Summit Engineering & Survey, Inc.

HYDRAULIC / HYDROLOGIC CALCULATIONS

SITE PLAN
150 Charlton Road
STURBRIDGE, MASSACHUSETTS

Prepared For:
Interstate Towing

Owner:
Cobra Realty Trust

Prepared By:
SUMMIT ENGINEERING & SURVEY, INC.
710 MAIN STREET
OXFORD, MASSACHUSETTS

June 13, 2022
October 12, 2021
Revised January 20, 2022
Revised February 28, 2022
Revised April 13, 2022

710 Main Street North Oxford MA 01537 (P) 508-987-8713 (F) 508-987-8714

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DRAINAGE SUMMARY

Summit Engineering & Survey, Inc. is pleased to provide the following Hydraulic / Hydrologic analysis for 150 Charlton Road, Sturbridge, Massachusetts. The existing site consists of predominantly un-developed land, portion of it is a grass field and the rest of it wooded with mature woodland. The hydrologic conditions were analyzed using TR-55 and HydroCAD® for the 2, 10, 25 and 100 year storm events utilizing Technical Paper 40, 24 hour Rainfall events.

The proposed site consists of the construction of a new 8,000 square foot light industrial building and supporting infrastructure. The project will also consist of the installation of all utilities to service the proposed building. The proposed drainage system for the site will consist of proposed catch basins to drain manholes to hydrodynamic separators (Stormceptor or equal) to underground storage/infiltration basin. The proposed roof runoff will be collected discharges directly into the underground basin for infiltration. All portions of the paved area will be pretreated by hydrodynamic separators prior to discharging into the underground basin for infiltration. The project as designed conforms to the Massachusetts DEP Stormwater Management Policy.

EXISTING CONDITIONS:

The site is abutted by Charlton Road (Route 20) and the Massachusetts Turnpike Authority. The site is predominately wooded with a grass field in the middle of it. There is a bordering vegetated wetland system on the westerly portion of the site with a stream located within it. There is another isolated wetland located adjacent to Route 20. The wetland system conveys water from the south to the north toward the Massachusetts Turnpike.

The topography of the site is sloped from Route 20 toward the northwest where the wetland with the stream is located. A majority of the site is graded toward the northwest.

For the purpose of the analysis of the effect on site development, the site was analyzed as one independent watershed. In the Pre-Development Condition, Subcatchment 1 represents the tributary area of the property that flows to the wetland and the stream.

According to the online USGS soil survey, the analyzed area consists of soils with “C” hydrologic ratings. On site soil testing confirms the condition along with varying depths to groundwater. The cover consists of a grass field and woodland.

PROPOSED CONDITIONS:

The proposed condition of the site includes the construction of an access driveway, employee and visitor parking areas, loading area and the 8,000 square foot light industrial building. The site is serviced by municipal water and sewer systems.

The site will be re-graded to support the project and control stormwater in accordance with the Massachusetts Stormwater Management Policy. The development includes the construction of a subsurface drainage basin, roof runoff collection system, catch basins and proprietary devices to provide stormwater treatment and attenuation to reduce the impact of surface alterations.

In order to analyze the surface water flows, the site was divided into multiple subcatchents. The interest point, which is the wetland to the north is then compared to the Pre-Development Conditions.

In summary, the peak rates of runoff were compared under pre-development and post-development conditions for analysis of the 2 year, 10 year, 25 year and 100 year storm events. The following is a **Peak Discharge Summary Table**:

Design Point Analysis:

Watershed		Design Event			
		2 Year	10 Year	25 Year	100 Year
Pre-Development	IP-E	3.25	7.24	8.70	13.32
Post Development	IP-P	3.08	7.02	8.40	13.23

DEP Stormwater Management Standards:

Standard #1: The proposed changes will not cause erosion in adjacent waters of the Commonwealth, as BMP measures are proposed in accordance with the design requirements of the Stormwater Management handbook. The Erosion & Sedimentation Control Plan provides for the installation of siltation barriers, temporary basins, and temporary construction entrances and outlines intermediary measures to control runoff during construction and after construction.

Standard #2: The proposed development peak discharge rates for the total off-site flow are less than or equal to pre-development discharge rates for the 2 year, 10 year, and 100 year storm events for the design points analyzed. Attached calculations show how the site mitigates the increased flow rates due to surface changes from the site development.

Standard #3: The roof drain runoff is directed to the infiltration basin that meets the recharge requirement for Class C Soils. Basin 6P is also designed to infiltrate runoff from the driveway and parking areas after pre-treatment. Infiltration depths are designed to drain in under 72 hours as required by the Policy.

Standard #4: Over 80% TSS shall occur based on the BMP measurements provided. The treatment train varies for each section. TSS worksheets are provided in the report for each treatment train in the site. The water quality volume was determined using 1.0" of runoff over the proposed impervious area.

Standard #5: The proposed development will not generate higher potential pollutant loads and therefore will not require additional BMP's.

Standard #6: The proposed project is not near a critical area.

Standard #7: The proposed project is not a redevelopment project.

Standard #8: Erosion and sediment control measures are proposed as part of the proposed project.

Standard #9: An Operation & Maintenance plan is provided within this document

Standard #10: This project does not propose any illicit discharges.

STORMWATER MANAGEMENT CHECKLIST

Summit Engineering & Survey, Inc.
710 Main Street North Oxford MA 01537 (P) 508-987-8713 (F) 508-987-8714

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

Checklist for Stormwater Report

Cobra Realty trust, 150 Charlton Road, Sturbridge, Mass.

A. Introduction

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

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

The Stormwater Report must include:

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

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

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

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

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

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

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

Checklist for Stormwater Report

Cobra Realty trust, 150 Charlton Road, Sturbridge, Mass.

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

June 13, 2022, 2022
Mikael A. Lassila, P.E.

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

Cobra Realty trust, 150 Charlton Road, Sturbridge, Mass.

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

Cobra Realty trust, 150 Charlton Road, Sturbridge, Mass.

Checklist (continued)

Standard 2: Peak Rate Attenuation

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

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

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

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

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

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

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Cobra Realty trust, 150 Charlton Road, Sturbridge, Mass.

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;
- 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;
- Pavement 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

Cobra Realty trust, 150 Charlton Road, Sturbridge, Mass.

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

Cobra Realty trust, 150 Charlton Road, Sturbridge, Mass.

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

Cobra Realty trust, 150 Charlton Road, Sturbridge, Mass.

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

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

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

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

Standard 10: Prohibition of Illicit Discharges

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

☒ An Illicit Discharge Compliance Statement is attached;

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

STANDARD #2- PEAK DISCHARGE RATES

Design Point Analysis:

Watershed		Design Event			
		2 Year	10 Year	25 Year	100 Year
Pre-Development	IP-E	3.25	7.24	8.70	13.32
Post Development	IP-P	3.08	7.02	8.40	13.23

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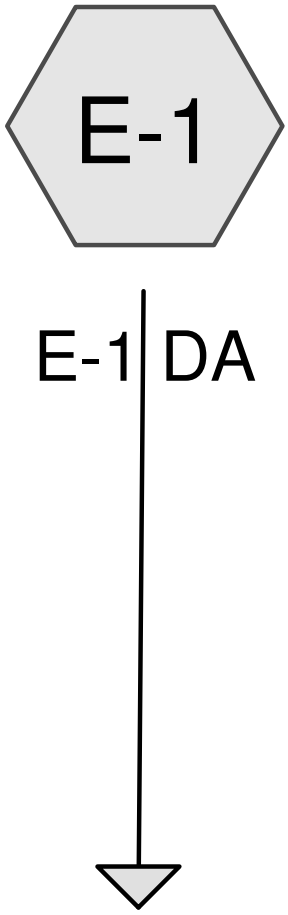
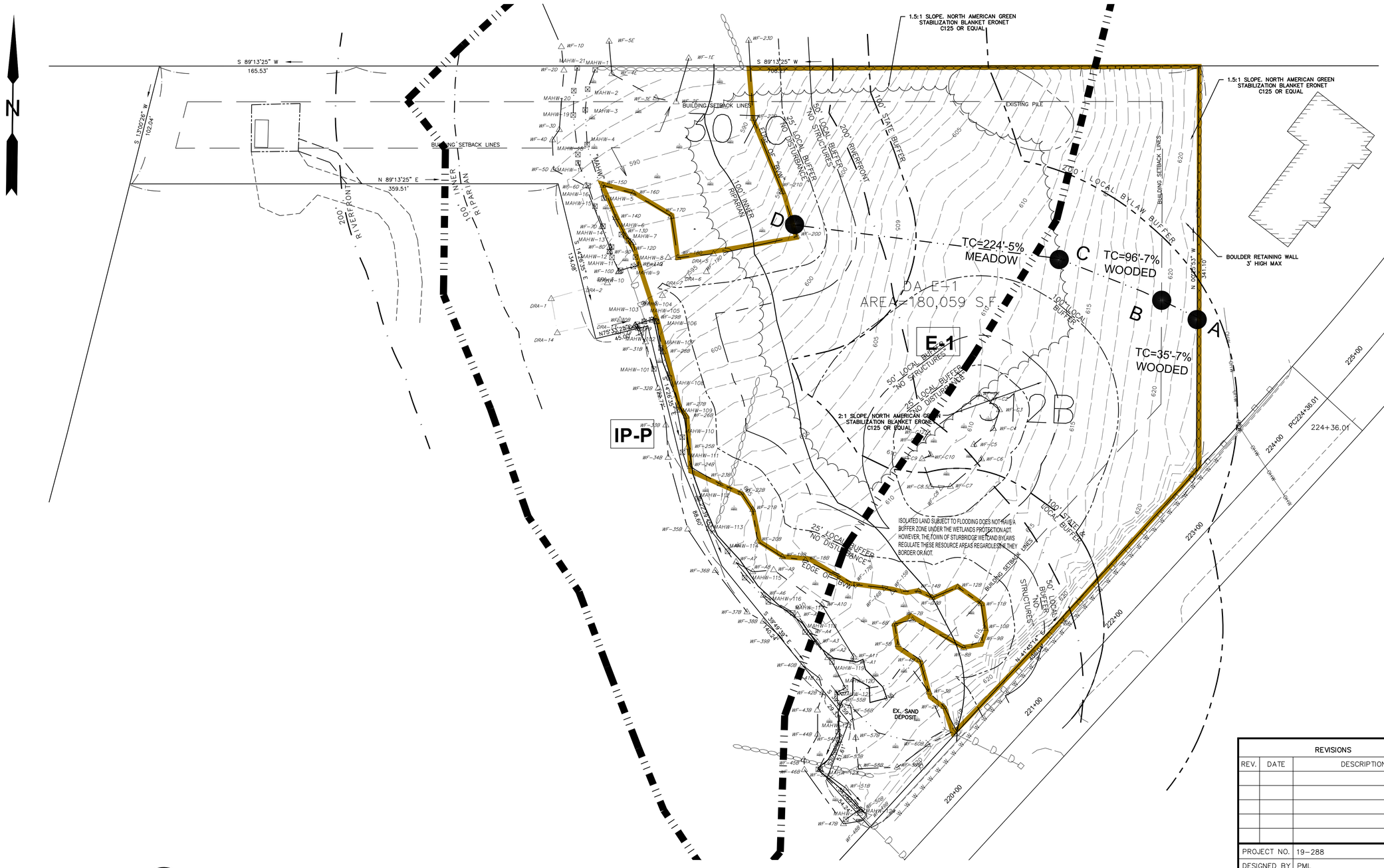


WETLAND/STREAM

Subcat Reach Pond Link

Routing Diagram for Cobra_Stormtech pml
Prepared by Tauper Land Survey, Inc., Printed 6/7/2022



P.E.	P.L.S.

APPROVAL UNDER SITE PLAN REVIEW.
STURBRIDGE PLANNING BOARD

BEING A MAJORITY

APPROVAL DATE: _____

ENDORSEMENT DATE: _____

LEGEND

- IRON PIPE FOUND
- DRILL HOLE FOUND
- STONE OR CONCRETE MONUMENT
- SEWER MANHOLE
- DRAIN MANHOLE
- ELECTRIC MANHOLE
- TELEPHONE MANHOLE
- WATER MANHOLE
- UNDETERMINED MANHOLE
- CATCH BASIN
- CLEANOUT
- MONITORING WELL
- ANCHOR
- UTILITY POLE
- WATER GATE VALVE
- WATER SHUT OFF
- HYDRANT
- BENCHMARK
- GAS VALVE
- SIGN
- LIGHT POLE / LAMP POST
- SPOT LIGHT
- MAILBOX (MBX)
- BOLLARD
- OBSERVATION TEST PIT
- HYDRIC SOIL TEST PIT
- BORING TEST PIT
- SHRUBS, BUSHES, ETC.
- DECIDUOUS TREE
- CONIFEROUS TREE
- WF-26 WETLAND FLAG
- BOULDER
- VGC VERTICAL GRANITE CURBING
- CNCRB CONCRETE CURBING
- CCB CAPE COD BERM (BITUMINOUS)
- BTCRB BITUMINOUS CURBING (GENERIC)
- ELECTRIC LINE
- SEWER LINE
- DRAIN LINE
- WATER LINE
- GAS LINE
- TELEPHONE LINE
- FIRE PROTECTION LINE
- OVERHEAD WIRES
- CABLE TELEVISION
- ROOF DRAIN
- STONEWALL
- EDGE OF PAVEMENT
- FENCING (AS NOTED)
- GUARD RAILING (AS NOTED)
- TREE LINE
- EDGE OF LANDSCAPING
- BORDERING VEGETATED WETLAND
- PROPERTY LINE
- SUBSURFACE DRAIN

DIG SAFE NOTE:

UTILITIES ARE PLOTTED FROM FIELD LOCATION AND ANY RECORD INFORMATION AVAILABLE, AND SHOULD BE CONSIDERED APPROXIMATE. OTHER UTILITIES MAY EXIST WHICH ARE NOT EVIDENT OR FOR WHICH RECORD INFORMATION WAS NOT AVAILABLE. CONTRACTORS (IN ACCORDANCE WITH MASS.G.L. CHAPTER 82 SECTION 40 AS AMENDED) MUST CONTACT ALL UTILITY COMPANIES BEFORE EXCAVATING AND DRILLING. ALSO, CALL "DIG-SAFE" AT 1(888)344-7233 [1(888)DIG-SAFE].

EXISTING LINES OTHER THAN THOSE INDICATED ON THESE DRAWINGS MAY BE ON THE SITE. THE CONTRACTOR IS WARNED TO PROCEED WITH CAUTION WITH ALL WORK, ESPECIALLY EXCAVATION WORK, AND TO MAKE ALL POSSIBLE INVESTIGATIONS AS TO POSSIBLE UNMARKED UTILITY LINES.

REVISIONS		
REV.	DATE	DESCRIPTION

PROJECT NO.	19-288
DESIGNED BY	PML
CHECKED BY	AB
DATE	5/26/22
CAD FILE	19-288_150 CHARLTON ST. SITE

GRAPHIC SCALE

40 0 20 40 80

(IN FEET)
1 inch = 40 feet

PREPARED BY:

SUMMIT
Engineering & Survey, Inc.
710 MAIN STREET
OXFORD, MA 01537
P:(508) 987-8713 F:(508) 987-8774

SHEET TITLE

PRE-DEVELOPMENT

DEFINITIVE SITE PLAN
at
150 CHARLTON ROAD
(ROUTE 20)
STURBRIDGE, MA
PREPARED FOR
COBRA REALTY TRUST

SHEET NO.

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.501	71	Meadow, non-grazed, HSG C (E-1)
2.632	70	Woods, Good, HSG C (E-1)

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
4.134	HSG C	E-1
0.000	HSG D	
0.000	Other	

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	1.501	0.000	0.000	1.501	Meadow, non-grazed	E-1
0.000	0.000	2.632	0.000	0.000	2.632	Woods, Good	E-1

Summary for Subcatchment E-1: E-1 DA

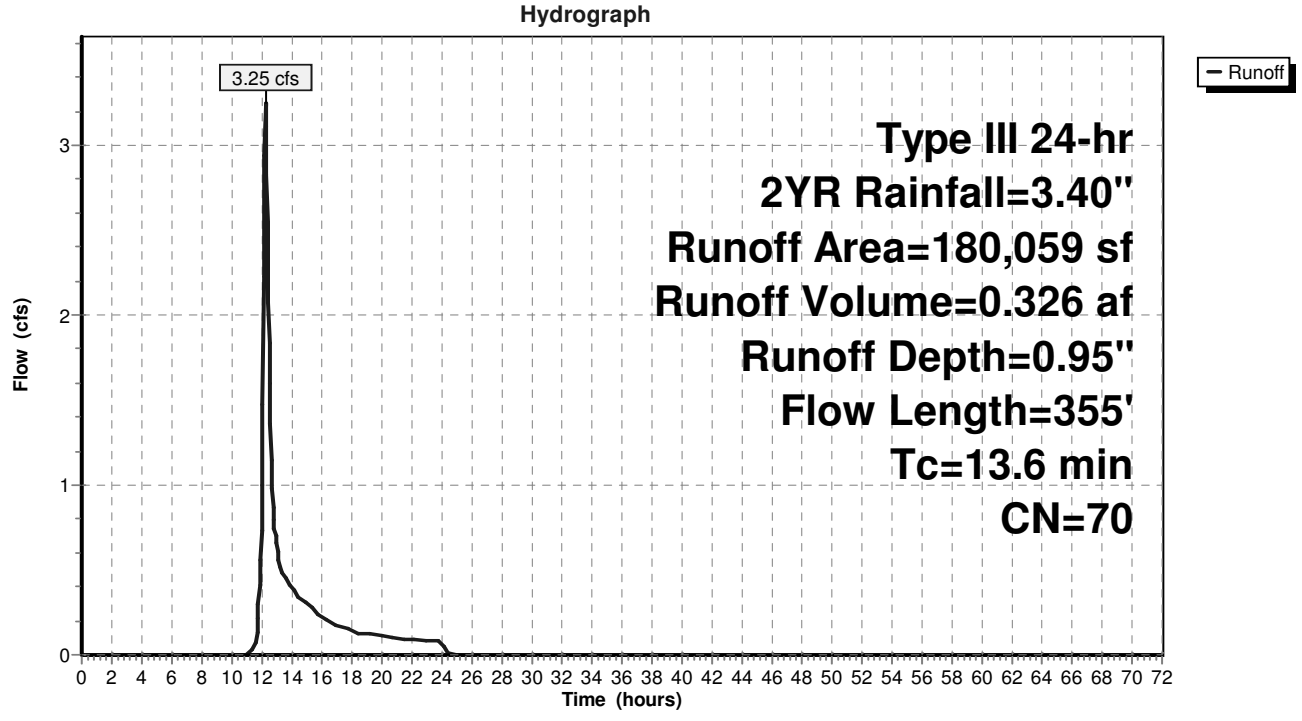
Runoff = 3.25 cfs @ 12.21 hrs, Volume= 0.326 af, Depth= 0.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2YR Rainfall=3.40"

Area (sf)	CN	Description
65,390	71	Meadow, non-grazed, HSG C
114,669	70	Woods, Good, HSG C
180,059	70	Weighted Average
180,059		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	35	0.0700	0.06		**Sheet Flow, TRAVEL PATH A TO B** Woods: Dense underbrush n= 0.800 P2= 3.20"
1.4	96	0.0500	1.12		**Shallow Concentrated Flow, TRAVEL PATH B TO C** Woodland Kv= 5.0 fps
2.4	224	0.0500	1.57		**Shallow Concentrated Flow, TRAVEL PATH C TO D** Short Grass Pasture Kv= 7.0 fps
13.6	355	Total			

Subcatchment E-1: E-1 DA

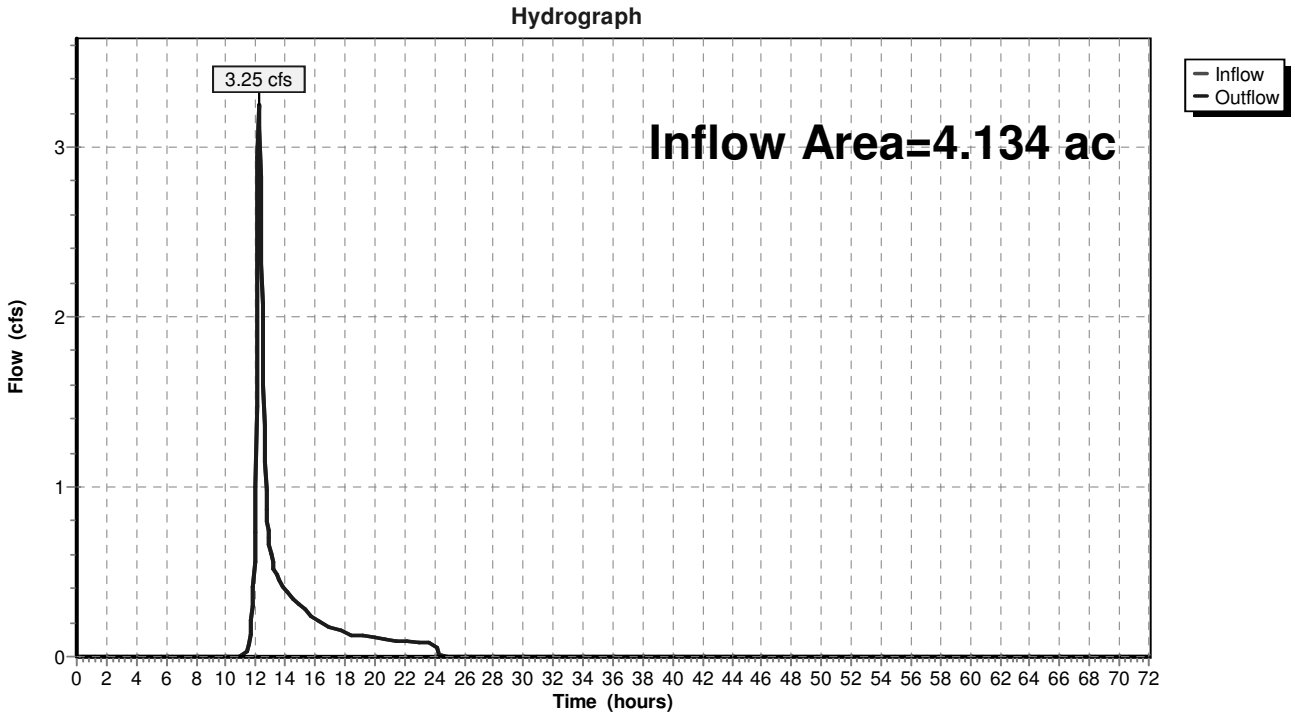


Summary for Reach IP-E: WETLAND/STREAM

Inflow Area = 4.134 ac, 0.00% Impervious, Inflow Depth = 0.95" for 2YR event
Inflow = 3.25 cfs @ 12.21 hrs, Volume= 0.326 af
Outflow = 3.25 cfs @ 12.21 hrs, Volume= 0.326 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach IP-E: WETLAND/STREAM



Summary for Subcatchment E-1: E-1 DA

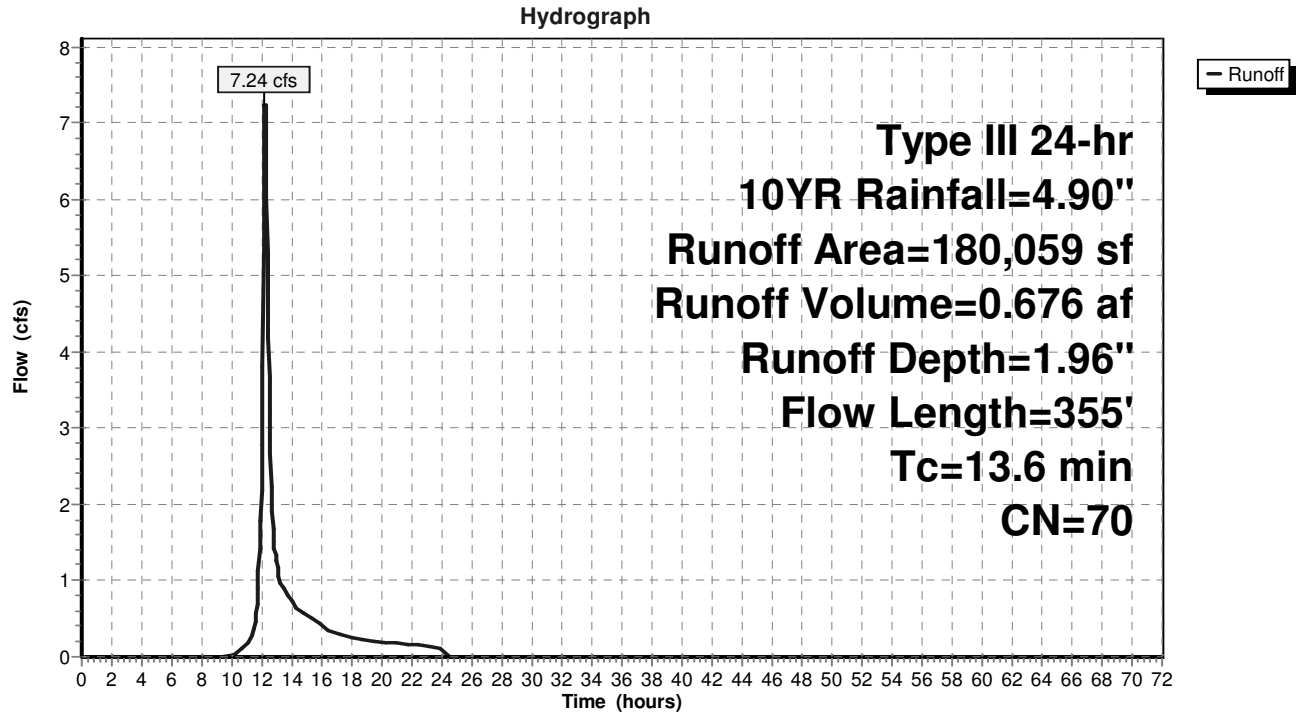
Runoff = 7.24 cfs @ 12.20 hrs, Volume= 0.676 af, Depth= 1.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10YR Rainfall=4.90"

Area (sf)	CN	Description
65,390	71	Meadow, non-grazed, HSG C
114,669	70	Woods, Good, HSG C
180,059	70	Weighted Average
180,059		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	35	0.0700	0.06		**Sheet Flow, TRAVEL PATH A TO B** Woods: Dense underbrush n= 0.800 P2= 3.20"
1.4	96	0.0500	1.12		**Shallow Concentrated Flow, TRAVEL PATH B TO C** Woodland Kv= 5.0 fps
2.4	224	0.0500	1.57		**Shallow Concentrated Flow, TRAVEL PATH C TO D** Short Grass Pasture Kv= 7.0 fps
13.6	355	Total			

Subcatchment E-1: E-1 DA

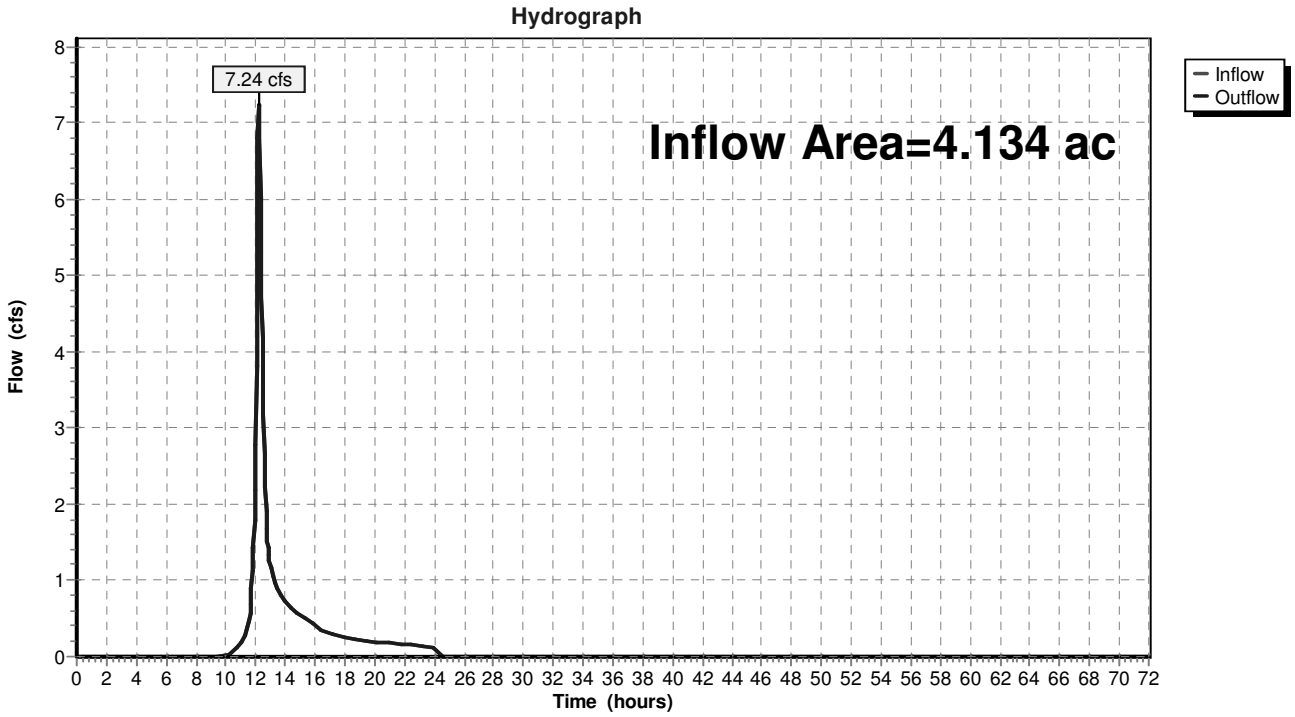


Summary for Reach IP-E: WETLAND/STREAM

Inflow Area = 4.134 ac, 0.00% Impervious, Inflow Depth = 1.96" for 10YR event
Inflow = 7.24 cfs @ 12.20 hrs, Volume= 0.676 af
Outflow = 7.24 cfs @ 12.20 hrs, Volume= 0.676 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach IP-E: WETLAND/STREAM



Summary for Subcatchment E-1: E-1 DA

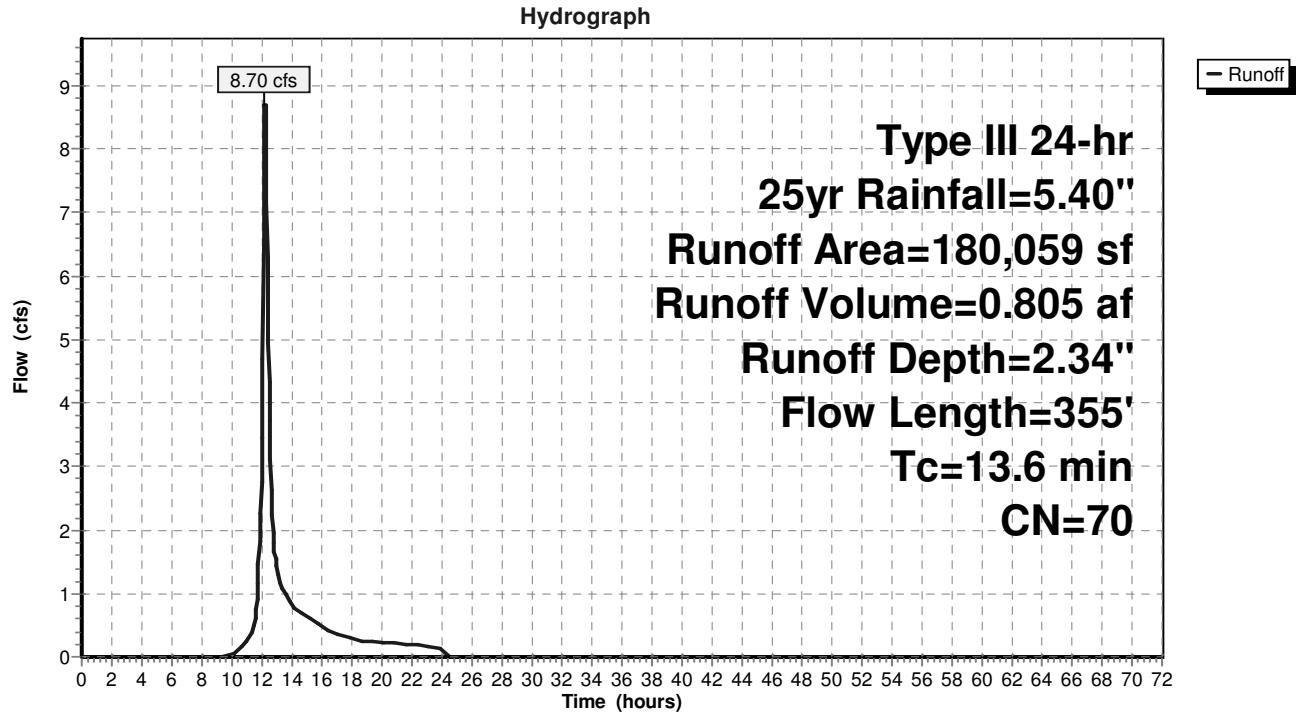
Runoff = 8.70 cfs @ 12.20 hrs, Volume= 0.805 af, Depth= 2.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25yr Rainfall=5.40"

Area (sf)	CN	Description
65,390	71	Meadow, non-grazed, HSG C
114,669	70	Woods, Good, HSG C
180,059	70	Weighted Average
180,059		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	35	0.0700	0.06		**Sheet Flow, TRAVEL PATH A TO B** Woods: Dense underbrush n= 0.800 P2= 3.20"
1.4	96	0.0500	1.12		**Shallow Concentrated Flow, TRAVEL PATH B TO C** Woodland Kv= 5.0 fps
2.4	224	0.0500	1.57		**Shallow Concentrated Flow, TRAVEL PATH C TO D** Short Grass Pasture Kv= 7.0 fps
13.6	355	Total			

Subcatchment E-1: E-1 DA

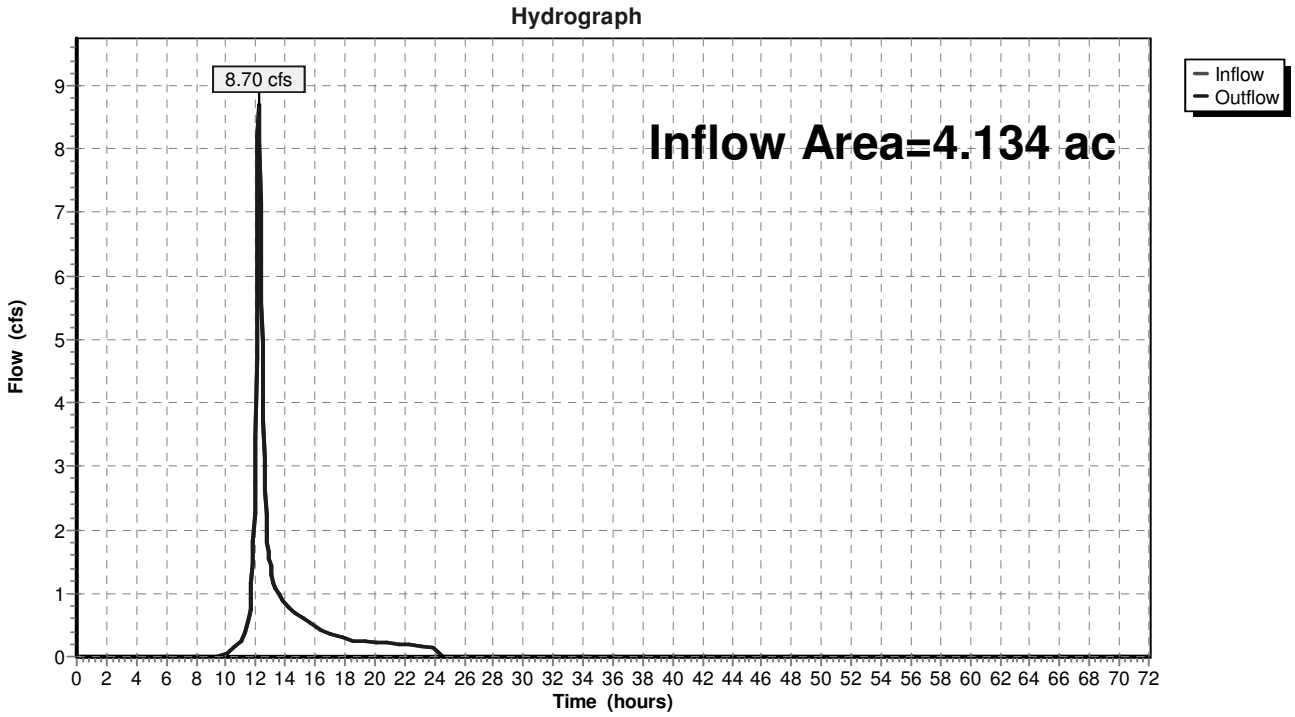


Summary for Reach IP-E: WETLAND/STREAM

Inflow Area = 4.134 ac, 0.00% Impervious, Inflow Depth = 2.34" for 25yr event
Inflow = 8.70 cfs @ 12.20 hrs, Volume= 0.805 af
Outflow = 8.70 cfs @ 12.20 hrs, Volume= 0.805 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach IP-E: WETLAND/STREAM



Summary for Subcatchment E-1: E-1 DA

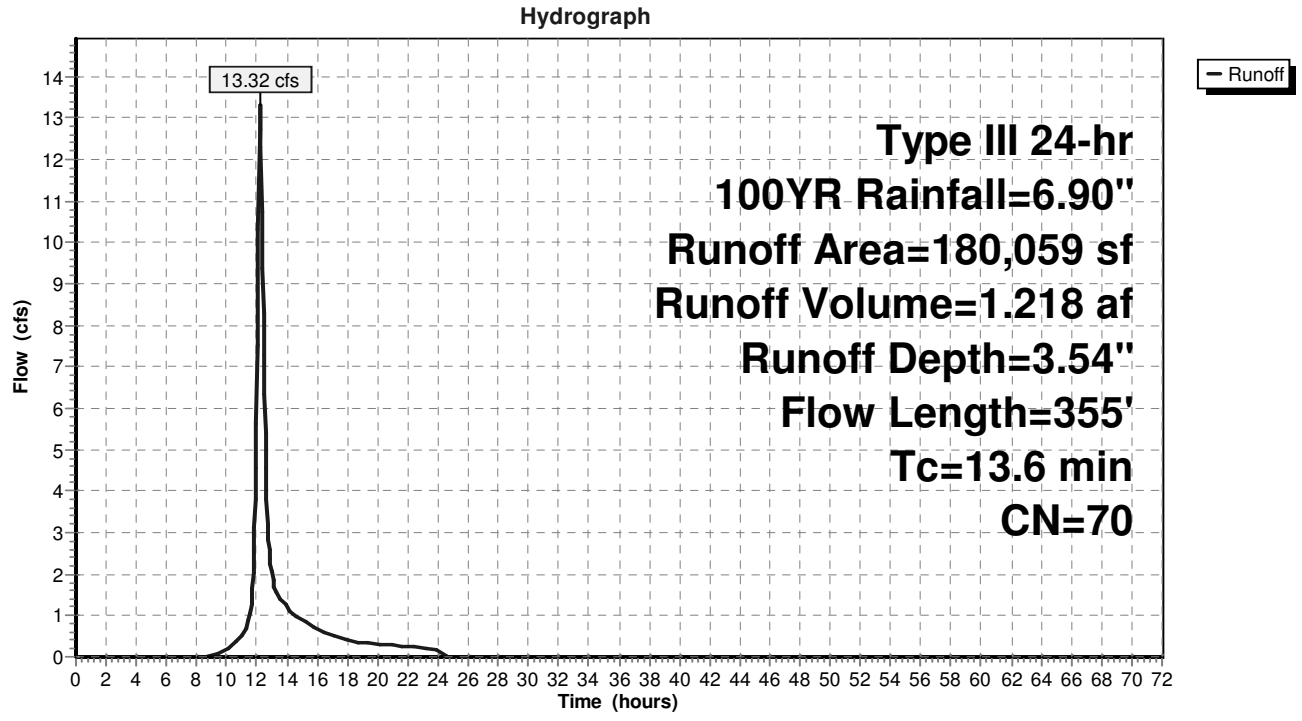
Runoff = 13.32 cfs @ 12.19 hrs, Volume= 1.218 af, Depth= 3.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100YR Rainfall=6.90"

Area (sf)	CN	Description
65,390	71	Meadow, non-grazed, HSG C
114,669	70	Woods, Good, HSG C
180,059	70	Weighted Average
180,059		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	35	0.0700	0.06		**Sheet Flow, TRAVEL PATH A TO B** Woods: Dense underbrush n= 0.800 P2= 3.20"
1.4	96	0.0500	1.12		**Shallow Concentrated Flow, TRAVEL PATH B TO C** Woodland Kv= 5.0 fps
2.4	224	0.0500	1.57		**Shallow Concentrated Flow, TRAVEL PATH C TO D** Short Grass Pasture Kv= 7.0 fps
13.6	355	Total			

Subcatchment E-1: E-1 DA

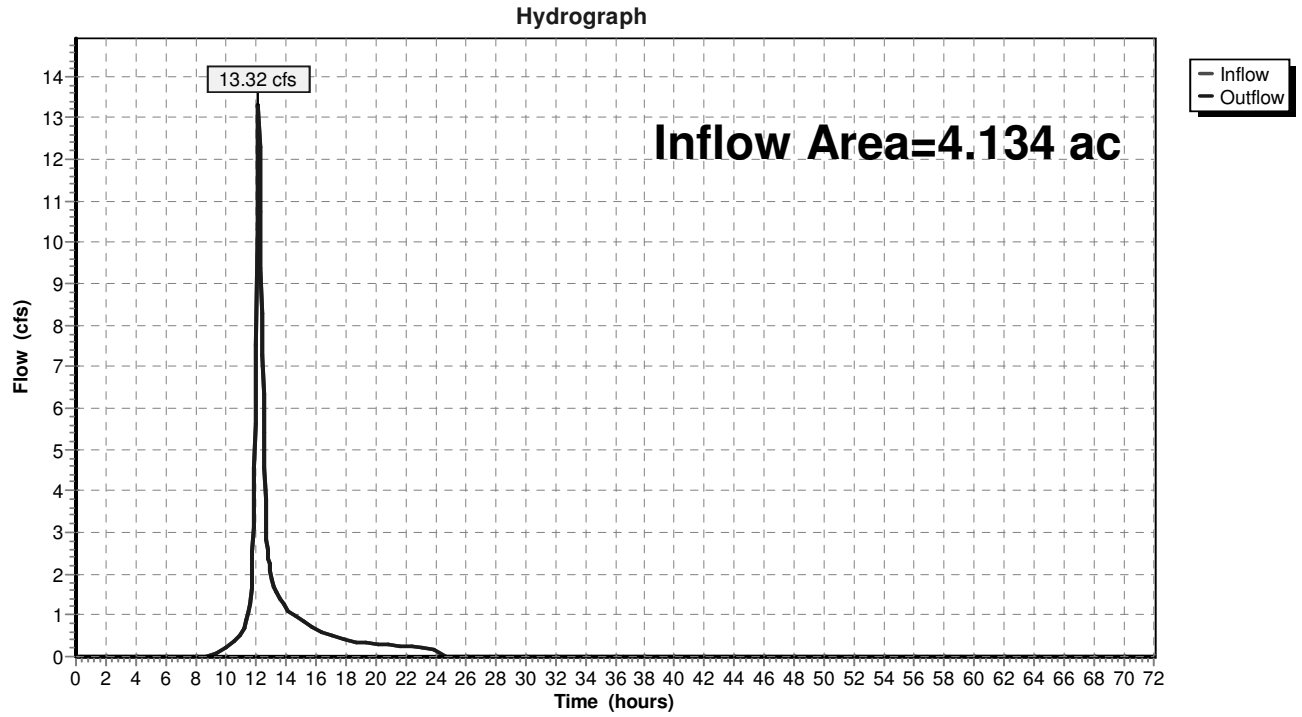


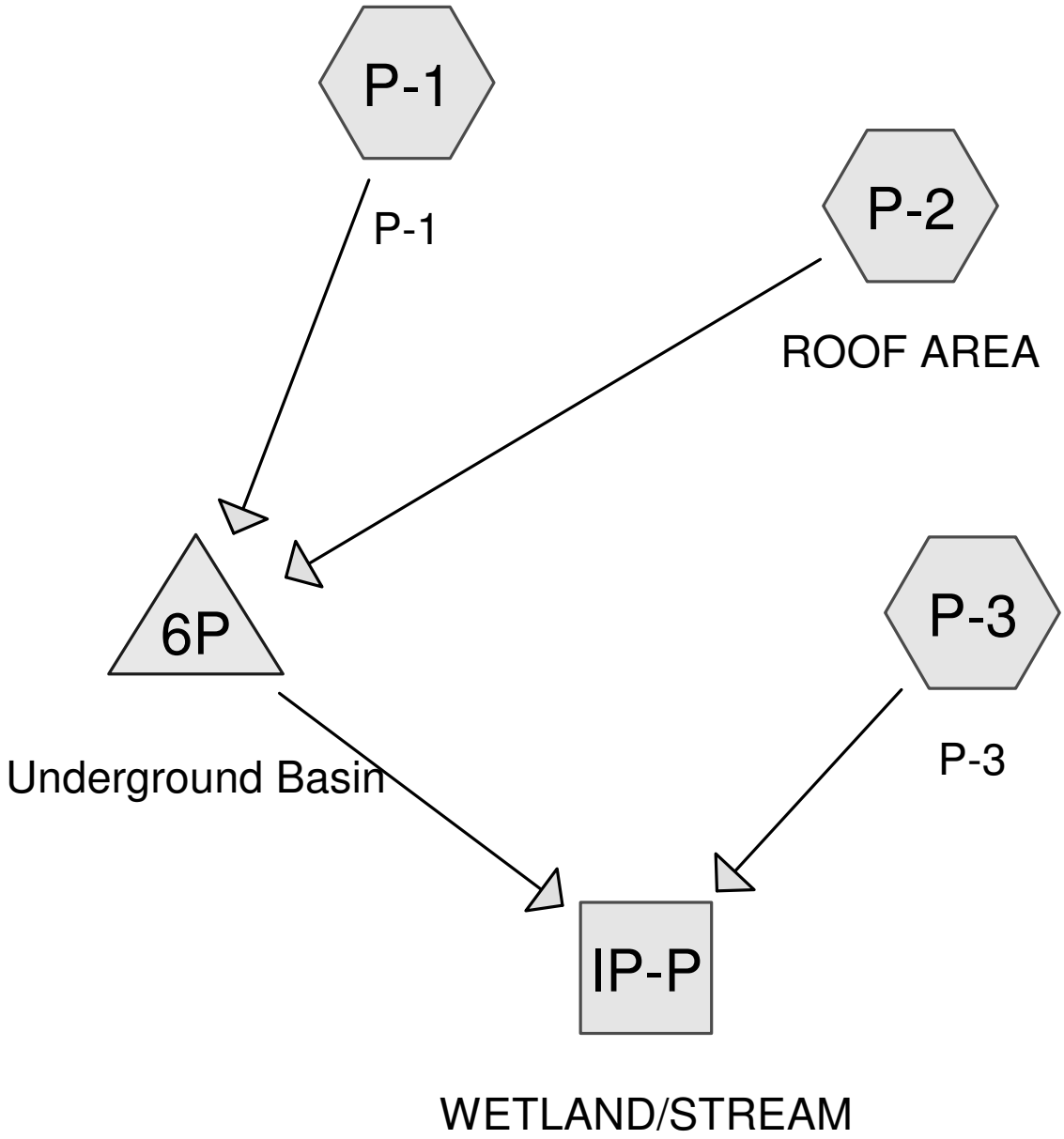
Summary for Reach IP-E: WETLAND/STREAM

Inflow Area = 4.134 ac, 0.00% Impervious, Inflow Depth = 3.54" for 100YR event
Inflow = 13.32 cfs @ 12.19 hrs, Volume= 1.218 af
Outflow = 13.32 cfs @ 12.19 hrs, Volume= 1.218 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

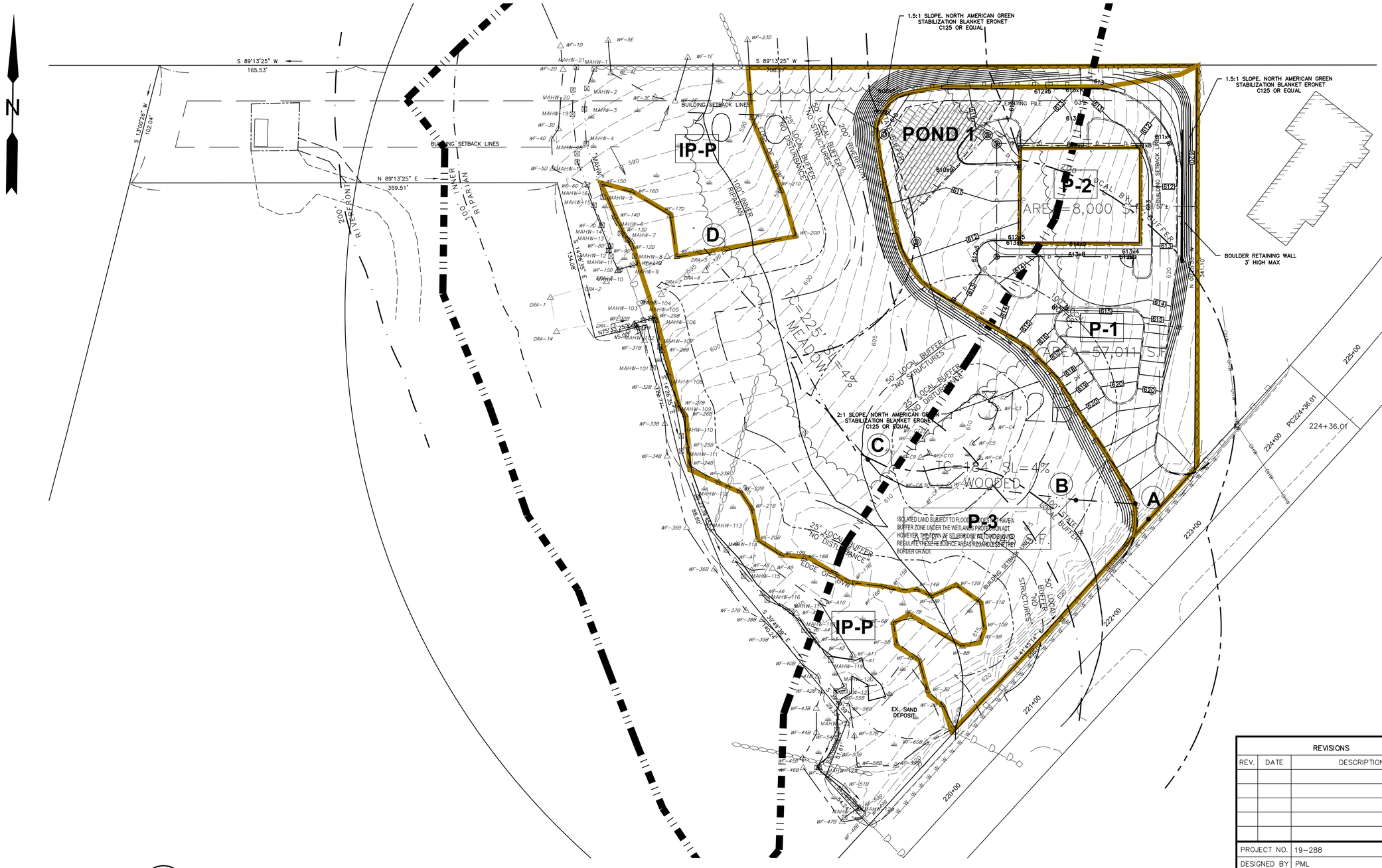
Reach IP-E: WETLAND/STREAM





Subcat Reach Pond Link

Routing Diagram for Cobra_Stormtech pml
Prepared by Tauper Land Survey, Inc., Printed 6/7/2022



DIG SAFE NOTE:

UTILITIES ARE PLOTTED FROM FIELD LOCATION AND ANY RECORD INFORMATION AVAILABLE, AND SHOULD BE CONSIDERED APPROXIMATE. OTHER UTILITIES MAY EXIST WHICH ARE NOT EVIDENT OR FOR WHICH RECORD INFORMATION WAS NOT AVAILABLE. CONTRACTORS (IN ACCORDANCE WITH MASS.G.L. CHAPTER 82 SECTION 40 AS AMENDED) MUST CONTACT ALL UTILITY COMPANIES BEFORE EXCAVATING AND DRILLING. ALSO, CALL "DIG-SAFE" AT 1(888)344-7233 1(888)DIG-SAFE).

EXISTING LINES OTHER THAN THOSE INDICATED ON THESE DRAWINGS MAY BE ON THE SITE. THE CONTRACTOR IS WARNED TO PROCEED WITH CAUTION WITH ALL WORK, ESPECIALLY EXCAVATION WORK, AND TO MAKE ALL POSSIBLE INVESTIGATIONS AS TO POSSIBLE UNMARKED UTILITY LINES.

REVISIONS		
REV.	DATE	DESCRIPTION

PROJECT NO.	19-288
DESIGNED BY	PML
CHECKED BY	SB
DATE	5/26/22
CAD FILE	19-288_150 CHARLTON ST. SITE

GRAPHIC SCALE

40 0 20 40 80

(IN FEET)

1 inch = 40 feet

P.E.	P.L.S.

APPROVAL UNDER SITE PLAN REVIEW.
STURBRIDGE PLANNING BOARD

BEING A MAJORITY

APPROVAL DATE: _____

ENDORSEMENT DATE: _____

LEGEND

- IRON PIPE FOUND
- DRILL HOLE FOUND
- STONE OR CONCRETE MONUMENT
- SEWER MANHOLE
- DRAIN MANHOLE
- ELECTRIC MANHOLE
- TELEPHONE MANHOLE
- WATER MANHOLE
- UNDETERMINED MANHOLE
- CATCH BASIN
- CLEANOUT
- MONITORING WELL
- ANCHOR
- UTILITY POLE
- WATER GATE VALVE
- WATER SHUT OFF
- HYDRANT
- BENCHMARK
- GAS VALVE
- SIGN
- LIGHT POLE / LAMP POST
- SPOT LIGHT
- MAILBOX (MBX)
- BOLLARD
- OBSERVATION TEST PIT
- HYDRIC SOIL TEST PIT
- BORING TEST PIT
- SHRUBS, BUSHES, ETC.
- DECIDUOUS TREE
- CONIFEROUS TREE
- WF-26 WETLAND FLAG
- BOULDER
- VGC VERTICAL GRANITE CURBING
- CNCRB CONCRETE CURBING
- CCB CAPE COD BERM (BITUMINOUS)
- BTCRB BITUMINOUS CURBING (GENERIC)
- ELECTRIC LINE
- SEWER LINE
- DRAIN LINE
- WATER LINE
- GAS LINE
- TELEPHONE LINE
- FIRE PROTECTION LINE
- OVERHEAD WIRES
- CABLE TELEVISION
- ROOF DRAIN
- STONEWALL
- EDGE OF PAVEMENT
- FENCING (AS NOTED)
- GUARD RAILING (AS NOTED)
- TREE LINE
- EDGE OF LANDSCAPING
- BORDERING VEGETATED WETLAND
- PROPERTY LINE
- SUBSURFACE DRAIN

PREPARED BY:

SUMMIT
Engineering & Survey, Inc.
710 MAIN STREET
OXFORD, MA 01537
P:(508) 987-8713 F:(508) 987-8714

SHEET TITLE

POST-DEVELOPMENT

DEFINITIVE SITE PLAN
at
150 CHARLTON ROAD
(ROUTE 20)
STURBRIDGE, MA
PREPARED FOR
COBRA REALTY TRUST

SHEET NO.

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.674	74	>75% Grass cover, Good, HSG C (P-1, P-3)
0.670	71	Meadow, non-grazed, HSG C (P-3)
0.895	98	Paved parking, HSG C (P-1)
0.184	98	Roofs, HSG C (P-2)
1.711	70	Woods, Good, HSG C (P-3)

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
4.134	HSG C	P-1, P-2, P-3
0.000	HSG D	
0.000	Other	

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.674	0.000	0.000	0.674	>75% Grass cover, Good	P-1, P-3
0.000	0.000	0.670	0.000	0.000	0.670	Meadow, non-grazed	P-3
0.000	0.000	0.895	0.000	0.000	0.895	Paved parking	P-1
0.000	0.000	0.184	0.000	0.000	0.184	Roofs	P-2
0.000	0.000	1.711	0.000	0.000	1.711	Woods, Good	P-3

Summary for Subcatchment P-1: P-1

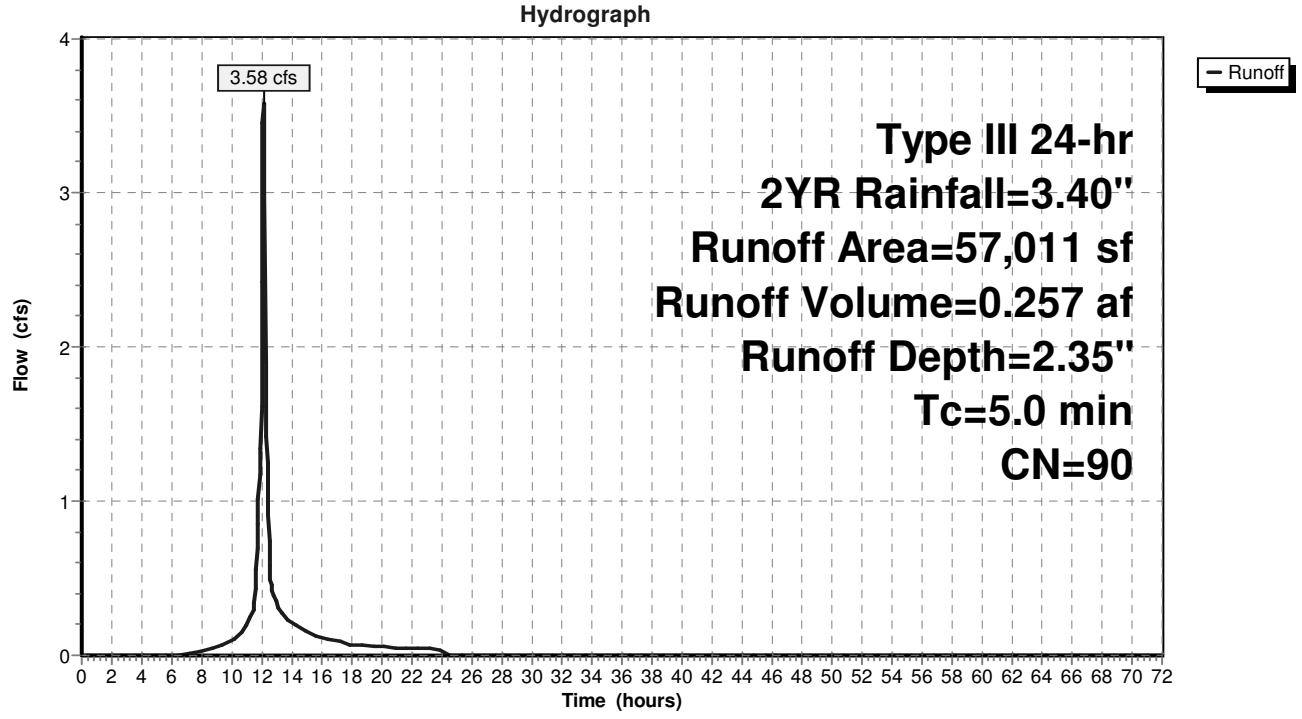
Runoff = 3.58 cfs @ 12.07 hrs, Volume= 0.257 af, Depth= 2.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2YR Rainfall=3.40"

Area (sf)	CN	Description
38,996	98	Paved parking, HSG C
18,015	74	>75% Grass cover, Good, HSG C
57,011	90	Weighted Average
18,015		31.60% Pervious Area
38,996		68.40% Impervious Area

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

Subcatchment P-1: P-1



Summary for Subcatchment P-2: ROOF AREA

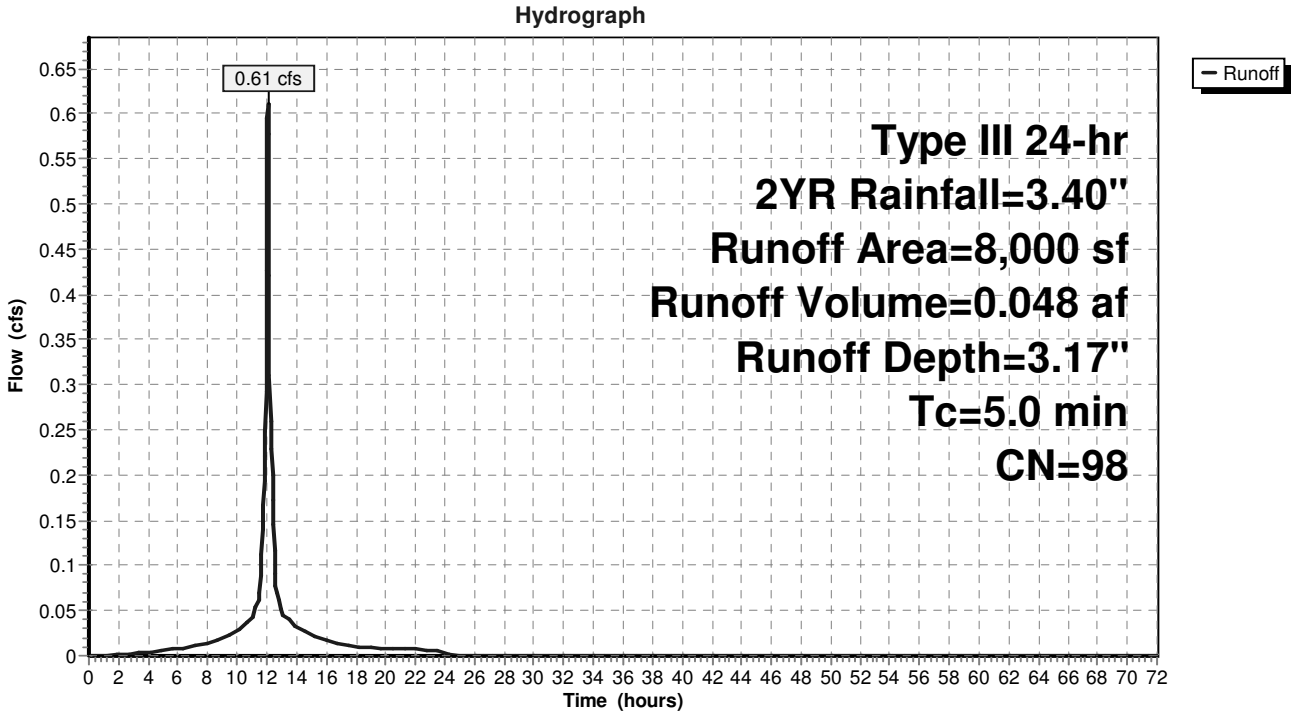
Runoff = 0.61 cfs @ 12.07 hrs, Volume= 0.048 af, Depth= 3.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2YR Rainfall=3.40"

Area (sf)	CN	Description
8,000	98	Roofs, HSG C
8,000		100.00% Impervious Area

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

Subcatchment P-2: ROOF AREA



Summary for Subcatchment P-3: P-3

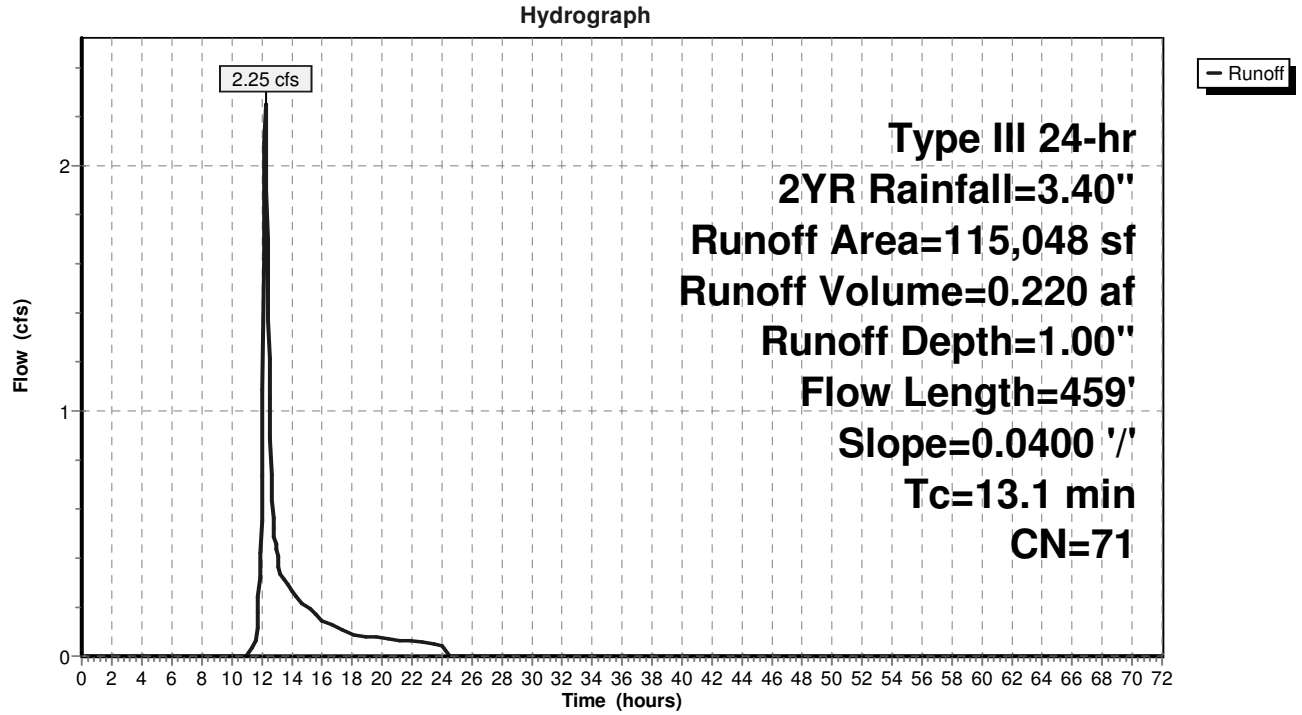
Runoff = 2.25 cfs @ 12.20 hrs, Volume= 0.220 af, Depth= 1.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2YR Rainfall=3.40"

Area (sf)	CN	Description
74,543	70	Woods, Good, HSG C
11,328	74	>75% Grass cover, Good, HSG C
29,177	71	Meadow, non-grazed, HSG C
115,048	71	Weighted Average
115,048		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	50	0.0400	0.20		**Sheet Flow, TRAVEL PATH A TO B** Grass: Short n= 0.150 P2= 3.20"
6.1	184	0.0400	0.50		**Shallow Concentrated Flow, TRAVEL PATH B TO C** Forest w/Heavy Litter Kv= 2.5 fps
2.7	225	0.0400	1.40		**Shallow Concentrated Flow, TRAVEL PATH C TO D** Short Grass Pasture Kv= 7.0 fps
13.1	459	Total			

Subcatchment P-3: P-3

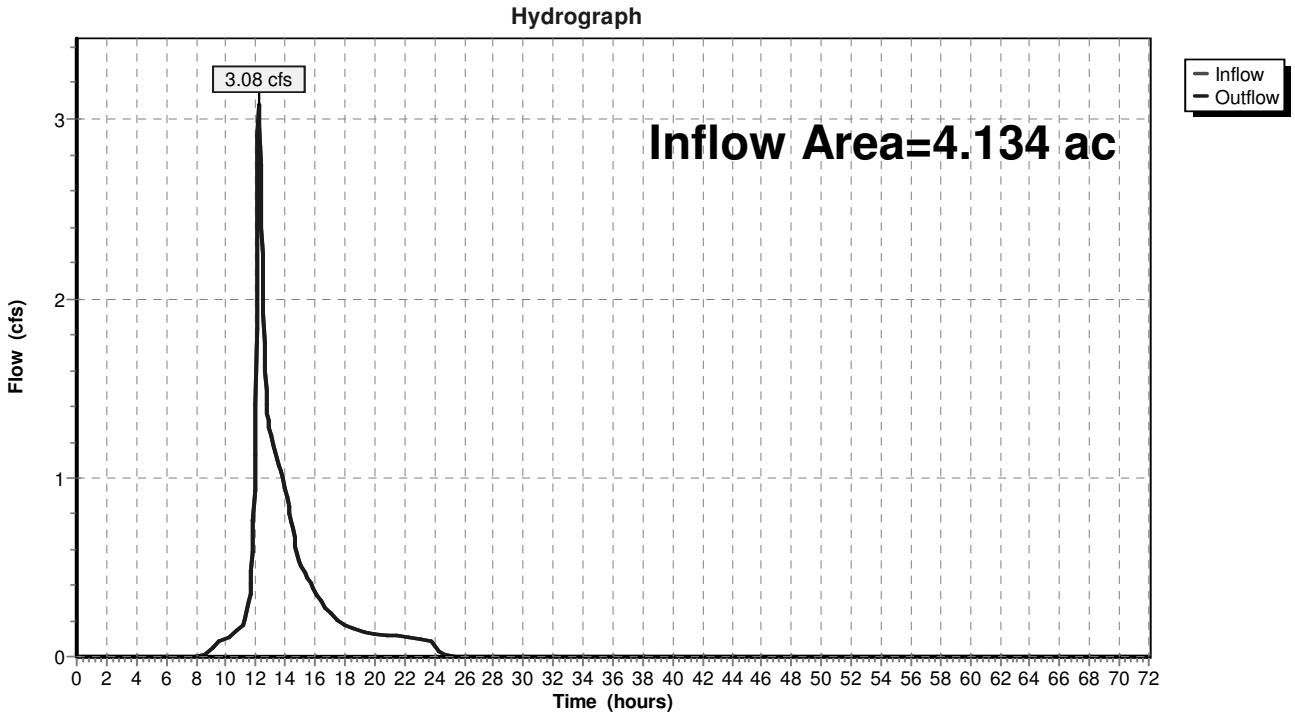


Summary for Reach IP-P: WETLAND/STREAM

Inflow Area = 4.134 ac, 26.10% Impervious, Inflow Depth = 1.46" for 2YR event
Inflow = 3.08 cfs @ 12.20 hrs, Volume= 0.505 af
Outflow = 3.08 cfs @ 12.20 hrs, Volume= 0.505 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach IP-P: WETLAND/STREAM



Summary for Pond 6P: Underground Basin

Inflow Area = 1.492 ac, 72.29% Impervious, Inflow Depth = 2.45" for 2YR event
Inflow = 4.19 cfs @ 12.07 hrs, Volume= 0.305 af
Outflow = 0.91 cfs @ 12.49 hrs, Volume= 0.305 af, Atten= 78%, Lag= 24.9 min
Discarded = 0.03 cfs @ 12.05 hrs, Volume= 0.021 af
Primary = 0.88 cfs @ 12.49 hrs, Volume= 0.284 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 606.80' @ 12.49 hrs Surf.Area= 4,983 sf Storage= 4,505 cf

Plug-Flow detention time= 68.7 min calculated for 0.305 af (100% of inflow)
Center-of-Mass det. time= 68.2 min (864.0 - 795.8)

Volume	Invert	Avail.Storage	Storage Description
#1	603.00'	1,726 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 6,452 cf Overall - 2,136 cf Embedded = 4,315 cf x 40.0% Voids
#2	603.75'	2,136 cf	**Cultec R-902HD** x 33 Inside #1 Effective Size= 69.8"W x 48.0"H => 17.65 sf x 3.67'L = 64.7 cf Overall Size= 78.0"W x 48.0"H x 4.10'L with 0.44' Overlap
#3	606.00'	2,761 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 8,996 cf Overall - 2,093 cf Embedded = 6,903 cf x 40.0% Voids
#4	606.50'	2,093 cf	**ADS_StormTech SC-310 +Cap** x 142 Inside #3 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap
		8,717 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
603.00	1,122	0	0
608.75	1,122	6,452	6,452

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
606.00	3,861	0	0
608.33	3,861	8,996	8,996

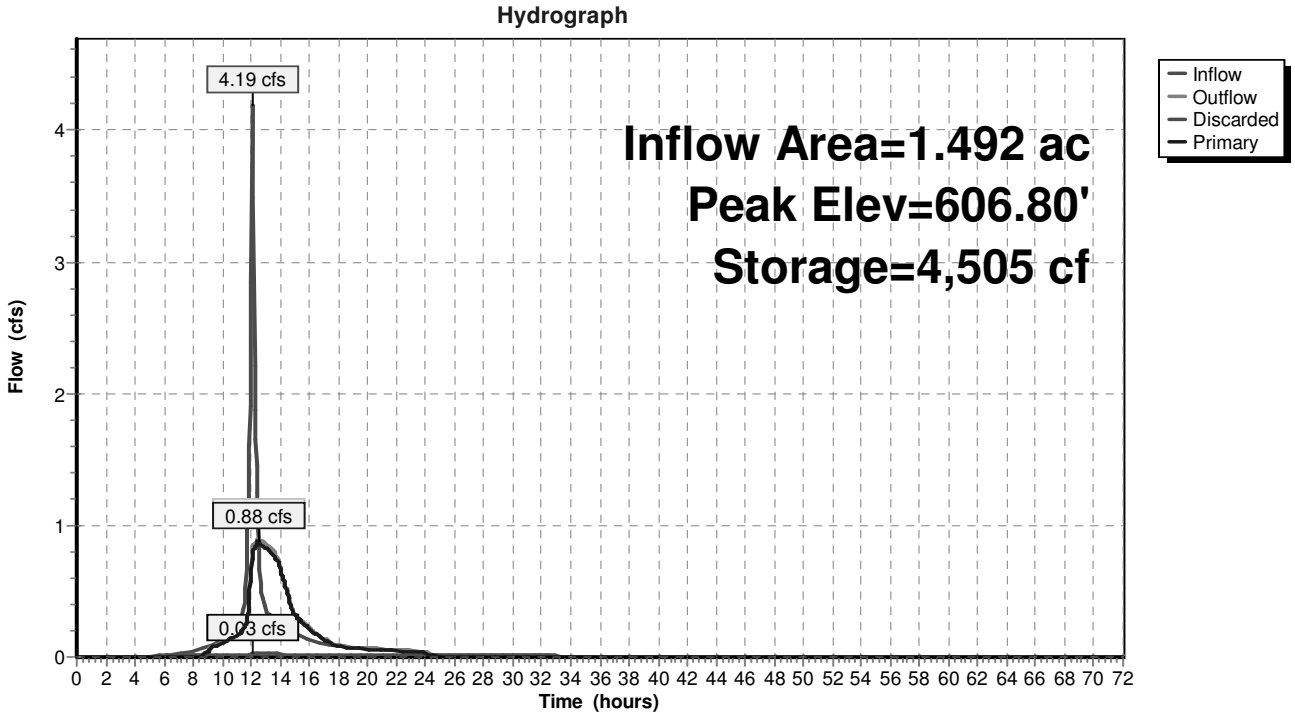
Device	Routing	Invert	Outlet Devices
#1	Discarded	603.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	603.00'	**24.0" Round Culvert** L= 50.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 603.00' / 603.00' S= 0.0000 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 3.14 sf
#3	Device 2	603.50'	**4.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 603.50' / 603.15' S= 0.0175 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.09 sf
#4	Device 2	604.60'	**3.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 604.60' / 603.00' S= 0.0800 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.05 sf
#5	Device 2	606.75'	**6.0" Round Culvert X 3.00** L= 20.0' CPP, projecting, no headwall, Ke= 0.900

Inlet / Outlet Invert= 606.75' / 606.00' S= 0.0375 '/' Cc= 0.900
n= 0.010 PVC, smooth interior, Flow Area= 0.20 sf
#6 Device 2 608.60' **12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.03 cfs @ 12.05 hrs HW=606.12' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.88 cfs @ 12.49 hrs HW=606.80' (Free Discharge)
└**2=Culvert** (Passes 0.88 cfs of 19.99 cfs potential flow)
├**3=Culvert** (Inlet Controls 0.59 cfs @ 6.73 fps)
├**4=Culvert** (Inlet Controls 0.27 cfs @ 5.48 fps)
├**5=Culvert** (Inlet Controls 0.02 cfs @ 0.61 fps)
└**6=Orifice/Grate** (Controls 0.00 cfs)

Pond 6P: Underground Basin



Summary for Subcatchment P-1: P-1

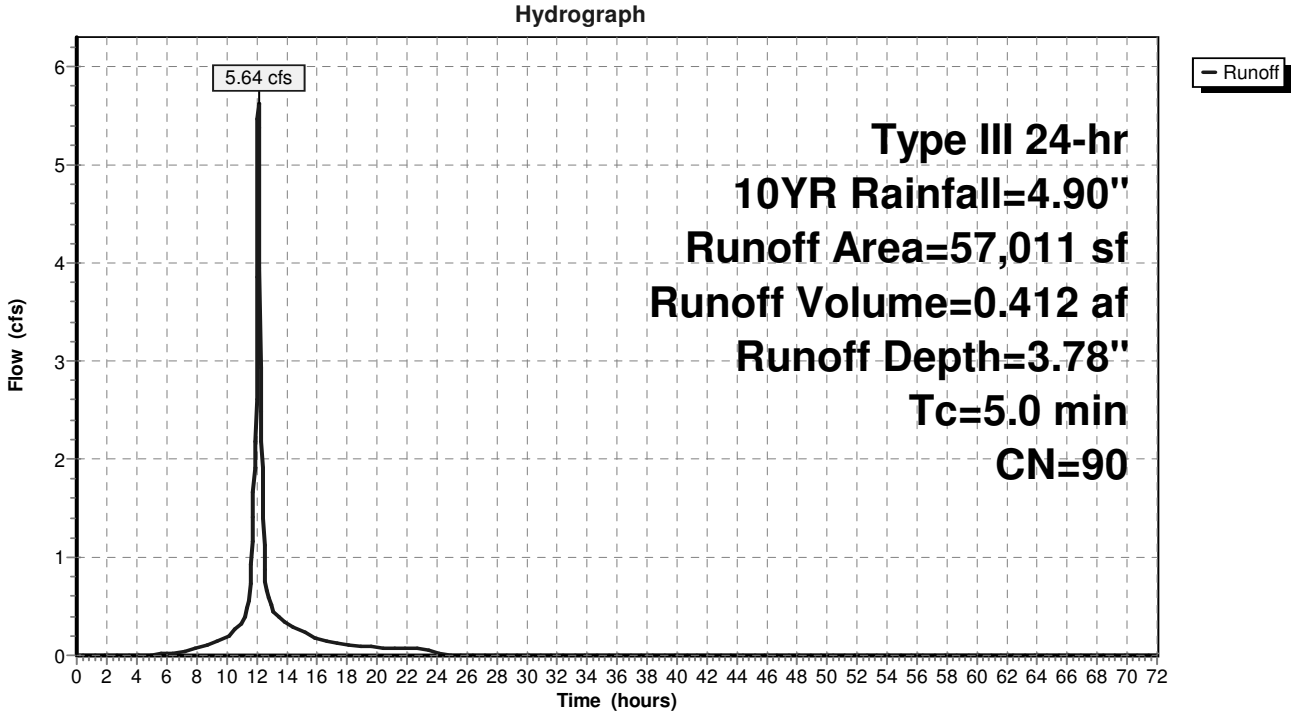
Runoff = 5.64 cfs @ 12.07 hrs, Volume= 0.412 af, Depth= 3.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10YR Rainfall=4.90"

Area (sf)	CN	Description
38,996	98	Paved parking, HSG C
18,015	74	>75% Grass cover, Good, HSG C
57,011	90	Weighted Average
18,015		31.60% Pervious Area
38,996		68.40% Impervious Area

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

Subcatchment P-1: P-1



Summary for Subcatchment P-2: ROOF AREA

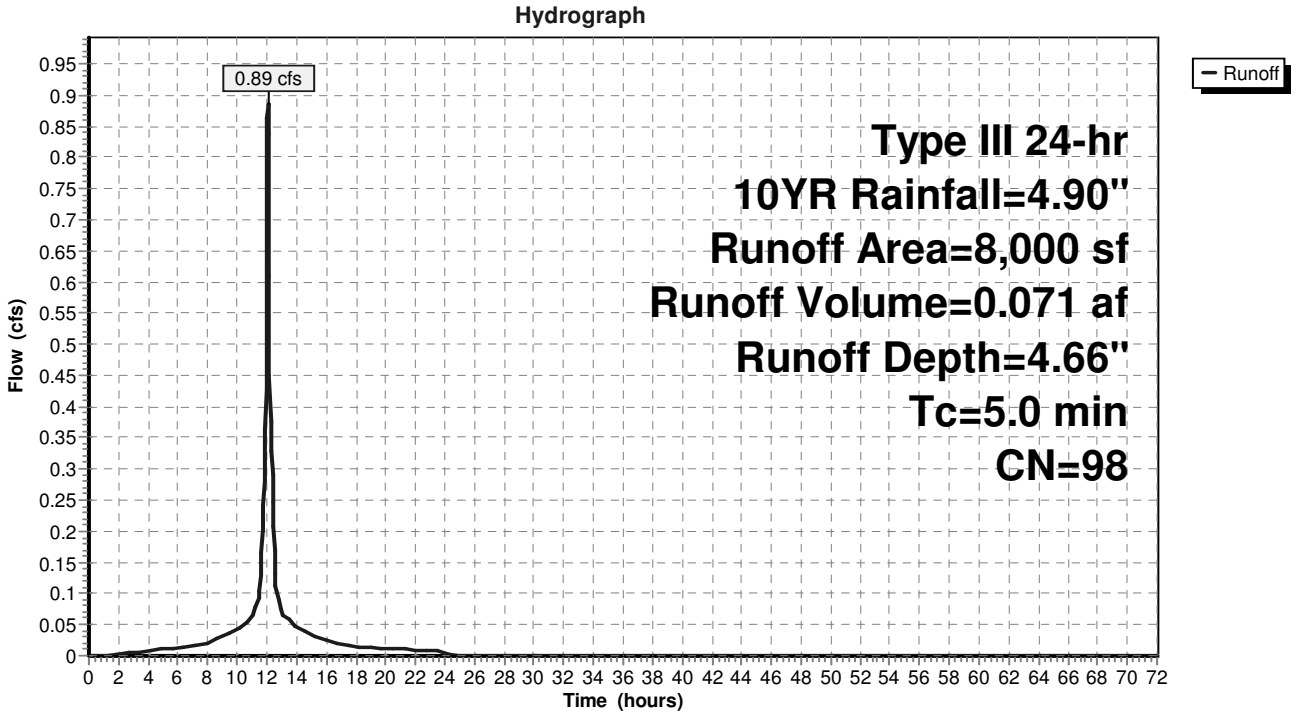
Runoff = 0.89 cfs @ 12.07 hrs, Volume= 0.071 af, Depth= 4.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10YR Rainfall=4.90"

Area (sf)	CN	Description
8,000	98	Roofs, HSG C
8,000		100.00% Impervious Area

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

Subcatchment P-2: ROOF AREA



Summary for Subcatchment P-3: P-3

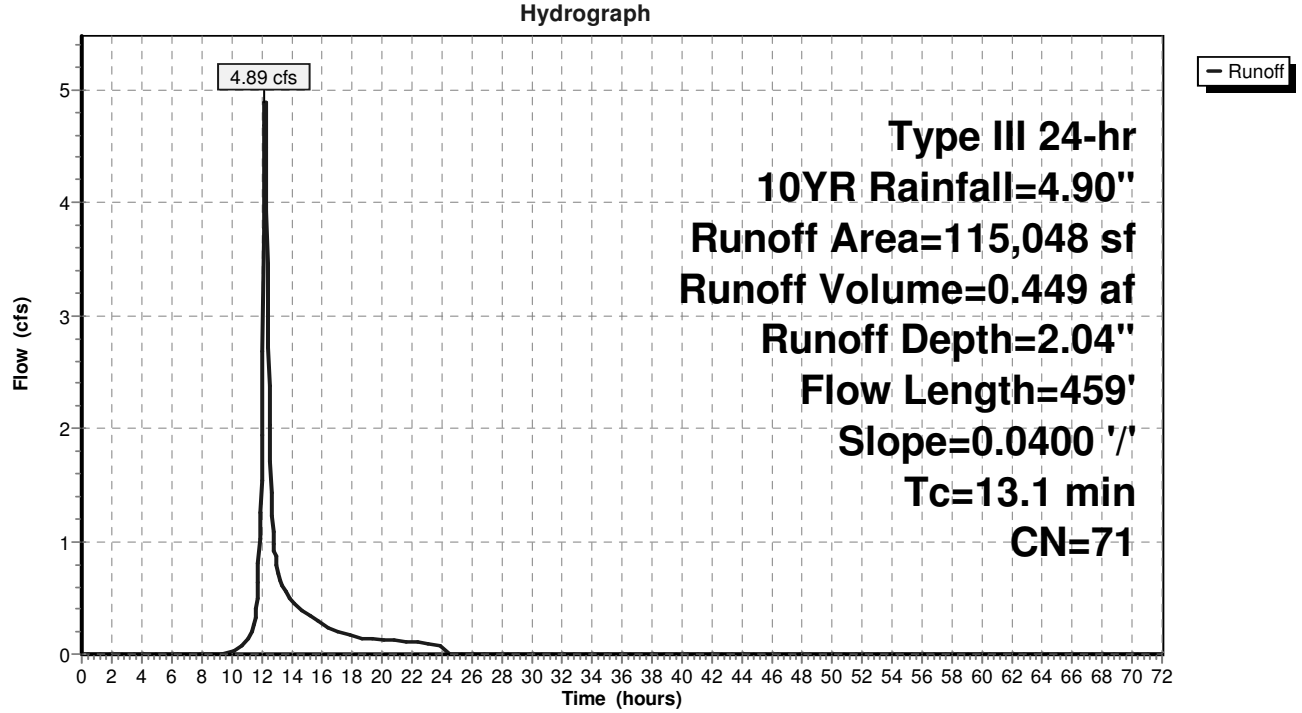
Runoff = 4.89 cfs @ 12.19 hrs, Volume= 0.449 af, Depth= 2.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10YR Rainfall=4.90"

Area (sf)	CN	Description
74,543	70	Woods, Good, HSG C
11,328	74	>75% Grass cover, Good, HSG C
29,177	71	Meadow, non-grazed, HSG C
115,048	71	Weighted Average
115,048		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	50	0.0400	0.20		**Sheet Flow, TRAVEL PATH A TO B** Grass: Short n= 0.150 P2= 3.20"
6.1	184	0.0400	0.50		**Shallow Concentrated Flow, TRAVEL PATH B TO C** Forest w/Heavy Litter Kv= 2.5 fps
2.7	225	0.0400	1.40		**Shallow Concentrated Flow, TRAVEL PATH C TO D** Short Grass Pasture Kv= 7.0 fps
13.1	459	Total			

Subcatchment P-3: P-3

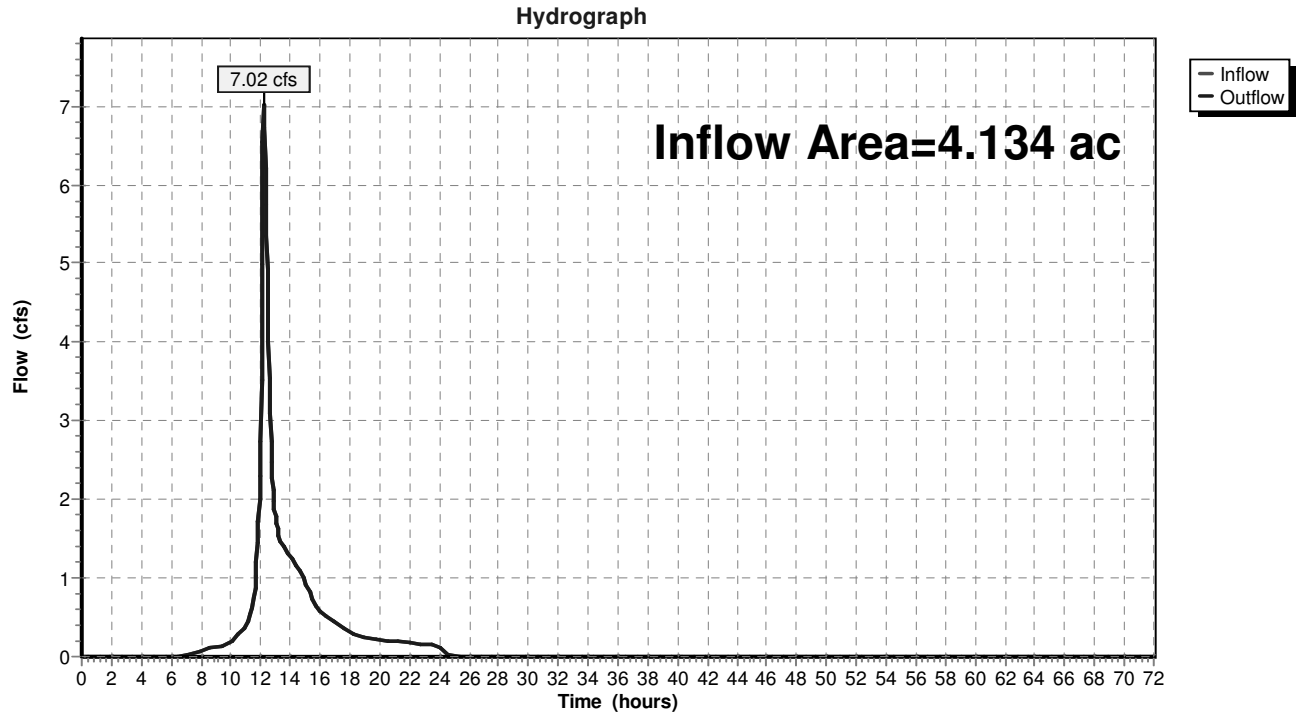


Summary for Reach IP-P: WETLAND/STREAM

Inflow Area = 4.134 ac, 26.10% Impervious, Inflow Depth = 2.64" for 10YR event
Inflow = 7.02 cfs @ 12.21 hrs, Volume= 0.909 af
Outflow = 7.02 cfs @ 12.21 hrs, Volume= 0.909 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach IP-P: WETLAND/STREAM



Summary for Pond 6P: Underground Basin

Inflow Area = 1.492 ac, 72.29% Impervious, Inflow Depth = 3.89" for 10YR event
Inflow = 6.52 cfs @ 12.07 hrs, Volume= 0.484 af
Outflow = 2.33 cfs @ 12.33 hrs, Volume= 0.484 af, Atten= 64%, Lag= 15.5 min
Discarded = 0.03 cfs @ 11.90 hrs, Volume= 0.024 af
Primary = 2.29 cfs @ 12.33 hrs, Volume= 0.460 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 607.37' @ 12.33 hrs Surf.Area= 4,983 sf Storage= 6,389 cf

Plug-Flow detention time= 60.6 min calculated for 0.483 af (100% of inflow)
Center-of-Mass det. time= 61.0 min (845.1 - 784.1)

Volume	Invert	Avail.Storage	Storage Description
#1	603.00'	1,726 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 6,452 cf Overall - 2,136 cf Embedded = 4,315 cf x 40.0% Voids
#2	603.75'	2,136 cf	**Cultec R-902HD** x 33 Inside #1 Effective Size= 69.8"W x 48.0"H => 17.65 sf x 3.67'L = 64.7 cf Overall Size= 78.0"W x 48.0"H x 4.10'L with 0.44' Overlap
#3	606.00'	2,761 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 8,996 cf Overall - 2,093 cf Embedded = 6,903 cf x 40.0% Voids
#4	606.50'	2,093 cf	**ADS_StormTech SC-310 +Cap** x 142 Inside #3 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap
		8,717 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
603.00	1,122	0	0
608.75	1,122	6,452	6,452

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
606.00	3,861	0	0
608.33	3,861	8,996	8,996

Device	Routing	Invert	Outlet Devices
#1	Discarded	603.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	603.00'	**24.0" Round Culvert** L= 50.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 603.00' / 603.00' S= 0.0000 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 3.14 sf
#3	Device 2	603.50'	**4.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 603.50' / 603.15' S= 0.0175 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.09 sf
#4	Device 2	604.60'	**3.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 604.60' / 603.00' S= 0.0800 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.05 sf
#5	Device 2	606.75'	**6.0" Round Culvert X 3.00** L= 20.0' CPP, projecting, no headwall, Ke= 0.900

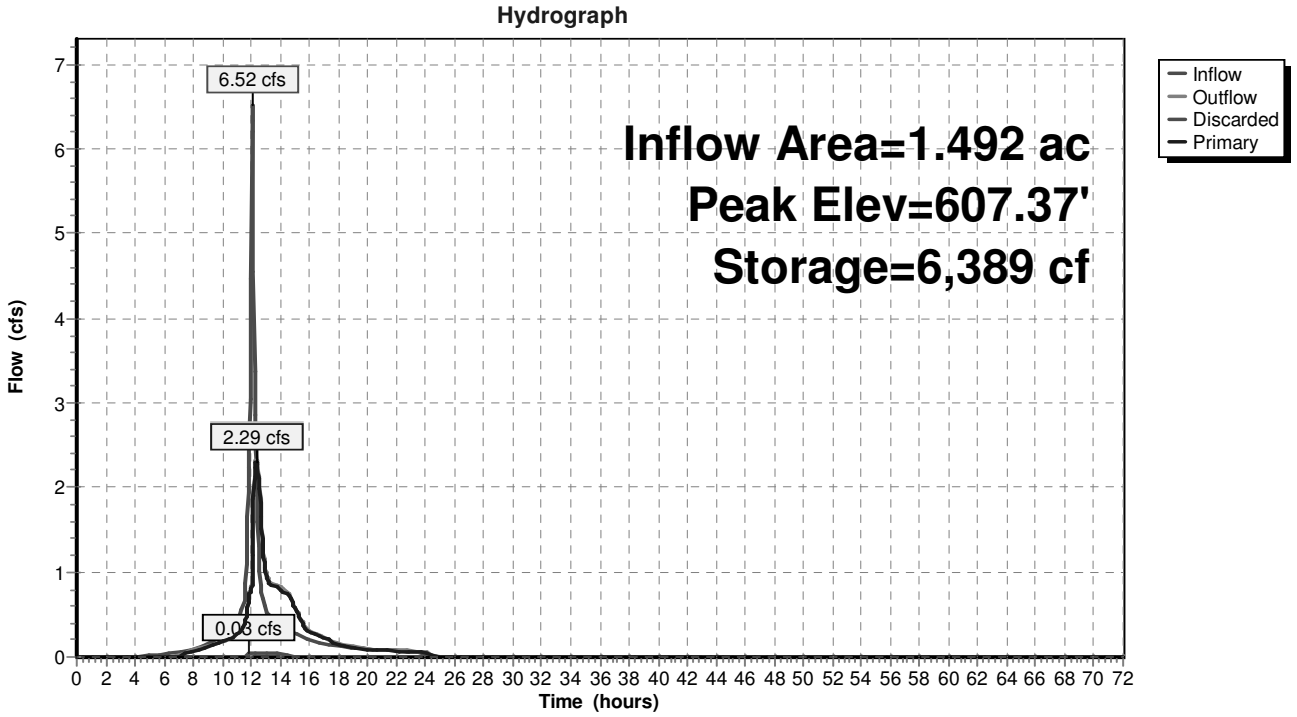
Inlet / Outlet Invert= 606.75' / 606.00' S= 0.0375 '/' Cc= 0.900
n= 0.010 PVC, smooth interior, Flow Area= 0.20 sf

#6 Device 2 608.60' **12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.03 cfs @ 11.90 hrs HW=606.10' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=2.29 cfs @ 12.33 hrs HW=607.36' (Free Discharge)
└**2=Culvert** (Passes 2.29 cfs of 21.90 cfs potential flow)
├**3=Culvert** (Inlet Controls 0.64 cfs @ 7.31 fps)
├**4=Culvert** (Inlet Controls 0.30 cfs @ 6.17 fps)
├**5=Culvert** (Inlet Controls 1.35 cfs @ 2.29 fps)
└**6=Orifice/Grate** (Controls 0.00 cfs)

Pond 6P: Underground Basin



Summary for Subcatchment P-1: P-1

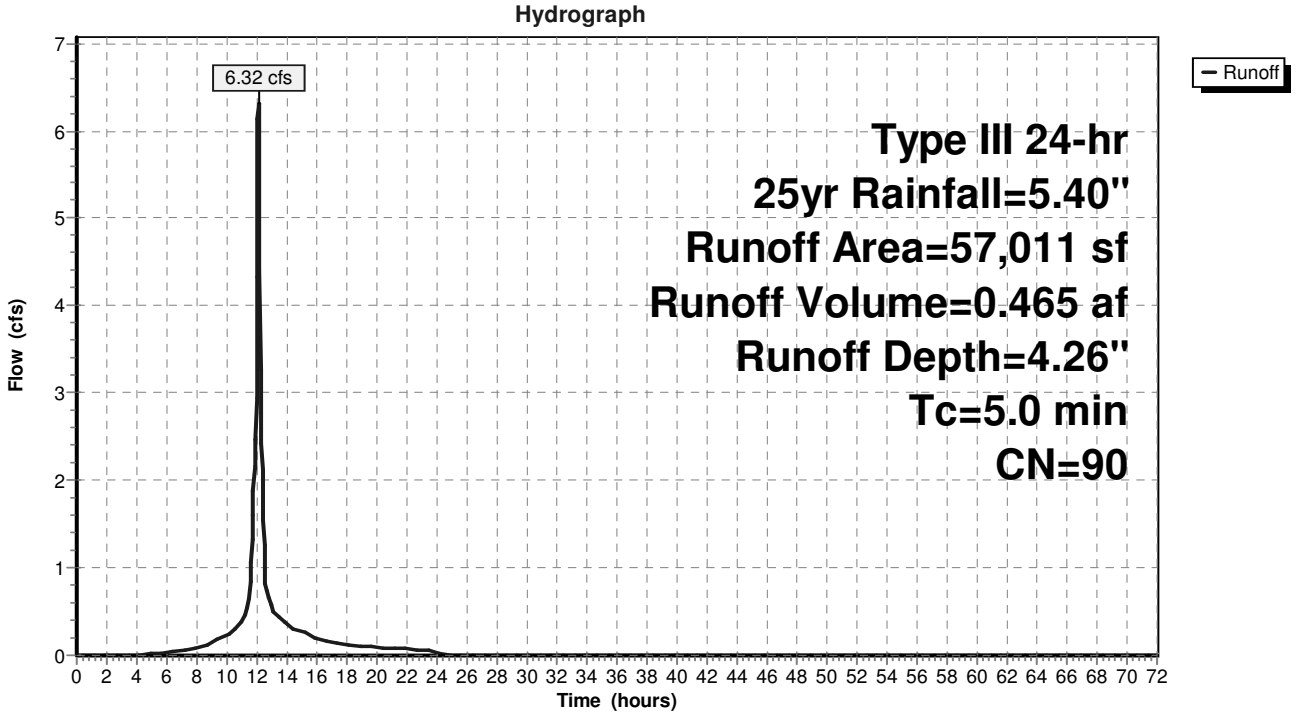
Runoff = 6.32 cfs @ 12.07 hrs, Volume= 0.465 af, Depth= 4.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25yr Rainfall=5.40"

Area (sf)	CN	Description
38,996	98	Paved parking, HSG C
18,015	74	>75% Grass cover, Good, HSG C
57,011	90	Weighted Average
18,015		31.60% Pervious Area
38,996		68.40% Impervious Area

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

Subcatchment P-1: P-1



Summary for Subcatchment P-2: ROOF AREA

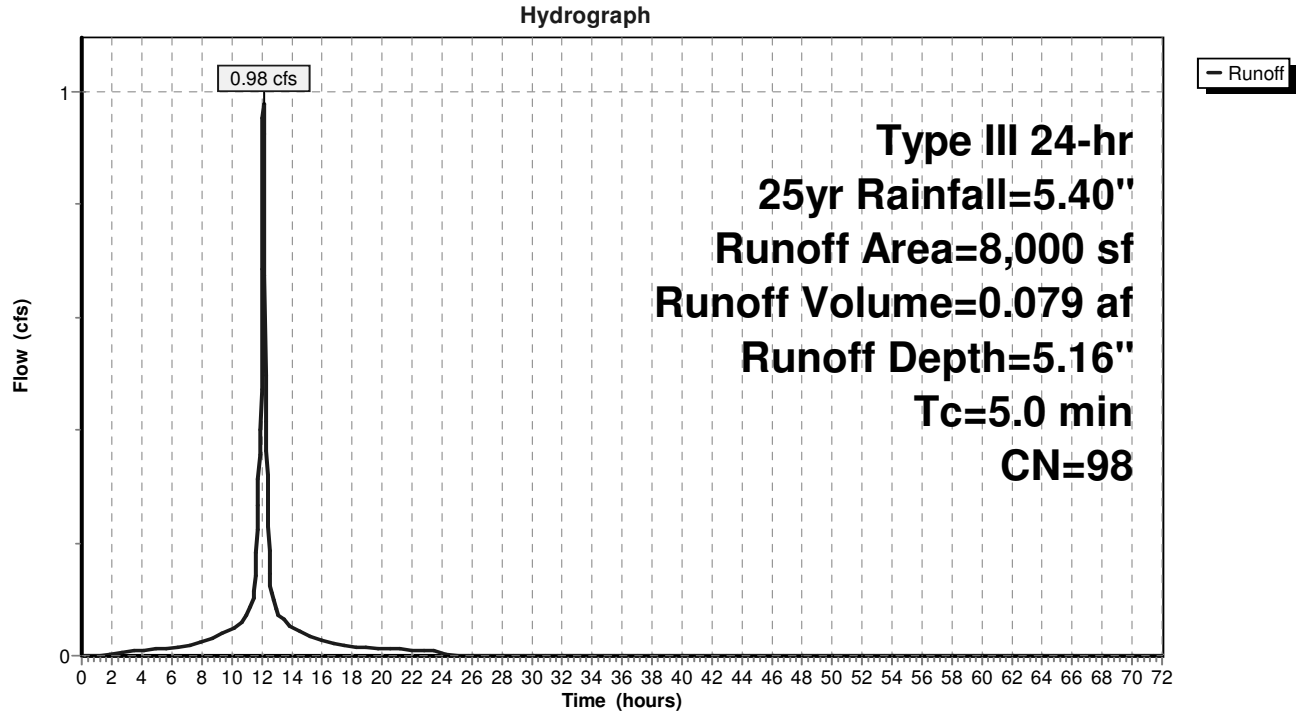
Runoff = 0.98 cfs @ 12.07 hrs, Volume= 0.079 af, Depth= 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25yr Rainfall=5.40"

Area (sf)	CN	Description
8,000	98	Roofs, HSG C
8,000		100.00% Impervious Area

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

Subcatchment P-2: ROOF AREA



Summary for Subcatchment P-3: P-3

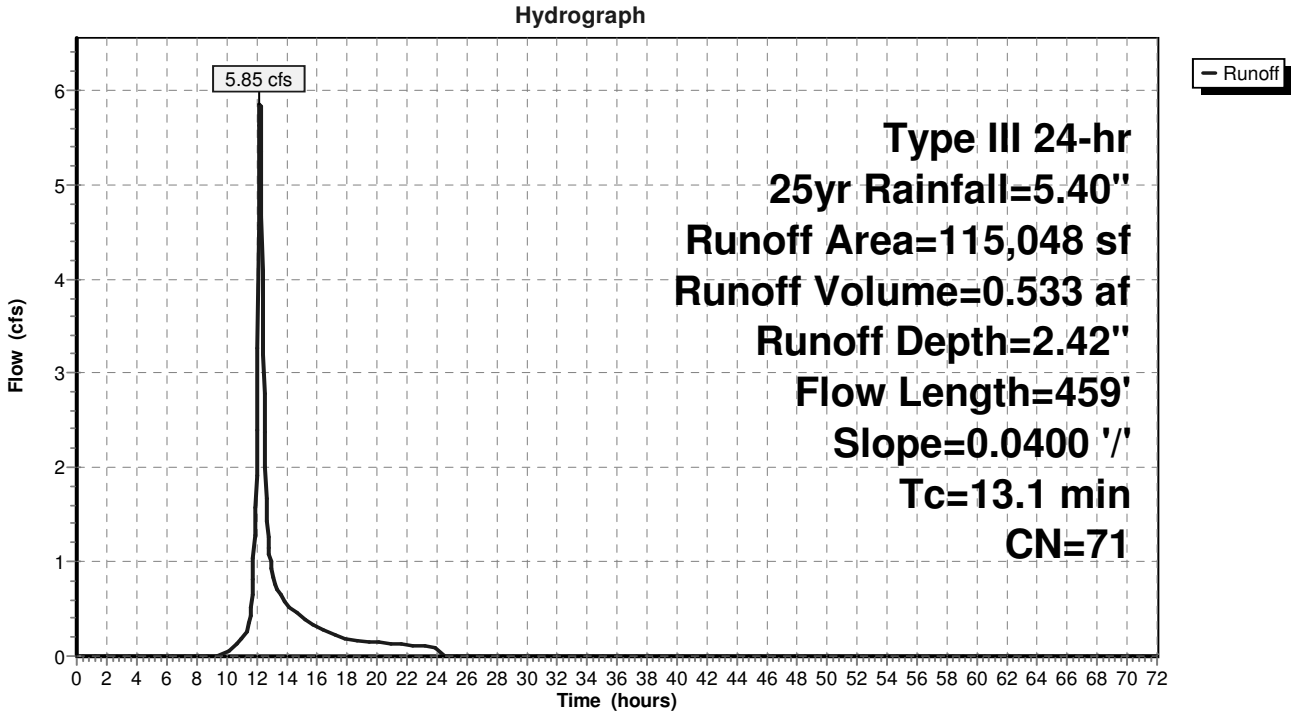
Runoff = 5.85 cfs @ 12.19 hrs, Volume= 0.533 af, Depth= 2.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25yr Rainfall=5.40"

Area (sf)	CN	Description
74,543	70	Woods, Good, HSG C
11,328	74	>75% Grass cover, Good, HSG C
29,177	71	Meadow, non-grazed, HSG C
115,048	71	Weighted Average
115,048		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	50	0.0400	0.20		**Sheet Flow, TRAVEL PATH A TO B** Grass: Short n= 0.150 P2= 3.20"
6.1	184	0.0400	0.50		**Shallow Concentrated Flow, TRAVEL PATH B TO C** Forest w/Heavy Litter Kv= 2.5 fps
2.7	225	0.0400	1.40		**Shallow Concentrated Flow, TRAVEL PATH C TO D** Short Grass Pasture Kv= 7.0 fps
13.1	459	Total			

Subcatchment P-3: P-3

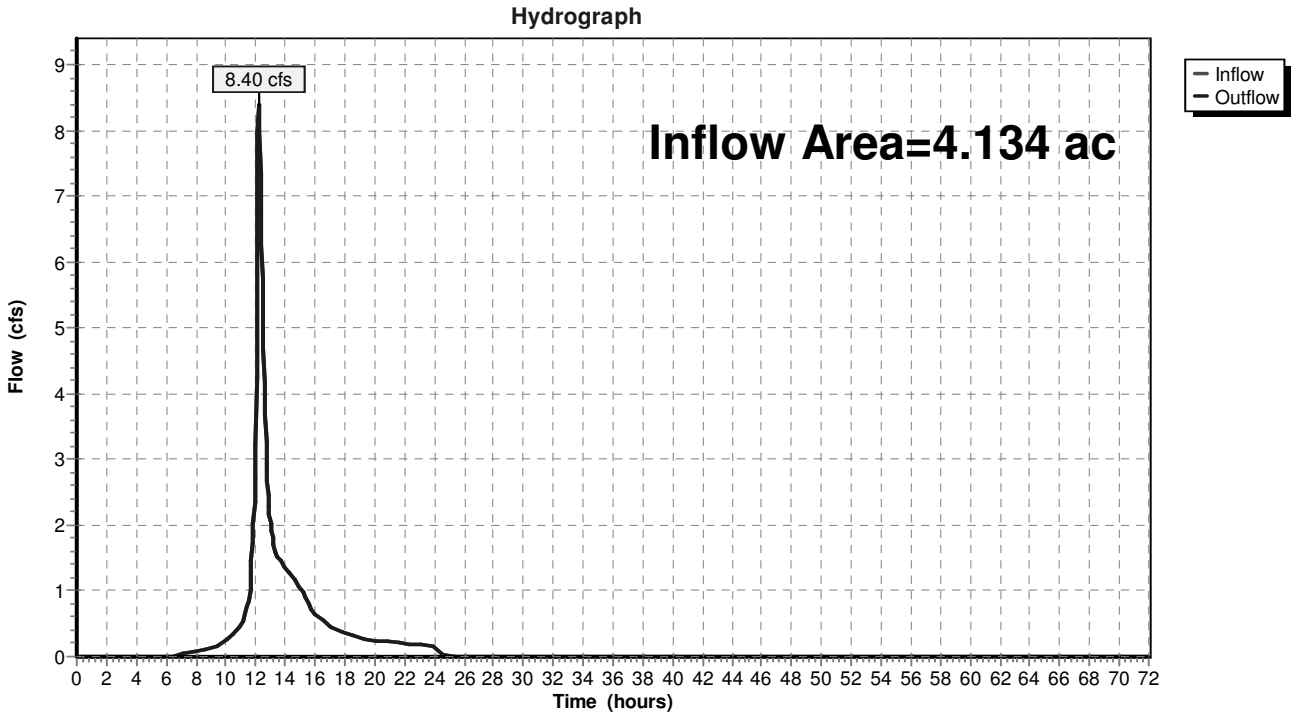


Summary for Reach IP-P: WETLAND/STREAM

Inflow Area = 4.134 ac, 26.10% Impervious, Inflow Depth = 3.06" for 25yr event
Inflow = 8.40 cfs @ 12.20 hrs, Volume= 1.053 af
Outflow = 8.40 cfs @ 12.20 hrs, Volume= 1.053 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach IP-P: WETLAND/STREAM



Summary for Pond 6P: Underground Basin

Inflow Area = 1.492 ac, 72.29% Impervious, Inflow Depth = 4.37" for 25yr event
Inflow = 7.29 cfs @ 12.07 hrs, Volume= 0.544 af
Outflow = 2.73 cfs @ 12.31 hrs, Volume= 0.544 af, Atten= 63%, Lag= 14.4 min
Discarded = 0.03 cfs @ 11.85 hrs, Volume= 0.024 af
Primary = 2.69 cfs @ 12.31 hrs, Volume= 0.520 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 607.59' @ 12.31 hrs Surf.Area= 4,983 sf Storage= 7,010 cf

Plug-Flow detention time= 58.7 min calculated for 0.544 af (100% of inflow)
Center-of-Mass det. time= 59.1 min (840.3 - 781.2)

Volume	Invert	Avail.Storage	Storage Description
#1	603.00'	1,726 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 6,452 cf Overall - 2,136 cf Embedded = 4,315 cf x 40.0% Voids
#2	603.75'	2,136 cf	**Cultec R-902HD** x 33 Inside #1 Effective Size= 69.8"W x 48.0"H => 17.65 sf x 3.67'L = 64.7 cf Overall Size= 78.0"W x 48.0"H x 4.10'L with 0.44' Overlap
#3	606.00'	2,761 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 8,996 cf Overall - 2,093 cf Embedded = 6,903 cf x 40.0% Voids
#4	606.50'	2,093 cf	**ADS_StormTech SC-310 +Cap** x 142 Inside #3 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap
		8,717 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
603.00	1,122	0	0
608.75	1,122	6,452	6,452

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
606.00	3,861	0	0
608.33	3,861	8,996	8,996

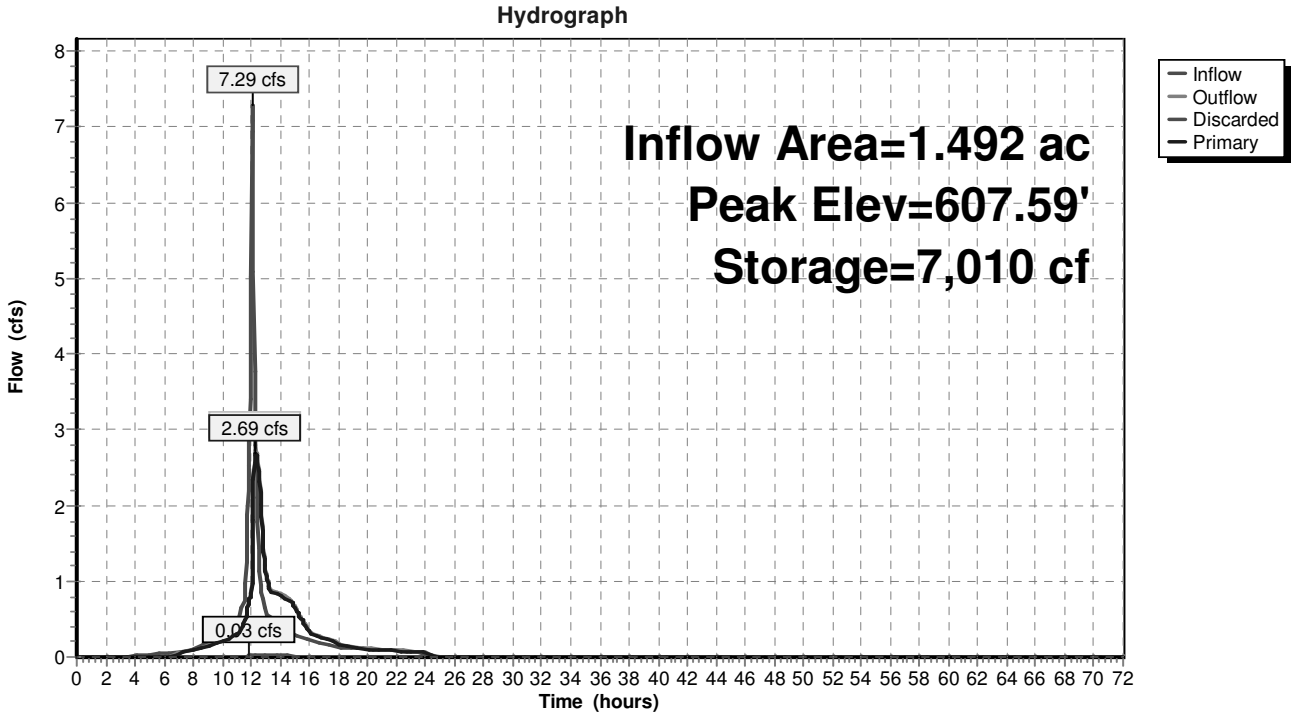
Device	Routing	Invert	Outlet Devices
#1	Discarded	603.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	603.00'	**24.0" Round Culvert** L= 50.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 603.00' / 603.00' S= 0.0000 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 3.14 sf
#3	Device 2	603.50'	**4.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 603.50' / 603.15' S= 0.0175 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.09 sf
#4	Device 2	604.60'	**3.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 604.60' / 603.00' S= 0.0800 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.05 sf
#5	Device 2	606.75'	**6.0" Round Culvert X 3.00** L= 20.0' CPP, projecting, no headwall, Ke= 0.900

Inlet / Outlet Invert= 606.75' / 606.00' S= 0.0375 '/' Cc= 0.900
n= 0.010 PVC, smooth interior, Flow Area= 0.20 sf
#6 Device 2 608.60' **12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.03 cfs @ 11.85 hrs HW=606.10' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=2.69 cfs @ 12.31 hrs HW=607.59' (Free Discharge)
└**2=Culvert** (Passes 2.69 cfs of 22.62 cfs potential flow)
├**3=Culvert** (Inlet Controls 0.66 cfs @ 7.53 fps)
├**4=Culvert** (Inlet Controls 0.32 cfs @ 6.43 fps)
├**5=Culvert** (Inlet Controls 1.72 cfs @ 2.92 fps)
└**6=Orifice/Grate** (Controls 0.00 cfs)

Pond 6P: Underground Basin



Summary for Subcatchment P-1: P-1

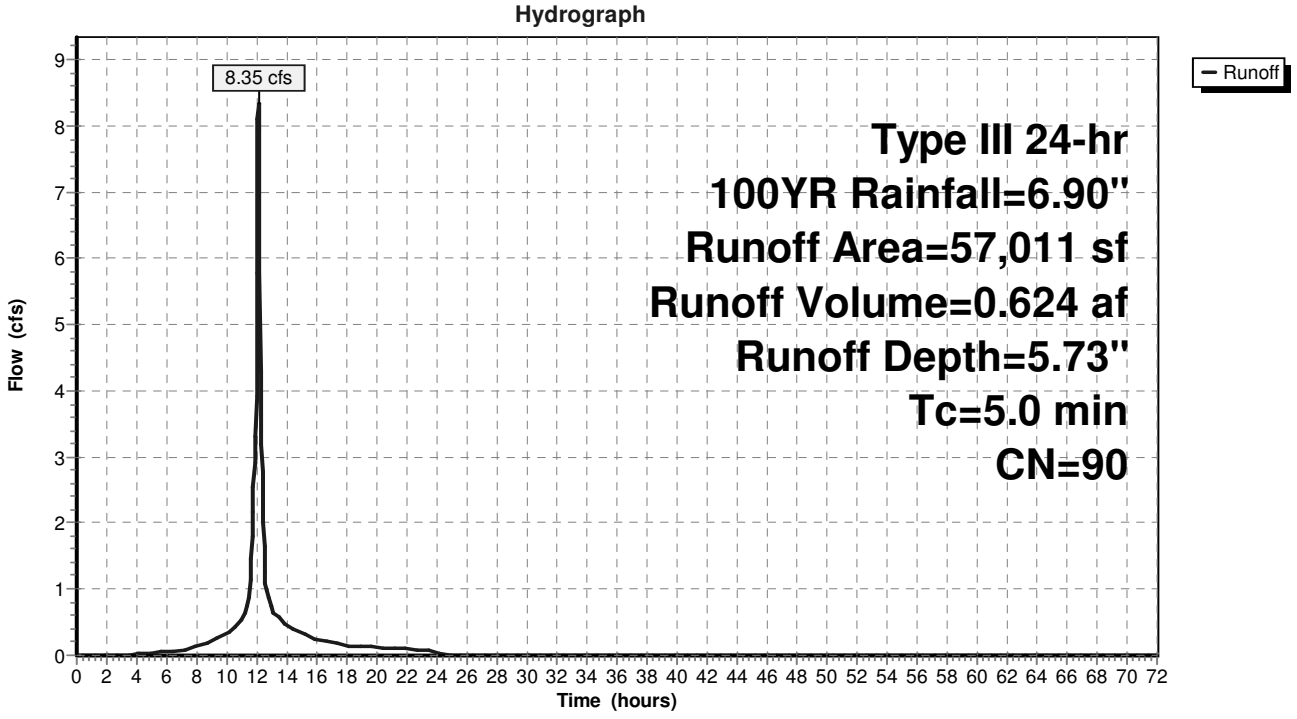
Runoff = 8.35 cfs @ 12.07 hrs, Volume= 0.624 af, Depth= 5.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100YR Rainfall=6.90"

Area (sf)	CN	Description
38,996	98	Paved parking, HSG C
18,015	74	>75% Grass cover, Good, HSG C
57,011	90	Weighted Average
18,015		31.60% Pervious Area
38,996		68.40% Impervious Area

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

Subcatchment P-1: P-1



Summary for Subcatchment P-2: ROOF AREA

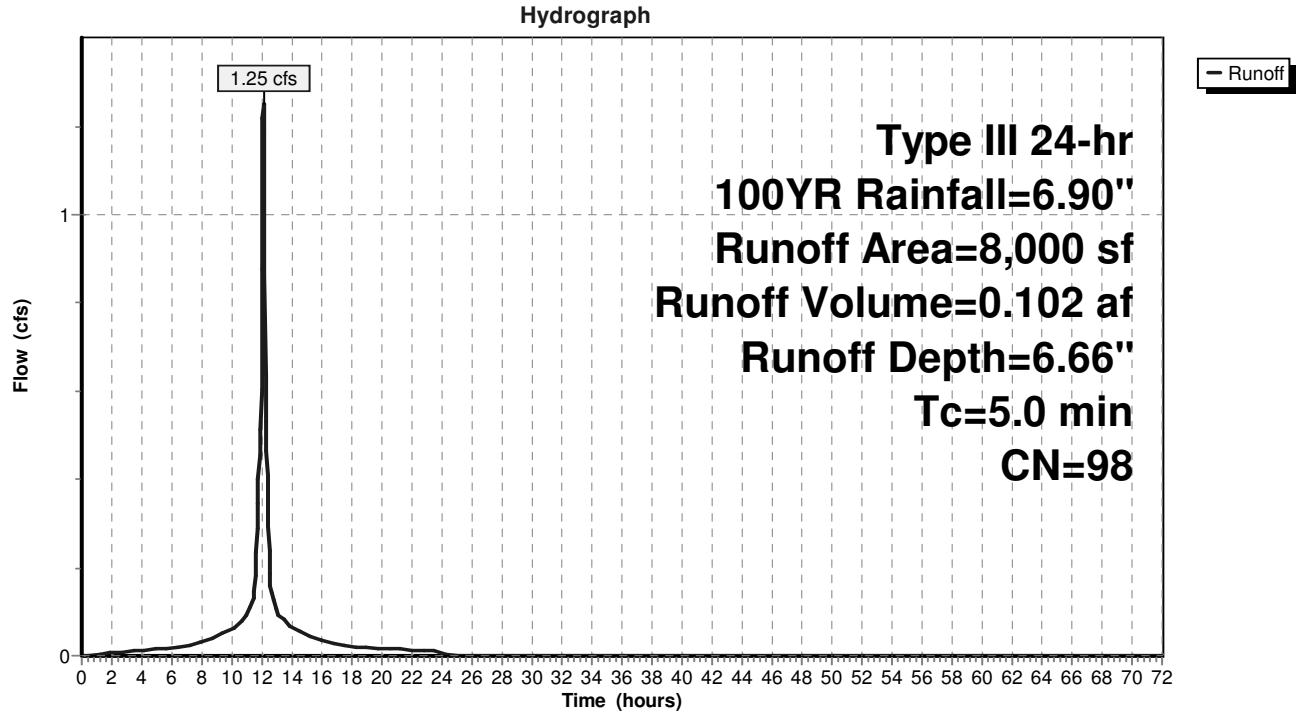
Runoff = 1.25 cfs @ 12.07 hrs, Volume= 0.102 af, Depth= 6.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100YR Rainfall=6.90"

Area (sf)	CN	Description
8,000	98	Roofs, HSG C
8,000		100.00% Impervious Area

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

Subcatchment P-2: ROOF AREA



Summary for Subcatchment P-3: P-3

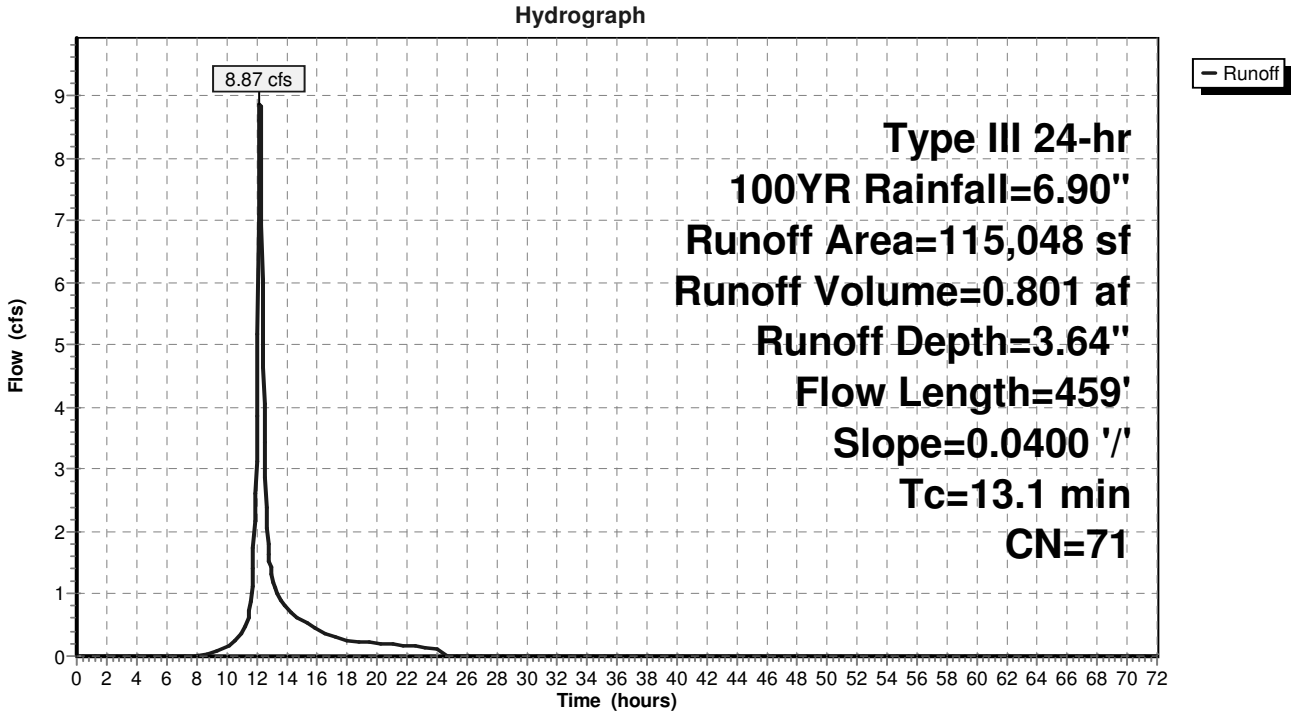
Runoff = 8.87 cfs @ 12.19 hrs, Volume= 0.801 af, Depth= 3.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100YR Rainfall=6.90"

Area (sf)	CN	Description
74,543	70	Woods, Good, HSG C
11,328	74	>75% Grass cover, Good, HSG C
29,177	71	Meadow, non-grazed, HSG C
115,048	71	Weighted Average
115,048		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	50	0.0400	0.20		**Sheet Flow, TRAVEL PATH A TO B** Grass: Short n= 0.150 P2= 3.20"
6.1	184	0.0400	0.50		**Shallow Concentrated Flow, TRAVEL PATH B TO C** Forest w/Heavy Litter Kv= 2.5 fps
2.7	225	0.0400	1.40		**Shallow Concentrated Flow, TRAVEL PATH C TO D** Short Grass Pasture Kv= 7.0 fps
13.1	459	Total			

Subcatchment P-3: P-3

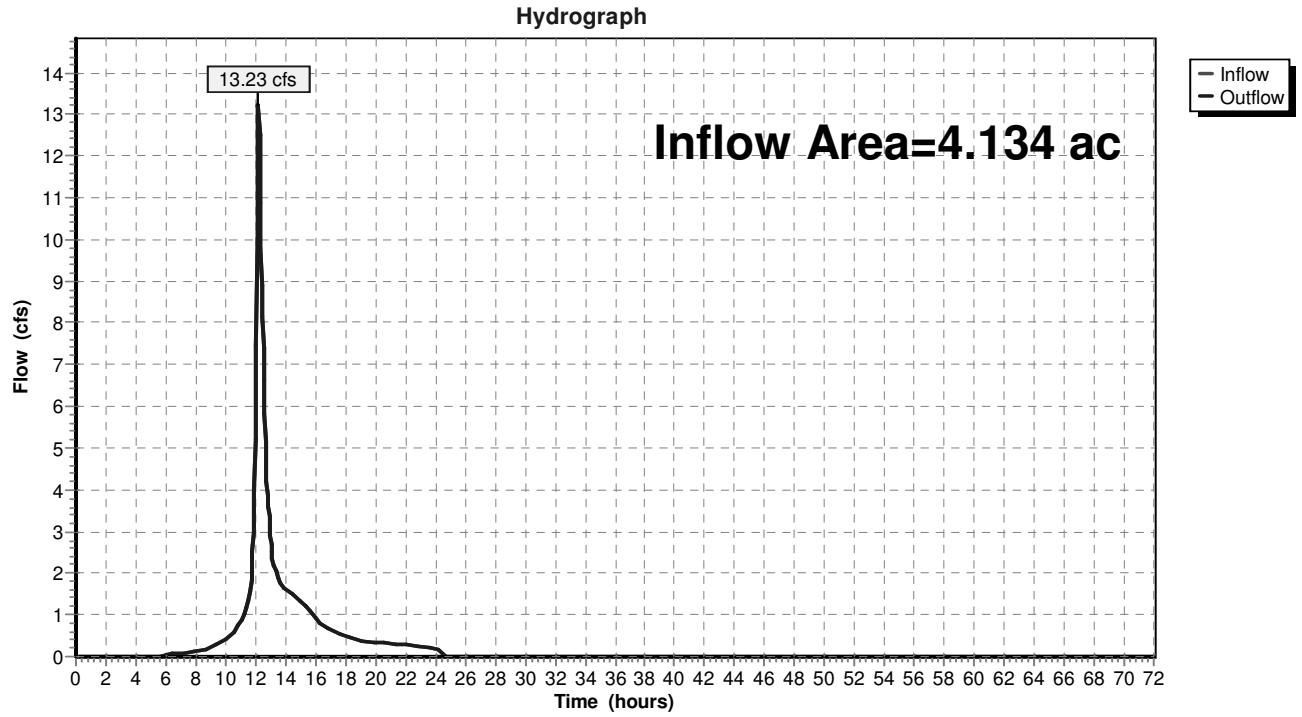


Summary for Reach IP-P: WETLAND/STREAM

Inflow Area = 4.134 ac, 26.10% Impervious, Inflow Depth = 4.36" for 100YR event
Inflow = 13.23 cfs @ 12.21 hrs, Volume= 1.501 af
Outflow = 13.23 cfs @ 12.21 hrs, Volume= 1.501 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach IP-P: WETLAND/STREAM



Summary for Pond 6P: Underground Basin

Inflow Area = 1.492 ac, 72.29% Impervious, Inflow Depth = 5.84" for 100YR event
Inflow = 9.60 cfs @ 12.07 hrs, Volume= 0.726 af
Outflow = 4.59 cfs @ 12.23 hrs, Volume= 0.726 af, Atten= 52%, Lag= 9.7 min
Discarded = 0.03 cfs @ 11.70 hrs, Volume= 0.026 af
Primary = 4.56 cfs @ 12.23 hrs, Volume= 0.700 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 608.74' @ 12.23 hrs Surf.Area= 4,983 sf Storage= 8,711 cf

Plug-Flow detention time= 54.4 min calculated for 0.726 af (100% of inflow)
Center-of-Mass det. time= 54.8 min (829.0 - 774.2)

Volume	Invert	Avail.Storage	Storage Description
#1	603.00'	1,726 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 6,452 cf Overall - 2,136 cf Embedded = 4,315 cf x 40.0% Voids
#2	603.75'	2,136 cf	**Cultec R-902HD** x 33 Inside #1 Effective Size= 69.8"W x 48.0"H => 17.65 sf x 3.67'L = 64.7 cf Overall Size= 78.0"W x 48.0"H x 4.10'L with 0.44' Overlap
#3	606.00'	2,761 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 8,996 cf Overall - 2,093 cf Embedded = 6,903 cf x 40.0% Voids
#4	606.50'	2,093 cf	**ADS_StormTech SC-310 +Cap** x 142 Inside #3 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap
		8,717 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
603.00	1,122	0	0
608.75	1,122	6,452	6,452

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
606.00	3,861	0	0
608.33	3,861	8,996	8,996

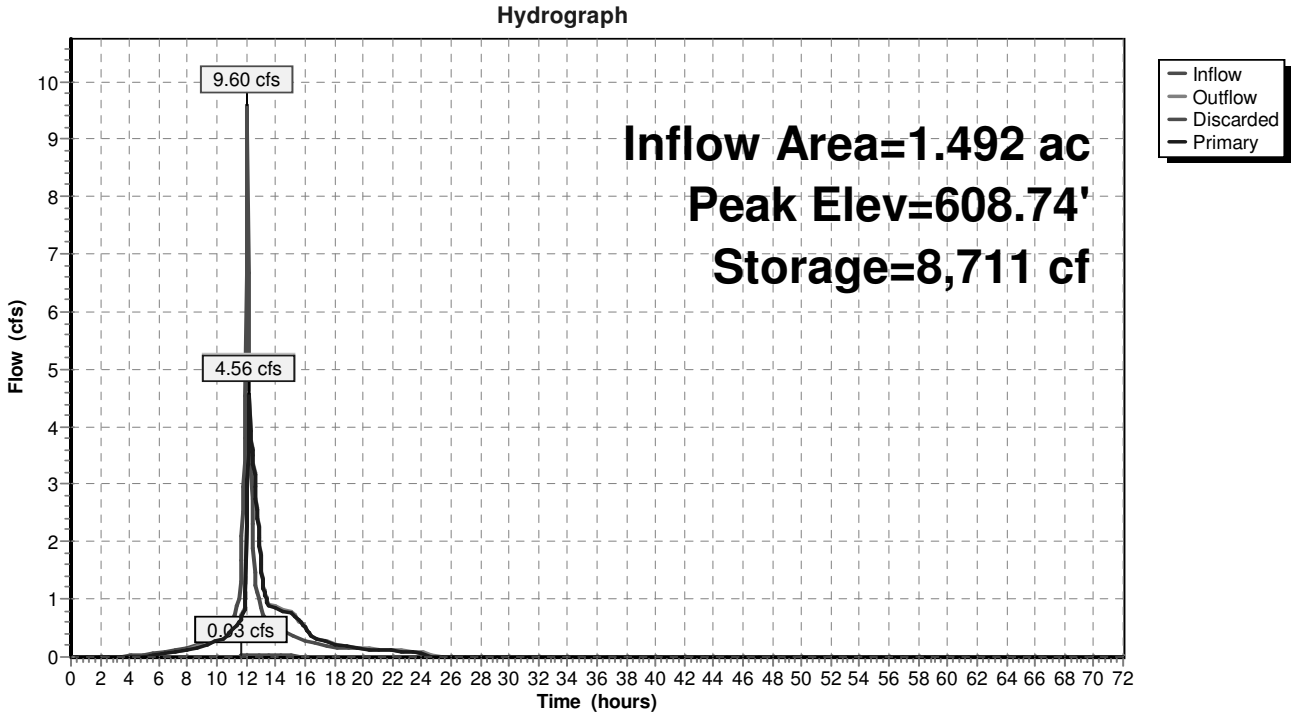
Device	Routing	Invert	Outlet Devices
#1	Discarded	603.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	603.00'	**24.0" Round Culvert** L= 50.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 603.00' / 603.00' S= 0.0000 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 3.14 sf
#3	Device 2	603.50'	**4.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 603.50' / 603.15' S= 0.0175 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.09 sf
#4	Device 2	604.60'	**3.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 604.60' / 603.00' S= 0.0800 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.05 sf
#5	Device 2	606.75'	**6.0" Round Culvert X 3.00** L= 20.0' CPP, projecting, no headwall, Ke= 0.900

Inlet / Outlet Invert= 606.75' / 606.00' S= 0.0375 '/' Cc= 0.900
n= 0.010 PVC, smooth interior, Flow Area= 0.20 sf
#6 Device 2 608.60' **12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.03 cfs @ 11.70 hrs HW=606.05' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=4.47 cfs @ 12.23 hrs HW=608.72' (Free Discharge)
└**2=Culvert** (Passes 4.47 cfs of 25.94 cfs potential flow)
├**3=Culvert** (Inlet Controls 0.75 cfs @ 8.54 fps)
├**4=Culvert** (Inlet Controls 0.37 cfs @ 7.60 fps)
├**5=Culvert** (Inlet Controls 2.94 cfs @ 4.98 fps)
└**6=Orifice/Grate** (Weir Controls 0.42 cfs @ 1.12 fps)

Pond 6P: Underground Basin



STANDARD #3 –LOSS OF ANNUAL RECHARGE

The site is predominately un-developed. The site design incorporates direct recharge of roof drains to infiltration basins. Basins A and B are designed to infiltrate retained runoff after pre-treatment. Soils were found to be Class C permeability.

The table below shows the required and provided recharge volumes for the project. As shown, the proposed condition exceeds the minimum requirement for the additional impervious areas.

Recharge Volume Summary

Soil Type	Recharge Factor (in. runoff)	Existing Impervious Area (sf)	Additional Impervious Area (sf)	Min. Req. Recharge Volume (cf)
A	0.60	0	0	0
B	0.35	0	0	0
C	0.25	0	46,996	979
D	0.10	0	0	0
Total Required				**979**

Standard #3 Only Applies to Additional Impervious

Provided Recharge Volume (cf)		
Basin 6P		984
Total Provided		**984**

Rechage Volume Calculation:

Rv = F x I
Rv = Required Recharge Volume
F = Recharge Factor
I = Total Impervious Area
Rv = (0.25")/(1'/12") x 46,996 s.f. = 979 c.f. (Required)

Provided Infiltration is 984 c.f. taken from Hydrograph

Stage-Area-Storage for Pond 6P: Underground Basin

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
603.00	1,122	0
603.10	1,122	45
603.20	1,122	90
603.30	1,122	135
603.40	1,122	180
603.50	1,122	224
603.60	1,122	269
603.70	1,122	314
603.80	1,122	380
603.90	1,122	467
604.00	1,122	554
604.10	1,122	640
604.20	1,122	726
604.30	1,122	812
604.40	1,122	898
604.50	1,122	984
604.60	1,122	1,069
604.70	1,122	1,154
604.80	1,122	1,238
604.90	1,122	1,322
605.00	1,122	1,406
605.10	1,122	1,490
605.20	1,122	1,573
605.30	1,122	1,656
605.40	1,122	1,738
605.50	1,122	1,820
605.60	1,122	1,902
605.70	1,122	1,983
605.80	1,122	2,064
605.90	1,122	2,145
606.00	**4,983**	2,224
606.10	4,983	2,458
606.20	4,983	2,691
606.30	4,983	2,923
606.40	4,983	3,155
606.50	4,983	3,385
606.60	4,983	3,760
606.70	4,983	4,131
606.80	4,983	4,495
606.90	4,983	4,853
607.00	4,983	5,202
607.10	4,983	5,542
607.20	4,983	5,871
607.30	4,983	6,189
607.40	4,983	6,491
607.50	4,983	6,775
607.60	4,983	7,031
607.70	4,983	7,260
607.80	4,983	7,471
607.90	4,983	7,671
608.00	4,983	7,871
608.10	4,983	8,070
608.20	4,983	8,269
608.30	4,983	8,469
608.40	4,983	8,560
608.50	4,983	8,605
608.60	4,983	8,649
608.70	4,983	**8,694**
608.80	4,983	**8,717**
608.90	4,983	8,717
609.00	4,983	8,717
609.10	4,983	8,717
609.20	4,983	8,717
609.30	4,983	8,717
609.40	4,983	8,717
609.50	4,983	8,717
609.60	4,983	8,717

Drawdown Calculation:

Basin#6P

$$Time_{drawdown} = \frac{Rv}{(K)(Bottom\ Area)}$$

Where:

Rv = Storage Volume (984 c.f.)

K = Saturated Hydraulic Conductivity For “Static” and “Simple Dynamic” Methods, use Rawls Rate (see 0.27 in/hour)

Bottom Area = Bottom Area of Recharge Structure 1122 s.f.)

984 c.f./ (0.27 in/hour)(foot/12inch)(1122 s.f.) =39.0 hours

Hydrograph for Pond 6P: Underground Basin

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)
0.00	0.00	0	603.00	0.00	0.00	0.00
2.50	0.01	18	603.04	0.01	0.01	0.00
5.00	0.05	166	603.37	0.01	0.01	0.00
7.50	0.13	360	603.78	0.12	0.01	0.11
10.00	**0.38**	**851**	**604.35**	**0.28**	**0.01**	**0.27**
12.50	**1.88**	**7,993**	**608.06**	**3.37**	**0.03**	**3.34**
15.00	0.39	2,684	606.20	0.79	0.03	0.75
17.50	0.19	821	604.31	0.27	0.01	0.27
20.00	0.13	423	603.85	0.15	0.01	0.14
22.50	0.10	350	603.77	0.11	0.01	0.10
25.00	0.00	237	603.53	0.01	0.01	0.00
27.50	0.00	172	603.38	0.01	0.01	0.00
30.00	0.00	109	603.24	0.01	0.01	0.00
32.50	0.00	46	603.10	0.01	0.01	0.00
35.00	0.00	5	603.01	0.00	0.00	0.00
37.50	0.00	0	603.00	0.00	0.00	0.00
40.00	0.00	0	603.00	0.00	0.00	0.00
42.50	0.00	0	603.00	0.00	0.00	0.00
45.00	0.00	0	603.00	0.00	0.00	0.00
47.50	0.00	0	603.00	0.00	0.00	0.00
50.00	0.00	0	603.00	0.00	0.00	0.00
52.50	0.00	0	603.00	0.00	0.00	0.00
55.00	0.00	0	603.00	0.00	0.00	0.00
57.50	0.00	0	603.00	0.00	0.00	0.00
60.00	0.00	0	603.00	0.00	0.00	0.00
62.50	0.00	0	603.00	0.00	0.00	0.00
65.00	0.00	0	603.00	0.00	0.00	0.00
67.50	0.00	0	603.00	0.00	0.00	0.00
70.00	0.00	0	603.00	0.00	0.00	0.00

STANDARD #4- 80% TSS REMOVAL

ESTIMATED PROPOSED NEW PAVED COVER= 38,996 S.F.

REQUIRED WATER QUALITY VOLUME:

Water Quality Volume		
Required Treatment Volume	0.5	Inches Over Impervious Areas
Watershed Series	Paved Area	Water Quality Volume
DA- P-1	38,996	1,625

The design of the drainage system is such that the site is routed through a series of treatment BMP's meeting the Standard. The attached TSS worksheets and Proprietary systems show the site meeting this requirement. No bypass is designed of the BMP's reducing the WQV.

STANDARD #9- OPERATION & MAINTENANCE

OPERATION & MAINTENANCE PLAN:

Property Tax Id:

ASSESSORS PARCEL ID: 208-02612-150

CURRENT OWNER & RESPONSIBLE PARTY:

COBRA REALTY TRUST MICHAEL CIESLA & MELVIN GLICKMAN
14 HARVARD STREET
WORCESTER, MA
(Contractor/Future Owner shall be responsible during construction)
COBRA REALTY TRUST MICHAEL CIESLA & MELVIN GLICKMAN
14 HARVARD STREET
WORCESTER, MA
413-593-1900

FUTURE OWNER & RESPONSIBLE PARTY:

TBD

DURING CONSTRUCTION:

***SILT FENCE BARRIER*:**

The silt fence barrier shall be installed prior to construction.

During construction the contractor shall inspect the silt fence barrier on a weekly basis and after any significant rainstorm resulting in greater than 0.5" of rainfall. The barrier shall be inspected for any breaches or disturbed silt fence and repaired immediately.

After construction the barrier shall be maintained as stated above until all new areas are vegetated.

After construction these duties shall transfer to the property owner.

***CONSTRUCTION ENTRANCE APRONS*:**

Construction aprons shall be installed to protect Route 20. The construction entrance apron shall be installed prior to commencement of construction and shall be inspected weekly. The construction entrance apron shall be replaced when debris becomes noticeable on the existing pavement surfaces leading to and from the construction site.

***SLOPE STABILIZATION*:**

The slope stabilization controls shall be installed immediately upon obtaining final grades as shown on the project plans. Slopes in the swale area shall be stabilized according to the details provided. All 3:1 slopes established on-site shall be loamed and seeded as soon as weather permits. Any 2:1 slopes established shall be covered with slope stabilization fabric, then loamed and seeded as soon as weather permits. Areas in failure shall be re-graded to final grade and stabilized as necessary.

***TEMPORARY BASINS*:**

The temporary basins shall be inspected immediately after storm events and cleaned to remove sediment build-up. Outfalls shall be inspected for erosion or scouring. Additional rip rap shall be added as required to minimize erosion.

***CATCH BASINS*:**

Catch basin entrances shall have temporary stone or other filtration device installed around inlet to prevent sediment deposits. Sediment shall be removed when accumulation exceeds 1" depth on paved surfaces.

***PROPRIETARY SEPARATOR*:**

The proprietary separator shall be inspected immediately after storm events and cleaned to remove sediment build-up. Cleaning methods shall adhere to the manufacturer's directions.

During construction the proprietary separator shall be inspected on a weekly basis for evidence of clogging or other situation that may adversely affect its function.

***CONSTRUCTION COMPLETION*:**

The entire stormwater management system shall be inspected upon completion of construction. Portions of the system containing sediment shall be cleaned and all sediment properly removed.

AFTER CONSTRUCTION:

Stormceptor Unit (Catch Basin#3)

At a minimum, the catch basins shall be inspected and cleaned on a quarterly basis. It is preferred that collection of accumulated sediment shall be accomplished by means of vacuum pumping and not by means of a clamshell bucket. Disposal of accumulated sediment shall be performed in accordance with applicable local, state, and federal guidelines and regulations

***CATCH BASINS*:**

At a minimum, the catch basins shall be inspected and cleaned on a quarterly basis. It is preferred that collection of accumulated sediment shall be accomplished by means of vacuum pumping and not by means of a clamshell bucket. Disposal of accumulated sediment shall be performed in accordance with applicable local, state, and federal guidelines and regulations.

Rip Rap Aprons

Rip Rap Aprons shall be visually inspected monthly for accumulation of debris, slope failure, or stone displacement. Slopes shall be mowed quarterly. Bottom shall be swept, vacuumed of accumulated debris semi-annually.

Underground Dry Wells

The following guidelines shall be adhered to for the operation and maintenance of the Cultec/Stormtech stormwater management system:
A. The owner shall keep a maintenance log which shall include details of any events which would have an effect on the system's operational capacity.
B. The operation and maintenance procedure shall be reviewed periodically and changed to meet site conditions.
C. Maintenance of the stormwater management system shall be performed by qualified workers and shall follow applicable occupational health and safety requirements.
D. Debris removed from the stormwater management system shall be disposed of in accordance with applicable laws and regulations.

- Monthly in first year - Check inlets and outlets for clogging and remove any debris, as required. Spring and Fall Check inlets and outlets for clogging and remove any debris, as required.

- One year after commissioning and every third year following Check inlets and outlets for clogging and remove any debris, as required.

LONG TERM POLLUTION PREVENTION PLAN

The following are the material management practices that shall be used to reduce the risk of spills or other accidental exposure of materials and substances to stormwater runoff.

Good Housekeeping: The following good housekeeping practices will be followed on site during the construction project and continued upon completion of the construction activities.

1. A concerted effort shall be made to store only enough product required to complete a particular task.
2. All materials stored on site shall be stored in a neat and orderly fashion in their appropriate containers and, if possible, under a roof or other secure enclosure.

3. Products shall be kept in their original containers with the original manufacture's label.
4. Substances shall not be mixed with one another unless recommended by the manufacturer.
5. Whenever possible, all of a product shall be used up before disposing of the container.
6. Manufacture's recommendations for proper use and disposal shall be followed.
7. The site superintendent shall inspect daily to ensure proper use and disposal of materials on site.

Hazardous Products: The following practices are intended to reduce the risks associated with hazardous materials.

1. Products shall be kept in original containers unless they are not re-sealable.
2. Where feasible, the original label and material safety data shall be retained, whereas they contain important product information.
3. If surplus product must be disposed of, follow manufacturers or local and State recommended methods for proper disposal.

Product Specific Practices: The following product-specific practices shall be followed on site:
Petroleum Products:

1. All on site vehicles shall be monitored for leaks and receive regular preventative maintenance to reduce the risk of leakage.
2. Petroleum products shall be stored in tightly sealed containers which are clearly labeled.
3. Petroleum Products shall be stored in compliance with Fire Marshall regulations.

Bituminous Concrete:
Any bituminous concrete or asphalt substances used on site shall be applied according to the manufacturer's recommendations.

Fertilizers:
No pesticides or fertilizers may be used within 100' buffer zone of any wetlands, water body or resource area. No quick release fertilizers may be used within 200' buffer of any wetlands, water body or resource area. No alteration or disturbance of any vegetation or soil may be conducted within 25 feet of any wetland, water body or resource area.

Paints:

1. All containers shall be tightly sealed and stored when not required for use.
2. Excess paint shall not be discharged into any catch basin, drain manhole or any portion of the stormwater management system.
3. Excess paint shall be properly disposed of according to manufacturer's recommendations or State and local regulations.

Concrete Trucks:
Concrete trucks shall not be allowed to wash out or discharge surplus concrete or drum wash water on site.

SPILL CONTROL PRACTICES

In addition to the good housekeeping and material management practices discussed in the previous sections of this plan, the following practices shall be followed for spill prevention and cleanup:

1. Manufacturer's recommended methods for cleanup shall be readily available at the onsite trailer, and site personnel shall be made aware of the procedures and the location of the information.
2. Materials and equipment necessary for spill clean up shall be kept in the material storage area on site. Equipment and materials shall include, but not be limited to, brooms, dust pans, mops, rags, gloves, goggles, kitty litter, sand, sawdust and plastic and metal trash containers specifically for this purpose.
3. All spills shall be cleaned up immediately after discovery.
4. The spill area shall be kept well ventilated, and personnel shall wear appropriate protective clothing to prevent injury from contact with hazardous substance.
5. Spills of toxic or hazardous material shall be reported to the appropriate State and/or local authority in accordance with local and/or State regulations.
6. The spill prevention plan shall be adjusted to include measures to prevent a particular type of spill from reoccurring and instructions on how to clean up the spill if there is another occurrence. A description of the spill, what caused it, and the clean up measures shall also be included.
7. The "Manager" shall be the spill prevention and cleanup coordinator. The "Manager" shall designate at least three other site personnel who will be trained in the spill control practices identified above.

APPENDICES:

Rip Rap Calculations

Groundwater Mounding Calculations

Pipe Sizing Calculations

Grate Capacity Calculations

Soil Information

After & During Inspection Logs

BMP Inspection Map

Rip Rap Calculations

Summit Engineering & Survey, Inc.
710 Main Street North Oxford MA 01537 (P) 508-987-8713 (F) 508-987-8714

150 Charlton Road, Sturbridge Ma
June 6, 2022

Project# 20-409

Apron Sizing – Drainage Outfalls

Basin#6P Rip Rap Apron
Length = 4xD = 4x1.0'=4'
Depth=3.3xD50 = 3.3x0.1=0.33'
Width= 3xD+2/3xL = 3x1+2/3(4')=6'

Groundwater Mounding Calculations

Summit Engineering & Survey, Inc.
710 Main Street North Oxford MA 01537 (P) 508-987-8713 (F) 508-987-8714

20-409 -UG Pond 6P
150 Charlton Road Sturbridge Ma
HANTUSH GROUNDWATER MOUND CALCULATOR

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin.

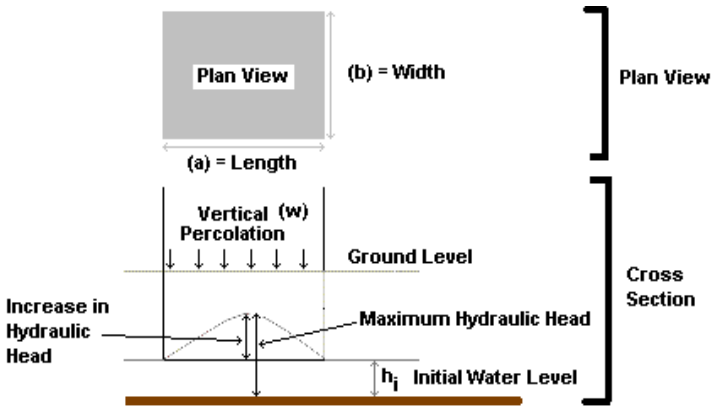
Basin	Length	Width	Volume	Time		Total		w (perc)
	ft	ft	cf	start	end	Hrs	Days	ft/d
6P	82	63	663	5	55	50	2.08	0.062

di

K (hyd. Conductivity)*

Texture	m/yr	m/d	ft/d
sand	5.55E+03	15.21	49.89
loamy sand	4.93E+03	13.51	44.31
sandy loam	1.09E+03	2.99	9.80
silty loam	2.27E+02	0.62	2.04
loam	2.19E+02	0.60	1.97
sandy clay loam	1.99E+02	0.55	1.79
silty clay loam	5.36E+01	0.15	0.48
clay loam	7.73E+01	0.21	0.69
sandy clay	6.84E+01	0.19	0.61
silty clay	3.21E+01	0.09	0.29
clay	4.05E+01	0.11	0.36

Source: Clapp and Hornberger (1978)

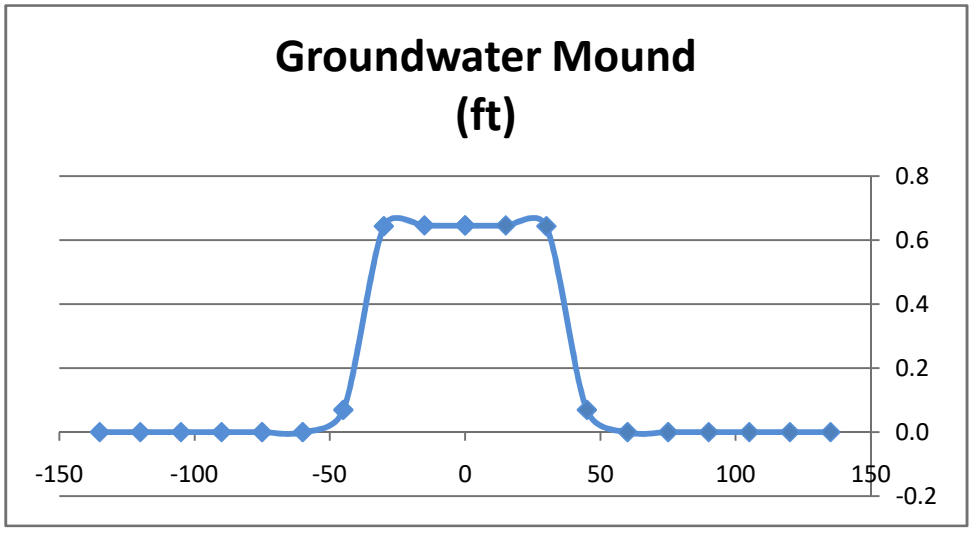


Input Values

0.54	K	Horizontal hydraulic conductivity (feet/day)
0.200	Sy	Specific yield (dimensionless)
2.000	hi	Initial Water Level (feet)
82.000	a	Basin Length (feet)
63.000	b	Basin Width (feet)
0.0620	*w*	Recharge (infiltration) rate (feet/day)
2.083	t	duration of infiltration period (days)

2.646	h(max)	Maximum Hydraulic Head (feet)
0.646	Δh(max)	Maximum Groundwater Mound (feet)

Ground-water Mound (ft)	Distance from Center (ft)
0.646	0
0.646	15
0.644	30
0.070	45
0.000	60
0.000	75
0.000	90
0.000	105
0.000	120
0.000	135
Increment	15



Pipe Sizing Calculations

Summit Engineering & Survey, Inc.
710 Main Street North Oxford MA 01537 (P) 508-987-8713 (F) 508-987-8714

6/14/2022

RATIONAL METHOD PIPE DESIGN WORKSHEET

LOCATION	PIPE SEGMENT From	To	INCREMENTAL AREA DESIGNATION	A (Acres)	Total A	C	C*A	Sum (C*A)	FLOW TIME (min.) To Inlet	In Chan.	Tot.	25-Yr I (in/hr)	25-Yr Q (cfs)	DESIGN CONDITIONS Pipe Diam (in.)	Length (ft)	Slope (%)	Q-full (cfs)	V-Full (fps)	Design (25-Yr) Depth Peak (in.)	V-Peak (fps)	Inverts Up	Down	Remarks
Site To DMH-1																							
	CB-1	DMH-1		0.018		0.90	**0.02**		5		5	6.0	**0.10**	8	18	0.020	**1.86**	5.32	0.4	0.28	609.16	608.80	CB-1 Rim =613.1
	CB-2	DMH-1		0.202		0.67	**0.14**		5		5	6.0	**0.82**	8	110	0.010	**1.31**	3.76	5.0	2.34	609.90	608.80	CB-2 Rim=612.90
	DMH-1	DMH-2			0.220			**0.15**	10		10	6.0	**0.91**	12	95	0.011	**4.07**	5.18	2.7	1.16	608.70	607.65	DMH-1 Rim=613.45
Site To Stormceptor-1																							
	CB-3	DMH-2		0.379		0.81	**0.31**		5		5	6.0	**1.84**	8	145	0.005	**0.94**	2.70	15.6	5.29	608.40	607.65	CB-3 Rim =611.40
	CB-4	DMH-2		0.440		0.60	**0.26**		5		5	6.0	**1.58**	8	25	0.010	**1.31**	3.76	9.7	4.54	607.40	607.15	CB-4 Rim=610.00
	DMH-1	DMH-2		0.220		0.68	**0.15**		10		5	6.0	**0.90**	12	95	0.011	**4.07**	5.18	2.7	1.15	608.70	607.65	DMH-2 Rim=611.75
	DMH-2	SC-1			1.039			**0.72**	20		5	6.0	**4.33**	12	10	0.010	**3.87**	4.93	13.4	5.51	607.05	606.95	SC-1 Rim=611.70
Stormceptors to UG Basin 6P																							
	SC-2	UG Basin		0.271		0.90	**0.24**		5		5	6.0	**1.46**	12	15	0.010	**2.60**	3.31	6.8	1.86	606.70	606.55	SC-2 Rim = 609.75
	SC-1	UG Basin		2.250		0.88	**1.98**		5		5	6.0	**11.88**	12	80	0.005	**1.84**	2.34	77.7	15.13	606.70	606.30	SC-1 Rim=611.70
Pond 6P		UG Basin	Q Values For Pond Outlet Based on TR-20 25-Year Storm									Q_{25}	**2.69**	12	36	0.056	**9.42**	12.00	8.1	3.34	600.00	598.00	12"HPDE Pipe to Wetlands
												Q_{100}	4.56										
Roof to Underground Basin 6P																							
	Roof	UG Basin		0.184		0.90	**0.17**		5		5	6.0	**0.99**	8	223	0.025	**1.38**	3.96	5.7	2.85	612.00	606.50	
Drop Inlet																							

3) Five (5) minute minimum flow time used for minimum time of concentration (Tc) to CB inlet to system

4) Massachusetts Cascade Grate Inlet Capacity = 1.26 cfs @ 100% efficiency, Standard Grate = 0.95 cfs est.

5) Blue Highlight denotes calculated peak flow (cfs) to CB Inlet

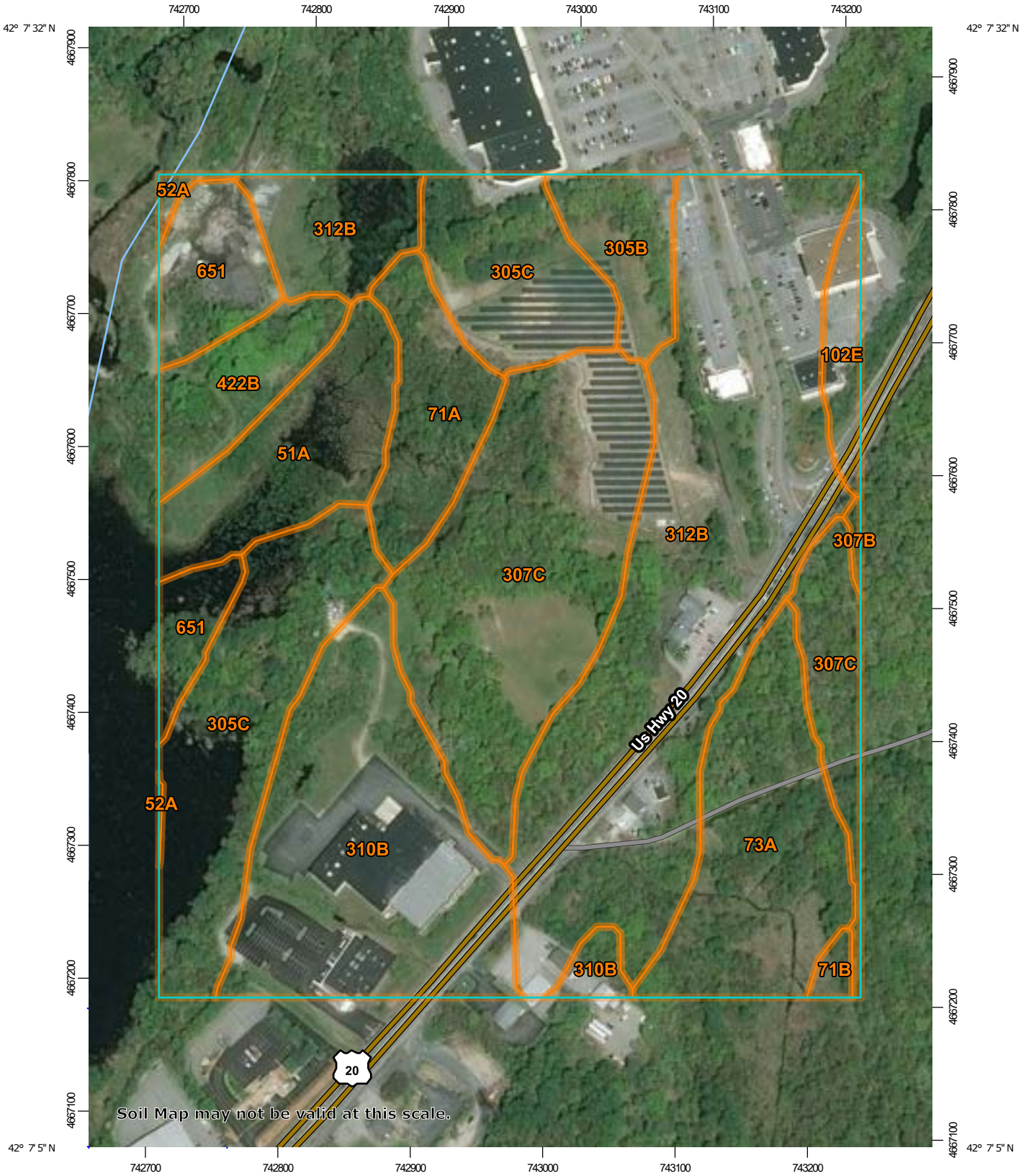
Grate Capacity Calculations

Summit Engineering & Survey, Inc.
710 Main Street North Oxford MA 01537 (P) 508-987-8713 (F) 508-987-8714

Soil Information

Summit Engineering & Survey, Inc.
710 Main Street North Oxford MA 01537 (P) 508-987-8713 (F) 508-987-8714

Soil Map—Worcester County, Massachusetts, Southern Part
(20-385 Charlton Road Sturbridge Ma)



Map Scale: 1:4,110 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 50 100 200 300

Feet
0 150 300 600 900

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Worcester County, Massachusetts, Southern Part
Survey Area Data: Version 13, Jun 11, 2020

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

Date(s) aerial images were photographed: May 18, 2019—Jul 9, 2019

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
51A	Swansea muck, 0 to 1 percent slopes	4.5	5.5%
52A	Freetown muck, 0 to 1 percent slopes	0.2	0.3%
71A	Ridgebury fine sandy loam, 0 to 3 percent slopes, extremely stony	3.3	4.1%
71B	Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony	0.3	0.4%
73A	Whitman fine sandy loam, 0 to 3 percent slopes, extremely stony	6.7	8.3%
102E	Chatfield-Hollis-Rock outcrop complex, 15 to 35 percent slopes	1.2	1.5%
305B	Paxton fine sandy loam, 3 to 8 percent slopes	2.2	2.7%
305C	Paxton fine sandy loam, 8 to 15 percent slopes	11.1	13.6%
307B	Paxton fine sandy loam, 0 to 8 percent slopes, extremely stony	0.1	0.2%
307C	Paxton fine sandy loam, 8 to 15 percent slopes, extremely stony	13.1	16.1%
310B	Woodbridge fine sandy loam, 3 to 8 percent slopes	11.0	13.5%
312B	Woodbridge fine sandy loam, 0 to 8 percent slopes, extremely stony	21.6	26.6%
422B	Canton fine sandy loam, 0 to 8 percent slopes, extremely stony	2.6	3.2%
651	Udorthents, smoothed	3.4	4.2%
Totals for Area of Interest		**81.4**	**100.0%**

Commonwealth of Massachusetts
City/Town of Sturbridge

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Interstate Towing
Owner Name

Charlton Road
Street Address

208-2612-150
Map/Lot #

Sturbridge
City

MA
State

01566
Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade ☐ Repair

2. Soil Survey Available? ☒ Yes ☐ No If yes: Mass. GIS (Source) 307C (Soil Map Unit)

Paxton
Soil Name

stony
Soil Limitations

Glacial Till
Soil Parent material

Ground Moraine
Landform

3. Surficial Geological Report Available? ☐ Yes ☒ No If yes: _____ (Year Published/Source) _____ (Map Unit)

Description of Geologic Map Unit:

4. Flood Rate Insurance Map Within a regulatory floodway? ☐ Yes ☒ No

5. Within a velocity zone? ☐ Yes ☒ No

6. Within a Mapped Wetland Area? ☐ Yes ☒ No If yes, MassGIS Wetland Data Layer: _____ (Wetland Type)

7. Current Water Resource Conditions (USGS): December 2020 (Month/Day/ Year) Range: ☐ Above Normal ☐ Normal ☒ Below Normal

8. Other references reviewed:

Commonwealth of Massachusetts
City/Town of Sturbridge

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: 1 (Hole #) | 12-3-20 (Date) | 8:00 (Time) | clear 45 (Weather) | _____ (Latitude) | _____ (Longitude:)

1. Land Use: Vacant Lot (e.g., woodland, agricultural field, vacant lot, etc.) | Grass Field (Vegetation) | none (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 2% (Slope (%))

Description of Location: _____

2. Soil Parent Material: Glacial Till | Ground Moraine (Landform) | _____ (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body n/a feet | Drainage Way n/a feet | Wetlands 80 feet | Property Line 150 feet | Drinking Water Well n/a feet | Other _____ feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 30" Depth Weeping from Pit | n/a Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-18	AP	S.L.	10YR4/4	N/A			N/A				
18-30	Bw	S.L.	10YR6/6	30"	10YR5/8	50	N/A				
30-76	Cd	S.L.	10YR5/8	N/A			N/A	10			

Additional Notes: _____

Commonwealth of Massachusetts
City/Town of Sturbridge

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: 2 (Hole #) | 12/3/20 (Date) | 8:30 (Time) | Clear (Weather) | _____ (Latitude) | _____ (Longitude:)

1. Land Use: Vacant Lot (e.g., woodland, agricultural field, vacant lot, etc.) | Grass Field (Vegetation) | none (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 2% (Slope (%))

Description of Location: _____

2. Soil Parent Material: Glacial Till | Ground Moraine (Landform) | _____ (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body n/a feet | Drainage Way n/a feet | Wetlands 80 feet
Property Line 150 feet | Drinking Water Well n/a feet | Other _____ feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 30" Depth Weeping from Pit | n/a Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-10	Ap	S.L.	10YR4/4	N/A							
10-24	Bw	S.L.	10YR6/6	24"							
24-76	Cd	Silty Loam	10YR5/8	N/A							

Additional Notes: _____

Commonwealth of Massachusetts
City/Town of Sturbridge

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: 3 (Hole #) | 12-3-20 (Date) | 8:45 (Time) | clear 45 (Weather) | (Latitude) | (Longitude:)

1. Land Use: Vacant Lot (e.g., woodland, agricultural field, vacant lot, etc.) | Grass Field (Vegetation) | none (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 2% (Slope (%))

Description of Location:

2. Soil Parent Material: Glacial Till | Ground Moraine (Landform) | (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body n/a feet | Drainage Way n/a feet | Wetlands 125 feet | Property Line 300 feet | Drinking Water Well n/a feet | Other _____ feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 24" Depth Weeping from Pit | n/a Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-10	AP	S.L.	10YR4/4	N/A			N/A				
10-18	Bw	S.L.	10YR6/6	N/A			N/A				
18-76	Cd	Silty Loam.	10YR5/6	24"	10YR5/8	45	N/A	10			

Additional Notes:

Commonwealth of Massachusetts
City/Town of Sturbridge

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: 4 (Hole #) | 12/3/20 (Date) | 9:00 (Time) | Clear (Weather) | _____ (Latitude) | _____ Longitude:

1. Land Use: Vacant Lot (e.g., woodland, agricultural field, vacant lot, etc.) | Wooded Area (Vegetation) | none (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 2% (Slope (%))

Description of Location: _____

2. Soil Parent Material: Glacial Till | Ground Moraine (Landform) | _____ (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body n/a feet | Drainage Way n/a feet | Wetlands 65 feet
Property Line 75 feet | Drinking Water Well n/a feet | Other _____ feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 30" Depth Weeping from Pit | n/a Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-10	Ap	S.L.	10YR4/4	N/A							
10-30	Bw	S.L.	10YR6/6	30"	10YR5/8	50					
30-76	Cd	Silty Loam	10YR5/6	N/A							

Additional Notes: _____

Commonwealth of Massachusetts
City/Town of Sturbridge

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: 5 (Hole #) | 12-3-20 (Date) | 9:15 (Time) | clear 45 (Weather) | (Latitude) | (Longitude:)

1. Land Use: Vacant Lot (e.g., woodland, agricultural field, vacant lot, etc.) | Grass Field (Vegetation) | none (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 2% (Slope (%))

Description of Location:

2. Soil Parent Material: Glacial Till | Ground Moraine (Landform) | (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body n/a feet | Drainage Way n/a feet | Wetlands 200 feet | Property Line 100 feet | Drinking Water Well n/a feet | Other ____ feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 20" Depth Weeping from Pit | n/a Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-10	AP	S.L.	10YR4/4	N/A			N/A				
10-24	Bw	S.L.	10YR6/6	N/A			N/A				
24-76	C	S.L..	10YR5/6	24"	10YR5/8	45	N/A	10			

Additional Notes:

Commonwealth of Massachusetts
City/Town of Sturbridge

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: 6 (Hole #) | 12/3/20 (Date) | 9:30 (Time) | Clear (Weather) | _____ (Latitude) | _____ (Longitude:)

1. Land Use: Vacant Lot (e.g., woodland, agricultural field, vacant lot, etc.) | Grass Field (Vegetation) | none (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 2% (Slope (%))

Description of Location: _____

2. Soil Parent Material: Glacial Till | Ground Moraine (Landform) | _____ (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body n/a feet | Drainage Way n/a feet | Wetlands 65 feet
Property Line 30 feet | Drinking Water Well n/a feet | Other _____ feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 24" Depth Weeping from Pit | n/a Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-12	Ap	S.L.	10YR4/4	N/A							
12-24	Bw	S.L.	10YR6/6	24"	10YR5/8	50					
24-76	C	S.L.	10YR5/6	N/A							

Additional Notes: _____

Commonwealth of Massachusetts
City/Town of Sturbridge

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Interstate Towing
Owner Name

Charlton Road
Street Address

208-2612-150
Map/Lot #

Sturbridge
City

MA
State

01566
Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade ☐ Repair

2. Soil Survey Available? ☒ Yes ☐ No If yes: Mass. GIS (Source) 307C (Soil Map Unit)

Paxton
Soil Name

stony
Soil Limitations

Glacial Till
Soil Parent material

Ground Moraine
Landform

3. Surficial Geological Report Available? ☐ Yes ☒ No If yes: _____ (Year Published/Source) _____ (Map Unit)

Description of Geologic Map Unit:

4. Flood Rate Insurance Map Within a regulatory floodway? ☐ Yes ☒ No

5. Within a velocity zone? ☐ Yes ☒ No

6. Within a Mapped Wetland Area? ☐ Yes ☒ No If yes, MassGIS Wetland Data Layer: _____ (Wetland Type)

7. Current Water Resource Conditions (USGS): December 2020 (Month/Day/ Year) Range: ☐ Above Normal ☐ Normal ☒ Below Normal

8. Other references reviewed:

Commonwealth of Massachusetts
City/Town of Sturbridge

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used:

	Obs. Hole #1	Obs. Hole #2
☐ Depth observed standing water in observation hole	_____ inches	_____ inches
☒ Depth weeping from side of observation hole	30 inches	24 inches
☒ Depth to soil redoximorphic features (mottles)	36 inches	30 inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	_____ inches	_____ inches

_____ Index Well Number

_____ Reading Date

$S_h = S_c – [S_r \times (OW_c – OW_{max})/OW_r]$

Obs. Hole/Well# _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

2. Estimated Depth to High Groundwater: _____ inches

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

☒ Yes ☐ No

b. If yes, at what depth was it observed (exclude A and O Horizons)?	Upper boundary:	24 inches	Lower boundary:	76+ inches
c. If no, at what depth was impervious material observed?	Upper boundary:	_____ inches	Lower boundary:	_____ inches

Commonwealth of Massachusetts
City/Town of Sturbridge

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used:

	Obs. Hole #3	Obs. Hole #4
☐ Depth observed standing water in observation hole	_____ inches	_____ inches
☒ Depth weeping from side of observation hole	24 inches	30 inches
☒ Depth to soil redoximorphic features (mottles)	24 inches	30 inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	_____ inches	_____ inches

_____ Index Well Number _____ Reading Date

$S_h = S_c – [S_r \times (OW_c – OW_{max})/OW_r]$

Obs. Hole/Well# _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

2. Estimated Depth to High Groundwater: _____ inches

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

☒ Yes ☐ No

b. If yes, at what depth was it observed (exclude A and O Horizons)?	Upper boundary:	30 inches	Lower boundary:	76+ inches
c. If no, at what depth was impervious material observed?	Upper boundary:	_____ inches	Lower boundary:	_____ inches

Commonwealth of Massachusetts
City/Town of Sturbridge

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used:

	Obs. Hole #5	Obs. Hole #6
☐ Depth observed standing water in observation hole	_____ inches	_____ inches
☒ Depth weeping from side of observation hole	20 inches	24 inches
☒ Depth to soil redoximorphic features (mottles)	24 inches	24 inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	_____ inches	_____ inches

_____ Index Well Number _____ Reading Date

$S_h = S_c – [S_r \times (OW_c – OW_{max})/OW_r]$

Obs. Hole/Well# _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

2. Estimated Depth to High Groundwater: _____ inches

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

☒ Yes ☐ No

b. If yes, at what depth was it observed (exclude A and O Horizons)?	Upper boundary:	24 inches	Lower boundary:	76+ inches
c. If no, at what depth was impervious material observed?	Upper boundary:	_____ inches	Lower boundary:	_____ inches

Commonwealth of Massachusetts
City/Town of Sturbridge

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

	12-3-20
Signature of Soil Evaluator	Date
Peter Lavoie #1332	2023
Typed or Printed Name of Soil Evaluator / License #	Expiration Date of License
Name of Approving Authority Witness	Approving Authority

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

Field Diagrams: Use this area for field diagrams:

After & During Inspection Logs

Summit Engineering & Survey, Inc.
710 Main Street North Oxford MA 01537 (P) 508-987-8713 (F) 508-987-8714

Inspection and Maintenance Log FOR: 150 Charlton Road
AFTER CONSTRUCTION & After 3.0" Rain

Components	**Date**
UG Basin#6P **– twice a year**	
Comments during insp.	
Note corrective measures performed & Date	
Catch Basin 1 **– 8 inches of sediment or twice a year**	
Comments during insp.	
Note corrective measures performed & date	
Catch Basin 2 **– 8 inches of sediment or twice a year**	
Comments during insp.	
Note corrective measures performed & date	
Catch Basin 3 **– 8 inches of sediment or twice a year**	
Comments during insp.	
Note corrective measures performed & date	
Catch Basin 4 **– 8 inches of sediment or twice a year**	
Comments during insp.	
Note corrective measures performed & date _____. Inspector Title Date	
_____.	

Inspection and Maintenance Log FOR: 150 Charlton Road
AFTER CONSTRUCTION & After 3.0" Rain

	Address Tel#	

Components	**Date**
Outlet Control Structure 1 **-as-needed**	
Comments during insp.	
Note corrective measures performed & date	
All Flared end sections and rip rap aprons **– twice a year**	
Comments during insp.	
Note corrective measures performed & date	
Rip Rap & Flared End After Outlet Basin 6P **-twice a year**	
Comments during insp.	
Note corrective measures performed & date	
Gutters on Building **-As needed**	
Comments during insp.	
Note corrective measures performed & date	
Street Sweeping **– twice a year**	
Comments during insp.	
Note corrective measures performed & date	
Comments during insp.	
Note corrective measures performed & date _____. Inspector Title Date	

Inspection and Maintenance Log FOR: 150 Charlton Road
AFTER CONSTRUCTION & After 3.0" Rain

Components	Date
Comments during insp.	
Note corrective measures performed & date	
Comments during insp.	
Note corrective measures performed & date	
Comments during insp.	
Note corrective measures performed & date	
Comments during insp.	
Note corrective measures performed & date	
Comments during insp.	
Note corrective measures performed & date	
Comments during insp.	
Note corrective measures performed & date	
Comments during insp.	
Note corrective measures performed & date _____. Inspector Title Date	

WEEKLY
Inspection and Maintenance Log FOR: 150 Charlton RD
DURING CONSTRUCTION & After 0.5" Rain

Components	**Date**
Erosion Control – Weekly	
Comments during insp.	
Note corrective measures performed & Date	
On Site Pavement Sweeping – as Needed	
Comments during insp.	
Note corrective measures performed & date	
Silt Fence & Composite Sock– Monthly	
Comments during insp.	
Note corrective measures performed & date	
Temporary Basin Area as Needed	
Comments during insp.	
Note corrective measures performed & date	
Construction Entrance as Needed	
Comments during insp.	
Note corrective measures performed & date _____. Inspector Title Date	
_____. Address Tel#	

WEEKLY
Inspection and Maintenance Log FOR: 150 Charlton RD
DURING CONSTRUCTION & After 0.5" Rain

Components	**Date**
Notify Cons. Comm. Issues effecting Resource Areas	
Comments during insp.	
Note corrective measures performed & date	
Silt of Public (Charlton Road) Streets – Daily	
Comments during insp.	
Note corrective measures performed & date	
Stockpile Materials Ring with Composite Sock – Weekly	
Comments during insp.	
Note corrective measures performed & date	
Any Spill Fuel, Chemical- Daily	
Comments during insp.	
Note corrective measures performed & date	
Temporary Ground Cover Area – Weekly	
Comments during insp.	
Note corrective measures performed & date	
Temporary Stone at Access Drive as Needed	
Comments during insp.	
Note corrective measures performed & date _____. Inspector Title Date	
_____. Address Tel#	

WEEKLY
Inspection and Maintenance Log FOR: 150 Charlton RD
DURING CONSTRUCTION & After 0.5" Rain

Components	**Date**
Lawn Area / Mulch Area **Erosion, Washouts**	
Comments during insp.	
Note corrective measures performed & date	
Stone Aprons at Outfalls Exit **as Needed**	
Comments during insp.	
Note corrective measures performed & date	
Forebay **as Needed**	
Comments during insp.	
Note corrective measures performed & date	
Basins 6P **as Needed**	
Comments during insp.	
Note corrective measures performed & date	
Illicit Drainage **Discharge**	
Comments during insp.	
Note corrective measures performed & date _____. Inspector Title Date	
_____. Address Tel#	

WEEKLY
Inspection and Maintenance Log FOR: 150 Charlton RD
DURING CONSTRUCTION & After 0.5" Rain

BMP Inspection Map

Summit Engineering & Survey, Inc.
710 Main Street North Oxford MA 01537 (P) 508-987-8713 (F) 508-987-8714

Flood Map

Summit Engineering & Survey, Inc.
710 Main Street North Oxford MA 01537 (P) 508-987-8713 (F) 508-987-8714

National Flood Hazard Layer FIRMette

72°3'56"W 42°7'30"N

72°3'19"W 42°7'3"N

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

1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

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

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

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

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

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

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

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

N

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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 6/7/2022 at 11:04 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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