



STORMWATER REPORT

**ALL STATES MATERIAL GROUP (ASMG)
HAUL IMPROVEMENTS & NEW PAD SITE
FRANKLIN COUNTY, MASSACHUSETTS**

PROPERTY OWNER:

ALL STATES MATERIALS GROUP
901 RIVER ROAD
DEERFIELD, MA 01342

REPORT PREPARER:

KLEINFELDER
1500 MAIN STREET, SUITE 1506
SPRINGFIELD, MA 01115
(413) 739-1307

SUBMISSION

MAY 04, 2022

Copyright 2022 Kleinfelder
All Rights Reserved

ONLY THE CLIENT OR ITS DESIGNATED REPRESENTATIVES MAY USE THIS DOCUMENT AND ONLY FOR THE SPECIFIC PROJECT FOR WHICH THIS REPORT WAS PREPARED.

A Report Prepared for:

All States Materials Group
Daniel J. Hartman, PE
Environmental Engineering Manager
112 Amherst Road
Sunderland, MA 01375
(413) 712-0759

STORMWATER REPORT
ASMG Haul Road Improvements & New Pad Site

Prepared by:



Kurt Violette
Project Professional

Approved by:

Joe Wojnas, P.E.
Project Manager

KLEINFELDER
1500 Main Street, Suite 1506
Springfield, MA 01115

Kleinfelder Project No.: 20193649.001A

TABLE OF CONTENTS

Section

MA Department of Environmental Protection Stormwater Management Checklist

APPENDIX A – PROJECT DESCRIPTION

- 1.0 Introduction
- 2.0 Stormwater Management Standards
 - 2.1 Standard 1: No New Untreated Discharge
 - 2.2 Standard 2: Peak Rate Attenuation
 - 2.3 Standard 3: Recharge
 - 2.4 Standard 4: Water Quality
 - 2.5 Standard 5: Land Uses with Higher Potential Pollutant Loads
 - 2.6 Standard 6: Critical Areas
 - 2.7 Standard 7: Redevelopment Projects and Other Projects Subject to the Standards only to the Maximum Extents Practicable
 - 2.8 Standard 8: Construction Period Pollution Prevention and Erosion and Sediment Control
 - 2.9 Standard 9: Operation and Maintenance Plan
 - 2.10 Standard 10: Illicit Discharge
- 3.0 Conclusion

APPENDIX B – EXISTING CONDITIONS

- B1 Aerial Map
- B2 Abutters List
- B3 Abutters Maps

APPENDIX C – SUPPORT DOCUMENTS

- C1 FEMA Map
- C2 USDA NRCS Hydrologic Soil Group

APPENDIX D – HYDROLOGY MAPS

- D1 ED-1 Pre-Development Hydrology Map
- D2 PD-1 Post-Development Hydrology Map
- D3 PD-1 Post-Development Hydrology

APPENDIX E – STORMWATER COMPUTATIONS

- E0 Rainfall Data
- E1 TSS Removal Calculation Worksheet
- E2 Temporary Sediment Traps
- E3 Conveyance Swale Design & Lining
- E4 Storm Drainage Culverts
- E5 Water Quality Volume

APPENDIX F – DRAINAGE CALCULATIONS (HydroCAD)

F1 Pre-Development Hydrology

F2 Post-Development Hydrology

F3 Post-Development BMP

F4 Erosion & Sedimentation Control (Temporary Sediment Traps)

APPENDIX G – EROSION AND SEDIMENTATION CONTROL PLANS

APPENDIX H – OPERATION AND MAINTENANCE PLAN

APPENDIX I – ILLICIT DISCHARGE COMPLIANCE STATEMENT

APPENDIX J – HY-8 CULVERT ANALYSIS REPORT

J1 Pre-Development

J2 Post-Development

STORMWATER MANAGEMENT CHECKLIST



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 8²
- 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 for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

- Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.
- Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.
- Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

- Soil Analysis provided.
- Required Recharge Volume calculation provided.
- Required Recharge volume reduced through use of the LID site Design Credits.
- Sizing the infiltration, BMPs is based on the following method: Check the method used.
 - Static
 - Simple Dynamic
 - Dynamic Field¹
- Runoff from all impervious areas at the site discharging to the infiltration BMP.
- Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.
- Recharge BMPs have been sized to infiltrate the Required Recharge Volume.
- Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:
 - Site is comprised solely of C and D soils and/or bedrock at the land surface
 - M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
 - Solid Waste Landfill pursuant to 310 CMR 19.000
 - Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.
- Calculations showing that the infiltration BMPs will drain in 72 hours are provided.
- Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

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



Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

- The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.
- Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

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

- Good housekeeping practices;
 - Provisions for storing materials and waste products inside or under cover;
 - Vehicle washing controls;
 - Requirements for routine inspections and maintenance of stormwater BMPs;
 - Spill prevention and response plans;
 - Provisions for maintenance of lawns, gardens, and other landscaped areas;
 - Requirements for storage and use of fertilizers, herbicides, and pesticides;
 - Pet waste management provisions;
 - Provisions for operation and management of septic systems;
 - Provisions for solid waste management;
 - Snow disposal and plowing plans relative to Wetland Resource Areas;
 - Winter Road Salt and/or Sand Use and Storage restrictions;
 - Street sweeping schedules;
 - Provisions for prevention of illicit discharges to the stormwater management system;
 - Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
 - Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
 - List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.
- A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.
 - Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:
 - is within the Zone II or Interim Wellhead Protection Area
 - is near or to other critical areas
 - is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
 - involves runoff from land uses with higher potential pollutant loads.
 - The Required Water Quality Volume is reduced through use of the LID site Design Credits.
 - Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.



Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

- The BMP is sized (and calculations provided) based on:
 - The ½" or 1" Water Quality Volume or
 - The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.
- The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.
- A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

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

- The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.
- The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted **prior to** the discharge of stormwater to the post-construction stormwater BMPs.
- The NPDES Multi-Sector General Permit does **not** cover the land use.
- LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.
- All exposure has been eliminated.
- All exposure has **not** been eliminated and all BMPs selected are on MassDEP LUHPPL list.
- The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

- The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.
- Critical areas and BMPs are identified in the Stormwater Report.



Checklist for Stormwater Report

Checklist (continued)

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

- The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:
- Limited Project
 - Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
 - Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
 - Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
 - Bike Path and/or Foot Path
 - Redevelopment Project
 - Redevelopment portion of mix of new and redevelopment.
 - Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.
 - The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

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

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

- Narrative;
 - Construction Period Operation and Maintenance Plan;
 - Names of Persons or Entity Responsible for Plan Compliance;
 - Construction Period Pollution Prevention Measures;
 - Erosion and Sedimentation Control Plan Drawings;
 - Detail drawings and specifications for erosion control BMPs, including sizing calculations;
 - Vegetation Planning;
 - Site Development Plan;
 - Construction Sequencing Plan;
 - Sequencing of Erosion and Sedimentation Controls;
 - Operation and Maintenance of Erosion and Sedimentation Controls;
 - Inspection Schedule;
 - Maintenance Schedule;
 - Inspection and Maintenance Log Form.
- A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.



Checklist for Stormwater Report

Checklist (continued)

X **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.

APPENDIX A – PROJECT DESCRIPTION

1.0 INTRODUCTION

The purpose of this report is to provide an analysis and summary of the existing and proposed stormwater management system associated with the proposed road redevelopment of the Haul Road referred to as Lenny Lane in the center of the All States Materials Group property located in Deerfield, Massachusetts. The proposed improvements include redevelopment of Lenny Lane to a Mine Safety and Health Administration (MSHA) compliant haul road with an improved stormwater management system. Proposed improvement also includes new BMP's for outfalls DSN-007 and DSN-008 and proposed culvert crossing for the unnamed stream (tributary to Deerfield River). The proposed stormwater management system and proposed site improvements are intended to be in full compliance with the State and Town regulations.

The overall project site is approximately 212-acres utilized as a rock quarry and aggregate processing plant (by Trew Stone, LLC), operates two hot mix asphalt plants (by Warner Brothers, LLC), and operates an above ground storage tank farm (by All States Asphalt, LLC).

The existing project drainage area is approximately 175 acres comprised of the following areas:

- 160.43+/- acres (Drainage Area 1),
- 7.50+/- acres (Drainage Area 2),
- 0.63+/- acres (Drainage Area 3),
- 0.09+/- acres (Drainage Area 4),
- 6.35+/- acres (Drainage Area 5)

The site is located approximately 1,200-feet south of River Road and 3,300-feet east of Massachusetts Route 10 and within the Deerfield Commercial zone. Existing site access is from River Road via existing private gravel roads. The site is bounded to the north and west by MassDOT rail serving Amtrak and Pan Am Southern, bounded to the east by River Road, and bounded to the south by residential/agricultural zone properties. See **Appendix B** for an Abutter's Map and list of Abutters within 300 ft of the site property lines.

The existing haul road (Lenny Lane) consist of a gravel surface and varies in width from approximately 22-feet to 34-feet wide. The existing haul road has an overall slope down grade from east to west with elevations varying from approximately 187 feet to 350 feet. The site consists of the intersection of 2 gravel roads, 2 small ponds, drainage pipes and culverts, and the majority being woods. There are no existing open storage areas for waste disposal. Two (2) 36-inch diameter culverts, adjacent to DSN-007 & DSN-008, convey the unnamed stream beneath the haul road. Two wetlands were identified adjacent to the site outside the limit of disturbance. The wetlands are at a higher existing and elevation to the proposed site work and will be protected and undisturbed. See **Appendix B** for an aerial image of the existing site.

The proposed site is approximately 175 acres comprised of the following areas:

- 151.84+/- acres (Drainage Area 1),
- 7.50+/- acres (Drainage Area 2),
- 0.98+/- acres (Drainage Area 3),
- 14.95+/- acres (Drainage Area 4),
- 0.53+/- acres (Drainage Area 5)

Proposed site improvements of the existing haul road to a MSHA compliant haul road include 2680 feet of roadway being widened, 170 feet of roadway being regraded, a 60-ft x 100-ft gravel pad in the corner of Mathers Way and Lenny Lane, a level spreader, a pocket wetland, drainage swales, drainage culverts, and minor landscaping. There are no proposed open storage areas for waste disposal. The site demolition that will occur includes the removal of two (2) detention ponds (Pond 7P, Pond 11P), three (3) catch basins, several culverts, and (1) permitted discharge point (DSN-006), removal of trees and shrubs, and clearing and grubbing within the limits of work. Two (2) permitted discharge points (DSN-007, DSN-008) will be relocated at locations shown in the plans. The drainage currently directed towards Pond 11P and DSN-006 will be directed to DSN-007. Outfall DSN-001 will remain.

Per the FEMA Flood Insurance Rate Map the site resides outside of any FEMA designated flood areas. See **Appendix C** to view the FEMA floodplain per FIRMette 2501150011B.

The Stormwater Report is submitted to document compliance with the Stormwater Management Standards as shown in the Massachusetts Stormwater Handbook (MSH) and in compliance with the Stormwater Regulations for the Town of Deerfield (SRTD).

2.0 STORMWATER MANAGEMENT STANDARDS

2.1 Standard 1: No New Untreated Discharges

There are no new drainage outfalls associated with the stormwater management system improvements. Two (2) permitted discharge points (DSN-007, DSN-008) will be relocated at locations shown in the plans. The drainage currently directed towards Pond 11P and DSN-006 will be directed to DSN-007. One (1) permitted discharge point (DSN-001) will remain.

The stormwater management system best management practices (BMP's) includes a constructed stormwater wetland (pocket wetland) (80% TSS removal rate), sediment forebay (25% TSS removal rate) and deep-sump and hooded catch basins (25% TSS removal rate) for the system.

2.2 Standard 2: Peak Rate Attenuation

The stormwater management system is designed so that the hydrologic characteristics of post-development run-off from the site will mimic pre-development patterns and intensities for a 2-year, 10-year and 100-year 24-hour storm event.

Analysis Methodology

The hydrologic analysis to determine peak stormwater discharge rates was performed using the HydroCAD stormwater modeling system computer program developed by HydroCAD Software Solutions, LLC. Hydrographs for each watershed were developed using the SCS Synthetic Unit Hydrograph Method TR-20 with a Type III rainfall distribution, Antecedent Moisture Condition II, and rainfall depths per the Massachusetts Stormwater Handbook for Franklin County for the calculation of peak flow rates and are listed in **Table 1**. The drainage areas, or subcatchments as labeled by the program, are depicted by hexagons on the attached drainage diagrams. Storage

areas, or pond nodes, are depicted by triangles. Pre-Development and Post-Development HydroCAD calculations output, including runoff curve numbers and time of concentrations, can be found in **Appendix F**.

**Table 1 – Rainfall Data from Rainfall Frequency Atlas of the United States (Atlas 14)
24-hour Rainfall by Deerfield Massachusetts**

Storm Event Frequency	Inches / 24-hour
2-year	2.94
10-year	4.48
100-year	6.93

Curve number (CN) is used to quantify the portion of rainfall which results in runoff. CN was estimated based on soil and land use data for the project area. Soil data were obtained from the Natural Resources Conservation Service (NRCS) Web Soil Survey for Franklin County, Massachusetts (Date: 9/12/2019). Land use data were obtained from the State of Massachusetts GIS data service (Date: 2016). Existing land use consists of industrial, pastureland, woods, brush, and wetlands and surface waters.

The time of concentration (T_c) is the travel time it takes storm water to travel from the most remote point in the watershed to the point of interest (also known as the design point). Storm water runoff travels through the watershed as sheet flow, shallow concentrated flow, and open channel flow depending on the site topography. The time of concentration was calculated within HydroCAD. The site was modeled using a Manning's number based on surface description, land slope and a maximum length of 100 feet for sheet flow. The shallow concentrated flow was modeled using a velocity factor based on surface description, land slope and flow length. The minimum time of concentration is 5 minutes.

Pre-Development Conditions

Pre-development stormwater management for the project consists of three (3) detention ponds (Pond 1P, Pond 7P, Pond 11P), two (2) catch basins, several culverts, and four (4) permitted discharge points (DSN-001, DSN-006, DSN-007, DSN-008). Runoff from the project area has the potential to discharge to the existing stream, both upstream and downstream of the existing road. Runoff discharging to the upstream section (S1) of the existing stream is monitored via outfalls DSN-007 and DSN-008. Runoff discharging to the downstream section (S2) of the existing stream is monitored via outfalls DSN-001 and DSN-006. The point of analysis used to evaluate pre-development flows is in existing stream section S2.

The total pre-development project watershed area is 175.00 acres and is approximately 2.7% impervious. The project watershed is subdivided into five (5) basins, labeled DA-1 through DA-5. DA-1 represents mostly undisturbed areas that drain directly to S1. DA-2 represents a north-south section of the existing road and additional onsite areas that drain to Pond 1P. DA-3 represents an east-west section of the existing road, which drains to catch basins that discharge to outfall DSN-007 before discharging to S1. DA-4 represents the small area draining directly to Pond 7P. Pond 1P discharges via culverts to both DSN-001 and Pond 7P. For the purposes of this analysis, all discharge from Pond 1P is routed to Pond 7P and the portion discharging to DSN-001 was ignored. The primary discharge from Pond 7P is via culverts under the existing road to DSN-008 and then to S1. Additional discharge from Pond 7P occurs via an emergency spillway to S2. No

permitted outfall is associated with this spillway. All runoff routed to S1 ultimately drains under the existing road via two (2) culverts into S2. DA-5 represents undisturbed areas and a north-south section of the existing road that drains to Pond 11P, which discharges via outfall DSN-006 to S2.

Refer to the Pre-Development Hydrology Map (Figure ED-1) in **Appendix D** for detailed drainage areas, time of concentration flow paths, flow directions, stormwater management features, and topography in the pre-development condition. See **Appendix F** for detailed inputs and results of the Pre-Development HydroCAD Model. See **Appendix J** for details inputs and results of the Pre-Development HY-8 model.

Post-Development Conditions

The post-development condition is similar to the pre-development condition, with modifications to basins and stormwater management features due to the proposed haul road and pad. Post-development stormwater management for the project consists of one (1) detention pond (Pond 1P), one pocket wetland, four (4) catch basins, several culverts, several swales, and three (3) permitted discharge points (DSN-001, DSN-007, DSN-008). Ponds 7P and 11P are eliminated due to the expansion of the existing road. Multiple culverts and catch basins are either abandoned, replaced, or rerouted to accommodate the proposed haul road. Multiple swales are added to convey runoff from the proposed haul road. Outfall DSN-001 remains unchanged from the pre-development condition. Outfalls DSN-007 and DSN-008 are moved in the post-development condition. DSN-006 is eliminated due to expansion of the existing road. Runoff from the project area has the potential to discharge similar to the pre-development condition (to the existing stream, both upstream and downstream of the existing road). Runoff discharging to the upstream section (S1) of the existing stream is monitored via outfalls DSN-007 and DSN-008. Runoff discharging to the downstream section (S2) of the existing stream is monitored via outfall DSN-001. The point of analysis used is the same as the pre-development condition.

The total post-development project watershed area is 175.80 acres and is approximately 2.8% impervious. The project watershed is subdivided into five (5) basins, which are modified versions of the pre-development basins. DA-1 is slightly reduced in area, but still represents mostly undisturbed areas that drain directly to the S1. DA-2 represents a north-south section of the proposed road and additional onsite areas that drain to Pond 1P, which discharges either to DSN-001 or to the pocket wetland via outfall DSN-007 and then to S1 via outfall DSN-008. For the purposes of this analysis, all discharge from Pond 1P is routed to the pocket wetland and the portion discharging to DSN-001 was ignored. DA-3 represents an east-west section of the proposed road, which drains to catch basins that discharge to the proposed pocket wetland and then outfall DSN-008 before discharging to S1. DA-4 from the pre-development condition is eliminated in the post-development condition due to expansion of the east-west road section. DA-5 from the pre-development condition is subdivided into two (2) post-development basins. DA-5a represents the majority of the basin and includes undisturbed areas and a north-south section of the existing road that drains to catch basins and then into basin DA-1. DA-5b represents the remaining area that drains directly offsite to S2. All runoff routed to S1 ultimately drains under the existing road via one (1) proposed culvert into S2.

Refer to the Post-Development Hydrology Map (Figure PD-1) in **Appendix D** for detailed drainage areas, time of concentration flow paths, stormwater management features, and topography in the post-development condition. See **Appendix F** for detailed inputs and results of the Post-Development HydroCAD Model. See **Appendix J** for details inputs and results of the Post-Development HY-8 model.

Table 2 - Comparison of Pre-Development and Post-Development Peak Runoff Rates

System: Point of Analysis

	Q_{2yr} (cfs)	Q_{10yr} (cfs)	Q_{100yr} (cfs)
Pre- Development	34.33	102.43	273.50
Post- Development	34.19	112.30	225.90
Delta =	-0.14	+9.87	-47.60

The change in peak runoff from pre- to post-development can be attributed to the proposed haul road (wider and higher elevation than existing road), the proposed crossing (two 30 in CPP culverts replaced by one 60 in CMP culvert), and the rerouting of flows to accommodate the proposed haul road. Runoff for the 2-year, 24-hour storm is slightly lower in the post-development condition. The proposed haul road and crossing have little to no impact on this storm event. Runoff for the 10-year, 24-hour storm is slightly higher in the post-development condition. This is because the proposed crossing (60 in CMP) is sized appropriately; the culvert conveys the 10-year storm without retaining water upstream of the culvert. The existing crossing (two 30 in CPPs) is undersized for the 10-year storm, which results in more water being retained upstream of the crossing and therefore a lower discharge rate from the culverts. Runoff from the 100-year, 24-hour storm is lower in the post-development condition. This can also be attributed to the proposed crossing being sized appropriately. In the pre-development condition, the 100-year storm results in overflow of the existing road and therefore higher discharge. Road overflow is eliminated in the post-development condition.

Hydraulic Analysis

The culvert capacities for the existing crossing (two 30 in CPP culverts) and proposed crossing (one 60 in CMP culvert) were analyzed using HY-8. Minimum, design, and maximum flows needed to be conveyed by the crossing were the 2-, 10-, and 100-year, 24-hour storms, respectively. Peak discharge for each storm was obtained from the HydroCAD analysis. For each condition, the capacity of the culvert(s) was evaluated based on upstream and downstream stages. The post-development condition has slightly higher upstream stage for the 2-year storm and lower upstream peak stage for the 10- and 100-year storms. For the 10-year storm, upstream stage is below the top of culvert elevation in the post-development condition, indicating that the proposed crossing is sized appropriately. In the pre-development condition the 10-year storm results in upstream stage several feet above the top of culvert elevation, indicating the existing crossing is undersized. For the 100-year storm, upstream stage results in discharge over the existing road in the pre-development condition. Road discharge is eliminated in the post-development condition, which is another indication that the proposed crossing is sized appropriately. The stages downstream of the crossing are lower in the pre-development condition for all storms. Results indicate that the proposed crossing is appropriately sized and will not have an adverse impact on flows or stages upstream or downstream of the crossing.

Refer to **Appendix J** for detailed inputs and results of the pre- and post-development HY-8 culvert analyses.

2.3 Standard 3: Recharge

The required recharge volume equals the recharge volume multiplied by the total impervious area within the NRCS Hydrologic Group that is impervious. For this project, the post-development net increase impervious area is 0 sf, as the existing and proposed roads are pervious gravel material. The annual recharge from the post-development site will match the pre-development conditions based on soil type.

2.4 Standard 4: Water Quality

Stormwater quality control will be achieved through a program of Best Management Practices (BMPs). The proposed development is designed to achieve a minimum of 80% total suspended solids (TSS) removal in accordance with the MA DEP Stormwater Management Standards. Effective stormwater management practices include good housekeeping, storing materials under cover, routine inspections, and maintenance of stormwater BMPs during and after construction. MassDEP assigns a maximum 80% TSS removal rate of a pocket wetland. The majority of the surface water for the haul road will sheet flow thru the surface aggregate stone layer, directed to two (2) deep-sump hooded catch basins, at the stream crossing, to a sediment forebay of the constructed stormwater wetland (pocket wetland).

There is a portion of the proposed haul road that will be directed to conveyance vegetated swales with stone check dams at regular intervals along the swale. The conveyance vegetated swales are directed towards a level spreader or energy dissipators. A small portion of the haul road area is considered 'de minimus' per the Stormwater Management Regulations. Capturing runoff from this area is not possible due to topographic constraints.

For the project site discharges, the required water quality volume (WQV) equals 1 inch of runoff times the total impervious area of the post-development site. For this project, the post-development net increase impervious area is 0 sf, as the existing and proposed roads are pervious gravel material. However, WQV calculations were performed on stormwater sub area (300 – haul road) to demonstrate the constructed stormwater wetland (pocket wetland) is designed to accommodate the WQV. See **Appendix E** and **Appendix F** (F3 Post-Development BMP) for all detention and water quality calculations.

2.5 Standard 5: Land Uses with Higher Potential Pollutant Loads

In accordance with the Stormwater Management Standards, the proposed development use in not considered a Land Use with Higher Potential Pollutant Loads. Therefore, this standard does not apply to the project.

2.6 Standard 6: Critical Area

The project site is tributary to an environmentally critical area as defined by the Stormwater Management Standards. The Deerfield River is classified as a cold-water fishery by the Massachusetts's Division of Fisheries and Wildlife. The proposed stormwater treatment train provided > 80% TSS removal prior to discharge. The treatment train uses structural BMPs suitable

for the area. All BMPs must be designed, constructed, operated, and maintained in accordance with the specifications set forth in Volume 2 of the Massachusetts Stormwater Handbook.

2.7 Standard 7: Redevelopment and Other Projects Subject to the Standards only to the Maximum Extent Practicable

An Erosion and Sedimentation Control Plan has been provided in **Appendix E**.

An Illicit Discharge Compliance Statement has been provided in **Appendix I**.

The project meets all standards for redevelopment to the maximum extent practicable. Proposed stormwater controls result in a reduction in the annual pollutant loads from the site while treat the water quality volume.

2.8 Standard 8: Construction Period Pollution Prevention and Erosion and Sediment Control

The NPDES Construction General Permit requires a s Stormwater Pollution Prevention Plan (SWPPP) to be prepared for any project resulting in over 1-acre of disturbed land. The proposed project limits of disturbance are approximately 10.1-acres of land. Therefore, a SWPPP will be prepared by the owner for this project.

2.9 Standard 9: Operation and Maintenance Plan

An Operation & Maintenance Plan has been provided in **Appendix H**.

2.10 Standard 10: Illicit Discharges

An illicit discharge statement has been provided in **Appendix I**.

3.0 CONCLUSION

The proposed drainage patterns mimic the existing drainage patterns and conforms to the MassDEP Stormwater Management Regulations. The implementation of Best Management Practices including a constructed stormwater wetland (pocket wetland), sediment forebay, deep-sump catch basins will minimize Total Suspended Solids (TSS) and other pollutants based on permit benchmark concentration levels to the maximum extents practicable.

APPENDIX B – EXISTING CONDITIONS

B1: Aerial Map

B2: Abutters List

B3: Abutters Maps

B1: AERIAL MAP



Parcel Number	GIS Number	Cama Number	Property Address	Owner Name	Co-Owner Name	Owner Address	Owner Address 2	Owner City	Owner State	Owner Zip
20-13	20-13	20-13	736 GREENFIELD RD	GAGNON SCOTT		127 BENT NAIL DR		SHELburne FALLS	MA	01370
20-14	20-14	20-14	OFF GREENFIELD RD	GAGNON SCOTT		127 BENT NAIL DR		SHELburne FALLS	MA	01370
20-15	20-15	20-15	734 GREENFIELD RD	CAMPBELL MARY SUE +	ADAMS EMERY	734 GREENFIELD RD		DEERFIELD	MA	01342
20-18	20-18	20-18	724 GREENFIELD RD	LAMORE WILLIAM R		724 GREENFIELD RD		DEERFIELD	MA	01342
20-2	20-2	20-2	705 GREENFIELD RD	PENFIELD ROBERT G + MARK R		308 COUNTRY CLUB RD		GREENFIELD	MA	01301
20-20	20-20	20-20	GREENFIELD RD	LAMORE WILLIAM R		724 GREENFIELD RD		DEERFIELD	MA	01342
22-1	22-1	22-1	RIVER RD	BYRNE JAMES J + BENJAMIN L		86 RIVER ST		GREENFIELD	MA	01301
22-12	22-12	22-12	RIVER RD	SMITH BARBARA F		784 RIVER RD		DEERFIELD	MA	01342
22-13	22-13	22-13	791 RIVER RD	SCHAEFER AMIE L		791 RIVER RD		DEERFIELD	MA	01342
22-14	22-14	22-14	795 RIVER RD	GILBERT NATHAN JAMES		1558 MAIN ST APT 2		WORCESTER	MA	01603
22-15	22-15	22-15	797 RIVER RD	ZAMOJSKI BRIAN		797 RIVER RD		DEERFIELD	MA	01342
22-16	22-16	22-16	RIVER RD	ZAMOJSKI BRIAN		797 RIVER RD		DEERFIELD	MA	01342
22-19	22-19	22-19	RIVER RD	CLARK LEWIS B	C/O DANNY ABBOTT	10 LAUREL LN		MONTAGUE	MA	01351
22-2	22-2	22-2	769 RIVER RD	BYRNES JAMES J JR		86 RIVER ST		GREENFIELD	MA	01301
22-20	22-20	22-20	803 RIVER RD	ABBOTT DANNY L + PHYLLIS R		10 LAUREL LN		MONTAGUE	MA	01351
22-21	22-21	22-21	799 RIVER RD	CLARK CHARLES L + SHIRLEY I		801 RIVER RD		DEERFIELD	MA	01342
22-22	22-22	22-22	801 RIVER RD	CLARK CHARLES L + SHIRLEY I		801 RIVER RD		DEERFIELD	MA	01342
22-24	22-24	22-24	796 RIVER RD	CANEDY RUSSELL R		796 RIVER RD		DEERFIELD	MA	01342
22-25	22-25	22-25	RIVER RD	HARTSHORN CHRISTOPHER C		790 RIVER RD		DEERFIELD	MA	01342
22-26	22-26	22-26	790 RIVER RD	HARTSHORN CHRISTOPHER C		790 RIVER RD		DEERFIELD	MA	01342
22-27	22-27	22-27	RIVER RD	SMITH ARTHUR H + BARBARA F		784 RIVER RD		DEERFIELD	MA	01342
22-28	22-28	22-28	784 RIVER RD	SMITH BARBARA F		784 RIVER RD		DEERFIELD	MA	01342
22-29	22-29	22-29	778 RIVER RD	BLANCHARD BRUCE E		778 RIVER RD		DEERFIELD	MA	01342
22-3	22-3	22-3	769 RIVER RD	BYRNES JAMES J JR		86 RIVER ST		GREENFIELD	MA	01301
22-4	22-4	22-4	769 RIVER RD	BYRNES JAMES J JR		86 RIVER ST		GREENFIELD	MA	01301
22-7	22-7	22-7	767 RIVER RD	BYRNE JAMES J + BENJAMIN L		86 RIVER ST		GREENFIELD	MA	01301
23-1	23-1	23-1	RIVER RD	BYRNE JAMES J JR + BENJAMIN L		767 RIVER RD		DEERFIELD	MA	01342
24-10	24-10	24-10	757 RIVER RD	CHAGNON JANET A +	ROMANKO DARRELL	757 RIVER RD		DEERFIELD	MA	01342
24-11	24-11	24-11	RIVER RD	LAVIGNE DANA M		754 RIVER RD		DEERFIELD	MA	01342
24-12	24-12	24-12	754 RIVER RD	LAVIGNE DANA M		754 RIVER RD		DEERFIELD	MA	01342
24-13	24-13	24-13	752 RIVER RD	AGAPOV ANDREY N + GALINA		55 ORCHARD ST		GREENFIELD	MA	01301
24-14	24-14	24-14	RIVER RD	WESTERN MASS ELECTRIC CO	PROPERTY TAX UNIT	PO BOX 270		HARTFORD	CT	06141
24-15	24-15	24-15	736 RIVER RD	ARMSTRONG-BUSHEY ELISABETH S		736 RIVER RD		DEERFIELD	MA	01342
24-16	24-16	24-16	MCCLELLAND FARM RD	FREDERICK L THOMPSON LIV TRUST	THOMPSON FREDERICK L TRUSTEE	38 MCCLELLAND FARM ROAD		DEERFIELD	MA	01342
24-4	24-4	24-4	RIVER RD	FRANKLIN COUNTY LEAGUE OF	SPORTSMEN'S CLUB INC	PO BOX 716		TURNERS FALLS	MA	01376-0716
24-5	24-5	24-5	725 RIVER RD	ELLIOT MARTHA P		725 RIVER RD		DEERFIELD	MA	01342
24-6	24-6	24-6	729 RIVER RD	ROWE MELISSA A		729 RIVER RD		DEERFIELD	MA	01342
24-7	24-7	24-7	RIVER RD	FRANKLIN COUNTY LEAGUE OF	SPORTSMEN'S CLUB INC	PO BOX 716		TURNERS FALLS	MA	01376-0716
24-9	24-9	24-9	753 RIVER RD	ROBINSON JUDITH ELLEN +	CROWHURST-ROBINSON ZOE M	160 3RD ST		POINT REYES STATION	CA	94956

25-1	25-1	25-1	721 RIVER RD	FRANKLIN CO SPORTSMENS CLUB IN		PO BOX 716		TURNERS FALLS	MA	01376-0716
25-2	25-2	25-2	OFF RIVER RD	BYRNE JAMES J JR + BENJAMIN L		767 RIVER RD		DEERFIELD	MA	01342
26-2	26-2	26-2	KEETS RD	DEERFIELD ACADEMY TRUSTEES OF		PO BOX 87		DEERFIELD	MA	01342
26-3	26-3	26-3	KEETS RD	WT LAND LLC		PO BOX 91		SUNDERLAND	MA	01375
27-10	27-10	27-10	KEETS RD	MALTBY DANIEL L		30 KEETS RD		DEERFIELD	MA	01342
27-11	27-11	27-11	35 KEETS RD	ARNOLD WENDY + KENNETH D		35 KEETS RD		DEERFIELD	MA	01342
27-12	27-12	27-12	39 KEETS RD	CHARLES SALZBERG REV TRUST	SALZBERG CHARLES TRUSTEE	PO BOX 121		ERVING	MA	01344
27-14	27-14	27-14	KEETS RD	WT LAND LLC		PO BOX 91		SUNDERLAND	MA	01375
27-16	27-16	27-16	KEETS RD	DELTA SAND AND GRAVEL INC		PO BOX 395		SUNDERLAND	MA	01375
27-5	27-5	27-5	GREENFIELD RD	YAZWINSKI EDWARD J+ CHESTER T	FRANK S YAZWINSKI III NOM TRST	109 OLD MAIN ST, BOX 296		DEERFIELD	MA	01342
27-9	27-9	27-9	OFF KEETS RD	MALTBY DANIEL L		17 KEETS RD		DEERFIELD	MA	01342
41-5	41-5	41-5	OFF JINGLE HILL RD	DEERFIELD ACADEMY TRUSTEES OF		PO BOX 87		DEERFIELD	MA	01342
42-1	42-1	42-1	103 KEETS RD	WOOLMAN HILL INC		107 KEETS RD		DEERFIELD	MA	01342
42-2	42-2	42-2	JINGLE HILL RD	ALLEN CHASE FOUNDATION	EAGLEBROOK SCHOOL	PO BOX 7		DEERFIELD	MA	01342
42-7	42-7	42-7	JINGLE HILL RD	ALLEN CHASE FOUNDATION	EAGLEBROOK SCHOOL	PO BOX 7		DEERFIELD	MA	01342
7-10	7-10	7-10	RIVER RD	HAYES KARA M		823 RIVER RD		DEERFIELD	MA	01342
7-11	7-11	7-11	RIVER RD	HAYES KARA M		823 RIVER RD		DEERFIELD	MA	01342
7-12	7-12	7-12	825 RIVER RD	RUDNICKI WALTER J + SUSAN J		825 RIVER RD		DEERFIELD	MA	01342
7-13	7-13	7-13	RIVER RD	RUDNICKI WALTER JR + SUSAN		825 RIVER RD		DEERFIELD	MA	01342
7-4	7-4	7-4	16 RAILROAD	COMMONWEALTH OF MASS		TEN PARK PLAZA		BOSTON	MA	02108
7-5	7-5	7-5	100 RAILROAD	PAN AM SOUTHERN LLC		1700 IRON HORSE PARK		N BILLERICA	MA	01862-1692
7-6	7-6	7-6	854 RIVER RD	MITCHELL THOMAS F		93 LEONARD RD		SHUTESBURY	MA	01072
7-7	7-7	7-7	RIVER RD	WELCOME LAWRENCE G +	BARBARA A	860 RIVER RD		DEERFIELD	MA	01342
7-8	7-8	7-8	RIVER RD	KONVELSKI JAMES + JANE		PO BOX 117		S DEERFIELD	MA	01373
7-9	7-9	7-9	823 RIVER RD	HAYES KARA M		823 RIVER RD		DEERFIELD	MA	01342
8-12	8-12	8-12	860 RIVER RD	WELCOME LAWRENCE JR +	WELCOME BARBARA A	860 RIVER RD		DEERFIELD	MA	01342
8-2	8-2	8-2	RIVER RD	WT LAND LLC		PO BOX 91		SUNDERLAND	MA	01375
8-3	8-3	8-3	RIVER RD	WT LAND LLC		PO BOX 91		SUNDERLAND	MA	01375
8-4	8-4	8-4	RIVER RD	PAN AM SOUTHERN LLC		1700 IRON HORSE PARK		N BILLERICA	MA	01862-1692
8-6	8-6	8-6	RIVER RD	DELTA SAND AND GRAVEL INC		PO BOX 395		SUNDERLAND	MA	01375
8-7	8-7	8-7	RIVER RD	DELTA SAND AND GRAVEL INC		PO BOX 395		SUNDERLAND	MA	01375
9-3	9-3	9-3	RIVER RD	WT LAND LLC		PO BOX 91		SUNDERLAND	MA	01375
9-4	9-4	9-4	RIVER RD	DOUG LLC aka DOUG AUTOMOTIVE	C/O RYAN DOUGLAS JAMES	28 VLADISH AVE		TURNERS FALLS	MA	01376
9-5	9-5	9-5	941 RIVER RD	DOUG LLC aka DOUG AUTOMOTIVE	C/O RYAN DOUGLAS JAMES	28 VLADISH AVE		TURNERS FALLS	MA	01376
9-6	9-6	9-6	951 RIVER RD	DOUG LLC aka DOUG AUTOMOTIVE	C/O RYAN DOUGLAS JAMES	28 VLADISH AVE		TURNERS FALLS	MA	01376
9-7	9-7	9-7	RIVER RD	DOUG LLC aka DOUG AUTOMOTIVE	C/O RYAN DOUGLAS JAMES	28 VLADISH AVE		TURNERS FALLS	MA	01376
9-8	9-8	9-8	RIVER RD	WT LAND LLC		PO BOX 91		SUNDERLAND	MA	01375



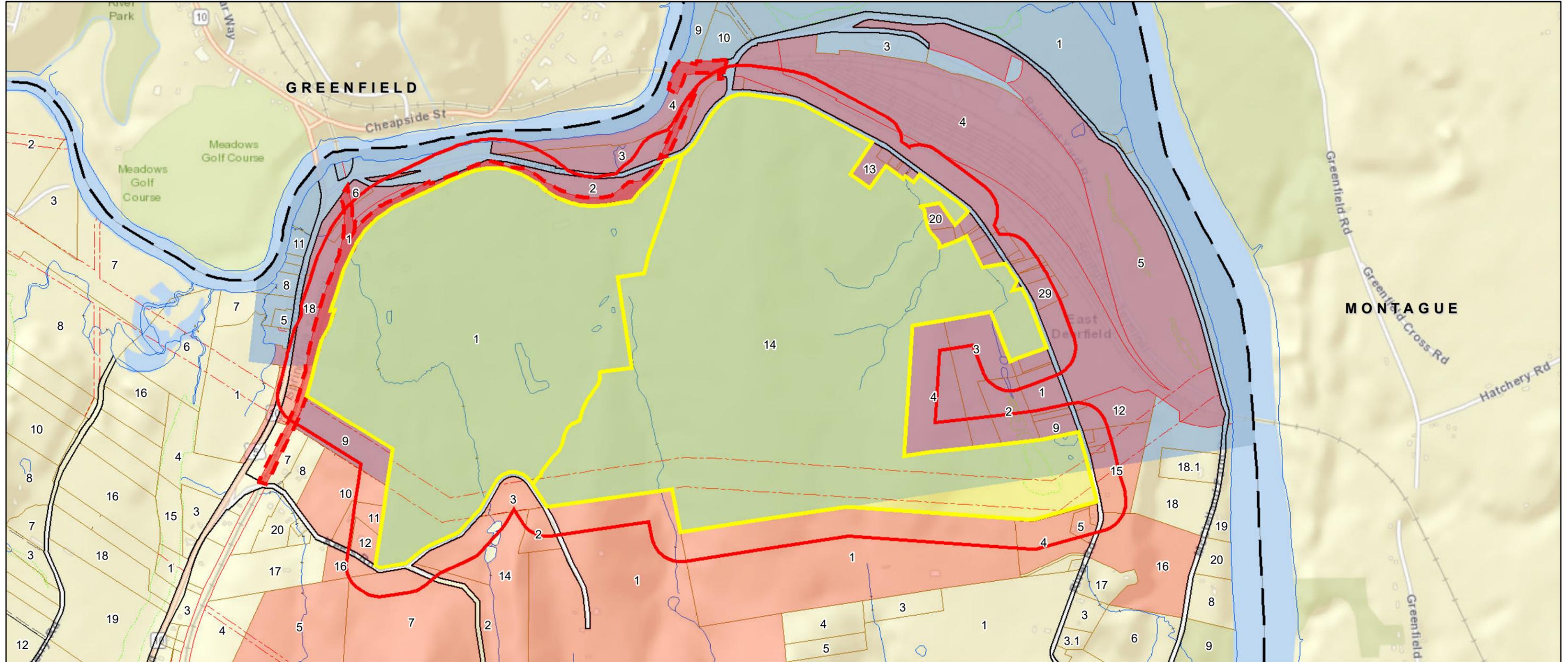
February 5, 2022

Deerfield, MA

1 inch = 1000 Feet



www.cai-tech.com



Large Scale	Railroad	Property Hook
CAI Town Line	Private Road ROW	Property TIC
PWater	Right of Way	Wetland
Private Road	Utility	WaterLines
Property Line	Utility	Commercial
Public Road	PropNotPar	Residential/Agricultural

Data shown on this map is provided for planning and informational purposes only. The municipality and CAI Technologies are not responsible for any use for other purposes or misuse or misrepresentation of this map.



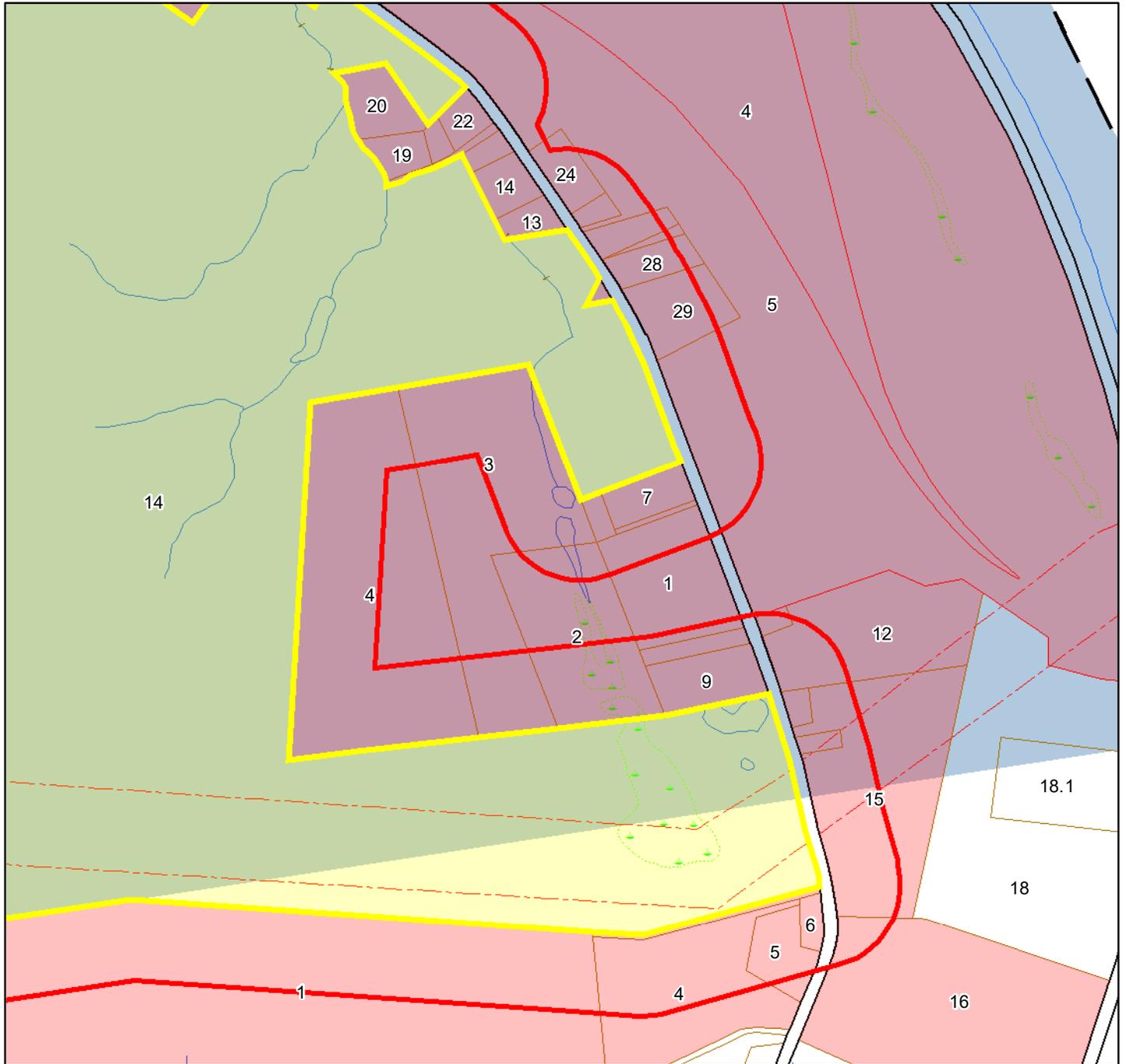
Deerfield, MA



February 5, 2022

1 inch = 554 Feet

www.cai-tech.com



Large Scale	Public Road	Wetland	Residential/Agricultural
CAI Town Line	Railroad	WaterLines	
PWater	Utility	Wet Areas	
Property Line	Property Hook	Commercial	

Data shown on this map is provided for planning and informational purposes only. The municipality and CAI Technologies are not responsible for any use for other purposes or misuse or misrepresentation of this map.



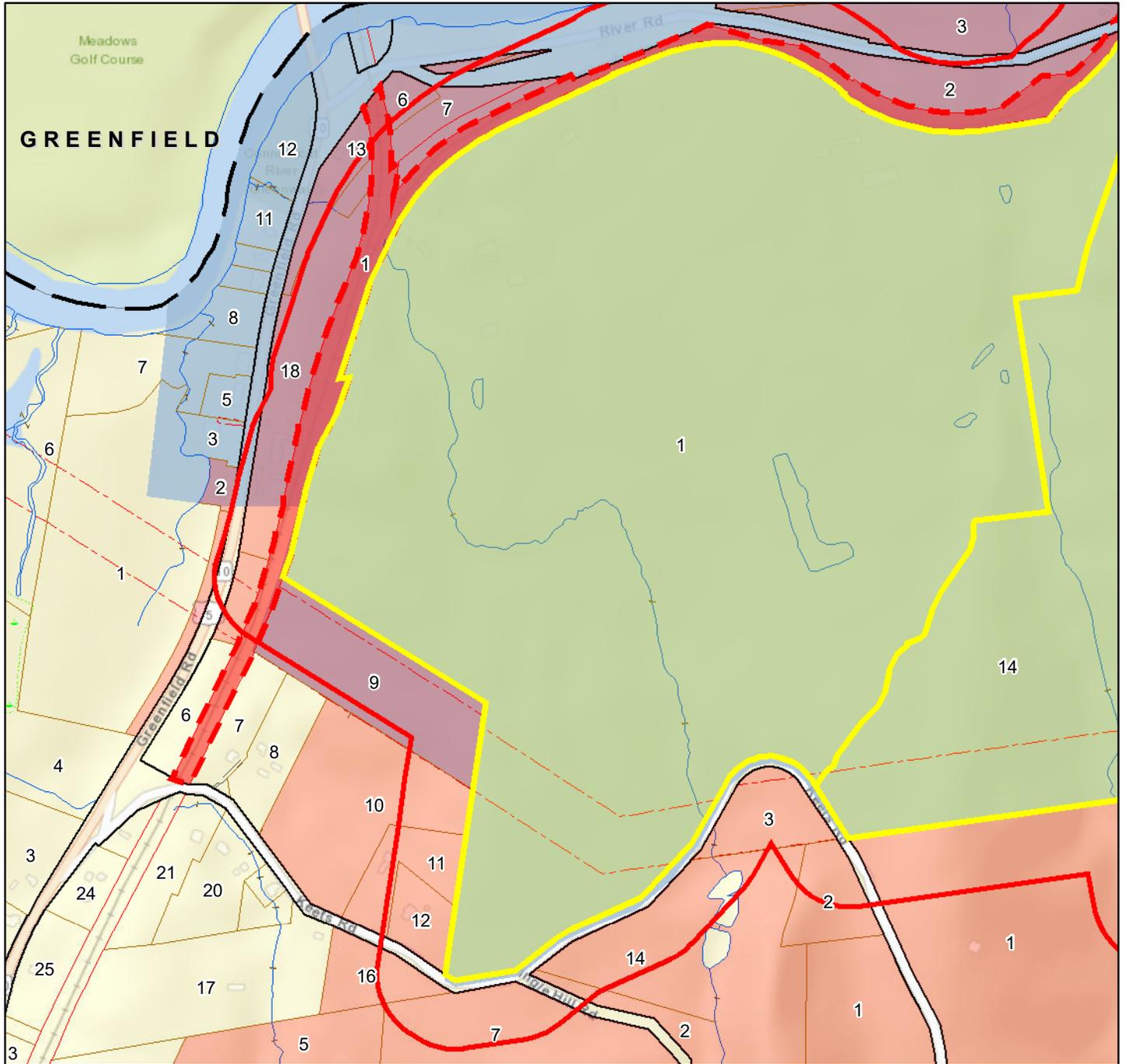
Deerfield, MA



February 5, 2022

1 inch = 650 Feet

www.cai-tech.com



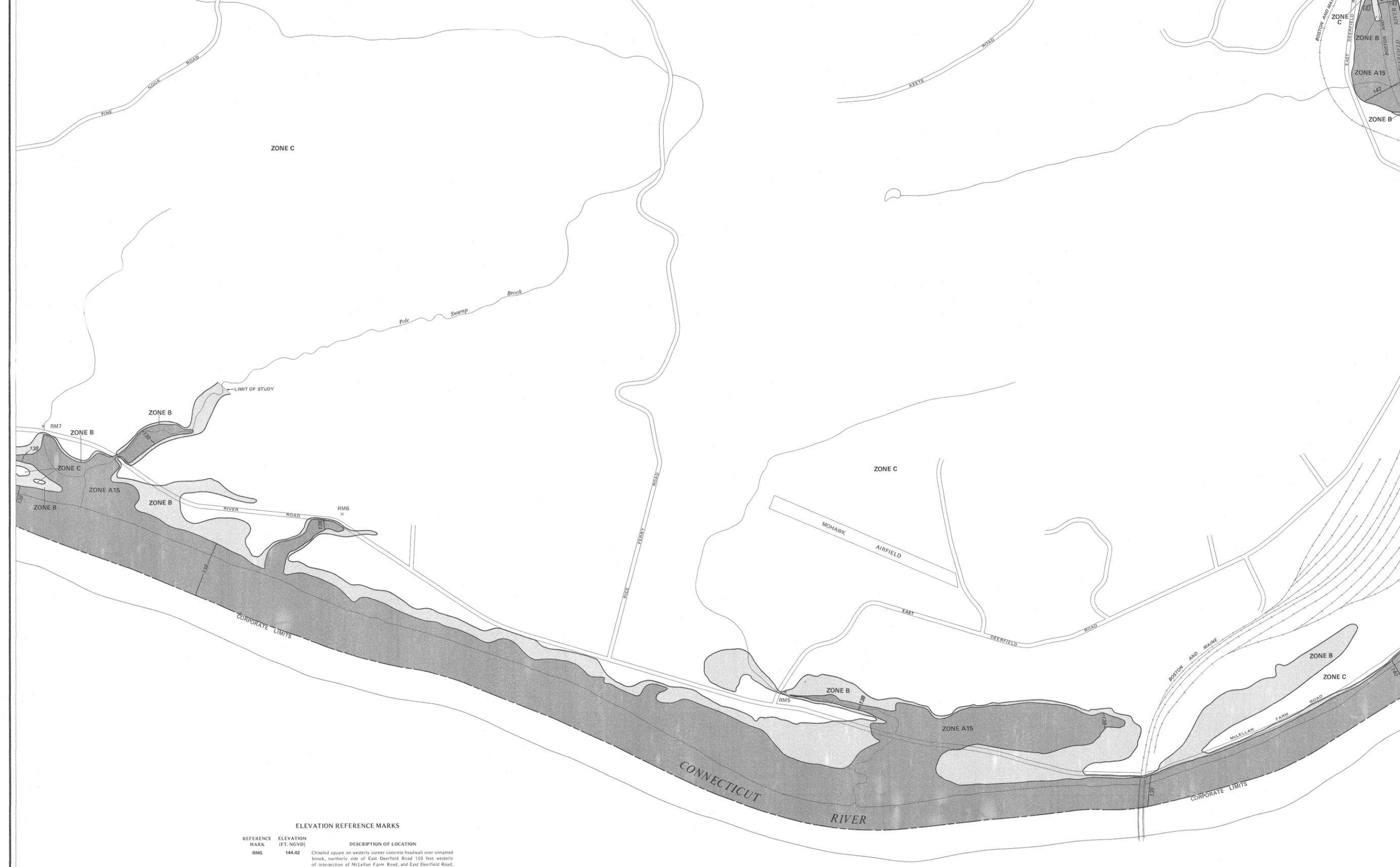
Large Scale	Public Road	Property Hook	Wet Areas
CAI Town Line	Railroad	Property TIC	Commercial
PWater	Right of Way	Wetland	Residential/Agricultural
Property Line	Utility	WaterLines	

Data shown on this map is provided for planning and informational purposes only. The municipality and CAI Technologies are not responsible for any use for other purposes or misuse or misrepresentation of this map.

APPENDIX C – SUPPORT DOCUMENTS

C1: Federal Insurance Rate Map: FIRMette 250115 001 B

C2: USDA NRCS Hydrologic Soil Group



100-Year Flood Boundary
 Zone Designations* With Date of Identification
 e.g., 12/2/74
 100-Year Flood Boundary
 500-Year Flood Boundary
 Base Flood Elevation Line With Elevation In Feet**
 Base Flood Elevation In Feet Where Uniform Within Zone**
 Elevation Reference Mark
 River Mile
 **Referenced to the National Geodetic Vertical Datum of 1929

ZONE B
 ZONE A1 DATE
 ZONE A5 DATE
 ZONE B
 513
 (EL 987)
 RM7x
 M1.5

- *EXPLANATION OF ZONE DESIGNATIONS**
- | ZONE | EXPLANATION |
|--------|--|
| A | Areas of 100-year flood; base flood elevations and flood hazard factors not determined. |
| A0 | Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; average depths of inundation are shown, but no flood hazard factors are determined. |
| AH | Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; base flood elevations are shown, but no flood hazard factors are determined. |
| A1-A30 | Areas of 100-year flood; base flood elevations and flood hazard factors determined. |
| A99 | Areas of 100-year flood to be protected by flood protection system under construction; base flood elevations and flood hazard factors not determined. |
| B | Areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than one (1) foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood. (Medium shading) |
| C | Areas of minimal flooding. (No shading) |
| D | Areas of undetermined, but possible, flood hazards. |
| V | Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors not determined. |
| V1-V30 | Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors determined. |

NOTES TO USER

Certain areas not in the special flood hazard areas (zones A and V) may be protected by flood control structures.

This map is for flood insurance purposes only; it does not necessarily show all areas subject to flooding in the community or all planimetric features outside special flood hazard areas.

For adjoining map panels, see separately printed Index To Map Panels.

INITIAL IDENTIFICATION:
 SEPTEMBER 13, 1974

FLOOD HAZARD BOUNDARY MAP REVISIONS:
 JULY 30, 1976

FLOOD INSURANCE RATE MAP EFFECTIVE:
 JULY 2, 1980

FLOOD INSURANCE RATE MAP REVISIONS:

Refer to the FLOOD INSURANCE RATE MAP EFFECTIVE date shown on this map to determine when actuarial rates apply to structures in the zones where elevations or depths have been established.

To determine if flood insurance is available in this community, contact your insurance agent, or call the National Flood Insurance Program, at (800) 638-6620, or (800) 424-8872.



ELEVATION REFERENCE MARKS

REFERENCE MARK	ELEVATION (FT. NGVD)	DESCRIPTION OF LOCATION
RM5	144.42	Chiseled square on westerly corner concrete headwall over unnamed brook, northerly side of East Deerfield Road 150 feet westerly of intersection of McLellan Farm Road, and East Deerfield Road, 40 feet northwesterly of pole no. 108/118. Established by Moore Survey and Mapping Company.
RM6	137.99	Chiseled square on stone (part of stone and mortar header) on the westerly side of River Road, 4500 feet southerly of intersection with McLellan Farm Road, 150 feet southerly of pole no. 138/148, 15 feet westerly of centerline. Established by Moore Survey and Mapping Company.
RM7	144.97	Chiseled square on southwesterly inside corner of stone and mortar header (not wing) on the westerly side of River Road, 3500 feet northerly of intersection with Keith Cross Road, 75 feet southerly of pole no. 159/23/170, 20 feet westerly of centerline. Established by Moore Survey and Mapping Company.

NATIONAL FLOOD INSURANCE PROGRAM

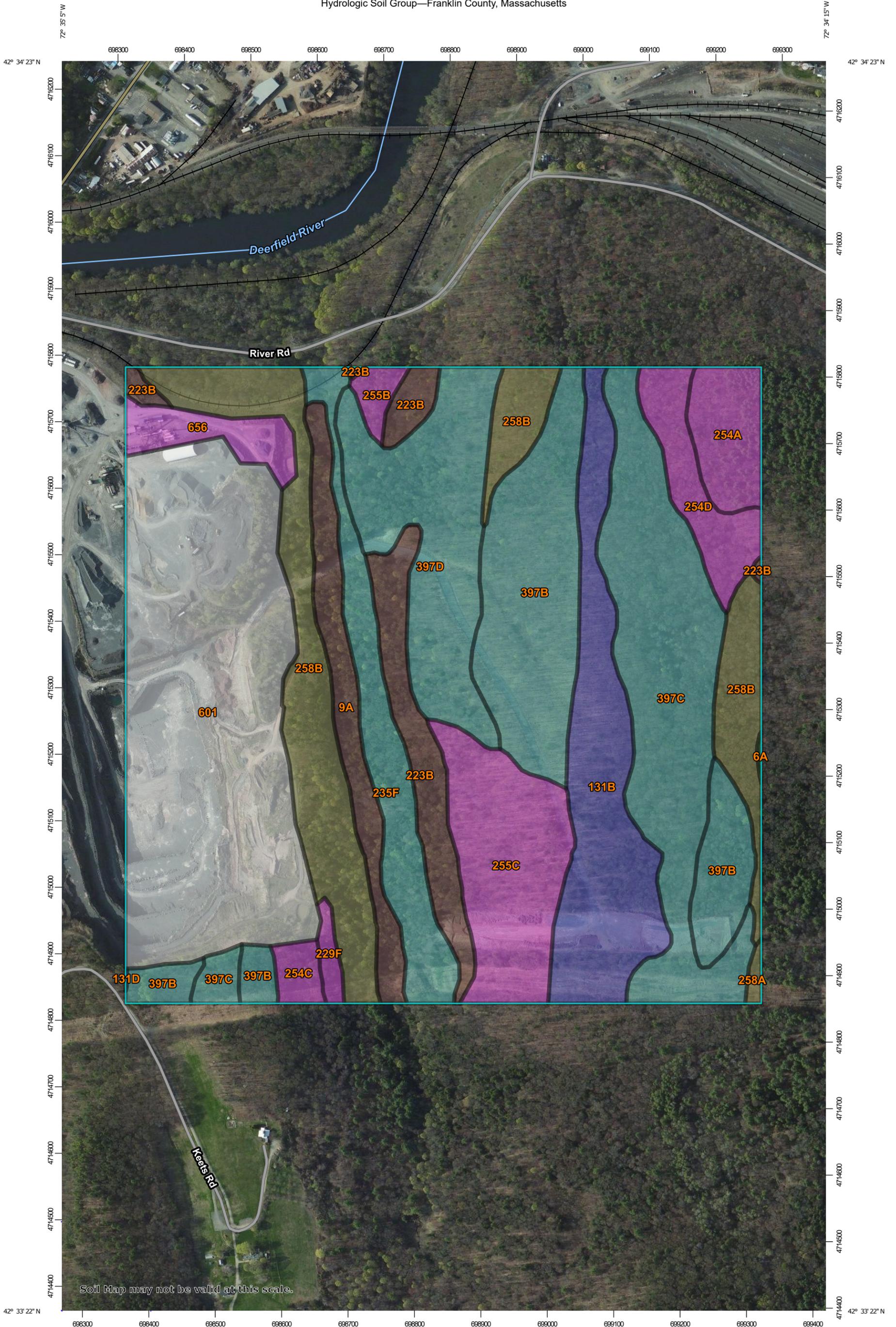
FIRM
 FLOOD INSURANCE RATE MAP

TOWN OF
DEERFIELD,
 MASSACHUSETTS
 FRANKLIN COUNTY

PANEL 11 OF 12
 (SEE MAP INDEX FOR PANELS NOT PRINTED)

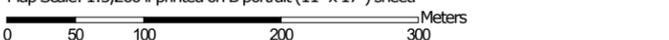
COMMUNITY-PANEL NUMBER
 250115 0011 B

EFFECTIVE DATE:
 JULY 2, 1980



Soil Map may not be valid at this scale.

Map Scale: 1:5,260 if printed on B portrait (11" x 17") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N 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 1:12,000.

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: Franklin County, Massachusetts
 Survey Area Data: Version 16, Sep 2, 2021

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

Date(s) aerial images were photographed: Apr 9, 2011—May 12, 2011

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.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
6A	Scarboro mucky sandy loam, 0 to 2 percent slopes	A/D	0.1	0.0%
9A	Birdsall mucky silt loam, 0 to 2 percent slopes	B/D	8.2	3.6%
131B	Yalesville-Holyoke complex, 3 to 8 percent slopes, rocky	B	19.3	8.5%
131D	Yalesville-Holyoke complex, 15 to 25 percent slopes, rocky	B	0.0	0.0%
223B	Scio silt loam, 3 to 8 percent slopes	B/D	10.1	4.5%
229F	Windsor and Merrimac soils, 25 to 60 percent slopes	A	1.0	0.4%
235F	Poocham silt loam, 25 to 60 percent slopes	C	11.5	5.0%
254A	Merrimac fine sandy loam, 0 to 3 percent slopes	A	5.3	2.3%
254C	Merrimac fine sandy loam, 8 to 15 percent slopes	A	1.6	0.7%
254D	Merrimac fine sandy loam, 15 to 25 percent slopes	A	6.0	2.6%
255B	Windsor loamy sand, 3 to 8 percent slopes	A	1.3	0.6%
255C	Windsor loamy sand, 8 to 15 percent slopes	A	14.4	6.3%
258A	Amostown fine sandy loam, 0 to 3 percent slopes	C/D	0.4	0.2%
258B	Amostown fine sandy loam, 3 to 8 percent slopes	C/D	25.7	11.3%
397B	Wethersfield very fine sandy loam, 3 to 8 percent slopes	C	25.3	11.1%
397C	Wethersfield very fine sandy loam, 8 to 15 percent slopes	C	27.3	12.0%
397D	Wethersfield very fine sandy loam, 15 to 25 percent slopes	C	18.5	8.2%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
601	Pits, quarry		47.1	20.7%
656	Udorthents-Urban land complex	A	4.0	1.8%
Totals for Area of Interest			227.0	100.0%

Description

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.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

APPENDIX D – HYDROLOGY MAPS

D1: Pre-Development Hydrology Map (ED-1)

D2: Post-Development Hydrology Map (PD-1)

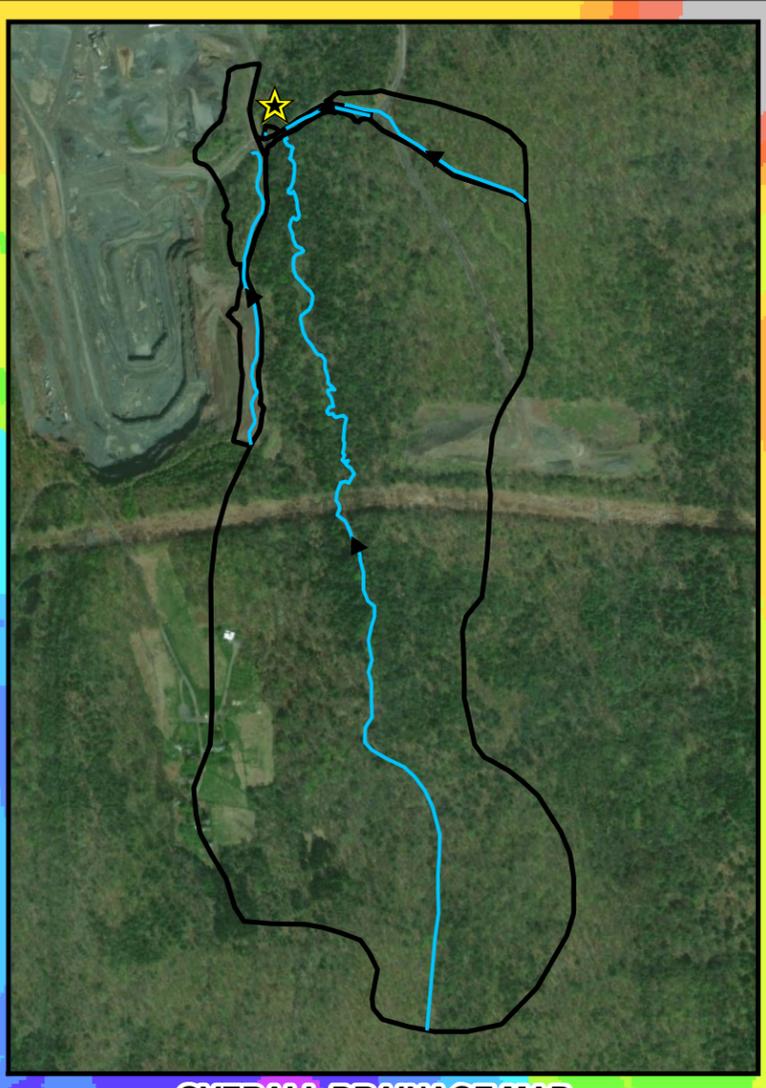
D3: Post-Development Hydrology (PD-1)

Source: Imagery was obtained from ESRI Basemap (Vivid Maxar, 5/6/2019). Existing topography derived from USGS LiDAR point cloud (LPC) for MA (2018). Vertical Datum: NAVD88.

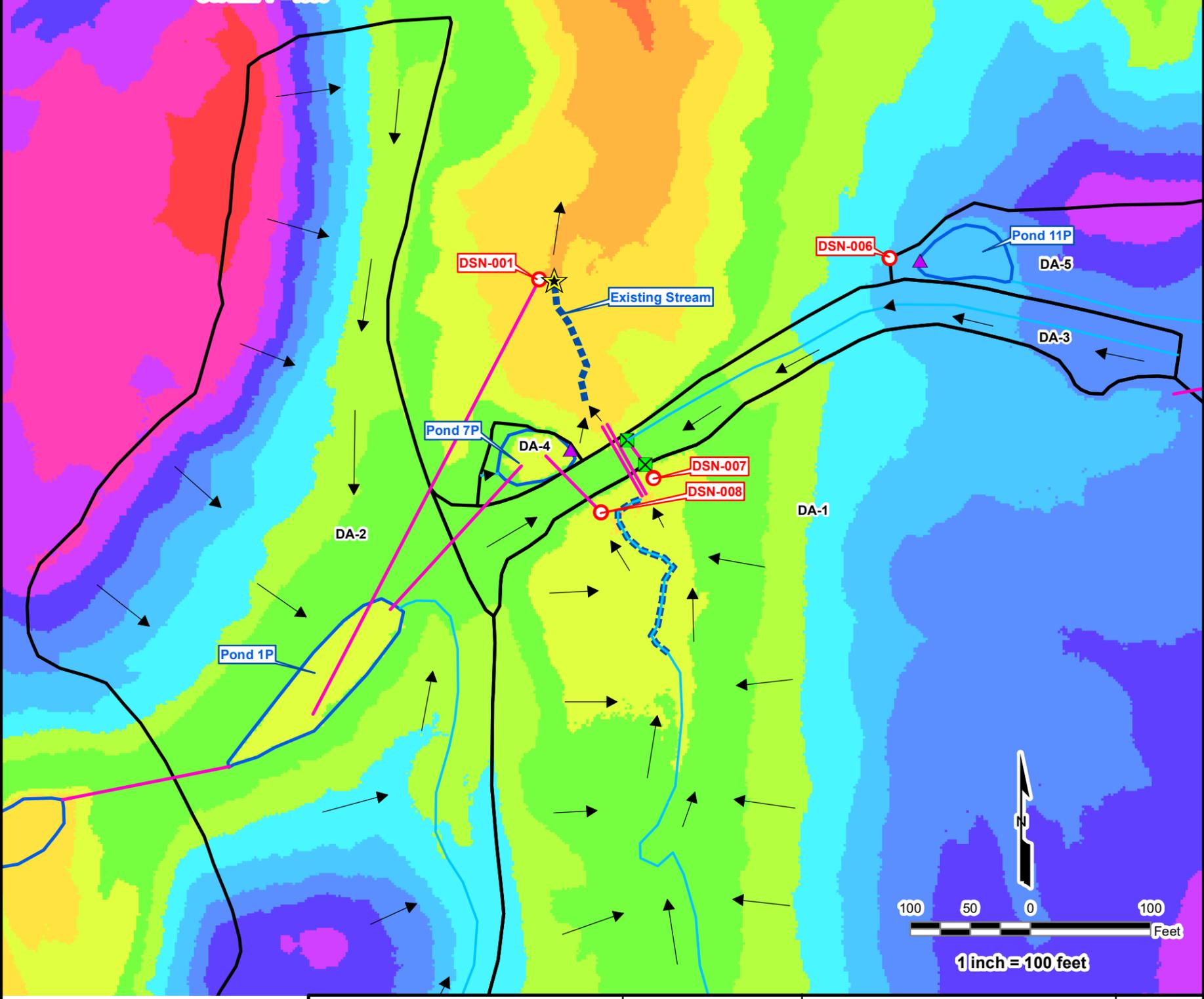
- Legend**
- ★ Point of Analysis
 - ▭ Pre-Development Basin
 - ➔ Pre-Development Time of Concentration Flow Path
 - ➔ Pre-Development Flow Direction
 - Existing Outfall
 - ✕ Existing Catch Basin
 - ▲ Existing Spillway
 - Existing Culvert
 - ▬ Existing Stream
 - ▭ Existing Detention Pond

- Existing Topography (ft-NAVD) (USGS, 2018)
- 191-200
 - 201-210
 - 211-220
 - 221-230
 - 231-240
 - 241-250
 - 251-260
 - 261-270
 - 271-280
 - 130-140
 - 141-150
 - 151-160
 - 161-170
 - 171-180
 - 181-190

PRE-DEVELOPMENT BASIN RUNOFF PARAMETERS			
Basin ID	AREA (AC.)	CN	TIME OF CONCENTRATION, Tc (MIN)
DA-1	160.43	65	48
DA-2	7.50	84	7
DA-3	0.63	93	5
DA-4	0.09	96	5
DA-5	6.35	74	23



OVERALL DRAINAGE MAP
SCALE: 1"=1000'



The information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.



PROJECT NO. 20221383.001A
 DRAWN: 5/4/2022
 DRAWN BY: NCD
 CHECKED BY: JW
 FILE NAME: ASMG Drain Exist.mxd

Pre-Development Hydrology Map

All States Materials Group
 901 River Road

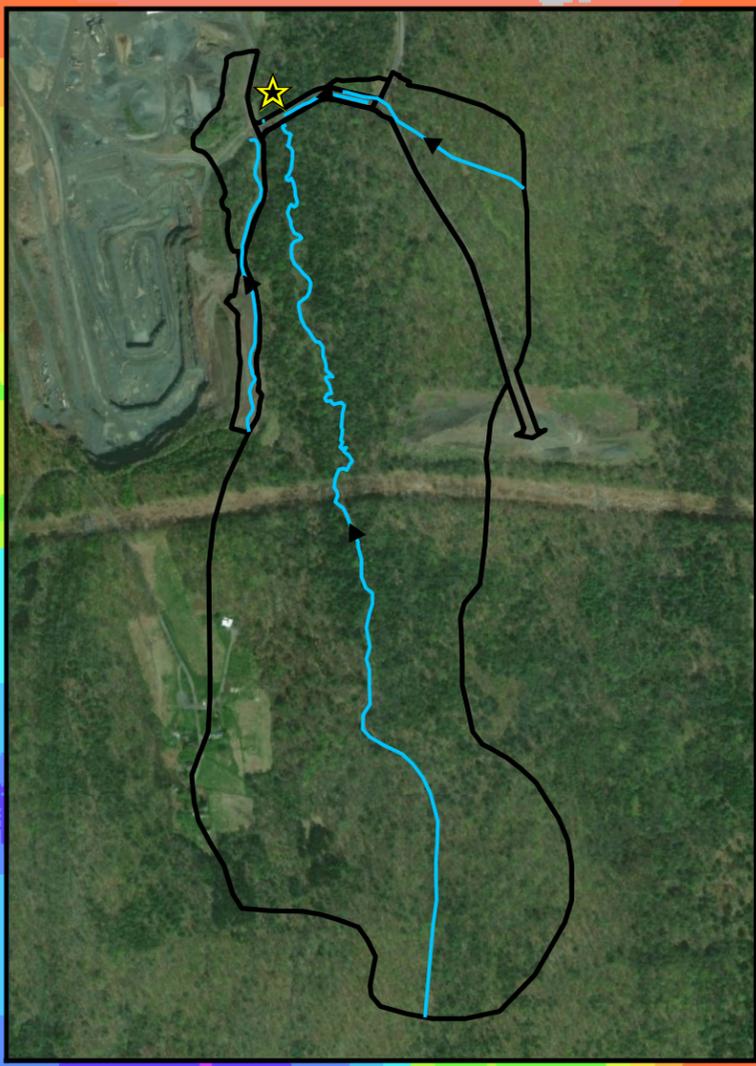
FIGURE
ED-1

Source: Imagery was obtained from ESRI Basemap (Vivid Maxar, 5/6/2019). Existing topography derived from USGS LiDAR point cloud (LPC) for MA (2018). Vertical Datum: NAVD88.

- Legend**
- ★ Point of Analysis
 - ▭ Post-Development Basin
 - ▶ Post-Development Time of Concentration Flow Path
 - Post-Development Flow Direction
 - Proposed Contours
 - Existing Outfall
 - Proposed Outfall
 - ⊠ Proposed Catch Basin
 - Existing Culvert
 - ▬ Existing Stream
 - Proposed Culvert
 - Proposed Swale
 - ▭ Existing Detention Pond
 - ▭ Proposed Level Spreader
 - ▭ Proposed Pocket Wetland
 - ▨ Proposed Pad

Existing Topography (ft-NAVD) (USGS, 2018)

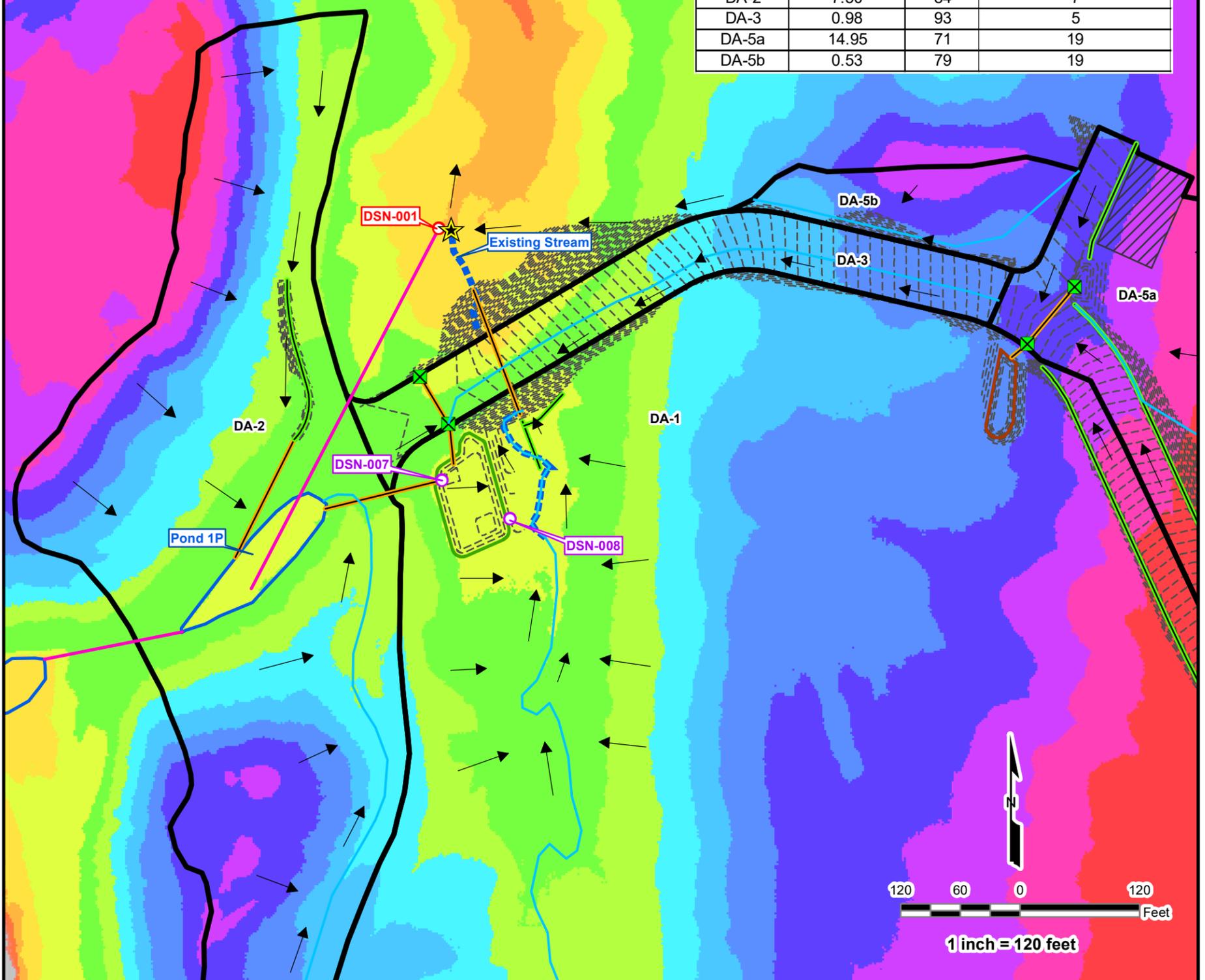
191-200
201-210
211-220
221-230
231-240
241-250
251-260
261-270
271-280



OVERALL DRAINAGE MAP
SCALE: 1"=1000'

POST-DEVELOPMENT BASIN RUNOFF PARAMETERS

Basin ID	AREA (AC.)	CN	TIME OF CONCENTRATION, T _c (MIN)
DA-1	151.84	65	48
DA-2	7.50	84	7
DA-3	0.98	93	5
DA-5a	14.95	71	19
DA-5b	0.53	79	19



The information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.



PROJECT NO. 20221383.001A
 DRAWN: 5/4/2022
 DRAWN BY: NCD
 CHECKED BY: JW
 FILE NAME: ASMG Drain Prop.mxd

Post-Development Hydrology Map

All States Materials Group
 901 River Road

FIGURE
PD-1

APPENDIX E – STORMWATER COMPUTATIONS

E0: Rainfall Data

E1: TSS Removal Calculation Worksheet

E2: Temporary Sediment Traps

E3: Conveyance Swale Design & Lining

E4: Storm Drainage Culverts

E5: Water Quality Volume

Rainfall Data

PROJECT NAME: All State Material Group

NOAA STATION LOCATION: Deerfield, Massachusetts

NOAA FREQUENCY ESTIMATES (INCHES) AVERAGE RECURRENCE INTERVAL (YEARS)

	1	2	5	10	25	50	100	200	500
DURATION									
5-MIN	0.314	0.368	0.455	0.528	0.627	0.703	0.781	0.863	0.974
10-MIN	0.445	0.521	0.645	0.747	0.888	0.996	1.11	1.22	1.38
15-MIN	0.524	0.613	0.758	0.879	1.05	1.17	1.3	1.44	1.62
30-MIN	0.731	0.855	1.06	1.23	1.46	1.64	1.82	2.01	2.27
60-MIN	0.938	1.1	1.36	1.58	1.87	2.1	2.33	2.58	2.91
2-HR	1.19	1.39	1.73	2.01	2.4	2.69	2.99	3.32	3.78
3-HR	1.35	1.59	1.99	2.31	2.76	3.1	3.45	3.85	4.41
6-HR	1.68	1.99	2.5	2.93	3.52	3.95	4.42	4.96	5.75
12-HR	2.05	2.46	3.13	3.68	4.44	5.01	5.62	6.35	7.44
24-HR	2.42	2.94	3.78	4.48	5.44	6.16	6.93	7.88	9.35

NOAA INTENSITY ESTIMATES (INCHES/HOUR) AVERAGE RECURRENCE INTERVAL (YEARS)

	1	2	5	10	25	50	100	200	500
DURATION									
5-MIN	3.77	4.42	5.46	6.34	7.52	8.44	9.37	10.4	11.7
10-MIN	2.67	3.13	3.87	4.48	5.33	5.98	6.64	7.33	8.27
15-MIN	2.1	2.45	3.03	3.52	4.18	4.69	5.2	5.75	6.49
30-MIN	1.46	1.71	2.12	2.45	2.92	3.27	3.64	4.02	4.54
60-MIN	0.938	1.1	1.36	1.58	1.87	2.1	2.33	2.58	2.91
2-HR	0.593	0.696	0.865	1.01	1.2	1.35	1.5	1.66	1.89
3-HR	0.45	0.53	0.661	0.77	0.919	1.03	1.15	1.28	1.47
6-HR	0.28	0.332	0.418	0.489	0.587	0.66	0.738	0.828	0.959
12-HR	0.17	0.204	0.26	0.306	0.369	0.416	0.466	0.527	0.618
24-HR	0.101	0.122	0.158	0.187	0.227	0.256	0.289	0.328	0.389

[NOAA Precipitation Frequency Data Server \(PFDS\)](#)



POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

NOAA, National Weather Service, Silver Spring, Maryland

[PF tabular](#) | [PF graphical](#) | [Maps & aeriels](#)

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.314 (0.249-0.391)	0.368 (0.290-0.458)	0.455 (0.358-0.570)	0.528 (0.413-0.664)	0.627 (0.473-0.819)	0.703 (0.519-0.936)	0.781 (0.555-1.07)	0.863 (0.584-1.22)	0.974 (0.632-1.42)	1.06 (0.671-1.58)
10-min	0.445 (0.352-0.554)	0.521 (0.412-0.649)	0.645 (0.507-0.806)	0.747 (0.585-0.940)	0.888 (0.670-1.16)	0.996 (0.734-1.33)	1.11 (0.787-1.52)	1.22 (0.828-1.73)	1.38 (0.896-2.02)	1.50 (0.950-2.24)
15-min	0.524 (0.414-0.652)	0.613 (0.484-0.764)	0.758 (0.597-0.949)	0.879 (0.688-1.11)	1.05 (0.788-1.37)	1.17 (0.863-1.56)	1.30 (0.925-1.79)	1.44 (0.973-2.03)	1.62 (1.05-2.37)	1.77 (1.12-2.64)
30-min	0.731 (0.578-0.910)	0.855 (0.676-1.07)	1.06 (0.833-1.32)	1.23 (0.960-1.54)	1.46 (1.10-1.91)	1.64 (1.21-2.18)	1.82 (1.29-2.50)	2.01 (1.36-2.84)	2.27 (1.47-3.32)	2.47 (1.56-3.69)
60-min	0.938 (0.742-1.17)	1.10 (0.867-1.37)	1.36 (1.07-1.70)	1.58 (1.23-1.98)	1.87 (1.41-2.45)	2.10 (1.55-2.80)	2.33 (1.66-3.21)	2.58 (1.75-3.65)	2.91 (1.89-4.26)	3.18 (2.01-4.74)
2-hr	1.19 (0.944-1.47)	1.39 (1.11-1.73)	1.73 (1.37-2.15)	2.01 (1.58-2.51)	2.40 (1.82-3.12)	2.69 (2.00-3.57)	2.99 (2.15-4.10)	3.32 (2.26-4.67)	3.78 (2.47-5.50)	4.15 (2.64-6.16)
3-hr	1.35 (1.08-1.67)	1.59 (1.27-1.96)	1.99 (1.58-2.46)	2.31 (1.83-2.88)	2.76 (2.11-3.58)	3.10 (2.31-4.10)	3.45 (2.49-4.73)	3.85 (2.62-5.39)	4.41 (2.88-6.39)	4.87 (3.10-7.19)
6-hr	1.68 (1.35-2.05)	1.99 (1.60-2.44)	2.50 (2.00-3.08)	2.93 (2.33-3.62)	3.52 (2.70-4.54)	3.95 (2.97-5.21)	4.42 (3.22-6.04)	4.96 (3.39-6.90)	5.75 (3.76-8.27)	6.40 (4.08-9.39)
12-hr	2.05 (1.66-2.50)	2.46 (1.99-3.00)	3.13 (2.52-3.82)	3.68 (2.95-4.52)	4.44 (3.44-5.71)	5.01 (3.79-6.58)	5.62 (4.13-7.68)	6.35 (4.35-8.78)	7.44 (4.89-10.6)	8.37 (5.36-12.2)
24-hr	2.42 (1.98-2.93)	2.94 (2.39-3.55)	3.78 (3.07-4.59)	4.48 (3.61-5.46)	5.44 (4.24-6.97)	6.16 (4.70-8.06)	6.93 (5.13-9.45)	7.88 (5.42-10.8)	9.35 (6.16-13.3)	10.6 (6.81-15.4)
2-day	2.77 (2.27-3.32)	3.39 (2.78-4.08)	4.42 (3.61-5.33)	5.27 (4.28-6.39)	6.45 (5.06-8.21)	7.31 (5.62-9.53)	8.25 (6.17-11.2)	9.45 (6.53-12.9)	11.3 (7.49-16.0)	13.0 (8.36-18.7)
3-day	3.02 (2.49-3.61)	3.72 (3.06-4.45)	4.85 (3.98-5.82)	5.79 (4.72-6.99)	7.09 (5.59-9.00)	8.04 (6.20-10.5)	9.09 (6.83-12.4)	10.4 (7.22-14.2)	12.6 (8.32-17.7)	14.5 (9.33-20.7)
4-day	3.25 (2.69-3.87)	3.99 (3.30-4.76)	5.20 (4.28-6.23)	6.21 (5.07-7.47)	7.59 (6.00-9.61)	8.60 (6.65-11.2)	9.72 (7.32-13.2)	11.2 (7.73-15.1)	13.5 (8.92-18.9)	15.5 (10.0-22.1)
7-day	3.89 (3.24-4.61)	4.71 (3.92-5.59)	6.05 (5.01-7.20)	7.17 (5.89-8.57)	8.70 (6.90-10.9)	9.82 (7.62-12.6)	11.1 (8.34-14.9)	12.6 (8.78-17.0)	15.1 (10.0-21.0)	17.2 (11.2-24.5)
10-day	4.54 (3.79-5.36)	5.40 (4.50-6.38)	6.80 (5.65-8.07)	7.97 (6.57-9.50)	9.57 (7.61-12.0)	10.8 (8.35-13.7)	12.0 (9.06-16.0)	13.6 (9.51-18.3)	16.1 (10.7-22.3)	18.2 (11.8-25.7)
20-day	6.56 (5.51-7.69)	7.47 (6.27-8.76)	8.95 (7.48-10.5)	10.2 (8.45-12.1)	11.9 (9.47-14.6)	13.2 (10.2-16.5)	14.5 (10.8-18.8)	16.0 (11.2-21.3)	18.1 (12.1-24.9)	19.8 (12.9-27.9)
30-day	8.24 (6.95-9.62)	9.18 (7.74-10.7)	10.7 (9.00-12.6)	12.0 (10.0-14.2)	13.8 (11.0-16.8)	15.1 (11.8-18.8)	16.5 (12.3-21.2)	17.9 (12.6-23.7)	19.8 (13.3-27.1)	21.3 (13.9-29.8)
45-day	10.3 (8.72-12.0)	11.3 (9.56-13.2)	12.9 (10.9-15.1)	14.3 (12.0-16.8)	16.2 (13.0-19.6)	17.7 (13.8-21.8)	19.1 (14.2-24.3)	20.5 (14.5-27.0)	22.3 (15.0-30.3)	23.5 (15.4-32.8)
60-day	12.0 (10.2-13.9)	13.1 (11.1-15.2)	14.8 (12.5-17.3)	16.3 (13.7-19.1)	18.3 (14.7-22.1)	19.9 (15.5-24.4)	21.4 (16.0-27.0)	22.8 (16.2-30.0)	24.6 (16.6-33.4)	25.8 (16.9-35.9)

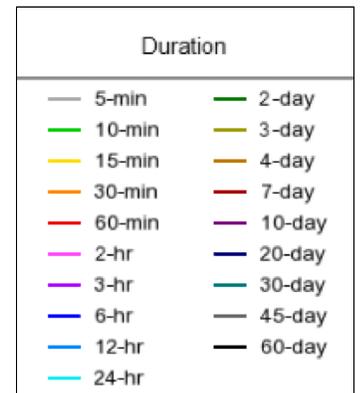
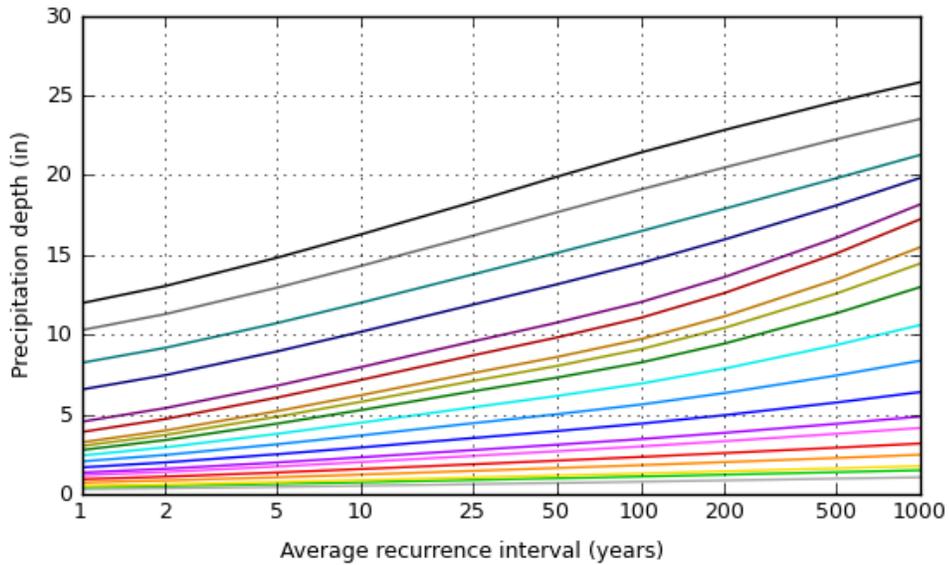
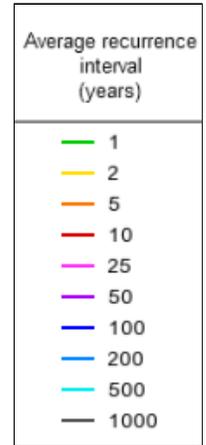
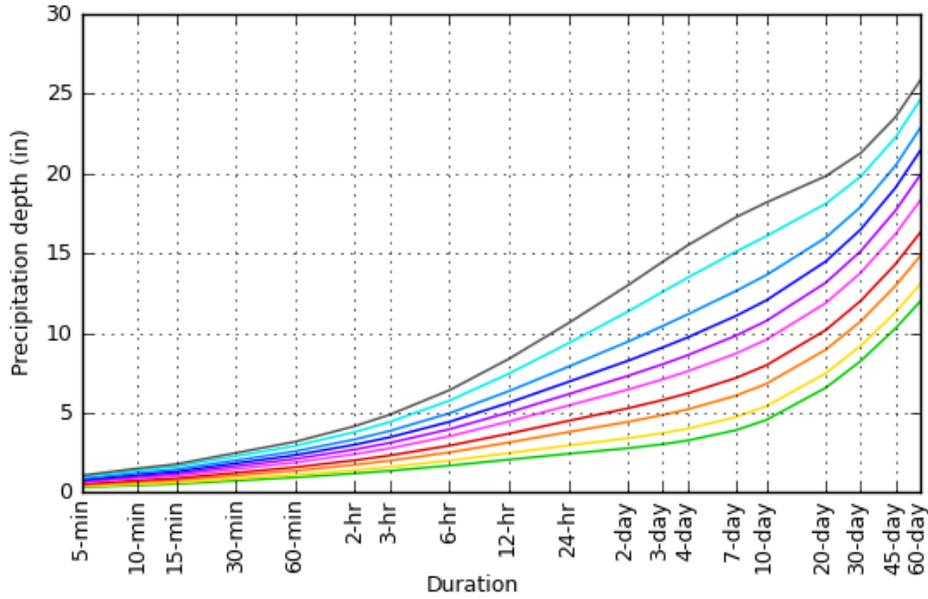
¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values. Please refer to NOAA Atlas 14 document for more information.

[Back to Top](#)

PF graphical

PDS-based depth-duration-frequency (DDF) curves

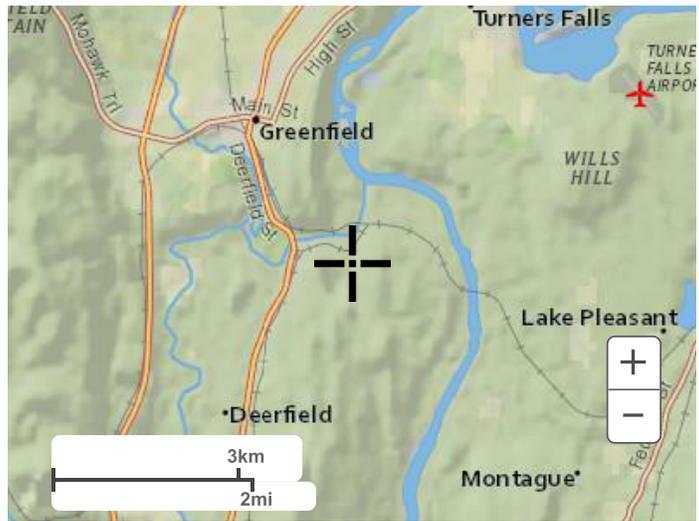
Latitude: 42.5664°, Longitude: -72.5799°



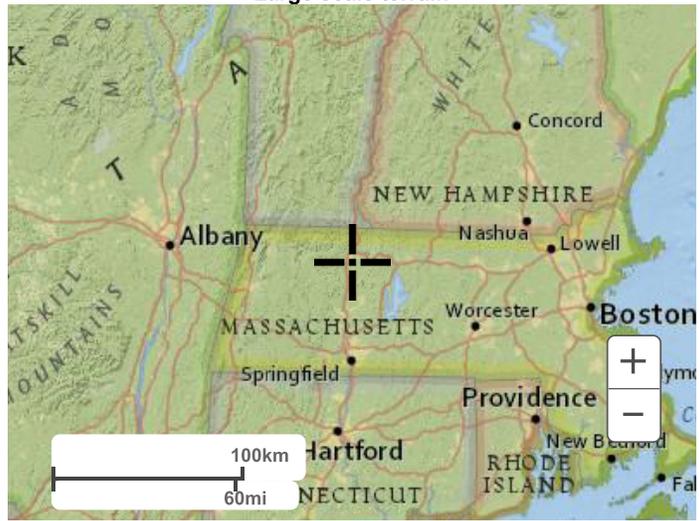
[Back to Top](#)

Maps & aerials

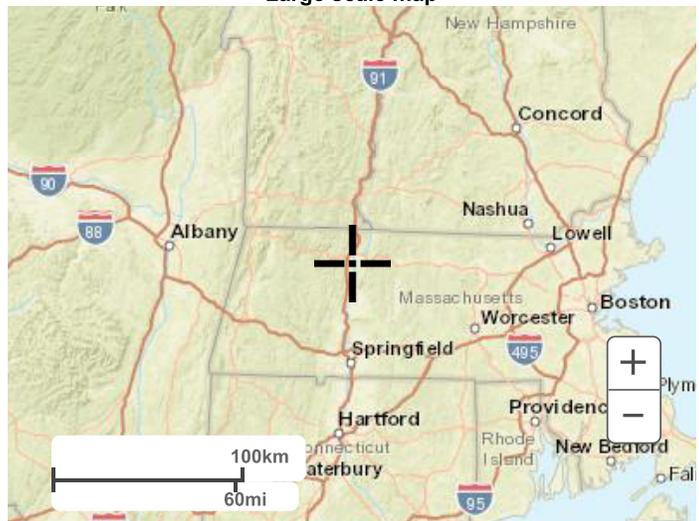
Small scale terrain



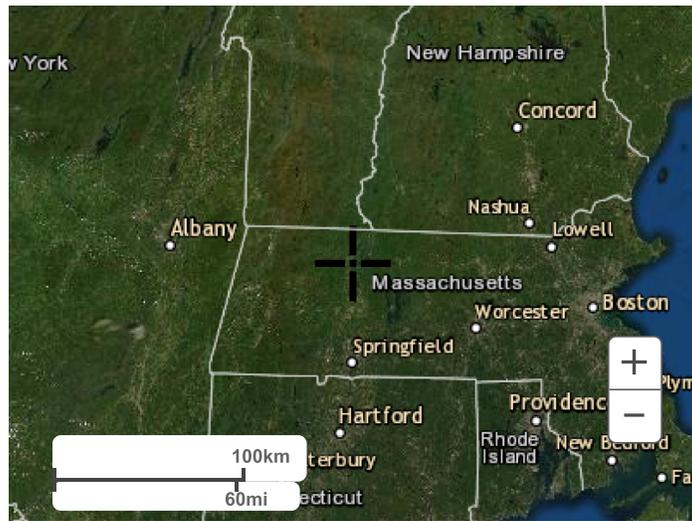
Large scale terrain



Large scale map



Large scale aerial



[Back to Top](#)

[US Department of Commerce](#)
[National Oceanic and Atmospheric Administration](#)
[National Weather Service](#)
[National Water Center](#)
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

[Disclaimer](#)

INSTRUCTIONS:

1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Version 1, Automated: Mar. 4, 2008

Location:

TSS Removal Calculation Worksheet

B BMP ¹	C TSS Removal Rate ¹	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Sediment Forebay	0.25	1.00	0.25	0.75
Constructed Stormwater Wetland	0.80	0.75	0.60	0.15
Deep Sump and Hooded Catch Basin	0.25	0.15	0.04	0.11
	0.00	0.11	0.00	0.11
	0.00	0.11	0.00	0.11

Total TSS Removal =

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

Project:
 Prepared By:
 Date:

*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

Temporary Sediment Traps

**DESIGN
STORM:**

10

SEDIMENT TRAP SUMMARY										
DESIGN										
TRAP NUMBER	DRAINAGE AREA (DA) (sf)	DRAINAGE AREA (DA) (acres)	REQUIRED VOLUME (1800 CF per acre of DA) (cf)	DEPTH* (ft)	WATER SURFACE LENGTH** (ft)	WATER SURFACE WIDTH** (ft)	BASIN BOTTOM LENGTH (ft)	BASIN BOTTOM WIDTH (ft)	VOLUME PROVIDED (cf)	MEETS REQUIRED VOLUME
TST-1	12002	0.28	496	See Erosion & Sedimentation Control Plans					947	Yes
TST-2	54862	1.26	2,267						2,690	Yes
TST-3	68762	1.58	2,841						17,231	Yes
TST-4	75630	1.74	3,125						3,398	Yes
TST-5	103735	2.38	4,287						4,707	Yes

*Depth is from basin bottom to water surface elevation, 2' minimum

**Minimum L/W Ratio = 2:1

Volume Provide: see HydroCAD calculations

Conveyance Swale Design and Lining

DESIGN
STORM:

10

CONVEYANCE SWALE DESIGN AND LINING																							
SWALES NAME	DRAINAGE AREA (sq. ft.)	DRAINAGE AREA (acres)	tc TIME OF CONC. (min)	RUNOFF COEFFICIENT, C	I INTENSITY (10-Yr) (in/hr)	Q (10-Yr) (cfs)	TOTAL RUNOFF, Q (cfs)	CHANNEL SLOPE (ft/ft)	CHANNEL SECTION	BOTTOM WIDTH (ft)	LEFT SIDE SLOPE, Z:1 (ft)	RIGHT SIDE SLOPE, Z:1 (ft)	CHANNEL DEPTH, D (ft)	LENGTH (ft)	UPPER INVERT (ft)	LOWER INVERT (ft)	NORMAL DEPTH (25-Yr) (ft)	FREEBOAR D (25-Yr) (ft)	SHEAR STRESS (lb/ft2)	VELOCITY (fps)	n VALUE	TEMPORARY LINER	PERMANENT LINER
Conveyance Swale #1 (Riprap)	64,010	1.47	10.0	0.75	4.48	4.94	4.94	0.058	TRAPEZOIDAL	2.00	2.00	2.00	2.00	170	201.80	192.00	0.57	1.43	2.05	2.78	0.069	RIPRAP	RIPRAP
Conveyance Swale #2 (Riprap)	332,230	7.63	10.0	0.75	4.48	25.63	25.63	0.298	TRAPEZOIDAL	2.00	2.00	2.00	2.00	47	246.00	232.00	0.87	1.13	16.17	7.90	0.069	RIPRAP	RIPRAP
Conveyance Swale #3 (Vegetated)	332,230	7.63	10.0	0.75	4.48	25.63	25.63	0.066	TRAPEZOIDAL	2.00	2.00	2.00	2.00	1,580	349.60	246.00	0.71	1.29	2.90	10.50	0.022	NORTH AMERICAN GREEN SC150	NORTH AMERICAN GREEN SC150
Conveyance Swale #4 (Vegetated)	51,830	1.19	10.0	0.75	4.48	4.00	4.00	0.082	TRAPEZOIDAL	2.00	2.00	2.00	2.00	1,046	332.00	246.00	0.25	1.75	1.28	6.55	0.022	NORTH AMERICAN GREEN SC150	NORTH AMERICAN GREEN SC150
Conveyance Swale #5 (Vegetated)	12,850	0.29	5.0	0.75	6.34	1.40	1.40	0.036	TRAPEZOIDAL	2.00	2.00	2.00	2.00	342	349.60	337.40	0.17	1.83	0.38	3.52	0.022	NORTH AMERICAN GREEN SC150	NORTH AMERICAN GREEN SC150
Conveyance Swale #6 (Riprap)	72,820	1.67	10.0	0.75	4.48	5.62	5.62	0.040	TRAPEZOIDAL	2.00	2.00	2.00	2.00	125	248.00	243.00	0.67	1.33	1.67	2.52	0.069	RIPRAP	RIPRAP

* Normal depth from FlowMaster * Velocity from FlowMaster
* Normal depth for 10-yr storm

Inputs

Design Storm = 10-year

Swale Calculation Summary

The image displays two screenshots of the Bentley FlowMaster V8i software interface, showing the results of swale calculations for two different swales. Both screenshots are for a 10-year return period (10yr) and use the Manning Formula for friction.

Worksheet: Swale #1_10yr (riprap)

Input Parameters:

- Roughness Coefficient: 0.069
- Channel Slope: 0.05800 ft/ft
- Normal Depth: 0.57 ft
- Left Side Slope: 2.00 ft/ft (H:V)
- Right Side Slope: 2.00 ft/ft (H:V)
- Bottom Width: 2.00 ft
- Discharge: 4.94 ft³/s

Output Results:

- Flow Area: 1.78 ft²
- Wetted Perimeter: 4.54 ft
- Hydraulic Radius: 0.39 ft
- Top Width: 4.27 ft
- Critical Depth: 0.49 ft
- Critical Slope: 0.10461 ft/ft
- Velocity: 2.78 ft/s
- Velocity Head: 0.12 ft
- Specific Energy: 0.69 ft
- Froude Number: 0.76
- Flow Type: Subcritical

Calculation Successful.

Worksheet: Swale #2_10yr (riprap)

Input Parameters:

- Roughness Coefficient: 0.069
- Channel Slope: 0.29800 ft/ft
- Normal Depth: 0.87 ft
- Left Side Slope: 2.00 ft/ft (H:V)
- Right Side Slope: 2.00 ft/ft (H:V)
- Bottom Width: 2.00 ft
- Discharge: 25.63 ft³/s

Output Results:

- Flow Area: 3.24 ft²
- Wetted Perimeter: 5.88 ft
- Hydraulic Radius: 0.55 ft
- Top Width: 5.47 ft
- Critical Depth: 1.18 ft
- Critical Slope: 0.08429 ft/ft
- Velocity: 7.90 ft/s
- Velocity Head: 0.97 ft
- Specific Energy: 1.84 ft
- Froude Number: 1.81
- Flow Type: Supercritical

Calculation Successful.

Worksheet : Swale #3_10yr (veg mat)

Uniform Flow **Gradually Varied Flow** Messages

Solve For: **Normal Depth** Friction Method: **Manning Formula**

Roughness Coefficient:	0.022		Flow Area:	2.44	ft ²
Channel Slope:	0.06600	ft/ft	Wetted Perimeter:	5.19	ft
Normal Depth:	0.71	ft	Hydraulic Radius:	0.47	ft
Left Side Slope:	2.00	ft/ft (H:V)	Top Width:	4.85	ft
Right Side Slope:	2.00	ft/ft (H:V)	Critical Depth:	1.18	ft
Bottom Width:	2.00	ft	Critical Slope:	0.00857	ft/ft
Discharge:	25.63	ft ³ /s	Velocity:	10.50	ft/s
			Velocity Head:	1.71	ft
			Specific Energy:	2.42	ft
			Froude Number:	2.61	
			Flow Type:	Supercritical	

Calculation Successful.

Worksheet : Swale #4_10yr (veg mat)

Uniform Flow **Gradually Varied Flow** Messages

Solve For: **Normal Depth** Friction Method: **Manning Formula**

Roughness Coefficient:	0.022		Flow Area:	0.61	ft ²
Channel Slope:	0.08200	ft/ft	Wetted Perimeter:	3.10	ft
Normal Depth:	0.25	ft	Hydraulic Radius:	0.20	ft
Left Side Slope:	2.00	ft/ft (H:V)	Top Width:	2.98	ft
Right Side Slope:	2.00	ft/ft (H:V)	Critical Depth:	0.43	ft
Bottom Width:	2.00	ft	Critical Slope:	0.01095	ft/ft
Discharge:	4.00	ft ³ /s	Velocity:	6.55	ft/s
			Velocity Head:	0.67	ft
			Specific Energy:	0.91	ft
			Froude Number:	2.55	
			Flow Type:	Supercritical	

Calculation Successful.

Worksheet : Swale #5_10yr (veg mat)

Uniform Flow **Gradually Varied Flow** Messages

Solve For: Normal Depth Friction Method: Manning Formula

Roughness Coefficient:	0.022		Flow Area:	0.40	ft ²
Channel Slope:	0.03600	ft/ft	Wetted Perimeter:	2.76	ft
Normal Depth:	0.17	ft	Hydraulic Radius:	0.14	ft
Left Side Slope:	2.00	ft/ft (H:V)	Top Width:	2.68	ft
Right Side Slope:	2.00	ft/ft (H:V)	Critical Depth:	0.23	ft
Bottom Width:	2.00	ft	Critical Slope:	0.01281	ft/ft
Discharge:	1.40	ft ³ /s	Velocity:	3.52	ft/s
			Velocity Head:	0.19	ft
			Specific Energy:	0.36	ft
			Froude Number:	1.61	
			Flow Type:	Supercritical	

Calculation Successful.

Worksheet : Swale #6_10yr (riprap)

Uniform Flow **Gradually Varied Flow** Messages

Solve For: Normal Depth Friction Method: Manning Formula

Roughness Coefficient:	0.069		Flow Area:	2.23	ft ²
Channel Slope:	0.04000	ft/ft	Wetted Perimeter:	4.99	ft
Normal Depth:	0.67	ft	Hydraulic Radius:	0.45	ft
Left Side Slope:	2.00	ft/ft (H:V)	Top Width:	4.67	ft
Right Side Slope:	2.00	ft/ft (H:V)	Critical Depth:	0.52	ft
Bottom Width:	2.00	ft	Critical Slope:	0.10278	ft/ft
Discharge:	5.62	ft ³ /s	Velocity:	2.52	ft/s
			Velocity Head:	0.10	ft
			Specific Energy:	0.77	ft
			Froude Number:	0.64	
			Flow Type:	Subcritical	

Calculation Successful.

Storm Drainage Culverts

DESIGN STORM: 10

STORM DRAINAGE COMPUTATIONS															
CULVERT ID	DRAINAGE AREA (ac)	tc TIME OF CONC. (min)	RUNOFF COEFFICIENT, C	10-YEAR			SLOPE (ft/ft)	Dtheo (in)	SIZE (in)	Vfull (ft/sec)	LENGTH (ft)	UPPER INVERT (ft)	LOWER INVERT (ft)	TOP EL (ft)	PIPE MATERIAL
				I INTENSITY (10-Yr) (in/hr)	Q (10-Yr) (cfs)	Q TOTAL FLOW (cfs)									
CULVERT 1	1.47	5.0	0.91	6.34	8.50	8.50	0.015	76.6	12	0.1	130.00	192.00	190.00	193.60	RCP
CULVERT 2	2.50	5.0	0.91	6.34	14.46	14.46	0.048	75.7	24	0.2	121.00	190.00	184.25	198.00	CPP
CULVERT 3a	0.10	5.0	0.91	6.34	0.56	0.56	0.022	25.9	18	0.1	51.00	189.10	188.00	193.30	CPP
CULVERT 3b	1.17	5.0	0.91	6.34	6.74	7.31	0.051	56.0	18	0.2	39.00	186.00	184.00	188.00	CPP
CULVERT 4	108.65	5.0	0.91	6.34	628.59	628.59	0.052	305.6	60	0.4	133.00	179.99	173.01	195.60	CMP
CULVERT 5a	9.30	15.0	0.91	3.52	29.87	29.87	0.001	204.9	24	0.0	70.00	235.50	235.43	243.60	CPP
CULVERT 5b	9.30	15.0	0.91	3.52	29.87	29.87	0.001	200.9	24	0.0	18.00	235.33	235.31	243.60	CPP

MAX. ALLOW HEADWATER

Culvert Report

Culvert #1

Invert Elev Dn (ft)	=	190.00
Pipe Length (ft)	=	130.00
Slope (%)	=	1.54
Invert Elev Up (ft)	=	192.00
Rise (in)	=	12.0
Shape	=	Circular
Span (in)	=	12.0
No. Barrels	=	1
n-Value	=	0.015
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

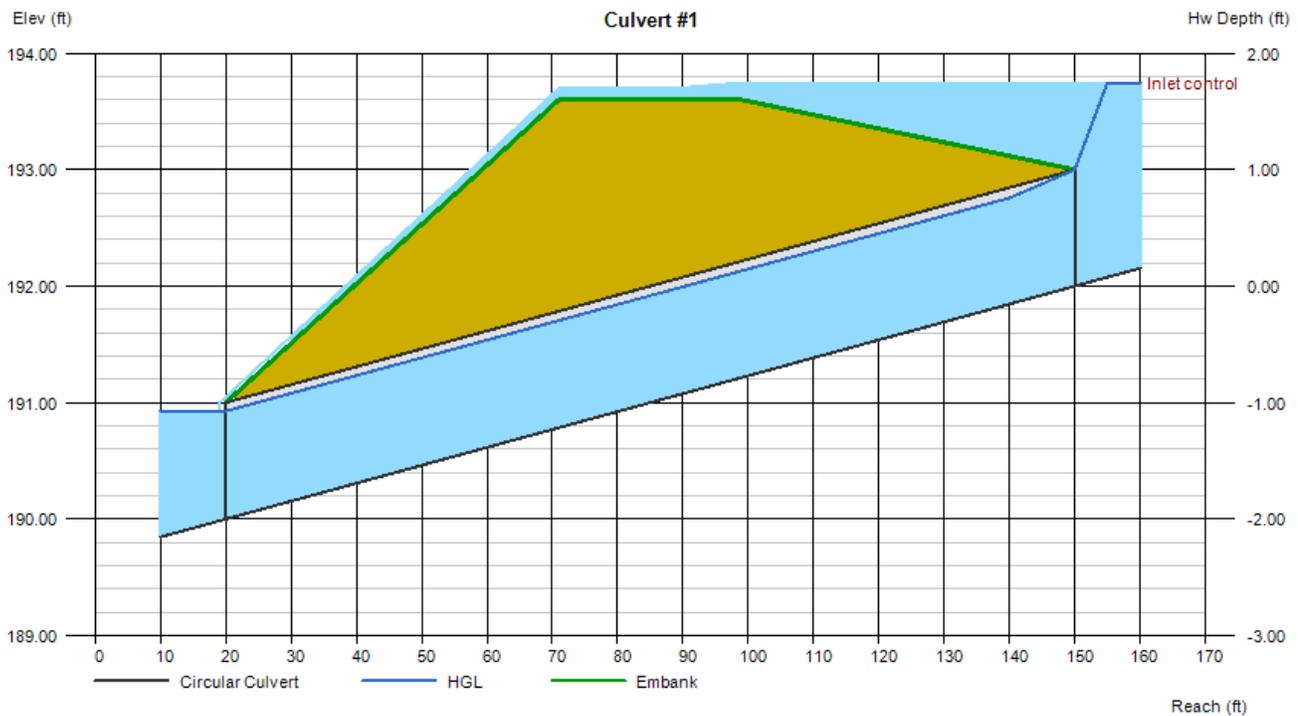
Top Elevation (ft)	=	193.60
Top Width (ft)	=	28.00
Crest Width (ft)	=	28.00

Calculations

Qmin (cfs)	=	8.50
Qmax (cfs)	=	8.50
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	8.50
Qpipe (cfs)	=	4.10
Qovertop (cfs)	=	4.40
Veloc Dn (ft/s)	=	5.40
Veloc Up (ft/s)	=	5.47
HGL Dn (ft)	=	190.93
HGL Up (ft)	=	192.91
Hw Elev (ft)	=	193.75
Hw/D (ft)	=	1.75
Flow Regime	=	Inlet Control



Culvert Report

Culvert #2

Invert Elev Dn (ft)	=	184.25
Pipe Length (ft)	=	121.00
Slope (%)	=	4.75
Invert Elev Up (ft)	=	190.00
Rise (in)	=	24.0
Shape	=	Circular
Span (in)	=	24.0
No. Barrels	=	1
n-Value	=	0.015
Culvert Type	=	Circular Culvert
Culvert Entrance	=	Smooth tapered inlet throat
Coeff. K,M,c,Y,k	=	0.534, 0.555, 0.0196, 0.9, 0.2

Embankment

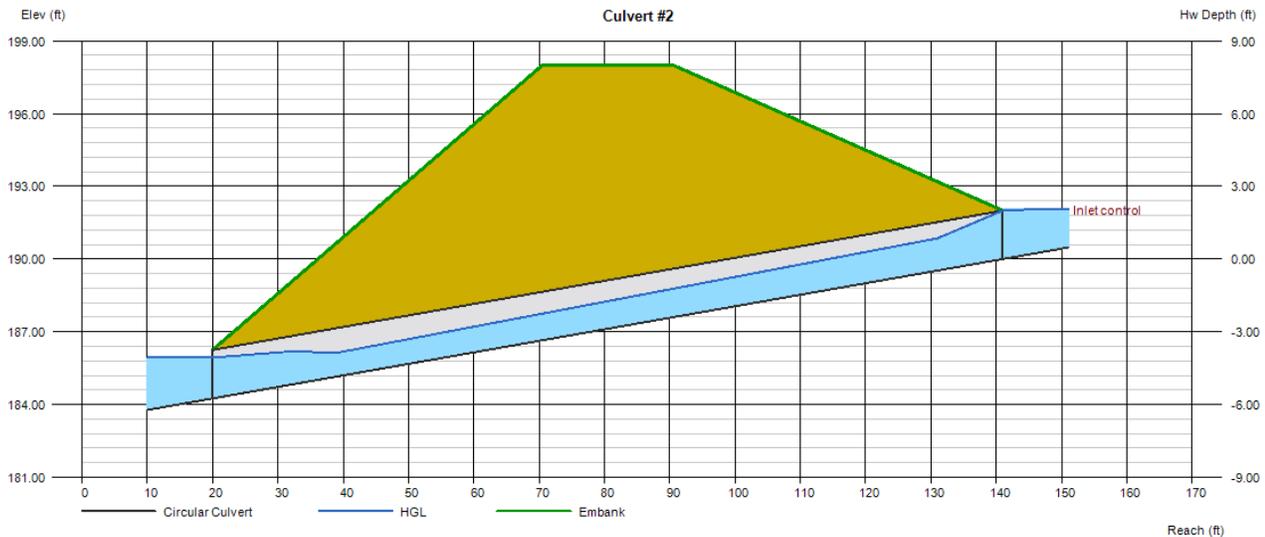
Top Elevation (ft)	=	198.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	14.46
Qmax (cfs)	=	14.46
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	14.46
Qpipe (cfs)	=	14.46
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	5.12
Veloc Up (ft/s)	=	6.31
HGL Dn (ft)	=	185.93
HGL Up (ft)	=	191.37
Hw Elev (ft)	=	192.06
Hw/D (ft)	=	1.03
Flow Regime	=	Inlet Control



Culvert Report

Culvert #3a

Invert Elev Dn (ft)	=	188.00
Pipe Length (ft)	=	51.00
Slope (%)	=	2.16
Invert Elev Up (ft)	=	189.10
Rise (in)	=	18.0
Shape	=	Circular
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.015
Culvert Type	=	Circular Culvert
Culvert Entrance	=	Smooth tapered inlet throat
Coeff. K,M,c,Y,k	=	0.534, 0.555, 0.0196, 0.9, 0.2

Embankment

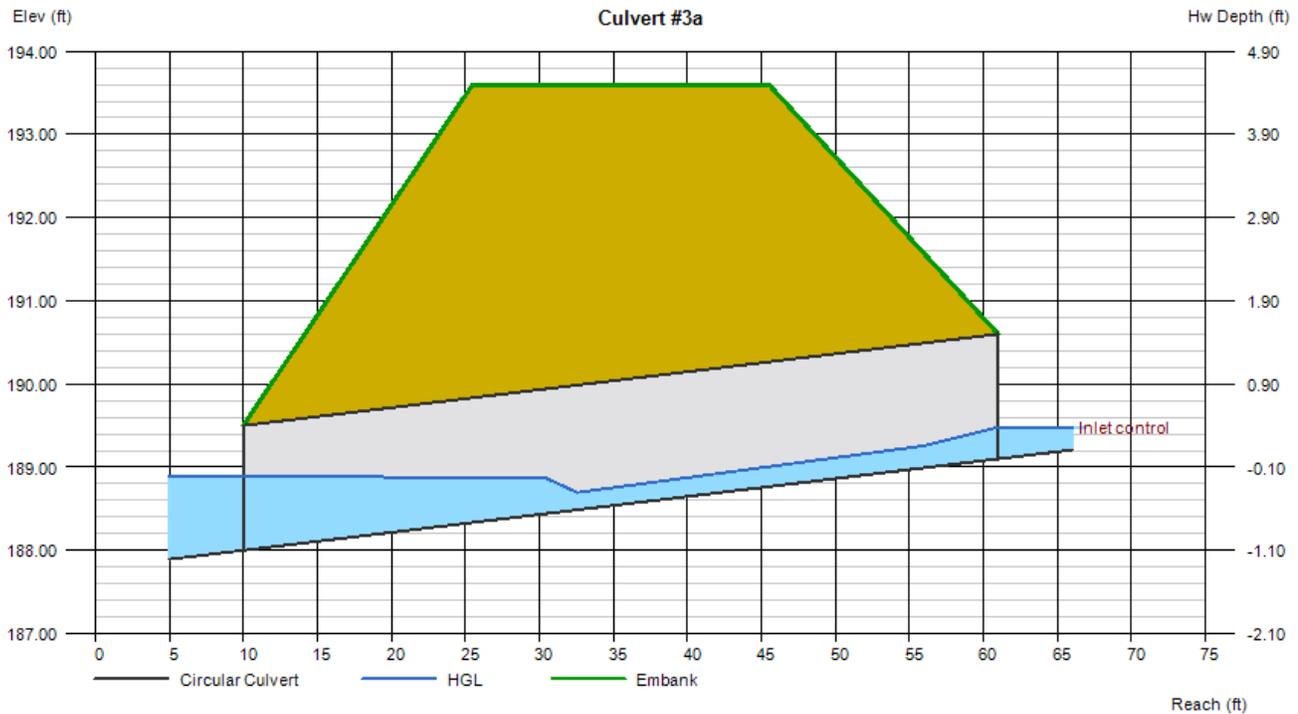
Top Elevation (ft)	=	193.60
Top Width (ft)	=	20.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	0.56
Qmax (cfs)	=	0.56
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	0.56
Qpipe (cfs)	=	0.56
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	0.51
Veloc Up (ft/s)	=	2.49
HGL Dn (ft)	=	188.89
HGL Up (ft)	=	189.38
Hw Elev (ft)	=	189.48
Hw/D (ft)	=	0.25
Flow Regime	=	Inlet Control



Culvert Report

Culvert #3b

Invert Elev Dn (ft)	= 184.00
Pipe Length (ft)	= 39.00
Slope (%)	= 5.13
Invert Elev Up (ft)	= 186.00
Rise (in)	= 18.0
Shape	= Circular
Span (in)	= 18.0
No. Barrels	= 1
n-Value	= 0.015
Culvert Type	= Circular Culvert
Culvert Entrance	= Smooth tapered inlet throat
Coeff. K,M,c,Y,k	= 0.534, 0.555, 0.0196, 0.9, 0.2

Embankment

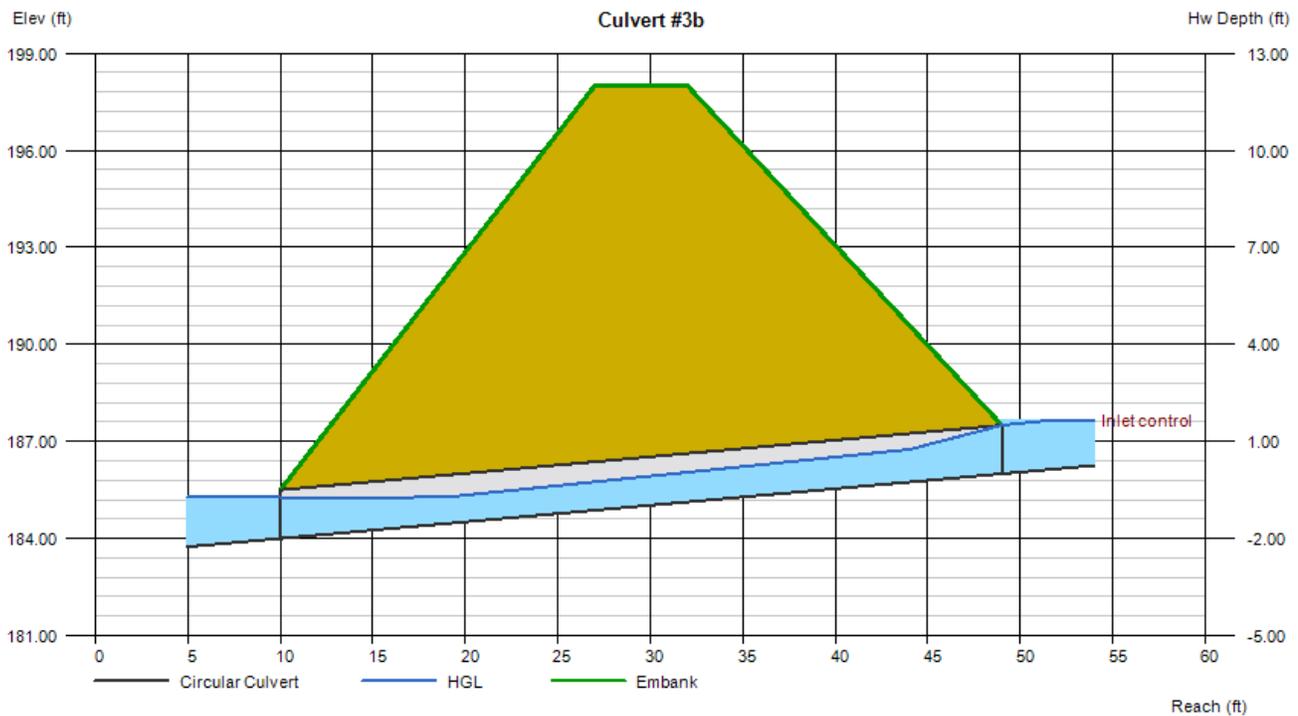
Top Elevation (ft)	= 198.00
Top Width (ft)	= 5.00
Crest Width (ft)	= 5.00

Calculations

Qmin (cfs)	= 7.31
Qmax (cfs)	= 7.31
Tailwater Elev (ft)	= (dc+D)/2

Highlighted

Qtotal (cfs)	= 7.31
Qpipe (cfs)	= 7.31
Qovertop (cfs)	= 0.00
Veloc Dn (ft/s)	= 4.57
Veloc Up (ft/s)	= 5.55
HGL Dn (ft)	= 185.27
HGL Up (ft)	= 187.05
Hw Elev (ft)	= 187.65
Hw/D (ft)	= 1.10
Flow Regime	= Inlet Control



Culvert Report

Culvert #5a

Invert Elev Dn (ft)	=	235.50
Pipe Length (ft)	=	70.00
Slope (%)	=	-0.10
Invert Elev Up (ft)	=	235.43
Rise (in)	=	24.0
Shape	=	Circular
Span (in)	=	24.0
No. Barrels	=	1
n-Value	=	0.015
Culvert Type	=	Circular Culvert
Culvert Entrance	=	Smooth tapered inlet throat
Coeff. K,M,c,Y,k	=	0.534, 0.555, 0.0196, 0.9, 0.2

Embankment

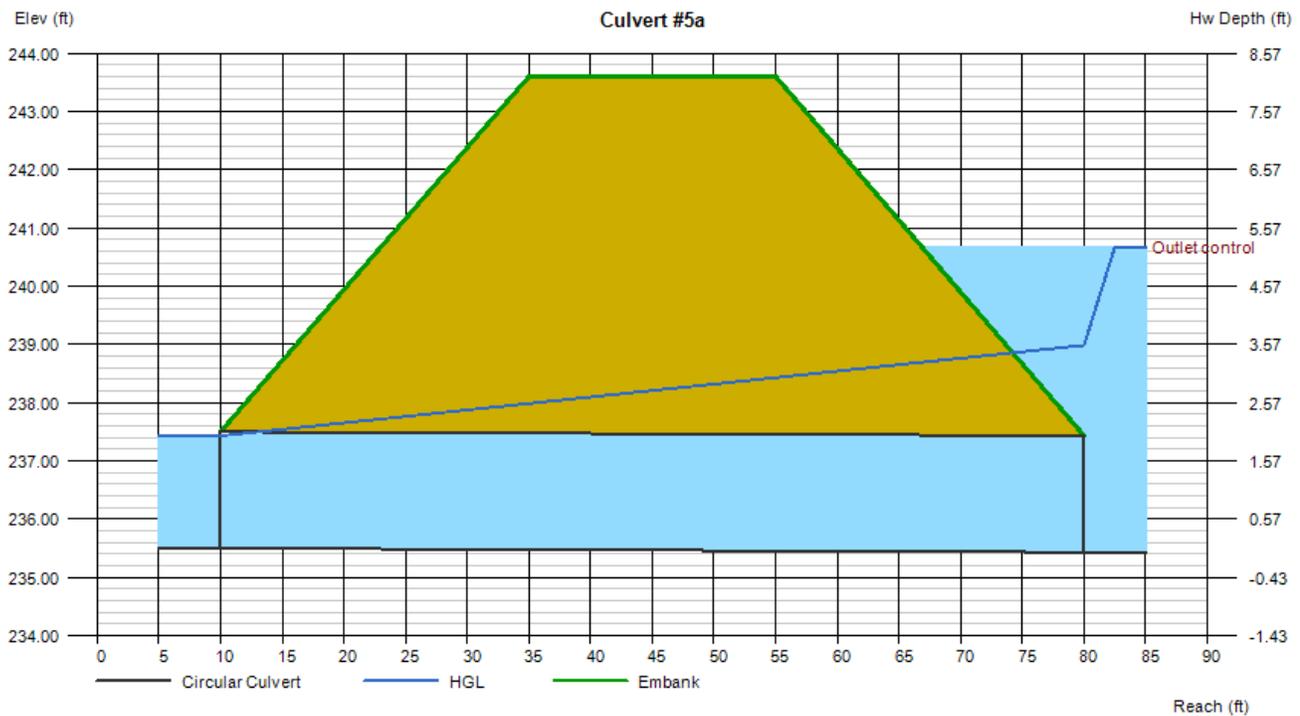
Top Elevation (ft)	=	243.60
Top Width (ft)	=	20.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	29.87
Qmax (cfs)	=	29.87
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	29.87
Qpipe (cfs)	=	29.87
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	9.61
Veloc Up (ft/s)	=	9.51
HGL Dn (ft)	=	237.43
HGL Up (ft)	=	238.99
Hw Elev (ft)	=	240.67
Hw/D (ft)	=	2.62
Flow Regime	=	Outlet Control



Culvert Report

Culvert #5b

Invert Elev Dn (ft)	= 235.31
Pipe Length (ft)	= 18.00
Slope (%)	= 0.11
Invert Elev Up (ft)	= 235.33
Rise (in)	= 24.0
Shape	= Circular
Span (in)	= 24.0
No. Barrels	= 1
n-Value	= 0.015
Culvert Type	= Circular Culvert
Culvert Entrance	= Smooth tapered inlet throat
Coeff. K,M,c,Y,k	= 0.534, 0.555, 0.0196, 0.9, 0.2

Embankment

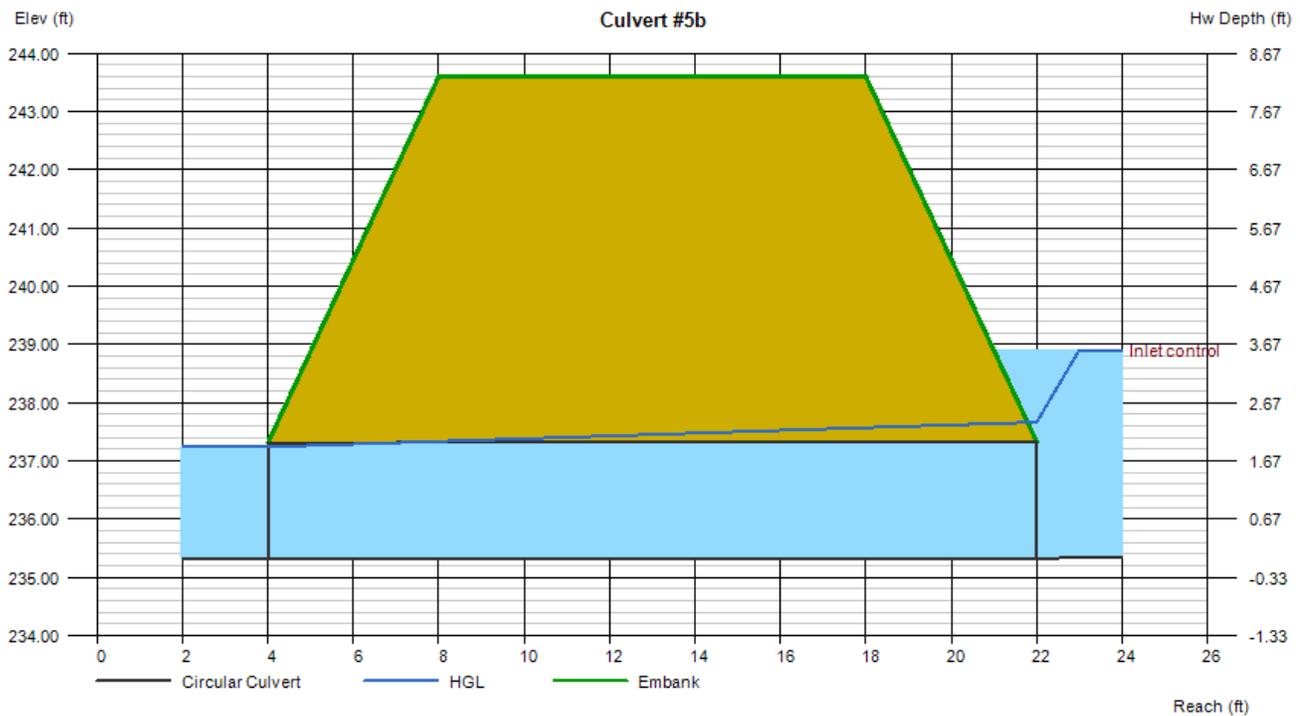
Top Elevation (ft)	= 243.60
Top Width (ft)	= 10.00
Crest Width (ft)	= 10.00

Calculations

Qmin (cfs)	= 29.87
Qmax (cfs)	= 29.87
Tailwater Elev (ft)	= (dc+D)/2

Highlighted

Qtotal (cfs)	= 29.87
Qpipe (cfs)	= 29.87
Qovertop (cfs)	= 0.00
Veloc Dn (ft/s)	= 9.61
Veloc Up (ft/s)	= 9.51
HGL Dn (ft)	= 237.24
HGL Up (ft)	= 237.66
Hw Elev (ft)	= 238.90
Hw/D (ft)	= 1.79
Flow Regime	= Inlet Control



STANDARD 4: WATER QUALITY VOLUME

Reference: Massachusetts Stormwater Handbook, Chapter 1, Standard 4

Required Water Quality Volume (WQV)

1

inch of runoff

TSS REMOVAL CALCULATION

Description	Impervious Area		WQV (cf)	% TSS Removal	Treatment Device
	(sf)	(acres)			
Sub Area 300	50,785	1.2	4232	80%	Pocket Wetland

WQV

Equation:

$$WQV = \text{Imp. Area} \times 1.0\text{-inches} \times 1'/12''$$

D = Depth of Water in Structure (in)

IR = Infiltration Rate * (in/hr)

Notes:

1. Refer to the attached TSS Removal Calculation Worksheet for % TSS removal

APPENDIX F – DRAINAGE CALCULATIONS (HYDROCAD)

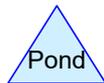
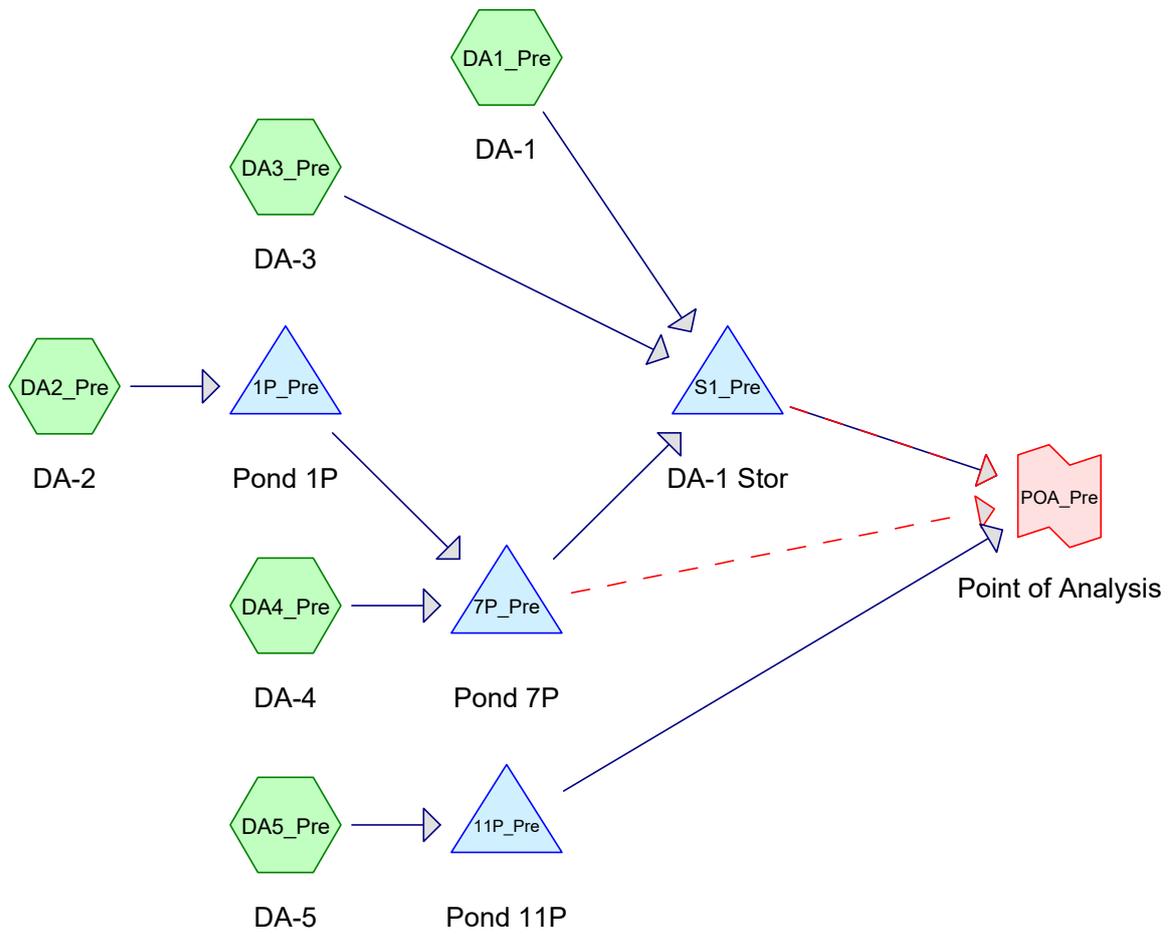
F1: Pre-Development Hydrology

F2: Post-Development Hydrology

F3: Post-Development BMP

F4: Erosion & Sedimentation Control (Temporary Sediment Traps)

PRE-DEVELOPMENT



ASMG_221383_Hydrology

Prepared by ITS

HydroCAD® 10.10-5a s/n 09112 © 2020 HydroCAD Software Solutions LLC

Printed 5/4/2022

Page 2

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-yr (Hampden)	Type III 24-hr		Default	24.00	1	2.94	2
2	10-yr (Hampden)	Type III 24-hr		Default	24.00	1	4.48	2
3	100-yr (Hampden)	Type III 24-hr		Default	24.00	1	6.93	2

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentDA1_Pre: DA-1 Runoff Area=160.430 ac 2.51% Impervious Runoff Depth=0.48"
Flow Length=5,870' Tc=47.5 min CN=65 Runoff=30.15 cfs 6.403 af

SubcatchmentDA2_Pre: DA-2 Runoff Area=7.500 ac 16.69% Impervious Runoff Depth=1.47"
Flow Length=1,705' Slope=0.0711 '/' Tc=7.0 min CN=84 Runoff=12.43 cfs 0.917 af

SubcatchmentDA3_Pre: DA-3 Runoff Area=0.630 ac 72.00% Impervious Runoff Depth=2.20"
Tc=5.0 min CN=93 Runoff=1.64 cfs 0.115 af

SubcatchmentDA4_Pre: DA-4 Runoff Area=0.090 ac 87.56% Impervious Runoff Depth=2.49"
Tc=5.0 min CN=96 Runoff=0.26 cfs 0.019 af

SubcatchmentDA5_Pre: DA-5 Runoff Area=6.350 ac 3.74% Impervious Runoff Depth=0.87"
Flow Length=1,153' Slope=0.1040 '/' Tc=22.5 min CN=74 Runoff=3.83 cfs 0.461 af

Pond 1P_Pre: Pond 1P Peak Elev=188.25' Storage=4,861 cf Inflow=12.43 cfs 0.917 af
Outflow=8.62 cfs 0.908 af

Pond 7P_Pre: Pond 7P Peak Elev=184.23' Storage=199 cf Inflow=8.75 cfs 0.926 af
Primary=8.71 cfs 0.926 af Secondary=0.00 cfs 0.000 af Outflow=8.71 cfs 0.926 af

Pond 11P_Pre: Pond 11P Peak Elev=224.26' Storage=262 cf Inflow=3.83 cfs 0.461 af
Outflow=3.83 cfs 0.461 af

Pond S1_Pre: DA-1 Stor Peak Elev=179.67' Storage=186 cf Inflow=32.49 cfs 7.444 af
Primary=32.48 cfs 7.444 af Secondary=0.00 cfs 0.000 af Outflow=32.48 cfs 7.444 af

Link POA_Pre: Point of Analysis Inflow=34.33 cfs 7.905 af
Primary=34.33 cfs 7.905 af

Total Runoff Area = 175.000 ac Runoff Volume = 7.914 af Average Runoff Depth = 0.54"
96.55% Pervious = 168.954 ac 3.45% Impervious = 6.046 ac

Summary for Subcatchment DA1_Pre: DA-1

Runoff = 30.15 cfs @ 12.82 hrs, Volume= 6.403 af, Depth= 0.48"

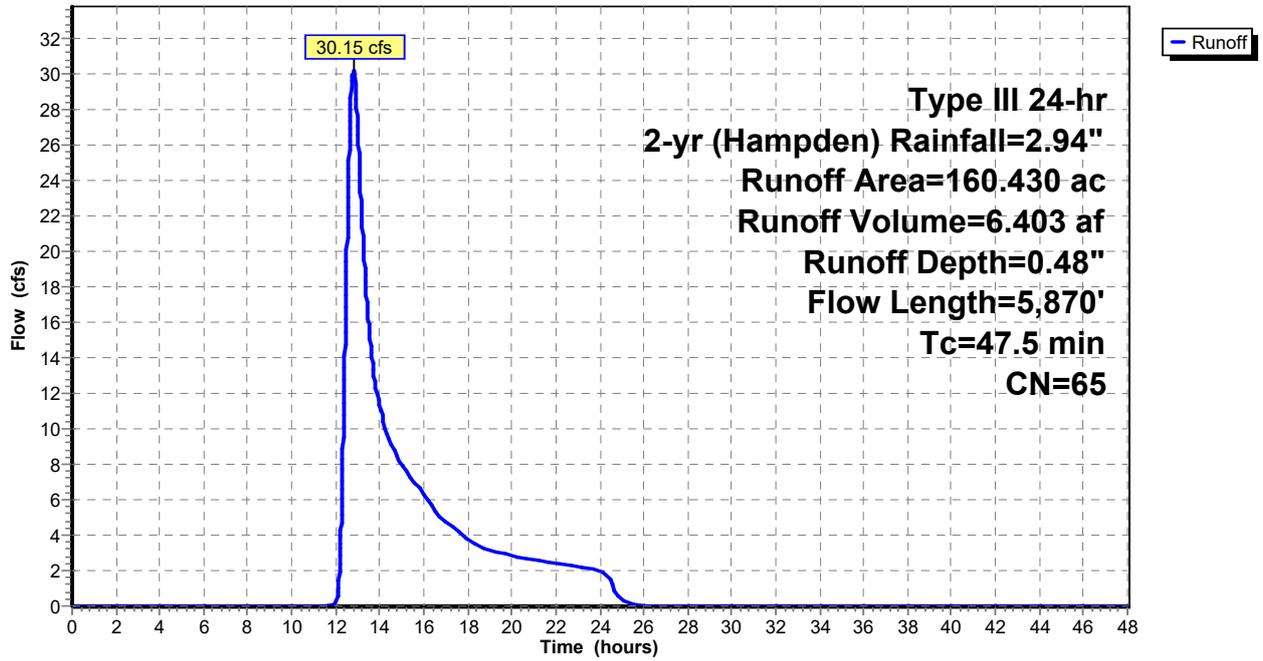
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type III 24-hr 2-yr (Hampden) Rainfall=2.94"

Area (ac)	CN	Description
0.580	35	Brush, Fair, HSG A
0.450	70	Brush, Fair, HSG C
0.460	77	Brush, Fair, HSG D
2.450	93	Urban industrial, 72% imp, HSG D
2.480	49	Pasture/grassland/range, Fair, HSG A
0.660	69	Pasture/grassland/range, Fair, HSG B
5.930	79	Pasture/grassland/range, Fair, HSG C
1.220	84	Pasture/grassland/range, Fair, HSG D
* 2.260	98	Wetland
30.690	36	Woods, Fair, HSG A
29.080	60	Woods, Fair, HSG B
45.970	73	Woods, Fair, HSG C
38.200	79	Woods, Fair, HSG D
160.430	65	Weighted Average
156.406		97.49% Pervious Area
4.024		2.51% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.6	100	0.0581	0.11		Sheet Flow, Sheet-Woods Woods: Light underbrush n= 0.400 P2= 2.94"
24.9	1,800	0.0581	1.21		Shallow Concentrated Flow, SCF-Woods Woodland Kv= 5.0 fps
8.0	3,970	0.0200	8.31	199.43	Parabolic Channel, W=18.00' D=2.00' Area=24.0 sf Perim=18.6' n= 0.030
47.5	5,870	Total			

Subcatchment DA1_Pre: DA-1

Hydrograph



Summary for Subcatchment DA2_Pre: DA-2

Runoff = 12.43 cfs @ 12.10 hrs, Volume= 0.917 af, Depth= 1.47"

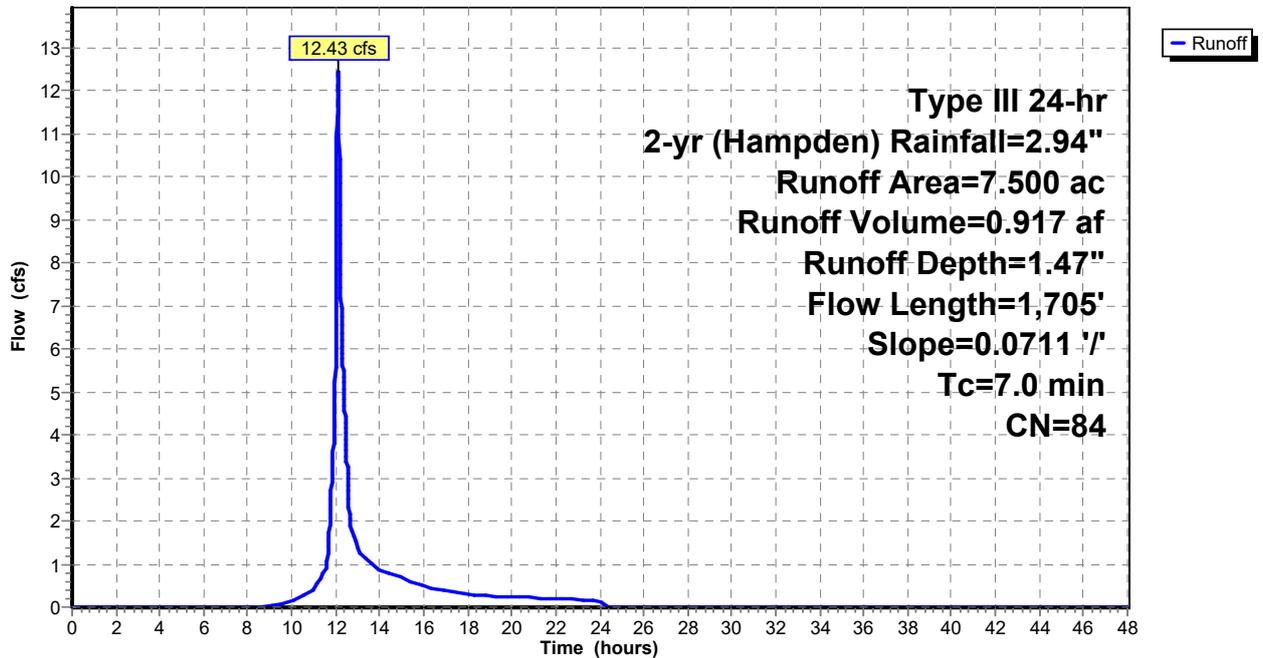
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type III 24-hr 2-yr (Hampden) Rainfall=2.94"

Area (ac)	CN	Description
1.530	93	Urban industrial, 72% imp, HSG D
2.080	84	Pasture/grassland/range, Fair, HSG D
0.150	98	Water Surface, HSG D
3.740	79	Woods, Fair, HSG D
7.500	84	Weighted Average
6.248		83.31% Pervious Area
1.252		16.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	100	0.0711	2.19		Sheet Flow, Sheet-Rd Smooth surfaces n= 0.011 P2= 2.94"
6.2	1,605	0.0711	4.29		Shallow Concentrated Flow, SCF-Rd Unpaved Kv= 16.1 fps
7.0	1,705	Total			

Subcatchment DA2_Pre: DA-2

Hydrograph



Summary for Subcatchment DA3_Pre: DA-3

Runoff = 1.64 cfs @ 12.07 hrs, Volume= 0.115 af, Depth= 2.20"

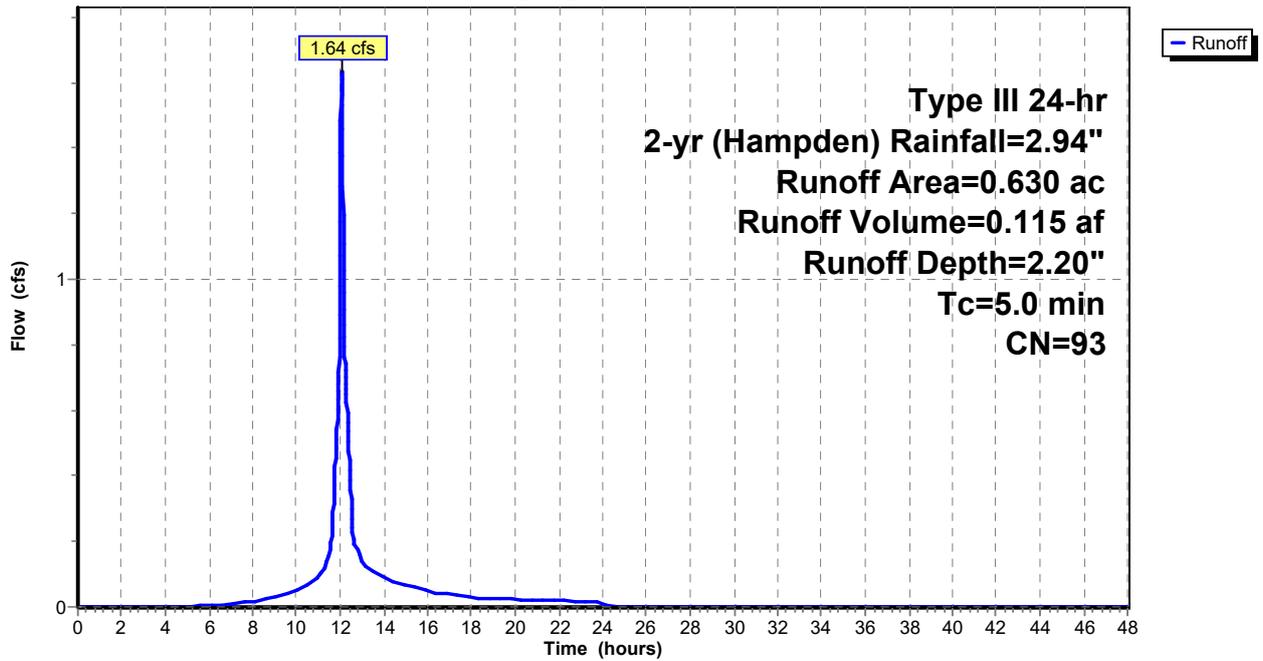
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type III 24-hr 2-yr (Hampden) Rainfall=2.94"

Area (ac)	CN	Description
0.630	93	Urban industrial, 72% imp, HSG D
0.176		28.00% Pervious Area
0.454		72.00% Impervious Area

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

Subcatchment DA3_Pre: DA-3

Hydrograph



Summary for Subcatchment DA4_Pre: DA-4

Runoff = 0.26 cfs @ 12.07 hrs, Volume= 0.019 af, Depth= 2.49"

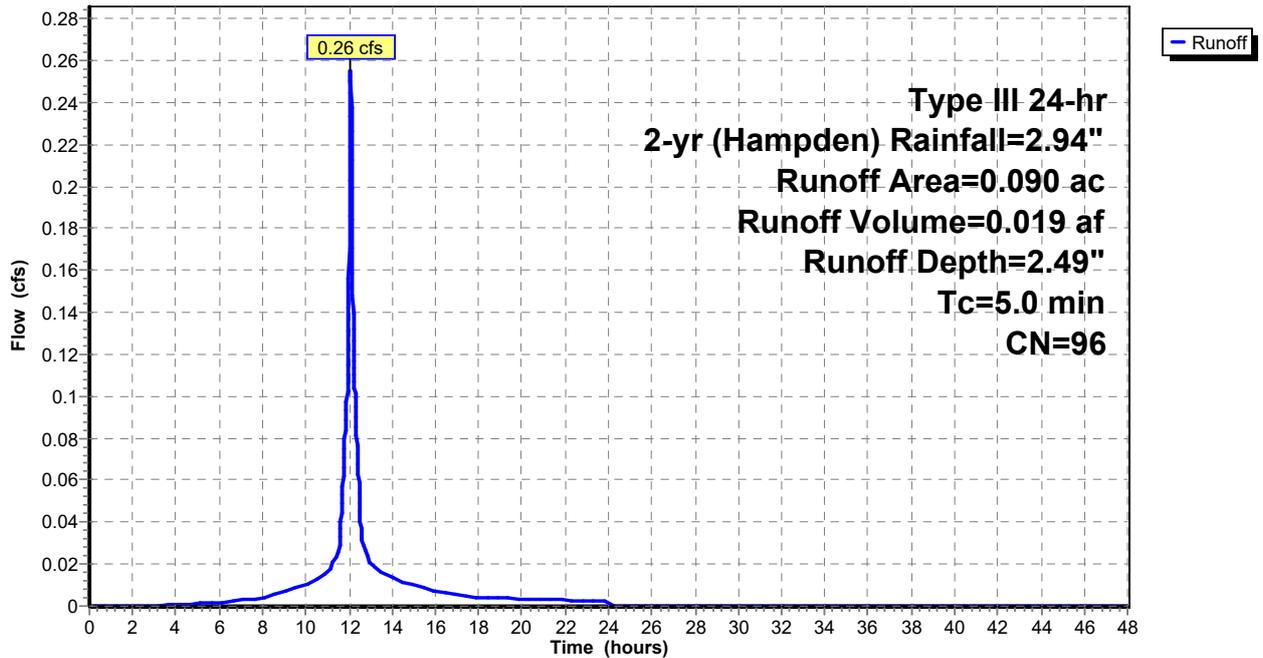
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type III 24-hr 2-yr (Hampden) Rainfall=2.94"

Area (ac)	CN	Description
0.040	93	Urban industrial, 72% imp, HSG D
0.050	98	Water Surface, HSG D
0.090	96	Weighted Average
0.011		12.44% Pervious Area
0.079		87.56% Impervious Area

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

Subcatchment DA4_Pre: DA-4

Hydrograph



Summary for Subcatchment DA5_Pre: DA-5

Runoff = 3.83 cfs @ 12.34 hrs, Volume= 0.461 af, Depth= 0.87"

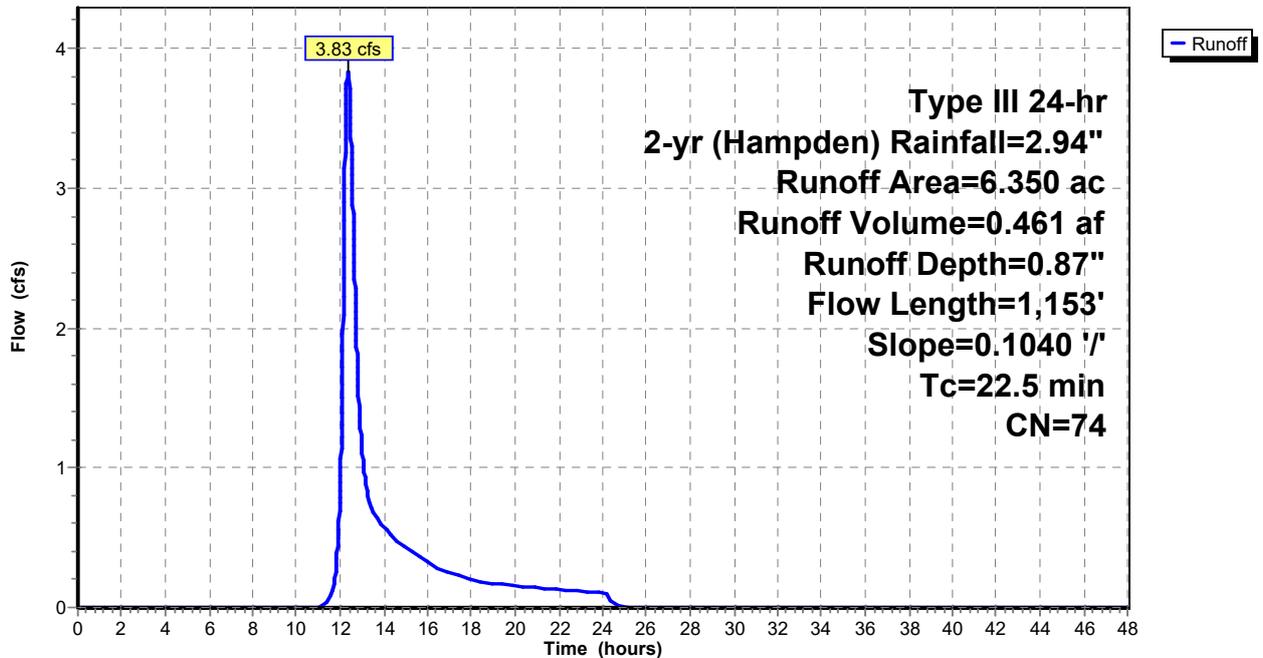
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type III 24-hr 2-yr (Hampden) Rainfall=2.94"

Area (ac)	CN	Description
0.270	91	Urban industrial, 72% imp, HSG C
0.060	93	Urban industrial, 72% imp, HSG D
0.280	79	Pasture/grassland/range, Fair, HSG C
0.050	84	Pasture/grassland/range, Fair, HSG D
0.180	60	Woods, Fair, HSG B
5.350	73	Woods, Fair, HSG C
0.160	79	Woods, Fair, HSG D
6.350	74	Weighted Average
6.112		96.26% Pervious Area
0.238		3.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.6	100	0.1040	0.14		Sheet Flow, Sheet-Woods
					Woods: Light underbrush n= 0.400 P2= 2.94"
10.9	1,053	0.1040	1.61		Shallow Concentrated Flow, SCF-Woods
					Woodland Kv= 5.0 fps
22.5	1,153	Total			

Subcatchment DA5_Pre: DA-5

Hydrograph



Summary for Pond 1P_Pre: Pond 1P

Inflow Area = 7.500 ac, 16.69% Impervious, Inflow Depth = 1.47" for 2-yr (Hampden) event
 Inflow = 12.43 cfs @ 12.10 hrs, Volume= 0.917 af
 Outflow = 8.62 cfs @ 12.20 hrs, Volume= 0.908 af, Atten= 31%, Lag= 5.5 min
 Primary = 8.62 cfs @ 12.20 hrs, Volume= 0.908 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 188.25' @ 12.20 hrs Surf.Area= 4,157 sf Storage= 4,861 cf

Plug-Flow detention time= 22.7 min calculated for 0.908 af (99% of inflow)
 Center-of-Mass det. time= 16.5 min (851.0 - 834.4)

Volume	Invert	Avail.Storage	Storage Description
#1	186.00'	51,062 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
186.00	0	0	0
188.00	3,866	3,866	3,866
189.00	5,039	4,453	8,319
190.00	6,026	5,533	13,851
191.00	7,099	6,563	20,414
192.00	8,299	7,699	28,113
194.00	14,650	22,949	51,062

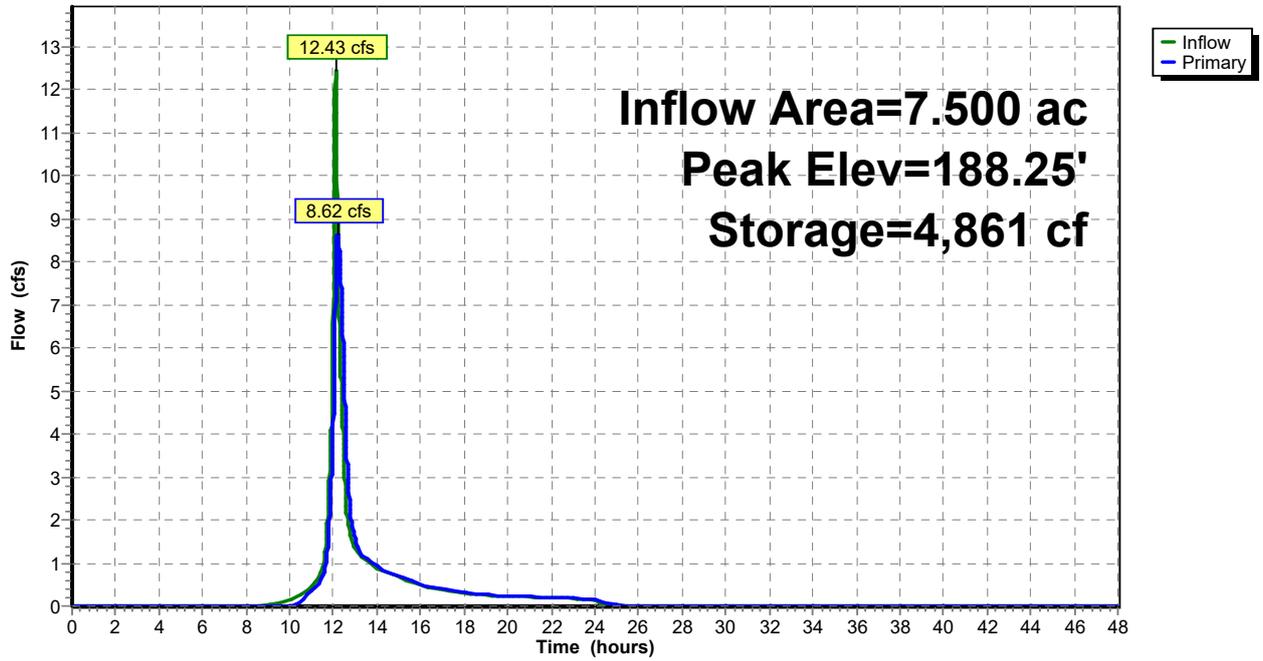
Device	Routing	Invert	Outlet Devices
#1	Primary	186.65'	15.0" Round 15" CPP 1 L= 161.8' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 186.65' / 183.17' S= 0.0215 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf
#2	Primary	186.88'	15.0" Round 15" CPP 2 L= 162.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 186.88' / 182.88' S= 0.0247 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=8.62 cfs @ 12.20 hrs HW=188.25' (Free Discharge)

↑ **1=15" CPP 1** (Inlet Controls 4.60 cfs @ 3.75 fps)
 ↓ **2=15" CPP 2** (Inlet Controls 4.02 cfs @ 3.28 fps)

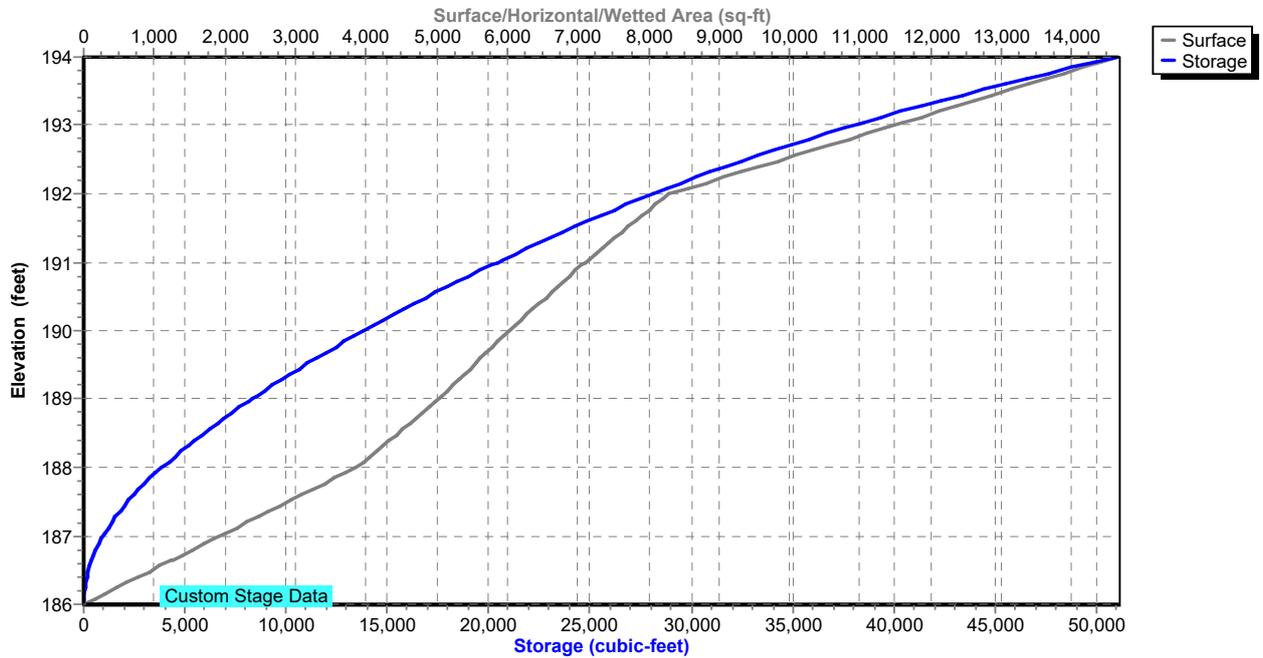
Pond 1P_Pre: Pond 1P

Hydrograph



Pond 1P_Pre: Pond 1P

Stage-Area-Storage



Summary for Pond 7P_Pre: Pond 7P

Inflow Area = 7.590 ac, 17.53% Impervious, Inflow Depth = 1.46" for 2-yr (Hampden) event
 Inflow = 8.75 cfs @ 12.19 hrs, Volume= 0.926 af
 Outflow = 8.71 cfs @ 12.21 hrs, Volume= 0.926 af, Atten= 0%, Lag= 1.3 min
 Primary = 8.71 cfs @ 12.21 hrs, Volume= 0.926 af
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 184.23' @ 12.21 hrs Surf.Area= 300 sf Storage= 199 cf

Plug-Flow detention time= 0.4 min calculated for 0.926 af (100% of inflow)
 Center-of-Mass det. time= 0.2 min (849.7 - 849.4)

Volume	Invert	Avail.Storage	Storage Description
#1	182.00'	5,536 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
182.00	0	0	0
183.00	13	7	7
184.00	247	130	137
185.00	479	363	500
186.00	682	581	1,080
187.00	920	801	1,881
188.00	1,114	1,017	2,898
189.00	1,312	1,213	4,111
190.00	1,538	1,425	5,536

Device	Routing	Invert	Outlet Devices
#1	Primary	182.74'	12.0" Round 12" RCP 1 L= 69.5' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 182.74' / 181.83' S= 0.0131 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf
#2	Primary	182.84'	12.0" Round 12" RCP 1 L= 65.8' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 182.84' / 181.60' S= 0.0188 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf
#3	Secondary	186.00'	Emergency Spillway, Cv= 2.62 (C= 3.28) Head (feet) 0.00 1.00 2.00 3.00 4.00 Width (feet) 4.26 9.60 15.15 20.50 31.66

Primary OutFlow Max=8.71 cfs @ 12.21 hrs HW=184.23' (Free Discharge)

↑1=12" RCP 1 (Barrel Controls 4.26 cfs @ 5.42 fps)

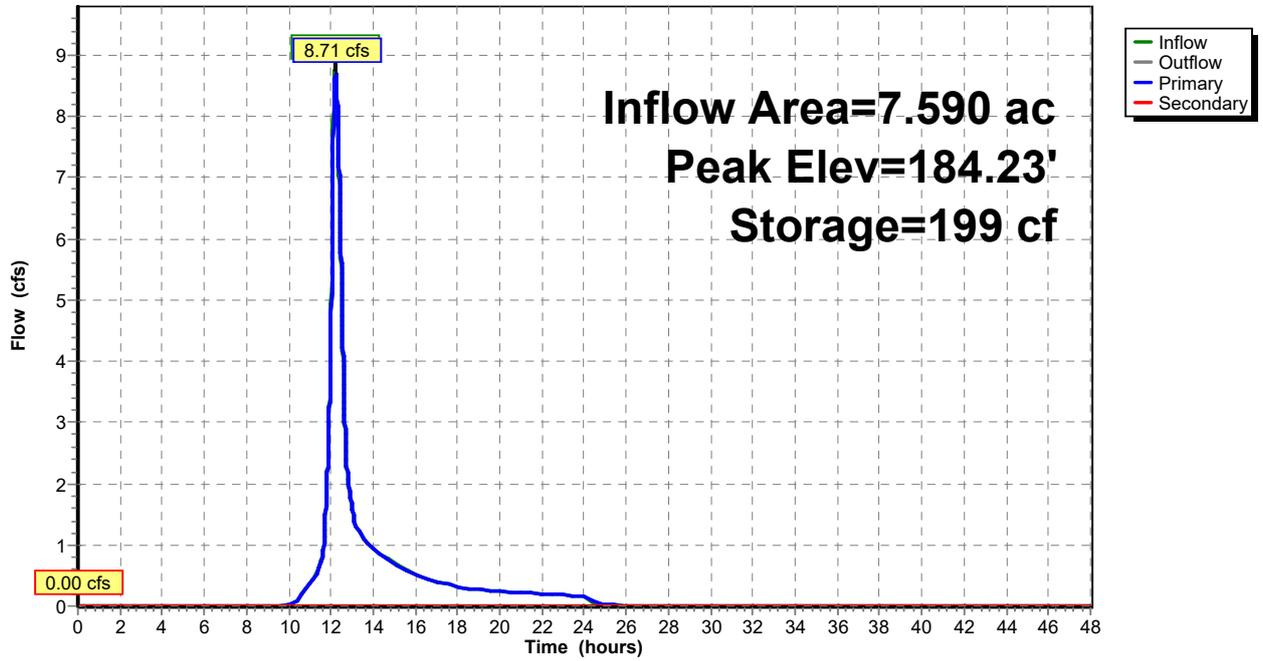
↳2=12" RCP 1 (Inlet Controls 4.45 cfs @ 5.67 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=182.00' (Free Discharge)

↑3=Emergency Spillway (Controls 0.00 cfs)

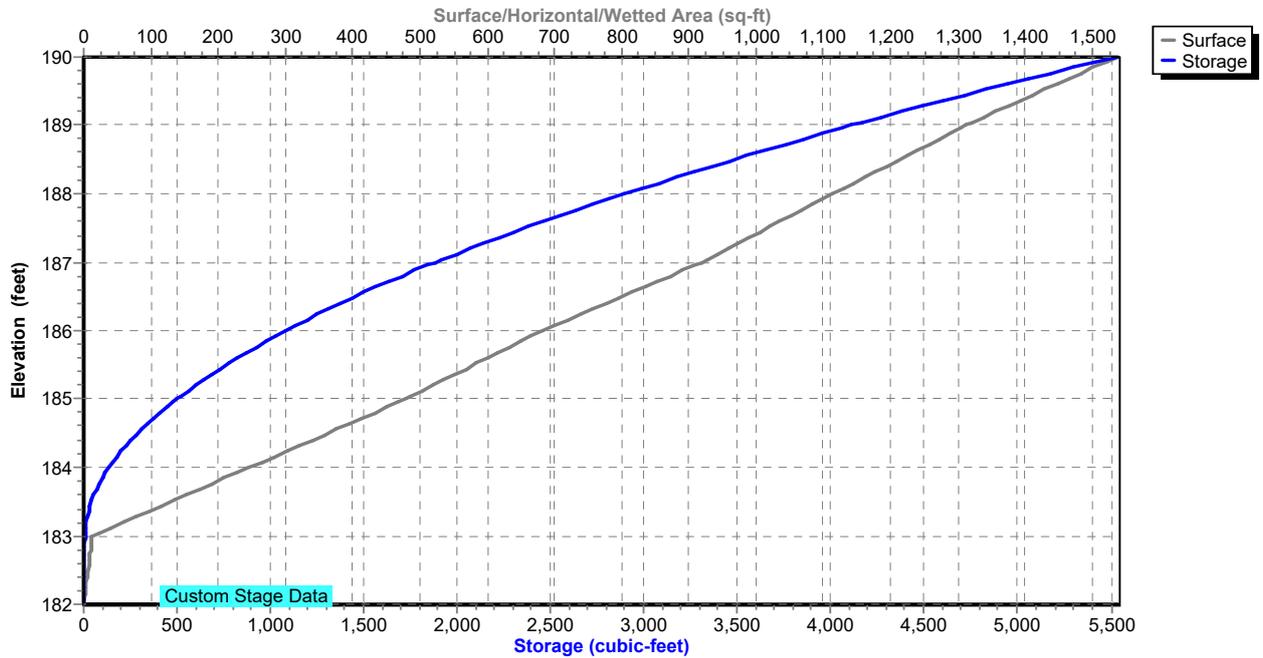
Pond 7P_Pre: Pond 7P

Hydrograph



Pond 7P_Pre: Pond 7P

Stage-Area-Storage



Summary for Pond 11P_Pre: Pond 11P

Inflow Area = 6.350 ac, 3.74% Impervious, Inflow Depth = 0.87" for 2-yr (Hampden) event
 Inflow = 3.83 cfs @ 12.34 hrs, Volume= 0.461 af
 Outflow = 3.83 cfs @ 12.36 hrs, Volume= 0.461 af, Atten= 0%, Lag= 0.9 min
 Primary = 3.83 cfs @ 12.36 hrs, Volume= 0.461 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 224.26' @ 12.36 hrs Surf.Area= 1,096 sf Storage= 262 cf

Plug-Flow detention time= 2.1 min calculated for 0.460 af (100% of inflow)
 Center-of-Mass det. time= 2.1 min (885.0 - 882.9)

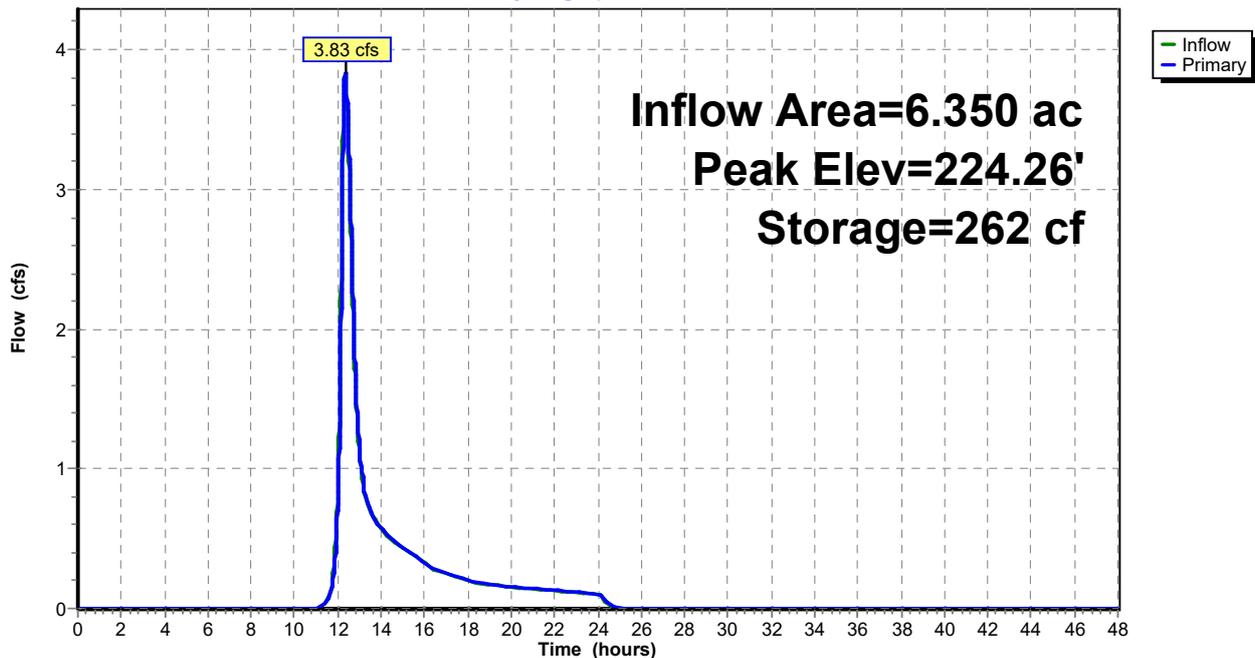
Volume	Invert	Avail.Storage	Storage Description
#1	224.00'	3,026 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
224.00	953	0	0
225.00	1,513	1,233	1,233
226.00	2,072	1,793	3,026

Device	Routing	Invert	Outlet Devices
#1	Primary	224.00'	Emergency Spillway, Cv= 2.62 (C= 3.28) Head (feet) 0.00 1.00 2.00 Width (feet) 8.00 18.00 26.00

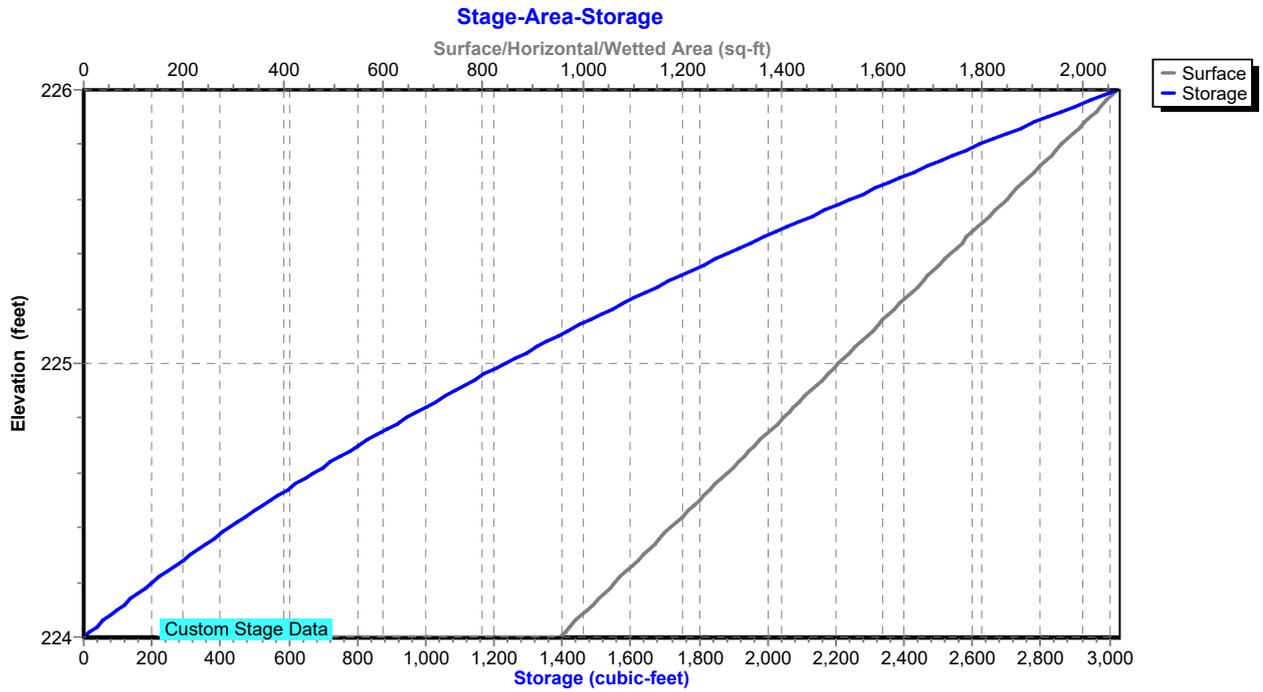
Primary OutFlow Max=3.83 cfs @ 12.36 hrs HW=224.26' (Free Discharge)
 ←1=Emergency Spillway (Weir Controls 3.83 cfs @ 1.61 fps)

Pond 11P_Pre: Pond 11P

Hydrograph



Pond 11P_Pre: Pond 11P



Summary for Pond S1_Pre: DA-1 Stor

Inflow Area = 168.650 ac, 3.44% Impervious, Inflow Depth = 0.53" for 2-yr (Hampden) event
 Inflow = 32.49 cfs @ 12.77 hrs, Volume= 7.444 af
 Outflow = 32.48 cfs @ 12.78 hrs, Volume= 7.444 af, Atten= 0%, Lag= 0.3 min
 Primary = 32.48 cfs @ 12.78 hrs, Volume= 7.444 af
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 179.67' @ 12.78 hrs Surf.Area= 332 sf Storage= 186 cf

Plug-Flow detention time= 0.1 min calculated for 7.443 af (100% of inflow)
 Center-of-Mass det. time= 0.1 min (929.0 - 928.9)

Volume	Invert	Avail.Storage	Storage Description	
#1	177.00'	237,211 cf	Custom Stage Data (Conic) Listed below (Recalc)	
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
177.00	0	0	0	0
178.00	21	7	7	23
179.00	83	49	56	89
180.00	512	267	323	522
181.00	1,306	879	1,201	1,323
182.00	2,393	1,822	3,023	2,420
183.00	4,058	3,189	6,213	4,097
184.00	5,691	4,852	11,064	5,748
185.00	8,000	6,813	17,877	8,076
186.00	10,421	9,184	27,061	10,521
188.00	16,620	26,801	53,862	16,773
190.00	26,218	42,475	96,337	26,427
192.00	34,530	60,558	156,894	34,830
194.00	46,063	80,317	237,211	46,450

Device	Routing	Invert	Outlet Devices
#1	Primary	177.50'	30.0" Round 30" CPP 1 L= 66.6' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 177.50' / 175.36' S= 0.0321 '/ Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 4.91 sf
#2	Primary	177.80'	30.0" Round 30" CPP 2 L= 66.4' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 177.80' / 175.50' S= 0.0346 '/ Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 4.91 sf
#3	Secondary	191.00'	Emergency Spillway, Cv= 2.62 (C= 3.28) Head (feet) 0.00 1.00 2.00 3.00 Width (feet) 38.32 93.77 128.55 162.52

Primary OutFlow Max=32.49 cfs @ 12.78 hrs HW=179.67' (Free Discharge)

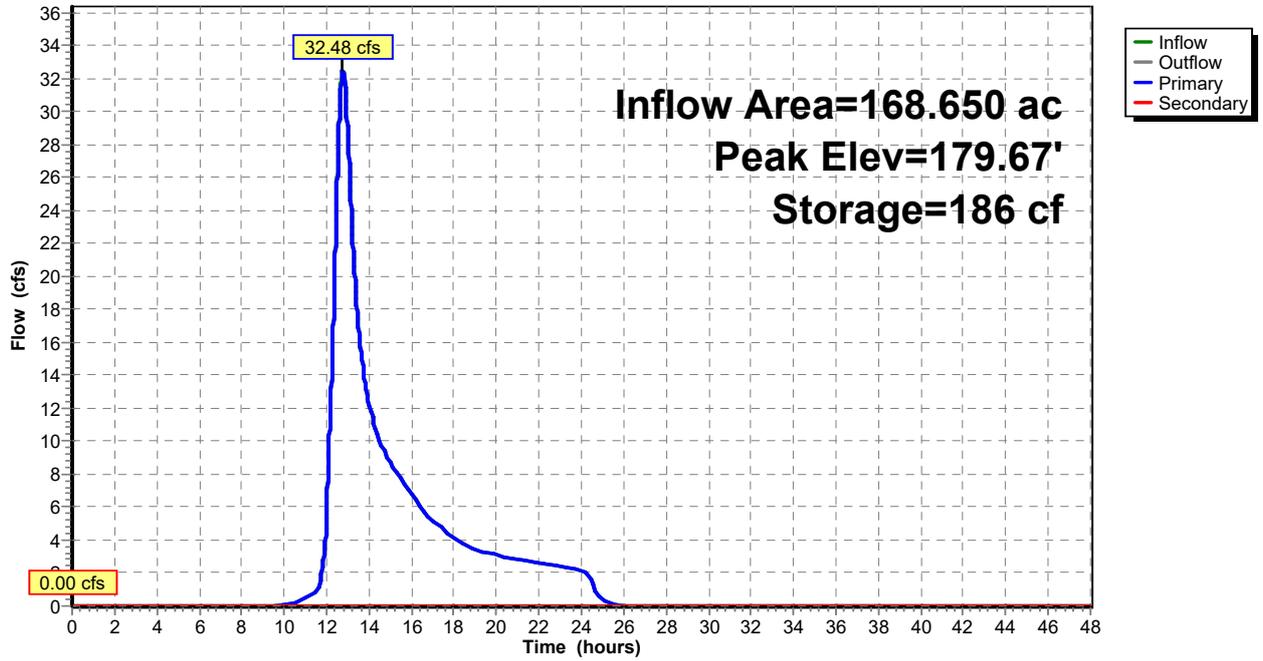
- ↑1=30" CPP 1 (Inlet Controls 17.97 cfs @ 3.96 fps)
- ↑2=30" CPP 2 (Inlet Controls 14.53 cfs @ 3.68 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=177.00' (Free Discharge)

- ↑3=Emergency Spillway (Controls 0.00 cfs)

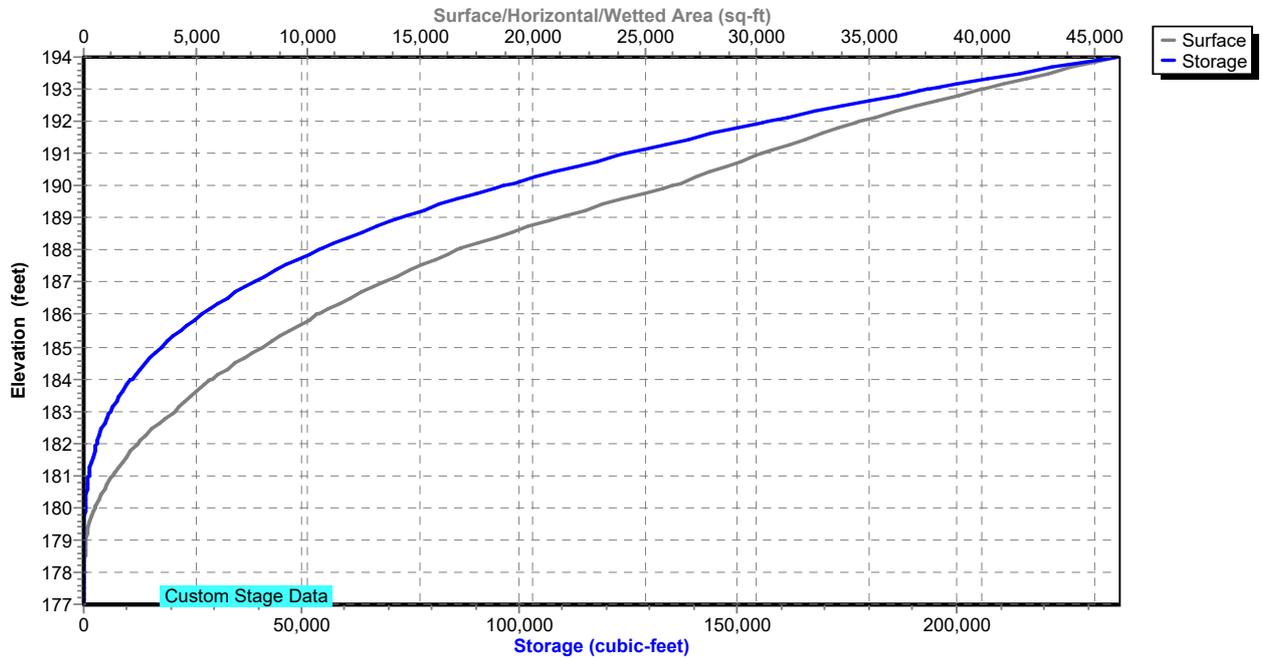
Pond S1_Pre: DA-1 Stor

Hydrograph



Pond S1_Pre: DA-1 Stor

Stage-Area-Storage



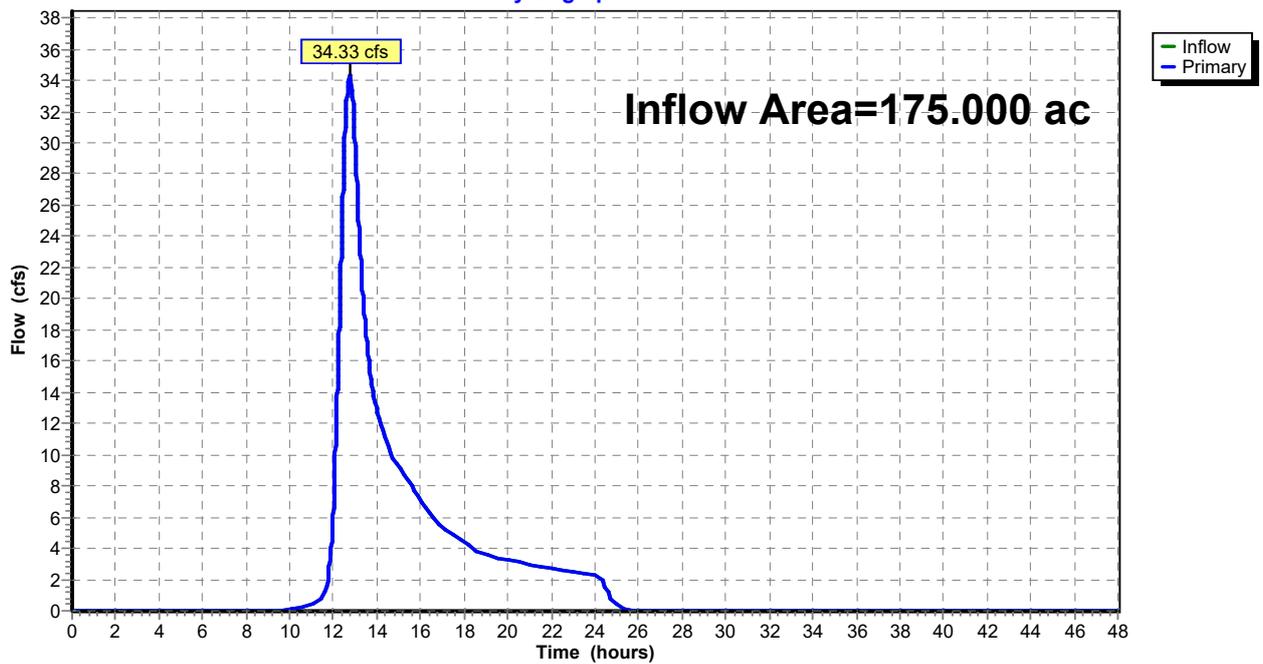
Summary for Link POA_Pre: Point of Analysis

Inflow Area = 175.000 ac, 3.45% Impervious, Inflow Depth = 0.54" for 2-yr (Hampden) event
Inflow = 34.33 cfs @ 12.73 hrs, Volume= 7.905 af
Primary = 34.33 cfs @ 12.73 hrs, Volume= 7.905 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link POA_Pre: Point of Analysis

Hydrograph



Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentDA1_Pre: DA-1 Runoff Area=160.430 ac 2.51% Impervious Runoff Depth=1.32"
Flow Length=5,870' Tc=47.5 min CN=65 Runoff=103.03 cfs 17.619 af

SubcatchmentDA2_Pre: DA-2 Runoff Area=7.500 ac 16.69% Impervious Runoff Depth=2.80"
Flow Length=1,705' Slope=0.0711 '/' Tc=7.0 min CN=84 Runoff=23.68 cfs 1.749 af

SubcatchmentDA3_Pre: DA-3 Runoff Area=0.630 ac 72.00% Impervious Runoff Depth=3.69"
Tc=5.0 min CN=93 Runoff=2.67 cfs 0.194 af

SubcatchmentDA4_Pre: DA-4 Runoff Area=0.090 ac 87.56% Impervious Runoff Depth=4.02"
Tc=5.0 min CN=96 Runoff=0.40 cfs 0.030 af

SubcatchmentDA5_Pre: DA-5 Runoff Area=6.350 ac 3.74% Impervious Runoff Depth=1.96"
Flow Length=1,153' Slope=0.1040 '/' Tc=22.5 min CN=74 Runoff=9.22 cfs 1.036 af

Pond 1P_Pre: Pond 1P Peak Elev=189.45' Storage=10,664 cf Inflow=23.68 cfs 1.749 af
Outflow=13.37 cfs 1.740 af

Pond 7P_Pre: Pond 7P Peak Elev=186.01' Storage=1,084 cf Inflow=13.55 cfs 1.770 af
Primary=13.18 cfs 1.770 af Secondary=0.02 cfs 0.000 af Outflow=13.21 cfs 1.770 af

Pond 11P_Pre: Pond 11P Peak Elev=224.44' Storage=469 cf Inflow=9.22 cfs 1.036 af
Outflow=9.21 cfs 1.036 af

Pond S1_Pre: DA-1 Stor Peak Elev=185.98' Storage=26,804 cf Inflow=110.94 cfs 19.582 af
Primary=99.26 cfs 19.582 af Secondary=0.00 cfs 0.000 af Outflow=99.26 cfs 19.582 af

Link POA_Pre: Point of Analysis Inflow=102.43 cfs 20.618 af
Primary=102.43 cfs 20.618 af

Total Runoff Area = 175.000 ac Runoff Volume = 20.627 af Average Runoff Depth = 1.41"
96.55% Pervious = 168.954 ac 3.45% Impervious = 6.046 ac

Summary for Subcatchment DA1_Pre: DA-1

Runoff = 103.03 cfs @ 12.72 hrs, Volume= 17.619 af, Depth= 1.32"

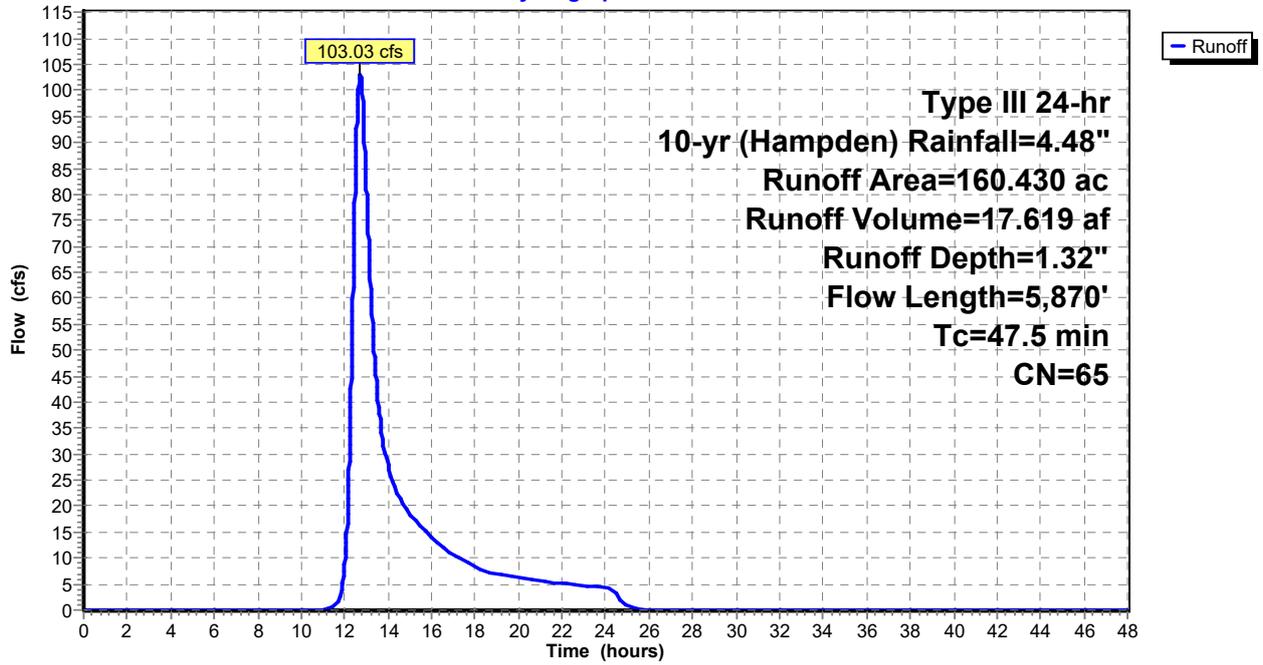
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10-yr (Hampden) Rainfall=4.48"

Area (ac)	CN	Description
0.580	35	Brush, Fair, HSG A
0.450	70	Brush, Fair, HSG C
0.460	77	Brush, Fair, HSG D
2.450	93	Urban industrial, 72% imp, HSG D
2.480	49	Pasture/grassland/range, Fair, HSG A
0.660	69	Pasture/grassland/range, Fair, HSG B
5.930	79	Pasture/grassland/range, Fair, HSG C
1.220	84	Pasture/grassland/range, Fair, HSG D
* 2.260	98	Wetland
30.690	36	Woods, Fair, HSG A
29.080	60	Woods, Fair, HSG B
45.970	73	Woods, Fair, HSG C
38.200	79	Woods, Fair, HSG D
160.430	65	Weighted Average
156.406		97.49% Pervious Area
4.024		2.51% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.6	100	0.0581	0.11		Sheet Flow, Sheet-Woods Woods: Light underbrush n= 0.400 P2= 2.94"
24.9	1,800	0.0581	1.21		Shallow Concentrated Flow, SCF-Woods Woodland Kv= 5.0 fps
8.0	3,970	0.0200	8.31	199.43	Parabolic Channel, W=18.00' D=2.00' Area=24.0 sf Perim=18.6' n= 0.030
47.5	5,870	Total			

Subcatchment DA1_Pre: DA-1

Hydrograph



Summary for Subcatchment DA2_Pre: DA-2

Runoff = 23.68 cfs @ 12.10 hrs, Volume= 1.749 af, Depth= 2.80"

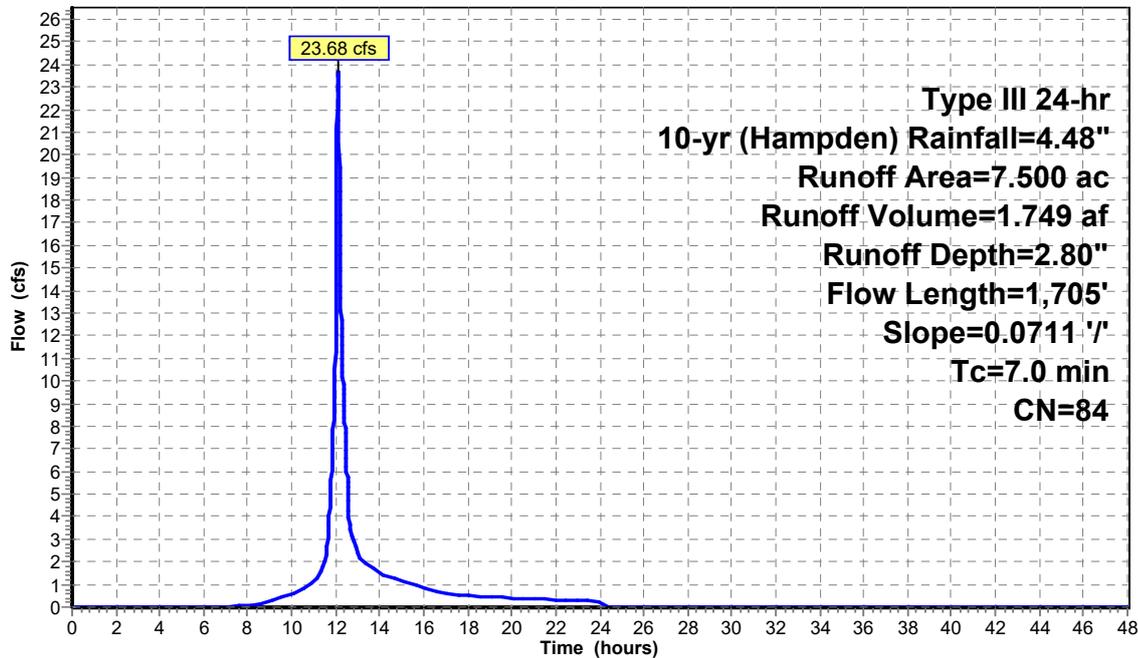
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10-yr (Hampden) Rainfall=4.48"

Area (ac)	CN	Description
1.530	93	Urban industrial, 72% imp, HSG D
2.080	84	Pasture/grassland/range, Fair, HSG D
0.150	98	Water Surface, HSG D
3.740	79	Woods, Fair, HSG D
7.500	84	Weighted Average
6.248		83.31% Pervious Area
1.252		16.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	100	0.0711	2.19		Sheet Flow, Sheet-Rd Smooth surfaces n= 0.011 P2= 2.94"
6.2	1,605	0.0711	4.29		Shallow Concentrated Flow, SCF-Rd Unpaved Kv= 16.1 fps
7.0	1,705	Total			

Subcatchment DA2_Pre: DA-2

Hydrograph



Summary for Subcatchment DA3_Pre: DA-3

Runoff = 2.67 cfs @ 12.07 hrs, Volume= 0.194 af, Depth= 3.69"

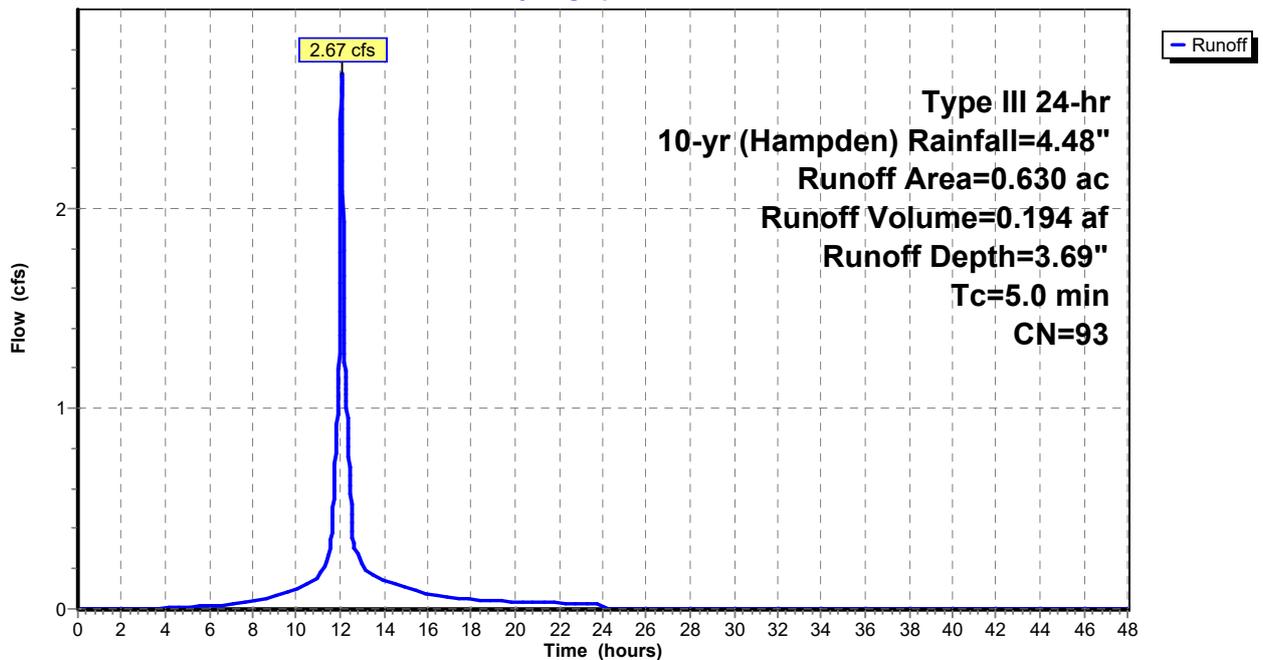
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10-yr (Hampden) Rainfall=4.48"

Area (ac)	CN	Description
0.630	93	Urban industrial, 72% imp, HSG D
0.176		28.00% Pervious Area
0.454		72.00% Impervious Area

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

Subcatchment DA3_Pre: DA-3

Hydrograph



Summary for Subcatchment DA4_Pre: DA-4

Runoff = 0.40 cfs @ 12.07 hrs, Volume= 0.030 af, Depth= 4.02"

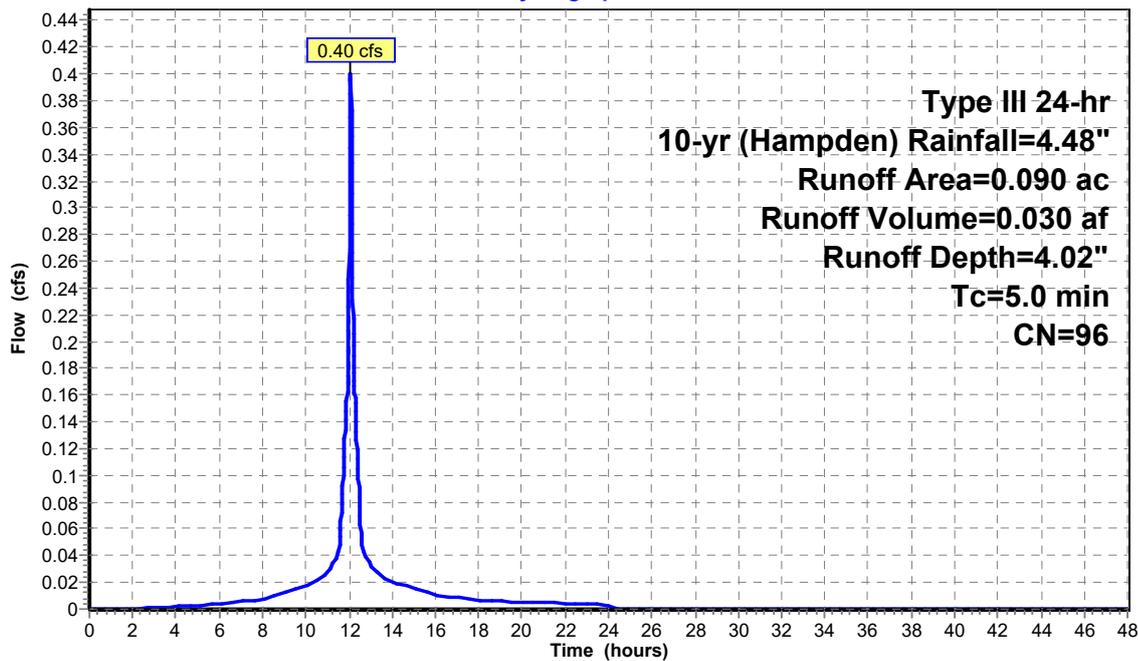
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10-yr (Hampden) Rainfall=4.48"

Area (ac)	CN	Description
0.040	93	Urban industrial, 72% imp, HSG D
0.050	98	Water Surface, HSG D
0.090	96	Weighted Average
0.011		12.44% Pervious Area
0.079		87.56% Impervious Area

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

Subcatchment DA4_Pre: DA-4

Hydrograph



Summary for Subcatchment DA5_Pre: DA-5

Runoff = 9.22 cfs @ 12.32 hrs, Volume= 1.036 af, Depth= 1.96"

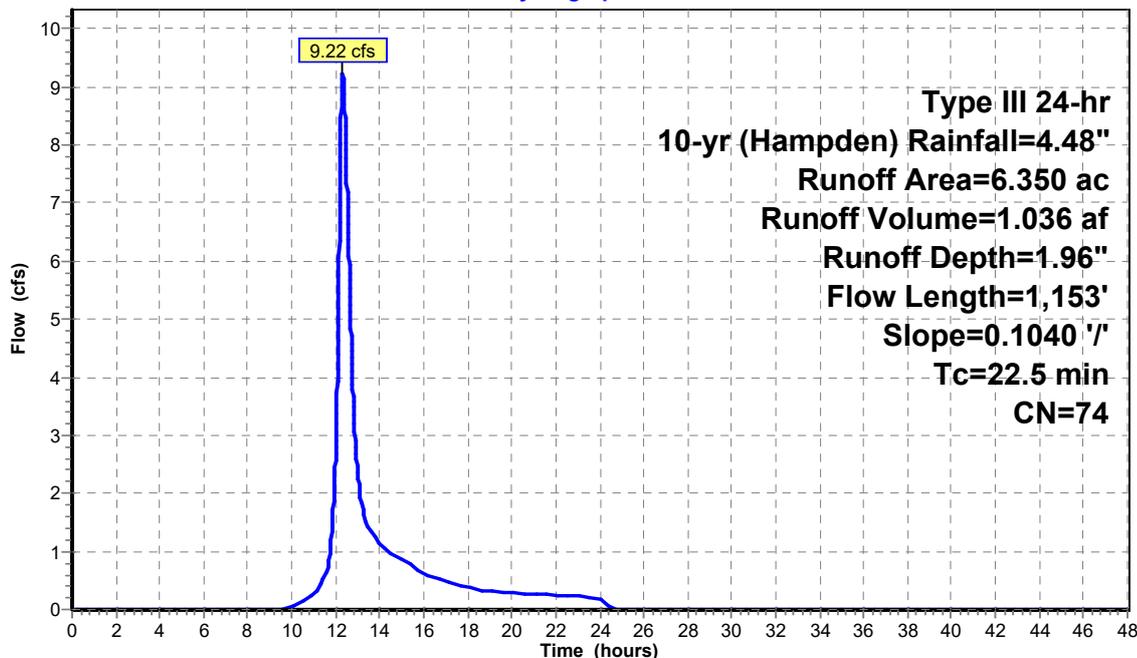
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10-yr (Hampden) Rainfall=4.48"

Area (ac)	CN	Description
0.270	91	Urban industrial, 72% imp, HSG C
0.060	93	Urban industrial, 72% imp, HSG D
0.280	79	Pasture/grassland/range, Fair, HSG C
0.050	84	Pasture/grassland/range, Fair, HSG D
0.180	60	Woods, Fair, HSG B
5.350	73	Woods, Fair, HSG C
0.160	79	Woods, Fair, HSG D
6.350	74	Weighted Average
6.112		96.26% Pervious Area
0.238		3.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.6	100	0.1040	0.14		Sheet Flow, Sheet-Woods
					Woods: Light underbrush n= 0.400 P2= 2.94"
10.9	1,053	0.1040	1.61		Shallow Concentrated Flow, SCF-Woods
					Woodland Kv= 5.0 fps
22.5	1,153	Total			

Subcatchment DA5_Pre: DA-5

Hydrograph



Runoff

Summary for Pond 1P_Pre: Pond 1P

Inflow Area = 7.500 ac, 16.69% Impervious, Inflow Depth = 2.80" for 10-yr (Hampden) event
 Inflow = 23.68 cfs @ 12.10 hrs, Volume= 1.749 af
 Outflow = 13.37 cfs @ 12.24 hrs, Volume= 1.740 af, Atten= 44%, Lag= 8.1 min
 Primary = 13.37 cfs @ 12.24 hrs, Volume= 1.740 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 189.45' @ 12.24 hrs Surf.Area= 5,479 sf Storage= 10,664 cf

Plug-Flow detention time= 17.9 min calculated for 1.740 af (99% of inflow)
 Center-of-Mass det. time= 14.5 min (830.4 - 815.9)

Volume	Invert	Avail.Storage	Storage Description
#1	186.00'	51,062 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
186.00	0	0	0
188.00	3,866	3,866	3,866
189.00	5,039	4,453	8,319
190.00	6,026	5,533	13,851
191.00	7,099	6,563	20,414
192.00	8,299	7,699	28,113
194.00	14,650	22,949	51,062

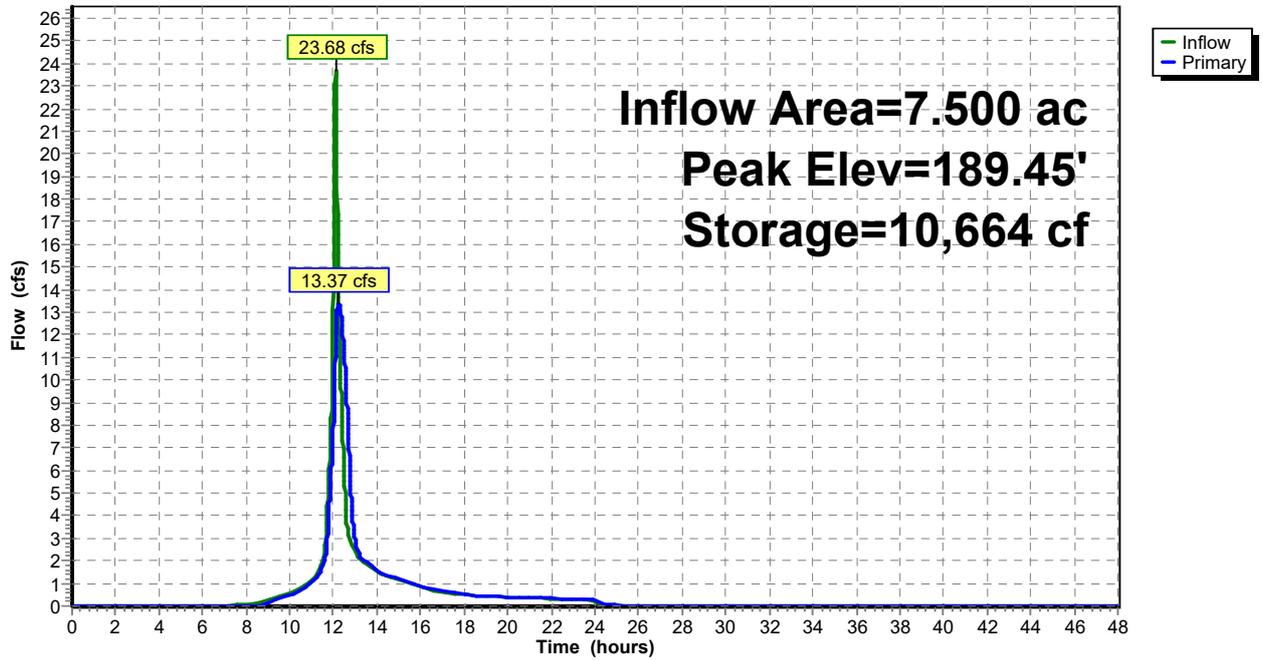
Device	Routing	Invert	Outlet Devices
#1	Primary	186.65'	15.0" Round 15" CPP 1 L= 161.8' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 186.65' / 183.17' S= 0.0215 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf
#2	Primary	186.88'	15.0" Round 15" CPP 2 L= 162.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 186.88' / 182.88' S= 0.0247 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=13.37 cfs @ 12.24 hrs HW=189.45' (Free Discharge)

- ↑ 1=15" CPP 1 (Inlet Controls 6.87 cfs @ 5.60 fps)
- └ 2=15" CPP 2 (Inlet Controls 6.50 cfs @ 5.30 fps)

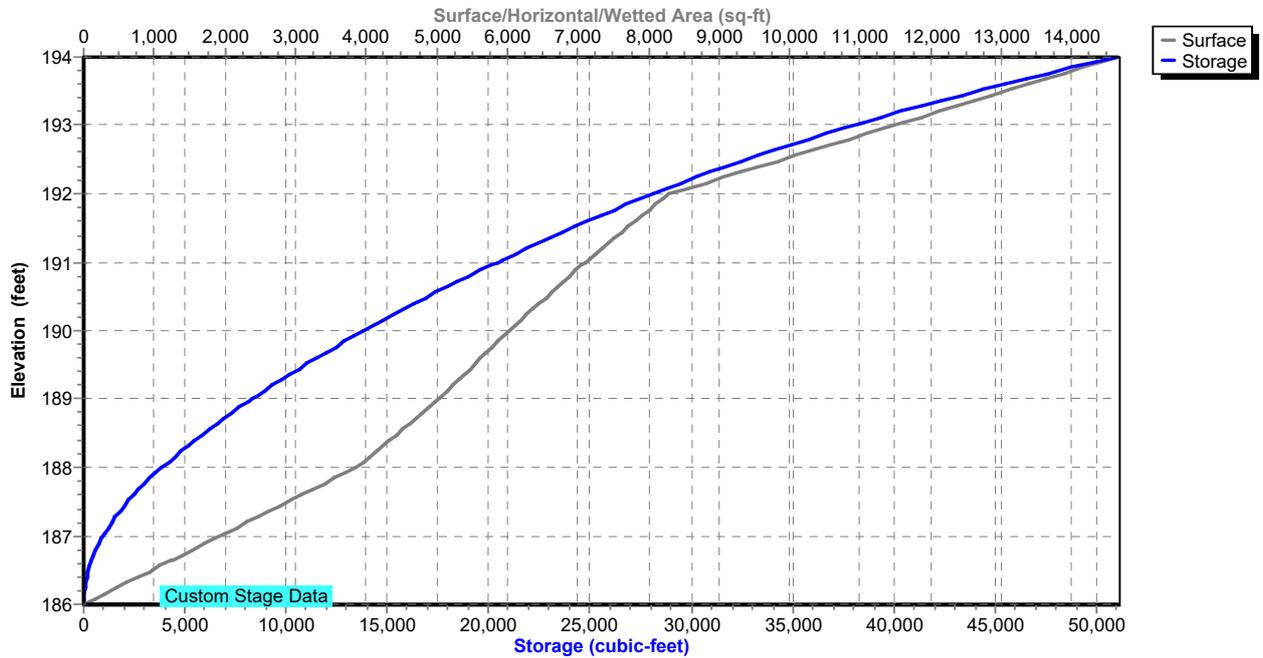
Pond 1P_Pre: Pond 1P

Hydrograph



Pond 1P_Pre: Pond 1P

Stage-Area-Storage



Summary for Pond 7P_Pre: Pond 7P

Inflow Area = 7.590 ac, 17.53% Impervious, Inflow Depth = 2.80" for 10-yr (Hampden) event
 Inflow = 13.55 cfs @ 12.23 hrs, Volume= 1.770 af
 Outflow = 13.21 cfs @ 12.32 hrs, Volume= 1.770 af, Atten= 3%, Lag= 5.6 min
 Primary = 13.18 cfs @ 12.32 hrs, Volume= 1.770 af
 Secondary = 0.02 cfs @ 12.32 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 186.01' @ 12.32 hrs Surf.Area= 683 sf Storage= 1,084 cf

Plug-Flow detention time= 0.5 min calculated for 1.769 af (100% of inflow)
 Center-of-Mass det. time= 0.5 min (829.7 - 829.3)

Volume	Invert	Avail.Storage	Storage Description
#1	182.00'	5,536 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
182.00	0	0	0
183.00	13	7	7
184.00	247	130	137
185.00	479	363	500
186.00	682	581	1,080
187.00	920	801	1,881
188.00	1,114	1,017	2,898
189.00	1,312	1,213	4,111
190.00	1,538	1,425	5,536

Device	Routing	Invert	Outlet Devices
#1	Primary	182.74'	12.0" Round 12" RCP 1 L= 69.5' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 182.74' / 181.83' S= 0.0131 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf
#2	Primary	182.84'	12.0" Round 12" RCP 1 L= 65.8' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 182.84' / 181.60' S= 0.0188 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf
#3	Secondary	186.00'	Emergency Spillway, Cv= 2.62 (C= 3.28) Head (feet) 0.00 1.00 2.00 3.00 4.00 Width (feet) 4.26 9.60 15.15 20.50 31.66

Primary OutFlow Max=13.18 cfs @ 12.32 hrs HW=186.01' (Free Discharge)

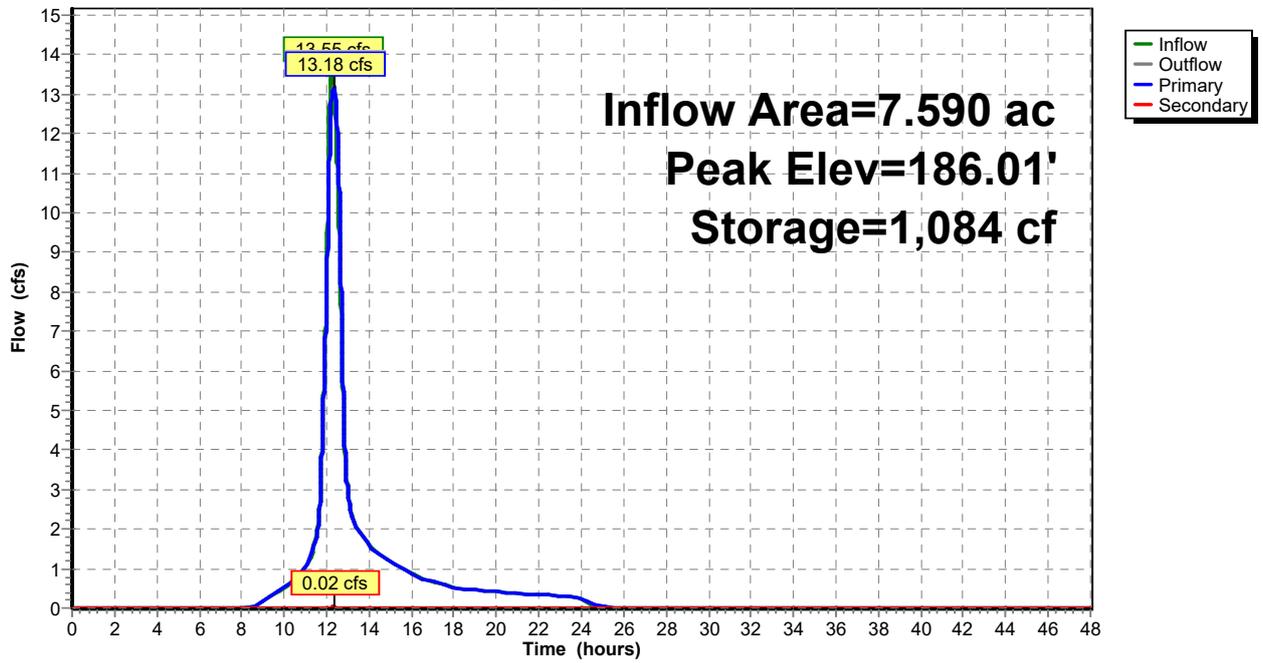
- ↑1=12" RCP 1 (Barrel Controls 6.42 cfs @ 8.18 fps)
- ↑2=12" RCP 1 (Barrel Controls 6.76 cfs @ 8.61 fps)

Secondary OutFlow Max=0.01 cfs @ 12.32 hrs HW=186.01' (Free Discharge)

- ↑3=Emergency Spillway (Weir Controls 0.01 cfs @ 0.24 fps)

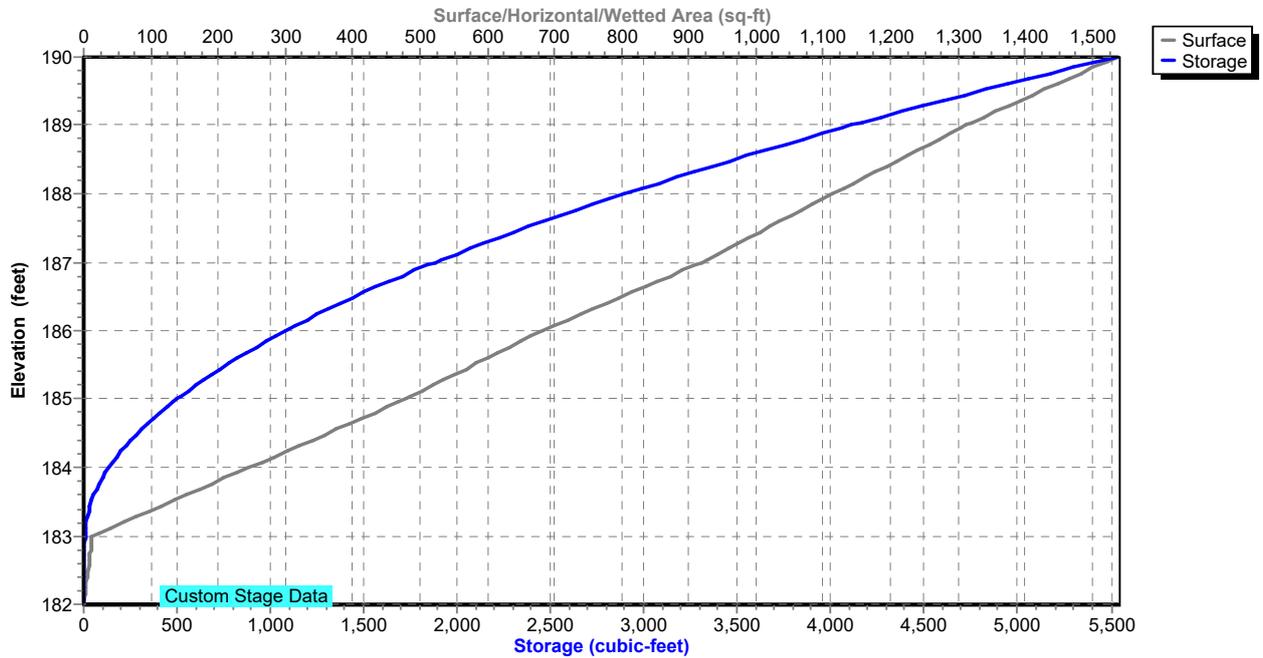
Pond 7P_Pre: Pond 7P

Hydrograph



Pond 7P_Pre: Pond 7P

Stage-Area-Storage



Summary for Pond 11P_Pre: Pond 11P

Inflow Area = 6.350 ac, 3.74% Impervious, Inflow Depth = 1.96" for 10-yr (Hampden) event
 Inflow = 9.22 cfs @ 12.32 hrs, Volume= 1.036 af
 Outflow = 9.21 cfs @ 12.33 hrs, Volume= 1.036 af, Atten= 0%, Lag= 0.5 min
 Primary = 9.21 cfs @ 12.33 hrs, Volume= 1.036 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 224.44' @ 12.33 hrs Surf.Area= 1,197 sf Storage= 469 cf

Plug-Flow detention time= 1.6 min calculated for 1.036 af (100% of inflow)
 Center-of-Mass det. time= 1.6 min (859.9 - 858.3)

Volume	Invert	Avail.Storage	Storage Description
#1	224.00'	3,026 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

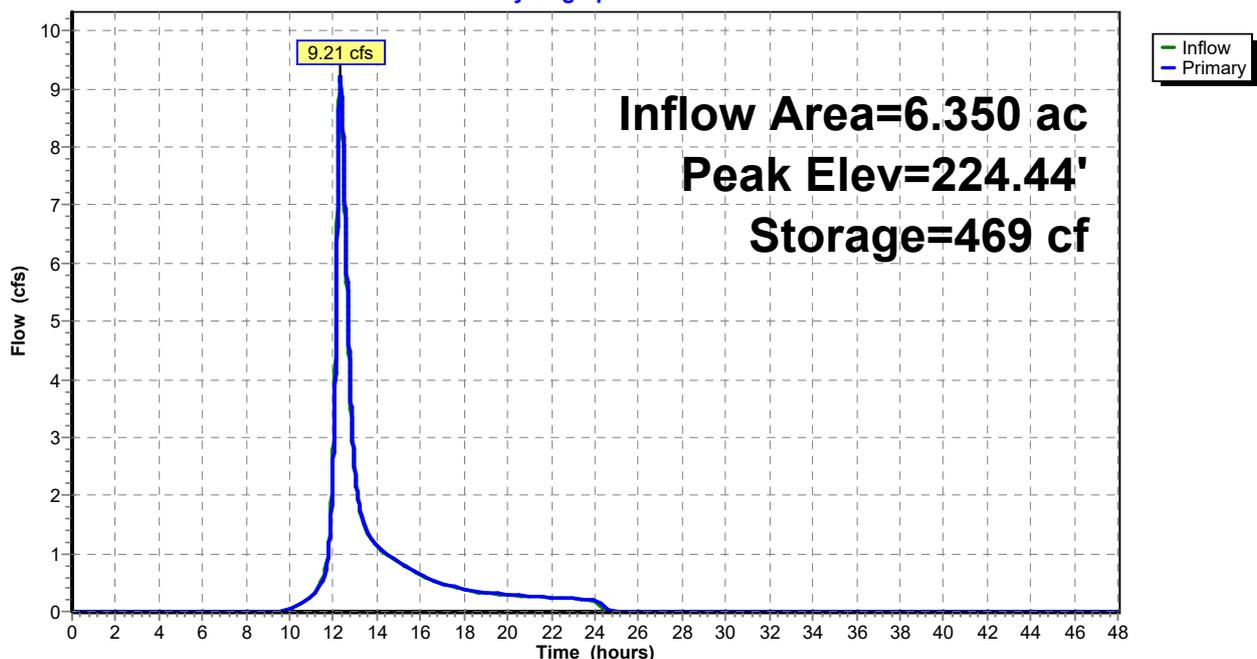
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
224.00	953	0	0
225.00	1,513	1,233	1,233
226.00	2,072	1,793	3,026

Device	Routing	Invert	Outlet Devices
#1	Primary	224.00'	Emergency Spillway, Cv= 2.62 (C= 3.28) Head (feet) 0.00 1.00 2.00 Width (feet) 8.00 18.00 26.00

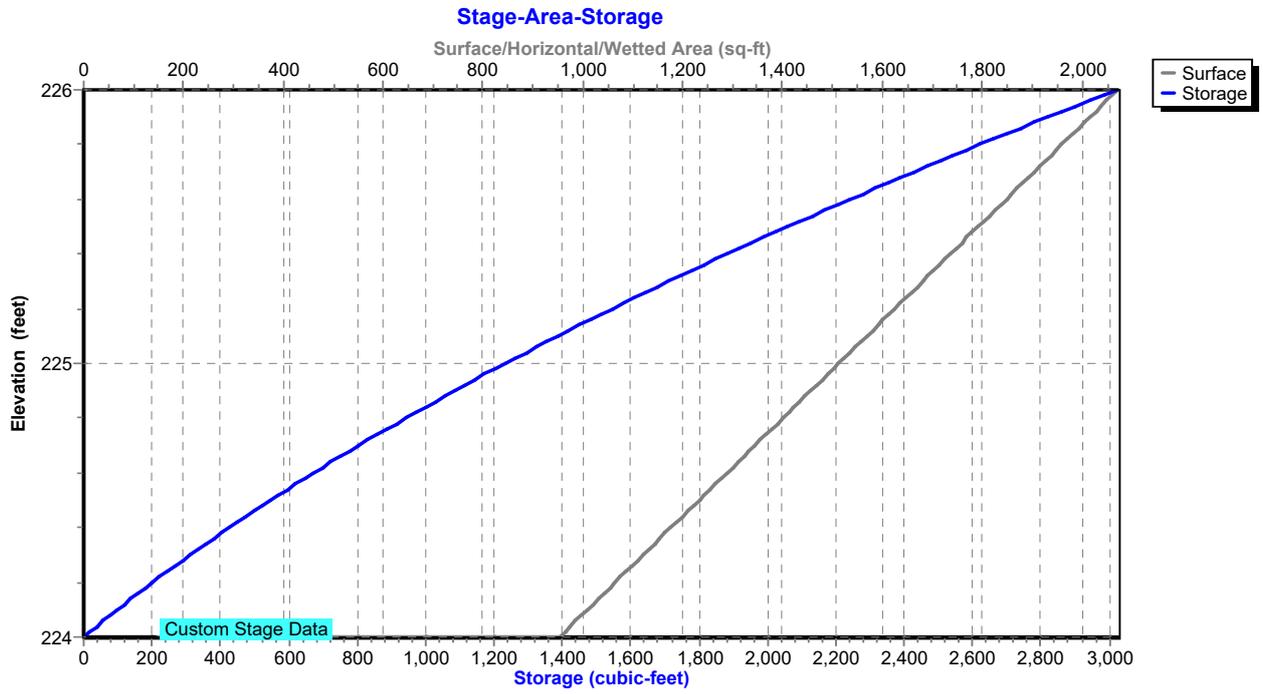
Primary OutFlow Max=9.21 cfs @ 12.33 hrs HW=224.44' (Free Discharge)
 ←1=Emergency Spillway (Weir Controls 9.21 cfs @ 2.07 fps)

Pond 11P_Pre: Pond 11P

Hydrograph



Pond 11P_Pre: Pond 11P



Summary for Pond S1_Pre: DA-1 Stor

Inflow Area = 168.650 ac, 3.44% Impervious, Inflow Depth = 1.39" for 10-yr (Hampden) event
 Inflow = 110.94 cfs @ 12.67 hrs, Volume= 19.582 af
 Outflow = 99.26 cfs @ 12.87 hrs, Volume= 19.582 af, Atten= 11%, Lag= 11.9 min
 Primary = 99.26 cfs @ 12.87 hrs, Volume= 19.582 af
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 185.98' @ 12.87 hrs Surf.Area= 10,357 sf Storage= 26,804 cf

Plug-Flow detention time= 1.2 min calculated for 19.578 af (100% of inflow)
 Center-of-Mass det. time= 1.2 min (899.5 - 898.3)

Volume	Invert	Avail.Storage	Storage Description
#1	177.00'	237,211 cf	Custom Stage Data (Conic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
177.00	0	0	0	0
178.00	21	7	7	23
179.00	83	49	56	89
180.00	512	267	323	522
181.00	1,306	879	1,201	1,323
182.00	2,393	1,822	3,023	2,420
183.00	4,058	3,189	6,213	4,097
184.00	5,691	4,852	11,064	5,748
185.00	8,000	6,813	17,877	8,076
186.00	10,421	9,184	27,061	10,521
188.00	16,620	26,801	53,862	16,773
190.00	26,218	42,475	96,337	26,427
192.00	34,530	60,558	156,894	34,830
194.00	46,063	80,317	237,211	46,450

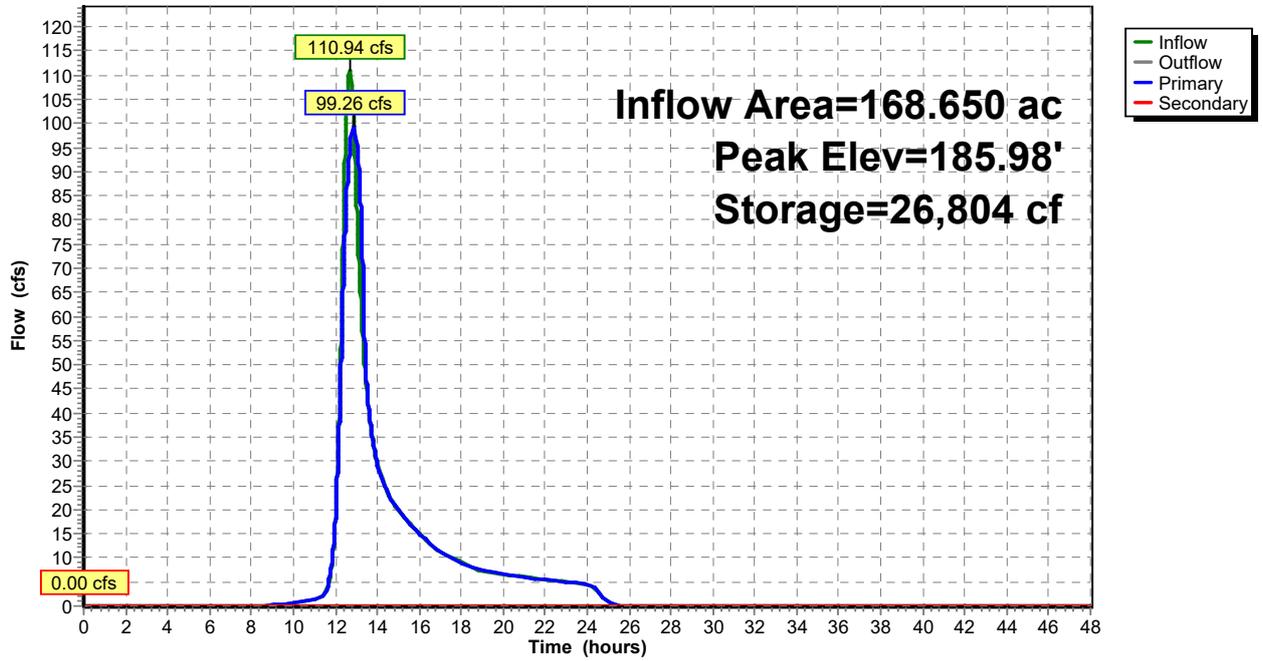
Device	Routing	Invert	Outlet Devices
#1	Primary	177.50'	30.0" Round 30" CPP 1 L= 66.6' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 177.50' / 175.36' S= 0.0321 '/ Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 4.91 sf
#2	Primary	177.80'	30.0" Round 30" CPP 2 L= 66.4' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 177.80' / 175.50' S= 0.0346 '/ Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 4.91 sf
#3	Secondary	191.00'	Emergency Spillway, Cv= 2.62 (C= 3.28) Head (feet) 0.00 1.00 2.00 3.00 Width (feet) 38.32 93.77 128.55 162.52

Primary OutFlow Max=99.26 cfs @ 12.87 hrs HW=185.97' (Free Discharge)
 ↑1=30" CPP 1 (Inlet Controls 50.16 cfs @ 10.22 fps)
 ↑2=30" CPP 2 (Inlet Controls 49.10 cfs @ 10.00 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=177.00' (Free Discharge)
 ↑3=Emergency Spillway (Controls 0.00 cfs)

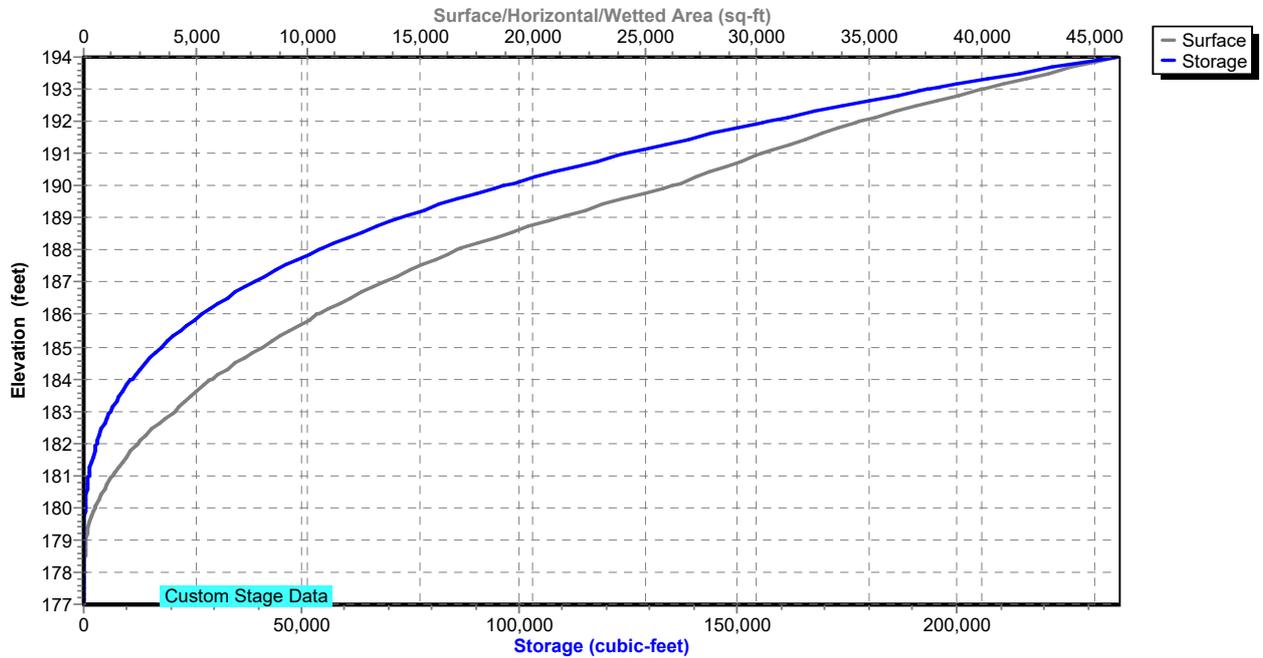
Pond S1_Pre: DA-1 Stor

Hydrograph



Pond S1_Pre: DA-1 Stor

Stage-Area-Storage



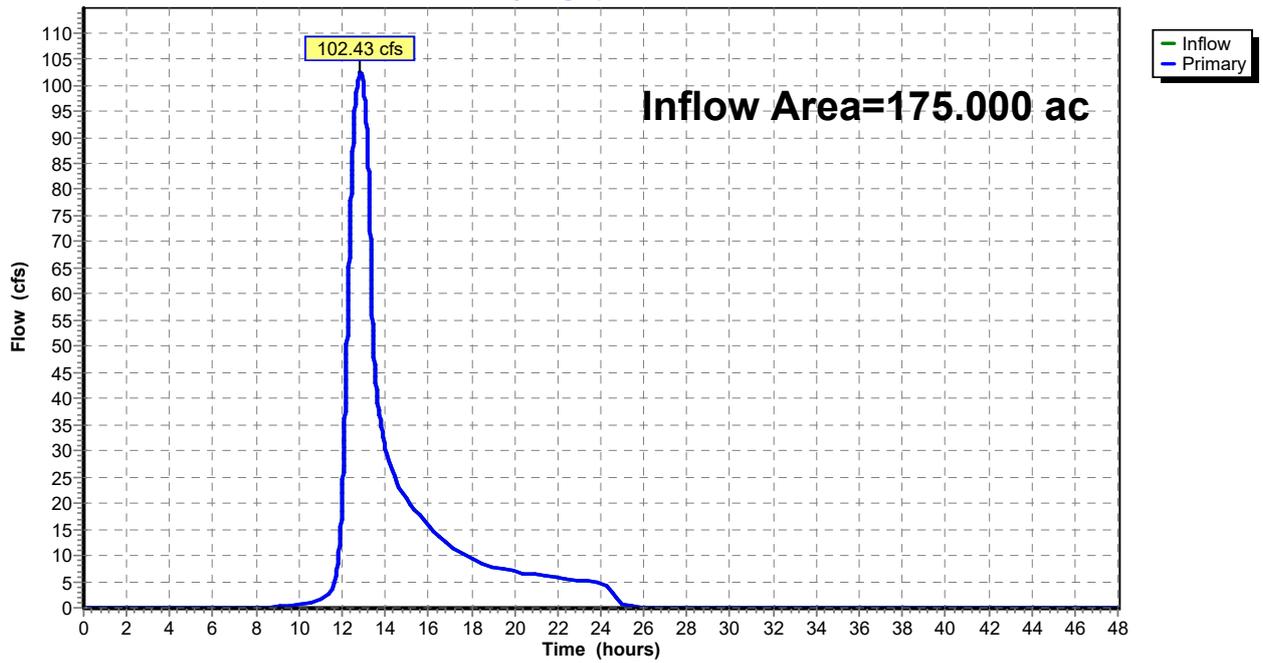
Summary for Link POA_Pre: Point of Analysis

Inflow Area = 175.000 ac, 3.45% Impervious, Inflow Depth = 1.41" for 10-yr (Hampden) event
Inflow = 102.43 cfs @ 12.84 hrs, Volume= 20.618 af
Primary = 102.43 cfs @ 12.84 hrs, Volume= 20.618 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link POA_Pre: Point of Analysis

Hydrograph



Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentDA1_Pre: DA-1 Runoff Area=160.430 ac 2.51% Impervious Runoff Depth=3.05"
Flow Length=5,870' Tc=47.5 min CN=65 Runoff=254.08 cfs 40.756 af

SubcatchmentDA2_Pre: DA-2 Runoff Area=7.500 ac 16.69% Impervious Runoff Depth=5.07"
Flow Length=1,705' Slope=0.0711 '/' Tc=7.0 min CN=84 Runoff=42.12 cfs 3.171 af

SubcatchmentDA3_Pre: DA-3 Runoff Area=0.630 ac 72.00% Impervious Runoff Depth=6.10"
Tc=5.0 min CN=93 Runoff=4.30 cfs 0.320 af

SubcatchmentDA4_Pre: DA-4 Runoff Area=0.090 ac 87.56% Impervious Runoff Depth=6.45"
Tc=5.0 min CN=96 Runoff=0.63 cfs 0.048 af

SubcatchmentDA5_Pre: DA-5 Runoff Area=6.350 ac 3.74% Impervious Runoff Depth=3.98"
Flow Length=1,153' Slope=0.1040 '/' Tc=22.5 min CN=74 Runoff=19.02 cfs 2.107 af

Pond 1P_Pre: Pond 1P Peak Elev=191.47' Storage=23,900 cf Inflow=42.12 cfs 3.171 af
Outflow=18.85 cfs 3.162 af

Pond 7P_Pre: Pond 7P Peak Elev=186.44' Storage=1,405 cf Inflow=19.08 cfs 3.210 af
Primary=14.03 cfs 2.998 af Secondary=5.05 cfs 0.212 af Outflow=19.08 cfs 3.210 af

Pond 11P_Pre: Pond 11P Peak Elev=224.67' Storage=759 cf Inflow=19.02 cfs 2.107 af
Outflow=19.01 cfs 2.107 af

Pond S1_Pre: DA-1 Stor Peak Elev=191.80' Storage=149,914 cf Inflow=268.26 cfs 44.075 af
Primary=134.01 cfs 39.575 af Secondary=130.09 cfs 4.500 af Outflow=264.10 cfs 44.075 af

Link POA_Pre: Point of Analysis Inflow=273.50 cfs 46.393 af
Primary=273.50 cfs 46.393 af

Total Runoff Area = 175.000 ac Runoff Volume = 46.403 af Average Runoff Depth = 3.18"
96.55% Pervious = 168.954 ac 3.45% Impervious = 6.046 ac

Summary for Subcatchment DA1_Pre: DA-1

Runoff = 254.08 cfs @ 12.67 hrs, Volume= 40.756 af, Depth= 3.05"

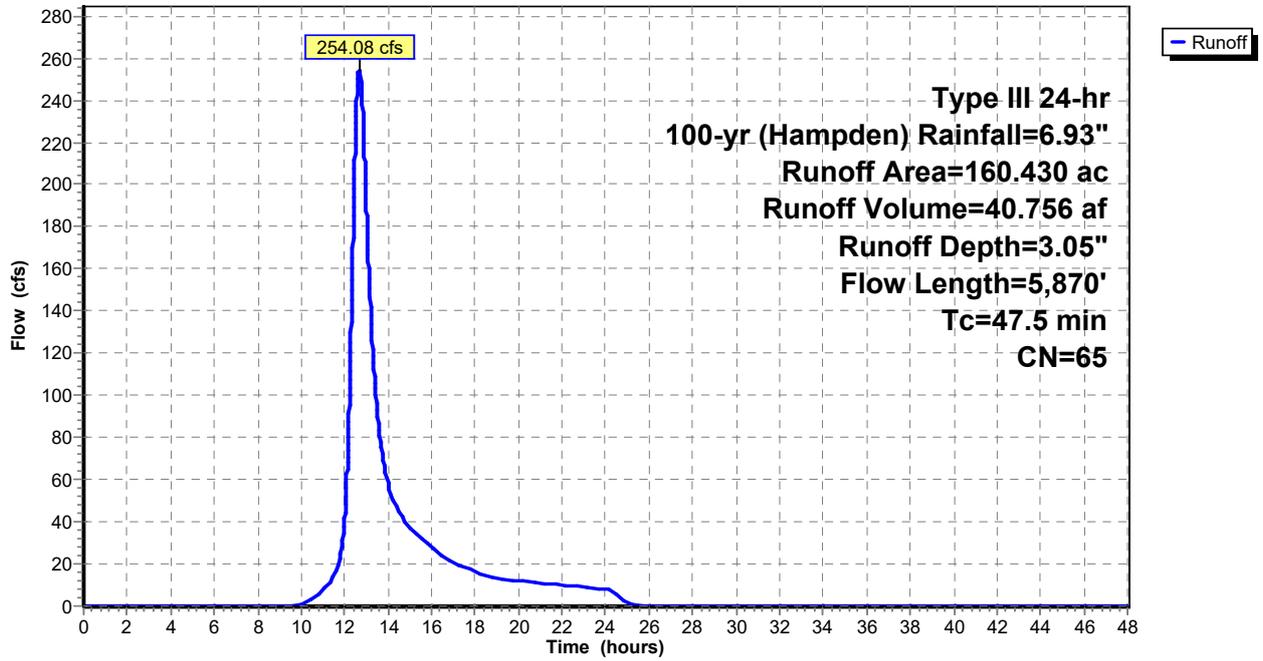
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-yr (Hampden) Rainfall=6.93"

Area (ac)	CN	Description
0.580	35	Brush, Fair, HSG A
0.450	70	Brush, Fair, HSG C
0.460	77	Brush, Fair, HSG D
2.450	93	Urban industrial, 72% imp, HSG D
2.480	49	Pasture/grassland/range, Fair, HSG A
0.660	69	Pasture/grassland/range, Fair, HSG B
5.930	79	Pasture/grassland/range, Fair, HSG C
1.220	84	Pasture/grassland/range, Fair, HSG D
* 2.260	98	Wetland
30.690	36	Woods, Fair, HSG A
29.080	60	Woods, Fair, HSG B
45.970	73	Woods, Fair, HSG C
38.200	79	Woods, Fair, HSG D
160.430	65	Weighted Average
156.406		97.49% Pervious Area
4.024		2.51% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.6	100	0.0581	0.11		Sheet Flow, Sheet-Woods Woods: Light underbrush n= 0.400 P2= 2.94"
24.9	1,800	0.0581	1.21		Shallow Concentrated Flow, SCF-Woods Woodland Kv= 5.0 fps
8.0	3,970	0.0200	8.31	199.43	Parabolic Channel, W=18.00' D=2.00' Area=24.0 sf Perim=18.6' n= 0.030
47.5	5,870	Total			

Subcatchment DA1_Pre: DA-1

Hydrograph



Summary for Subcatchment DA2_Pre: DA-2

Runoff = 42.12 cfs @ 12.10 hrs, Volume= 3.171 af, Depth= 5.07"

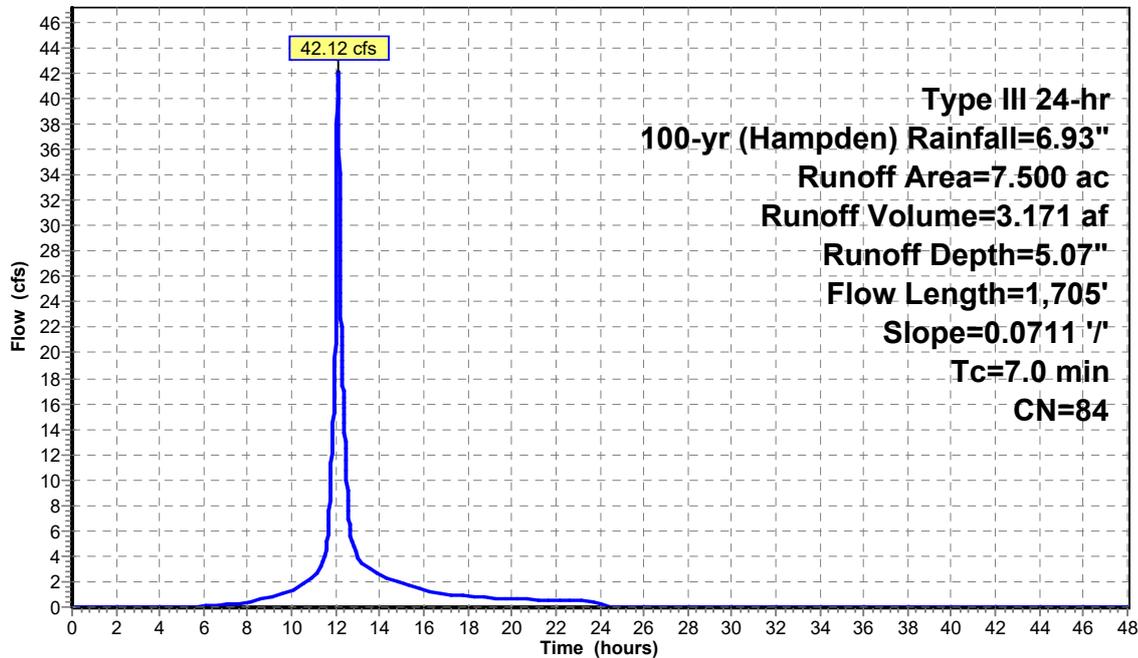
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-yr (Hampden) Rainfall=6.93"

Area (ac)	CN	Description
1.530	93	Urban industrial, 72% imp, HSG D
2.080	84	Pasture/grassland/range, Fair, HSG D
0.150	98	Water Surface, HSG D
3.740	79	Woods, Fair, HSG D
7.500	84	Weighted Average
6.248		83.31% Pervious Area
1.252		16.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	100	0.0711	2.19		Sheet Flow, Sheet-Rd Smooth surfaces n= 0.011 P2= 2.94"
6.2	1,605	0.0711	4.29		Shallow Concentrated Flow, SCF-Rd Unpaved Kv= 16.1 fps
7.0	1,705	Total			

Subcatchment DA2_Pre: DA-2

Hydrograph



Summary for Subcatchment DA3_Pre: DA-3

Runoff = 4.30 cfs @ 12.07 hrs, Volume= 0.320 af, Depth= 6.10"

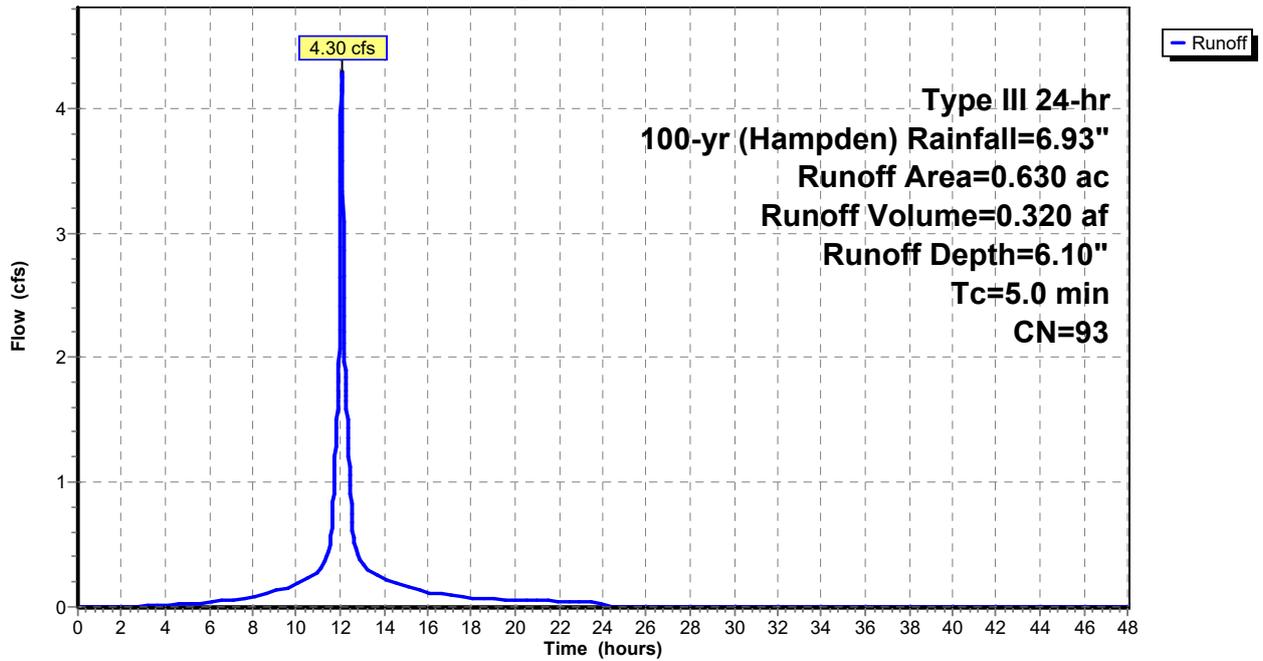
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-yr (Hampden) Rainfall=6.93"

Area (ac)	CN	Description
0.630	93	Urban industrial, 72% imp, HSG D
0.176		28.00% Pervious Area
0.454		72.00% Impervious Area

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

Subcatchment DA3_Pre: DA-3

Hydrograph



Summary for Subcatchment DA4_Pre: DA-4

Runoff = 0.63 cfs @ 12.07 hrs, Volume= 0.048 af, Depth= 6.45"

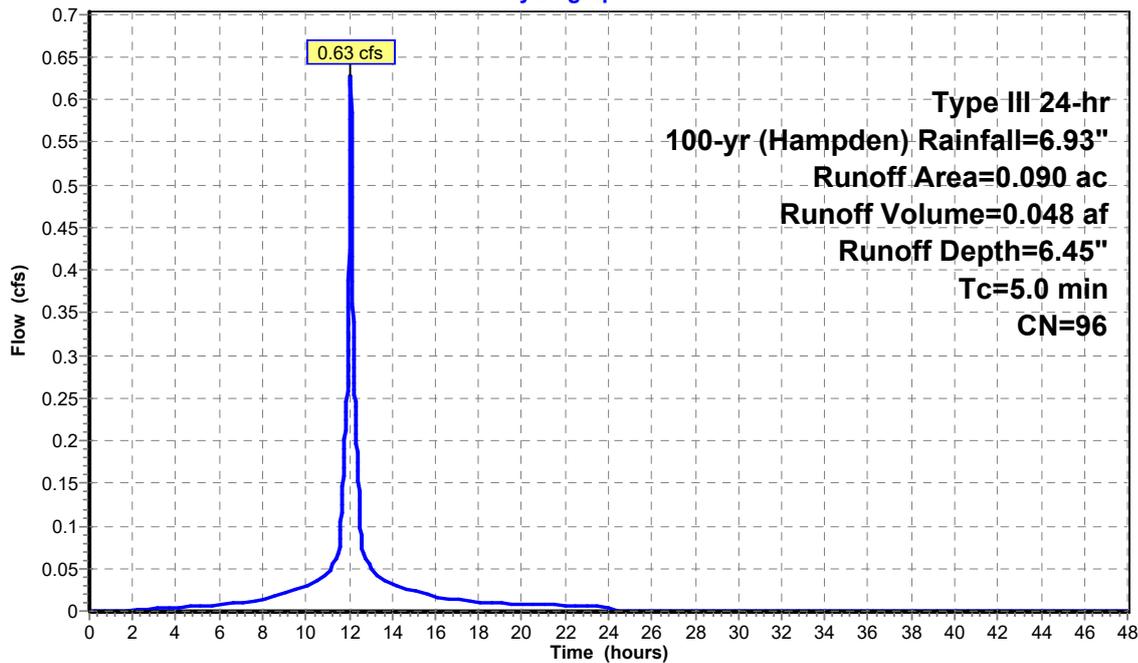
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-yr (Hampden) Rainfall=6.93"

Area (ac)	CN	Description
0.040	93	Urban industrial, 72% imp, HSG D
0.050	98	Water Surface, HSG D
0.090	96	Weighted Average
0.011		12.44% Pervious Area
0.079		87.56% Impervious Area

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

Subcatchment DA4_Pre: DA-4

Hydrograph



Summary for Subcatchment DA5_Pre: DA-5

Runoff = 19.02 cfs @ 12.32 hrs, Volume= 2.107 af, Depth= 3.98"

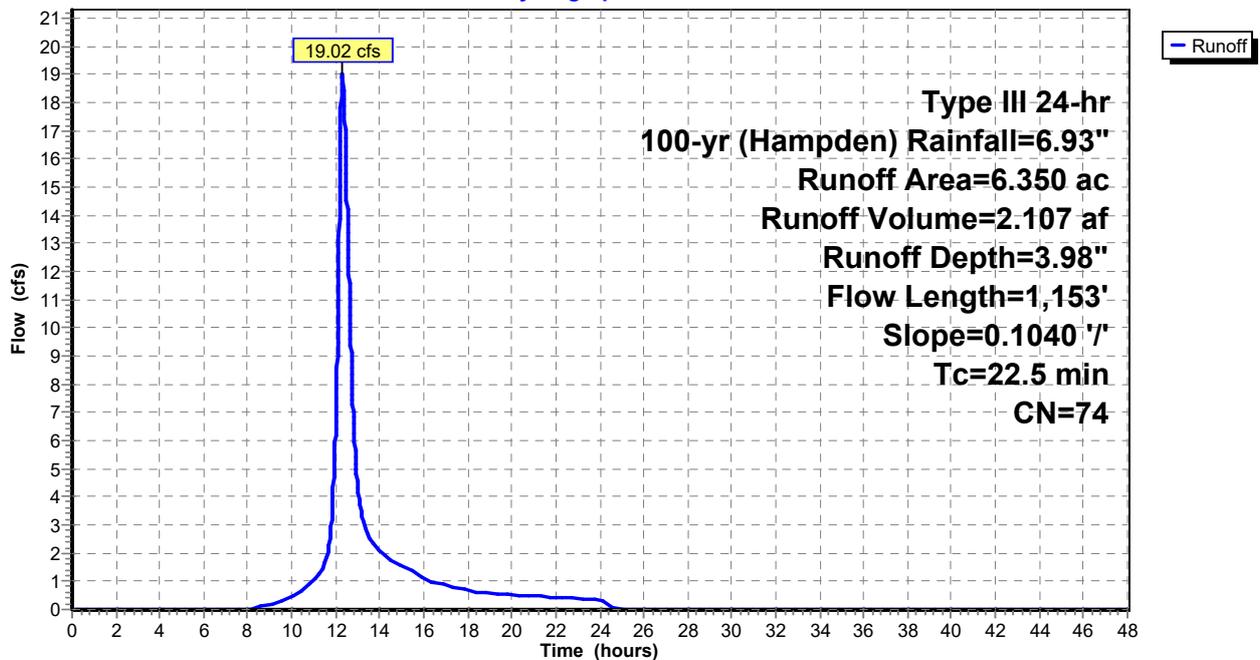
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-yr (Hampden) Rainfall=6.93"

Area (ac)	CN	Description
0.270	91	Urban industrial, 72% imp, HSG C
0.060	93	Urban industrial, 72% imp, HSG D
0.280	79	Pasture/grassland/range, Fair, HSG C
0.050	84	Pasture/grassland/range, Fair, HSG D
0.180	60	Woods, Fair, HSG B
5.350	73	Woods, Fair, HSG C
0.160	79	Woods, Fair, HSG D
6.350	74	Weighted Average
6.112		96.26% Pervious Area
0.238		3.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.6	100	0.1040	0.14		Sheet Flow, Sheet-Woods Woods: Light underbrush n= 0.400 P2= 2.94"
10.9	1,053	0.1040	1.61		Shallow Concentrated Flow, SCF-Woods Woodland Kv= 5.0 fps
22.5	1,153	Total			

Subcatchment DA5_Pre: DA-5

Hydrograph



Summary for Pond 1P_Pre: Pond 1P

Inflow Area = 7.500 ac, 16.69% Impervious, Inflow Depth = 5.07" for 100-yr (Hampden) event
 Inflow = 42.12 cfs @ 12.10 hrs, Volume= 3.171 af
 Outflow = 18.85 cfs @ 12.30 hrs, Volume= 3.162 af, Atten= 55%, Lag= 12.1 min
 Primary = 18.85 cfs @ 12.30 hrs, Volume= 3.162 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 191.47' @ 12.30 hrs Surf.Area= 7,666 sf Storage= 23,900 cf

Plug-Flow detention time= 17.0 min calculated for 3.161 af (100% of inflow)
 Center-of-Mass det. time= 15.1 min (814.2 - 799.1)

Volume	Invert	Avail.Storage	Storage Description
#1	186.00'	51,062 cf	Custom Stage Data (Prismatic) , listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
186.00	0	0	0
188.00	3,866	3,866	3,866
189.00	5,039	4,453	8,319
190.00	6,026	5,533	13,851
191.00	7,099	6,563	20,414
192.00	8,299	7,699	28,113
194.00	14,650	22,949	51,062

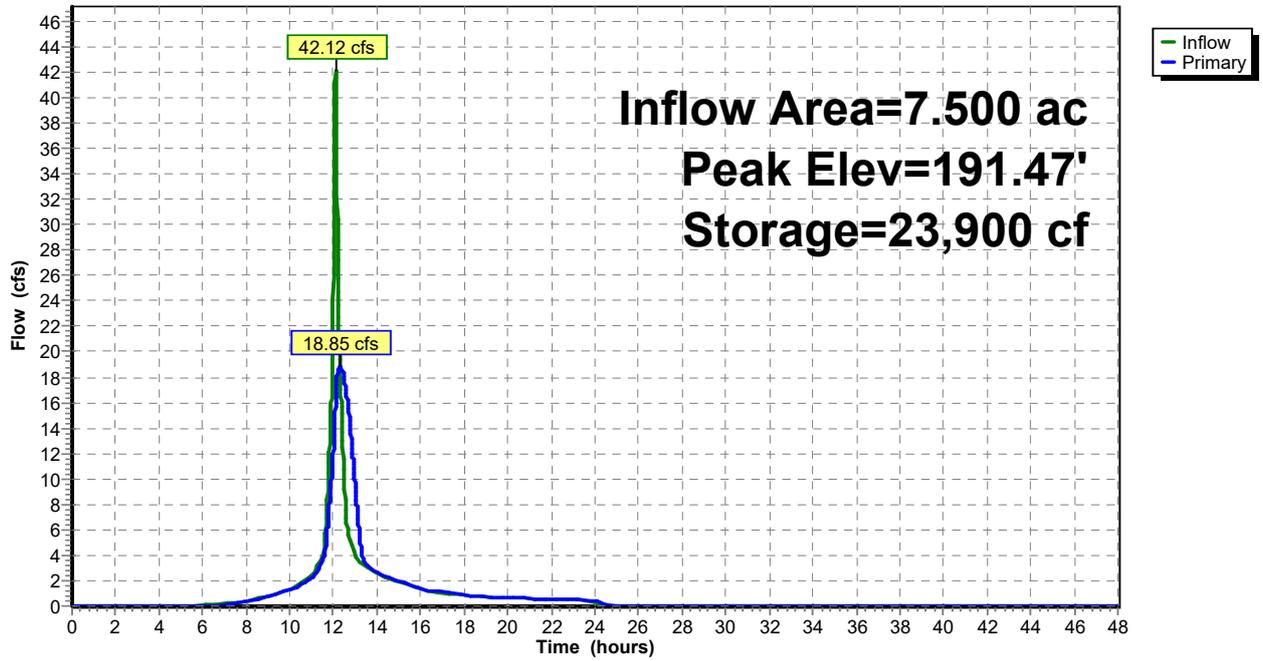
Device	Routing	Invert	Outlet Devices
#1	Primary	186.65'	15.0" Round 15" CPP 1 L= 161.8' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 186.65' / 183.17' S= 0.0215 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf
#2	Primary	186.88'	15.0" Round 15" CPP 2 L= 162.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 186.88' / 182.88' S= 0.0247 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=18.85 cfs @ 12.30 hrs HW=191.47' (Free Discharge)

- ↑ 1=15" CPP 1 (Inlet Controls 9.56 cfs @ 7.79 fps)
- └ 2=15" CPP 2 (Inlet Controls 9.29 cfs @ 7.57 fps)

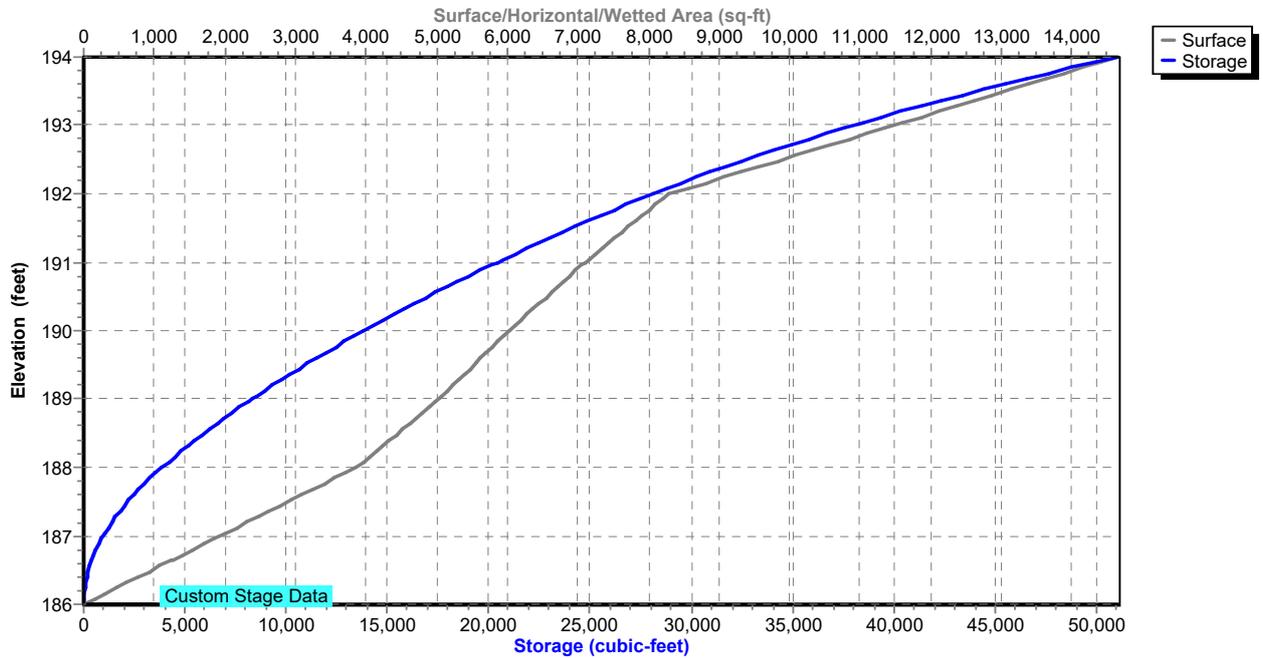
Pond 1P_Pre: Pond 1P

Hydrograph



Pond 1P_Pre: Pond 1P

Stage-Area-Storage



Summary for Pond 7P_Pre: Pond 7P

Inflow Area = 7.590 ac, 17.53% Impervious, Inflow Depth = 5.08" for 100-yr (Hampden) event
 Inflow = 19.08 cfs @ 12.29 hrs, Volume= 3.210 af
 Outflow = 19.08 cfs @ 12.30 hrs, Volume= 3.210 af, Atten= 0%, Lag= 0.7 min
 Primary = 14.03 cfs @ 12.30 hrs, Volume= 2.998 af
 Secondary = 5.05 cfs @ 12.30 hrs, Volume= 0.212 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 186.44' @ 12.30 hrs Surf.Area= 787 sf Storage= 1,405 cf

Plug-Flow detention time= 0.8 min calculated for 3.210 af (100% of inflow)
 Center-of-Mass det. time= 0.6 min (814.0 - 813.3)

Volume	Invert	Avail.Storage	Storage Description
#1	182.00'	5,536 cf	Custom Stage Data (Prismatic) , listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
182.00	0	0	0
183.00	13	7	7
184.00	247	130	137
185.00	479	363	500
186.00	682	581	1,080
187.00	920	801	1,881
188.00	1,114	1,017	2,898
189.00	1,312	1,213	4,111
190.00	1,538	1,425	5,536

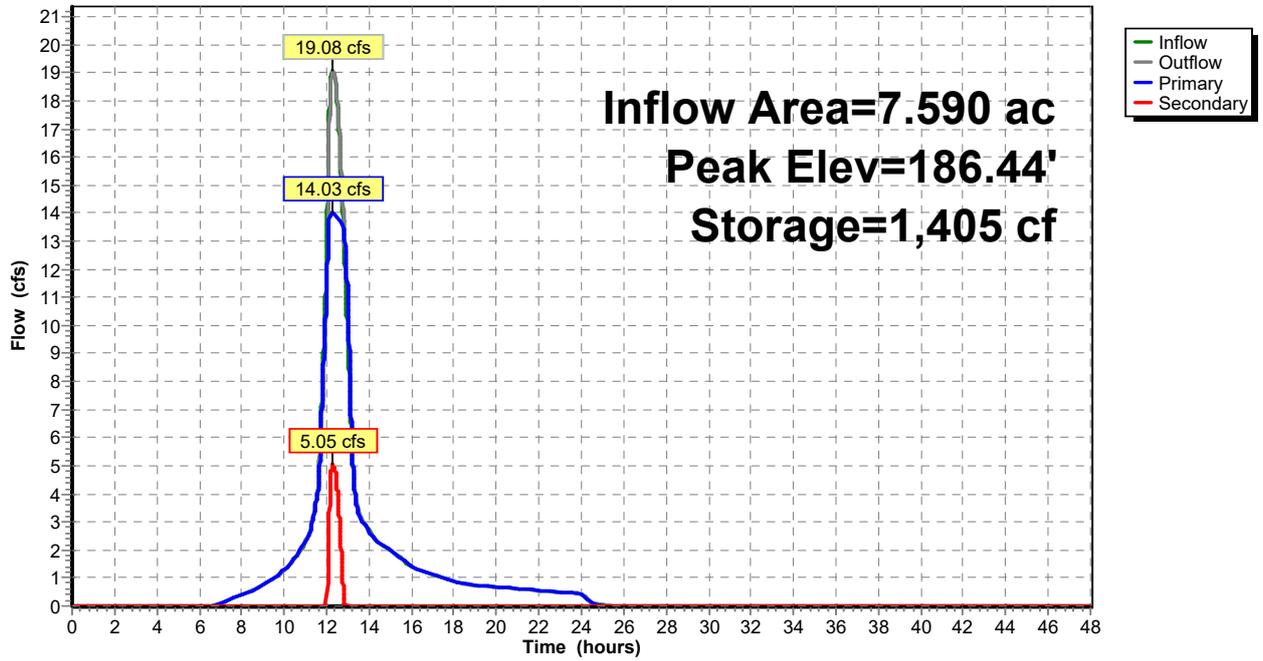
Device	Routing	Invert	Outlet Devices
#1	Primary	182.74'	12.0" Round 12" RCP 1 L= 69.5' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 182.74' / 181.83' S= 0.0131 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf
#2	Primary	182.84'	12.0" Round 12" RCP 1 L= 65.8' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 182.84' / 181.60' S= 0.0188 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf
#3	Secondary	186.00'	Emergency Spillway, Cv= 2.62 (C= 3.28) Head (feet) 0.00 1.00 2.00 3.00 4.00 Width (feet) 4.26 9.60 15.15 20.50 31.66

Primary OutFlow Max=14.03 cfs @ 12.30 hrs HW=186.44' (Free Discharge)
 ↖1=12" RCP 1 (Barrel Controls 6.85 cfs @ 8.72 fps)
 ↖2=12" RCP 1 (Barrel Controls 7.18 cfs @ 9.14 fps)

Secondary OutFlow Max=5.02 cfs @ 12.30 hrs HW=186.44' (Free Discharge)
 ↖3=Emergency Spillway (Weir Controls 5.02 cfs @ 2.08 fps)

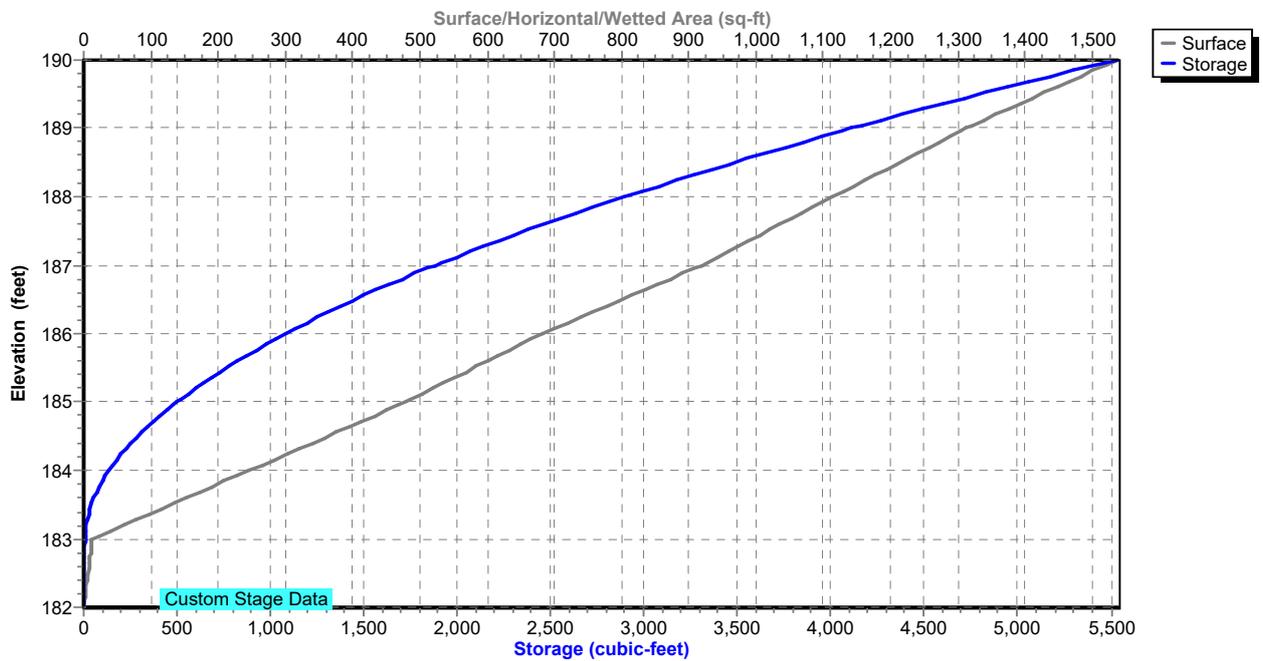
Pond 7P_Pre: Pond 7P

Hydrograph



Pond 7P_Pre: Pond 7P

Stage-Area-Storage



Summary for Pond 11P_Pre: Pond 11P

Inflow Area = 6.350 ac, 3.74% Impervious, Inflow Depth = 3.98" for 100-yr (Hampden) event
 Inflow = 19.02 cfs @ 12.32 hrs, Volume= 2.107 af
 Outflow = 19.01 cfs @ 12.32 hrs, Volume= 2.107 af, Atten= 0%, Lag= 0.3 min
 Primary = 19.01 cfs @ 12.32 hrs, Volume= 2.107 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 224.67' @ 12.32 hrs Surf.Area= 1,326 sf Storage= 759 cf

Plug-Flow detention time= 1.3 min calculated for 2.107 af (100% of inflow)
 Center-of-Mass det. time= 1.3 min (839.0 - 837.7)

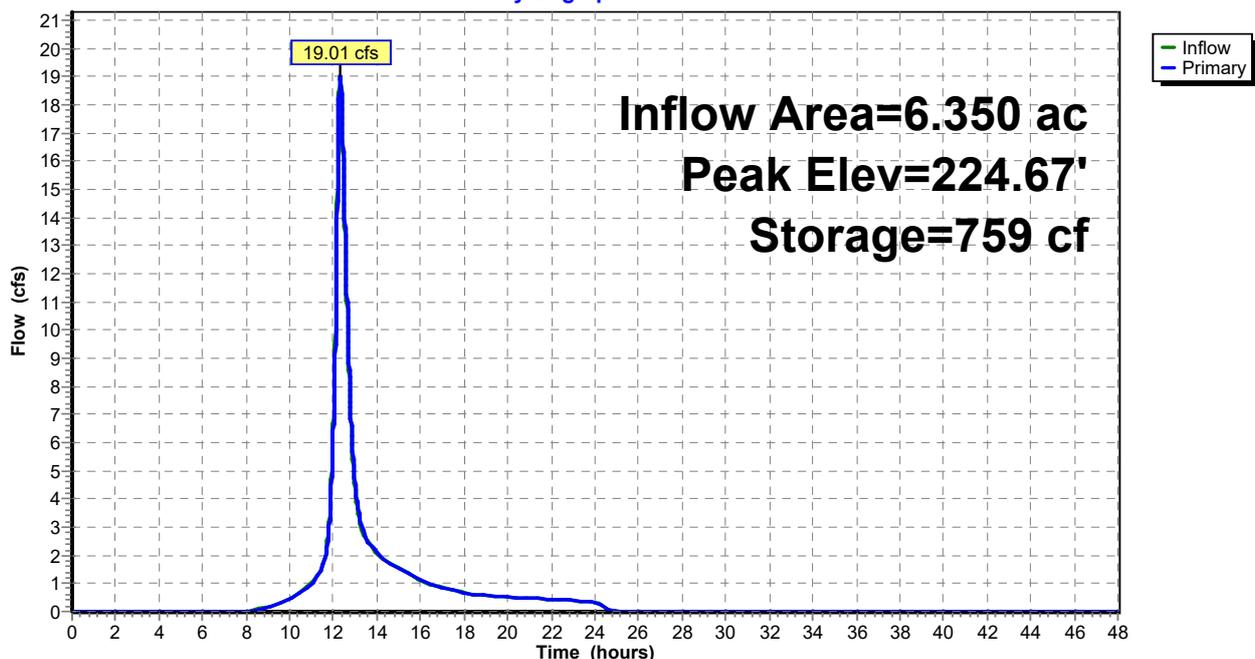
Volume	Invert	Avail.Storage	Storage Description
#1	224.00'	3,026 cf	Custom Stage Data (Prismatic) , listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
224.00	953	0	0
225.00	1,513	1,233	1,233
226.00	2,072	1,793	3,026

Device	Routing	Invert	Outlet Devices
#1	Primary	224.00'	Emergency Spillway, Cv= 2.62 (C= 3.28) Head (feet) 0.00 1.00 2.00 Width (feet) 8.00 18.00 26.00

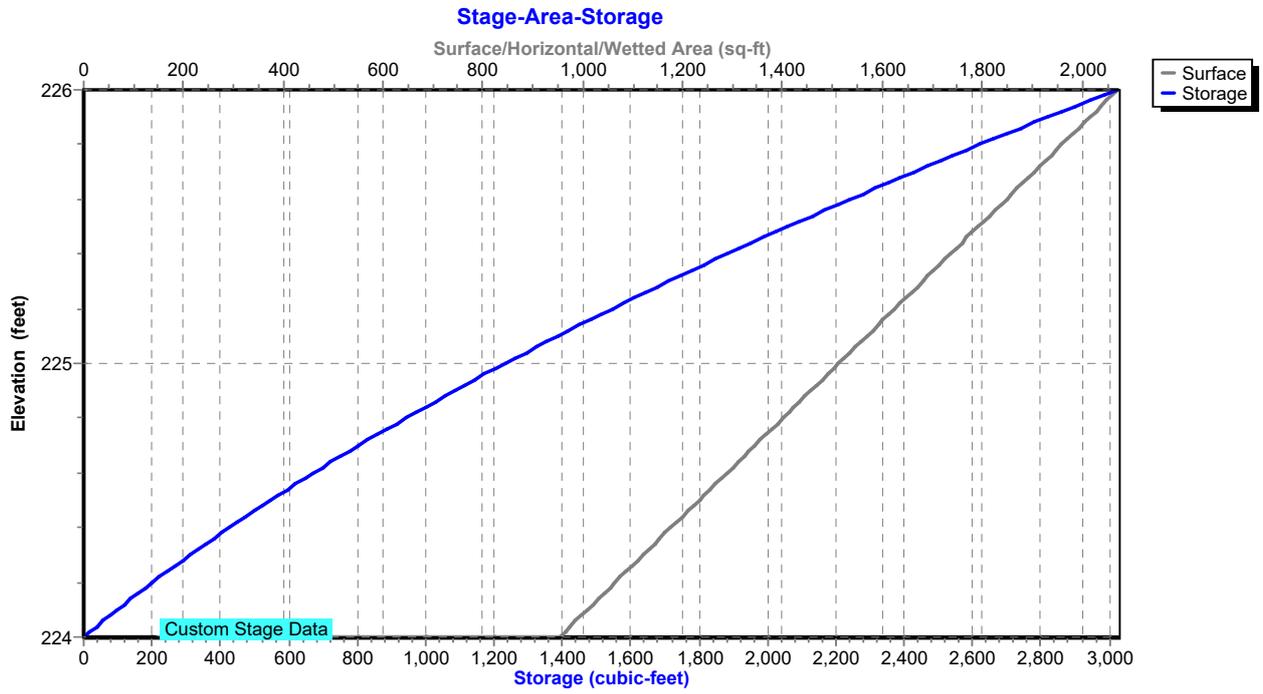
Primary OutFlow Max=19.00 cfs @ 12.32 hrs HW=224.67' (Free Discharge)
 ←1=Emergency Spillway (Weir Controls 19.00 cfs @ 2.52 fps)

Pond 11P_Pre: Pond 11P

Hydrograph



Pond 11P_Pre: Pond 11P



Summary for Pond S1_Pre: DA-1 Stor

Inflow Area = 168.650 ac, 3.44% Impervious, Inflow Depth = 3.14" for 100-yr (Hampden) event
 Inflow = 268.26 cfs @ 12.67 hrs, Volume= 44.075 af
 Outflow = 264.10 cfs @ 12.74 hrs, Volume= 44.075 af, Atten= 2%, Lag= 4.4 min
 Primary = 134.01 cfs @ 12.74 hrs, Volume= 39.575 af
 Secondary = 130.09 cfs @ 12.74 hrs, Volume= 4.500 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 191.80' @ 12.74 hrs Surf.Area= 33,626 sf Storage= 149,914 cf

Plug-Flow detention time= 6.0 min calculated for 44.066 af (100% of inflow)
 Center-of-Mass det. time= 6.0 min (881.9 - 875.9)

Volume	Invert	Avail.Storage	Storage Description	
#1	177.00'	237,211 cf	Custom Stage Data (Conic) Listed below (Recalc)	
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
177.00	0	0	0	0
178.00	21	7	7	23
179.00	83	49	56	89
180.00	512	267	323	522
181.00	1,306	879	1,201	1,323
182.00	2,393	1,822	3,023	2,420
183.00	4,058	3,189	6,213	4,097
184.00	5,691	4,852	11,064	5,748
185.00	8,000	6,813	17,877	8,076
186.00	10,421	9,184	27,061	10,521
188.00	16,620	26,801	53,862	16,773
190.00	26,218	42,475	96,337	26,427
192.00	34,530	60,558	156,894	34,830
194.00	46,063	80,317	237,211	46,450

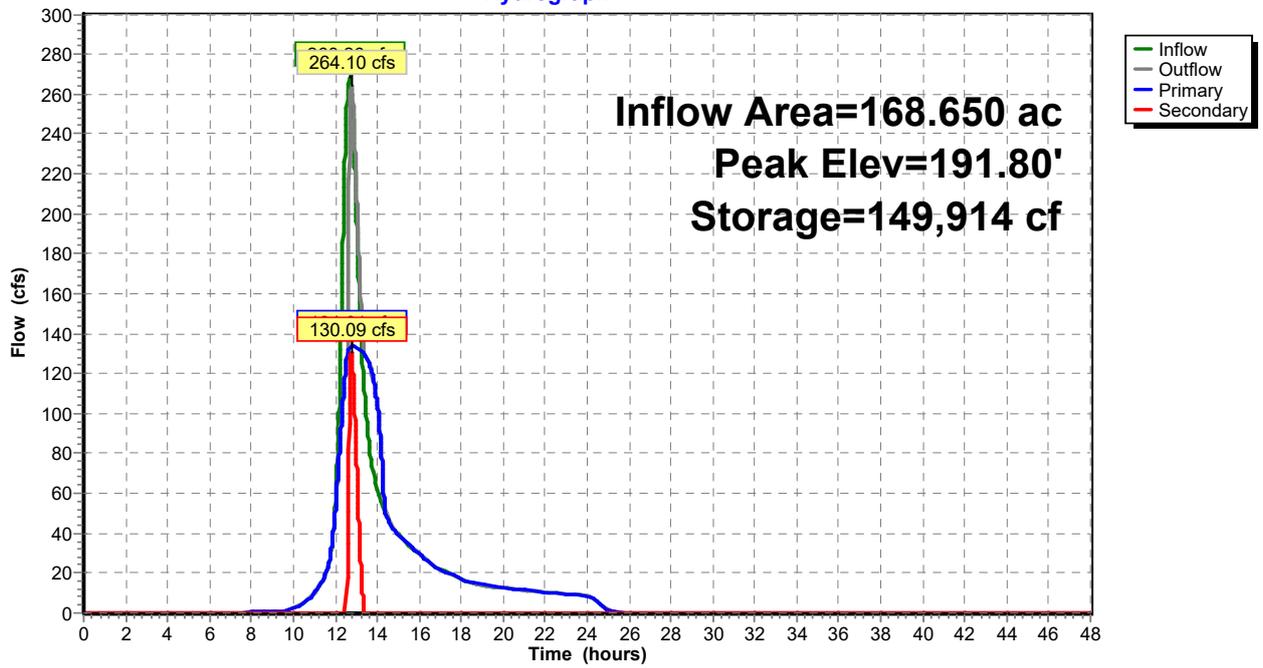
Device	Routing	Invert	Outlet Devices
#1	Primary	177.50'	30.0" Round 30" CPP 1 L= 66.6' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 177.50' / 175.36' S= 0.0321 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 4.91 sf
#2	Primary	177.80'	30.0" Round 30" CPP 2 L= 66.4' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 177.80' / 175.50' S= 0.0346 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 4.91 sf
#3	Secondary	191.00'	Emergency Spillway, Cv= 2.62 (C= 3.28) Head (feet) 0.00 1.00 2.00 3.00 Width (feet) 38.32 93.77 128.55 162.52

Primary OutFlow Max=134.01 cfs @ 12.74 hrs HW=191.80' (Free Discharge)
 ↑1=30" CPP 1 (Inlet Controls 67.39 cfs @ 13.73 fps)
 ↑2=30" CPP 2 (Inlet Controls 66.61 cfs @ 13.57 fps)

Secondary OutFlow Max=129.89 cfs @ 12.74 hrs HW=191.80' (Free Discharge)
 ↑3=Emergency Spillway (Weir Controls 129.89 cfs @ 2.71 fps)

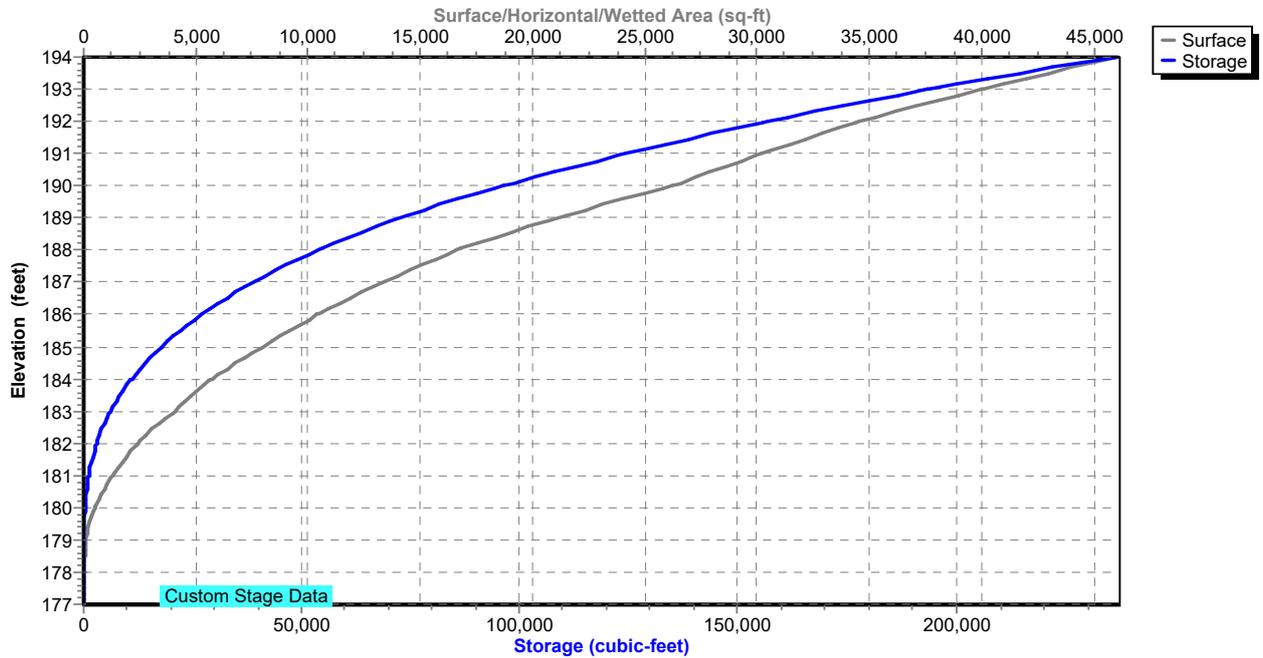
Pond S1_Pre: DA-1 Stor

Hydrograph



Pond S1_Pre: DA-1 Stor

Stage-Area-Storage

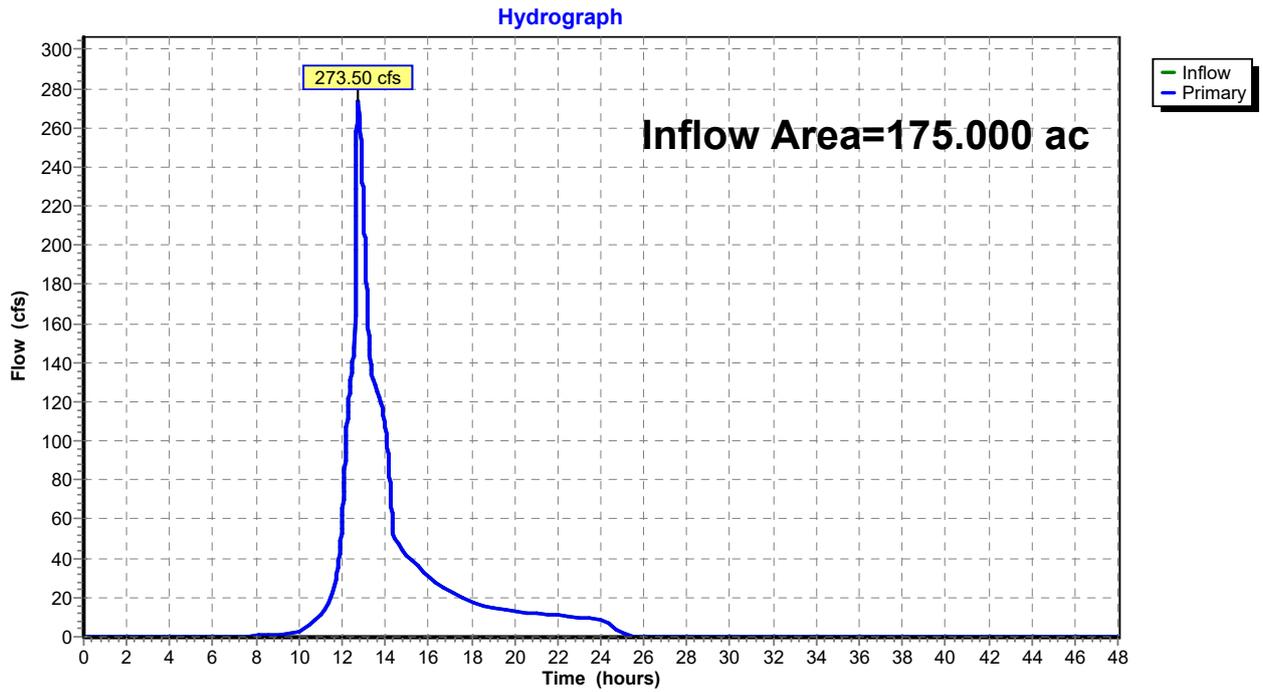


Summary for Link POA_Pre: Point of Analysis

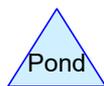
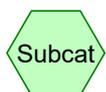
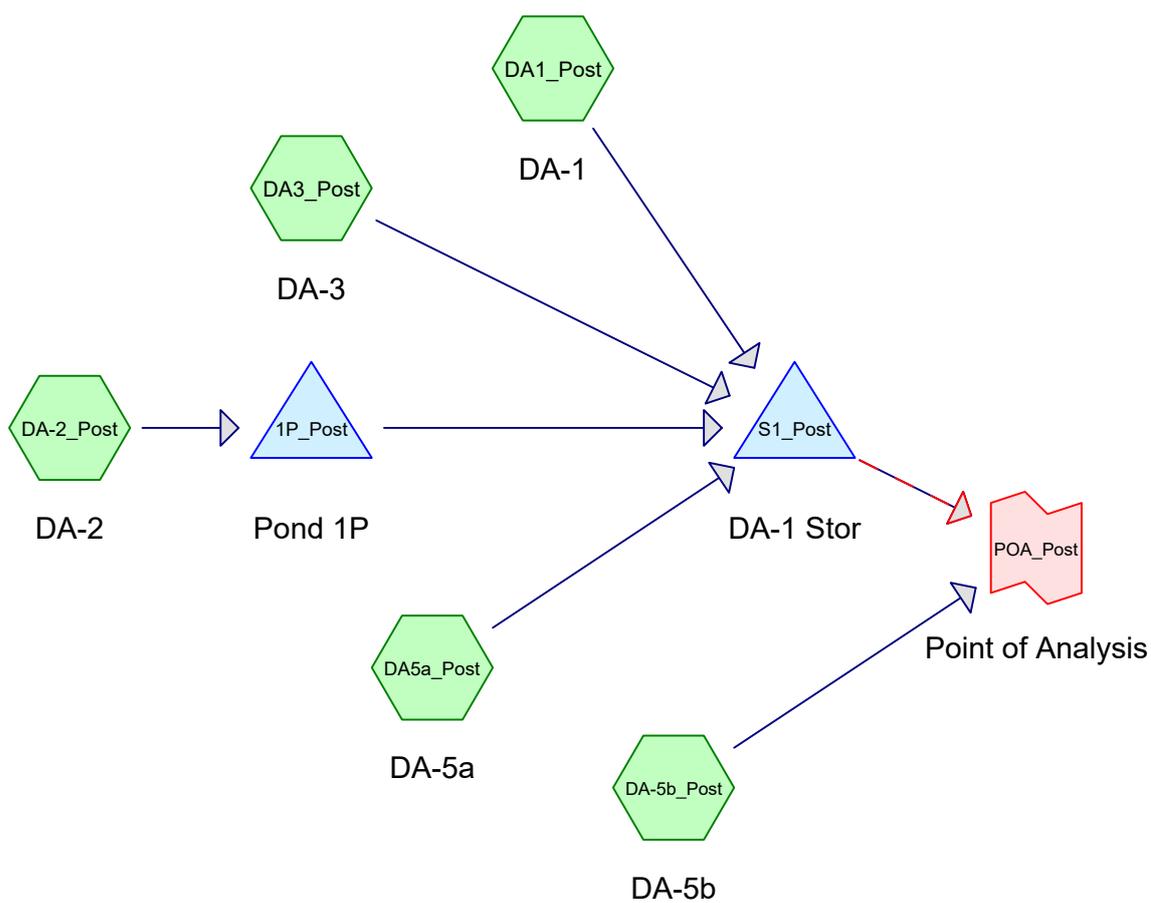
Inflow Area = 175.000 ac, 3.45% Impervious, Inflow Depth = 3.18" for 100-yr (Hampden) event
Inflow = 273.50 cfs @ 12.74 hrs, Volume= 46.393 af
Primary = 273.50 cfs @ 12.74 hrs, Volume= 46.393 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link POA_Pre: Point of Analysis



POST-DEVELOPMENT



ASMG_221383_Hydrology

Prepared by ITS

HydroCAD® 10.10-5a s/n 09112 © 2020 HydroCAD Software Solutions LLC

Printed 5/4/2022

Page 2

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-yr (Hampden)	Type III 24-hr		Default	24.00	1	2.94	2
2	10-yr (Hampden)	Type III 24-hr		Default	24.00	1	4.48	2
3	100-yr (Hampden)	Type III 24-hr		Default	24.00	1	6.93	2

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentDA-2_Post: DA-2 Runoff Area=7.500 ac 16.69% Impervious Runoff Depth=1.47"
Flow Length=1,705' Slope=0.0711 '/' Tc=7.0 min CN=84 Runoff=12.43 cfs 0.917 af

SubcatchmentDA-5b_Post: DA-5b Runoff Area=0.530 ac 8.15% Impervious Runoff Depth=1.14"
Flow Length=360' Slope=0.0560 '/' Tc=18.5 min CN=79 Runoff=0.48 cfs 0.051 af

SubcatchmentDA1_Post: DA-1 Runoff Area=151.840 ac 2.58% Impervious Runoff Depth=0.48"
Flow Length=5,870' Tc=47.5 min CN=65 Runoff=28.53 cfs 6.060 af

SubcatchmentDA3_Post: DA-3 Runoff Area=0.980 ac 72.00% Impervious Runoff Depth=2.20"
Tc=5.0 min CN=93 Runoff=2.55 cfs 0.179 af

SubcatchmentDA5a_Post: DA-5a Runoff Area=14.950 ac 2.75% Impervious Runoff Depth=0.73"
Flow Length=890' Tc=19.0 min CN=71 Runoff=7.65 cfs 0.905 af

Pond 1P_Post: Pond 1P Peak Elev=190.78' Storage=18,846 cf Inflow=12.43 cfs 0.917 af
24.0" Round Culvert n=0.012 L=121.0' S=0.0475 '/' Outflow=2.67 cfs 0.599 af

Pond S1_Post: DA-1 Stor Peak Elev=182.23' Storage=3,291 cf Inflow=34.12 cfs 7.743 af
Primary=34.04 cfs 7.743 af Secondary=0.00 cfs 0.000 af Outflow=34.04 cfs 7.743 af

Link POA_Post: Point of Analysis Inflow=34.19 cfs 7.793 af
Primary=34.19 cfs 7.793 af

Total Runoff Area = 175.800 ac Runoff Volume = 8.111 af Average Runoff Depth = 0.55"
96.40% Pervious = 169.466 ac 3.60% Impervious = 6.334 ac

Summary for Subcatchment DA-2_Post: DA-2

Runoff = 12.43 cfs @ 12.10 hrs, Volume= 0.917 af, Depth= 1.47"

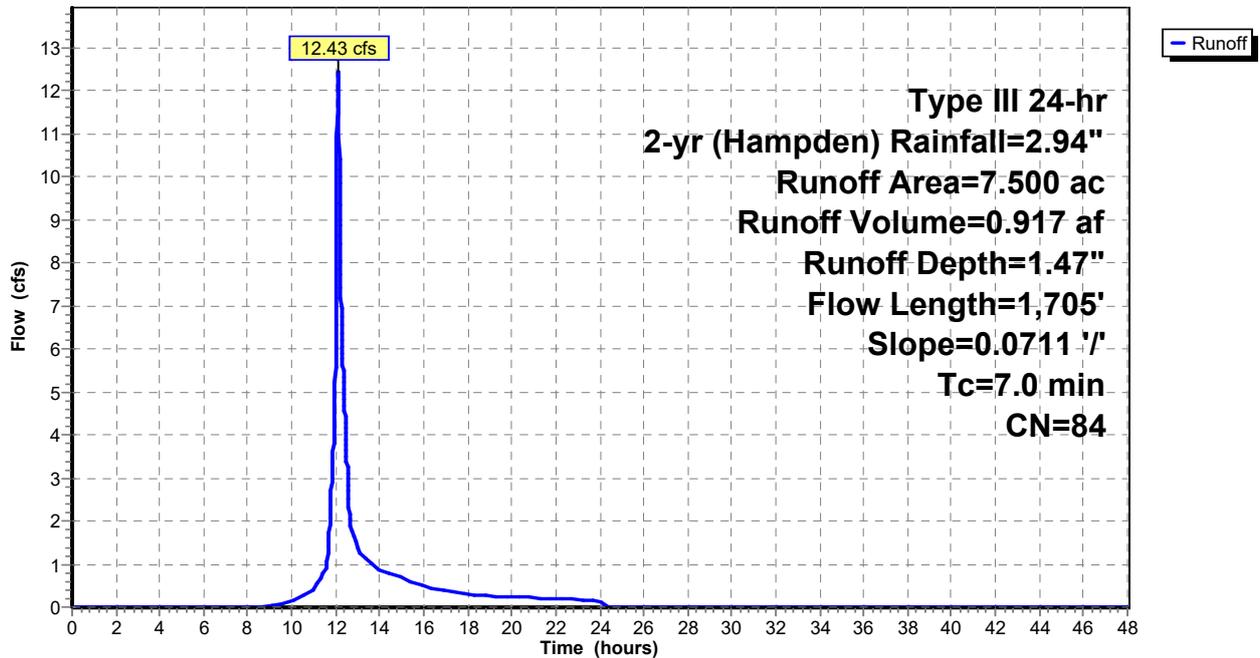
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type III 24-hr 2-yr (Hampden) Rainfall=2.94"

Area (ac)	CN	Description
1.530	93	Urban industrial, 72% imp, HSG D
2.080	84	Pasture/grassland/range, Fair, HSG D
0.150	98	Water Surface, HSG D
3.740	79	Woods, Fair, HSG D
7.500	84	Weighted Average
6.248		83.31% Pervious Area
1.252		16.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	100	0.0711	2.19		Sheet Flow, Sheet-Rd Smooth surfaces n= 0.011 P2= 2.94"
6.2	1,605	0.0711	4.29		Shallow Concentrated Flow, SCF-Rd Unpaved Kv= 16.1 fps
7.0	1,705	Total			

Subcatchment DA-2_Post: DA-2

Hydrograph



Summary for Subcatchment DA-5b_Post: DA-5b

Runoff = 0.48 cfs @ 12.27 hrs, Volume= 0.051 af, Depth= 1.14"

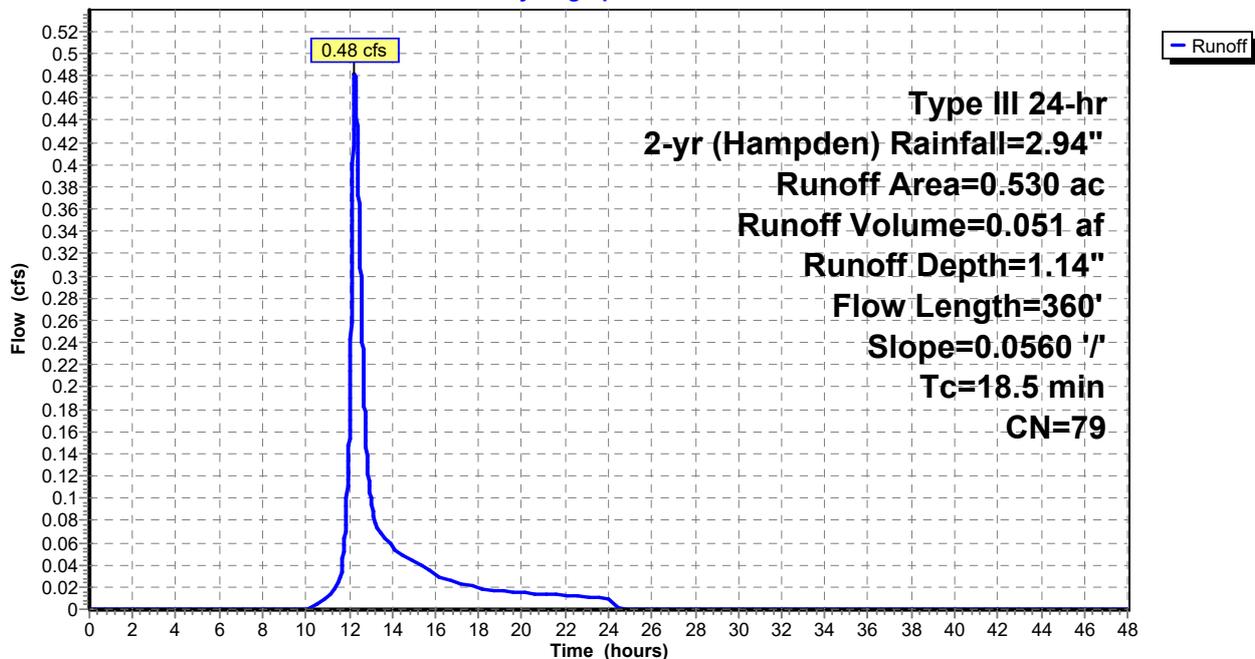
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type III 24-hr 2-yr (Hampden) Rainfall=2.94"

Area (ac)	CN	Description
0.040	91	Urban industrial, 72% imp, HSG C
0.020	93	Urban industrial, 72% imp, HSG D
0.130	79	Pasture/grassland/range, Fair, HSG C
0.040	84	Pasture/grassland/range, Fair, HSG D
0.140	73	Woods, Fair, HSG C
0.160	79	Woods, Fair, HSG D
0.530	79	Weighted Average
0.487		91.85% Pervious Area
0.043		8.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.8	100	0.0560	0.11		Sheet Flow, Sheet-Woods Woods: Light underbrush n= 0.400 P2= 2.94"
3.7	260	0.0560	1.18		Shallow Concentrated Flow, SCF-Woods Woodland Kv= 5.0 fps
18.5	360	Total			

Subcatchment DA-5b_Post: DA-5b

Hydrograph



Summary for Subcatchment DA1_Post: DA-1

Runoff = 28.53 cfs @ 12.82 hrs, Volume= 6.060 af, Depth= 0.48"

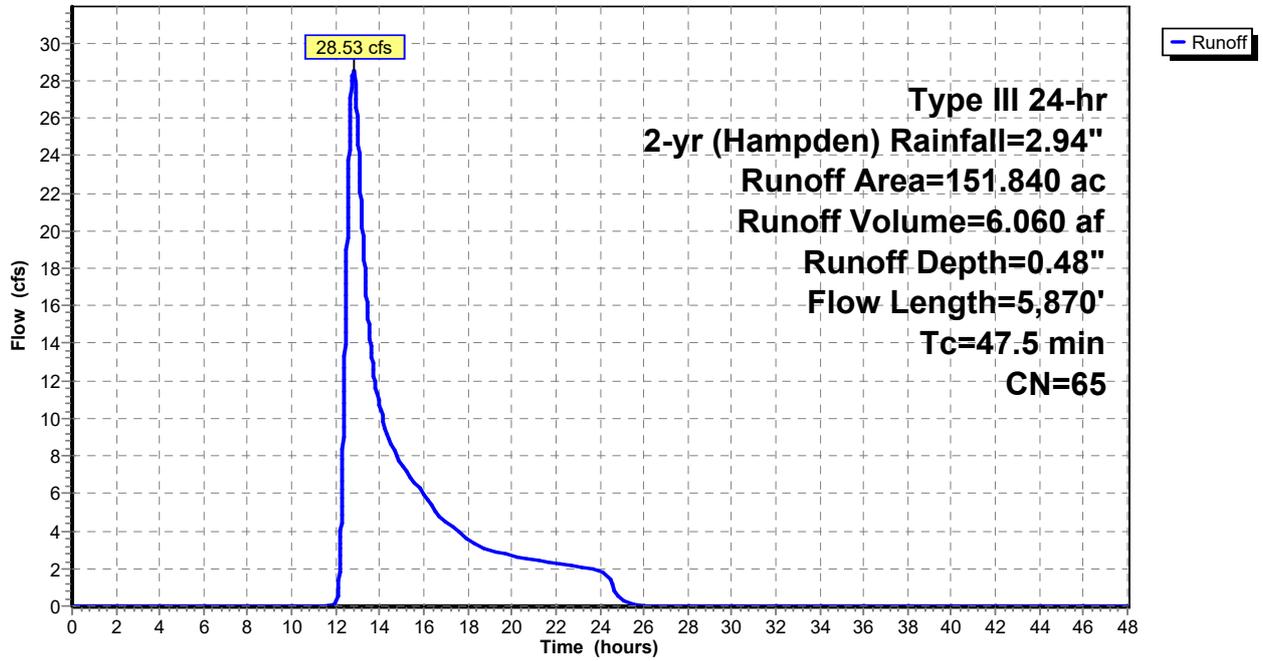
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type III 24-hr 2-yr (Hampden) Rainfall=2.94"

Area (ac)	CN	Description
0.580	35	Brush, Fair, HSG A
0.450	70	Brush, Fair, HSG C
0.460	77	Brush, Fair, HSG D
0.960	81	Urban industrial, 72% imp, HSG A
1.110	88	Urban industrial, 72% imp, HSG B
0.240	93	Urban industrial, 72% imp, HSG D
2.240	49	Pasture/grassland/range, Fair, HSG A
0.660	69	Pasture/grassland/range, Fair, HSG B
5.730	79	Pasture/grassland/range, Fair, HSG C
1.220	84	Pasture/grassland/range, Fair, HSG D
* 0.170	98	Wetland
* 0.030	98	Wetland
* 2.060	98	Wetland
30.430	36	Woods, Fair, HSG A
27.020	60	Woods, Fair, HSG B
40.240	73	Woods, Fair, HSG C
38.240	79	Woods, Fair, HSG D
151.840	65	Weighted Average
147.917		97.42% Pervious Area
3.923		2.58% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.6	100	0.0581	0.11		Sheet Flow, Sheet-Woods Woods: Light underbrush n= 0.400 P2= 2.94"
24.9	1,800	0.0581	1.21		Shallow Concentrated Flow, SCF-Woods Woodland Kv= 5.0 fps
8.0	3,970	0.0200	8.31	199.43	Parabolic Channel, W=18.00' D=2.00' Area=24.0 sf Perim=18.6' n= 0.030
47.5	5,870	Total			

Subcatchment DA1_Post: DA-1

Hydrograph



Summary for Subcatchment DA3_Post: DA-3

Runoff = 2.55 cfs @ 12.07 hrs, Volume= 0.179 af, Depth= 2.20"

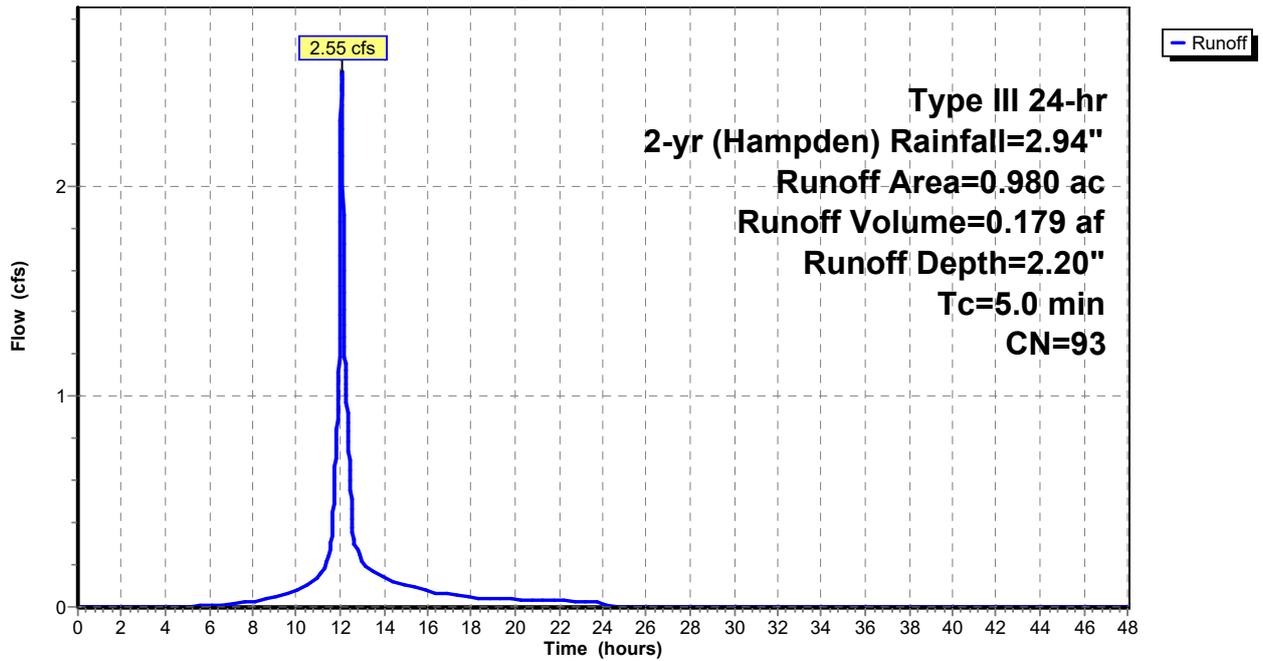
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type III 24-hr 2-yr (Hampden) Rainfall=2.94"

Area (ac)	CN	Description
0.980	93	Urban industrial, 72% imp, HSG D
0.274		28.00% Pervious Area
0.706		72.00% Impervious Area

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

Subcatchment DA3_Post: DA-3

Hydrograph



Summary for Subcatchment DA5a_Post: DA-5a

Runoff = 7.65 cfs @ 12.30 hrs, Volume= 0.905 af, Depth= 0.73"

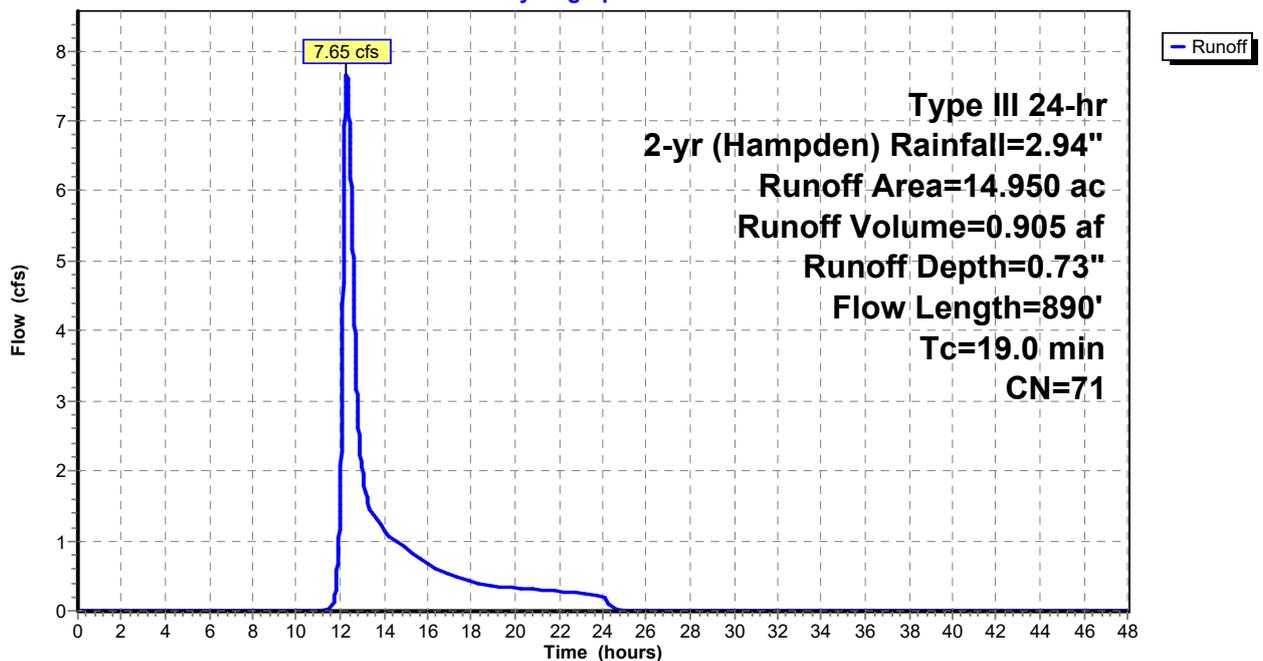
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type III 24-hr 2-yr (Hampden) Rainfall=2.94"

Area (ac)	CN	Description
0.060	81	Urban industrial, 72% imp, HSG A
0.190	88	Urban industrial, 72% imp, HSG B
0.320	91	Urban industrial, 72% imp, HSG C
0.240	49	Pasture/grassland/range, Fair, HSG A
0.250	69	Pasture/grassland/range, Fair, HSG B
0.310	79	Pasture/grassland/range, Fair, HSG C
0.270	36	Woods, Fair, HSG A
2.340	60	Woods, Fair, HSG B
10.970	73	Woods, Fair, HSG C
14.950	71	Weighted Average
14.540		97.25% Pervious Area
0.410		2.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.6	100	0.1040	0.14		Sheet Flow, Sheet-Woods Woods: Light underbrush n= 0.400 P2= 2.94"
6.9	665	0.1040	1.61		Shallow Concentrated Flow, SCF-Woods Woodland Kv= 5.0 fps
0.5	125	0.0800	4.24		Shallow Concentrated Flow, SCF-Grassed swale Grassed Waterway Kv= 15.0 fps
19.0	890	Total			

Subcatchment DA5a_Post: DA-5a

Hydrograph



Summary for Pond 1P_Post: Pond 1P

Inflow Area = 7.500 ac, 16.69% Impervious, Inflow Depth = 1.47" for 2-yr (Hampden) event
 Inflow = 12.43 cfs @ 12.10 hrs, Volume= 0.917 af
 Outflow = 2.67 cfs @ 12.55 hrs, Volume= 0.599 af, Atten= 79%, Lag= 27.0 min
 Primary = 2.67 cfs @ 12.55 hrs, Volume= 0.599 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 190.78' @ 12.55 hrs Surf.Area= 6,858 sf Storage= 18,846 cf

Plug-Flow detention time= 235.5 min calculated for 0.599 af (65% of inflow)
 Center-of-Mass det. time= 130.9 min (965.3 - 834.4)

Volume	Invert	Avail.Storage	Storage Description
#1	186.00'	51,062 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

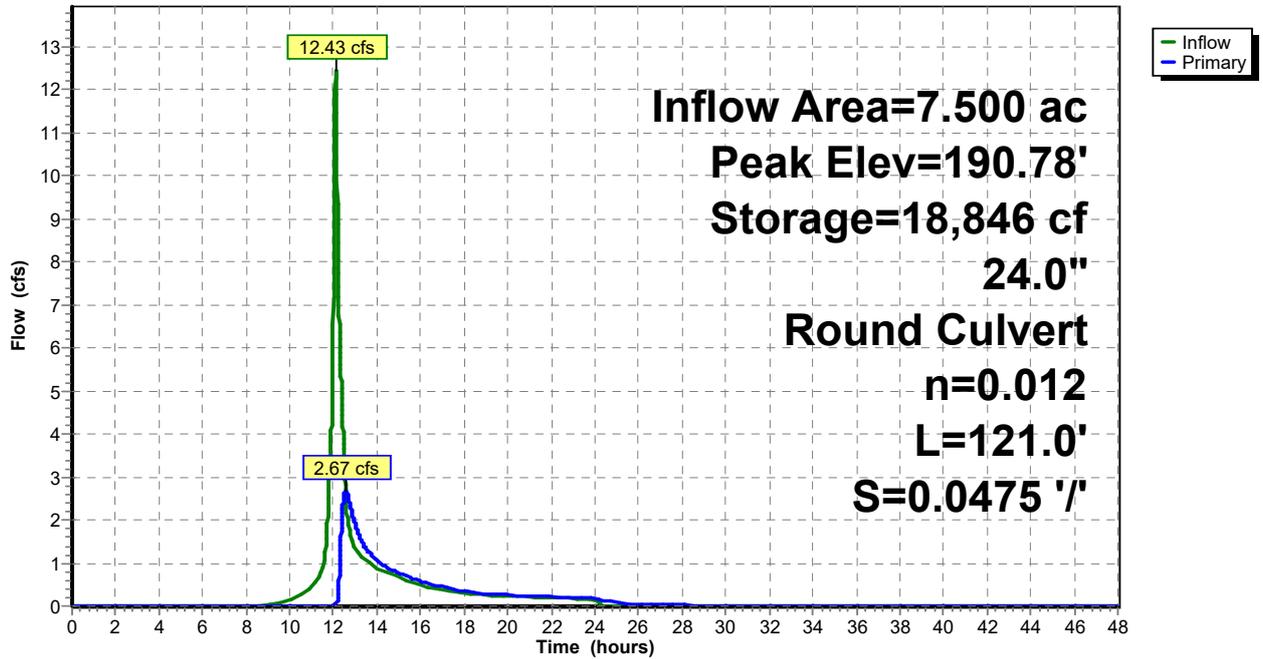
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
186.00	0	0	0
188.00	3,866	3,866	3,866
189.00	5,039	4,453	8,319
190.00	6,026	5,533	13,851
191.00	7,099	6,563	20,414
192.00	8,299	7,699	28,113
194.00	14,650	22,949	51,062

Device	Routing	Invert	Outlet Devices
#1	Primary	190.00'	24.0" Round 24" CPP L= 121.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 190.00' / 184.25' S= 0.0475 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 3.14 sf

Primary OutFlow Max=2.66 cfs @ 12.55 hrs HW=190.78' (Free Discharge)
 ←1=24" CPP (Inlet Controls 2.66 cfs @ 2.37 fps)

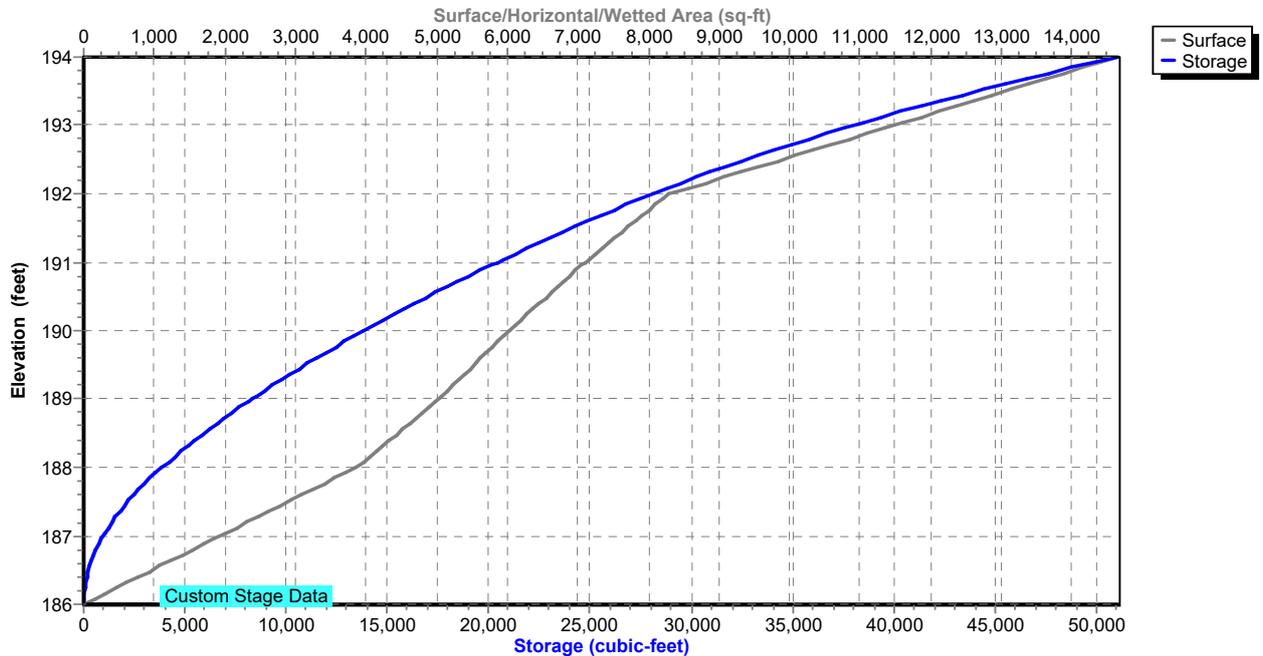
Pond 1P_Post: Pond 1P

Hydrograph



Pond 1P_Post: Pond 1P

Stage-Area-Storage



Summary for Pond S1_Post: DA-1 Stor

Inflow Area = 175.270 ac, 3.59% Impervious, Inflow Depth = 0.53" for 2-yr (Hampden) event
 Inflow = 34.12 cfs @ 12.72 hrs, Volume= 7.743 af
 Outflow = 34.04 cfs @ 12.78 hrs, Volume= 7.743 af, Atten= 0%, Lag= 3.1 min
 Primary = 34.04 cfs @ 12.78 hrs, Volume= 7.743 af
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 182.23' @ 12.78 hrs Surf.Area= 2,738 sf Storage= 3,291 cf

Plug-Flow detention time= 2.0 min calculated for 7.743 af (100% of inflow)
 Center-of-Mass det. time= 2.0 min (937.0 - 935.0)

Volume	Invert	Avail.Storage	Storage Description		
#1	180.00'	236,888 cf	Custom Stage Data (Conic) Listed below (Recalc)		
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)	
180.00	512	0	0	512	
181.00	1,306	879	879	1,313	
182.00	2,393	1,822	2,701	2,410	
183.00	4,058	3,189	5,890	4,087	
184.00	5,691	4,852	10,741	5,739	
185.00	8,000	6,813	17,554	8,066	
186.00	10,421	9,184	26,738	10,511	
188.00	16,620	26,801	53,539	16,764	
190.00	26,218	42,475	96,014	26,417	
192.00	34,530	60,558	156,572	34,820	
194.00	46,063	80,317	236,888	46,440	

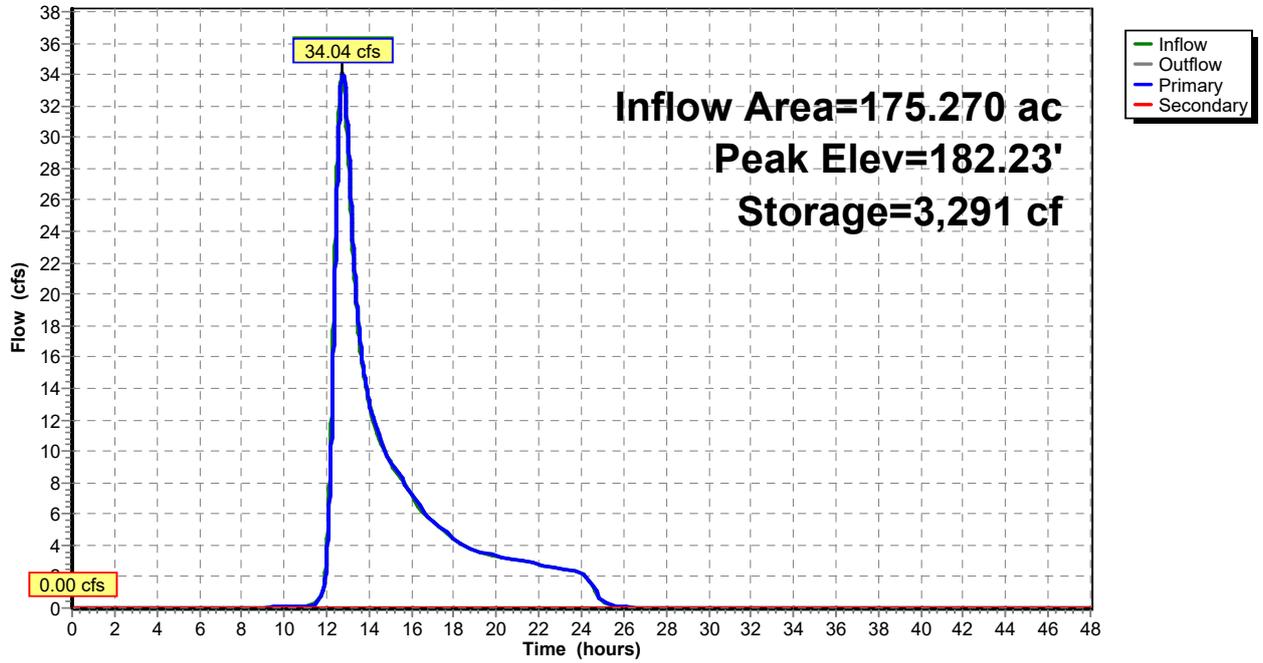
Device	Routing	Invert	Outlet Devices
#1	Primary	180.00'	60.0" Round 60" CMP L= 133.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 180.00' / 173.00' S= 0.0526 '/ Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 19.63 sf
#2	Secondary	195.00'	Road overflow, Cv= 2.62 (C= 3.28) Head (feet) 0.00 1.00 2.00 3.00 Width (feet) 38.32 93.77 128.55 162.52

Primary OutFlow Max=34.00 cfs @ 12.78 hrs HW=182.23' (Free Discharge)
 ↑1=60" CMP (Inlet Controls 34.00 cfs @ 4.01 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=180.00' (Free Discharge)
 ↑2=Road overflow (Controls 0.00 cfs)

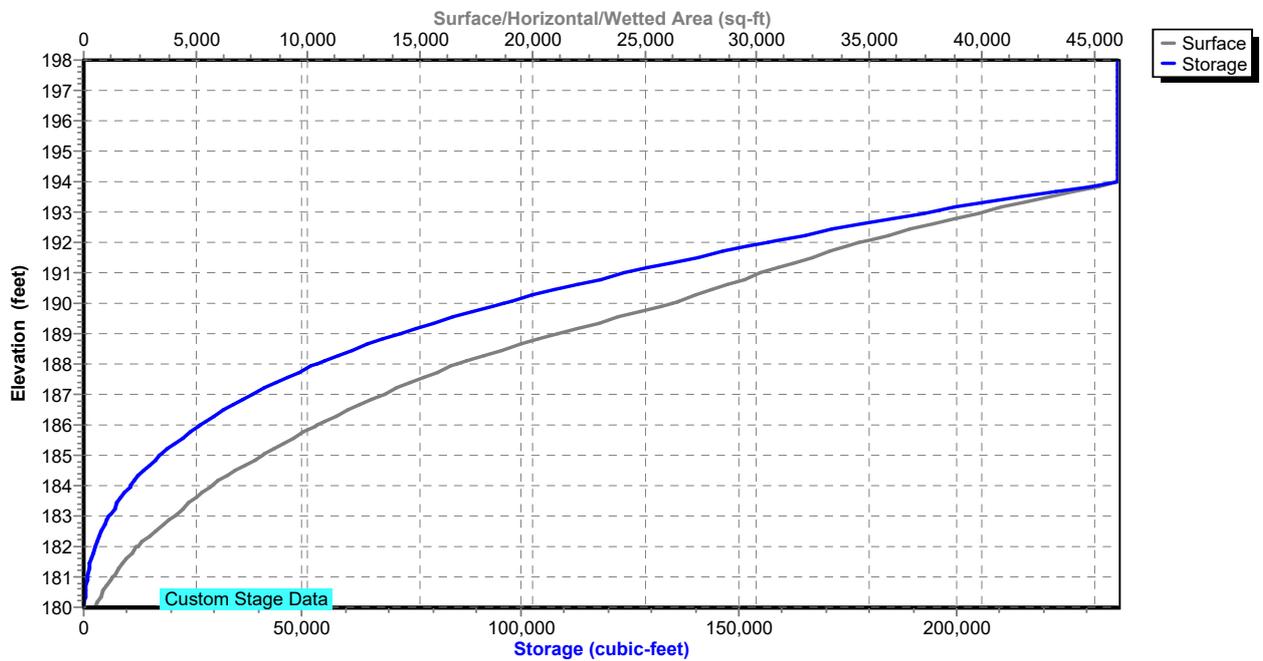
Pond S1_Post: DA-1 Stor

Hydrograph



Pond S1_Post: DA-1 Stor

Stage-Area-Storage



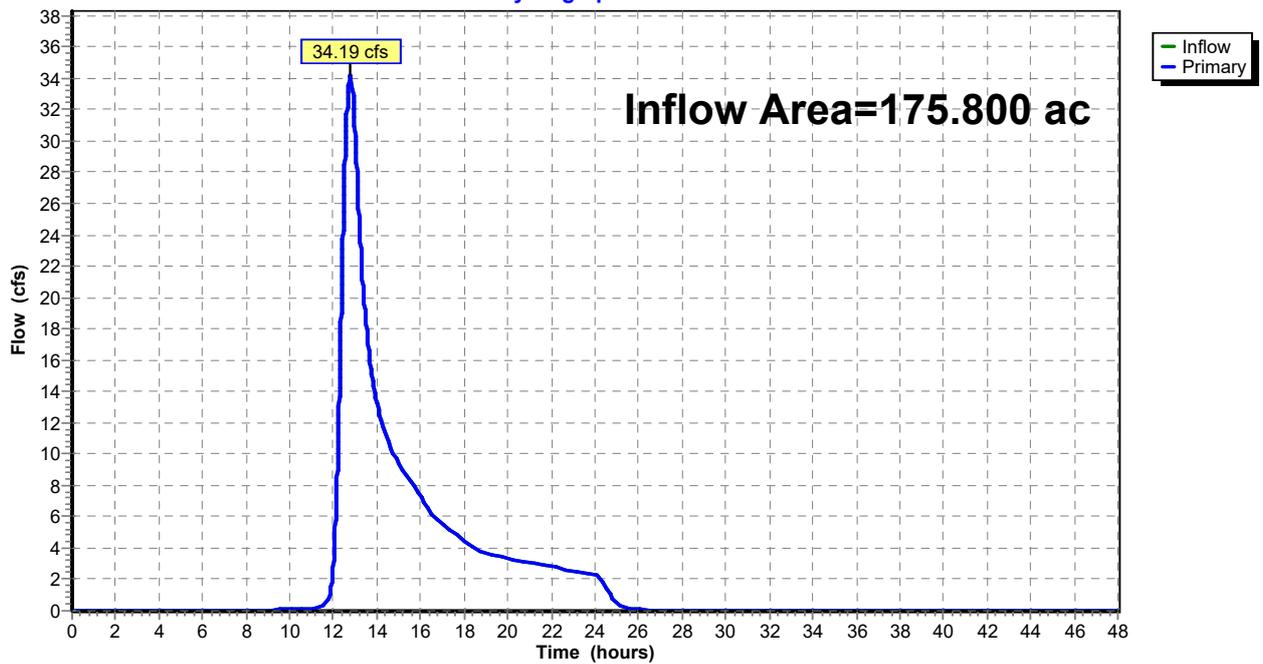
Summary for Link POA_Post: Point of Analysis

Inflow Area = 175.800 ac, 3.60% Impervious, Inflow Depth = 0.53" for 2-yr (Hampden) event
Inflow = 34.19 cfs @ 12.78 hrs, Volume= 7.793 af
Primary = 34.19 cfs @ 12.78 hrs, Volume= 7.793 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link POA_Post: Point of Analysis

Hydrograph



ASMG_221383_Hydrology

Type III 24-hr 10-yr (Hampden) Rainfall=4.48"

Prepared by ITS

Printed 5/4/2022

HydroCAD® 10.10-5a s/n 09112 © 2020 HydroCAD Software Solutions LLC

Page 15

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentDA-2_Post: DA-2 Runoff Area=7.500 ac 16.69% Impervious Runoff Depth=2.80"
 Flow Length=1,705' Slope=0.0711 '/' Tc=7.0 min CN=84 Runoff=23.68 cfs 1.749 af

SubcatchmentDA-5b_Post: DA-5b Runoff Area=0.530 ac 8.15% Impervious Runoff Depth=2.36"
 Flow Length=360' Slope=0.0560 '/' Tc=18.5 min CN=79 Runoff=1.02 cfs 0.104 af

SubcatchmentDA1_Post: DA-1 Runoff Area=151.840 ac 2.58% Impervious Runoff Depth=1.32"
 Flow Length=5,870' Tc=47.5 min CN=65 Runoff=97.52 cfs 16.675 af

SubcatchmentDA3_Post: DA-3 Runoff Area=0.980 ac 72.00% Impervious Runoff Depth=3.69"
 Tc=5.0 min CN=93 Runoff=4.16 cfs 0.301 af

SubcatchmentDA5a_Post: DA-5a Runoff Area=14.950 ac 2.75% Impervious Runoff Depth=1.73"
 Flow Length=890' Tc=19.0 min CN=71 Runoff=20.30 cfs 2.158 af

Pond 1P_Post: Pond 1P Peak Elev=191.91' Storage=27,406 cf Inflow=23.68 cfs 1.749 af
 24.0" Round Culvert n=0.012 L=121.0' S=0.0475 '/' Outflow=11.51 cfs 1.431 af

Pond S1_Post: DA-1 Stor Peak Elev=184.72' Storage=15,380 cf Inflow=113.42 cfs 20.565 af
 Primary=111.96 cfs 20.565 af Secondary=0.00 cfs 0.000 af Outflow=111.96 cfs 20.565 af

Link POA_Post: Point of Analysis Inflow=112.30 cfs 20.669 af
 Primary=112.30 cfs 20.669 af

Total Runoff Area = 175.800 ac Runoff Volume = 20.988 af Average Runoff Depth = 1.43"
96.40% Pervious = 169.466 ac 3.60% Impervious = 6.334 ac

Summary for Subcatchment DA-2_Post: DA-2

Runoff = 23.68 cfs @ 12.10 hrs, Volume= 1.749 af, Depth= 2.80"

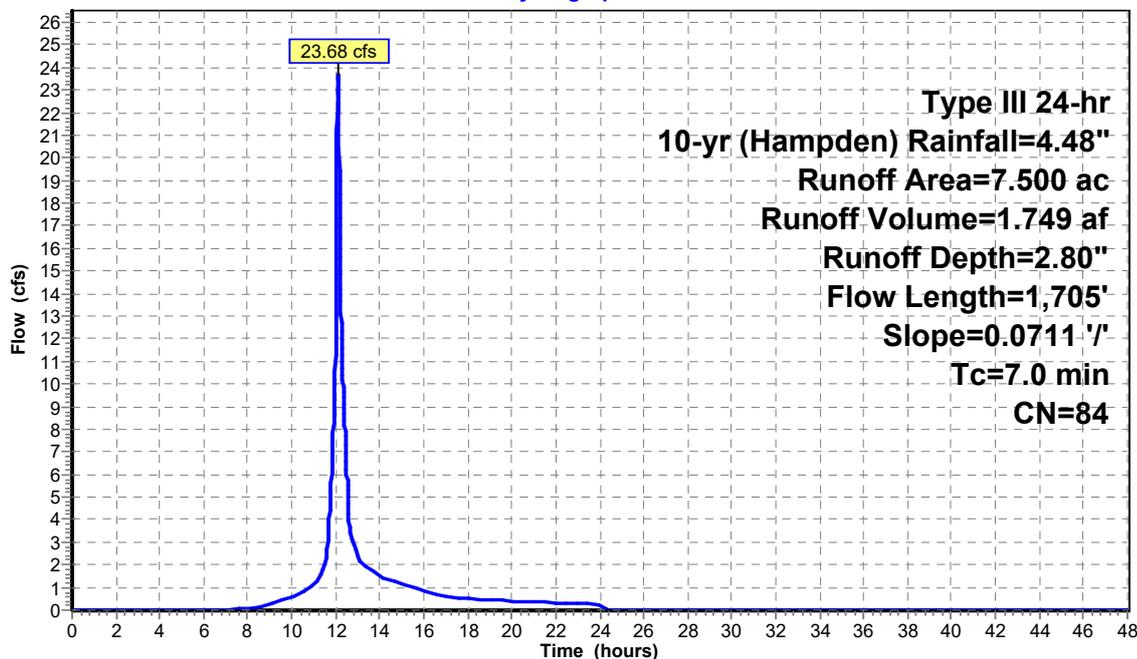
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10-yr (Hampden) Rainfall=4.48"

Area (ac)	CN	Description
1.530	93	Urban industrial, 72% imp, HSG D
2.080	84	Pasture/grassland/range, Fair, HSG D
0.150	98	Water Surface, HSG D
3.740	79	Woods, Fair, HSG D
7.500	84	Weighted Average
6.248		83.31% Pervious Area
1.252		16.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	100	0.0711	2.19		Sheet Flow, Sheet-Rd Smooth surfaces n= 0.011 P2= 2.94"
6.2	1,605	0.0711	4.29		Shallow Concentrated Flow, SCF-Rd Unpaved Kv= 16.1 fps
7.0	1,705	Total			

Subcatchment DA-2_Post: DA-2

Hydrograph



Summary for Subcatchment DA-5b_Post: DA-5b

Runoff = 1.02 cfs @ 12.26 hrs, Volume= 0.104 af, Depth= 2.36"

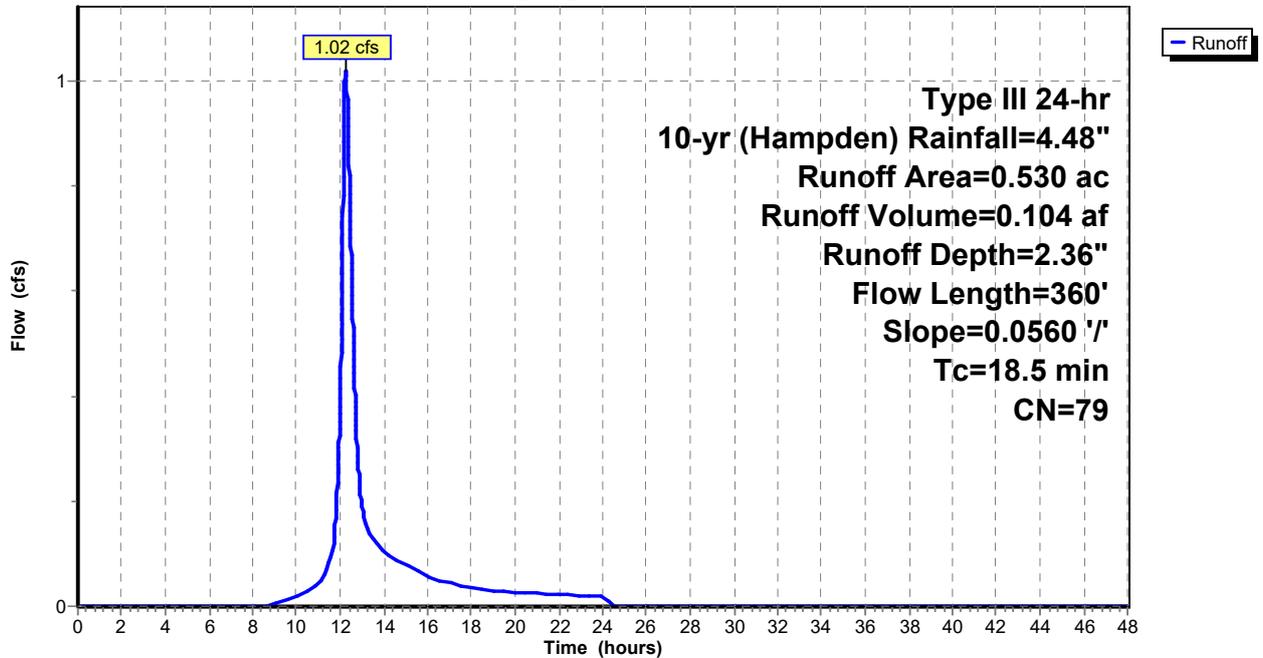
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10-yr (Hampden) Rainfall=4.48"

Area (ac)	CN	Description
0.040	91	Urban industrial, 72% imp, HSG C
0.020	93	Urban industrial, 72% imp, HSG D
0.130	79	Pasture/grassland/range, Fair, HSG C
0.040	84	Pasture/grassland/range, Fair, HSG D
0.140	73	Woods, Fair, HSG C
0.160	79	Woods, Fair, HSG D
0.530	79	Weighted Average
0.487		91.85% Pervious Area
0.043		8.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.8	100	0.0560	0.11		Sheet Flow, Sheet-Woods Woods: Light underbrush n= 0.400 P2= 2.94"
3.7	260	0.0560	1.18		Shallow Concentrated Flow, SCF-Woods Woodland Kv= 5.0 fps
18.5	360	Total			

Subcatchment DA-5b_Post: DA-5b

Hydrograph



Summary for Subcatchment DA1_Post: DA-1

Runoff = 97.52 cfs @ 12.72 hrs, Volume= 16.675 af, Depth= 1.32"

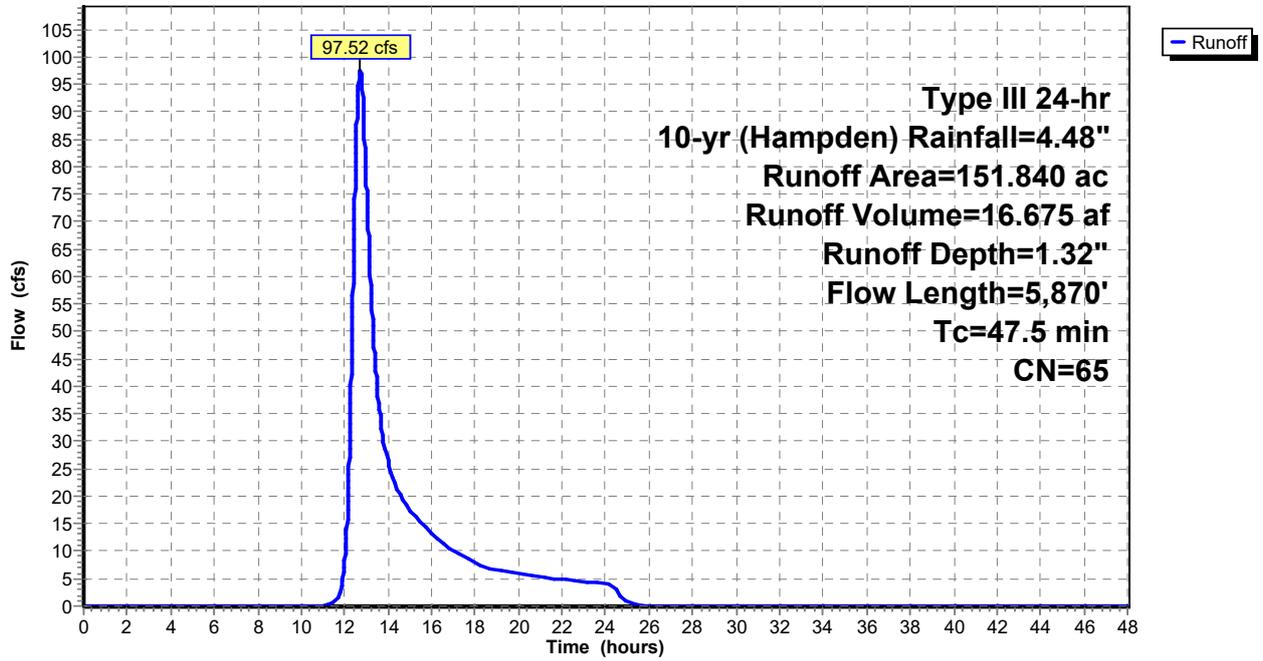
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10-yr (Hampden) Rainfall=4.48"

Area (ac)	CN	Description
0.580	35	Brush, Fair, HSG A
0.450	70	Brush, Fair, HSG C
0.460	77	Brush, Fair, HSG D
0.960	81	Urban industrial, 72% imp, HSG A
1.110	88	Urban industrial, 72% imp, HSG B
0.240	93	Urban industrial, 72% imp, HSG D
2.240	49	Pasture/grassland/range, Fair, HSG A
0.660	69	Pasture/grassland/range, Fair, HSG B
5.730	79	Pasture/grassland/range, Fair, HSG C
1.220	84	Pasture/grassland/range, Fair, HSG D
* 0.170	98	Wetland
* 0.030	98	Wetland
* 2.060	98	Wetland
30.430	36	Woods, Fair, HSG A
27.020	60	Woods, Fair, HSG B
40.240	73	Woods, Fair, HSG C
38.240	79	Woods, Fair, HSG D
151.840	65	Weighted Average
147.917		97.42% Pervious Area
3.923		2.58% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.6	100	0.0581	0.11		Sheet Flow, Sheet-Woods Woods: Light underbrush n= 0.400 P2= 2.94"
24.9	1,800	0.0581	1.21		Shallow Concentrated Flow, SCF-Woods Woodland Kv= 5.0 fps
8.0	3,970	0.0200	8.31	199.43	Parabolic Channel, W=18.00' D=2.00' Area=24.0 sf Perim=18.6' n= 0.030
47.5	5,870	Total			

Subcatchment DA1_Post: DA-1

Hydrograph



Summary for Subcatchment DA3_Post: DA-3

Runoff = 4.16 cfs @ 12.07 hrs, Volume= 0.301 af, Depth= 3.69"

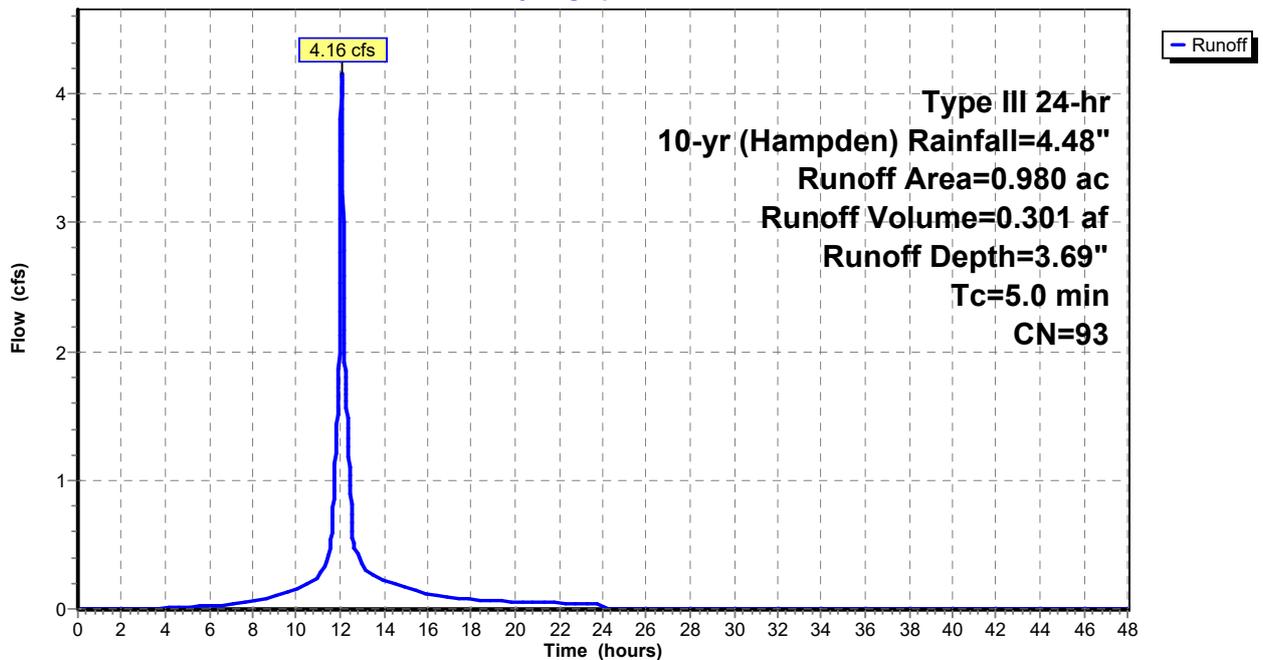
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10-yr (Hampden) Rainfall=4.48"

Area (ac)	CN	Description
0.980	93	Urban industrial, 72% imp, HSG D
0.274		28.00% Pervious Area
0.706		72.00% Impervious Area

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

Subcatchment DA3_Post: DA-3

Hydrograph



Summary for Subcatchment DA5a_Post: DA-5a

Runoff = 20.30 cfs @ 12.27 hrs, Volume= 2.158 af, Depth= 1.73"

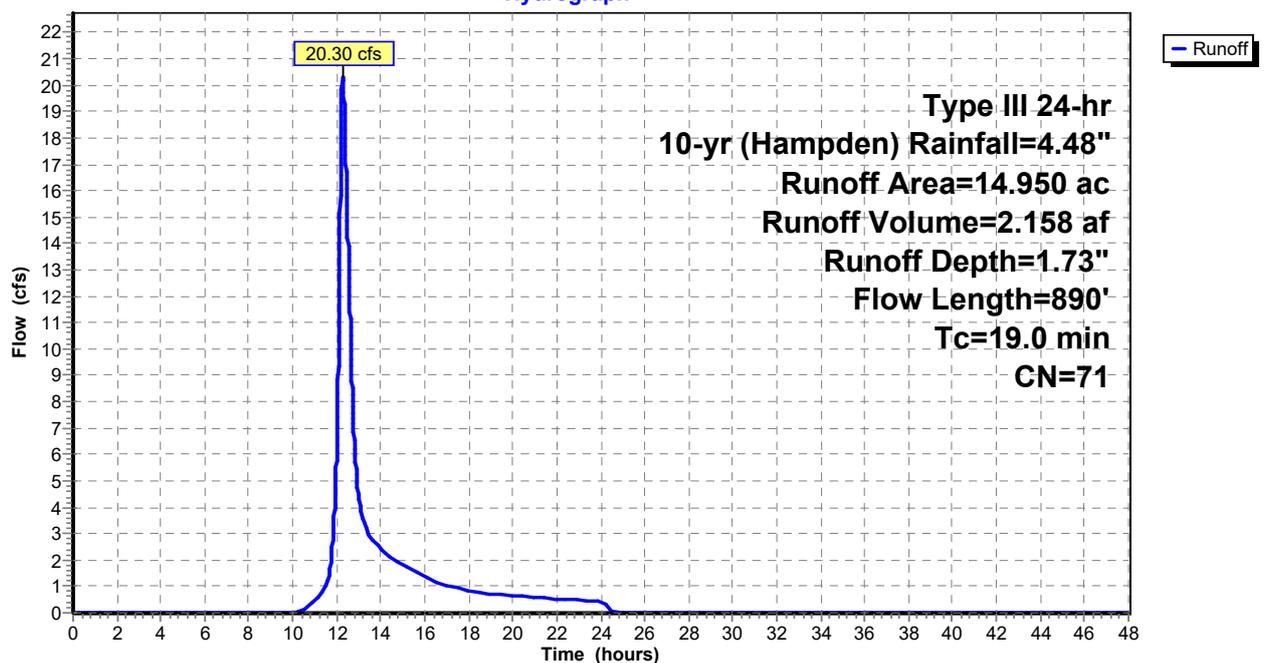
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr (Hampden) Rainfall=4.48"

Area (ac)	CN	Description
0.060	81	Urban industrial, 72% imp, HSG A
0.190	88	Urban industrial, 72% imp, HSG B
0.320	91	Urban industrial, 72% imp, HSG C
0.240	49	Pasture/grassland/range, Fair, HSG A
0.250	69	Pasture/grassland/range, Fair, HSG B
0.310	79	Pasture/grassland/range, Fair, HSG C
0.270	36	Woods, Fair, HSG A
2.340	60	Woods, Fair, HSG B
10.970	73	Woods, Fair, HSG C
14.950	71	Weighted Average
14.540		97.25% Pervious Area
0.410		2.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.6	100	0.1040	0.14		Sheet Flow, Sheet-Woods Woods: Light underbrush n= 0.400 P2= 2.94"
6.9	665	0.1040	1.61		Shallow Concentrated Flow, SCF-Woods Woodland Kv= 5.0 fps
0.5	125	0.0800	4.24		Shallow Concentrated Flow, SCF-Grassed swale Grassed Waterway Kv= 15.0 fps
19.0	890	Total			

Subcatchment DA5a_Post: DA-5a

Hydrograph



Summary for Pond 1P_Post: Pond 1P

Inflow Area = 7.500 ac, 16.69% Impervious, Inflow Depth = 2.80" for 10-yr (Hampden) event
 Inflow = 23.68 cfs @ 12.10 hrs, Volume= 1.749 af
 Outflow = 11.51 cfs @ 12.28 hrs, Volume= 1.431 af, Atten= 51%, Lag= 11.0 min
 Primary = 11.51 cfs @ 12.28 hrs, Volume= 1.431 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 191.91' @ 12.28 hrs Surf.Area= 8,196 sf Storage= 27,406 cf

Plug-Flow detention time= 147.3 min calculated for 1.431 af (82% of inflow)
 Center-of-Mass det. time= 74.7 min (890.5 - 815.9)

Volume	Invert	Avail.Storage	Storage Description
#1	186.00'	51,062 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

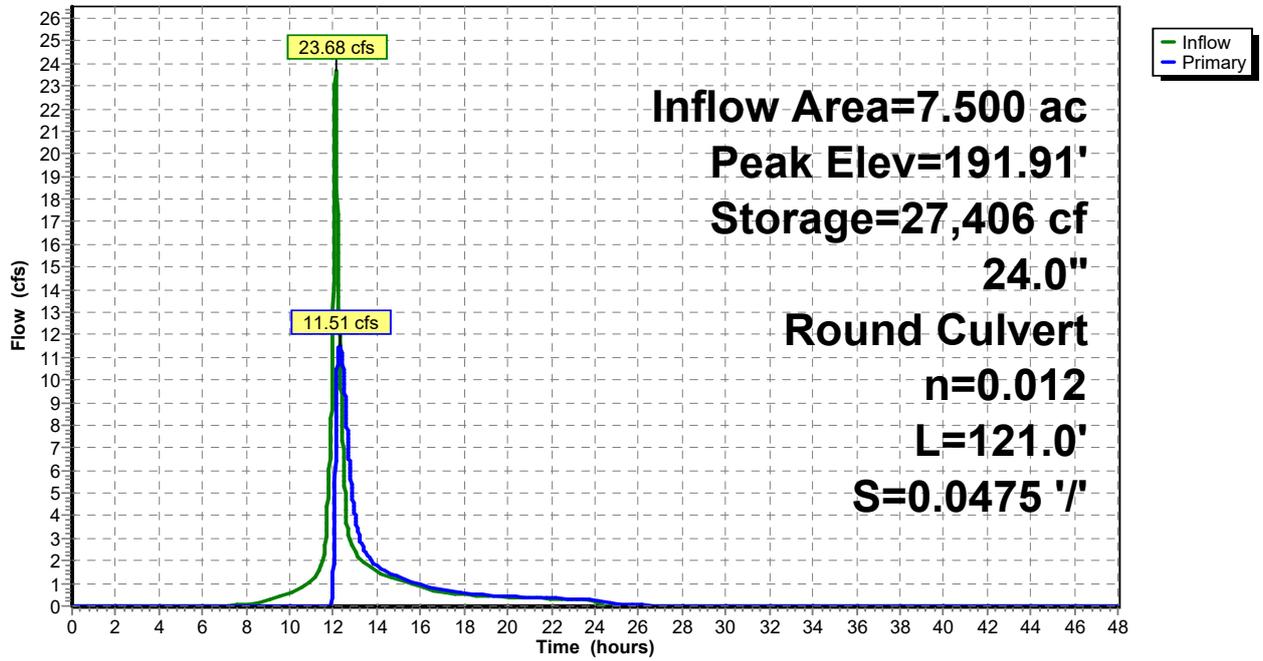
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
186.00	0	0	0
188.00	3,866	3,866	3,866
189.00	5,039	4,453	8,319
190.00	6,026	5,533	13,851
191.00	7,099	6,563	20,414
192.00	8,299	7,699	28,113
194.00	14,650	22,949	51,062

Device	Routing	Invert	Outlet Devices
#1	Primary	190.00'	24.0" Round 24" CPP L= 121.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 190.00' / 184.25' S= 0.0475 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 3.14 sf

Primary OutFlow Max=11.51 cfs @ 12.28 hrs HW=191.91' (Free Discharge)
 ↑1=24" CPP (Inlet Controls 11.51 cfs @ 3.72 fps)

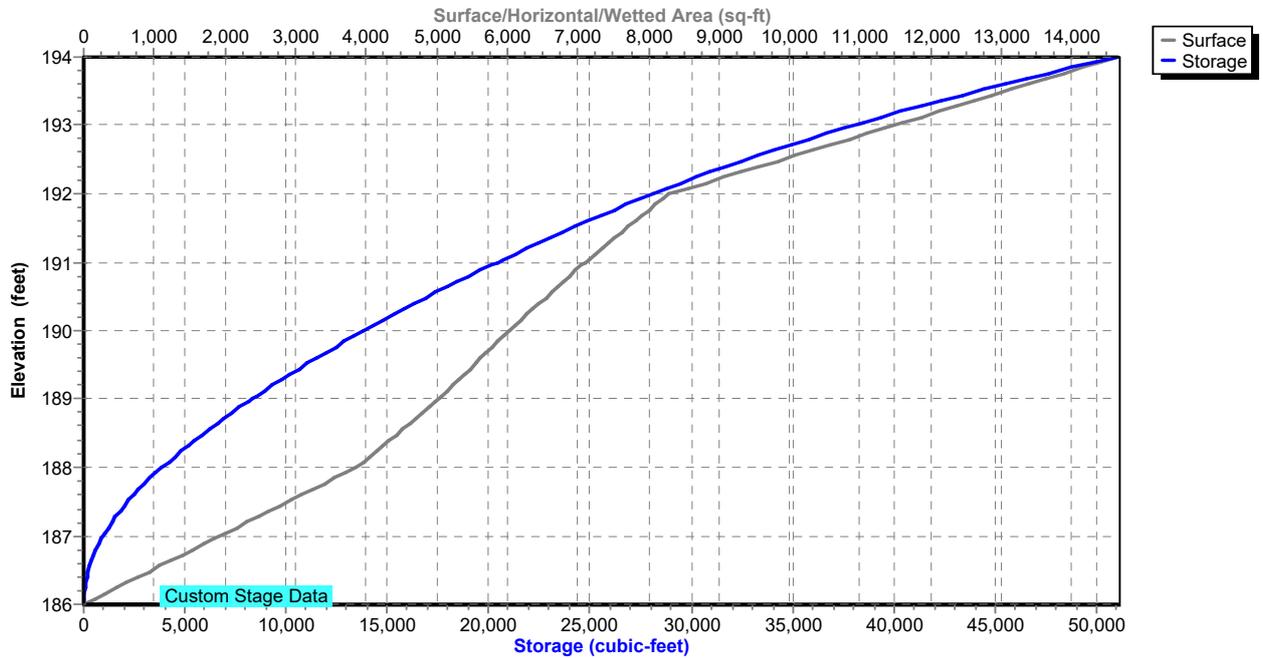
Pond 1P_Post: Pond 1P

Hydrograph



Pond 1P_Post: Pond 1P

Stage-Area-Storage



Summary for Pond S1_Post: DA-1 Stor

Inflow Area = 175.270 ac, 3.59% Impervious, Inflow Depth = 1.41" for 10-yr (Hampden) event
 Inflow = 113.42 cfs @ 12.62 hrs, Volume= 20.565 af
 Outflow = 111.96 cfs @ 12.72 hrs, Volume= 20.565 af, Atten= 1%, Lag= 6.2 min
 Primary = 111.96 cfs @ 12.72 hrs, Volume= 20.565 af
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 184.72' @ 12.72 hrs Surf.Area= 7,304 sf Storage= 15,380 cf

Plug-Flow detention time= 1.9 min calculated for 20.561 af (100% of inflow)
 Center-of-Mass det. time= 1.9 min (900.9 - 899.0)

Volume	Invert	Avail.Storage	Storage Description		
#1	180.00'	236,888 cf	Custom Stage Data (Conic) Listed below (Recalc)		
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)	
180.00	512	0	0	512	
181.00	1,306	879	879	1,313	
182.00	2,393	1,822	2,701	2,410	
183.00	4,058	3,189	5,890	4,087	
184.00	5,691	4,852	10,741	5,739	
185.00	8,000	6,813	17,554	8,066	
186.00	10,421	9,184	26,738	10,511	
188.00	16,620	26,801	53,539	16,764	
190.00	26,218	42,475	96,014	26,417	
192.00	34,530	60,558	156,572	34,820	
194.00	46,063	80,317	236,888	46,440	

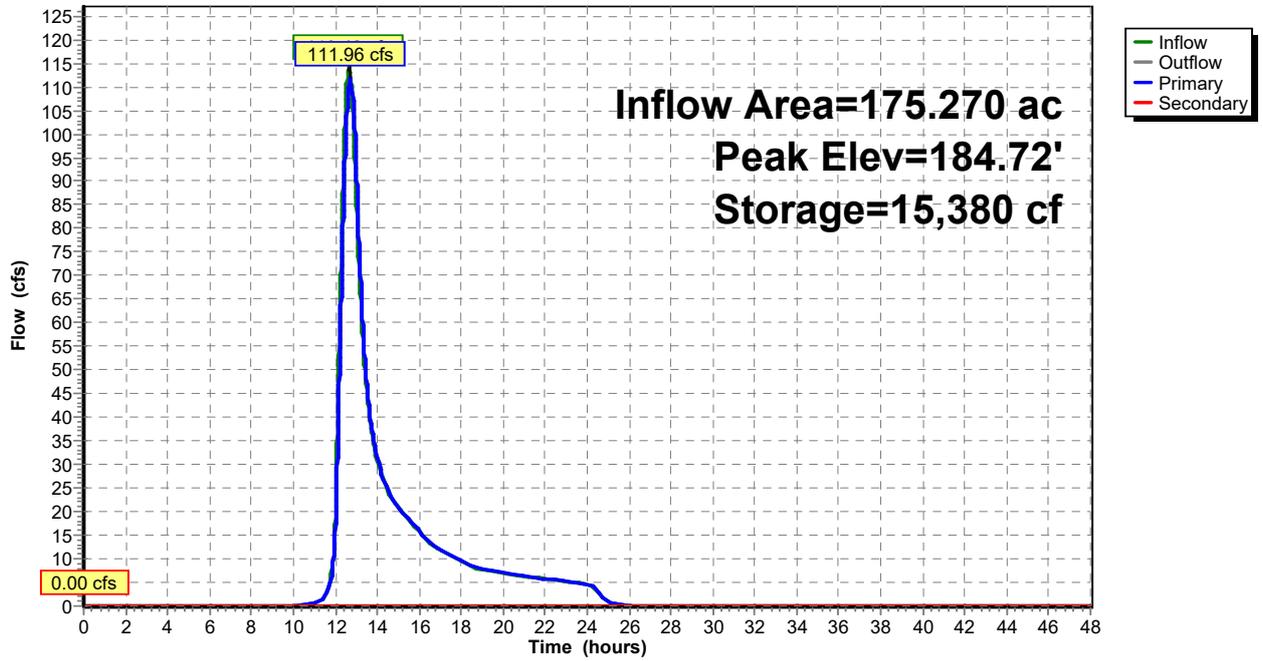
Device	Routing	Invert	Outlet Devices
#1	Primary	180.00'	60.0" Round 60" CMP L= 133.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 180.00' / 173.00' S= 0.0526 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 19.63 sf
#2	Secondary	195.00'	Road overflow, Cv= 2.62 (C= 3.28) Head (feet) 0.00 1.00 2.00 3.00 Width (feet) 38.32 93.77 128.55 162.52

Primary OutFlow Max=112.01 cfs @ 12.72 hrs HW=184.72' (Free Discharge)
 ↑1=60" CMP (Inlet Controls 112.01 cfs @ 5.84 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=180.00' (Free Discharge)
 ↑2=Road overflow (Controls 0.00 cfs)

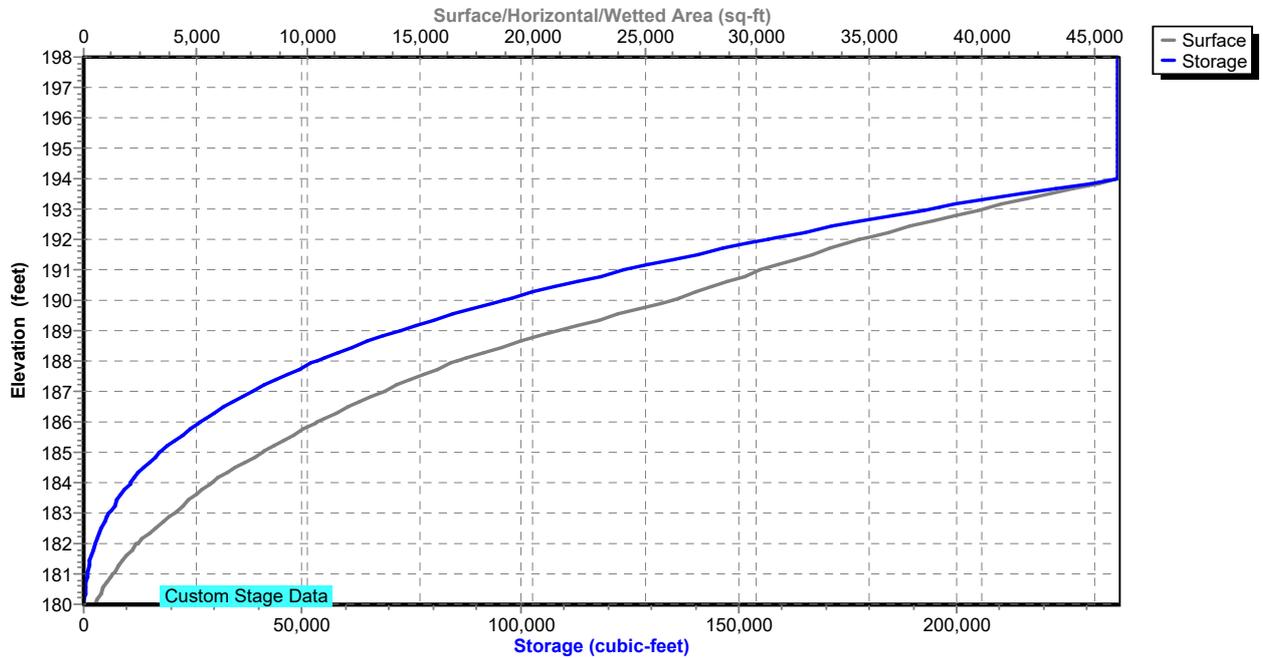
Pond S1_Post: DA-1 Stor

Hydrograph



Pond S1_Post: DA-1 Stor

Stage-Area-Storage



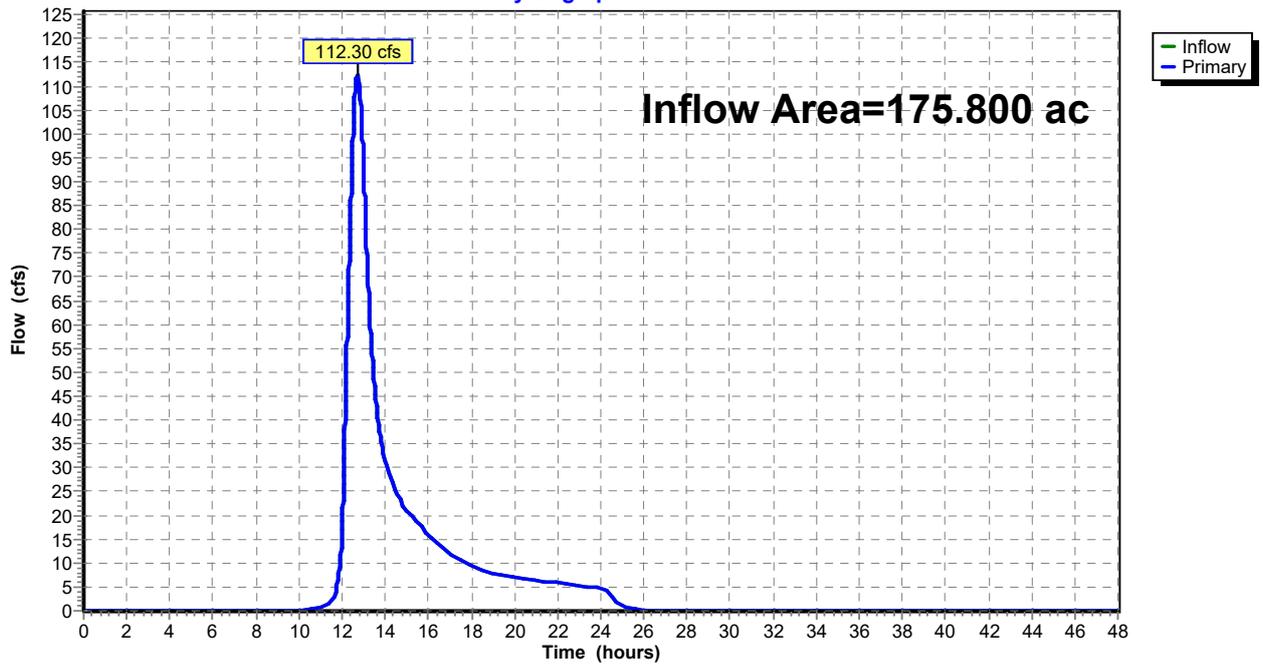
Summary for Link POA_Post: Point of Analysis

Inflow Area = 175.800 ac, 3.60% Impervious, Inflow Depth = 1.41" for 10-yr (Hampden) event
Inflow = 112.30 cfs @ 12.72 hrs, Volume= 20.669 af
Primary = 112.30 cfs @ 12.72 hrs, Volume= 20.669 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link POA_Post: Point of Analysis

Hydrograph



ASMG_221383_Hydrology

Type III 24-hr 100-yr (Hampden) Rainfall=6.93"

Prepared by ITS

Printed 5/4/2022

HydroCAD® 10.10-5a s/n 09112 © 2020 HydroCAD Software Solutions LLC

Page 27

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentDA-2_Post: DA-2 Runoff Area=7.500 ac 16.69% Impervious Runoff Depth=5.07"
 Flow Length=1,705' Slope=0.0711 '/' Tc=7.0 min CN=84 Runoff=42.12 cfs 3.171 af

SubcatchmentDA-5b_Post: DA-5b Runoff Area=0.530 ac 8.15% Impervious Runoff Depth=4.52"
 Flow Length=360' Slope=0.0560 '/' Tc=18.5 min CN=79 Runoff=1.95 cfs 0.200 af

SubcatchmentDA1_Post: DA-1 Runoff Area=151.840 ac 2.58% Impervious Runoff Depth=3.05"
 Flow Length=5,870' Tc=47.5 min CN=65 Runoff=240.48 cfs 38.574 af

SubcatchmentDA3_Post: DA-3 Runoff Area=0.980 ac 72.00% Impervious Runoff Depth=6.10"
 Tc=5.0 min CN=93 Runoff=6.68 cfs 0.498 af

SubcatchmentDA5a_Post: DA-5a Runoff Area=14.950 ac 2.75% Impervious Runoff Depth=3.66"
 Flow Length=890' Tc=19.0 min CN=71 Runoff=44.22 cfs 4.565 af

Pond 1P_Post: Pond 1P Peak Elev=193.41' Storage=43,002 cf Inflow=42.12 cfs 3.171 af
 24.0" Round Culvert n=0.012 L=121.0' S=0.0475 '/' Outflow=18.55 cfs 2.853 af

Pond S1_Post: DA-1 Stor Peak Elev=191.63' Storage=144,053 cf Inflow=276.86 cfs 46.491 af
 Primary=225.51 cfs 46.491 af Secondary=0.00 cfs 0.000 af Outflow=225.51 cfs 46.491 af

Link POA_Post: Point of Analysis Inflow=225.90 cfs 46.690 af
 Primary=225.90 cfs 46.690 af

Total Runoff Area = 175.800 ac Runoff Volume = 47.008 af Average Runoff Depth = 3.21"
96.40% Pervious = 169.466 ac 3.60% Impervious = 6.334 ac

Summary for Subcatchment DA-2_Post: DA-2

Runoff = 42.12 cfs @ 12.10 hrs, Volume= 3.171 af, Depth= 5.07"

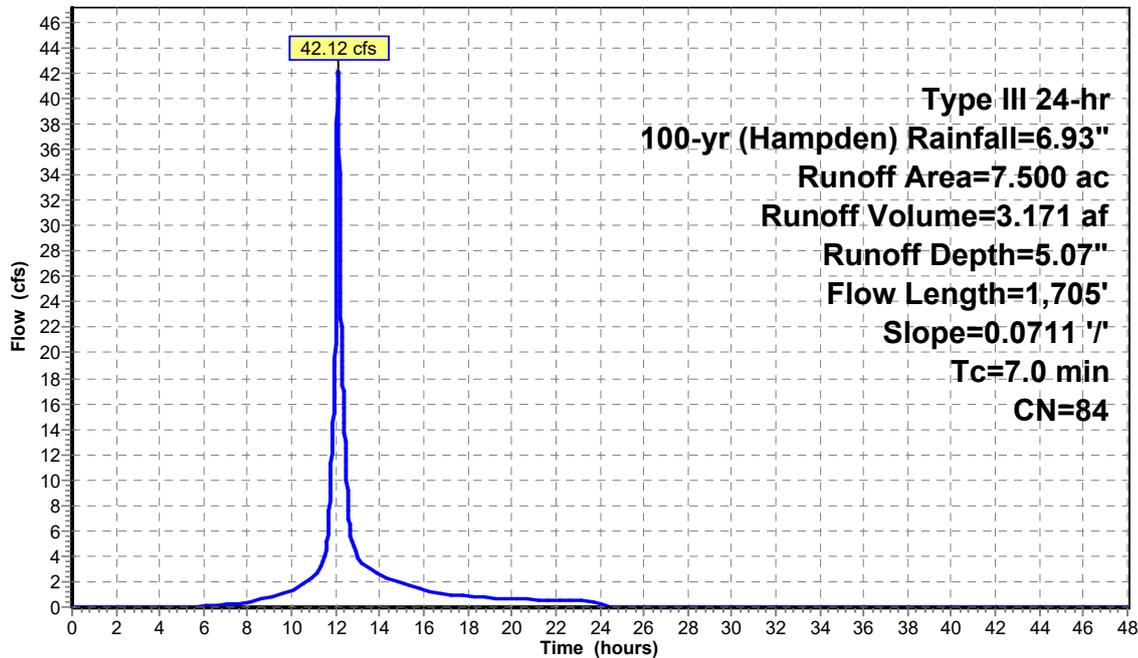
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-yr (Hampden) Rainfall=6.93"

Area (ac)	CN	Description
1.530	93	Urban industrial, 72% imp, HSG D
2.080	84	Pasture/grassland/range, Fair, HSG D
0.150	98	Water Surface, HSG D
3.740	79	Woods, Fair, HSG D
7.500	84	Weighted Average
6.248		83.31% Pervious Area
1.252		16.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	100	0.0711	2.19		Sheet Flow, Sheet-Rd Smooth surfaces n= 0.011 P2= 2.94"
6.2	1,605	0.0711	4.29		Shallow Concentrated Flow, SCF-Rd Unpaved Kv= 16.1 fps
7.0	1,705	Total			

Subcatchment DA-2_Post: DA-2

Hydrograph



Summary for Subcatchment DA-5b_Post: DA-5b

Runoff = 1.95 cfs @ 12.25 hrs, Volume= 0.200 af, Depth= 4.52"

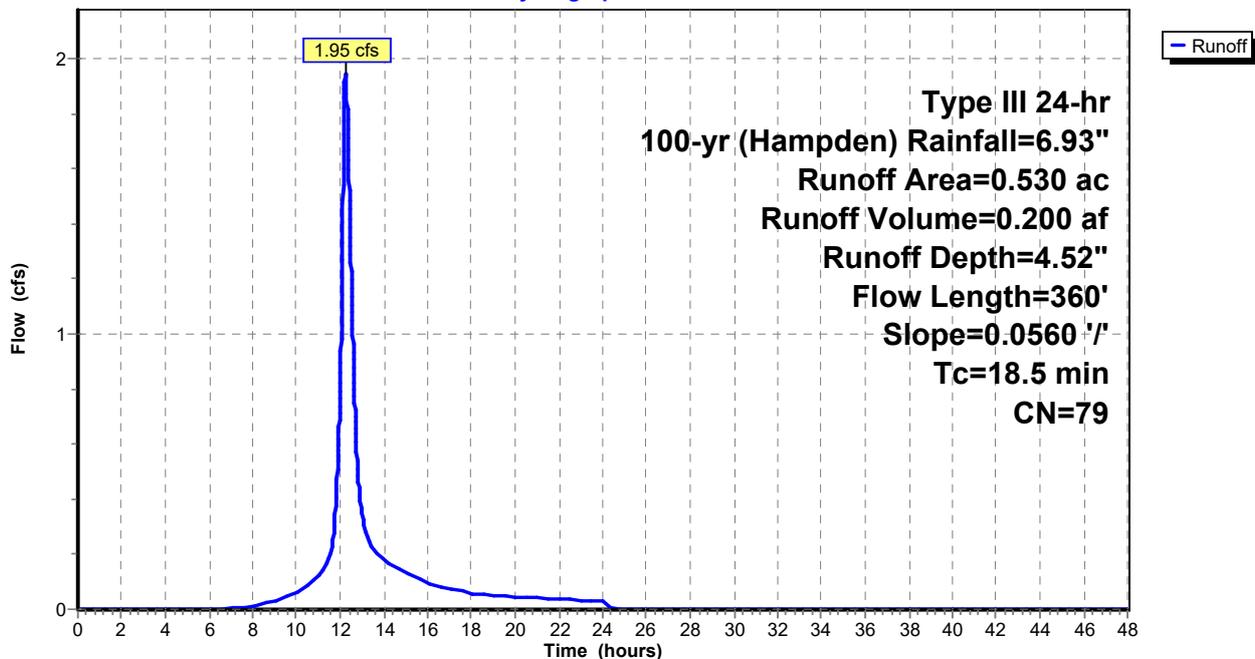
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-yr (Hampden) Rainfall=6.93"

Area (ac)	CN	Description
0.040	91	Urban industrial, 72% imp, HSG C
0.020	93	Urban industrial, 72% imp, HSG D
0.130	79	Pasture/grassland/range, Fair, HSG C
0.040	84	Pasture/grassland/range, Fair, HSG D
0.140	73	Woods, Fair, HSG C
0.160	79	Woods, Fair, HSG D
0.530	79	Weighted Average
0.487		91.85% Pervious Area
0.043		8.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.8	100	0.0560	0.11		Sheet Flow, Sheet-Woods
					Woods: Light underbrush n= 0.400 P2= 2.94"
3.7	260	0.0560	1.18		Shallow Concentrated Flow, SCF-Woods
					Woodland Kv= 5.0 fps
18.5	360	Total			

Subcatchment DA-5b_Post: DA-5b

Hydrograph



Summary for Subcatchment DA1_Post: DA-1

Runoff = 240.48 cfs @ 12.67 hrs, Volume= 38.574 af, Depth= 3.05"

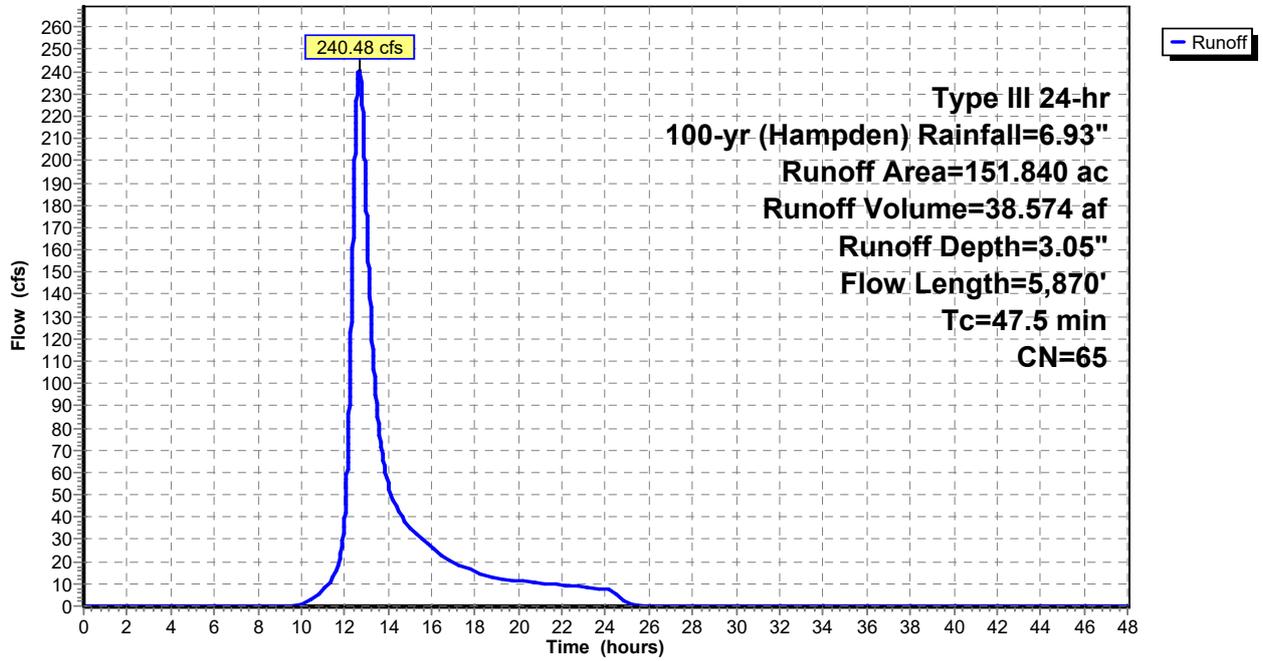
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-yr (Hampden) Rainfall=6.93"

Area (ac)	CN	Description
0.580	35	Brush, Fair, HSG A
0.450	70	Brush, Fair, HSG C
0.460	77	Brush, Fair, HSG D
0.960	81	Urban industrial, 72% imp, HSG A
1.110	88	Urban industrial, 72% imp, HSG B
0.240	93	Urban industrial, 72% imp, HSG D
2.240	49	Pasture/grassland/range, Fair, HSG A
0.660	69	Pasture/grassland/range, Fair, HSG B
5.730	79	Pasture/grassland/range, Fair, HSG C
1.220	84	Pasture/grassland/range, Fair, HSG D
* 0.170	98	Wetland
* 0.030	98	Wetland
* 2.060	98	Wetland
30.430	36	Woods, Fair, HSG A
27.020	60	Woods, Fair, HSG B
40.240	73	Woods, Fair, HSG C
38.240	79	Woods, Fair, HSG D
151.840	65	Weighted Average
147.917		97.42% Pervious Area
3.923		2.58% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.6	100	0.0581	0.11		Sheet Flow, Sheet-Woods Woods: Light underbrush n= 0.400 P2= 2.94"
24.9	1,800	0.0581	1.21		Shallow Concentrated Flow, SCF-Woods Woodland Kv= 5.0 fps
8.0	3,970	0.0200	8.31	199.43	Parabolic Channel, W=18.00' D=2.00' Area=24.0 sf Perim=18.6' n= 0.030
47.5	5,870	Total			

Subcatchment DA1_Post: DA-1

Hydrograph



Summary for Subcatchment DA3_Post: DA-3

Runoff = 6.68 cfs @ 12.07 hrs, Volume= 0.498 af, Depth= 6.10"

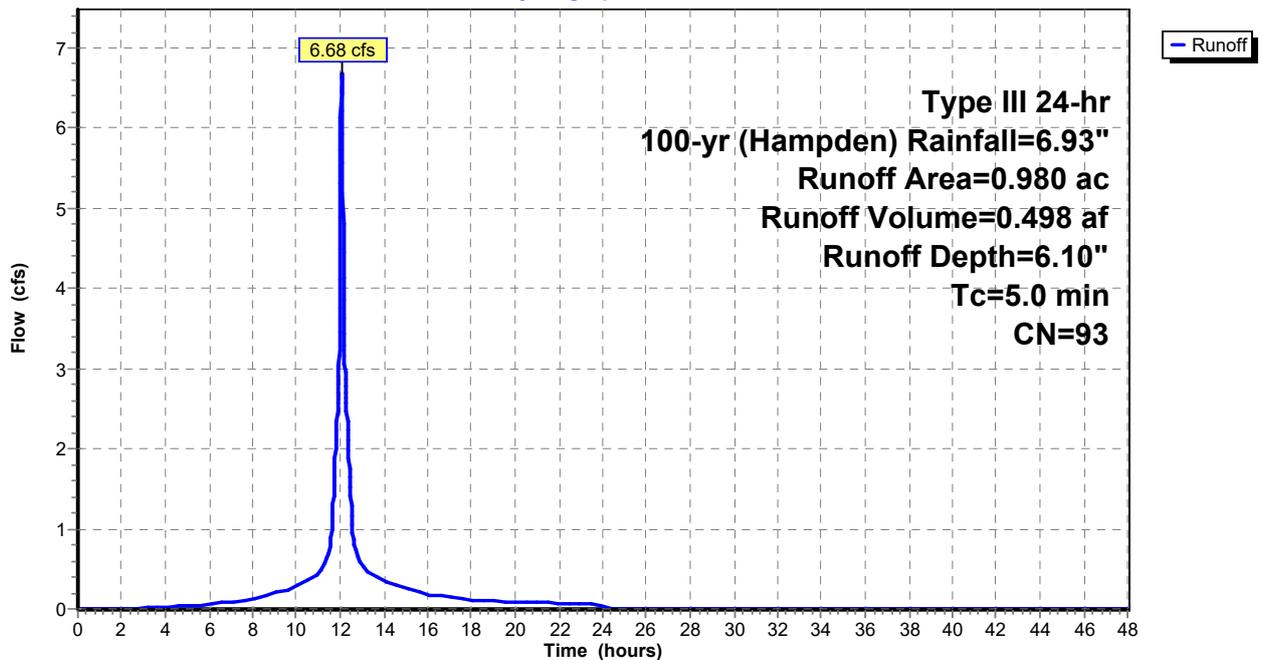
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-yr (Hampden) Rainfall=6.93"

Area (ac)	CN	Description
0.980	93	Urban industrial, 72% imp, HSG D
0.274		28.00% Pervious Area
0.706		72.00% Impervious Area

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

Subcatchment DA3_Post: DA-3

Hydrograph



Summary for Subcatchment DA5a_Post: DA-5a

Runoff = 44.22 cfs @ 12.26 hrs, Volume= 4.565 af, Depth= 3.66"

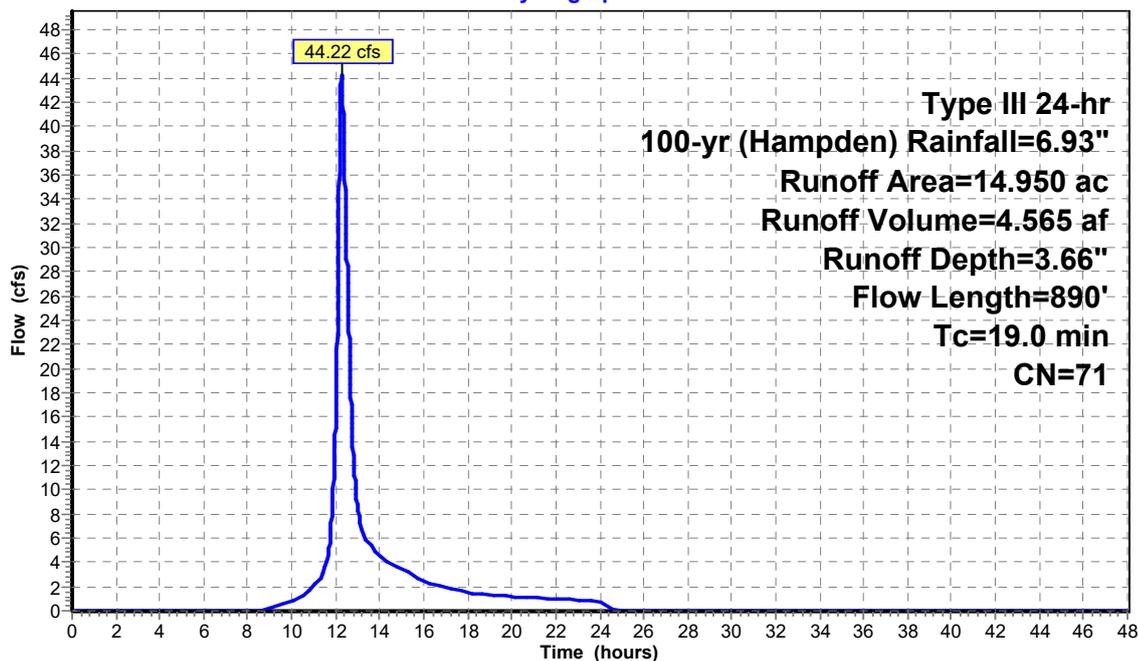
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-yr (Hampden) Rainfall=6.93"

Area (ac)	CN	Description
0.060	81	Urban industrial, 72% imp, HSG A
0.190	88	Urban industrial, 72% imp, HSG B
0.320	91	Urban industrial, 72% imp, HSG C
0.240	49	Pasture/grassland/range, Fair, HSG A
0.250	69	Pasture/grassland/range, Fair, HSG B
0.310	79	Pasture/grassland/range, Fair, HSG C
0.270	36	Woods, Fair, HSG A
2.340	60	Woods, Fair, HSG B
10.970	73	Woods, Fair, HSG C
14.950	71	Weighted Average
14.540		97.25% Pervious Area
0.410		2.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.6	100	0.1040	0.14		Sheet Flow, Sheet-Woods Woods: Light underbrush n= 0.400 P2= 2.94"
6.9	665	0.1040	1.61		Shallow Concentrated Flow, SCF-Woods Woodland Kv= 5.0 fps
0.5	125	0.0800	4.24		Shallow Concentrated Flow, SCF-Grassed swale Grassed Waterway Kv= 15.0 fps
19.0	890	Total			

Subcatchment DA5a_Post: DA-5a

Hydrograph



Summary for Pond 1P_Post: Pond 1P

Inflow Area = 7.500 ac, 16.69% Impervious, Inflow Depth = 5.07" for 100-yr (Hampden) event
 Inflow = 42.12 cfs @ 12.10 hrs, Volume= 3.171 af
 Outflow = 18.55 cfs @ 12.31 hrs, Volume= 2.853 af, Atten= 56%, Lag= 12.5 min
 Primary = 18.55 cfs @ 12.31 hrs, Volume= 2.853 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 193.41' @ 12.31 hrs Surf.Area= 12,784 sf Storage= 43,002 cf

Plug-Flow detention time= 106.8 min calculated for 2.853 af (90% of inflow)
 Center-of-Mass det. time= 58.1 min (857.2 - 799.1)

Volume	Invert	Avail.Storage	Storage Description
#1	186.00'	51,062 cf	Custom Stage Data (Prismatic) , listed below (Recalc)

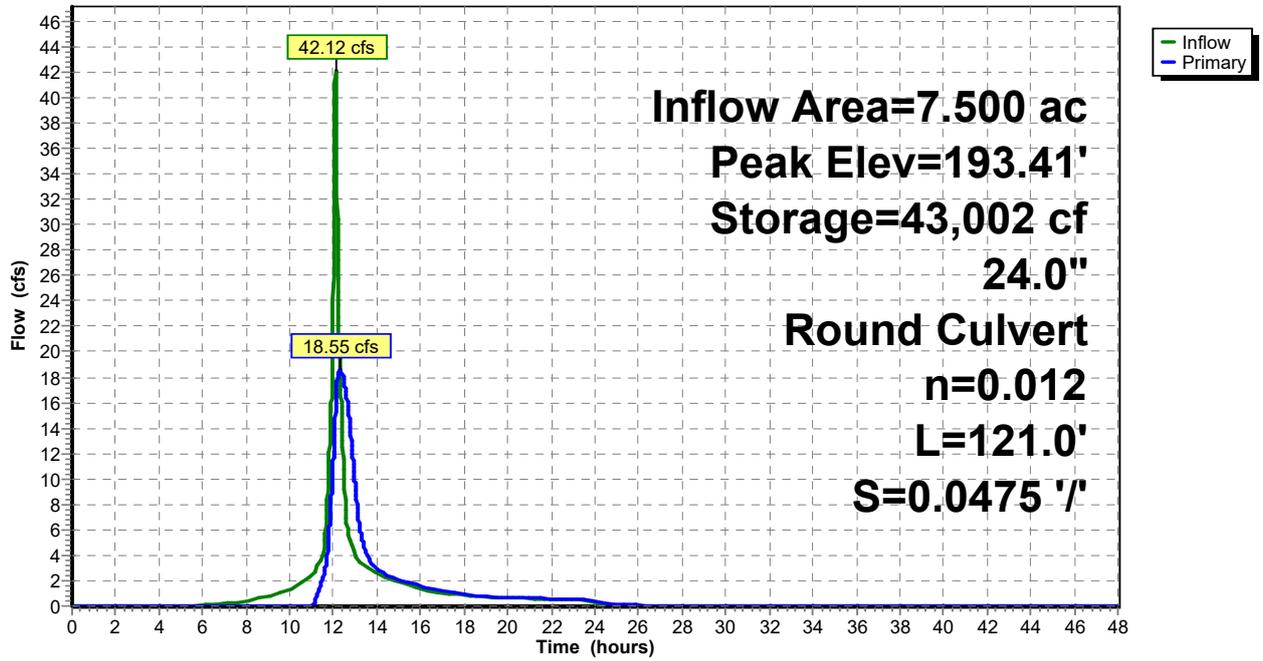
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
186.00	0	0	0
188.00	3,866	3,866	3,866
189.00	5,039	4,453	8,319
190.00	6,026	5,533	13,851
191.00	7,099	6,563	20,414
192.00	8,299	7,699	28,113
194.00	14,650	22,949	51,062

Device	Routing	Invert	Outlet Devices
#1	Primary	190.00'	24.0" Round 24" CPP L= 121.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 190.00' / 184.25' S= 0.0475 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 3.14 sf

Primary OutFlow Max=18.55 cfs @ 12.31 hrs HW=193.41' (Free Discharge)
 ↑1=24" CPP (Inlet Controls 18.55 cfs @ 5.90 fps)

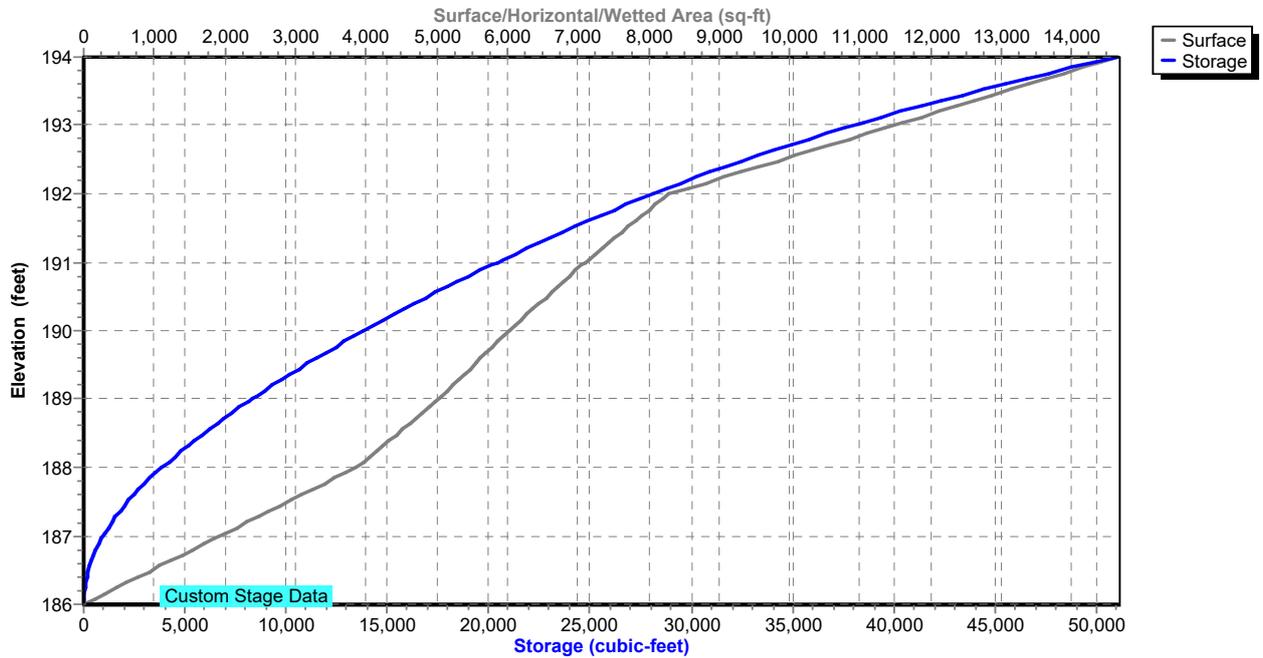
Pond 1P_Post: Pond 1P

Hydrograph



Pond 1P_Post: Pond 1P

Stage-Area-Storage



Summary for Pond S1_Post: DA-1 Stor

Inflow Area = 175.270 ac, 3.59% Impervious, Inflow Depth = 3.18" for 100-yr (Hampden) event
 Inflow = 276.86 cfs @ 12.62 hrs, Volume= 46.491 af
 Outflow = 225.51 cfs @ 12.90 hrs, Volume= 46.491 af, Atten= 19%, Lag= 17.2 min
 Primary = 225.51 cfs @ 12.90 hrs, Volume= 46.491 af
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 191.63' @ 12.90 hrs Surf.Area= 32,900 sf Storage= 144,053 cf

Plug-Flow detention time= 4.5 min calculated for 46.481 af (100% of inflow)
 Center-of-Mass det. time= 4.5 min (878.9 - 874.4)

Volume	Invert	Avail.Storage	Storage Description		
#1	180.00'	236,888 cf	Custom Stage Data (Conic) Listed below (Recalc)		
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)	
180.00	512	0	0	512	
181.00	1,306	879	879	1,313	
182.00	2,393	1,822	2,701	2,410	
183.00	4,058	3,189	5,890	4,087	
184.00	5,691	4,852	10,741	5,739	
185.00	8,000	6,813	17,554	8,066	
186.00	10,421	9,184	26,738	10,511	
188.00	16,620	26,801	53,539	16,764	
190.00	26,218	42,475	96,014	26,417	
192.00	34,530	60,558	156,572	34,820	
194.00	46,063	80,317	236,888	46,440	

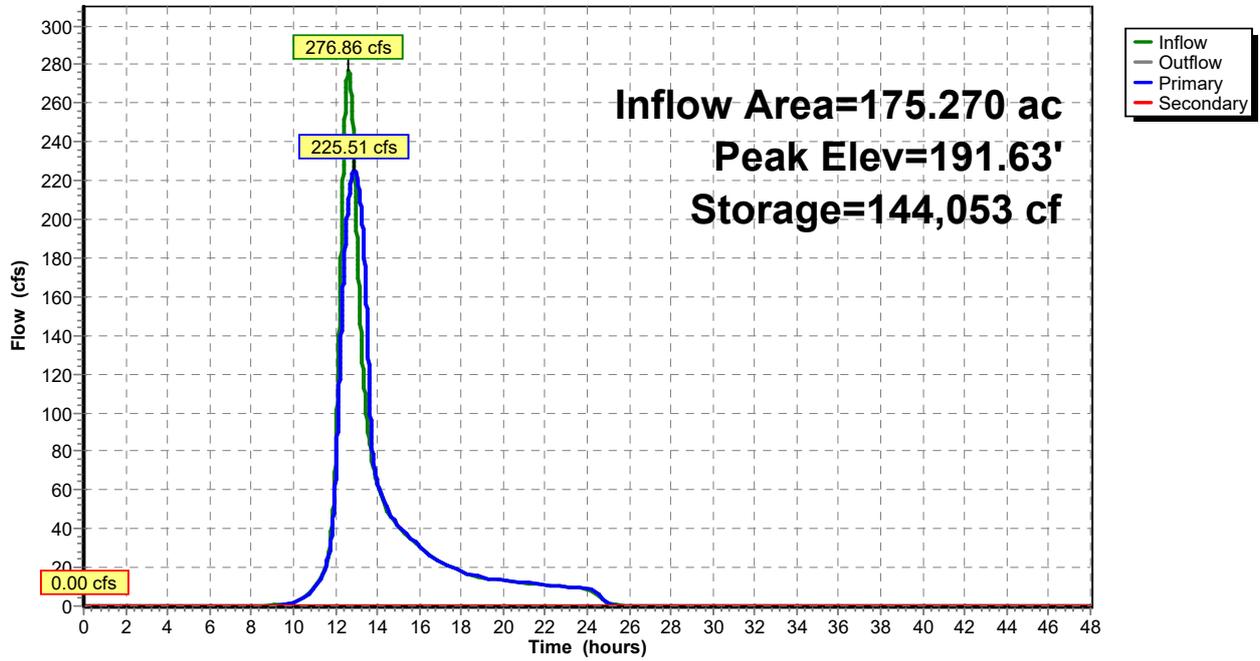
Device	Routing	Invert	Outlet Devices
#1	Primary	180.00'	60.0" Round 60" CMP L= 133.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 180.00' / 173.00' S= 0.0526 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 19.63 sf
#2	Secondary	195.00'	Road overflow, Cv= 2.62 (C= 3.28) Head (feet) 0.00 1.00 2.00 3.00 Width (feet) 38.32 93.77 128.55 162.52

Primary OutFlow Max=225.50 cfs @ 12.90 hrs HW=191.63' (Free Discharge)
 ↑1=60" CMP (Inlet Controls 225.50 cfs @ 11.48 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=180.00' (Free Discharge)
 ↑2=Road overflow (Controls 0.00 cfs)

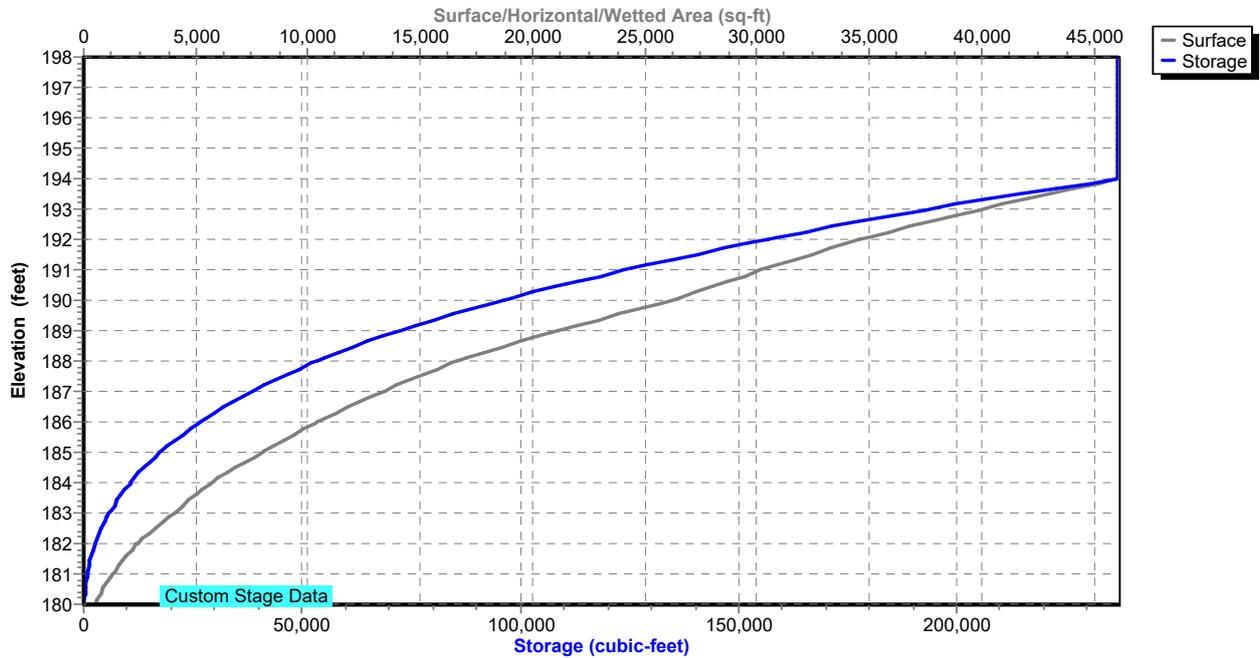
Pond S1_Post: DA-1 Stor

Hydrograph



Pond S1_Post: DA-1 Stor

Stage-Area-Storage

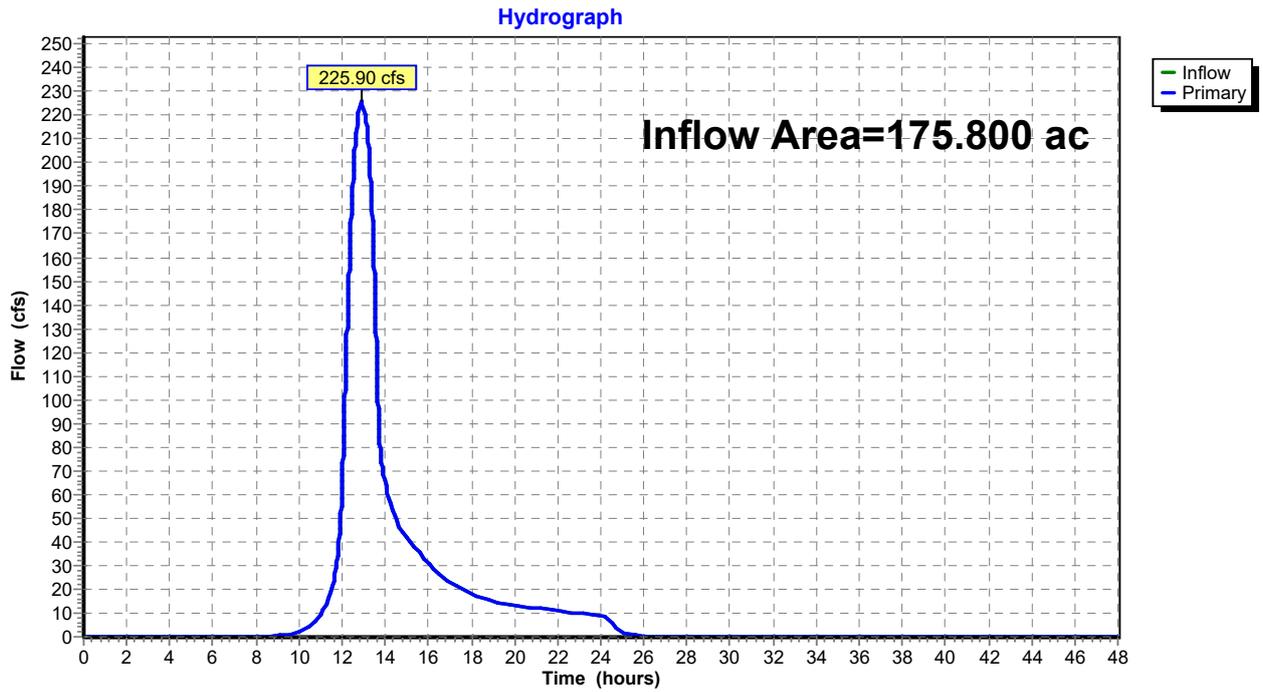


Summary for Link POA_Post: Point of Analysis

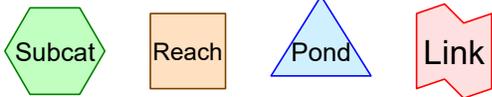
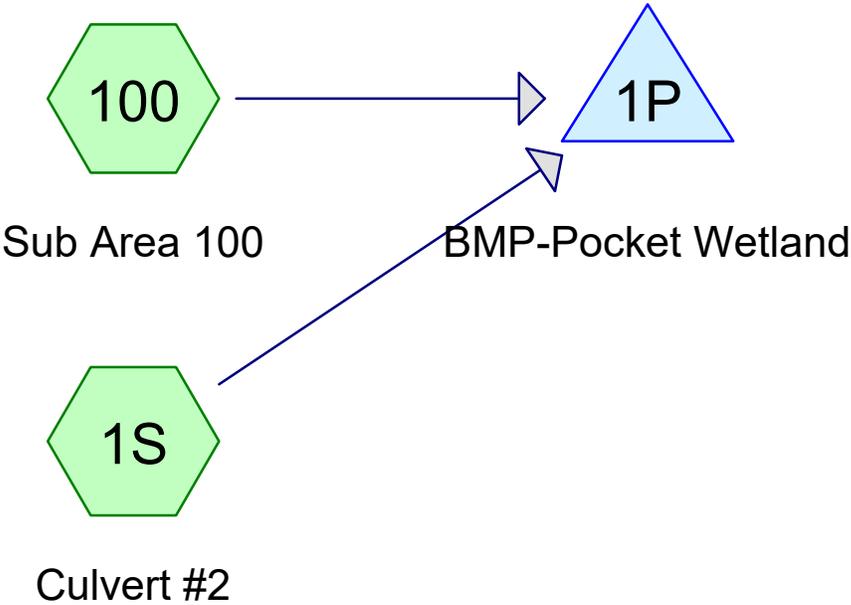
Inflow Area = 175.800 ac, 3.60% Impervious, Inflow Depth = 3.19" for 100-yr (Hampden) event
Inflow = 225.90 cfs @ 12.90 hrs, Volume= 46.690 af
Primary = 225.90 cfs @ 12.90 hrs, Volume= 46.690 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link POA_Post: Point of Analysis



POST-DEVELOPMENT



ASMG_221383_BMP

Prepared by ITS

HydroCAD® 10.00-19 s/n 08362 © 2016 HydroCAD Software Solutions LLC

Printed 5/2/2022

Page 2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
3.666	85	Gravel roads, HSG B (1S, 100)
0.304	79	Woods, Fair, HSG D (100)
3.969	85	TOTAL AREA

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: Culvert #2

Runoff Area=2.500 ac 0.00% Impervious Runoff Depth=1.54"
Tc=5.0 min CN=85 Runoff=4.67 cfs 0.320 af

Subcatchment100: Sub Area 100

Runoff Area=64,010 sf 0.00% Impervious Runoff Depth=1.47"
Flow Length=859' Tc=5.0 min CN=84 Runoff=2.62 cfs 0.180 af

Pond 1P: BMP-PocketWetland

Peak Elev=187.06' Storage=15,785 cf Inflow=7.29 cfs 0.500 af
Outflow=0.38 cfs 0.145 af

Total Runoff Area = 3.969 ac Runoff Volume = 0.500 af Average Runoff Depth = 1.51"
100.00% Pervious = 3.969 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: Culvert #2

Runoff = 4.67 cfs @ 12.08 hrs, Volume= 0.320 af, Depth= 1.54"

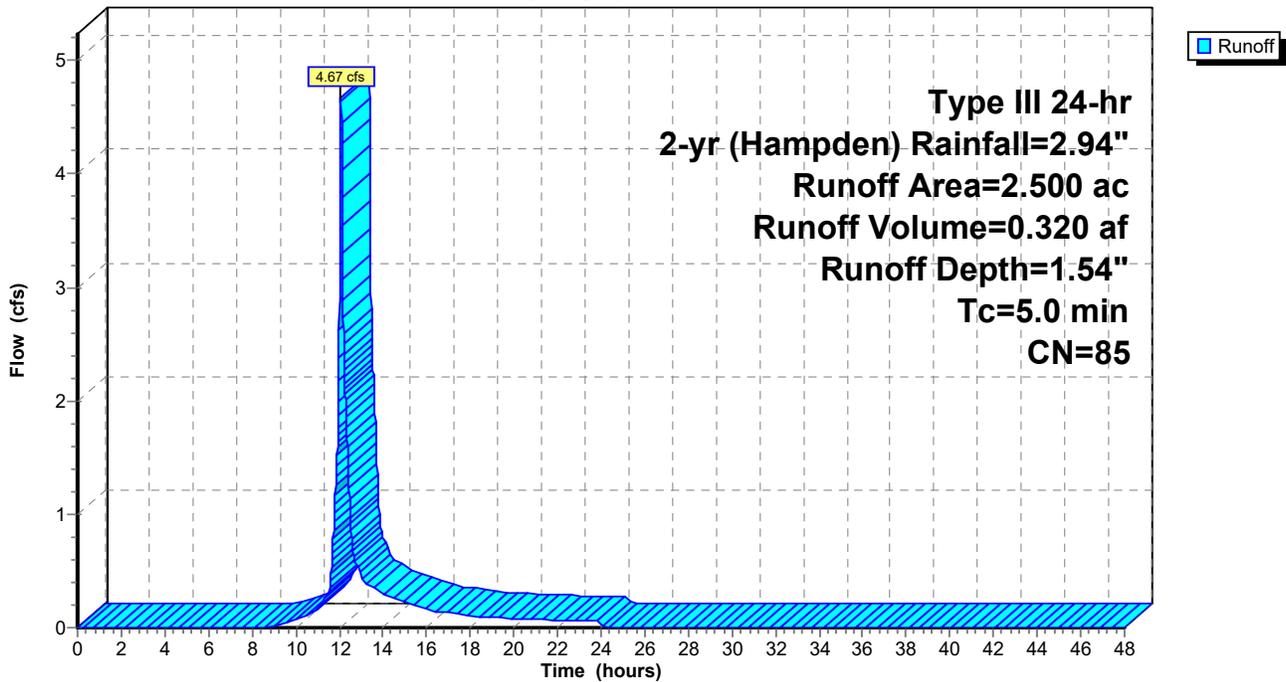
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type III 24-hr 2-yr (Hampden) Rainfall=2.94"

Area (ac)	CN	Description
2.500	85	Gravel roads, HSG B
2.500		100.00% Pervious Area

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

Subcatchment 1S: Culvert #2

Hydrograph



Summary for Subcatchment 100: Sub Area 100

Runoff = 2.62 cfs @ 12.08 hrs, Volume= 0.180 af, Depth= 1.47"

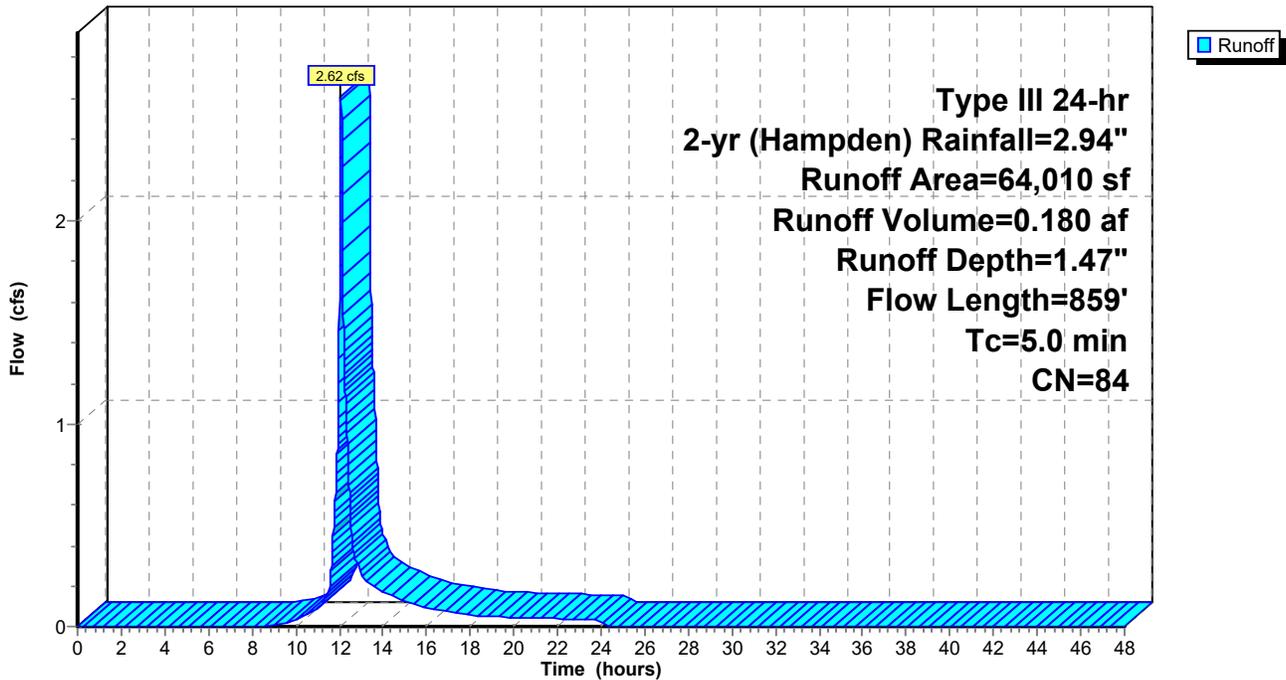
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type III 24-hr 2-yr (Hampden) Rainfall=2.94"

Area (sf)	CN	Description
50,785	85	Gravel roads, HSG B
13,225	79	Woods, Fair, HSG D
64,010	84	Weighted Average
64,010		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	100	0.0500	1.90		Sheet Flow, Sheet-Gravel Smooth surfaces n= 0.011 P2= 2.94"
2.6	720	0.0800	4.55		Shallow Concentrated Flow, SCF-Gravel Unpaved Kv= 16.1 fps
0.0	39	0.0500	13.29	23.49	Pipe Channel, Pipe 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Corrugated PE, smooth interior
3.5	859	Total, Increased to minimum Tc = 5.0 min			

Subcatchment 100: Sub Area 100

Hydrograph



Summary for Pond 1P: BMP-Pocket Wetland

Stage-area for elev 186 assumed based on culvert inverts.

Stage-area for elev 188-192 from civil survey.

Stage-area for elev 194 from KLF surface.

Inflow Area = 3.969 ac, 0.00% Impervious, Inflow Depth = 1.51" for 2-yr (Hampden) event
 Inflow = 7.29 cfs @ 12.08 hrs, Volume= 0.500 af
 Outflow = 0.38 cfs @ 14.78 hrs, Volume= 0.145 af, Atten= 95%, Lag= 162.0 min
 Primary = 0.38 cfs @ 14.78 hrs, Volume= 0.145 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 187.06' @ 14.78 hrs Surf.Area= 5,406 sf Storage= 15,785 cf

Plug-Flow detention time= 384.3 min calculated for 0.145 af (29% of inflow)
 Center-of-Mass det. time= 252.1 min (1,082.4 - 830.3)

Volume	Invert	Avail.Storage	Storage Description
#1	182.00'	21,138 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

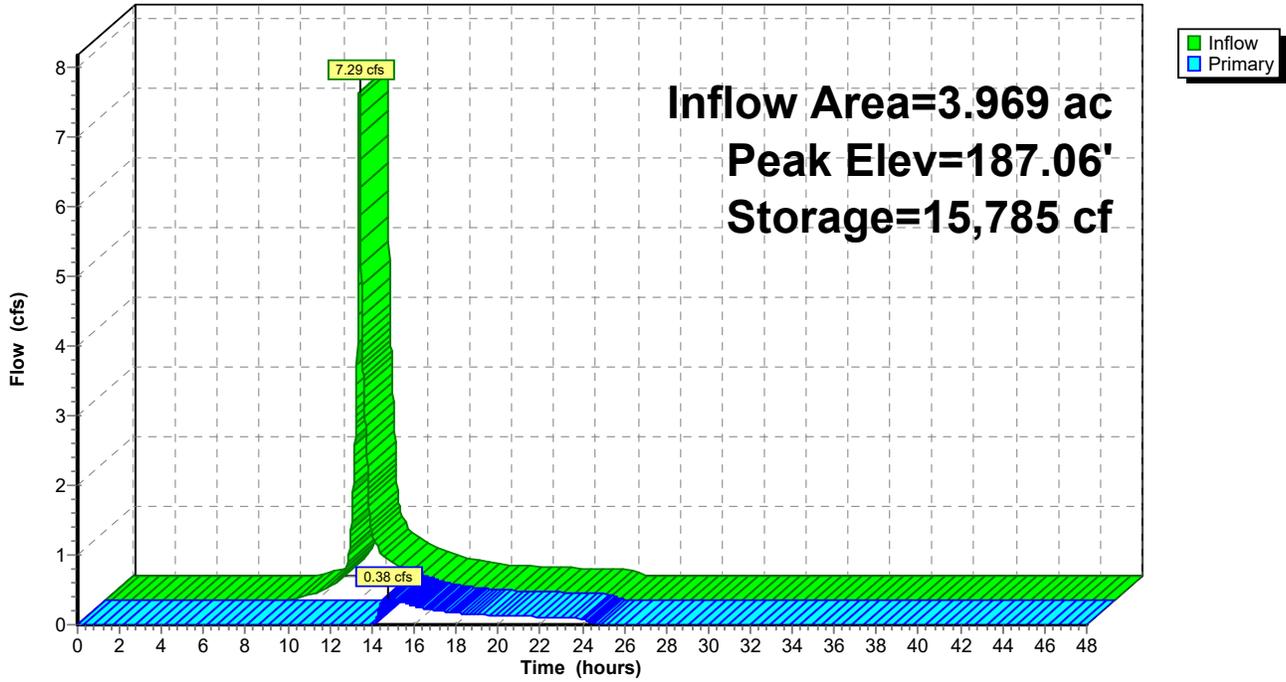
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
182.00	319	0	0
183.00	155	237	237
184.00	3,552	1,854	2,091
186.00	4,756	8,308	10,399
188.00	5,983	10,739	21,138

Device	Routing	Invert	Outlet Devices
#1	Primary	187.00'	10.0' long x 4.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=0.35 cfs @ 14.78 hrs HW=187.06' (Free Discharge)
 ↳ **1=Broad-Crested Rectangular Weir**(Weir Controls 0.35 cfs @ 0.58 fps)

Pond 1P: BMP-Pocket Wetland

Hydrograph



ASMG_221383_BMP

Type III 24-hr 10-yr (Hampden) Rainfall=4.48"

Prepared by ITS

Printed 5/2/2022

HydroCAD® 10.00-19 s/n 08362 © 2016 HydroCAD Software Solutions LLC

Page 8

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: Culvert #2

Runoff Area=2.500 ac 0.00% Impervious Runoff Depth=2.89"
Tc=5.0 min CN=85 Runoff=8.73 cfs 0.602 af

Subcatchment100: Sub Area 100

Runoff Area=64,010 sf 0.00% Impervious Runoff Depth=2.80"
Flow Length=859' Tc=5.0 min CN=84 Runoff=4.98 cfs 0.343 af

Pond 1P: BMP-PocketWetland

Peak Elev=187.38' Storage=17,567 cf Inflow=13.71 cfs 0.945 af
Outflow=6.02 cfs 0.590 af

Total Runoff Area = 3.969 ac Runoff Volume = 0.945 af Average Runoff Depth = 2.86"
100.00% Pervious = 3.969 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: Culvert #2

Runoff = 8.73 cfs @ 12.07 hrs, Volume= 0.602 af, Depth= 2.89"

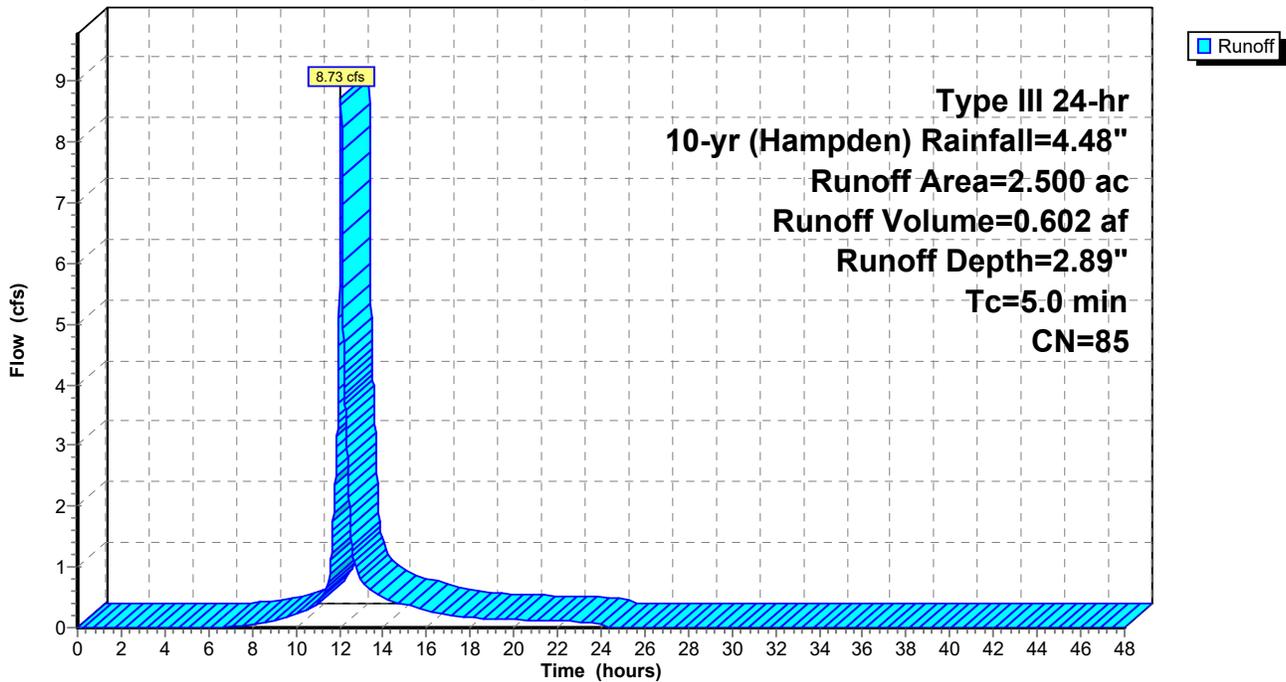
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10-yr (Hampden) Rainfall=4.48"

Area (ac)	CN	Description
2.500	85	Gravel roads, HSG B
2.500		100.00% Pervious Area

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

Subcatchment 1S: Culvert #2

Hydrograph



Summary for Subcatchment 100: Sub Area 100

Runoff = 4.98 cfs @ 12.07 hrs, Volume= 0.343 af, Depth= 2.80"

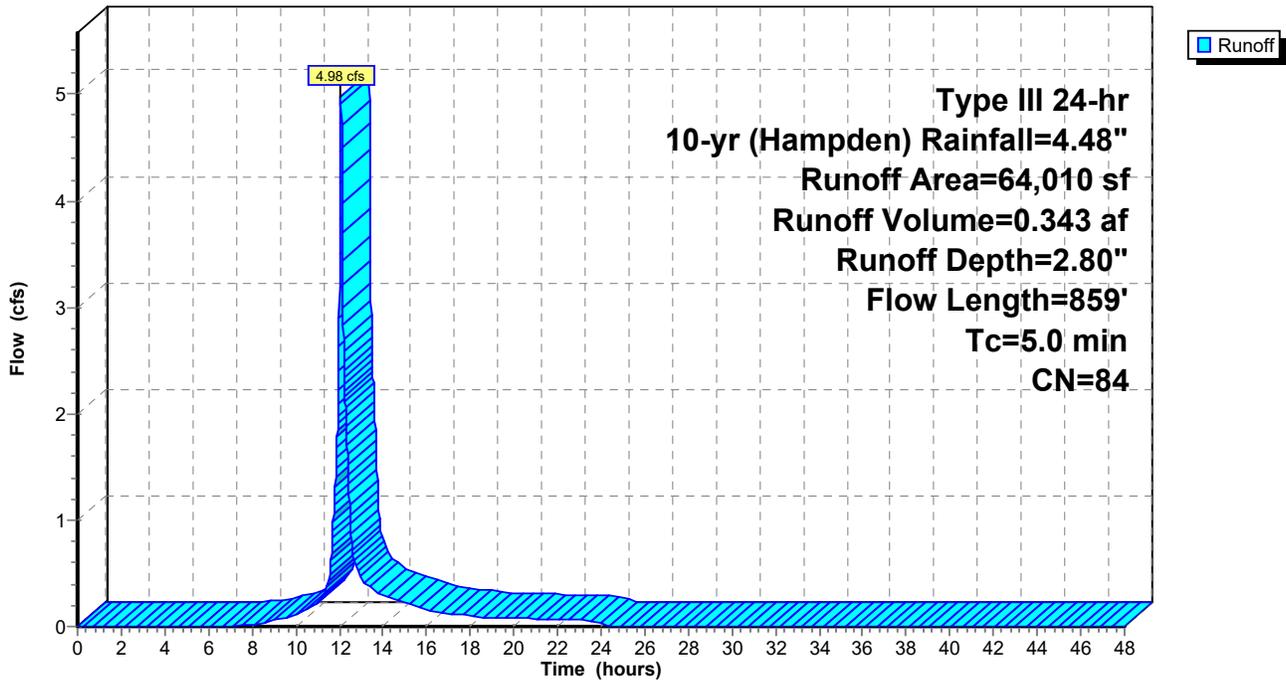
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10-yr (Hampden) Rainfall=4.48"

Area (sf)	CN	Description
50,785	85	Gravel roads, HSG B
13,225	79	Woods, Fair, HSG D
64,010	84	Weighted Average
64,010		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	100	0.0500	1.90		Sheet Flow, Sheet-Gravel Smooth surfaces n= 0.011 P2= 2.94"
2.6	720	0.0800	4.55		Shallow Concentrated Flow, SCF-Gravel Unpaved Kv= 16.1 fps
0.0	39	0.0500	13.29	23.49	Pipe Channel, Pipe 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Corrugated PE, smooth interior
3.5	859	Total, Increased to minimum Tc = 5.0 min			

Subcatchment 100: Sub Area 100

Hydrograph



Summary for Pond 1P: BMP-Pocket Wetland

Stage-area for elev 186 assumed based on culvert inverts.

Stage-area for elev 188-192 from civil survey.

Stage-area for elev 194 from KLF surface.

Inflow Area = 3.969 ac, 0.00% Impervious, Inflow Depth = 2.86" for 10-yr (Hampden) event
 Inflow = 13.71 cfs @ 12.07 hrs, Volume= 0.945 af
 Outflow = 6.02 cfs @ 12.25 hrs, Volume= 0.590 af, Atten= 56%, Lag= 10.8 min
 Primary = 6.02 cfs @ 12.25 hrs, Volume= 0.590 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 187.38' @ 12.25 hrs Surf.Area= 5,605 sf Storage= 17,567 cf

Plug-Flow detention time= 189.1 min calculated for 0.590 af (62% of inflow)
 Center-of-Mass det. time= 85.9 min (898.0 - 812.1)

Volume	Invert	Avail.Storage	Storage Description
#1	182.00'	21,138 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

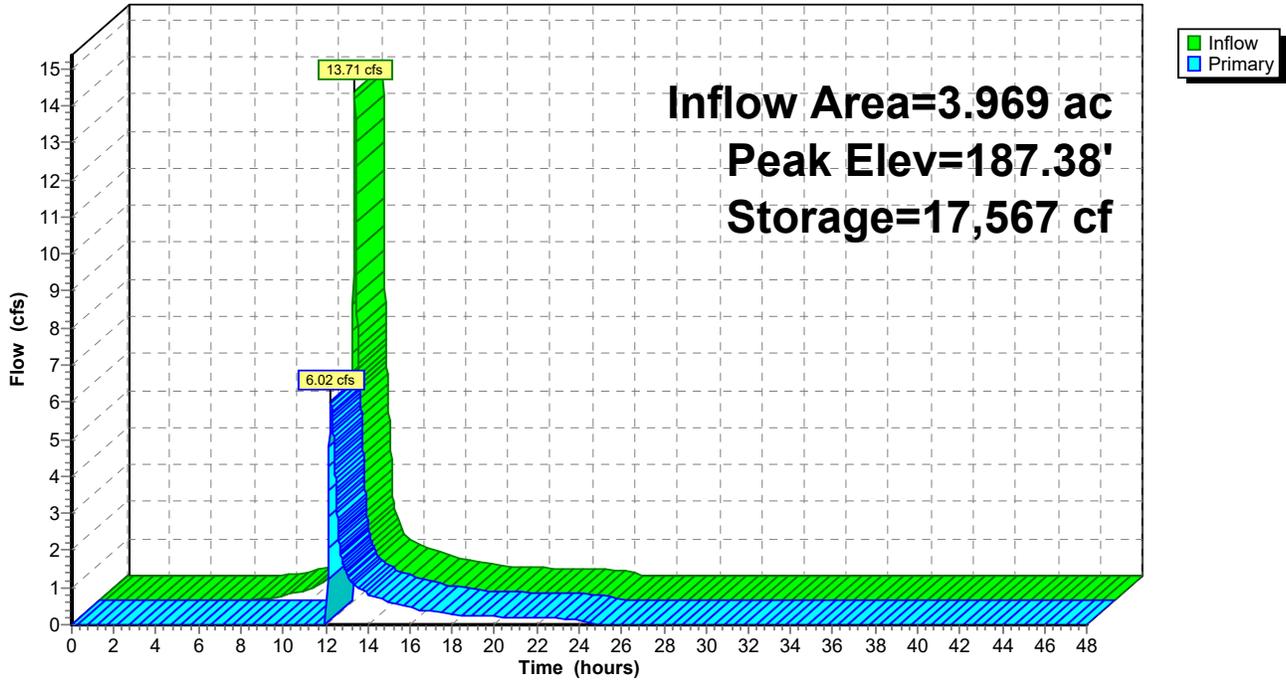
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
182.00	319	0	0
183.00	155	237	237
184.00	3,552	1,854	2,091
186.00	4,756	8,308	10,399
188.00	5,983	10,739	21,138

Device	Routing	Invert	Outlet Devices
#1	Primary	187.00'	10.0' long x 4.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=6.00 cfs @ 12.25 hrs HW=187.38' (Free Discharge)
 ↳ **1=Broad-Crested Rectangular Weir**(Weir Controls 6.00 cfs @ 1.57 fps)

Pond 1P: BMP-Pocket Wetland

Hydrograph



ASMG_221383_BMP*Type III 24-hr 100-yr (Hampden) Rainfall=6.93"*

Prepared by ITS

Printed 5/2/2022

HydroCAD® 10.00-19 s/n 08362 © 2016 HydroCAD Software Solutions LLC

Page 13

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: Culvert #2

Runoff Area=2.500 ac 0.00% Impervious Runoff Depth=5.19"
Tc=5.0 min CN=85 Runoff=15.32 cfs 1.080 af

Subcatchment100: Sub Area 100

Runoff Area=64,010 sf 0.00% Impervious Runoff Depth=5.07"
Flow Length=859' Tc=5.0 min CN=84 Runoff=8.85 cfs 0.621 af

Pond 1P: BMP-PocketWetland

Peak Elev=187.87' Storage=20,344 cf Inflow=24.18 cfs 1.702 af
Outflow=21.60 cfs 1.347 af

Total Runoff Area = 3.969 ac Runoff Volume = 1.702 af Average Runoff Depth = 5.14"
100.00% Pervious = 3.969 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: Culvert #2

Runoff = 15.32 cfs @ 12.07 hrs, Volume= 1.080 af, Depth= 5.19"

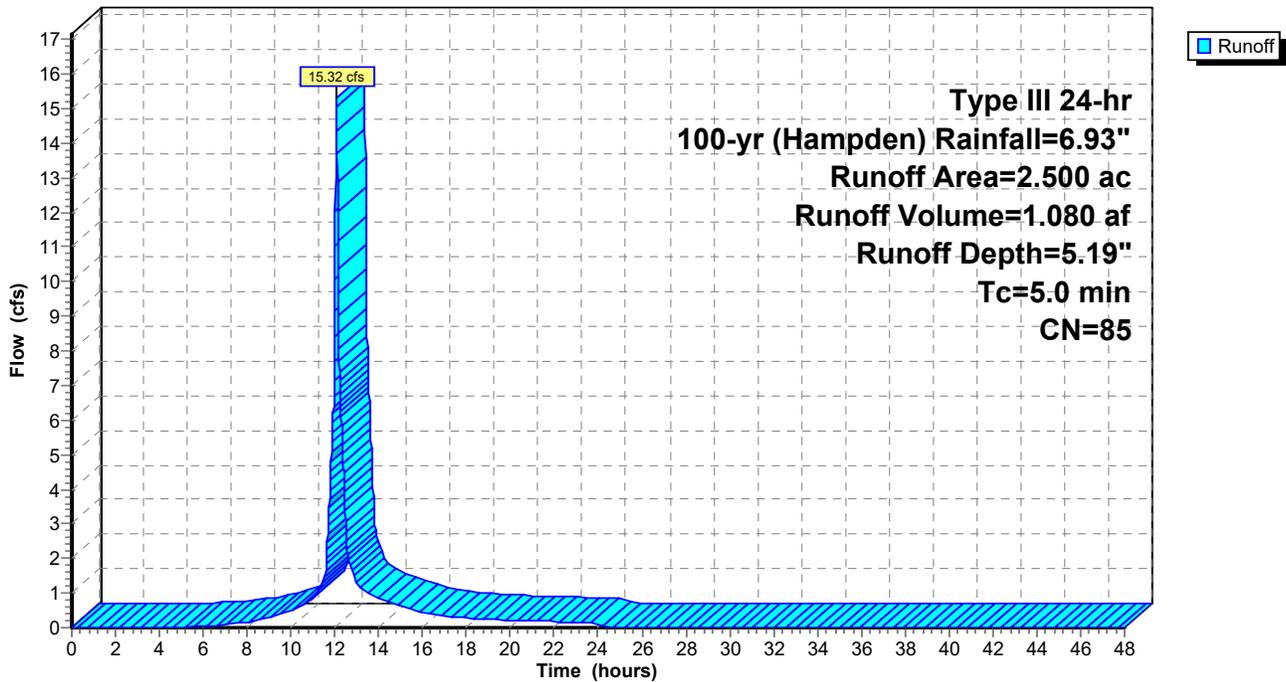
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-yr (Hampden) Rainfall=6.93"

Area (ac)	CN	Description
2.500	85	Gravel roads, HSG B
2.500		100.00% Pervious Area

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

Subcatchment 1S: Culvert #2

Hydrograph



Summary for Subcatchment 100: Sub Area 100

Runoff = 8.85 cfs @ 12.07 hrs, Volume= 0.621 af, Depth= 5.07"

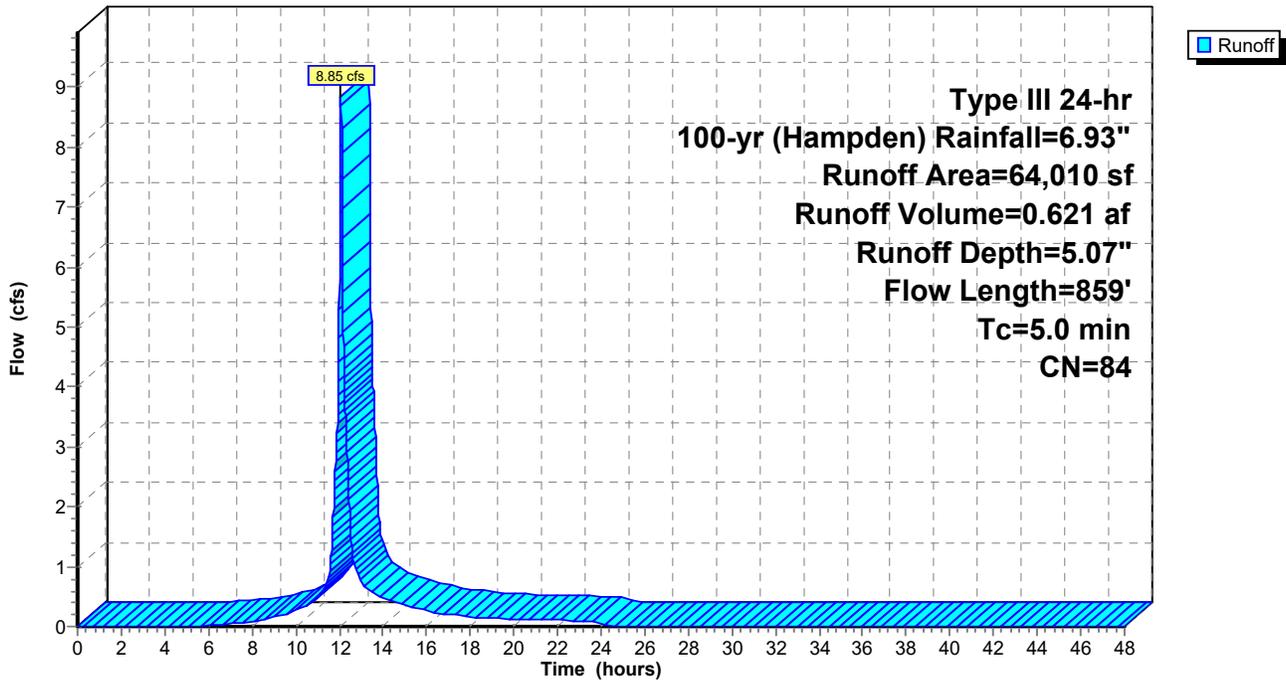
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr (Hampden) Rainfall=6.93"

Area (sf)	CN	Description
50,785	85	Gravel roads, HSG B
13,225	79	Woods, Fair, HSG D
64,010	84	Weighted Average
64,010		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	100	0.0500	1.90		Sheet Flow, Sheet-Gravel Smooth surfaces n= 0.011 P2= 2.94"
2.6	720	0.0800	4.55		Shallow Concentrated Flow, SCF-Gravel Unpaved Kv= 16.1 fps
0.0	39	0.0500	13.29	23.49	Pipe Channel, Pipe 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Corrugated PE, smooth interior
3.5	859	Total, Increased to minimum Tc = 5.0 min			

Subcatchment 100: Sub Area 100

Hydrograph



Summary for Pond 1P: BMP-Pocket Wetland

Stage-area for elev 186 assumed based on culvert inverts.

Stage-area for elev 188-192 from civil survey.

Stage-area for elev 194 from KLF surface.

Inflow Area = 3.969 ac, 0.00% Impervious, Inflow Depth = 5.14" for 100-yr (Hampden) event
 Inflow = 24.18 cfs @ 12.07 hrs, Volume= 1.702 af
 Outflow = 21.60 cfs @ 12.11 hrs, Volume= 1.347 af, Atten= 11%, Lag= 2.3 min
 Primary = 21.60 cfs @ 12.11 hrs, Volume= 1.347 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 187.87' @ 12.11 hrs Surf.Area= 5,901 sf Storage= 20,344 cf

Plug-Flow detention time= 129.7 min calculated for 1.347 af (79% of inflow)
 Center-of-Mass det. time= 52.3 min (847.8 - 795.5)

Volume	Invert	Avail.Storage	Storage Description
#1	182.00'	21,138 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

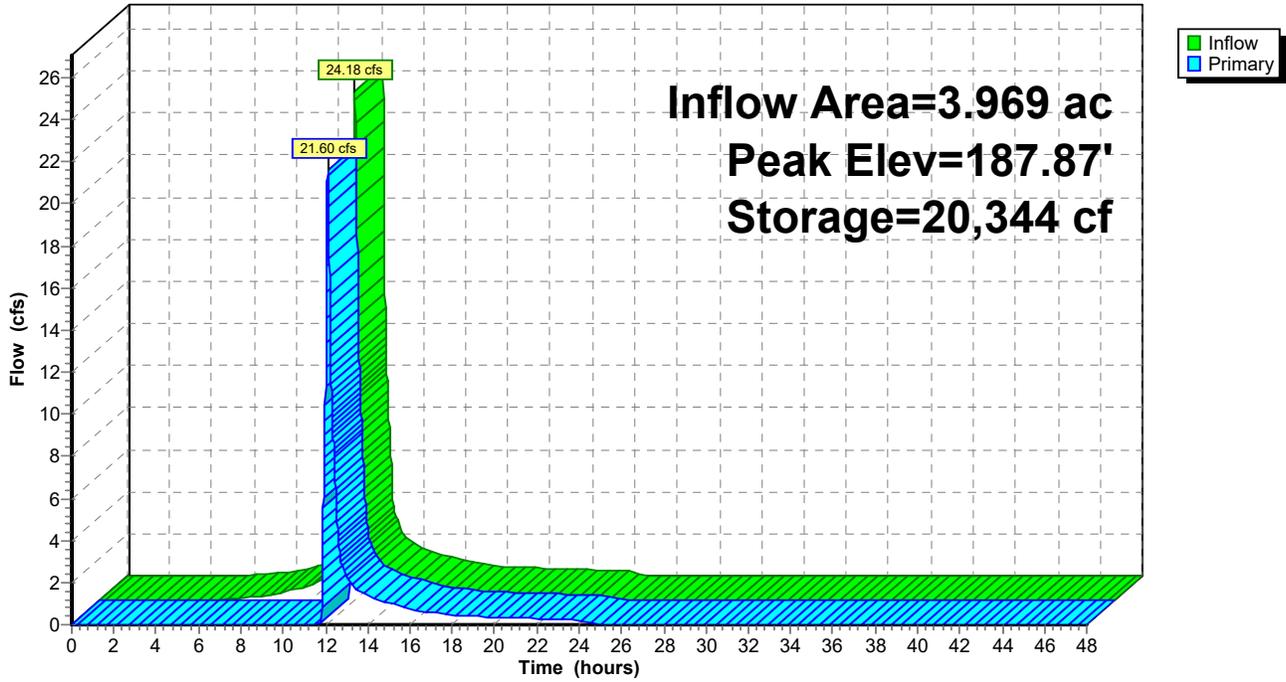
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
182.00	319	0	0
183.00	155	237	237
184.00	3,552	1,854	2,091
186.00	4,756	8,308	10,399
188.00	5,983	10,739	21,138

Device	Routing	Invert	Outlet Devices
#1	Primary	187.00'	10.0' long x 4.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

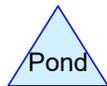
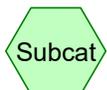
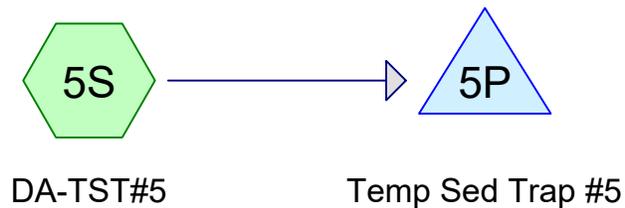
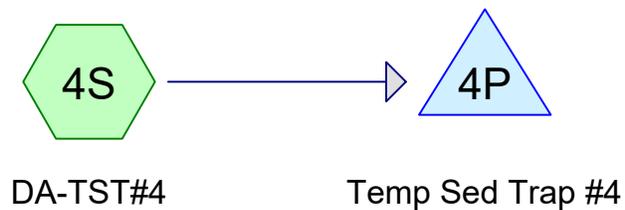
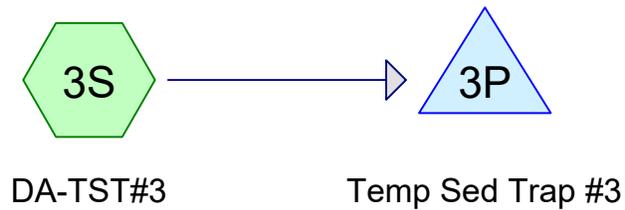
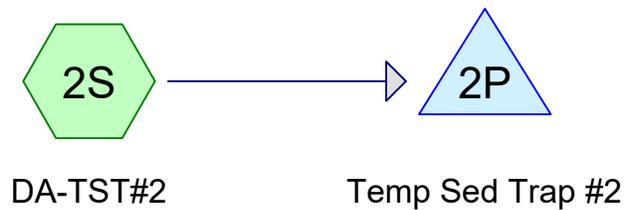
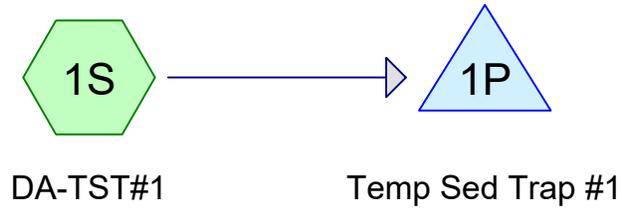
Primary OutFlow Max=21.59 cfs @ 12.11 hrs HW=187.87' (Free Discharge)
 ↳ **1=Broad-Crested Rectangular Weir**(Weir Controls 21.59 cfs @ 2.49 fps)

Pond 1P: BMP-Pocket Wetland

Hydrograph



EROSION & SEDIMENTATION CONTROL



ASMG_221383_Eros-Sed Control

Type III 24-hr 10-yr (Hampden) Rainfall=4.48"

Prepared by ITS

Printed 5/4/2022

HydroCAD® 10.00-19 s/n 08362 © 2016 HydroCAD Software Solutions LLC

Page 2

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: DA-TST#1	Runoff Area=0.280 ac 0.00% Impervious Runoff Depth=2.36" Tc=5.0 min CN=79 Runoff=0.80 cfs 0.055 af
Subcatchment2S: DA-TST#2	Runoff Area=1.260 ac 0.00% Impervious Runoff Depth=2.36" Tc=5.0 min CN=79 Runoff=3.61 cfs 0.248 af
Subcatchment3S: DA-TST#3	Runoff Area=1.580 ac 0.00% Impervious Runoff Depth=2.36" Tc=5.0 min CN=79 Runoff=4.53 cfs 0.311 af
Subcatchment4S: DA-TST#4	Runoff Area=1.740 ac 0.00% Impervious Runoff Depth=2.36" Tc=5.0 min CN=79 Runoff=4.99 cfs 0.342 af
Subcatchment5S: DA-TST#5	Runoff Area=2.380 ac 0.00% Impervious Runoff Depth=2.36" Tc=5.0 min CN=79 Runoff=6.83 cfs 0.468 af
Pond 1P: Temp Sed Trap #1	Peak Elev=177.10' Storage=1,016 cf Inflow=0.80 cfs 0.055 af Outflow=0.32 cfs 0.033 af
Pond 2P: Temp Sed Trap #2	Peak Elev=170.92' Storage=3,259 cf Inflow=3.61 cfs 0.248 af Outflow=2.73 cfs 0.186 af
Pond 3P: Temp Sed Trap #3	Peak Elev=186.28' Storage=13,534 cf Inflow=4.53 cfs 0.311 af Outflow=0.00 cfs 0.000 af
Pond 4P: Temp Sed Trap #4	Peak Elev=234.78' Storage=4,266 cf Inflow=4.99 cfs 0.342 af Outflow=4.01 cfs 0.264 af
Pond 5P: Temp Sed Trap #5	Peak Elev=244.63' Storage=5,912 cf Inflow=6.83 cfs 0.468 af Outflow=5.34 cfs 0.360 af

Total Runoff Area = 7.240 ac Runoff Volume = 1.424 af Average Runoff Depth = 2.36"
100.00% Pervious = 7.240 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: DA-TST#1

Runoff = 0.80 cfs @ 12.08 hrs, Volume= 0.055 af, Depth= 2.36"

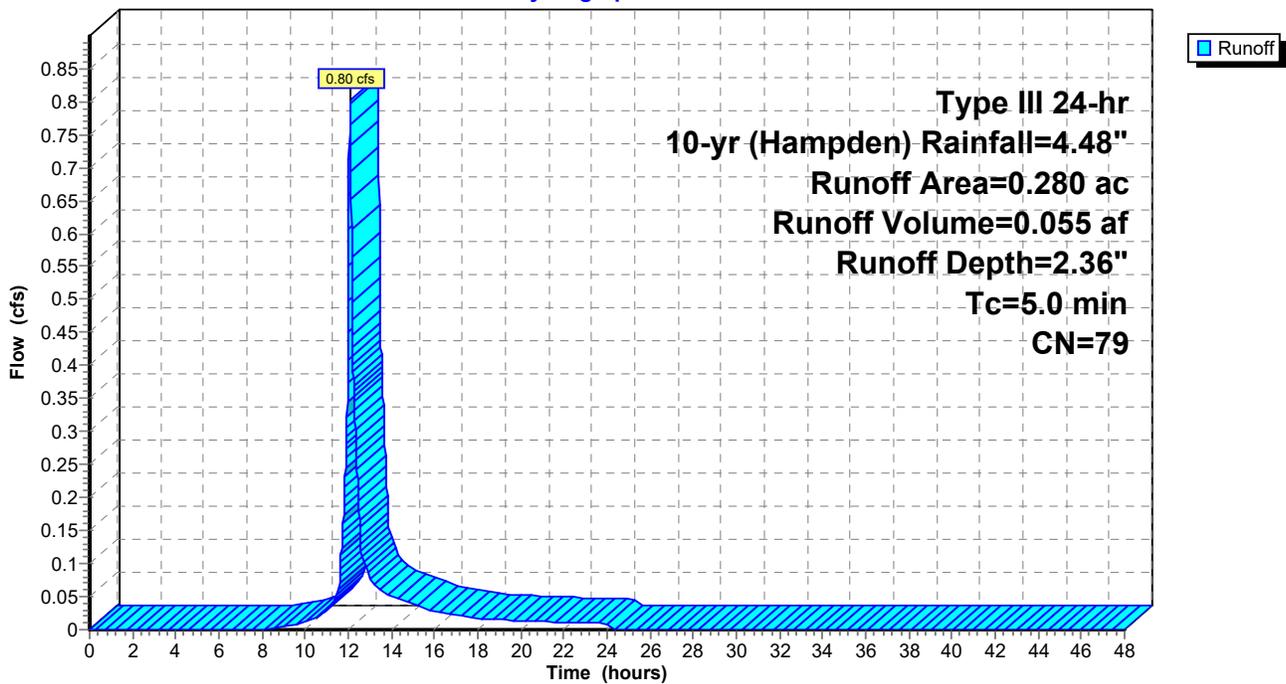
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10-yr (Hampden) Rainfall=4.48"

Area (ac)	CN	Description
0.280	79	Woods, Fair, HSG D
0.280		100.00% Pervious Area

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

Subcatchment 1S: DA-TST#1

Hydrograph



Summary for Subcatchment 2S: DA-TST#2

Runoff = 3.61 cfs @ 12.08 hrs, Volume= 0.248 af, Depth= 2.36"

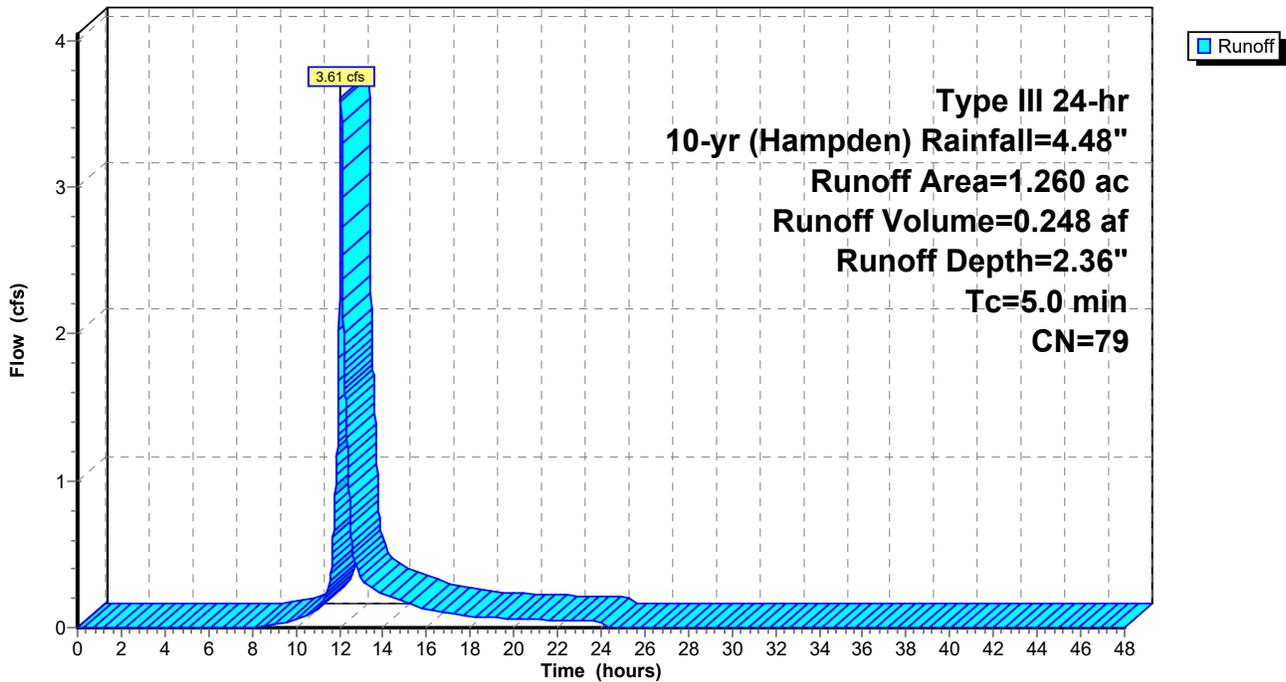
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10-yr (Hampden) Rainfall=4.48"

Area (ac)	CN	Description
1.260	79	Woods, Fair, HSG D
1.260		100.00% Pervious Area

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

Subcatchment 2S: DA-TST#2

Hydrograph



Summary for Subcatchment 3S: DA-TST#3

Runoff = 4.53 cfs @ 12.08 hrs, Volume= 0.311 af, Depth= 2.36"

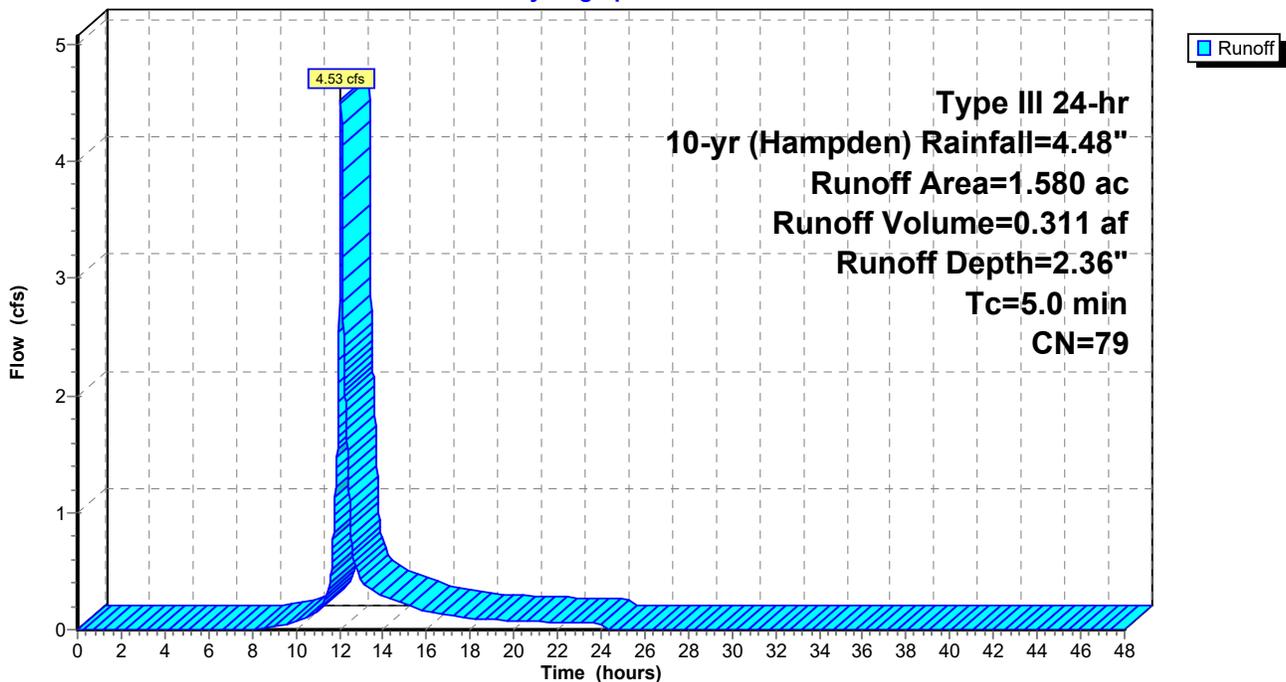
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10-yr (Hampden) Rainfall=4.48"

Area (ac)	CN	Description
1.580	79	Woods, Fair, HSG D
1.580		100.00% Pervious Area

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

Subcatchment 3S: DA-TST#3

Hydrograph



Summary for Subcatchment 4S: DA-TST#4

Runoff = 4.99 cfs @ 12.08 hrs, Volume= 0.342 af, Depth= 2.36"

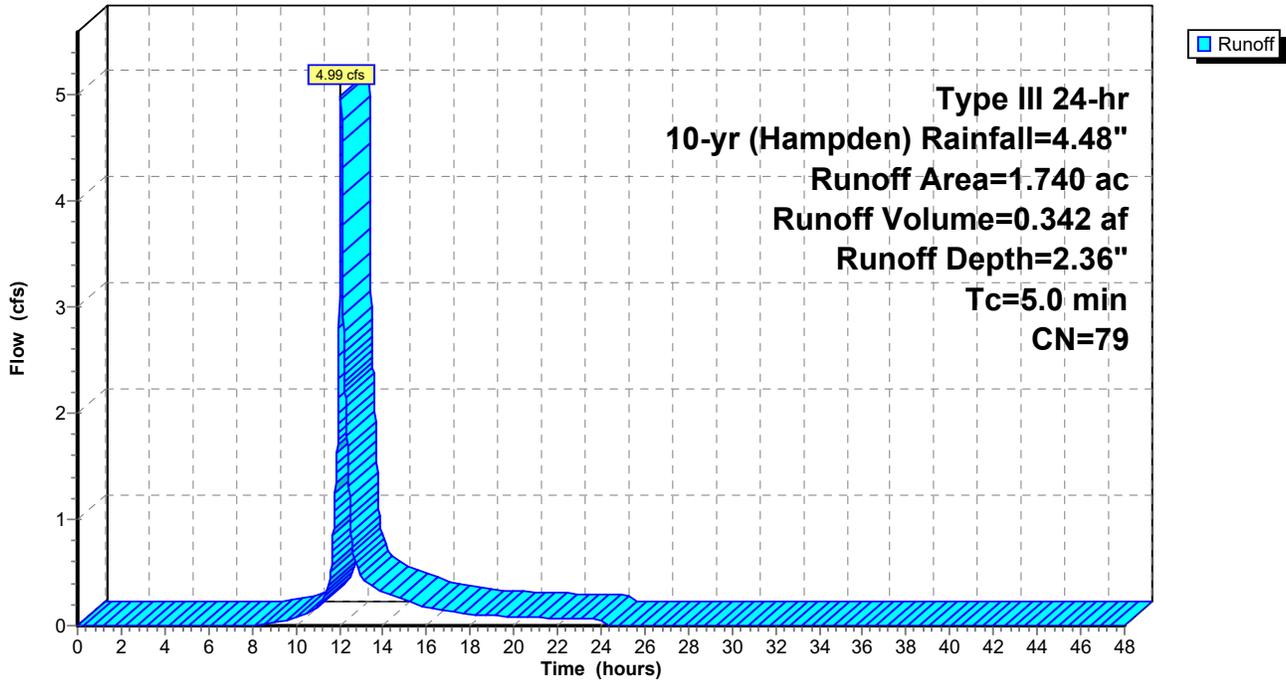
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10-yr (Hampden) Rainfall=4.48"

Area (ac)	CN	Description
1.740	79	Woods, Fair, HSG D
1.740		100.00% Pervious Area

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

Subcatchment 4S: DA-TST#4

Hydrograph



Summary for Subcatchment 5S: DA-TST#5

Runoff = 6.83 cfs @ 12.08 hrs, Volume= 0.468 af, Depth= 2.36"

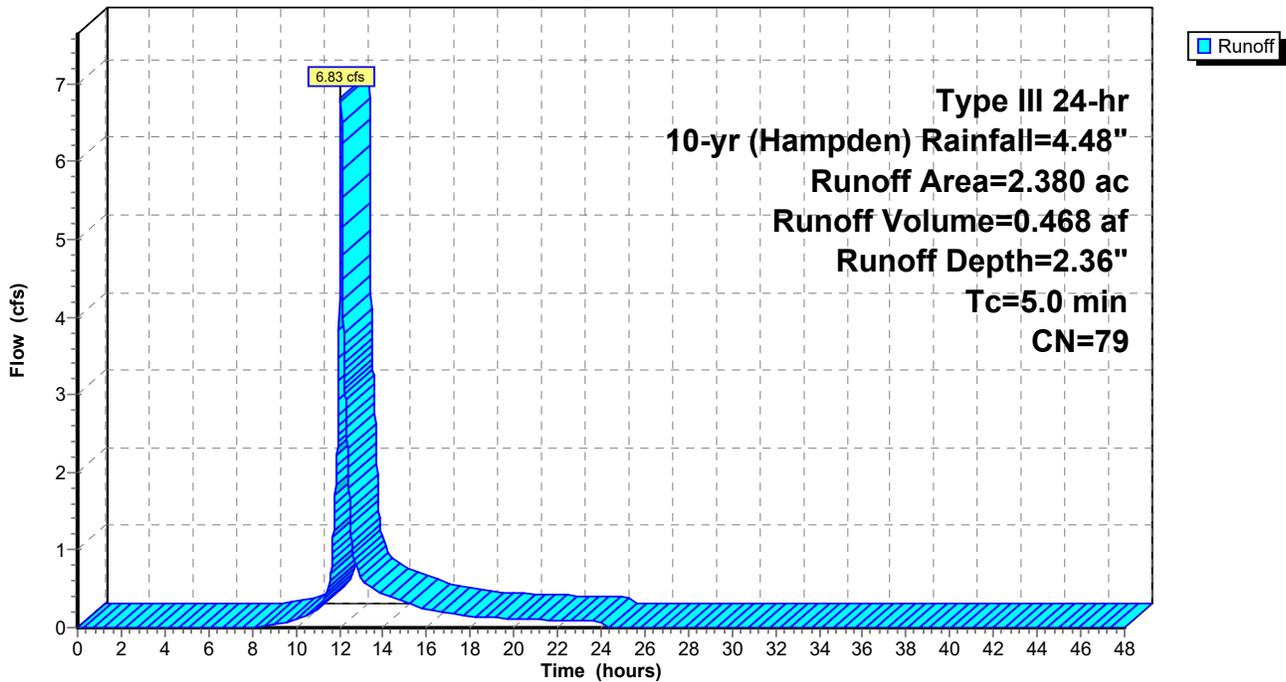
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10-yr (Hampden) Rainfall=4.48"

Area (ac)	CN	Description
2.380	79	Woods, Fair, HSG D
2.380		100.00% Pervious Area

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

Subcatchment 5S: DA-TST#5

Hydrograph



Summary for Pond 1P: Temp Sed Trap #1

Stage-area for elev 186 assumed based on culvert inverts.

Stage-area for elev 188-192 from civil survey.

Stage-area for elev 194 from KLF surface.

Inflow Area = 0.280 ac, 0.00% Impervious, Inflow Depth = 2.36" for 10-yr (Hampden) event
 Inflow = 0.80 cfs @ 12.08 hrs, Volume= 0.055 af
 Outflow = 0.32 cfs @ 12.32 hrs, Volume= 0.033 af, Atten= 61%, Lag= 14.5 min
 Primary = 0.32 cfs @ 12.32 hrs, Volume= 0.033 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 177.10' @ 12.32 hrs Surf.Area= 673 sf Storage= 1,016 cf

Plug-Flow detention time= 196.2 min calculated for 0.033 af (61% of inflow)
 Center-of-Mass det. time= 87.3 min (915.8 - 828.5)

Volume	Invert	Avail.Storage	Storage Description
#1	175.00'	1,703 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

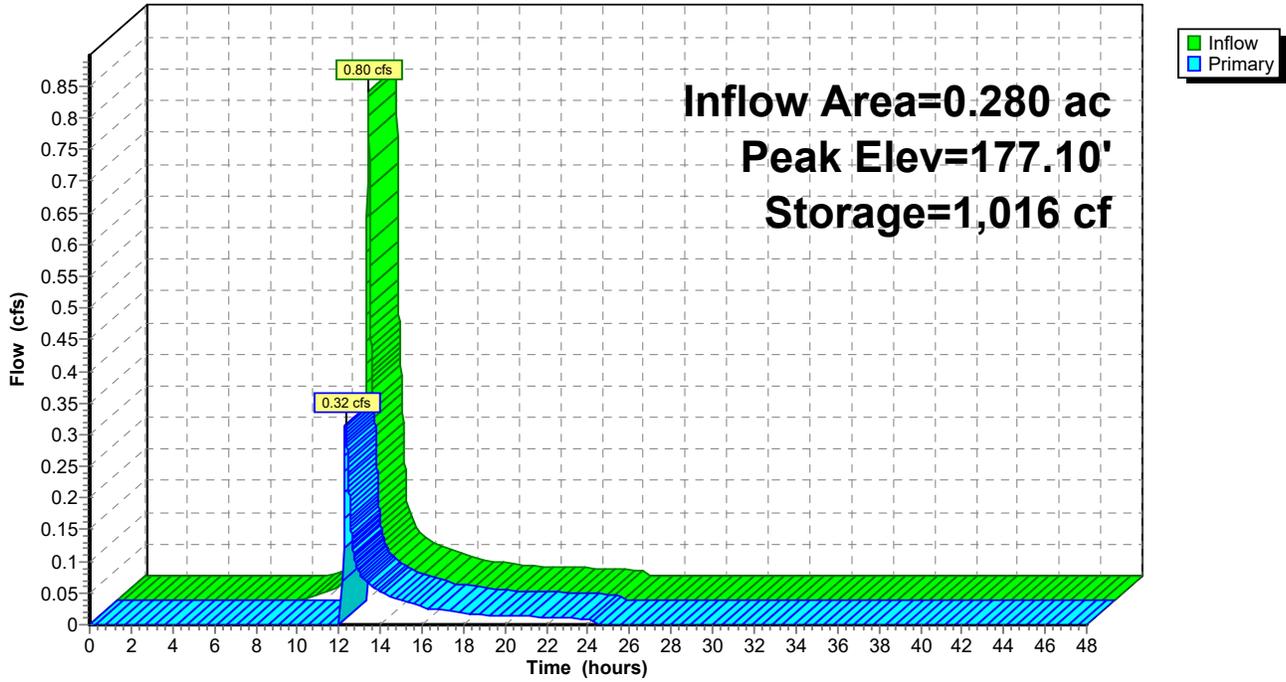
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
175.00	309	0	0
176.00	467	388	388
177.00	651	559	947
178.00	861	756	1,703

Device	Routing	Invert	Outlet Devices
#1	Primary	177.00'	4.0' long x 5.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=0.31 cfs @ 12.32 hrs HW=177.10' (Free Discharge)
 ↑1=**Broad-Crested Rectangular Weir**(Weir Controls 0.31 cfs @ 0.76 fps)

Pond 1P: Temp Sed Trap #1

Hydrograph



Summary for Pond 2P: Temp Sed Trap #2

Stage-area for elev 186 assumed based on culvert inverts.

Stage-area for elev 188-192 from civil survey.

Stage-area for elev 194 from KLF surface.

Inflow Area = 1.260 ac, 0.00% Impervious, Inflow Depth = 2.36" for 10-yr (Hampden) event
 Inflow = 3.61 cfs @ 12.08 hrs, Volume= 0.248 af
 Outflow = 2.73 cfs @ 12.14 hrs, Volume= 0.186 af, Atten= 24%, Lag= 3.9 min
 Primary = 2.73 cfs @ 12.14 hrs, Volume= 0.186 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 170.92' @ 12.14 hrs Surf.Area= 1,428 sf Storage= 3,259 cf

Plug-Flow detention time= 141.0 min calculated for 0.186 af (75% of inflow)
 Center-of-Mass det. time= 52.5 min (880.9 - 828.5)

Volume	Invert	Avail.Storage	Storage Description
#1	167.00'	4,127 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

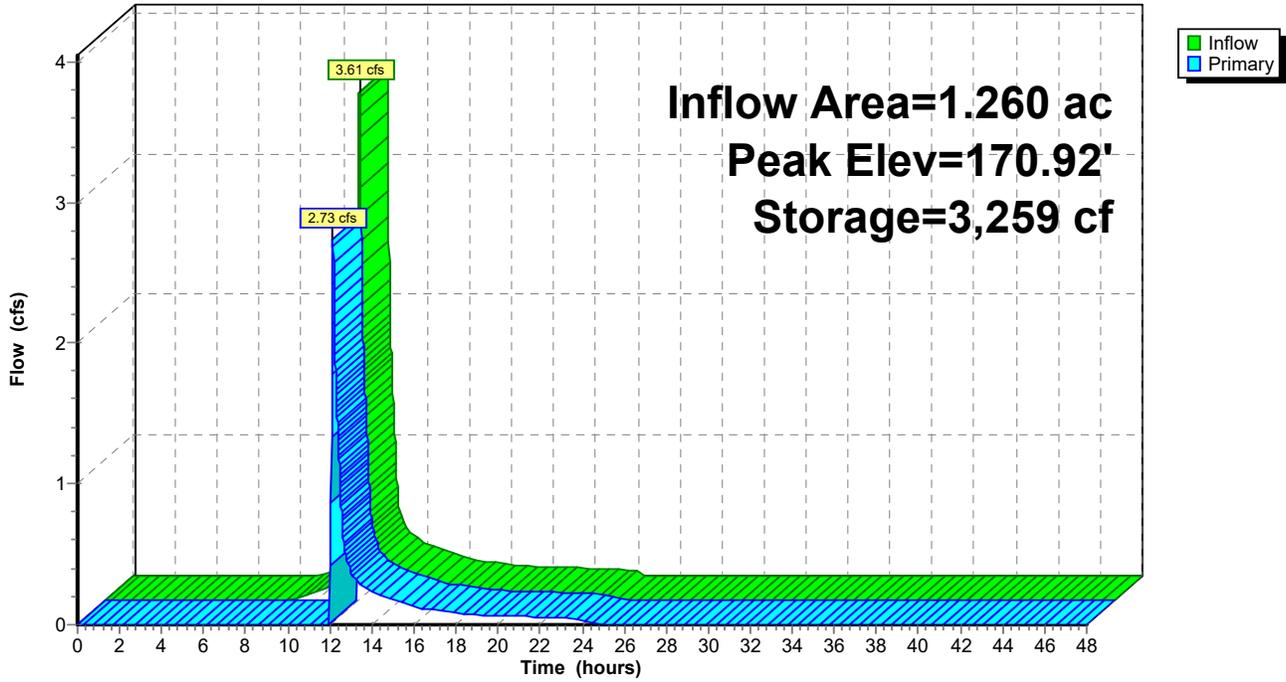
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
167.00	313	0	0
168.00	548	431	431
169.00	820	684	1,115
170.00	1,125	973	2,087
170.50	1,287	603	2,690
171.00	1,455	686	3,376
171.50	1,550	751	4,127

Device	Routing	Invert	Outlet Devices
#1	Primary	170.50'	4.0' long x 5.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=2.73 cfs @ 12.14 hrs HW=170.92' (Free Discharge)
 ↳ **1=Broad-Crested Rectangular Weir**(Weir Controls 2.73 cfs @ 1.63 fps)

Pond 2P: Temp Sed Trap #2

Hydrograph



Summary for Pond 3P: Temp Sed Trap #3

Stage-area for elev 186 assumed based on culvert inverts.

Stage-area for elev 188-192 from civil survey.

Stage-area for elev 194 from KLF surface.

Inflow Area = 1.580 ac, 0.00% Impervious, Inflow Depth = 2.36" for 10-yr (Hampden) event
 Inflow = 4.53 cfs @ 12.08 hrs, Volume= 0.311 af
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 186.28' @ 24.29 hrs Surf.Area= 4,921 sf Storage= 13,534 cf

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

Volume	Invert	Avail.Storage	Storage Description
#1	182.00'	22,896 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

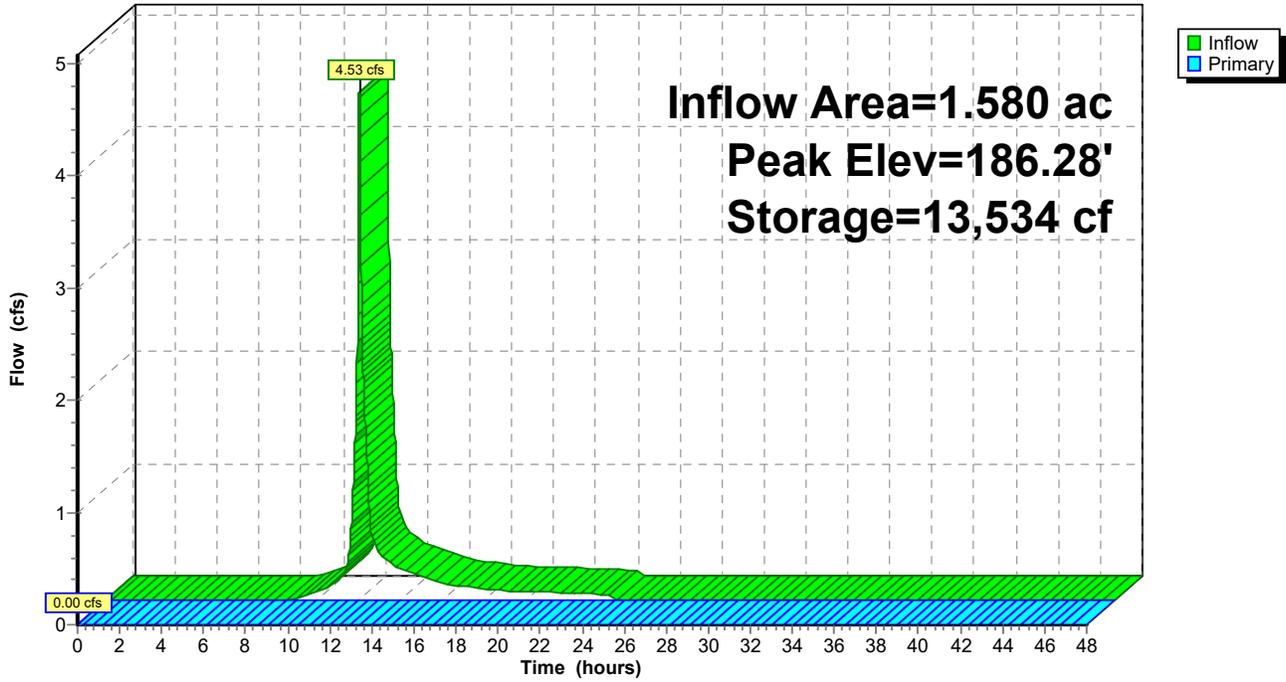
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
182.00	319	0	0
184.00	3,552	3,871	3,871
186.00	4,756	8,308	12,179
187.00	5,347	5,052	17,231
188.00	5,983	5,665	22,896

Device	Routing	Invert	Outlet Devices
#1	Primary	187.00'	4.0' long x 5.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=182.00' (Free Discharge)
 ↑1=**Broad-Crested Rectangular Weir**(Controls 0.00 cfs)

Pond 3P: Temp Sed Trap #3

Hydrograph



Summary for Pond 4P: Temp Sed Trap #4

Stage-area for elev 186 assumed based on culvert inverts.

Stage-area for elev 188-192 from civil survey.

Stage-area for elev 194 from KLF surface.

Inflow Area = 1.740 ac, 0.00% Impervious, Inflow Depth = 2.36" for 10-yr (Hampden) event
 Inflow = 4.99 cfs @ 12.08 hrs, Volume= 0.342 af
 Outflow = 4.01 cfs @ 12.13 hrs, Volume= 0.264 af, Atten= 20%, Lag= 3.4 min
 Primary = 4.01 cfs @ 12.13 hrs, Volume= 0.264 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 234.78' @ 12.13 hrs Surf.Area= 1,701 sf Storage= 4,266 cf

Plug-Flow detention time= 133.3 min calculated for 0.264 af (77% of inflow)
 Center-of-Mass det. time= 49.0 min (877.4 - 828.5)

Volume	Invert	Avail.Storage	Storage Description
#1	230.00'	5,094 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

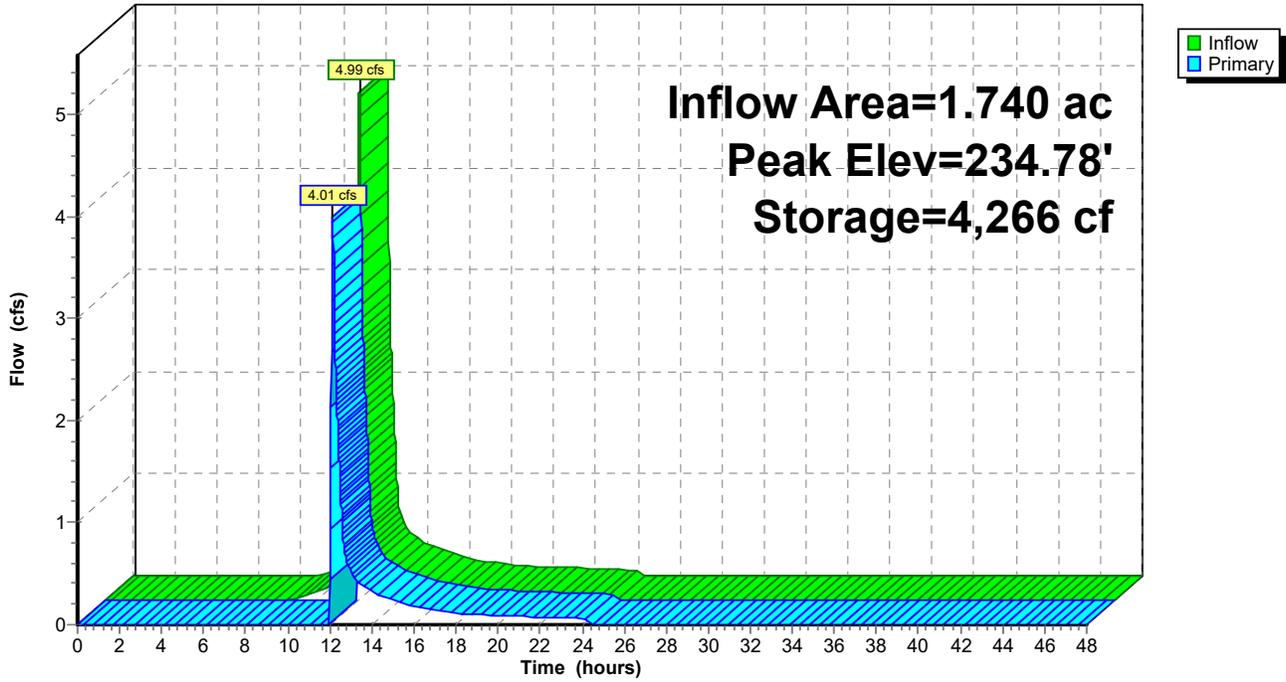
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
230.00	184	0	0
231.00	440	312	312
232.00	732	586	898
233.00	1,054	893	1,791
234.00	1,409	1,232	3,023
234.25	1,598	376	3,398
235.25	1,794	1,696	5,094

Device	Routing	Invert	Outlet Devices
#1	Primary	234.25'	4.0' long x 5.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=4.00 cfs @ 12.13 hrs HW=234.78' (Free Discharge)
 ↑1=**Broad-Crested Rectangular Weir**(Weir Controls 4.00 cfs @ 1.90 fps)

Pond 4P: Temp Sed Trap #4

Hydrograph



Summary for Pond 5P: Temp Sed Trap #5

Stage-area for elev 186 assumed based on culvert inverts.

Stage-area for elev 188-192 from civil survey.

Stage-area for elev 194 from KLF surface.

Inflow Area = 2.380 ac, 0.00% Impervious, Inflow Depth = 2.36" for 10-yr (Hampden) event
 Inflow = 6.83 cfs @ 12.08 hrs, Volume= 0.468 af
 Outflow = 5.34 cfs @ 12.14 hrs, Volume= 0.360 af, Atten= 22%, Lag= 3.6 min
 Primary = 5.34 cfs @ 12.14 hrs, Volume= 0.360 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 244.63' @ 12.14 hrs Surf.Area= 2,033 sf Storage= 5,912 cf

Plug-Flow detention time= 134.8 min calculated for 0.360 af (77% of inflow)
 Center-of-Mass det. time= 49.9 min (878.4 - 828.5)

Volume	Invert	Avail.Storage	Storage Description
#1	240.00'	6,697 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

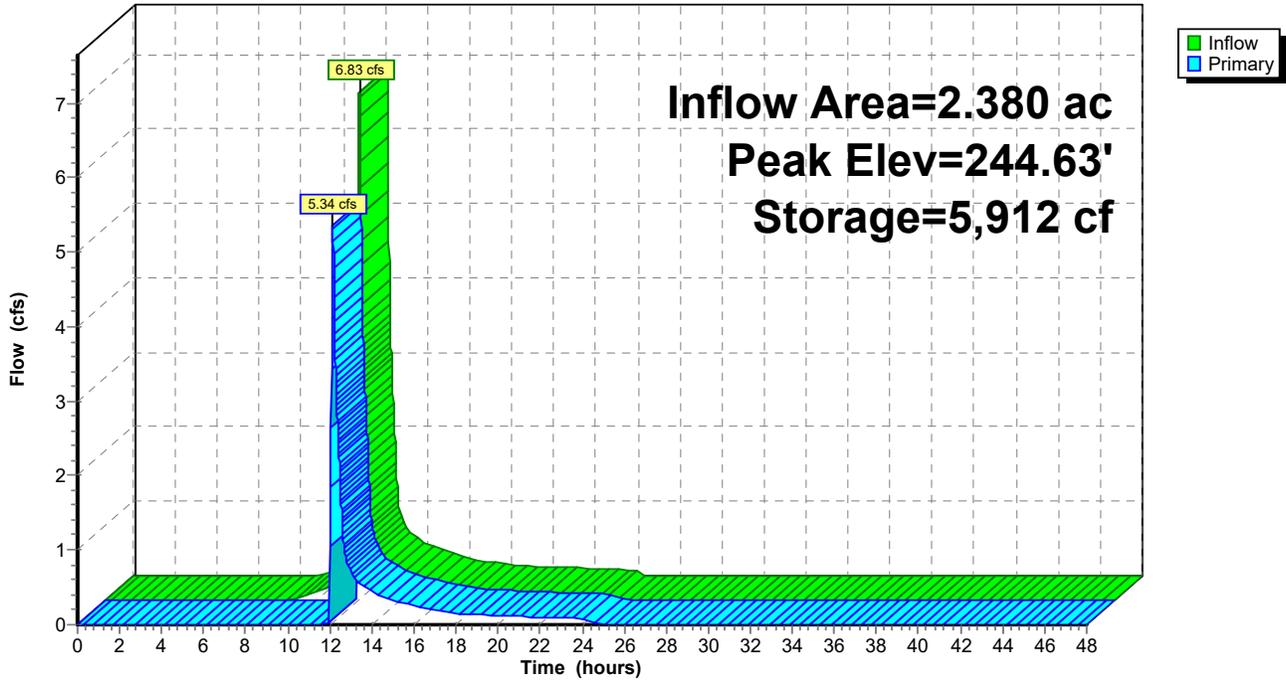
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
240.00	655	0	0
241.00	868	762	762
242.00	1,106	987	1,749
243.00	1,497	1,302	3,050
244.00	1,817	1,657	4,707
245.00	2,162	1,990	6,697

Device	Routing	Invert	Outlet Devices
#1	Primary	244.00'	4.0' long x 5.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=5.33 cfs @ 12.14 hrs HW=244.63' (Free Discharge)
 ↳ **1=Broad-Crested Rectangular Weir**(Weir Controls 5.33 cfs @ 2.13 fps)

Pond 5P: Temp Sed Trap #5

Hydrograph



APPENDIX G – EROSION AND SEDIMENTATION CONTROL PLAN

PLOTTED: 03/2022 10:27 AM BY: knt/ksd
 CAD FILE: C:\working\knt\erodraw\01\knt\erodraw\01\2509C-106_20221383_Exc-Sed Control Plan.dwg LAYOUT: C-106

EROSION CONTROL LEGEND

- LOD — PROPOSED LIMIT OF DISTURBANCE
- PROPOSED GRADING LIMITS
- ECM — TEMPORARY EROSION CONTROL DEVICE
- → → → TEMPORARY DIVERSION DITCH
- □ □ □ TEMPORARY SILT SACK AT CATCH BASINS
- TEMPORARY SLOPE PROTECTION AREA
- - - TEMPORARY ESC CONTOUR MINOR
- - - TEMPORARY ESC CONTOUR MAJOR
- ▨ ▨ ▨ ▨ TEMPORARY SEDIMENT TRAP
- ▨ ▨ ▨ ▨ EROSION CONTROL MATTING
- ⊗ ⊗ ⊗ ⊗ TEMPORARY STOCKPILE AREA



1500 Main Street, Suite 1506
 PO Box 15511
 Springfield, MA 01111-5511
 Phone: 413-739-1307

REVISIONS				
REV	DESCRIPTION	DSN DWN	CHK APP	DATE

ISSUED FOR PERMITTING

SCALE VERIFICATION

THIS BAR IS 1 INCH IN LENGTH ON ORIGINAL DRAWING



IF IT'S NOT 1 INCH ON THIS SHEET ADJUST YOUR SCALES ACCORDINGLY

0 40 80
SCALE: 1" = 40' SCALE IN FEET
ORIGINAL DRAWING SIZE IS 22 x 34

ISSUE FOR PERMIT (IFP) PLANS

ASGM HAUL ROAD DESIGN
 901 RIVER ROAD
 FRANKLIN COUNTY, MASSACHUSETTS

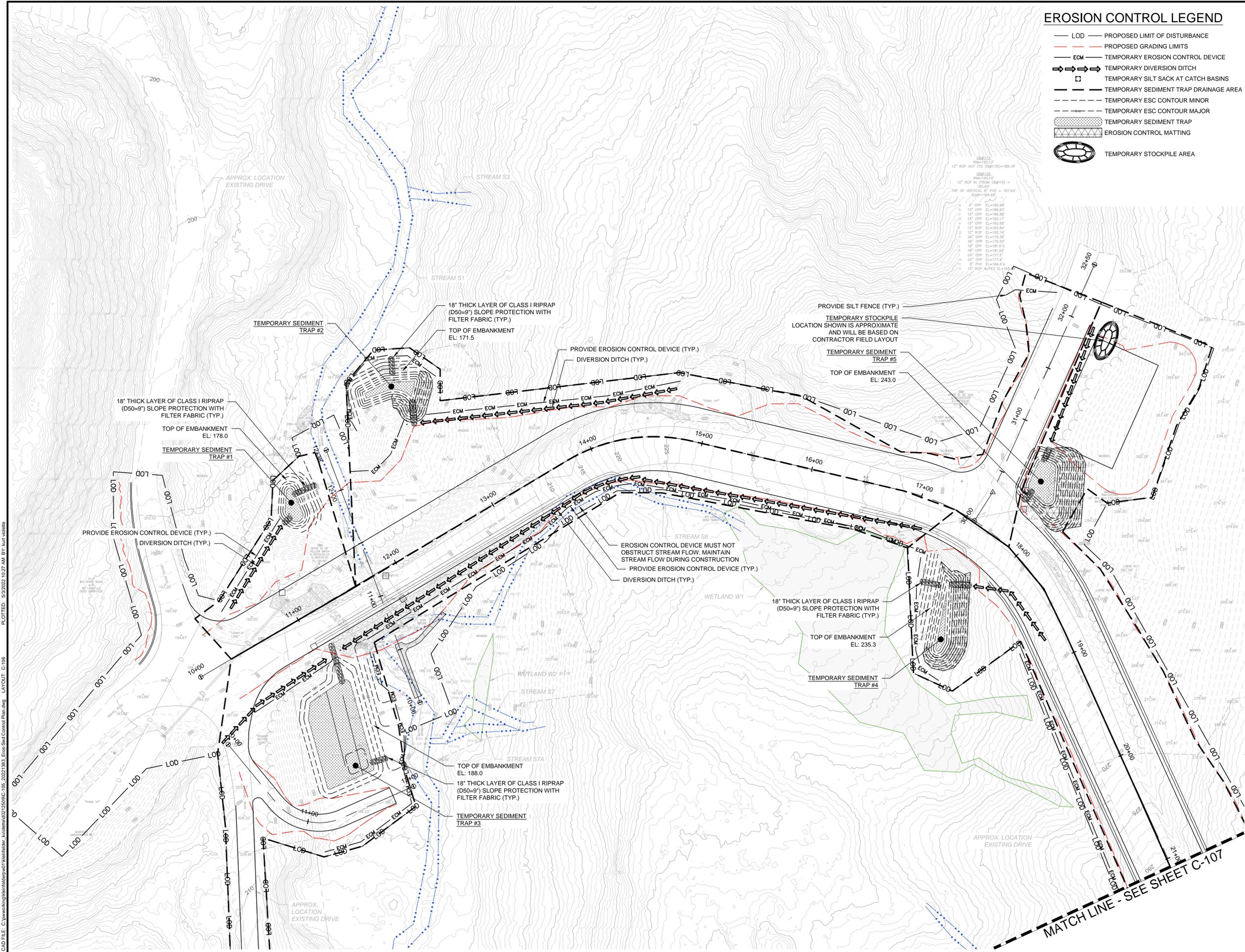


All States Materials Group

ALL STATES MATERIALS GROUP
 901 RIVER ROAD
 DEERFIELD, MA 01342

EROSION AND SEDIMENTATION CONTROL PLAN

PROJECT NO.	20221383.001A	C-106
ISSUE DATE	04/29/2022	
CURRENT REVISION	A	
DESIGNED BY	KRV	
DRAWN BY	KRV	
CHECKED BY	AGB	
APPROVED BY	JW	



12" RCP OUT (TO 098135)=188.18'
 12" RCP IN (FROM 098115) = 185.24'
 TOP OF VERTICAL 8" PVC = 187.64'
 500P=194.64'
 4" C/PV EL=189.90'
 10" C/PV EL=186.80'
 15" C/PV EL=185.57'
 15" C/PV EL=182.50'
 12" RCP EL=182.84'
 30" C/PV EL=175.30'
 18" C/PV EL=181.57'
 15" C/PV EL=181.82'
 24" C/PV EL=172.27'
 24" C/PV EL=177.87'
 8" PVC EL=184.87'
 10" RCP W/FES EL=184.87'

APPENDIX H – OPERATION AND MAINTENANCE PLAN

OPERATIONS AND MAINTENANCE (O&M) PLAN

System Owner: All States Material Group

Party Responsible for O&M: Following construction the system owner is responsible for the following items listed below.

The stormwater management system has been designed to provide stormwater treatment as a high priority so that the run-off from the site does not negatively impact the water quality of the receiving existing drainage system. In order to maintain the efficiency of this system proper operating and maintenance procedures must be followed. This document provides guidance for performing that maintenance.

Table 1 - Summary of Stormwater System Operation & Maintenance Task

Pocket Wetland Maintenance	
Activity	Frequency
In the first three years after construction, inspect the constructed stormwater wetlands	Twice a year during both the growing and non-growing seasons.
During inspections, record and map the following information: <ul style="list-style-type: none"> • The types and distribution of the dominant wetland plants in the marsh • The presence and distribution of planted wetland species • The presence and distribution of invasive wetland species (invasives must be removed) • Indications that other species are replacing the planted wetland species • Percentage of standing water that is unvegetated (excluding the deep water cells which are not suitable for emergent plant growth) • The maximum elevation and the vegetative condition in this zone, if the design elevation of the normal pool is being maintained for wetlands with extended zones • Stability of the original depth zones and the micro-topographic features and • Accumulation of sediment in the forebay and micropool; and survival rate of plants (cells with dead plants must be replanted). 	

Sediment Forebay Maintenance	
Activity	Frequency
<p>Sediment should be trapped and removed by the forebay or other type of basin before it reaches the wetland.</p> <p>Sediment forebay should be cleaned.</p>	Once a year.

Deep Sump Catch Basin Maintenance	
Activity	Frequency
Inspect units	Four times per year.
Clean units	Four times per year or whenever the depth of deposits is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe in the basin.

APPENDIX I – ILLICIT DISCHARGE COMPLIANCE STATEMENT

ILLICIT DISCHARGE COMPLIANT STATEMENT

Responsibility:

The Owner is responsible for ultimate compliance with all provisions of the Massachusetts Stormwater Management Policy, the USEPA NPDES Construction General Permit and responsible for identifying and eliminating illicit discharge (as defined by the USEPA).

Owner Name: All States Material Group

Address: 901 River Road, Deerfield, Massachusetts, 01342

Tel. Number: Project Manager Daniel J. Hartman, PE at 413-712-0759

Engineer's Compliance Statement:

To the best of my knowledge, the attached plans, computations and specifications meet the requirements of Standard 10 of the Massachusetts Stormwater Handbook regarding illicit discharges to the stormwater management system and that no detectable illicit discharges exist on the site. All documents and attachments were prepared under my direction and qualified personnel properly gathered and evaluated the information submitted, to the best of my knowledge.

Included with this statement are site plans, drawn to scale, that identify the location of systems for conveying stormwater on the site and shown that these systems do not allow the entry of any illicit discharges into the stormwater management system.

APPENDIX J – HY-8 CULVERT ANALYSIS REPORT

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 32.49 cfs

Design Flow: 110.94 cfs

Maximum Flow: 268.26 cfs

Table 1 - Summary of Culvert Flows at Crossing: EXIST CROSSING

Headwater Elevation (ft)	Total Discharge (cfs)	30 in CMP 1 Discharge (cfs)	30 in CMP 2 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
179.79	32.49	14.61	17.88	0.00	5
180.99	56.07	26.80	29.28	0.00	4
182.73	79.64	38.99	40.66	0.00	5
186.20	110.94	54.91	56.04	0.00	6
188.43	126.80	62.91	63.89	0.00	5
190.12	150.38	68.34	69.12	12.69	11
190.24	173.95	68.71	69.46	35.62	6
190.34	197.53	69.00	69.72	58.69	5
190.42	221.11	69.25	69.95	81.71	4
190.49	244.68	69.48	70.16	104.94	4
190.56	268.26	69.68	70.35	127.83	3
190.00	136.73	67.96	68.77	0.00	Overtopping

Rating Curve Plot for Crossing: EXIST CROSSING

Total Rating Curve

Crossing: EXIST CROSSING

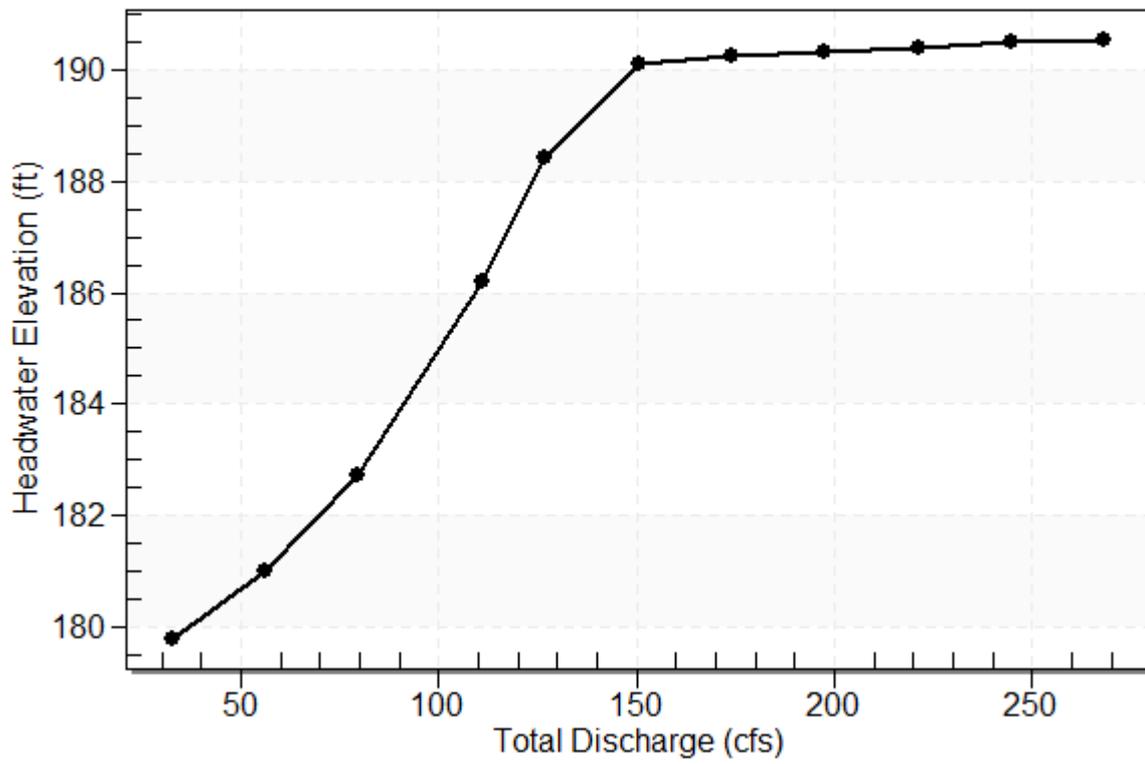


Table 2 - Culvert Summary Table: 30 in CMP 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
32.49	14.61	179.79	1.990	0.0*	1-S2n	1.025	1.288	1.025	0.628	7.708	4.222
56.07	26.80	180.99	3.193	1.306	5-S2n	1.464	1.765	1.464	0.864	8.976	5.099
79.64	38.99	182.73	4.929	3.899	5-S2n	1.928	2.106	1.928	1.059	9.597	5.735
110.94	54.91	186.20	8.397	7.860	7-M2c	2.500	2.353	2.353	1.280	11.457	6.391
126.80	62.91	188.43	10.632	10.339	7-M2c	2.500	2.257	2.257	1.381	13.490	6.670
150.38	68.34	190.12	12.323	12.169	6-FFc	2.500	2.500	2.500	1.521	13.922	7.040
173.95	68.71	190.24	12.442	12.299	6-FFc	2.500	2.500	2.500	1.651	13.997	7.367
197.53	69.00	190.34	12.537	12.401	6-FFc	2.500	2.500	2.500	1.773	14.056	7.661
221.11	69.25	190.42	12.618	12.489	6-FFc	2.500	2.500	2.500	1.887	14.107	7.929
244.68	69.48	190.49	12.694	12.570	6-FFc	2.500	2.500	2.500	1.996	14.153	8.176
268.26	69.68	190.56	12.763	12.645	6-FFc	2.500	2.500	2.500	2.100	14.196	8.404

* Full Flow Headwater elevation is below inlet invert.

Straight Culvert

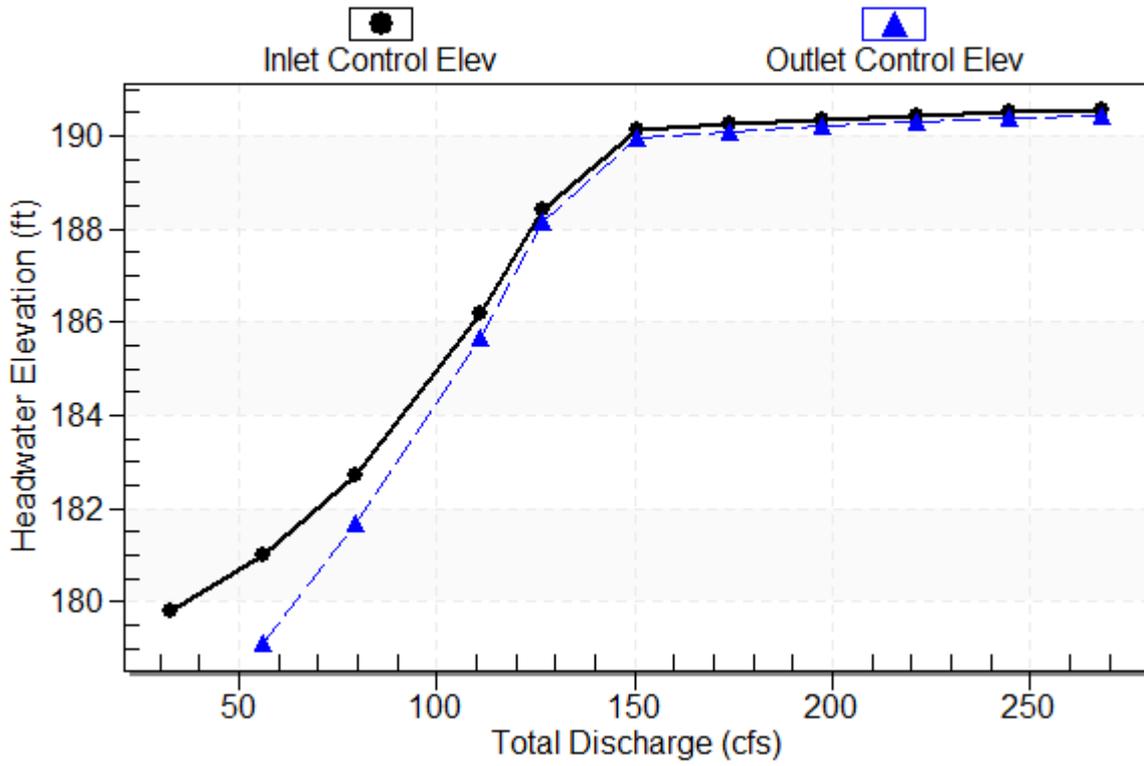
Inlet Elevation (invert): 177.80 ft, Outlet Elevation (invert): 175.50 ft

Culvert Length: 66.44 ft, Culvert Slope: 0.0346

Culvert Performance Curve Plot: 30 in CMP 1

Performance Curve

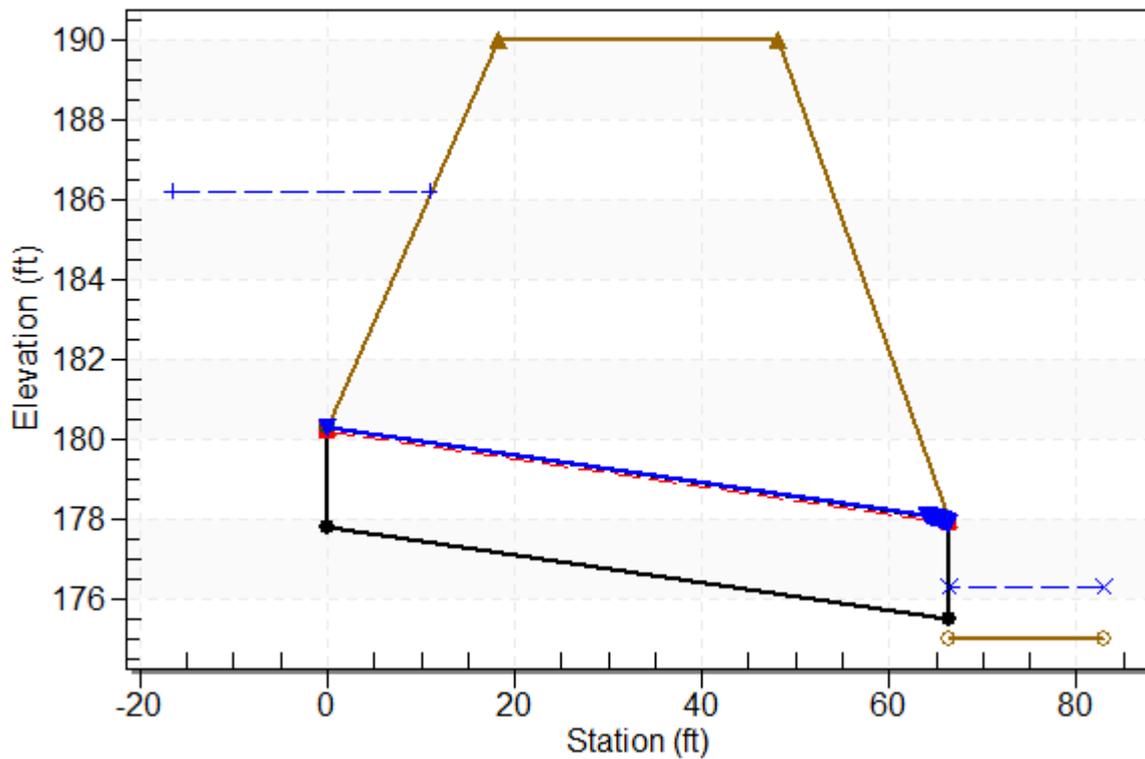
Culvert: 30 in CMP 1



Water Surface Profile Plot for Culvert: 30 in CMP 1

Crossing - EXIST CROSSING, Design Discharge - 110.9 cfs

Culvert - 30 in CMP 1, Culvert Discharge - 54.9 cfs



Site Data - 30 in CMP 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 177.80 ft

Outlet Station: 66.40 ft

Outlet Elevation: 175.50 ft

Number of Barrels: 1

Culvert Data Summary - 30 in CMP 1

Barrel Shape: Circular

Barrel Diameter: 2.50 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Thin Edge Projecting

Inlet Depression: None

Table 3 - Culvert Summary Table: 30 in CMP 2

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
32.49	17.88	179.79	2.289	0.112	1-S2n	1.173	1.432	1.173	0.628	7.908	4.222
56.07	29.28	180.99	3.493	1.905	5-S2n	1.591	1.845	1.591	0.864	8.882	5.099
79.64	40.66	182.73	5.229	4.424	5-S2n	2.095	2.143	2.095	1.059	9.256	5.735
110.94	56.04	186.20	8.698	8.360	7-M2c	2.500	2.363	2.363	1.280	11.665	6.391
126.80	63.89	188.43	10.933	10.835	7-M2c	2.500	2.178	2.178	1.381	14.077	6.670
150.38	69.12	190.12	12.583	12.623	6-FFc	2.500	2.500	2.500	1.521	14.081	7.040
173.95	69.46	190.24	12.694	12.743	6-FFc	2.500	2.500	2.500	1.651	14.150	7.367
197.53	69.72	190.34	12.781	12.837	6-FFc	2.500	2.500	2.500	1.773	14.204	7.661
221.11	69.95	190.42	12.856	12.919	6-FFc	2.500	2.500	2.500	1.887	14.250	7.929
244.68	70.16	190.49	12.926	12.994	6-FFc	2.500	2.500	2.500	1.996	14.293	8.176
268.26	70.35	190.56	12.989	13.063	6-FFc	2.500	2.500	2.500	2.100	14.332	8.404

Straight Culvert

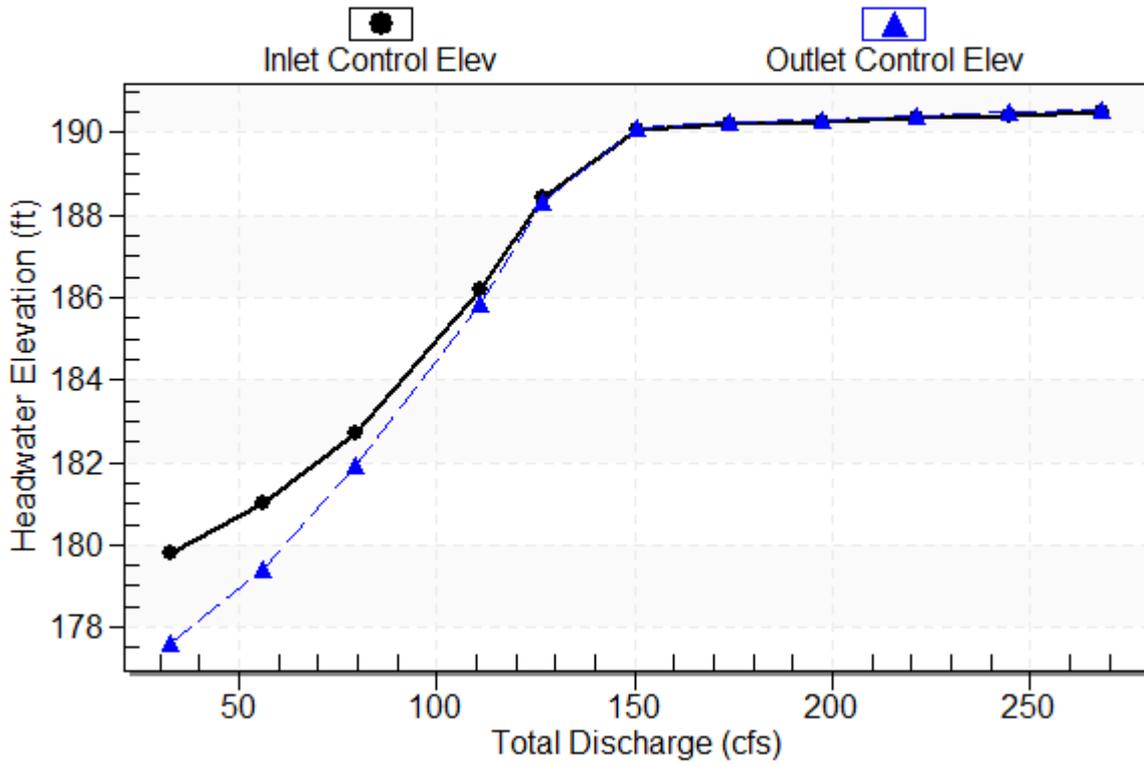
Inlet Elevation (invert): 177.50 ft, Outlet Elevation (invert): 175.36 ft

Culvert Length: 66.63 ft, Culvert Slope: 0.0321

Culvert Performance Curve Plot: 30 in CMP 2

Performance Curve

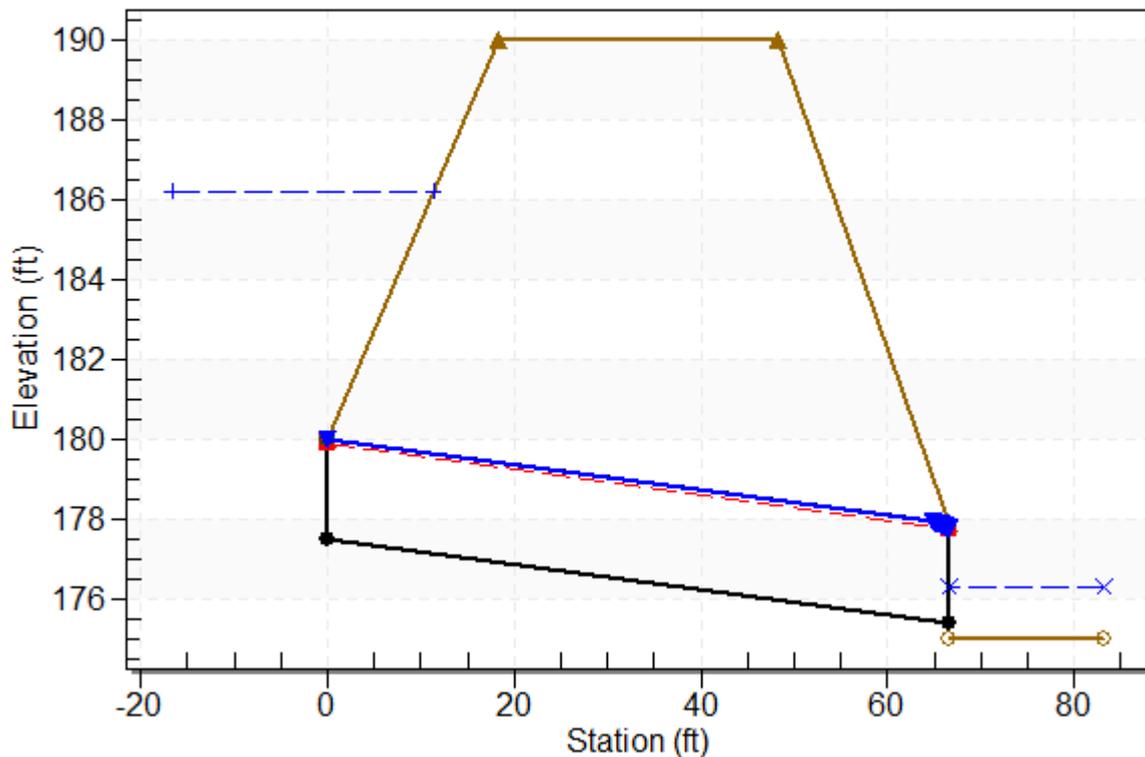
Culvert: 30 in CMP 2



Water Surface Profile Plot for Culvert: 30 in CMP 2

Crossing - EXIST CROSSING, Design Discharge - 110.9 cfs

Culvert - 30 in CMP 2, Culvert Discharge - 56.0 cfs



Site Data - 30 in CMP 2

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 177.50 ft

Outlet Station: 66.60 ft

Outlet Elevation: 175.36 ft

Number of Barrels: 1

Culvert Data Summary - 30 in CMP 2

Barrel Shape: Circular

Barrel Diameter: 2.50 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Thin Edge Projecting

Inlet Depression: None

Table 4 - Downstream Channel Rating Curve (Crossing: EXIST CROSSING)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
32.49	175.63	0.63	4.22	1.72	0.99
56.07	175.86	0.86	5.10	2.37	1.03
79.64	176.06	1.06	5.74	2.91	1.06
110.94	176.28	1.28	6.39	3.51	1.09
126.80	176.38	1.38	6.67	3.79	1.10
150.38	176.52	1.52	7.04	4.18	1.11
173.95	176.65	1.65	7.37	4.53	1.12
197.53	176.77	1.77	7.66	4.87	1.13
221.11	176.89	1.89	7.93	5.18	1.14
244.68	177.00	2.00	8.18	5.48	1.15
268.26	177.10	2.10	8.40	5.77	1.15

Tailwater Channel Data - EXIST CROSSING

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 11.00 ft

Side Slope (H:V): 2.00 (2:1)

Channel Slope: 0.0440

Channel Manning's n: 0.0500

Channel Invert Elevation: 175.00 ft

Roadway Data for Crossing: EXIST CROSSING

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 190.00 ft

Roadway Surface: Paved

Roadway Top Width: 30.00 ft

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 34.12 cfs

Design Flow: 113.42 cfs

Maximum Flow: 276.86 cfs

Table 1 - Summary of Culvert Flows at Crossing: PROP CROSSING

Headwater Elevation (ft)	Total Discharge (cfs)	60 in CMP Discharge (cfs)	Roadway Discharge (cfs)	Iterations
182.31	34.12	34.12	0.00	1
183.15	58.39	58.39	0.00	1
183.93	82.67	82.67	0.00	1
184.93	113.42	113.42	0.00	1
185.56	131.22	131.22	0.00	1
186.50	155.49	155.49	0.00	1
187.59	179.76	179.76	0.00	1
188.85	204.04	204.04	0.00	1
190.30	228.31	228.31	0.00	1
191.95	252.59	252.59	0.00	1
193.82	276.86	276.86	0.00	1
195.00	290.98	290.98	0.00	Overtopping

Rating Curve Plot for Crossing: PROP CROSSING

Total Rating Curve

Crossing: PROP CROSSING

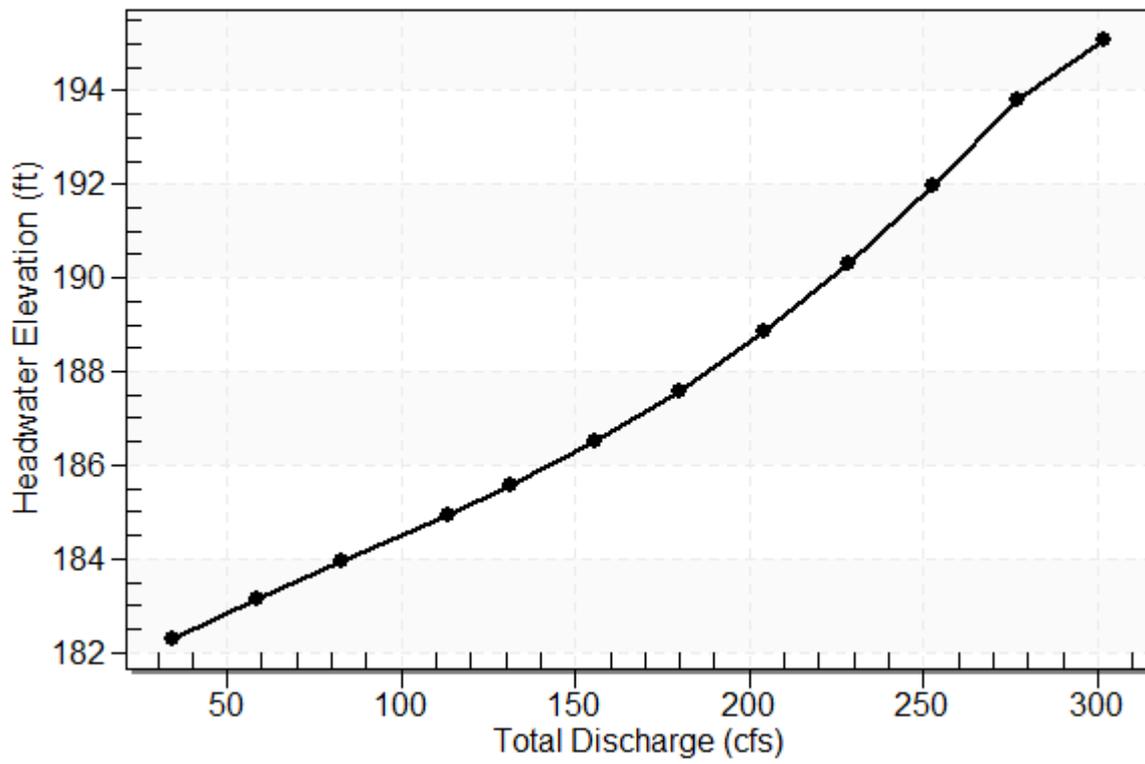


Table 2 - Culvert Summary Table: 60 in CMP

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
34.12	34.12	182.31	2.306	0.0*	1-S2n	1.116	1.625	1.116	0.646	10.425	4.295
58.39	58.39	183.15	3.151	0.0*	1-S2n	1.466	2.148	1.486	0.885	11.934	5.169
82.67	82.67	183.93	3.935	0.0*	1-S2n	1.758	2.576	1.758	1.082	13.407	5.806
113.42	113.42	184.93	4.933	0.0*	1-S2n	2.087	3.040	2.093	1.296	14.555	6.436
131.22	131.22	185.56	5.557	0.0*	5-S2n	2.265	3.278	2.265	1.408	15.181	6.743
155.49	155.49	186.50	6.501	0.171	5-S2n	2.498	3.575	2.498	1.550	15.853	7.114
179.76	179.76	187.59	7.589	2.226	5-S2n	2.726	3.840	2.750	1.682	16.244	7.441
204.04	204.04	188.85	8.848	3.728	5-S2n	2.952	4.073	2.980	1.805	16.721	7.737
228.31	228.31	190.30	10.299	5.389	5-S2n	3.181	4.273	3.219	1.921	17.088	8.007
252.59	252.59	191.95	11.954	7.208	5-S2n	3.419	4.439	3.457	2.032	17.440	8.254
276.86	276.86	193.82	13.818	9.186	5-S2n	3.672	4.571	3.714	2.137	17.703	8.484

* Full Flow Headwater elevation is below inlet invert.

Straight Culvert

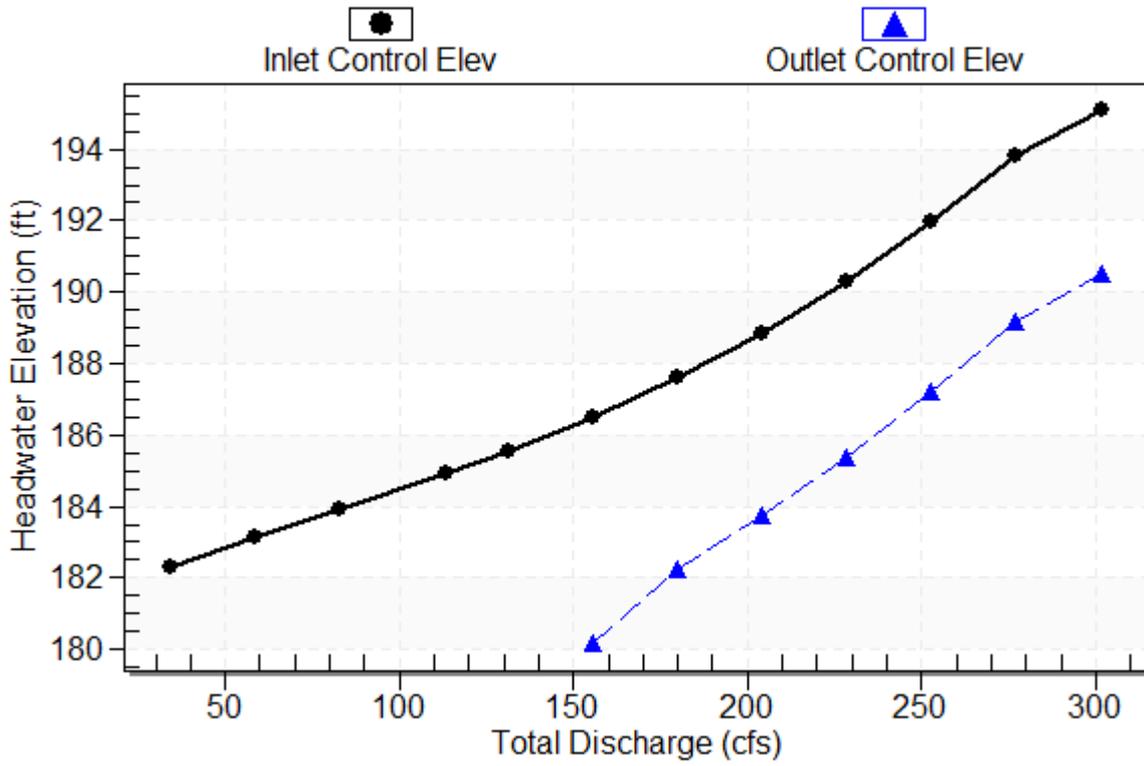
Inlet Elevation (invert): 180.00 ft, Outlet Elevation (invert): 173.00 ft

Culvert Length: 133.18 ft, Culvert Slope: 0.0526

Culvert Performance Curve Plot: 60 in CMP

Performance Curve

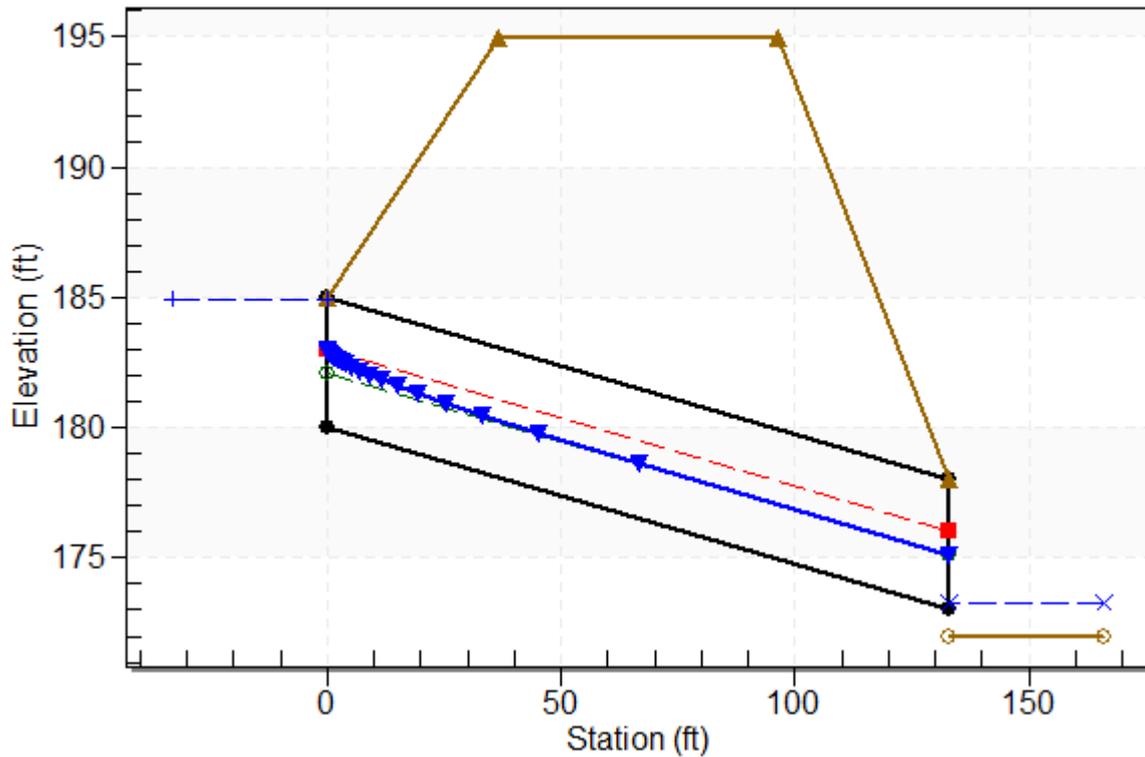
Culvert: 60 in CMP



Water Surface Profile Plot for Culvert: 60 in CMP

Crossing - PROP CROSSING, Design Discharge - 113.4 cfs

Culvert - 60 in CMP, Culvert Discharge - 113.4 cfs



Site Data - 60 in CMP

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 180.00 ft

Outlet Station: 133.00 ft

Outlet Elevation: 173.00 ft

Number of Barrels: 1

Culvert Data Summary - 60 in CMP

Barrel Shape: Circular

Barrel Diameter: 5.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0250

Culvert Type: Straight

Inlet Configuration: Thin Edge Projecting

Inlet Depression: None

Table 3 - Downstream Channel Rating Curve (Crossing: PROP CROSSING)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
34.12	172.65	0.65	4.29	1.77	0.99
58.39	172.88	0.88	5.17	2.43	1.03
82.67	173.08	1.08	5.81	2.97	1.06
113.42	173.30	1.30	6.44	3.56	1.09
131.22	173.41	1.41	6.74	3.87	1.10
155.49	173.55	1.55	7.11	4.26	1.11
179.76	173.68	1.68	7.44	4.62	1.12
204.04	173.81	1.81	7.74	4.96	1.13
228.31	173.92	1.92	8.01	5.27	1.14
252.59	174.03	2.03	8.25	5.58	1.15
276.86	174.14	2.14	8.48	5.87	1.16

Tailwater Channel Data - PROP CROSSING

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 11.00 ft

Side Slope (H:V): 2.00 (2:1)

Channel Slope: 0.0440

Channel Manning's n: 0.0500

Channel Invert Elevation: 172.00 ft

Roadway Data for Crossing: PROP CROSSING

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 195.00 ft

Roadway Surface: Paved

Roadway Top Width: 60.00 ft