides of system. Coverage of system bottom is recommended. However, follow engineer's design preference.

Table 4: CULTEC AFAB-HPF Woven Geotextile Specification Information

Properties	ASTM Test Method	Test Results
Appearance		Black
Tensile Strength	D 4632	320 lbs
Elongation @ Break	D 4632	15%
Wide Width Tensile	D 4595	52 kN/m
Wide Width Elongation	D 4595	15%
CBR Puncture	D 6241	1,500 lbs
Trapezoidal Tear	D 4533	120 lbs
Apparent Opening Size	D 4751	30 US Sieve
Permittivity	D 4491	0.2 Sec^{-1}
Water Flow Rate	D 4491	22 g/min/sf
UV Resistance @ 500 Hours	D 4355	70%

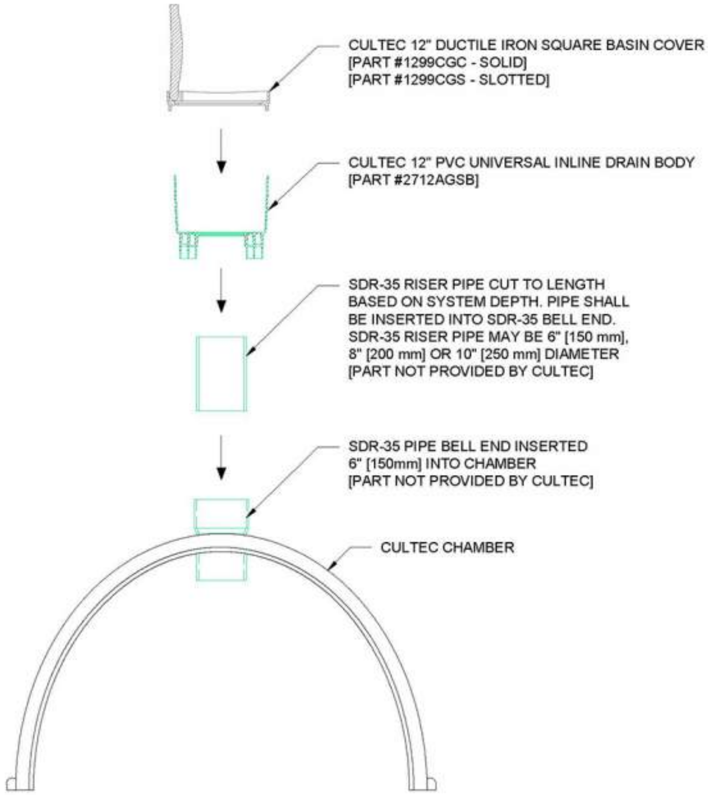
Substitutions must meet or exceed these minimums. To be used as scour protection and in conjunction with CULTEC Separator Row (if specified).

Table 5: Criteria for acceptable 1 - 2 inch washed, crushed, angular stone

Washed Crushed Stone	Description	Criteria
Acceptable	Angular	Stones have sharp edges and relatively plane sides with unpolished surfaces
	Subangular	Stones are similar to angular description but may have slightly rounded edges
Unacceptable	Subrounded	Stones have nearly plane sides but have well-rounded corners and edges
	Rounded	Stones have smoothly curved sides and no edges

See Item 1 and Item 2 of Table 3 on page 18 for additional stone requirements.

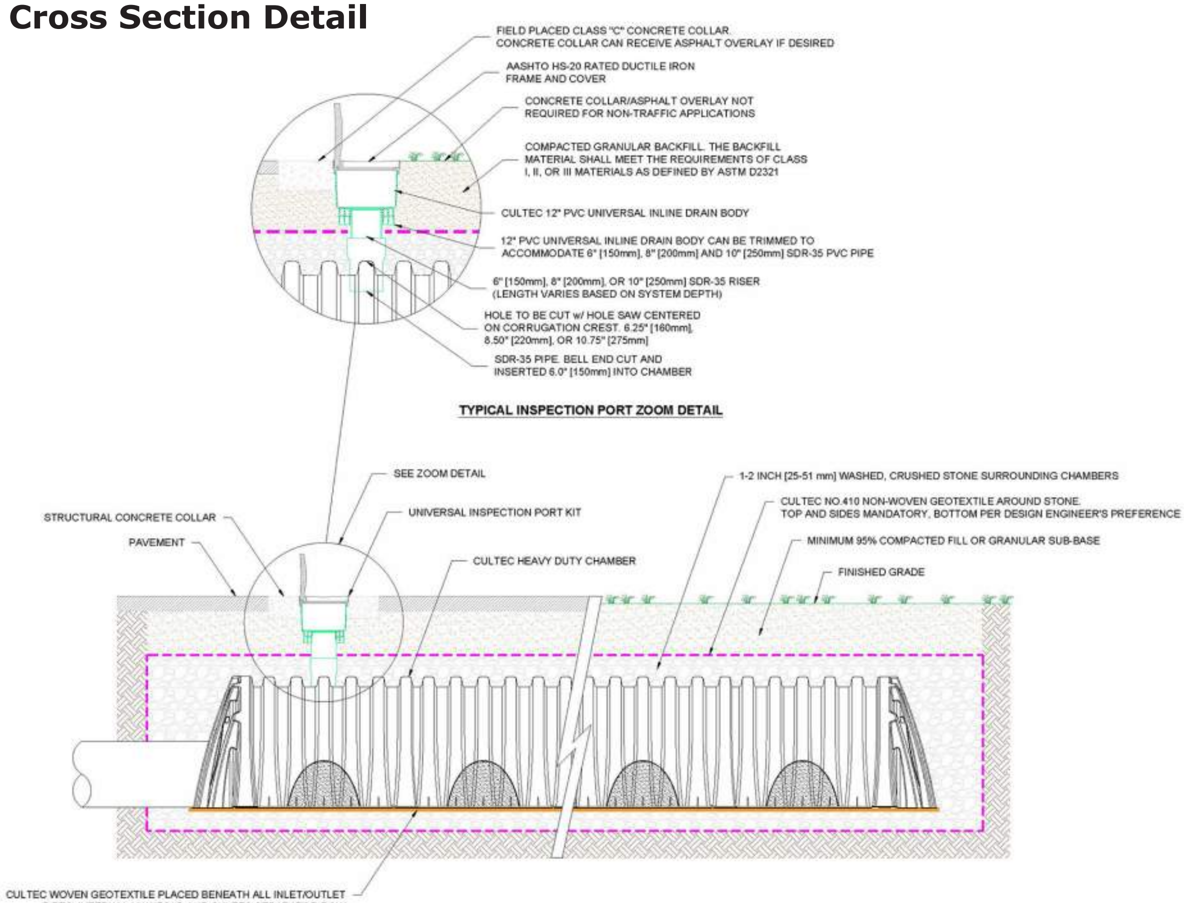
Inspection Port Detail for Paved Traffic Applications



Trim inspection port knock-out with reciprocating saw or hole-saw.

Corrugated pipe is not suitable for inspection port.

Typical Cross Section Detail



CULTEC
878 Federal Road • Brookfield, CT 06804 USA
P: (203) 775-4416 • Toll Free: 1(800) 4-CULTEC • CT-CustomerService@cultec.com • www.cultec.com

RETENTION • DETENTION • INFILTRATION • WATER QUALITY

CONTACTOR® & RECHARGER®

STORMWATER MANAGEMENT SOLUTIONS

OPERATION & MAINTENANCE GUIDELINES

FOR CULTEC STORMWATER MANAGEMENT SYSTEMS

CULTEC®

Published by
CULTEC
P.O. Box 280
878 Federal Road
Brookfield, Connecticut 06804 USA
www.cultec.com

Disclaimers:
The drawings, photographs and illustrations shown in this document are for illustrative purposes only and are not necessarily to scale.
Actual designs may vary.

CULTEC reserves the right to make design and/or specification changes at any time without notice at CULTEC's sole discretion.

Protected by one or more of the following patents owned by Cultec:
U.S. Patents 6,129,482; 6,322,288; 6,854,925; 7,226,241; 7,806,627; 8,366,346; 8,425,148; U.S. Designs D613,819; D638,095; D668,318; Canadian Patent 2,450,565; 2,591,255; Canadian Designs 129144; 135983; 159073; 160977; and/or other U.S. or Foreign Patent(s) or Patent(s) Pending.

Contact Information:
For general information on our other products and services, please contact our offices within the United States at (800)428-5832, (203)775-4416 ext. 202, or e-mail us at CT-CustomerService@cultec.com.

For technical support, please call (203)775-4416 ext. 203 or e-mail CT-Tech@cultec.com.

Visit www.cultec.com/downloads.html for Product Downloads and CAD details.

Doc ID: CLT057 11-23
November 2023

These instructions are for single-layer traffic applications only. For multi-layer applications, contact CULTEC.
All illustrations and photos shown herein are examples of typical situations. Be sure to follow the engineer's drawings.
Actual designs may vary.

This manual contains guidelines recommended by CULTEC and may be used in conjunction with, but not to supersede, local regulations or regulatory authorities. OSHA Guidelines must be followed when inspecting or cleaning any structure.

Introduction

The CULTEC Subsurface Stormwater Management System is a high-density polyethylene (HDPE) chamber system arranged in parallel rows surrounded by washed stone. The CULTEC chambers create arch-shaped voids within the washed stone to provide stormwater detention, retention, infiltration, and reclamation. Filter fabric is placed between the native soil and stone interface to prevent the intrusion of fines into the system. In order to minimize the amount of sediment which may enter the CULTEC system, a sediment collection device (stormwater pretreatment device) is recommended upstream from the CULTEC chamber system. Examples of pretreatment devices include, but are not limited to, an appropriately sized catch basin with sump, pretreatment catchment device, oil grit separator, or baffled distribution box. Manufactured pretreatment devices may also be used in accordance with CULTEC chambers. Installation, operation, and maintenance of these devices shall be in accordance with manufacturer's recommendations. Almost all of the sediment entering the stormwater management system will be collected within the pretreatment device.

Best Management Practices allow for the maintenance of the preliminary collection systems prior to feeding the CULTEC chambers. The pretreatment structures shall be inspected for any debris that will restrict inlet flow rates. Outfall structures, if any, such as outlet control must also be inspected for any obstructions that would restrict outlet flow rates. OSHA Guidelines must be followed when inspecting or cleaning any structure.

Operation and Maintenance Requirements

I. Operation

CULTEC stormwater management systems shall be operated to receive only stormwater run-off in accordance with applicable local regulations. CULTEC subsurface stormwater management chambers operate at peak performance when installed in series with pretreatment. Pretreatment of suspended solids is superior to treatment of solids once they have been introduced into the system. The use of pretreatment is adequate as long as the structure is maintained and the site remains stable with finished impervious surfaces such as parking lots, walkways, and pervious areas are properly maintained. If there is to be an unstable condition, such as improvements to buildings or parking areas, all proper silt control measures shall be implemented according to local regulations.

II. Inspection and Maintenance Options

A. The CULTEC system may be equipped with an inspection port located on the inlet row. The inspection port is a circular cast box placed in a rectangular concrete collar. When the lid is removed, a 6-inch (150 mm) pipe with a screw-in plug will be exposed. Remove the plug. This will provide access to the CULTEC Chamber row below. From the surface, through this access, the sediment may be measured at this location. A stadia rod may be used to measure the depth of sediment if any in this row. If the depth of sediment is in excess of 3 inches (76 mm), then this row should be cleaned with high pressure water through a culvert cleaning nozzle. This would be carried out through an upstream manhole or through the CULTEC StormFilter Unit (or other pre-treatment device). CCTV inspection of this row can be deployed through this access port to deter mine if any sediment has accumulated in the inlet row.

B. If the CULTEC bed is not equipped with an inspection port, then access to the inlet row will be through an upstream manhole or the CULTEC StormFilter.

1. **Manhole Access**
This inspection should only be carried out by persons trained in confined space entry and sewer inspection services. After the manhole cover has been removed a gas detector must be lowered into the manhole to ensure that there are not high concentrations of toxic gases present. The inspector should be lowered into the manhole with the proper safety equipment as per OSHA requirements. The inspector may be able to observe sediment from this location. If this is not possible, the inspector will need to deploy a CCTV robot to permit viewing of the sediment.

2. **StormFilter Access**
Remove the manhole cover to allow access to the unit. Typically a 30-inch (750 mm) pipe is used as a riser from the StormFilter to the surface. As in the case with manhole access, this access point requires a technician trained in confined space entry with proper gas detection equipment. This individual must be equipped with the proper safety equipment for entry into the StormFilter. The technician will be lowered onto the StormFilter unit. The hatch on the unit must be removed. Inside the unit are two filters which may be removed according to StormFilter maintenance guidelines. Once these filters are removed the inspector can enter the StormFilter unit to launch the CCTV camera robot.

C. The inlet row of the CULTEC system is placed on a polyethylene liner to prevent scouring of the washed stone beneath this row. This also facilitates the flushing of this row with high pressure water through a culvert cleaning nozzle. The nozzle is deployed through a manhole or the StormFilter and extended to the end of the row. The water is turned on and the inlet row is back-flushed into the manhole or StormFilter. This water is to be removed from the manhole or StormFilter using a vacuum truck.

III. Maintenance Guidelines

The following guidelines shall be adhered to for the operation and maintenance of the CULTEC stormwater management system:

A. The owner shall keep a maintenance log which shall include details of any events which would have an effect on the system's operational capacity.

B. The operation and maintenance procedure shall be reviewed periodically and changed to meet site conditions.

C. Maintenance of the stormwater management system shall be performed by qualified workers and shall follow applicable occupational health and safety requirements.

D. Debris removed from the stormwater management system shall be disposed of in accordance with applicable laws and regulations.

IV. Suggested Maintenance Schedules

A. **Minor Maintenance**
The following suggested schedule shall be followed for routine maintenance during the regular operation of the stormwater system:

Frequency	Action
Monthly in first year	Check inlets and outlets for clogging and remove any debris, as required.
Spring and Fall	Check inlets and outlets for clogging and remove any debris, as required.
One year after commissioning and every third year following	Check inlets and outlets for clogging and remove any debris, as required.

B. **Major Maintenance**
The following suggested maintenance schedule shall be followed to maintain the performance of the CULTEC stormwater management chambers. Additional work may be necessary due to insufficient performance and other issues that might be found during the inspection of the stormwater management chambers. (See table on next page)

	Frequency	Action
Inlets and Outlets	Every 3 years	• Obtain documentation that the inlets, outlets and vents have been cleaned and will function as intended.
	Spring and Fall	• Check inlet and outlets for clogging and remove any debris as required.
CULTEC Stormwater Chambers	2 years after commissioning	• Inspect the interior of the stormwater management chambers through inspection port for deficiencies using CCTV or comparable technique. • Obtain documentation that the stormwater management chambers and feed connectors will function as anticipated.
	9 years after commissioning every 9 years following	• Clean stormwater management chambers and feed connectors of any debris. • Inspect the interior of the stormwater management structures for deficiencies using CCTV or comparable technique. • Obtain documentation that the stormwater management chambers and feed connectors have been cleaned and will function as intended.
	45 years after commissioning	• Clean stormwater management chambers and feed connectors of any debris. • Determine the remaining life expectancy of the stormwater management chambers and recommended schedule and actions to rehabilitate the stormwater management chambers as required. • Inspect the interior of the stormwater management chambers for deficiencies using CCTV or comparable technique. • Replace or restore the stormwater management chambers in accordance with the schedule determined at the 45-year inspection. • Attain the appropriate approvals as required. • Establish a new operation and maintenance schedule.
Surrounding Site	Monthly in 1st year	• Check for depressions in areas over and surrounding the stormwater management system.
	Spring and Fall	• Check for depressions in areas over and surrounding the stormwater management system.
	Yearly	• Confirm that no unauthorized modifications have been performed to the site.

For additional information concerning the maintenance of CULTEC Subsurface Stormwater Management Chambers, please contact CULTEC at 1-800-428-5832.

WQMP
Operation & Maintenance (O&M) Plan

Project Name:____

Prepared for:

Project Name: ____

Address:____

City, State Zip:____

Prepared on:

Date:____

This O&M Plan describes the designated responsible party for implementation of this WQMP, including: operation and maintenance of all the structural BMP(s), conducting the training/educational program and duties, and any other necessary activities. The O&M Plan includes detailed inspection and maintenance requirements for all structural BMPs, including copies of any maintenance contract agreements, manufacturer's maintenance requirements, permits, etc.

8.1.1 Project Information

Project name	
Address	
City, State Zip	
Site size	
List of structural BMPs, number of each	
Other notes	

8.1.2 Responsible Party

The responsible party for implementation of this WQMP is:

Name of Person or HOA Property Manager	
Address	
City, State Zip	
Phone number	
24-Hour Emergency Contact number	
Email	

8.1.3 Record Keeping

Parties responsible for the O&M plan shall retain records for at least 5 years.

All training and educational activities and BMP operation and maintenance shall be documented to verify compliance with this O&M Plan. A sample Training Log and Inspection and Maintenance Log are included in this document.

8.1.4 Electronic Data Submittal

This document along with the Site Plan and Attachments shall be provided in PDF format. AutoCAD files and/or GIS coordinates of BMPs shall also be submitted to the City.

Appendix ___

BMP SITE PLAN

Site plan is preferred on minimum 11” by 17” colored sheets, as long as legible.

BMP OPERATION & MAINTENANCE LOG

Project Name: ______________________________

Today's Date: ______________________________

Name of Person Performing Activity (Printed): ______________________________

Signature: ______________________________

BMP Name (As Shown in O&M Plan)	Brief Description of Implementation, Maintenance, and Inspection Activity Performed

Minor Maintenance

Frequency		Action
Monthly in first year		Check inlets and outlets for clogging and remove any debris, as required.
		Notes
□ Month 1	Date:	
□ Month 2	Date:	
□ Month 3	Date:	
□ Month 4	Date	
□ Month 5	Date:	
□ Month 6	Date:	
□ Month 7	Date:	
□ Month 8	Date:	
□ Month 9	Date:	
□ Month 10	Date:	
□ Month 11	Date:	
□ Month 12	Date:	
Spring and Fall		Check inlets and outlets for clogging and remove any debris, as required.
		Notes
□ Spring	Date:	
□ Fall	Date:	
□ Spring	Date:	
□ Fall	Date:	
□ Spring	Date:	
□ Fall	Date:	
□ Spring	Date:	
□ Fall	Date:	
□ Spring	Date:	
□ Fall	Date:	
□ Spring	Date:	
□ Fall	Date:	
One year after commissioning and every third year following		Check inlets and outlets for clogging and remove any debris, as required.
		Notes
□ Year 1	Date:	
□ Year 4	Date:	
□ Year 7	Date:	
□ Year 10	Date:	
□ Year 13	Date:	
□ Year 16	Date:	
□ Year 19	Date:	
□ Year 22	Date:	

Major Maintenance

	Frequency		Action
Inlets and Outlets	**Every 3 years**		Obtain documentation that the inlets, outlets and vents have been cleaned and will function as intended.
			Notes
	□ Year 1	Date:	
	□ Year 4	Date:	
	□ Year 7	Date:	
	□ Year 10	Date:	
	□ Year 13	Date:	
	□ Year 16	Date:	
	□ Year 19	Date:	
	□ Year 22	Date:	
	Spring and Fall		Check inlet and outlets for clogging and remove any debris, as required.
			Notes
	□ Spring	Date:	
	□ Fall	Date:	
	□ Spring	Date:	
	□ Fall	Date:	
	□ Spring	Date:	
	□ Fall	Date:	
	□ Spring	Date:	
	□ Fall	Date:	
	□ Spring	Date:	
	□ Fall	Date:	
	□ Spring	Date:	
	□ Fall	Date:	
CULTEC Stormwater Chambers	**2 years after commissioning**		□ Inspect the interior of the stormwater management chambers through inspection port for deficiencies using CCTV or comparable technique. □ Obtain documentation that the stormwater management chambers and feed connectors will function as anticipated.
			Notes
	□ Year 2	Date:	

Major Maintenance

	Frequency		Action
CULTEC Stormwater Chambers	**9 years after commissioning every 9 years following**		□ Clean stormwater management chambers and feed connectors of any debris. □ Inspect the interior of the stormwater management structures for deficiencies using CCTV or comparable technique. □ Obtain documentation that the stormwater management chambers and feed connectors have been cleaned and will function as intended.
			Notes
	□ Year 9	Date:	
	□ Year 18	Date:	
	□ Year 27	Date:	
	□ Year 36	Date:	
	45 years after commissioning		□ Clean stormwater management chambers and feed connectors of any debris. □ Determine the remaining life expectancy of the stormwater management chambers and recommended schedule and actions to rehabilitate the stormwater management chambers as required. □ Inspect the interior of the stormwater management chambers for deficiencies using CCTV or comparable technique. □ Replace or restore the stormwater management chambers in accordance with the schedule determined at the 45-year inspection. □ Attain the appropriate approvals as required. □ Establish a new operation and maintenance schedule.
			Notes
	□ Year 45	Date:	

Major Maintenance

	Frequency		Action
Surrounding Site	**Monthly in 1st year**		□ Check for depressions in areas over and surrounding the stormwater management system.
			Notes
	□ Month 1	Date:	
	□ Month 2	Date:	
	□ Month 3	Date:	
	□ Month 4	Date:	
	□ Month 5	Date:	
	□ Month 6	Date:	
	□ Month 7	Date:	
	□ Month 8	Date:	
	□ Month 9	Date:	
	□ Month 10	Date:	
	□ Month 11	Date:	
	□ Month 12	Date:	
	Spring and Fall		□ Check for depressions in areas over and surrounding the stormwater management system.
			Notes
	□ Spring	Date:	
	□ Fall	Date:	
	□ Spring	Date:	
	□ Fall	Date:	
	□ Spring	Date:	
	□ Fall	Date:	
	□ Spring	Date:	
	□ Fall	Date:	
	□ Spring	Date:	
	□ Fall	Date:	
	□ Spring	Date:	
	□ Fall	Date:	
	Yearly		□ Confirm that no unauthorized modifications have been performed to the site.
			Notes
	□ Year 1	Date:	
	□ Year 2	Date:	
	□ Year 3	Date:	
	□ Year 4	Date:	
	□ Year 5	Date:	
	□ Year 6	Date:	
	□ Year 7	Date:	

CULTEC
878 Federal Road • P.O. Box 280 • Brookfield, CT 06804 USA
P: (203) 775-4416 • Toll Free: 1(800) 4-CULTEC • www.cultec.com

RETENTION • DETENTION • INFILTRATION • WATER QUALITY