Tauper Land Surveying, Inc.

HYDRAULIC / HYDROLOGIC CALCULATIONS

Site Plan
Stafford Street
Leicester Massachusetts

Prepared For:
Schold Development, LLC

Prepared By:

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

April 5, 2022
May 19, 2022

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DRAINAGE SUMMARY

Summit Engineering & Survey, Inc. is pleased to provide the following Hydraulic / Hydrologic analysis for the proposed site plan for Schold Development. The proposed project is located on Stafford Street in Leicester, Massachusetts. The existing site consists of an undeveloped parcel, much of it wooded with mature woodland. The hydrologic conditions were analyzed using TR-55 and HydroCAD® for the 2, 10 and 100 year storm events utilizing Technical Paper 40, 24 hour Rainfall events.
Project site consists of theconstruting a warehouse off ice building with parking area and access onto Stafford Street, installation of proposed septic and well and grading the site so all runoff generated from the proposed development can be collected and treated and mitigated before discharing it toward the existing wetlands located on the site. The project as designed conforms to the Massachusetts DEP Stormwater Management Policy.

EXISTING CONDITIONS: The project is located on Stafford Street near the intersection of Auburn Street. The parcel is 8.7 acres in size. The site wooded and has not been disturbed. There is an existing wetland that running parallel with Stafford Street.

The topography of the site slopes toward the back of the parcel, which is toward existing wetlands.

For the purpose of the analysis of the effect on the parcel toward the existing wetlands, the site was analyzed as one watershed. In the Pre-Development Condition, Subcatchment 1 represents the tributary area of the property that flows to the back of the parcel and the existing wetlands.

According to the online USGS soil survey, the analyzed area consists of soils with “B” hydrologic ratings. Per the soil map the soil on site are Paxton. The cover consists of predominantly woodland area.

PROPOSED CONDITIONS:

The proposed condition of the site will consists of a woodland area and the proposed development will be adjacent to the Street. The proposed drainage system will consist of catch basins to manhole design the is directed into an underground basin. The site will also use proposed stormceptors to help clean the runoff before it enters the underground basin.
In order to analyze the surface water flows, the site was divided into multiple Subcatchents, Ponds and a Reaches

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#1E	0.24	1.30	1.74	3.25
Post Development	IP#1P	0.21	1.23	1.73	3.24

DEP Stormwater Management Standards:

Standard #1: The proposed changes will not cause erosion in adjacent water 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, 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 proposed project does not propose any impervious area at this time. The proposed future site will address this Standard as required by Stormwater Management. The existing basin will continue to address this Standard as it was designed to infiltrate runoff from the Tractor Supply Site after pre-treatment. The existing basin will be monitored throughout the construction to ensure that the 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.
Standard #5: The proposed development will not generate higher potential pollutant loads and therefore will not require additional BMP practices.

Standard #6: The proposed project is 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

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature

Thaddeus Szkoda 5/23/22
Signature and Date

Checklist

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

☐ New development

Redevelopment

☒ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

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

☒ No disturbance to any Wetland Resource Areas

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

☐ Reduced Impervious Area (Redevelopment Only)

☐ Minimizing disturbance to existing trees and shrubs

☐ LID Site Design Credit Requested:

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

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

☐ Bioretention Cells (includes Rain Gardens)

☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)

☐ Treebox Filter

Water Quality Swale

Grass Channel

☐ Green Roof

☐ Other (describe): _____

Standard 1: No New Untreated Discharges

☒ No new untreated discharges

☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth

☒ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

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

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

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

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

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

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

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

Critical areas and BMPs are identified in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

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

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

☐ Limited Project

☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.

☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area

☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff

☐ Bike Path and/or Foot Path

Redevelopment Project

Redevelopment portion of mix of new and redevelopment.

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

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

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

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

Standard 10: Prohibition of Illicit Discharges

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

☒ An Illicit Discharge Compliance Statement is attached;

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

STANDARD #2- PEAK DISCHARGE RATES

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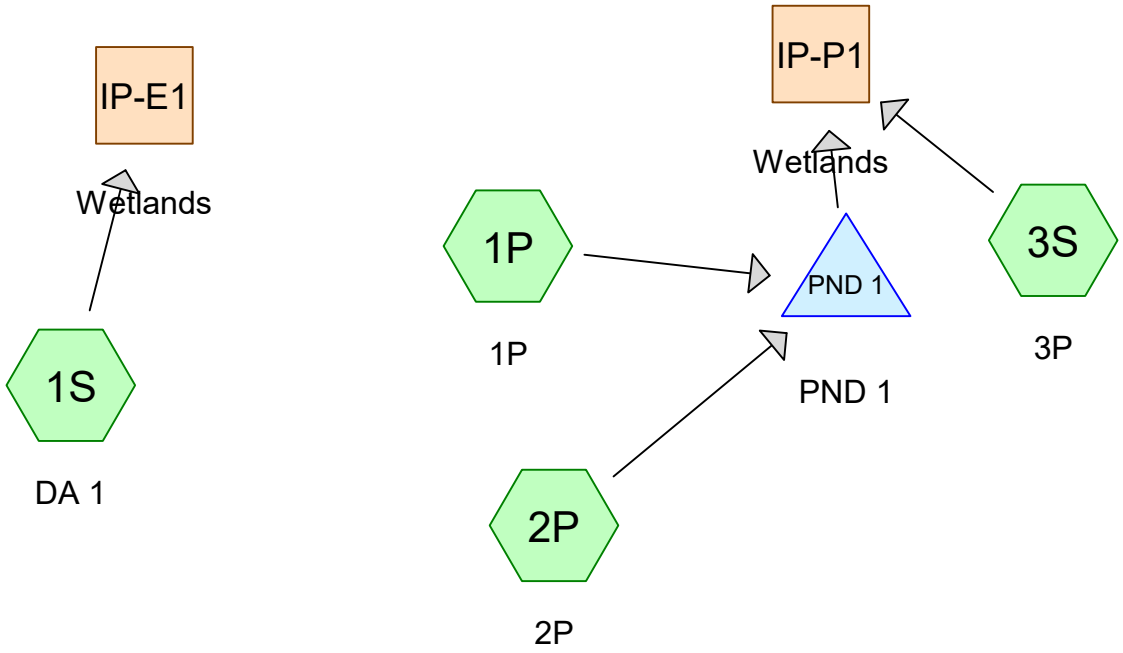


Subcat Reach Pond Link

Routing Diagram for Stafford St Development OPTION 2
Prepared by {enter your company name here}, Printed 5/19/2022
HydroCAD® 10.00-26 s/n 09589 © 2020 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.234	61	>75% Grass cover, Good, HSG B (1P, 2P, 3S)
0.462	98	Paved parking, HSG B (1P, 2P, 3S)
1.905	55	Woods, Good, HSG B (1S, 3S)
0.184	65	Woods/grass comb., Fair, HSG B (1S)
2.786	**63**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
2.786	HSG B	1P, 1S, 2P, 3S
0.000	HSG C	
0.000	HSG D	
0.000	Other	
2.786		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.234	0.000	0.000	0.000	0.234	>75% Grass cover, Good	1P, 2P, 3S
0.000	0.462	0.000	0.000	0.000	0.462	Paved parking	1P, 2P, 3S
0.000	1.905	0.000	0.000	0.000	1.905	Woods, Good	1S, 3S
0.000	0.184	0.000	0.000	0.000	0.184	Woods/grass comb., Fair	1S
0.000	**2.786**	**0.000**	**0.000**	**0.000**	**2.786**	**TOTAL AREA**	

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1P: 1P Runoff Area=13,258 sf 85.99% Impervious Runoff Depth>2.49"
Tc=6.0 min CN=93 Runoff=0.89 cfs 0.063 af

Subcatchment 1S: DA 1 Runoff Area=60,669 sf 0.00% Impervious Runoff Depth>0.30"
Tc=6.0 min CN=56 Runoff=0.24 cfs 0.034 af

Subcatchment 2P: 2P Runoff Area=12,229 sf 54.79% Impervious Runoff Depth>1.51"
Tc=6.0 min CN=81 Runoff=0.52 cfs 0.035 af

Subcatchment 3S: 3P Runoff Area=35,182 sf 5.76% Impervious Runoff Depth>0.36"
Tc=6.0 min CN=58 Runoff=0.21 cfs 0.024 af

Reach IP-E1: Wetlands Inflow=0.24 cfs 0.034 af
Outflow=0.24 cfs 0.034 af

Reach IP-P1: Wetlands Inflow=0.21 cfs 0.045 af
Outflow=0.21 cfs 0.045 af

Pond PND 1: PND 1 Peak Elev=783.14' Storage=2,069 cf Inflow=1.41 cfs 0.099 af
Discarded=0.05 cfs 0.044 af Primary=0.12 cfs 0.020 af Outflow=0.16 cfs 0.064 af

Total Runoff Area = 2.786 ac Runoff Volume = 0.157 af Average Runoff Depth = 0.68"
83.41% Pervious = 2.323 ac 16.59% Impervious = 0.462 ac

Summary for Subcatchment 1P: 1P

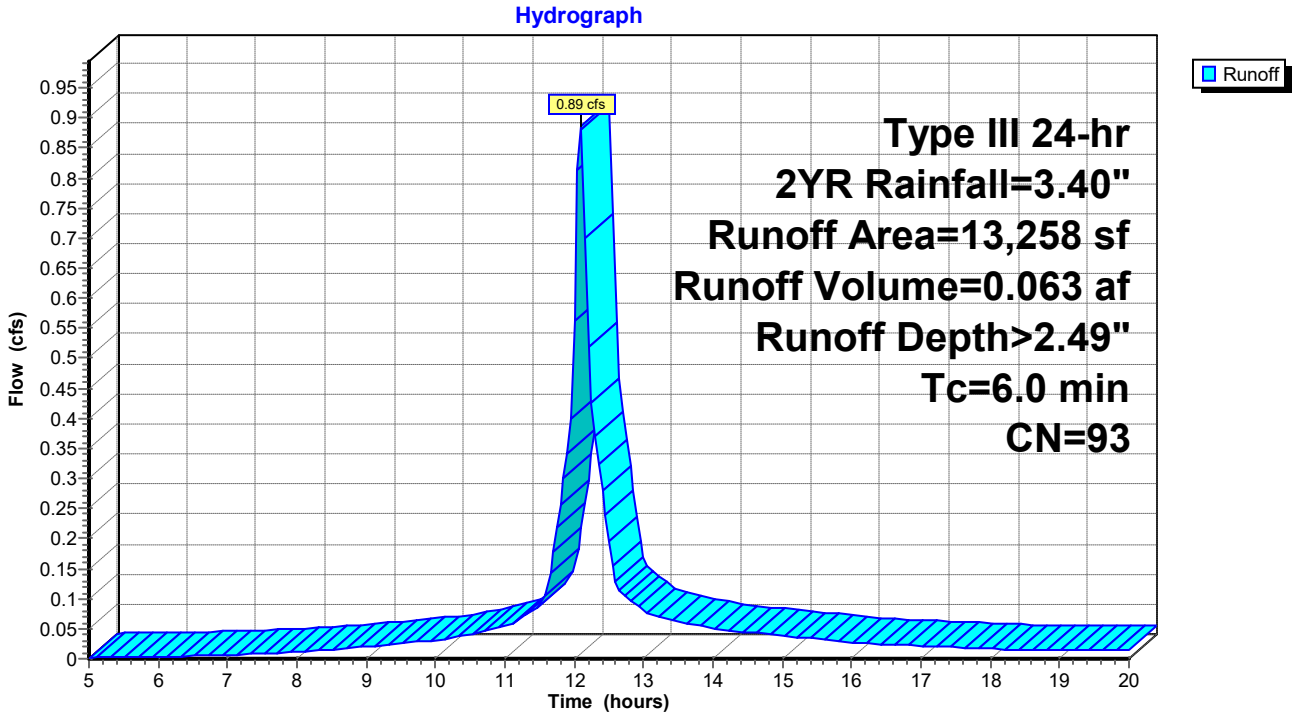
Runoff = 0.89 cfs @ 12.09 hrs, Volume= 0.063 af, Depth> 2.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2YR Rainfall=3.40"

Area (sf)	CN	Description
11,400	98	Paved parking, HSG B
1,858	61	>75% Grass cover, Good, HSG B
13,258	93	Weighted Average
1,858		14.01% Pervious Area
11,400		85.99% Impervious Area

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

Subcatchment 1P: 1P



Summary for Subcatchment 1S: DA 1

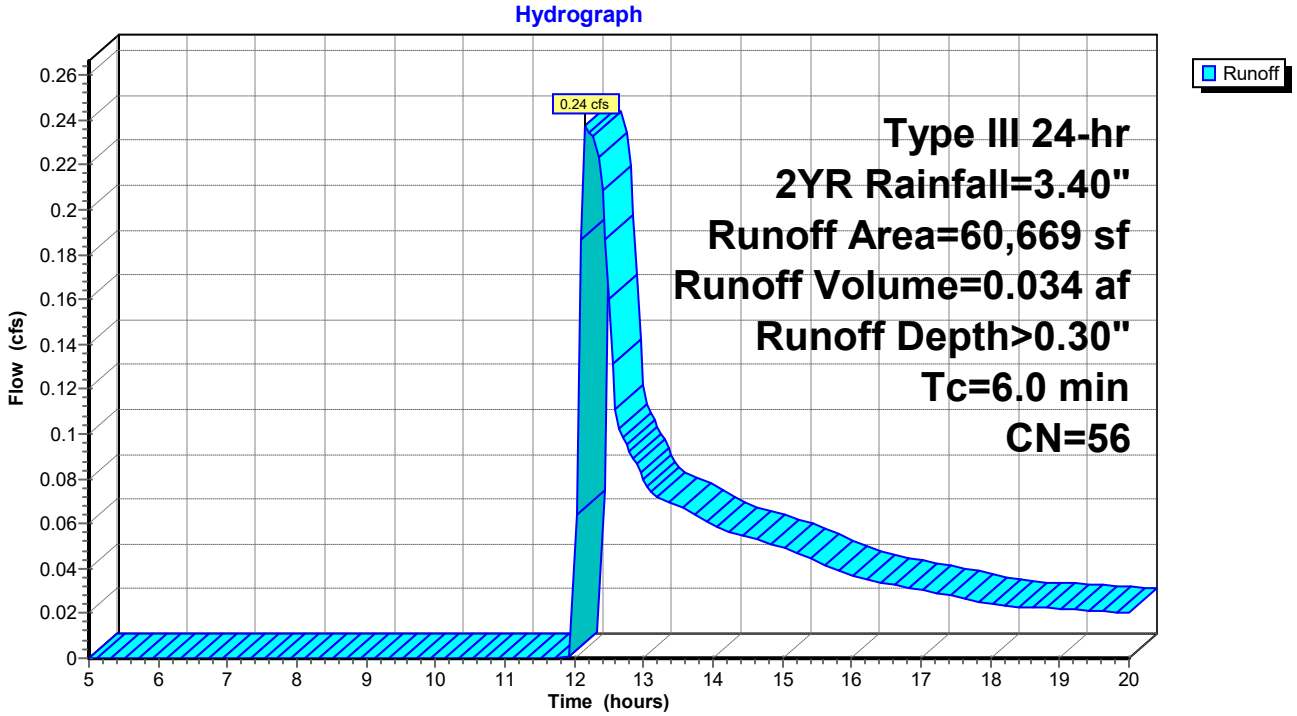
Runoff = 0.24 cfs @ 12.15 hrs, Volume= 0.034 af, Depth> 0.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2YR Rainfall=3.40"

Area (sf)	CN	Description
52,634	55	Woods, Good, HSG B
8,035	65	Woods/grass comb., Fair, HSG B
60,669	56	Weighted Average
60,669		100.00% Pervious Area

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

Subcatchment 1S: DA 1



Summary for Subcatchment 2P: 2P

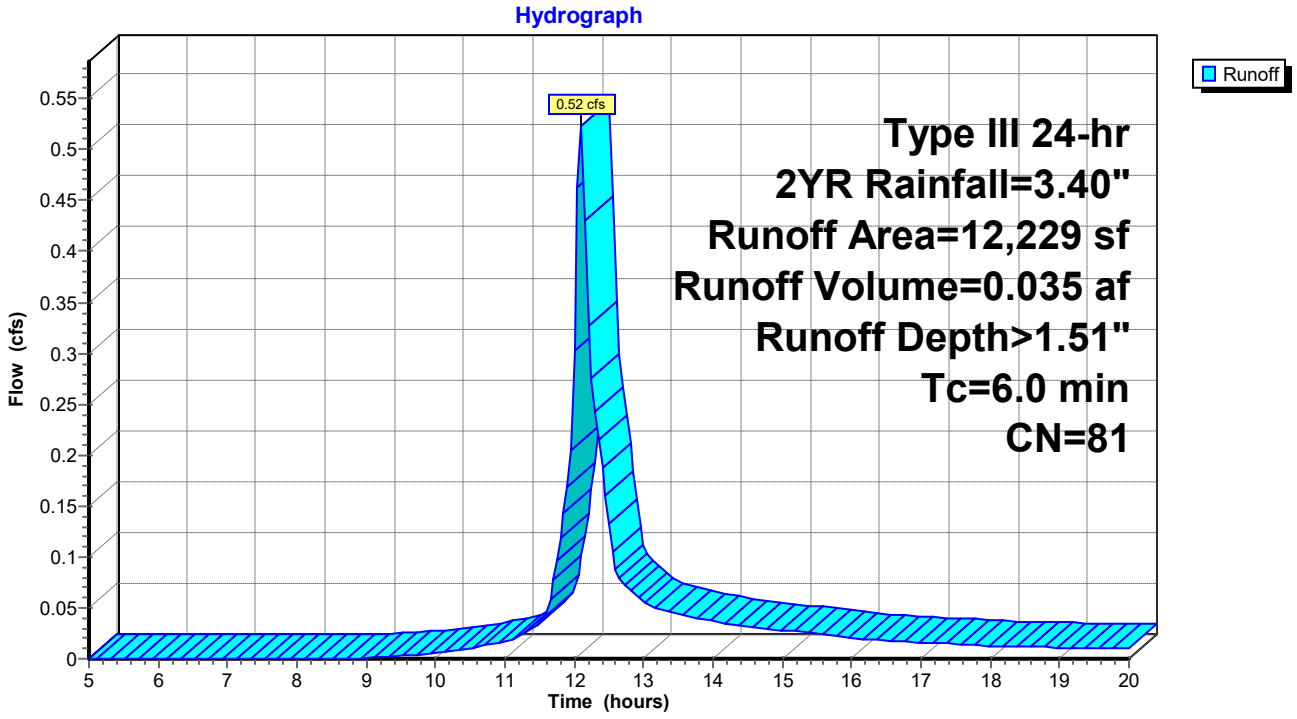
Runoff = 0.52 cfs @ 12.09 hrs, Volume= 0.035 af, Depth> 1.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2YR Rainfall=3.40"

Area (sf)	CN	Description
6,700	98	Paved parking, HSG B
5,529	61	>75% Grass cover, Good, HSG B
12,229	81	Weighted Average
5,529		45.21% Pervious Area
6,700		54.79% Impervious Area

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

Subcatchment 2P: 2P



Summary for Subcatchment 3S: 3P

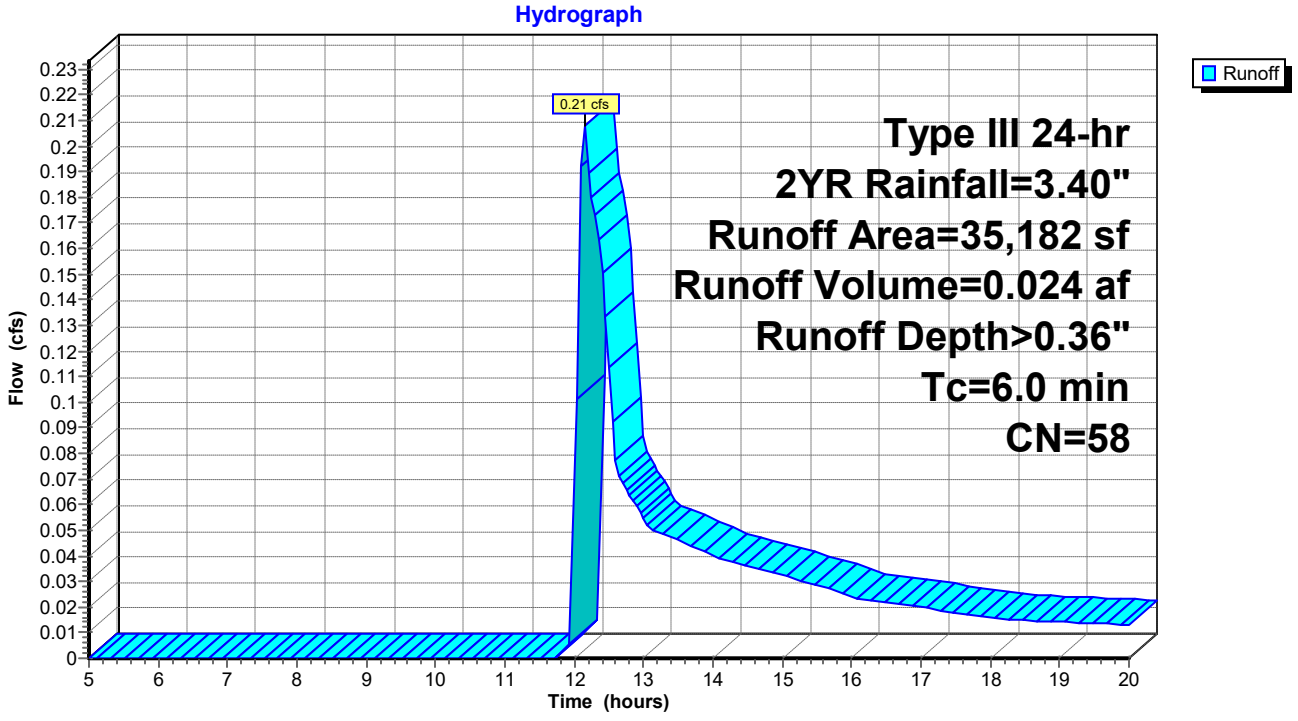
Runoff = 0.21 cfs @ 12.15 hrs, Volume= 0.024 af, Depth> 0.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2YR Rainfall=3.40"

Area (sf)	CN	Description
30,354	55	Woods, Good, HSG B
2,027	98	Paved parking, HSG B
2,801	61	>75% Grass cover, Good, HSG B
35,182	58	Weighted Average
33,155		94.24% Pervious Area
2,027		5.76% Impervious Area

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

Subcatchment 3S: 3P

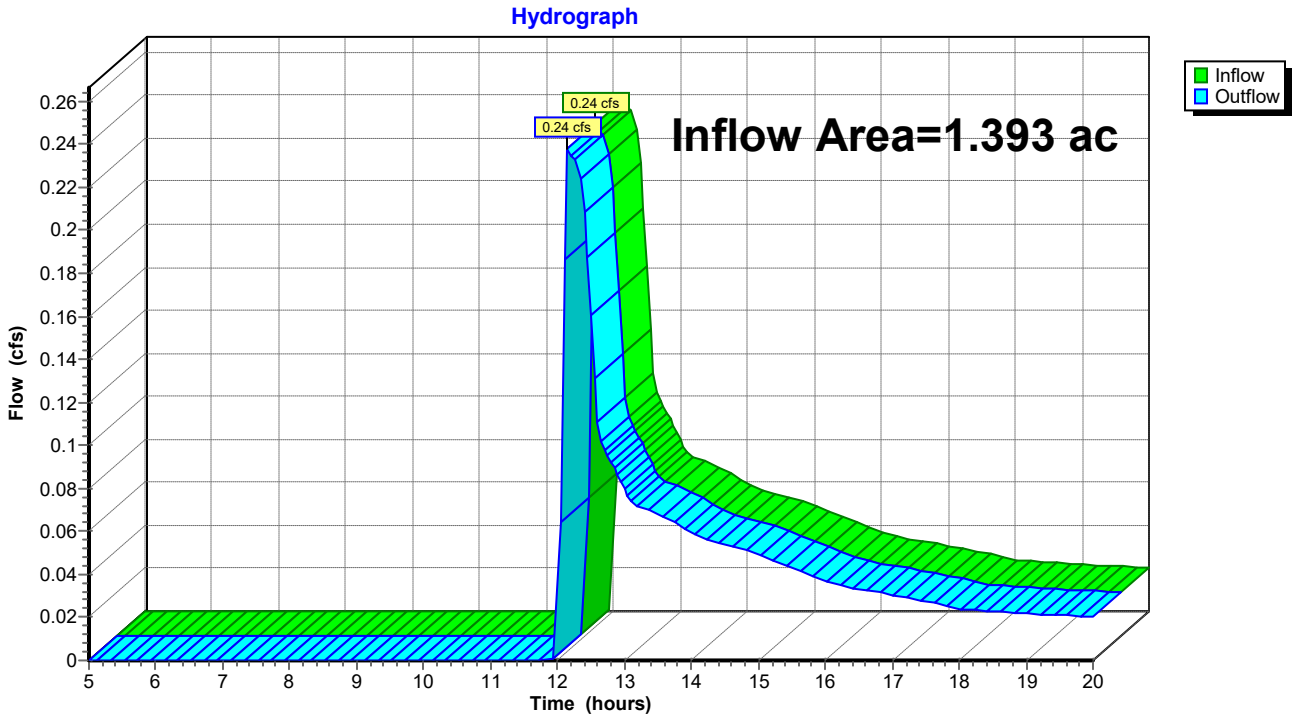


Summary for Reach IP-E1: Wetlands

Inflow Area = 1.393 ac, 0.00% Impervious, Inflow Depth > 0.30" for 2YR event
Inflow = 0.24 cfs @ 12.15 hrs, Volume= 0.034 af
Outflow = 0.24 cfs @ 12.15 hrs, Volume= 0.034 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach IP-E1: Wetlands

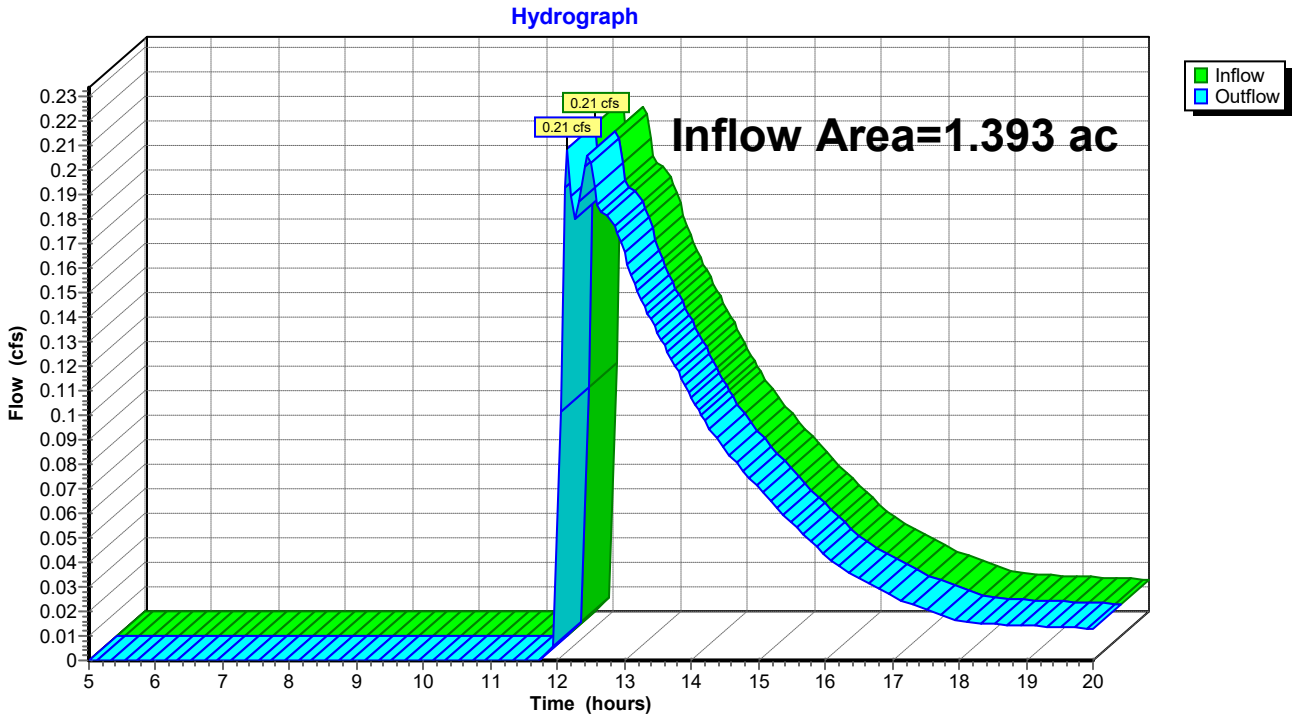


Summary for Reach IP-P1: Wetlands

Inflow Area = 1.393 ac, 33.18% Impervious, Inflow Depth > 0.38" for 2YR event
Inflow = 0.21 cfs @ 12.15 hrs, Volume= 0.045 af
Outflow = 0.21 cfs @ 12.15 hrs, Volume= 0.045 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach IP-P1: Wetlands



Summary for Pond PND 1: PND 1

Inflow Area = 0.585 ac, 71.02% Impervious, Inflow Depth > 2.02" for 2YR event
Inflow = 1.41 cfs @ 12.09 hrs, Volume= 0.099 af
Outflow = 0.16 cfs @ 12.81 hrs, Volume= 0.064 af, Atten= 88%, Lag= 43.3 min
Discarded = 0.05 cfs @ 10.75 hrs, Volume= 0.044 af
Primary = 0.12 cfs @ 12.81 hrs, Volume= 0.020 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 783.14' @ 12.81 hrs Surf.Area= 2,070 sf Storage= 2,069 cf

Plug-Flow detention time= 155.6 min calculated for 0.064 af (65% of inflow)
Center-of-Mass det. time= 84.0 min (858.3 - 774.4)

Volume	Invert	Avail.Storage	Storage Description
#1	782.00'	1,602 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 7,245 cf Overall - 3,241 cf Embedded = 4,004 cf x 40.0% Voids
#2	782.00'	3,241 cf	**Cultec R-330XLHD** x 60 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 10 rows
		4,843 cf	Total Available Storage

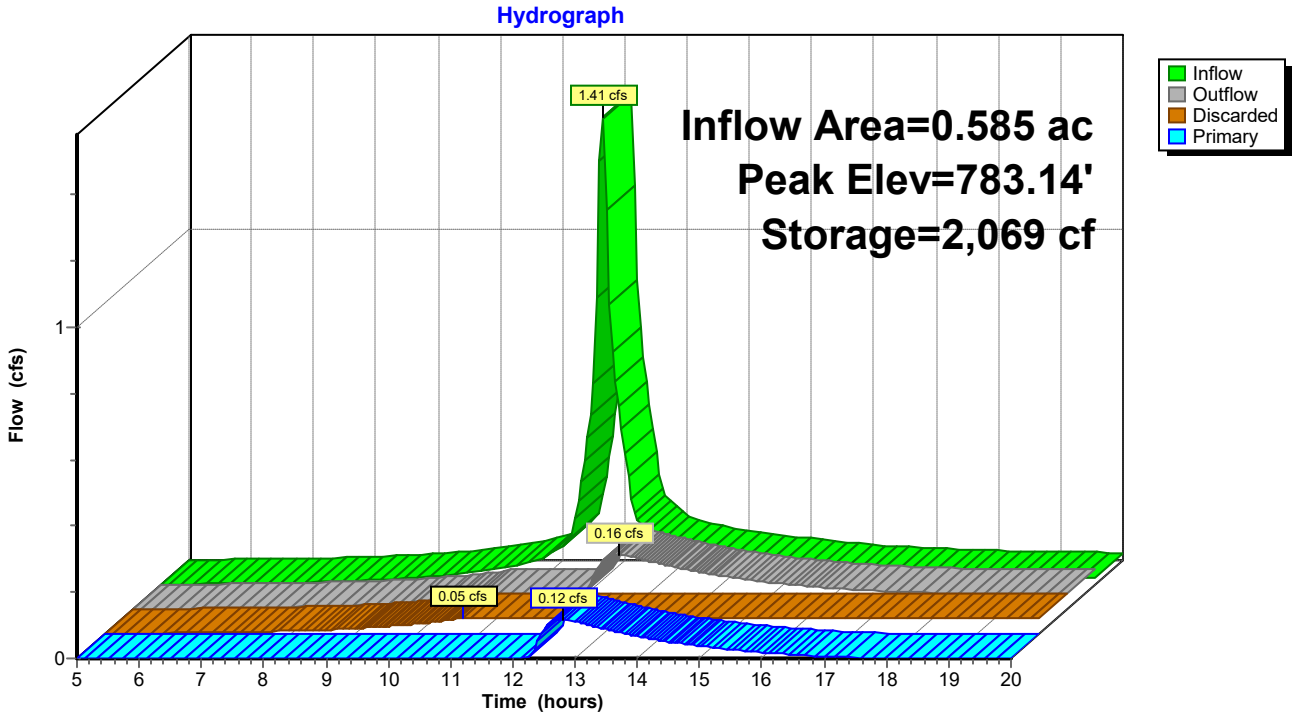
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
782.00	2,070	0	0
785.50	2,070	7,245	7,245

Device	Routing	Invert	Outlet Devices
#1	Discarded	782.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	782.90'	**4.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	783.12'	**6.0" Vert. Orifice/Grate** C= 0.600
#4	Primary	784.00'	**6.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.05 cfs @ 10.75 hrs HW=782.04' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.11 cfs @ 12.81 hrs HW=783.14' (Free Discharge)
├**2=Orifice/Grate** (Orifice Controls 0.11 cfs @ 1.67 fps)
├**3=Orifice/Grate** (Orifice Controls 0.00 cfs @ 0.50 fps)
└**4=Orifice/Grate** (Controls 0.00 cfs)

Pond PND 1: PND 1



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1P: 1P Runoff Area=13,258 sf 85.99% Impervious Runoff Depth>3.87"
Tc=6.0 min CN=93 Runoff=1.35 cfs 0.098 af

Subcatchment 1S: DA 1 Runoff Area=60,669 sf 0.00% Impervious Runoff Depth>0.88"
Tc=6.0 min CN=56 Runoff=1.30 cfs 0.103 af

Subcatchment 2P: 2P Runoff Area=12,229 sf 54.79% Impervious Runoff Depth>2.71"
Tc=6.0 min CN=81 Runoff=0.93 cfs 0.063 af

Subcatchment 3S: 3P Runoff Area=35,182 sf 5.76% Impervious Runoff Depth>1.00"
Tc=6.0 min CN=58 Runoff=0.89 cfs 0.067 af

Reach IP-E1: Wetlands Inflow=1.30 cfs 0.103 af
Outflow=1.30 cfs 0.103 af

Reach IP-P1: Wetlands Inflow=1.23 cfs 0.142 af
Outflow=1.23 cfs 0.142 af

Pond PND 1: PND 1 Peak Elev=783.58' Storage=2,815 cf Inflow=2.28 cfs 0.162 af
Discarded=0.05 cfs 0.049 af Primary=0.74 cfs 0.074 af Outflow=0.79 cfs 0.123 af

Total Runoff Area = 2.786 ac Runoff Volume = 0.331 af Average Runoff Depth = 1.43"
83.41% Pervious = 2.323 ac 16.59% Impervious = 0.462 ac

Summary for Subcatchment 1P: 1P

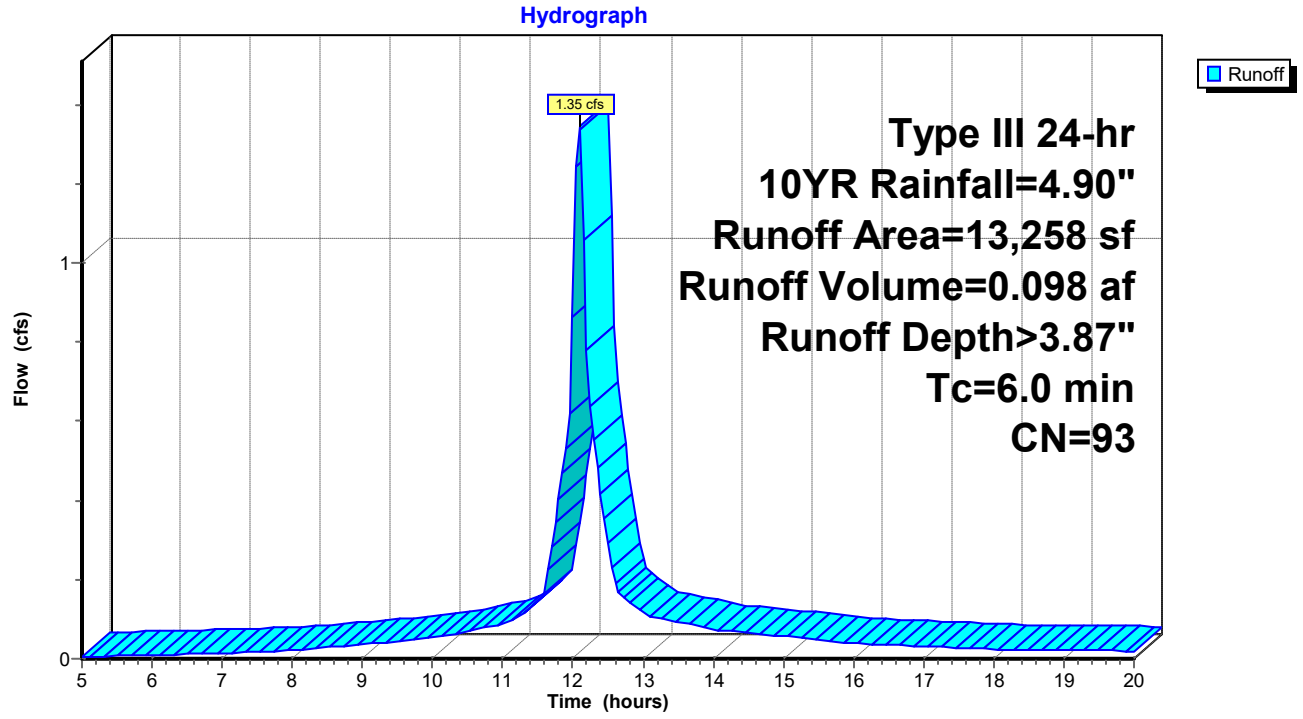
Runoff = 1.35 cfs @ 12.09 hrs, Volume= 0.098 af, Depth> 3.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10YR Rainfall=4.90"

Area (sf)	CN	Description
11,400	98	Paved parking, HSG B
1,858	61	>75% Grass cover, Good, HSG B
13,258	93	Weighted Average
1,858		14.01% Pervious Area
11,400		85.99% Impervious Area

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

Subcatchment 1P: 1P



Summary for Subcatchment 1S: DA 1

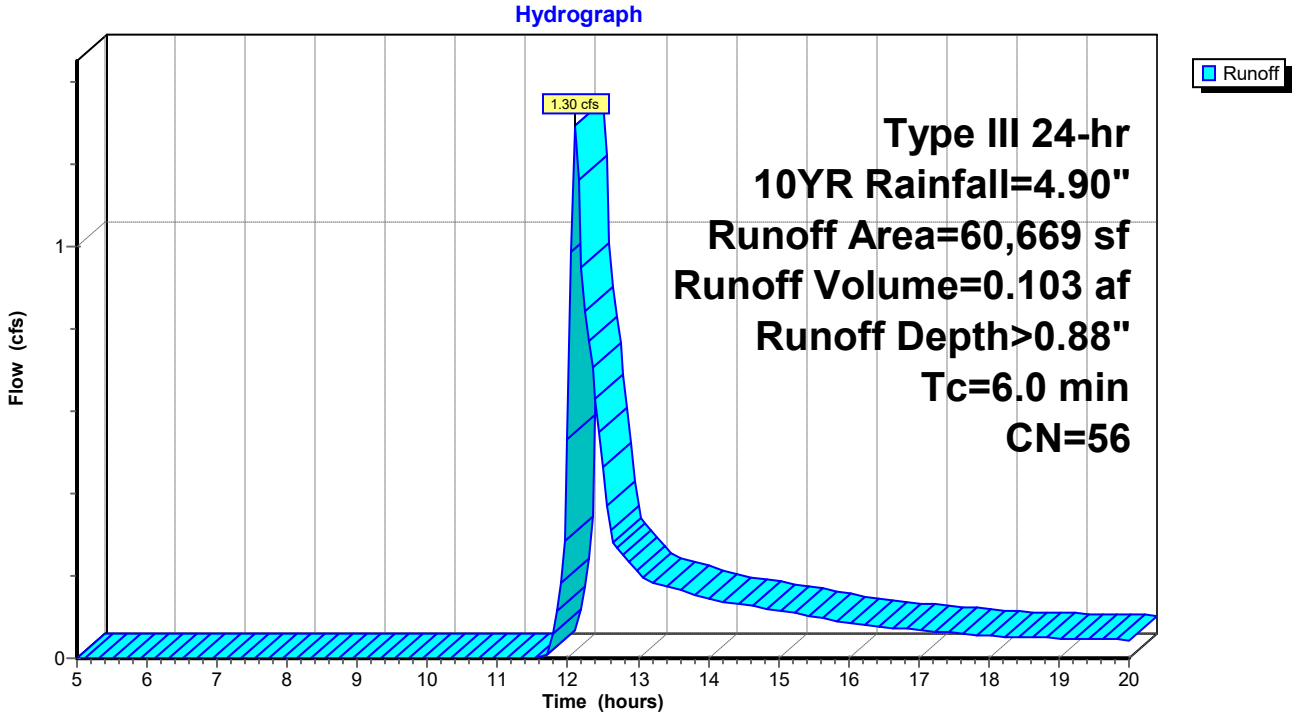
Runoff = 1.30 cfs @ 12.11 hrs, Volume= 0.103 af, Depth> 0.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10YR Rainfall=4.90"

Area (sf)	CN	Description
52,634	55	Woods, Good, HSG B
8,035	65	Woods/grass comb., Fair, HSG B
60,669	56	Weighted Average
60,669		100.00% Pervious Area

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

Subcatchment 1S: DA 1



Summary for Subcatchment 2P: 2P

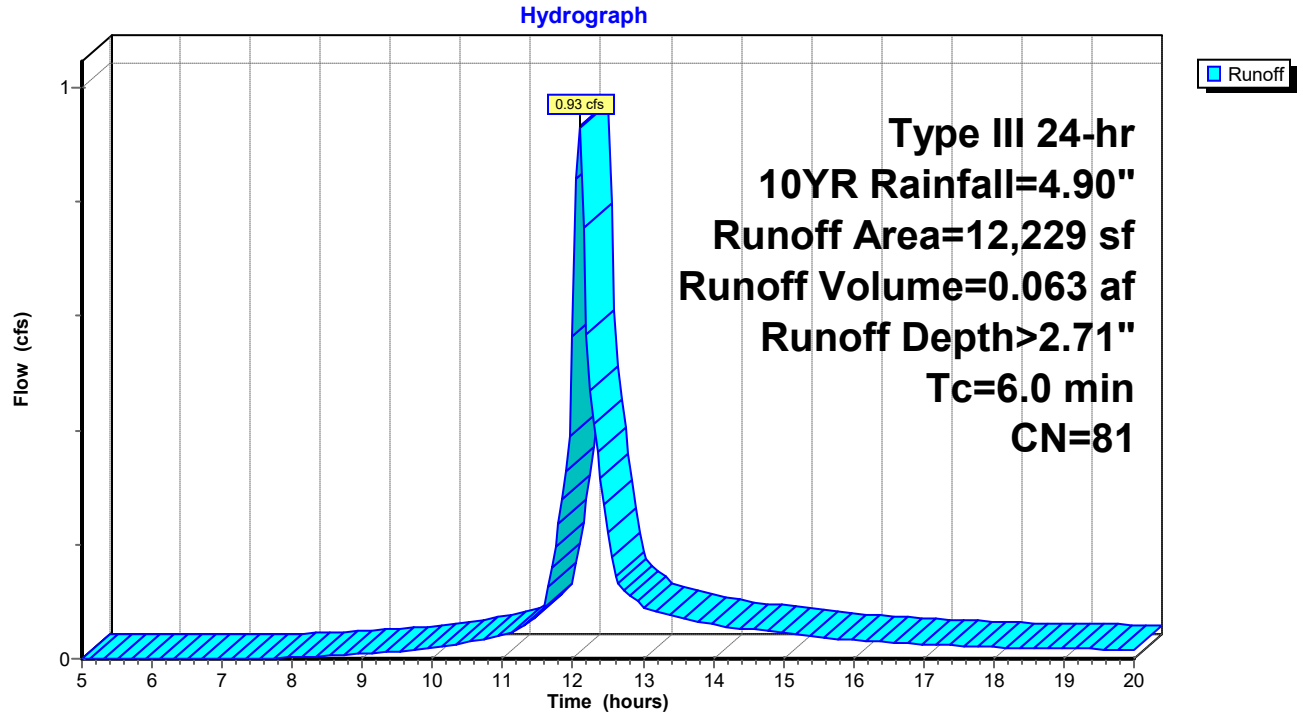
Runoff = 0.93 cfs @ 12.09 hrs, Volume= 0.063 af, Depth> 2.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10YR Rainfall=4.90"

Area (sf)	CN	Description
6,700	98	Paved parking, HSG B
5,529	61	>75% Grass cover, Good, HSG B
12,229	81	Weighted Average
5,529		45.21% Pervious Area
6,700		54.79% Impervious Area

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

Subcatchment 2P: 2P



Summary for Subcatchment 3S: 3P

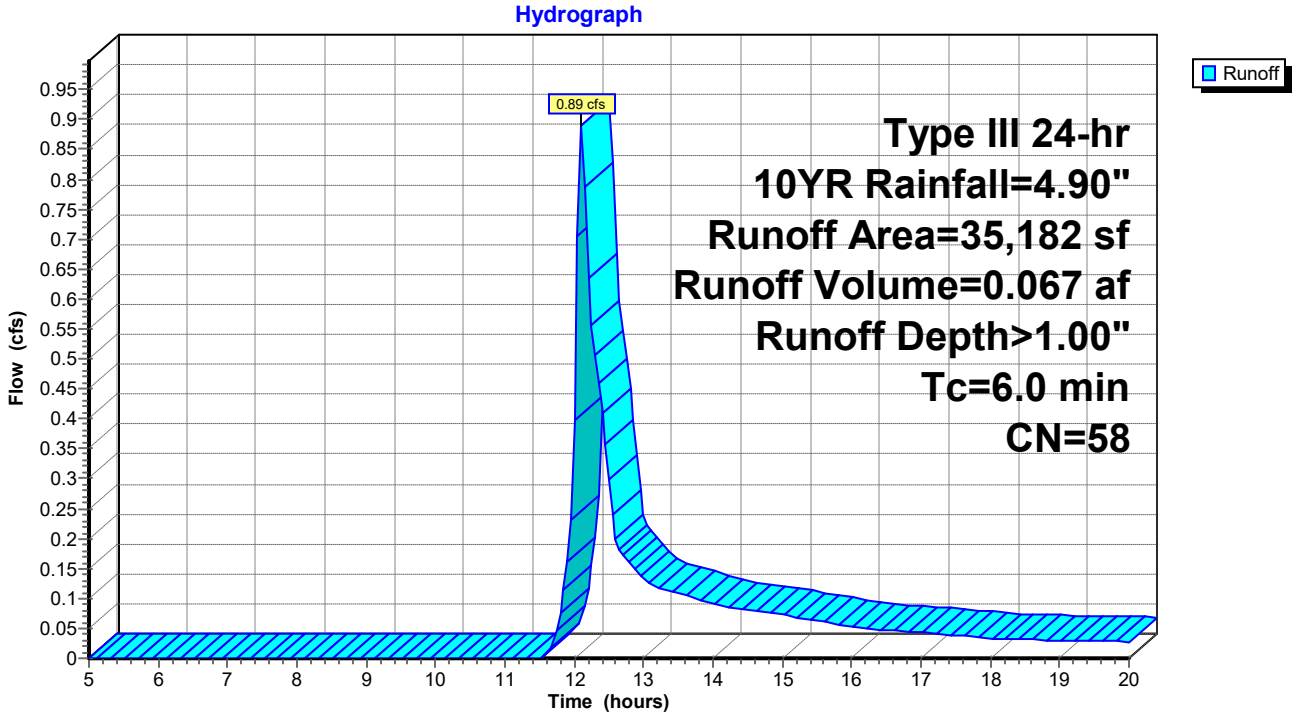
Runoff = 0.89 cfs @ 12.11 hrs, Volume= 0.067 af, Depth> 1.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10YR Rainfall=4.90"

Area (sf)	CN	Description
30,354	55	Woods, Good, HSG B
2,027	98	Paved parking, HSG B
2,801	61	>75% Grass cover, Good, HSG B
35,182	58	Weighted Average
33,155		94.24% Pervious Area
2,027		5.76% Impervious Area

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

Subcatchment 3S: 3P

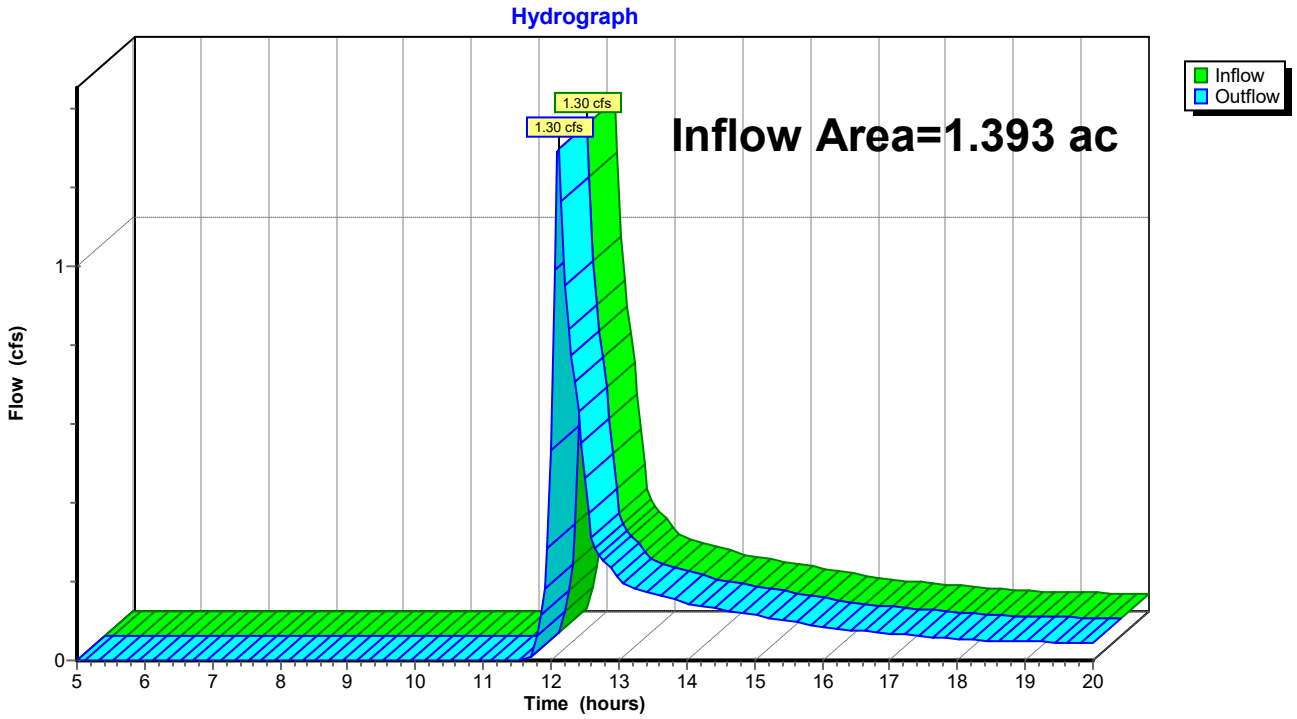


Summary for Reach IP-E1: Wetlands

Inflow Area = 1.393 ac, 0.00% Impervious, Inflow Depth > 0.88" for 10YR event
Inflow = 1.30 cfs @ 12.11 hrs, Volume= 0.103 af
Outflow = 1.30 cfs @ 12.11 hrs, Volume= 0.103 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach IP-E1: Wetlands

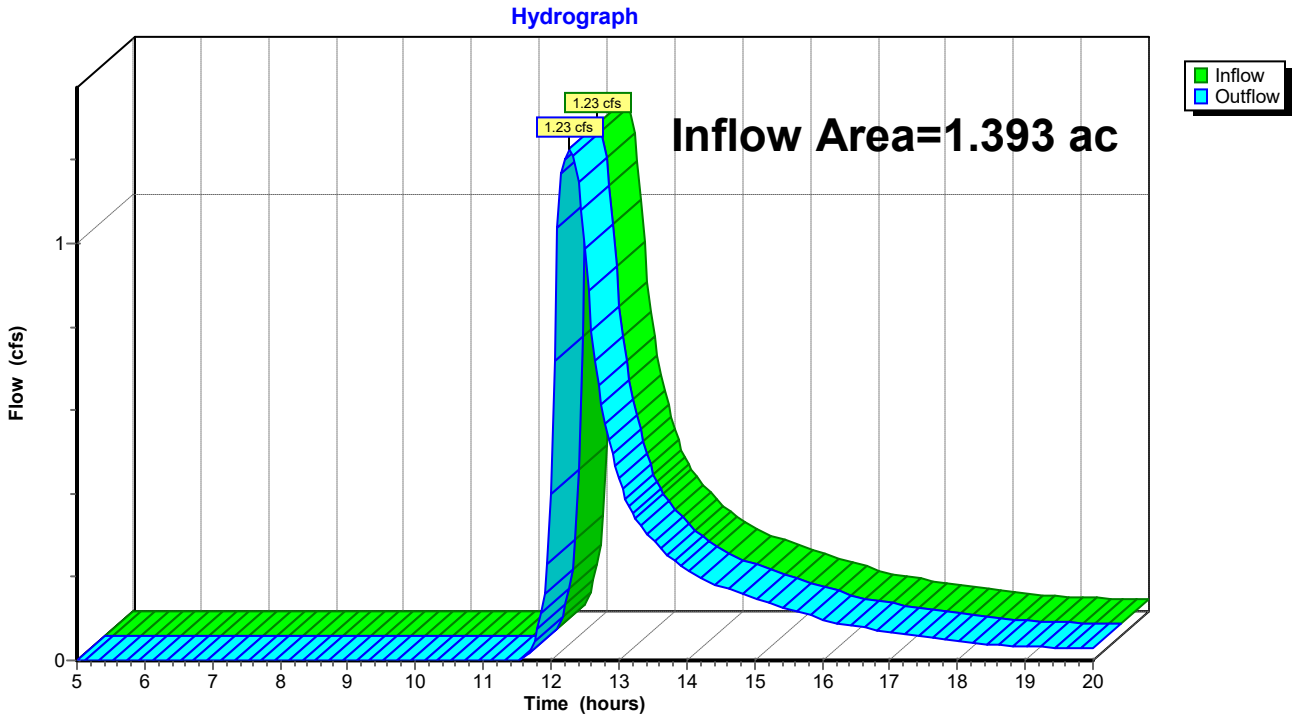


Summary for Reach IP-P1: Wetlands

Inflow Area = 1.393 ac, 33.18% Impervious, Inflow Depth > 1.22" for 10YR event
Inflow = 1.23 cfs @ 12.27 hrs, Volume= 0.142 af
Outflow = 1.23 cfs @ 12.27 hrs, Volume= 0.142 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach IP-P1: Wetlands



Summary for Pond PND 1: PND 1

Inflow Area = 0.585 ac, 71.02% Impervious, Inflow Depth > 3.31" for 10YR event
Inflow = 2.28 cfs @ 12.09 hrs, Volume= 0.162 af
Outflow = 0.79 cfs @ 12.37 hrs, Volume= 0.123 af, Atten= 65%, Lag= 17.1 min
Discarded = 0.05 cfs @ 9.55 hrs, Volume= 0.049 af
Primary = 0.74 cfs @ 12.37 hrs, Volume= 0.074 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 783.58' @ 12.37 hrs Surf.Area= 2,070 sf Storage= 2,815 cf

Plug-Flow detention time= 110.1 min calculated for 0.123 af (76% of inflow)
Center-of-Mass det. time= 51.7 min (816.7 - 765.1)

Volume	Invert	Avail.Storage	Storage Description
#1	782.00'	1,602 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 7,245 cf Overall - 3,241 cf Embedded = 4,004 cf x 40.0% Voids
#2	782.00'	3,241 cf	**Cultec R-330XLHD** x 60 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 10 rows
		4,843 cf	Total Available Storage

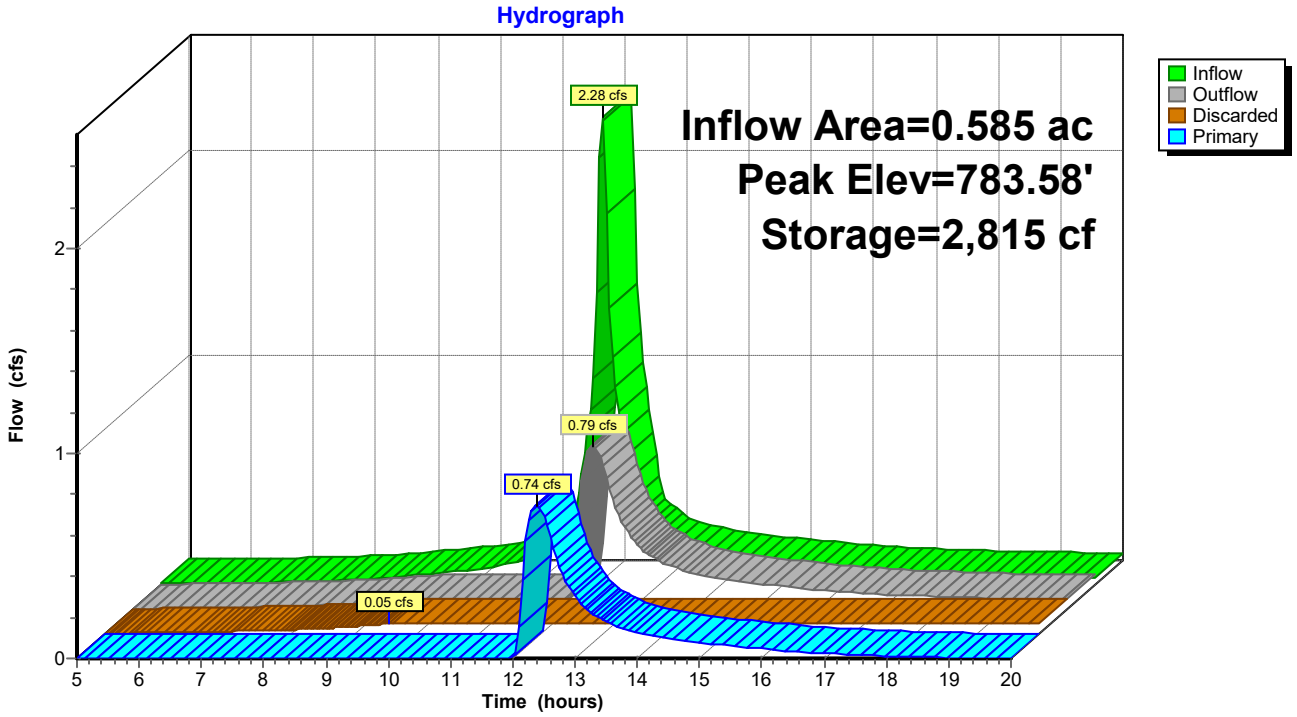
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
782.00	2,070	0	0
785.50	2,070	7,245	7,245

Device	Routing	Invert	Outlet Devices
#1	Discarded	782.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	782.90'	**4.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	783.12'	**6.0" Vert. Orifice/Grate** C= 0.600
#4	Primary	784.00'	**6.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.05 cfs @ 9.55 hrs HW=782.04' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.74 cfs @ 12.37 hrs HW=783.58' (Free Discharge)
├**2=Orifice/Grate** (Orifice Controls 0.30 cfs @ 3.46 fps)
├**3=Orifice/Grate** (Orifice Controls 0.44 cfs @ 2.31 fps)
└**4=Orifice/Grate** (Controls 0.00 cfs)

Pond PND 1: PND 1



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1P: 1P Runoff Area=13,258 sf 85.99% Impervious Runoff Depth>4.33"
Tc=6.0 min CN=93 Runoff=1.50 cfs 0.110 af

Subcatchment 1S: DA 1 Runoff Area=60,669 sf 0.00% Impervious Runoff Depth>1.13"
Tc=6.0 min CN=56 Runoff=1.74 cfs 0.131 af

Subcatchment 2P: 2P Runoff Area=12,229 sf 54.79% Impervious Runoff Depth>3.13"
Tc=6.0 min CN=81 Runoff=1.07 cfs 0.073 af

Subcatchment 3S: 3P Runoff Area=35,182 sf 5.76% Impervious Runoff Depth>1.26"
Tc=6.0 min CN=58 Runoff=1.17 cfs 0.085 af

Reach IP-E1: Wetlands Inflow=1.74 cfs 0.131 af
Outflow=1.74 cfs 0.131 af

Reach IP-P1: Wetlands Inflow=1.73 cfs 0.179 af
Outflow=1.73 cfs 0.179 af

Pond PND 1: PND 1 Peak Elev=783.75' Storage=3,078 cf Inflow=2.57 cfs 0.183 af
Discarded=0.05 cfs 0.050 af Primary=0.93 cfs 0.094 af Outflow=0.98 cfs 0.144 af

Total Runoff Area = 2.786 ac Runoff Volume = 0.399 af Average Runoff Depth = 1.72"
83.41% Pervious = 2.323 ac 16.59% Impervious = 0.462 ac

Summary for Subcatchment 1P: 1P

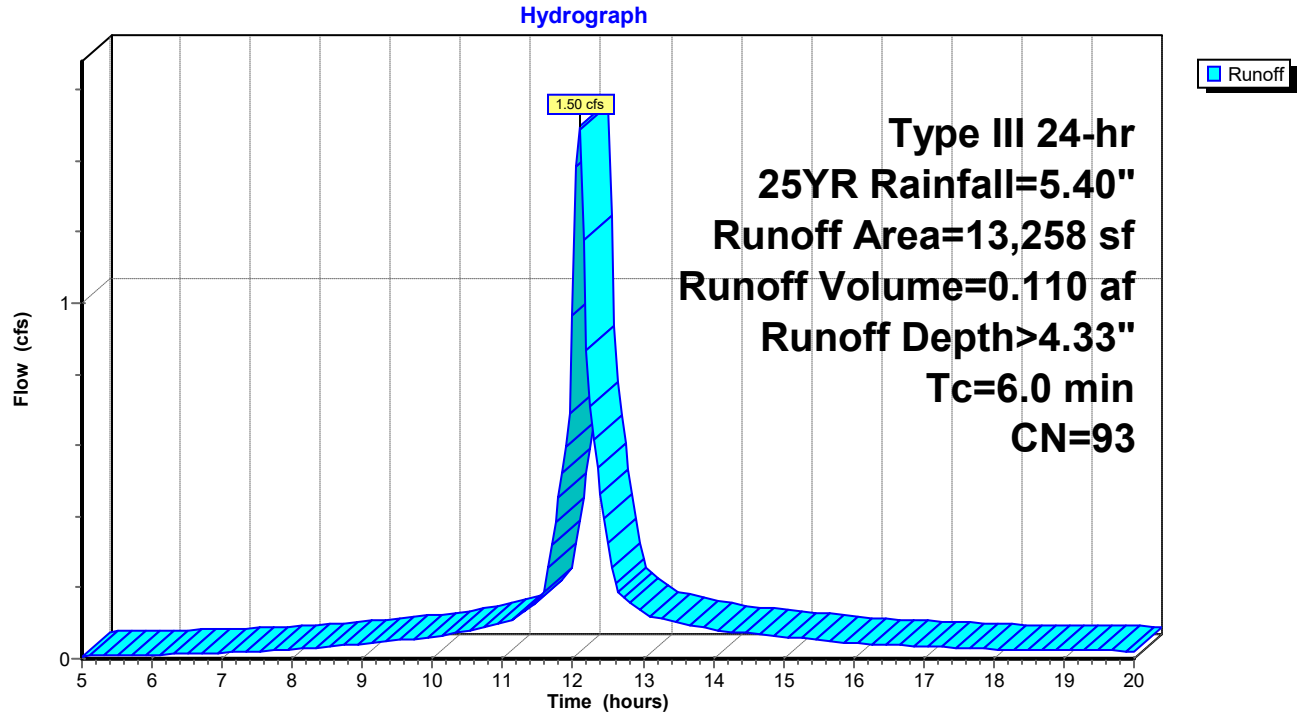
Runoff = 1.50 cfs @ 12.09 hrs, Volume= 0.110 af, Depth> 4.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25YR Rainfall=5.40"

Area (sf)	CN	Description
11,400	98	Paved parking, HSG B
1,858	61	>75% Grass cover, Good, HSG B
13,258	93	Weighted Average
1,858		14.01% Pervious Area
11,400		85.99% Impervious Area

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

Subcatchment 1P: 1P



Summary for Subcatchment 1S: DA 1

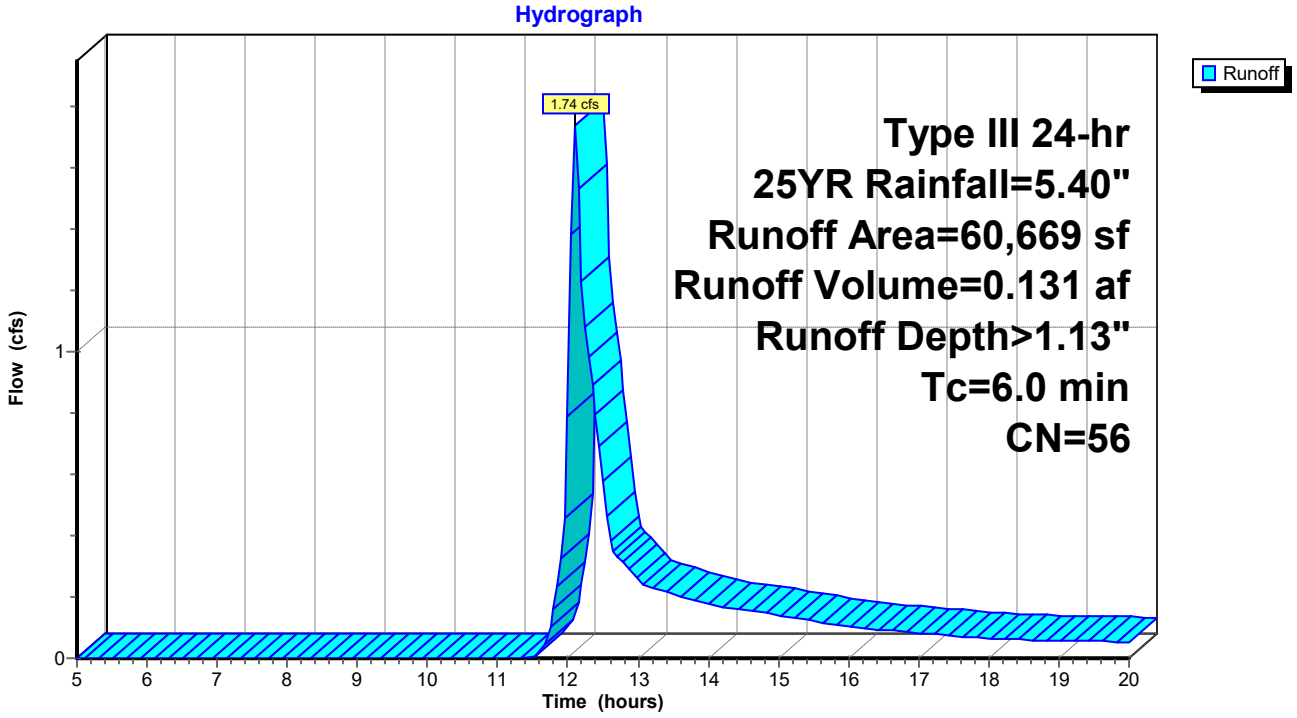
Runoff = 1.74 cfs @ 12.11 hrs, Volume= 0.131 af, Depth> 1.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25YR Rainfall=5.40"

Area (sf)	CN	Description
52,634	55	Woods, Good, HSG B
8,035	65	Woods/grass comb., Fair, HSG B
60,669	56	Weighted Average
60,669		100.00% Pervious Area

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

Subcatchment 1S: DA 1



Summary for Subcatchment 2P: 2P

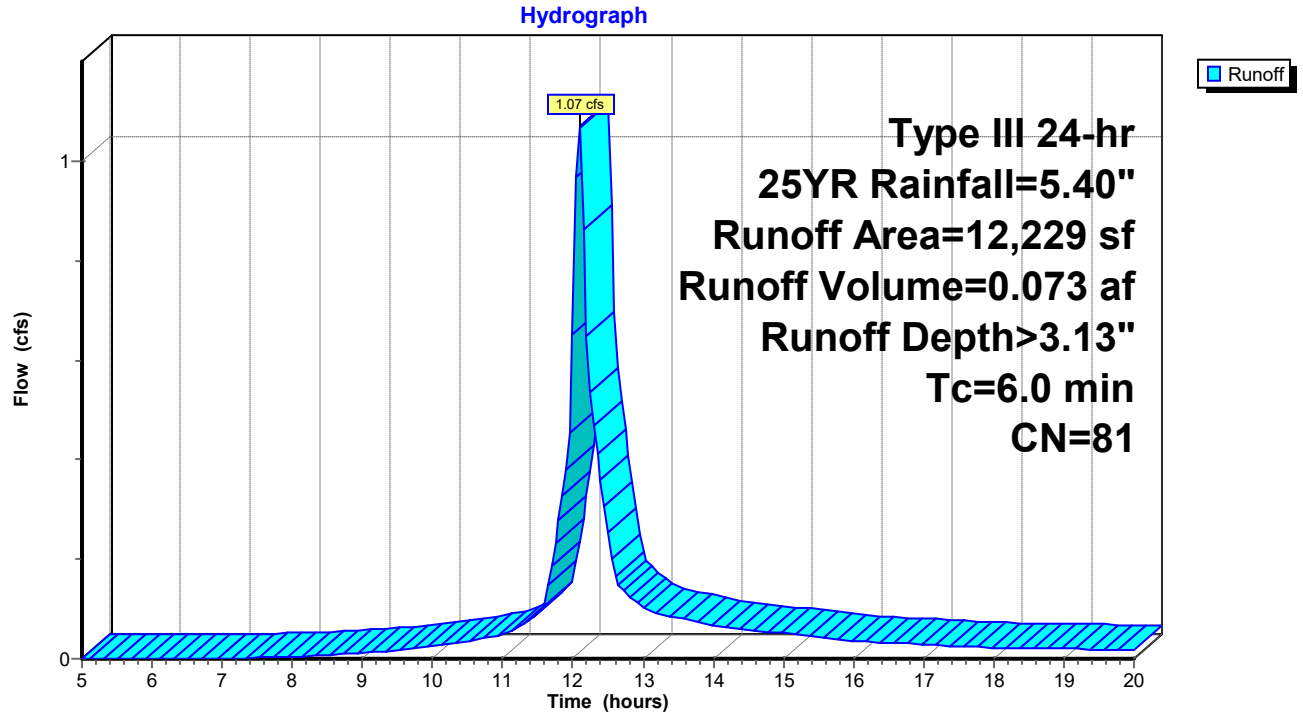
Runoff = 1.07 cfs @ 12.09 hrs, Volume= 0.073 af, Depth> 3.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25YR Rainfall=5.40"

Area (sf)	CN	Description
6,700	98	Paved parking, HSG B
5,529	61	>75% Grass cover, Good, HSG B
12,229	81	Weighted Average
5,529		45.21% Pervious Area
6,700		54.79% Impervious Area

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

Subcatchment 2P: 2P



Summary for Subcatchment 3S: 3P

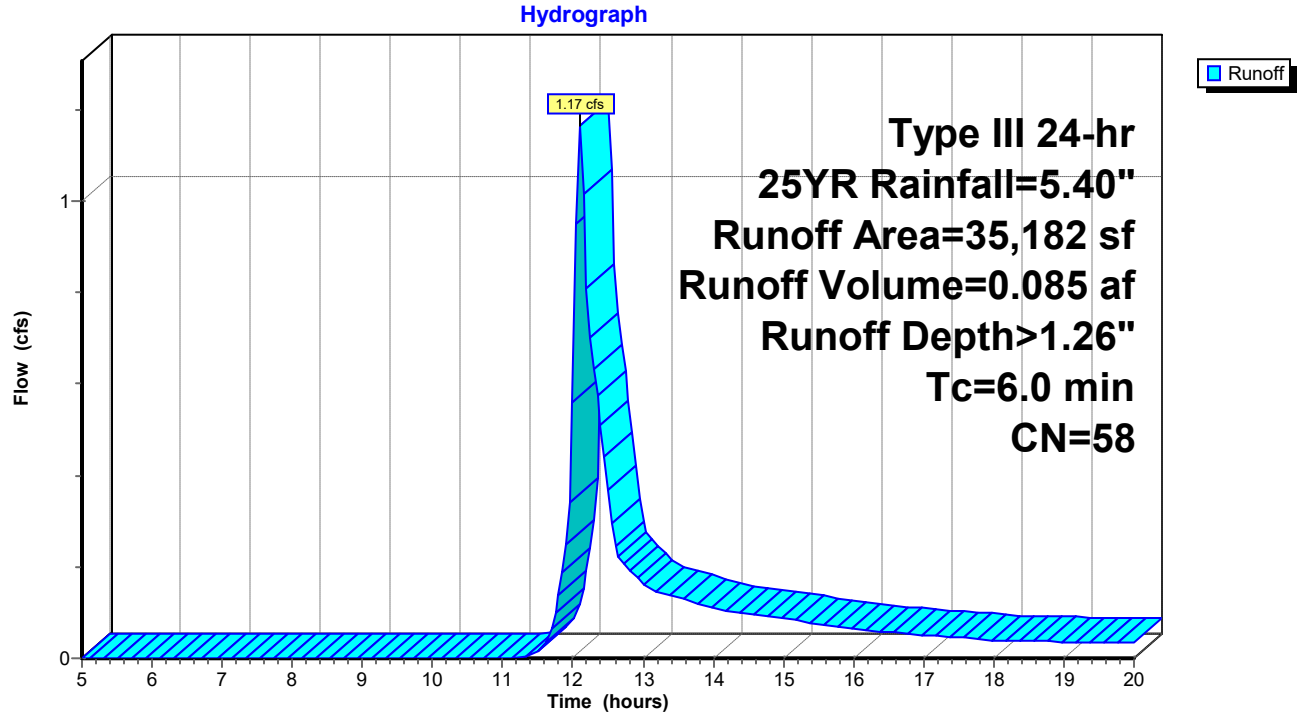
Runoff = 1.17 cfs @ 12.10 hrs, Volume= 0.085 af, Depth> 1.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25YR Rainfall=5.40"

Area (sf)	CN	Description
30,354	55	Woods, Good, HSG B
2,027	98	Paved parking, HSG B
2,801	61	>75% Grass cover, Good, HSG B
35,182	58	Weighted Average
33,155		94.24% Pervious Area
2,027		5.76% Impervious Area

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

Subcatchment 3S: 3P

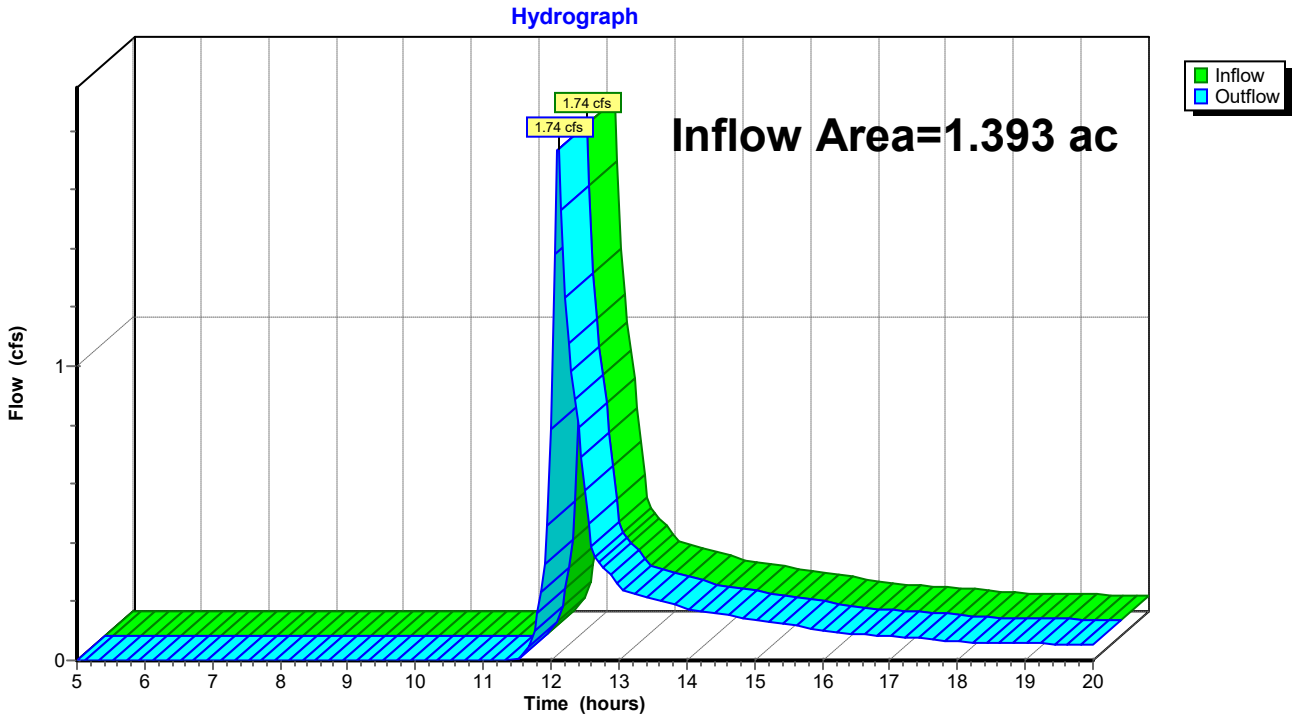


Summary for Reach IP-E1: Wetlands

Inflow Area = 1.393 ac, 0.00% Impervious, Inflow Depth > 1.13" for 25YR event
Inflow = 1.74 cfs @ 12.11 hrs, Volume= 0.131 af
Outflow = 1.74 cfs @ 12.11 hrs, Volume= 0.131 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach IP-E1: Wetlands

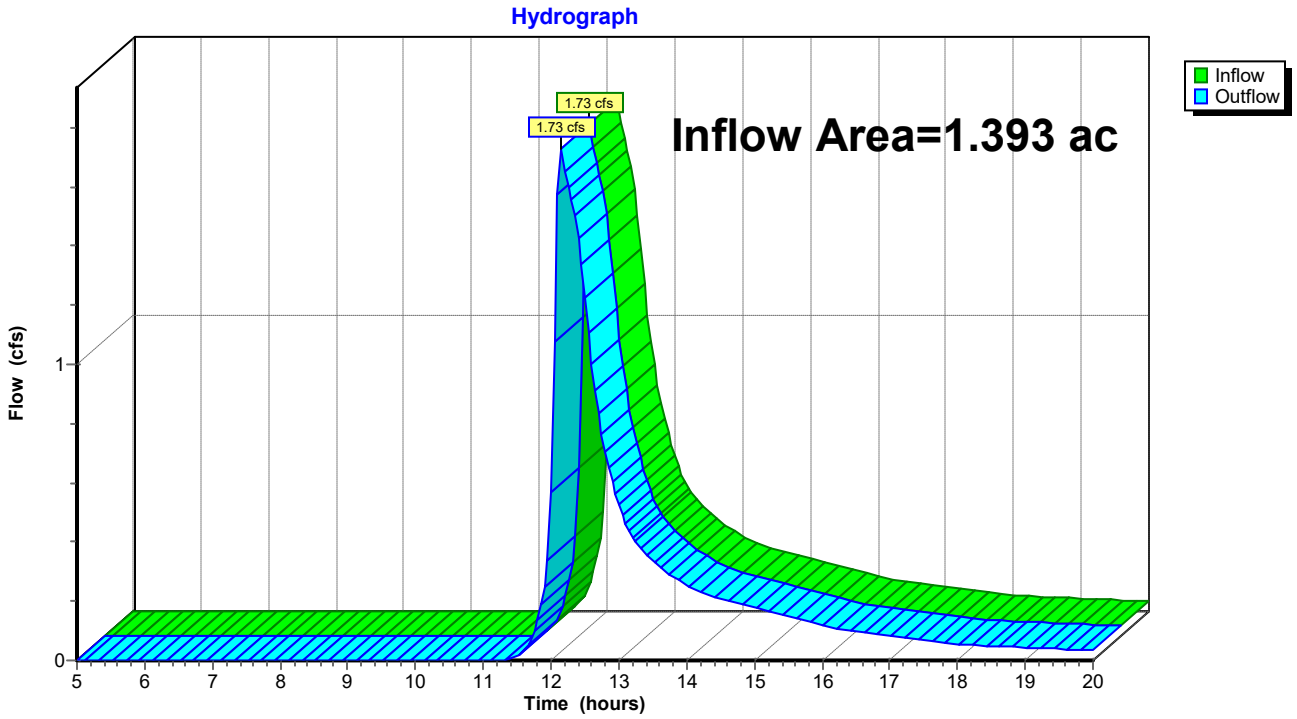


Summary for Reach IP-P1: Wetlands

Inflow Area = 1.393 ac, 33.18% Impervious, Inflow Depth > 1.54" for 25YR event
Inflow = 1.73 cfs @ 12.16 hrs, Volume= 0.179 af
Outflow = 1.73 cfs @ 12.16 hrs, Volume= 0.179 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach IP-P1: Wetlands



Summary for Pond PND 1: PND 1

Inflow Area = 0.585 ac, 71.02% Impervious, Inflow Depth > 3.76" for 25YR event
Inflow = 2.57 cfs @ 12.09 hrs, Volume= 0.183 af
Outflow = 0.98 cfs @ 12.34 hrs, Volume= 0.144 af, Atten= 62%, Lag= 15.0 min
Discarded = 0.05 cfs @ 9.20 hrs, Volume= 0.050 af
Primary = 0.93 cfs @ 12.34 hrs, Volume= 0.094 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 783.75' @ 12.34 hrs Surf.Area= 2,070 sf Storage= 3,078 cf

Plug-Flow detention time= 102.8 min calculated for 0.144 af (79% of inflow)
Center-of-Mass det. time= 47.9 min (810.7 - 762.8)

Volume	Invert	Avail.Storage	Storage Description
#1	782.00'	1,602 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 7,245 cf Overall - 3,241 cf Embedded = 4,004 cf x 40.0% Voids
#2	782.00'	3,241 cf	**Cultec R-330XLHD** x 60 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 10 rows
		4,843 cf	Total Available Storage

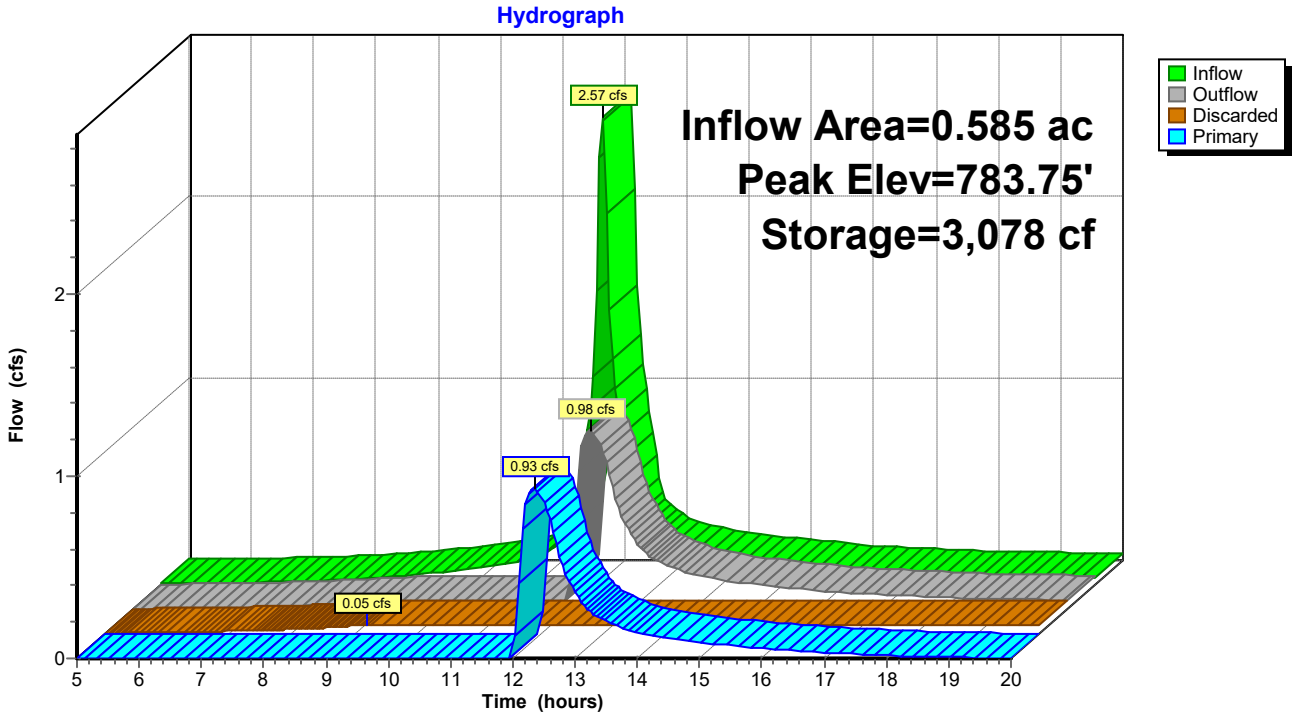
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
782.00	2,070	0	0
785.50	2,070	7,245	7,245

Device	Routing	Invert	Outlet Devices
#1	Discarded	782.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	782.90'	**4.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	783.12'	**6.0" Vert. Orifice/Grate** C= 0.600
#4	Primary	784.00'	**6.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.05 cfs @ 9.20 hrs HW=782.04' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.93 cfs @ 12.34 hrs HW=783.75' (Free Discharge)
├**2=Orifice/Grate** (Orifice Controls 0.35 cfs @ 3.98 fps)
├**3=Orifice/Grate** (Orifice Controls 0.58 cfs @ 2.97 fps)
└**4=Orifice/Grate** (Controls 0.00 cfs)

Pond PND 1: PND 1



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1P: 1P Runoff Area=13,258 sf 85.99% Impervious Runoff Depth>5.72"
Tc=6.0 min CN=93 Runoff=1.95 cfs 0.145 af

Subcatchment 1S: DA 1 Runoff Area=60,669 sf 0.00% Impervious Runoff Depth>1.96"
Tc=6.0 min CN=56 Runoff=3.25 cfs 0.228 af

Subcatchment 2P: 2P Runoff Area=12,229 sf 54.79% Impervious Runoff Depth>4.43"
Tc=6.0 min CN=81 Runoff=1.50 cfs 0.104 af

Subcatchment 3S: 3P Runoff Area=35,182 sf 5.76% Impervious Runoff Depth>2.14"
Tc=6.0 min CN=58 Runoff=2.09 cfs 0.144 af

Reach IP-E1: Wetlands Inflow=3.25 cfs 0.228 af
Outflow=3.25 cfs 0.228 af

Reach IP-P1: Wetlands Inflow=3.24 cfs 0.299 af
Outflow=3.24 cfs 0.299 af

Pond PND 1: PND 1 Peak Elev=784.32' Storage=3,847 cf Inflow=3.45 cfs 0.249 af
Discarded=0.05 cfs 0.054 af Primary=1.65 cfs 0.155 af Outflow=1.70 cfs 0.208 af

Total Runoff Area = 2.786 ac Runoff Volume = 0.620 af Average Runoff Depth = 2.67"
83.41% Pervious = 2.323 ac 16.59% Impervious = 0.462 ac

Summary for Subcatchment 1P: 1P

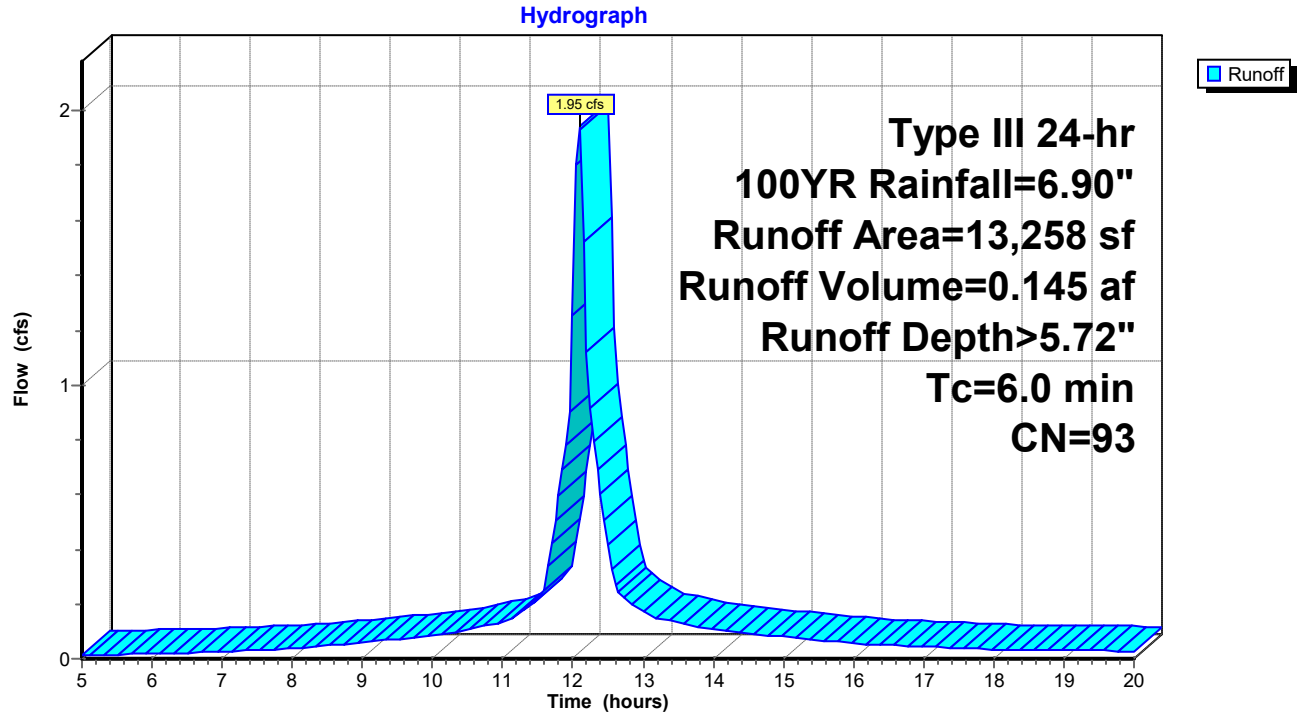
Runoff = 1.95 cfs @ 12.09 hrs, Volume= 0.145 af, Depth> 5.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100YR Rainfall=6.90"

Area (sf)	CN	Description
11,400	98	Paved parking, HSG B
1,858	61	>75% Grass cover, Good, HSG B
13,258	93	Weighted Average
1,858		14.01% Pervious Area
11,400		85.99% Impervious Area

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

Subcatchment 1P: 1P



Summary for Subcatchment 1S: DA 1

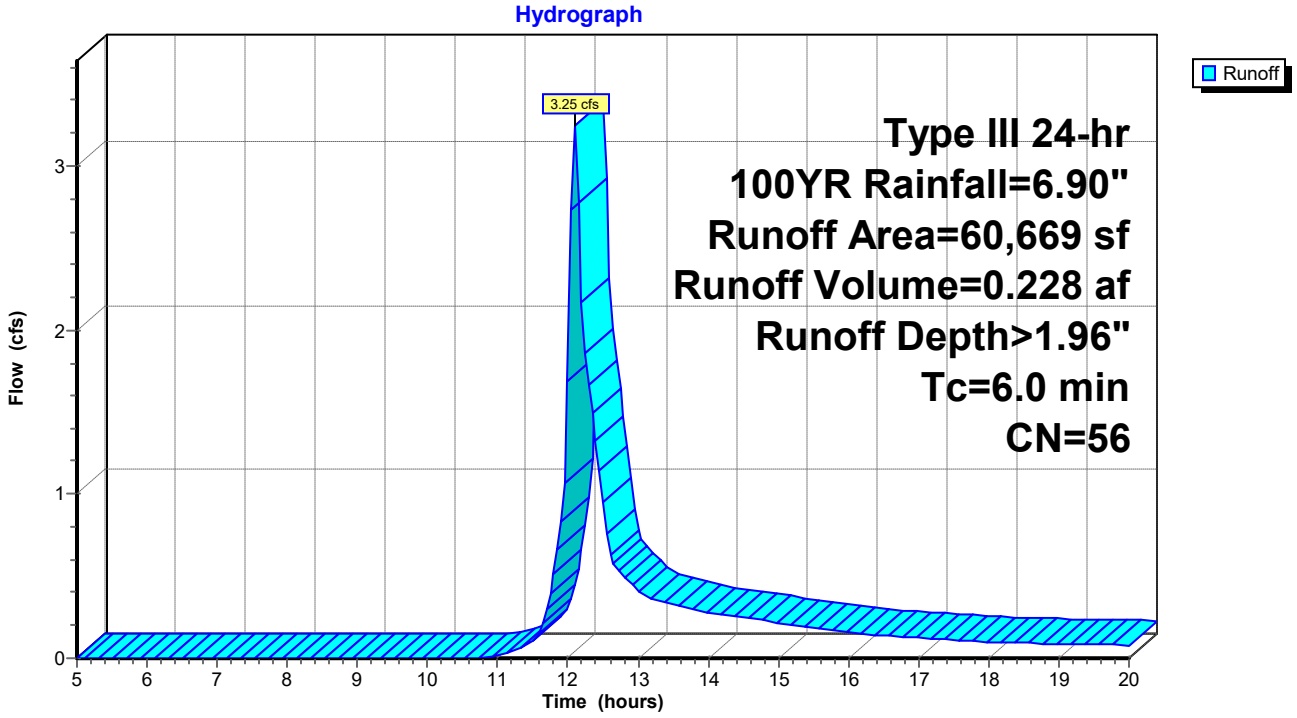
Runoff = 3.25 cfs @ 12.10 hrs, Volume= 0.228 af, Depth> 1.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100YR Rainfall=6.90"

Area (sf)	CN	Description
52,634	55	Woods, Good, HSG B
8,035	65	Woods/grass comb., Fair, HSG B
60,669	56	Weighted Average
60,669		100.00% Pervious Area

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

Subcatchment 1S: DA 1



Summary for Subcatchment 2P: 2P

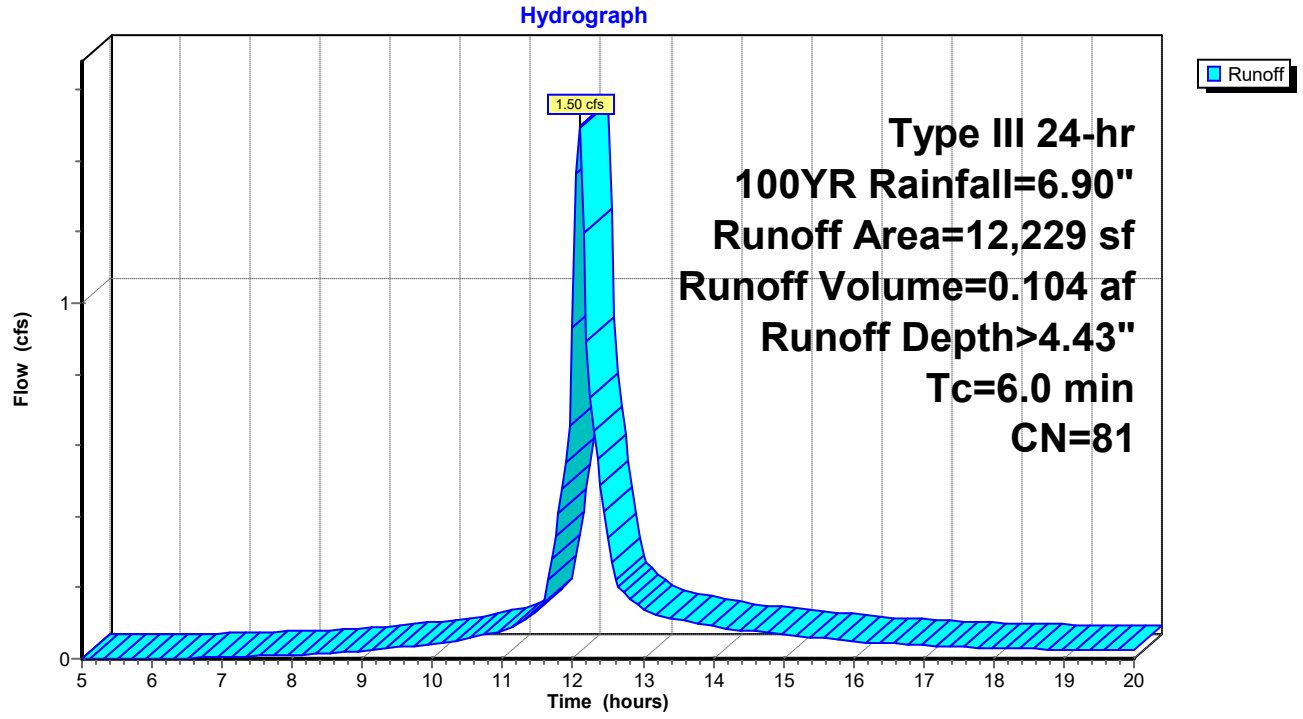
Runoff = 1.50 cfs @ 12.09 hrs, Volume= 0.104 af, Depth> 4.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100YR Rainfall=6.90"

Area (sf)	CN	Description
6,700	98	Paved parking, HSG B
5,529	61	>75% Grass cover, Good, HSG B
12,229	81	Weighted Average
5,529		45.21% Pervious Area
6,700		54.79% Impervious Area

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

Subcatchment 2P: 2P



Summary for Subcatchment 3S: 3P

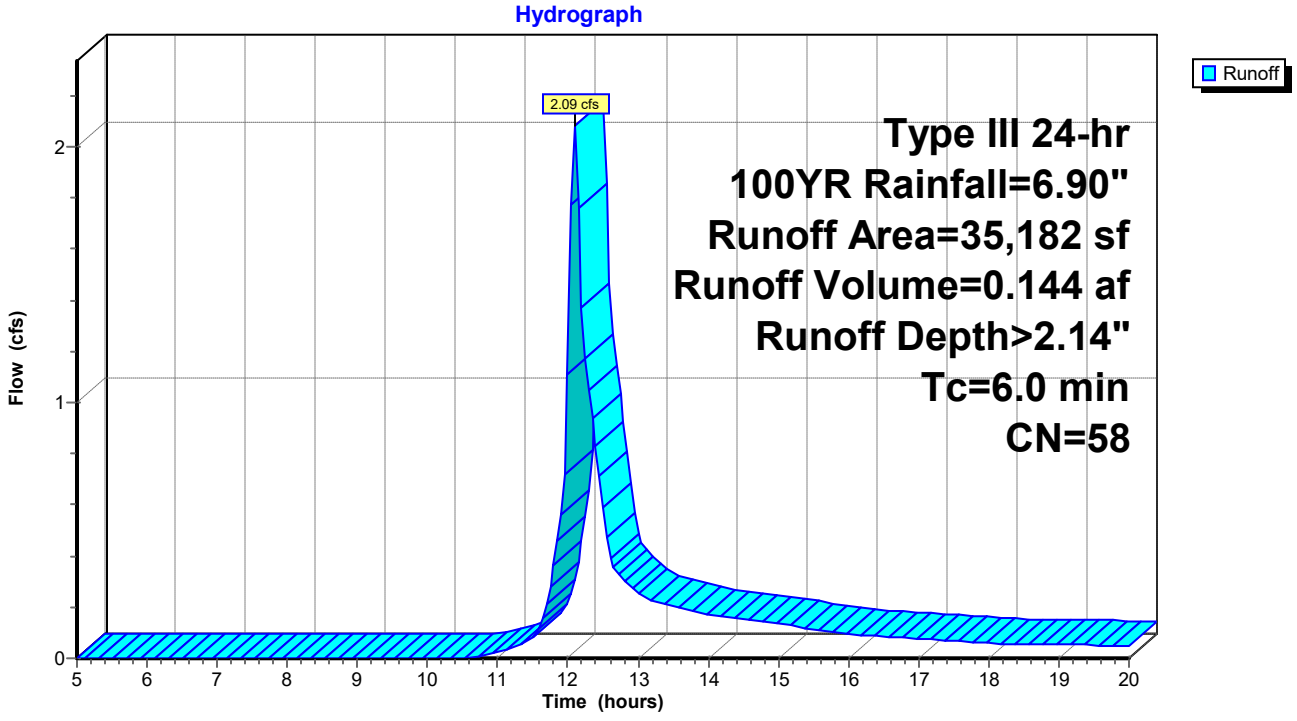
Runoff = 2.09 cfs @ 12.10 hrs, Volume= 0.144 af, Depth> 2.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100YR Rainfall=6.90"

Area (sf)	CN	Description
30,354	55	Woods, Good, HSG B
2,027	98	Paved parking, HSG B
2,801	61	>75% Grass cover, Good, HSG B
35,182	58	Weighted Average
33,155		94.24% Pervious Area
2,027		5.76% Impervious Area

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

Subcatchment 3S: 3P

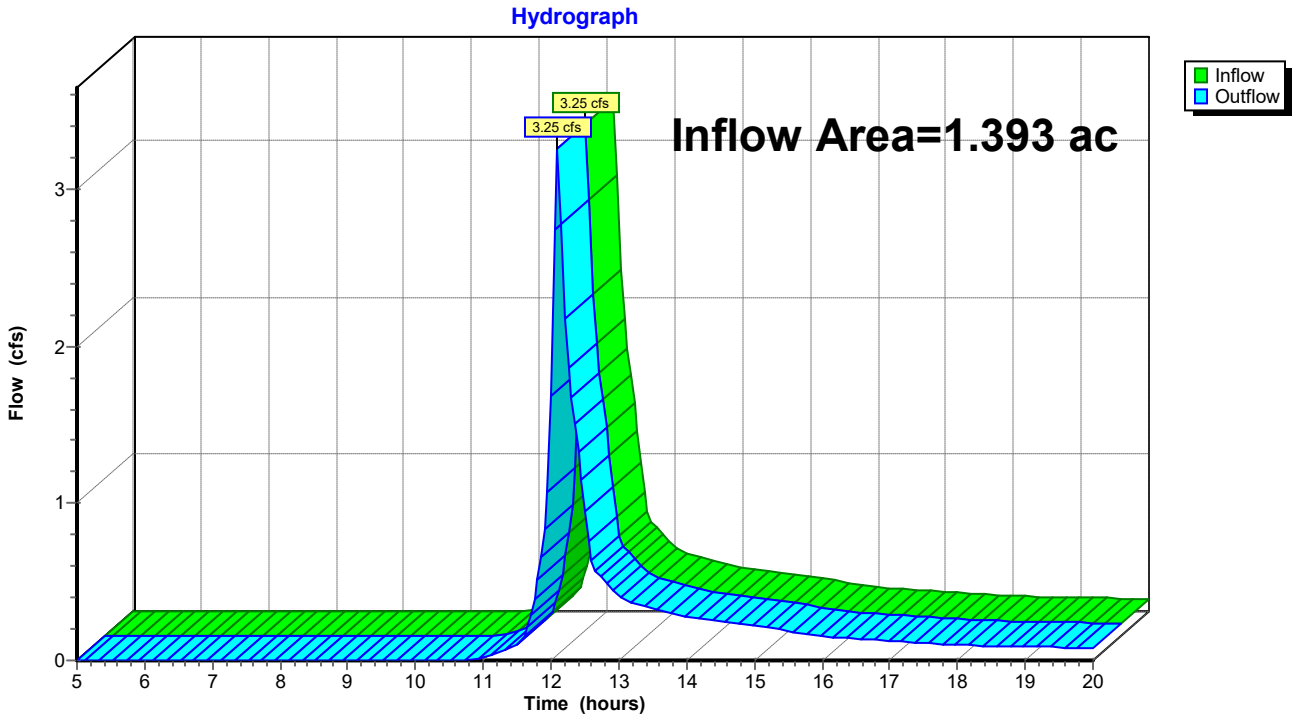


Summary for Reach IP-E1: Wetlands

Inflow Area = 1.393 ac, 0.00% Impervious, Inflow Depth > 1.96" for 100YR event
Inflow = 3.25 cfs @ 12.10 hrs, Volume= 0.228 af
Outflow = 3.25 cfs @ 12.10 hrs, Volume= 0.228 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach IP-E1: Wetlands

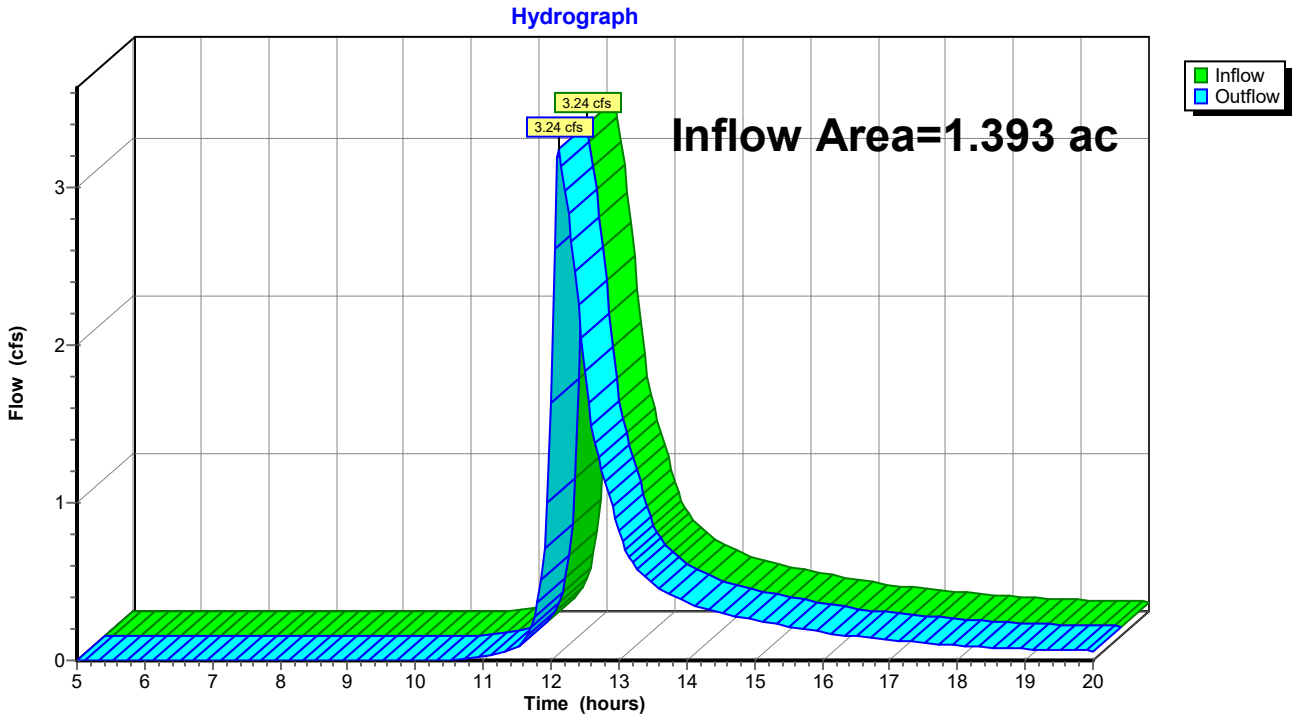


Summary for Reach IP-P1: Wetlands

Inflow Area = 1.393 ac, 33.18% Impervious, Inflow Depth > 2.57" for 100YR event
Inflow = 3.24 cfs @ 12.12 hrs, Volume= 0.299 af
Outflow = 3.24 cfs @ 12.12 hrs, Volume= 0.299 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach IP-P1: Wetlands



Summary for Pond PND 1: PND 1

Inflow Area = 0.585 ac, 71.02% Impervious, Inflow Depth > 5.10" for 100YR event
Inflow = 3.45 cfs @ 12.09 hrs, Volume= 0.249 af
Outflow = 1.70 cfs @ 12.25 hrs, Volume= 0.208 af, Atten= 51%, Lag= 9.8 min
Discarded = 0.05 cfs @ 8.35 hrs, Volume= 0.054 af
Primary = 1.65 cfs @ 12.25 hrs, Volume= 0.155 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 784.32' @ 12.25 hrs Surf.Area= 2,070 sf Storage= 3,847 cf

Plug-Flow detention time= 89.9 min calculated for 0.208 af (84% of inflow)
Center-of-Mass det. time= 42.6 min (799.9 - 757.3)

Volume	Invert	Avail.Storage	Storage Description
#1	782.00'	1,602 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 7,245 cf Overall - 3,241 cf Embedded = 4,004 cf x 40.0% Voids
#2	782.00'	3,241 cf	**Cultec R-330XLHD** x 60 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 10 rows
		4,843 cf	Total Available Storage

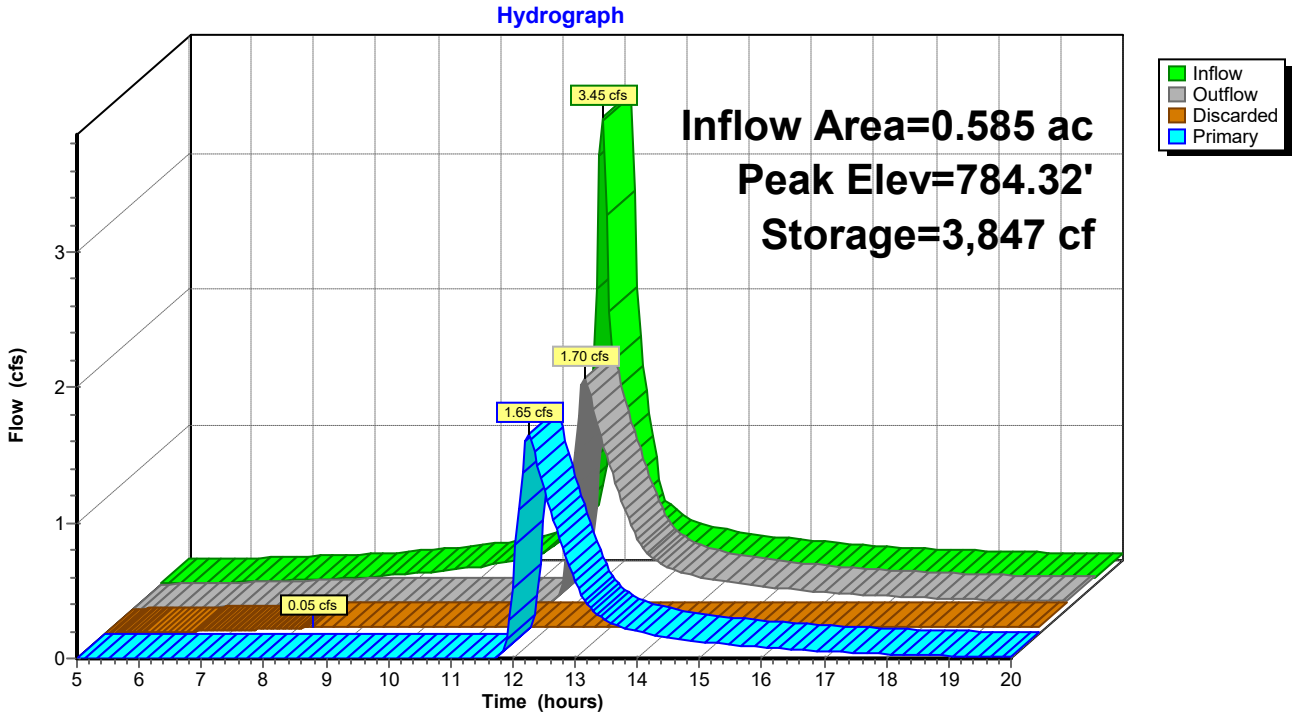
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
782.00	2,070	0	0
785.50	2,070	7,245	7,245

Device	Routing	Invert	Outlet Devices
#1	Discarded	782.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	782.90'	**4.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	783.12'	**6.0" Vert. Orifice/Grate** C= 0.600
#4	Primary	784.00'	**6.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.05 cfs @ 8.35 hrs HW=782.04' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=1.65 cfs @ 12.25 hrs HW=784.32' (Free Discharge)
├**2=Orifice/Grate** (Orifice Controls 0.47 cfs @ 5.39 fps)
├**3=Orifice/Grate** (Orifice Controls 0.92 cfs @ 4.70 fps)
└**4=Orifice/Grate** (Orifice Controls 0.26 cfs @ 1.93 fps)

Pond PND 1: PND 1



STANDARD #3 –LOSS OF ANNUAL RECHARGE

The site is predominately un-developed. Temporary Basin 1& 2 are constructed for pretreatment prior to the existing wetland located in the west corner of the parcel. 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	20,127	587
C	0.25	0	0	0
D	0.10	0	0	0
Total Required				**0**

Standard #3 Only Applies to Additional Impervious

Provided Recharge Volume (cf)		
(Pond#1)		1,656
		0
		0
Total Provided		**1,656**

Volume Recharge Calculation:

Rv = F x I
Rv = Required Recharge Volume
F = Recharge Factor
I = Total Impervious Area
Rv = (0.35")/(1'/12") x 20,127 s.f. = 587 cf (Required)

Provided Infiltration is 2,429 cf taken from Stage Storage Worksheet

Drawdown Calculation:

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

Where:

Rv = Storage Volume (1,656 c.f.)

K = Saturated Hydraulic Conductivity For “Static” and “Simple Dynamic” Methods, use Rawls Rate (see Table 2.3.3). For “Dynamic Field” Method, use 50% of the in-situ saturated hydraulic conductivity. (1.02 in/hour)

Bottom Area = Bottom Area of Recharge Structure 2,070 s.f.)

Time = 1,656 c.f./ (1.02 in/hour)(1inch/12foot)(2,070s.f.) = 10 hours

Tauper Land Surveying, Inc.
710 Main Street North Oxford MA 01537 (P) 508-987-8713 (F) 508-987-8714

STANDARD #4- 80% TSS REMOVAL

ESTIMATED PROPOSED NEW PAVED COVER= 28,064S.F.

REQUIRED WATER QUALITY VOLUME:

Water Quality Volume		
Required Treatment Volume	1.0	Inches Over Impervious Areas
Watershed Series	Paved Area	Water Quality Volume
P-1	11,400	946
P-2	6,700	556
P-3	2,027	168

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 how the water treatment prior to the existing basin located on. No bypass is designed of the BMP's reducing the WQV.

STAGE-STORAGE WORKSHEET

	DATE:	4/5/2022		CLIENT:	
PROJECT NUMBER:			CALCULATED BY:		PML
BASIN NUMBER:		1		CHECKED BY:	
	LOCATION:	basin 1			
		AVERAGE	VERTICAL	VOLUME	VOLUME
ELEVATION	AREA	AREA	INTERVAL	INCREMENTAL	CUMULATIVE
(FEET)	(FT^2)	(FT^2)	(FT)	(FT^3)	(FT^3)
782.0	2070				0
782.8	2070	2070	1	1656	1656

INSTRUCTIONS:

Version 1, Automated: Mar. 4, 2008

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

Location: Setting Pond, Stafford Street

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Stormceptor	0.80	1.00	0.80	0.20
Sediment Forebay	0.25	0.20	0.05	0.15
	0.00	0.15	0.00	0.15
	0.00	0.15	0.00	0.15
	0.00	0.15	0.00	0.15

Total TSS Removal = 85%

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

Project: 21-301

Prepared By: pml

Date: 5/18/2022

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

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed

1. From MassDEP Stormwater Handbook Vol. 1

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

Version 1, Automated: Mar. 4, 2008

Location: Basin#1, Stafford Street

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	0.25	1.00	0.25	0.75
Stormceptor	0.80	0.75	0.60	0.15
Infiltration Basin	0.80	0.15	0.12	0.03
	0.00	0.03	0.00	0.03
	0.00	0.03	0.00	0.03

Total TSS Removal = 97%

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

Project: 21-301
Prepared By: pml
Date: 1/19/2021

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

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed

1. From MassDEP Stormwater Handbook Vol. 1

STANDARD #9- OPERATION & MAINTENANCE

OPERATION & MAINTENANCE PLAN:

CURRENT OWNER & RESPONSIBLE PARTY:
Matt Schold (Contractor shall be responsible during construction)

FUTURE OWNER & RESPONSIBLE PARTY:
Matt Schold

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 Tractor Supply Parking Lot and Route 9. 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.

***Proposed outlet control structures*:**

Outlet control structures at basins 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.

***CHECK DAMS*:**

Check Dams shall be inspected weekly and after rainfall in excess of 0.5". Accumulated sediment shall be removed when depth exceeds 3" on the upstream sided of the dam. Stone or fabric shall be replaced when evidence of clogging is present.

***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:

***Existing 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.

SEDIMENT BASINS

Sediment Basins 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.

INFILTRATION BASIN

Inspect infiltration basin after major storm events (>3.0 inches) to verify stabilization and infiltration. Mow slopes, berms quarterly. Removed accumulated clippings from infiltration stone. Inspect basin semi-annually for the following:

- Signs of differential settlement

- Cracking
- Erosion
- Leakage in embankments
- Tree growth on embankments
- Condition of rip rap
- Sediment accumulation
- Turf health.

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:
Fertilizers shall be applied in the minimum amounts recommended by the manufacturer. Once applied, fertilizers shall be worked into the soil to limit exposure to stormwater. Storage shall be in a covered shed or trailer. The contents of any partially-used bags of fertilizer shall be transferred to a sealable plastic bag or bin to avoid spills

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:

Groundwater Mounding Calculation

Soil Logs and Soil Map Information

Rip Rap Calculations

Inspection & Maintenance Logs During & After Construction

Pipe Sizing Table

Pre-Development Watershed Map

Post-Developoment Watershed Map

21-301 -UG Pond 1
Stafford St, Leicester Ma
HANTUSH GROUNDWATER MOUND CALCULATOR

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

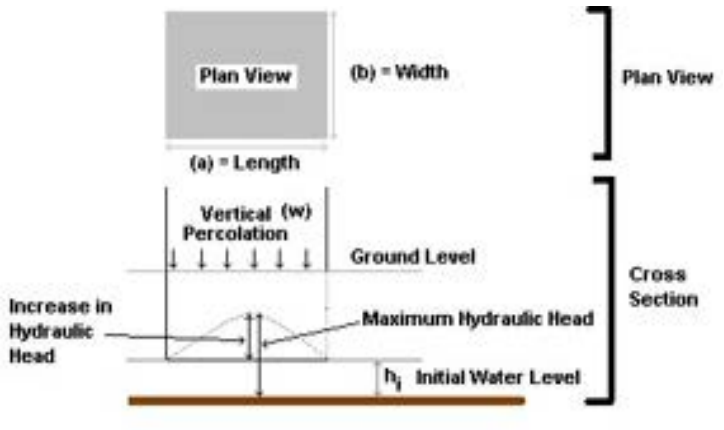
Basin	Length	Width	Volume	Time		Total		w (perc)
	ft	ft	cf	start	end	Hrs	Days	ft/d
1	44	47	1,656	5	55	50	2.08	0.384

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)

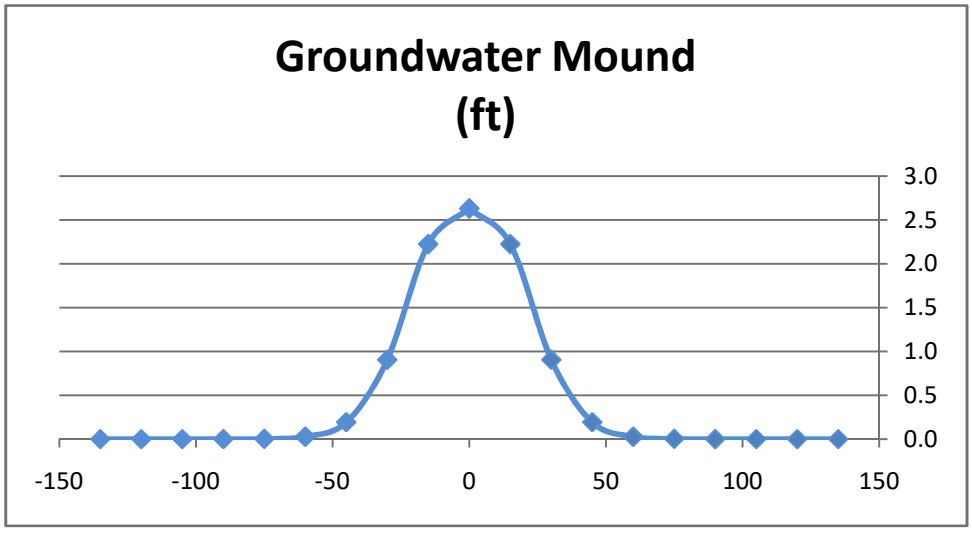


Input Values

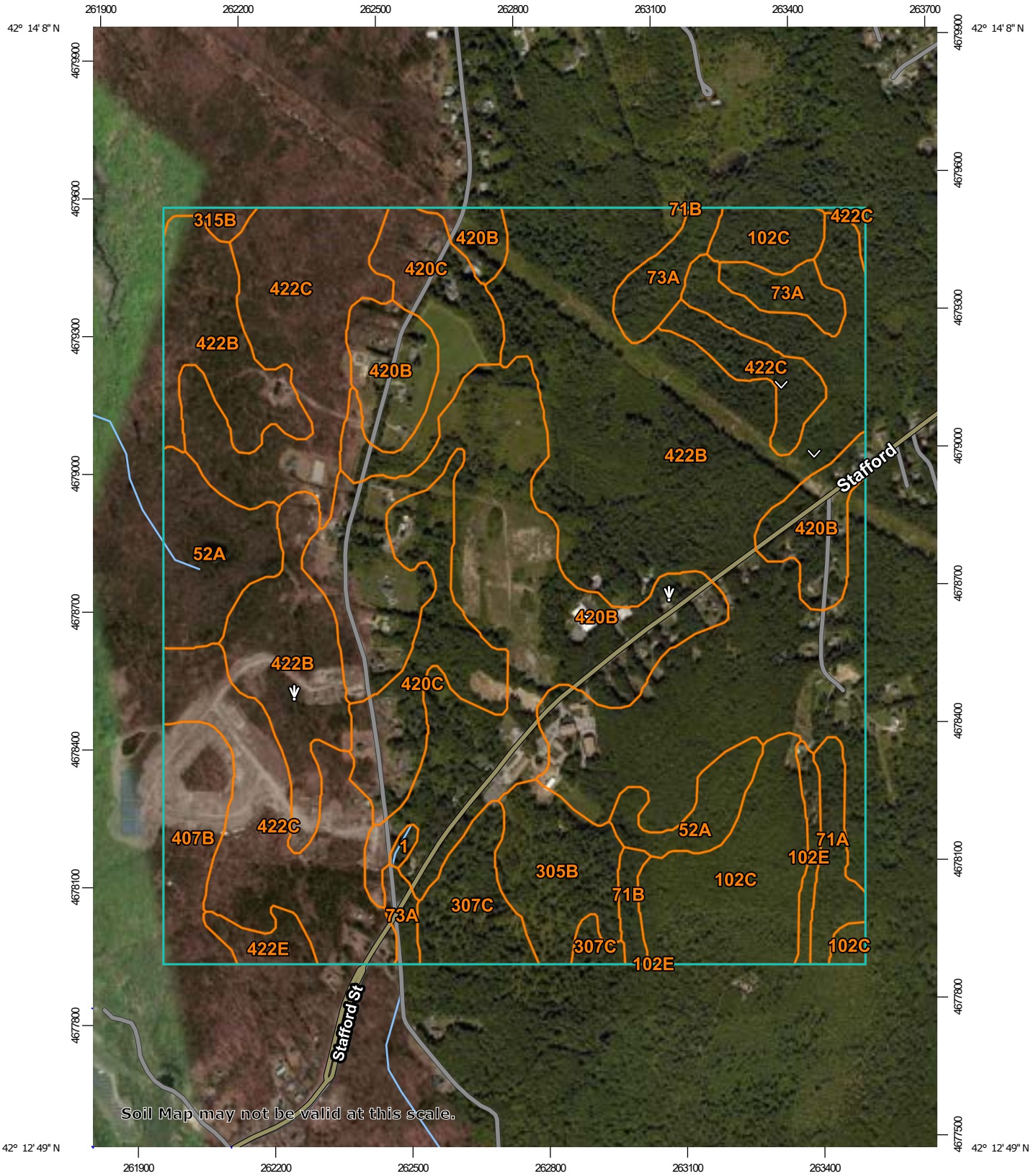
9.80	K	Horizontal hydraulic conductivity (feet/day)
0.200	Sy	Specific yield (dimensionless)
2.000	hi	Initial Water Level (feet)
44.000	a	Basin Length (feet)
47.000	b	Basin Width (feet)
0.3840	*w*	Recharge (infiltration) rate (feet/day)
2.083	t	duration of infiltration period (days)

4.634	h(max)	Maximum Hydraulic Head (feet)
2.634	Δh(max)	Maximum Groundwater Mound (feet)

Ground-water Mound (ft)	Distance from Center (ft)
2.634	0
2.227	15
0.908	30
0.194	45
0.028	60
0.004	75
0.001	90
0.001	105
0.001	120
0.001	135
Increment	15



Soil Map—Worcester County, Massachusetts, Southern Part
(Stafford Street Map Leicester Ma)



Map Scale: 1:11,900 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 150 300 600 900

Feet: 0 500 1000 2000 3000

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

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Worcester County, Massachusetts, Southern Part
Survey Area Data: Version 14, Sep 3, 2021

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

Date(s) aerial images were photographed: Apr 8, 2011—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
1	Water	0.8	0.1%
52A	Freetown muck, 0 to 1 percent slopes	27.5	4.4%
71A	Ridgebury fine sandy loam, 0 to 3 percent slopes, extremely stony	8.0	1.3%
71B	Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony	3.0	0.5%
73A	Whitman fine sandy loam, 0 to 3 percent slopes, extremely stony	16.3	2.6%
102C	Chatfield-Hollis-Rock outcrop complex, 0 to 15 percent slopes	37.6	6.0%
102E	Chatfield-Hollis-Rock outcrop complex, 15 to 35 percent slopes	3.7	0.6%
305B	Paxton fine sandy loam, 3 to 8 percent slopes	19.1	3.0%
307C	Paxton fine sandy loam, 8 to 15 percent slopes, extremely stony	15.5	2.5%
315B	Scituate fine sandy loam, 3 to 8 percent slopes	2.0	0.3%
407B	Charlton fine sandy loam, 3 to 8 percent slopes, extremely stony	16.3	2.6%
420B	Canton fine sandy loam, 3 to 8 percent slopes	122.4	19.5%
420C	Canton fine sandy loam, 8 to 15 percent slopes	45.8	7.3%
422B	Canton fine sandy loam, 0 to 8 percent slopes, extremely stony	213.6	34.1%
422C	Canton fine sandy loam, 8 to 15 percent slopes, extremely stony	90.5	14.4%
422E	Canton fine sandy loam, 15 to 35 percent slopes, extremely stony	4.5	0.7%
Totals for Area of Interest		**626.7**	**100.0%**

Worcester County, Massachusetts, Southern Part

420C—Canton fine sandy loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2w817
Elevation: 0 to 1,330 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Canton and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Canton

Setting

Landform: Hills, moraines, ridges
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, crest, side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Coarse-loamy over sandy melt-out till derived from gneiss, granite, and/or schist

Typical profile

Ap - 0 to 7 inches: fine sandy loam
Bw1 - 7 to 15 inches: fine sandy loam
Bw2 - 15 to 26 inches: gravelly fine sandy loam
2C - 26 to 65 inches: gravelly loamy sand

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 19 to 39 inches to strongly contrasting textural stratification
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e

Hydrologic Soil Group: B
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Montauk
Percent of map unit: 6 percent
Landform: Moraines, ground moraines, hills, drumlins
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Scituate
Percent of map unit: 6 percent
Landform: Hills, drumlins, ground moraines
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Charlton
Percent of map unit: 4 percent
Landform: Ridges, ground moraines, hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Newfields
Percent of map unit: 4 percent
Landform: Ground moraines, hills, moraines
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

Data Source Information

Soil Survey Area: Worcester County, Massachusetts, Southern Part
Survey Area Data: Version 14, Sep 3, 2021

Commonwealth of Massachusetts
City/Town of Leicester

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

A. Facility Information

Matt Schold
Owner Name

Stafford Street
Street Address

Map/Lot #

Leicester
City

MA
State

Zip Code

B. Site Information

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

2. Soil Survey Available? ☒ Yes ☐ No If yes: Mass. GIS (Source) 407B (Soil Map Unit)

Charlton
Soil Name

Soil Limitations

Glacial Till
Soil Parent material

Ridge
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): August 2021 (Month/Day/ Year) Range: ☒ Above Normal ☐ Normal ☐ Below Normal

8. Other references reviewed:

Commonwealth of Massachusetts
City/Town of Leicester

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 #) | 8-25-21 (Date) | 8:30 (Time) | clear 80 (Weather) | 42-05-12 N (Latitude) | 71-55-29 W (Longitude:)

1. Land Use: Vacant (e.g., woodland, agricultural field, vacant lot, etc.) | Wooded (Vegetation) | many (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 4 (Slope (%))

Description of Location:

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

3. Distances from: Open Water Body n/a feet | Drainage Way n/a feet | Wetlands 70 feet | Property Line 40 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: 36 Depth Weeping from Pit | 110 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				
10-28	Bw	S.L.	10YR4/6	N/A			N/A				
28-120	C	S.L.	5Y6/3	36"	10YR5/8	25	N/A				

Additional Notes:

Commonwealth of Massachusetts
City/Town of Leicester

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 #) | 8-25-21 (Date) | 9:00 (Time) | clear 80 (Weather) | 42-5-12 N (Latitude) | 71-55-29 W (Longitude:)

1. Land Use: Vacant (e.g., woodland, agricultural field, vacant lot, etc.) | Woodland (Vegetation) | Some (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 4 (Slope (%))

Description of Location:

2. Soil Parent Material: Chartlon | Ridge (Landform) | (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body n/a feet | Drainage Way n/a feet | Wetlands 70 feet | Property Line 40 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: 36" Depth Weeping from Pit | 110 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			
0-22	A	S.L.	10YR4/4	N/A							
22-32	B	S.L.	10YR6/6	N/A							
32-62	C1	S.L.	5Y6/3	36"	10YR5/8	25	N/A	N/A			
62-100	C2	L.S.	2.5Y5/4	N/A			N/A	N/A			
100-120	C3	S.L.	10YR4/4	N/A			N/A	N/A			

Additional Notes:

Commonwealth of Massachusetts
City/Town of Leicester

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	110 inches	110 inches
☒ Depth weeping from side of observation hole	36 inches	36 inches
☐ Depth to soil redoximorphic features (mottles)	36 inches	36 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:	28 inches	Lower boundary:	120 inches
c. If no, at what depth was impervious material observed?	Upper boundary:	_____ inches	Lower boundary:	_____ inches

Commonwealth of Massachusetts
City/Town of Leicester

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.

Peter Lavoie	8/25/21
Signature of Soil Evaluator	Date
Peter Lavoie #1332	2023
Typed or Printed Name of Soil Evaluator / License #	Expiration Date of License
Shelley Hammond	Leicester
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:

Commonwealth of Massachusetts
City/Town of Leicester

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

A. Facility Information

Matt Schold
Owner Name

Stafford Street
Street Address

Map/Lot #

Leicester
City

MA
State

Zip Code

B. Site Information

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

2. Soil Survey Available? ☒ Yes ☐ No If yes: Mass. GIS (Source) 407B (Soil Map Unit)

Charlton
Soil Name

Soil Limitations

Glacial Till
Soil Parent material

Ridge
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): August 2021 (Month/Day/ Year) Range: ☒ Above Normal ☐ Normal ☐ Below Normal

8. Other references reviewed:

Commonwealth of Massachusetts
City/Town of Leicester

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 #) | 8-25-21 (Date) | 9:30 (Time) | clear 80 (Weather) | 42-05-12 N (Latitude) | 71-55-29 W (Longitude:)

1. Land Use: Vacant (e.g., woodland, agricultural field, vacant lot, etc.) | Wooded (Vegetation) | many (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 4 (Slope (%))

Description of Location:

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

3. Distances from: Open Water Body n/a feet | Drainage Way n/a feet | Wetlands 70 feet | Property Line 40 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: 38 Depth Weeping from Pit | 116 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				
18-36	Bw	S.L.	10YR4/6	N/A			N/A				
36-62	C1	S.L.	5Y6/3	38"	10YR5/8	25	N/A				
62-100	C2	L.S.	2.5Y5/4	N/A			N/A				
100-120	C3	S.L.	5Y6/3	N/A			N/A				

Additional Notes:

Commonwealth of Massachusetts
City/Town of Leicester

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 #) | 8-25-21 (Date) | 10:00 (Time) | clear 80 (Weather) | 42-5-12 N (Latitude) | 71-55-29 W (Longitude:)

1. Land Use: Vacant (e.g., woodland, agricultural field, vacant lot, etc.) | Woodland (Vegetation) | Some (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 4 (Slope (%))

Description of Location:

2. Soil Parent Material: Chartlon | Ridge (Landform) | (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body n/a feet | Drainage Way n/a feet | Wetlands 70 feet | Property Line 40 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: 43" Depth Weeping from Pit | 118 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			
0-43	Fill										
43-58	C1	S.L.	5Y6/3	43"	10YR5/8	25					
58-120	C2	L.S.	2.5Y5/4	N/A			N/A	N/A			

Additional Notes:

Commonwealth of Massachusetts
City/Town of Leicester

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	116 inches	118 inches
☒ Depth weeping from side of observation hole	38 inches	43 inches
☒ Depth to soil redoximorphic features (mottles)	38 inches	43 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:	43 inches	Lower boundary:	120 inches
c. If no, at what depth was impervious material observed?	Upper boundary:	_____ inches	Lower boundary:	_____ inches

Commonwealth of Massachusetts
City/Town of Leicester

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.

Peter Lavoie	8/25/21
Signature of Soil Evaluator	Date
Peter Lavoie #1332	2023
Typed or Printed Name of Soil Evaluator / License #	Expiration Date of License
Shelley Hammond	Leicester
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:

Commonwealth of Massachusetts
City/Town of Leicester

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

A. Facility Information

Matt Schold
Owner Name

Stafford Street
Street Address

Map/Lot #

Leicester
City

MA
State

Zip Code

B. Site Information

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

2. Soil Survey Available? ☒ Yes ☐ No If yes: Mass. GIS (Source) 407B (Soil Map Unit)

Charlton
Soil Name

Soil Limitations

Glacial Till
Soil Parent material

Ridge
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): August 2021 (Month/Day/ Year) Range: ☒ Above Normal ☐ Normal ☐ Below Normal

8. Other references reviewed:

Commonwealth of Massachusetts
City/Town of Leicester

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 #) | 8-25-21 (Date) | 11:30 (Time) | clear 80 (Weather) | 42-05-12 N (Latitude) | 71-55-29 W (Longitude:)

1. Land Use: Vacant (e.g., woodland, agricultural field, vacant lot, etc.) | Wooded (Vegetation) | many (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 4 (Slope (%))

Description of Location:

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

3. Distances from: Open Water Body n/a feet | Drainage Way n/a feet | Wetlands 70 feet | Property Line 40 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: 38 Depth Weeping from Pit 116 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				
18-36	Bw	S.L.	10YR4/6	N/A			N/A				
36-62	C1	S.L.	5Y6/3	38"	10YR5/8	25	N/A				
62-100	C2	L.S.	2.5Y5/4	N/A			N/A				
100-120	C3	S.L.	5Y6/3	N/A			N/A				

Additional Notes:

Commonwealth of Massachusetts
City/Town of Leicester

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 #) | 8-25-21 (Date) | 12:00 (Time) | clear 80 (Weather) | 42-5-12 N (Latitude) | 71-55-29 W (Longitude:)

1. Land Use: Vacant (e.g., woodland, agricultural field, vacant lot, etc.) | Woodland (Vegetation) | Some (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 4 (Slope (%))

Description of Location:

2. Soil Parent Material: Chartlon | Ridge (Landform) | (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body n/a feet | Drainage Way n/a feet | Wetlands 70 feet | Property Line 40 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: 75" Depth Weeping from Pit | 118 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	A	S.L.	10YR4/4	N/A							
43-58	C1	S.L.	5Y6/3	75"	10YR5/8	25					
58-120	C2	L.S.	2.5Y5/4	N/A			N/A	N/A			

Additional Notes:

Commonwealth of Massachusetts
City/Town of Leicester

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

D. Determination of High Groundwater Elevation

1. Method Used:	Obs. Hole #3	Obs. Hole #6
☒ Depth observed standing water in observation hole	116 inches	118 inches
☒ Depth weeping from side of observation hole	38 inches	75 inches
☒ Depth to soil redoximorphic features (mottles)	38 inches	75 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:	36 inches	Lower boundary:	120 inches
c. If no, at what depth was impervious material observed?	Upper boundary:	_____ inches	Lower boundary:	_____ inches

Commonwealth of Massachusetts
City/Town of Leicester

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.

	8/25/21
Signature of Soil Evaluator	Date
Peter Lavoie #1332	2023
Typed or Printed Name of Soil Evaluator / License #	Expiration Date of License
Shelley Hammond	Leicester
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:

Stafford Street, Leicester MA
May 18, 2022

Project# 21-301

Riprap Stone Sizing – Drainage Outfalls

Method – ARS Rock Chutes (Slopes 2%-40%)
Reference: National Engineering Handbook, TS14C-8

#FES-1–Rock Apron- Basin#1 (HydroCAD)
Slope = 0.02 ft/ft
q (100-yr) = 1.71 cfs

$D_{50} = 12(1.923qS^{1.5})^{0.529}$
$= D_{50} = 12(1.923(1.72)(0.02^{1.5})^{0.529}$
D_{50} =4" required
D_{50} =8" provided

$L= (1.8 (Q-5)/1.0^{1.5}+10) = (1.8(1.71-5)/ 1.0^{1.5}+10) = 11$feet
W1=3D = 3(1')= 3 feet
W2= 3D+0.7L= 3(1)+0.7(11) = 11 feet

#FES-2–Rock Apron- Inlet Settling Pond
Slope = 0.02 ft/ft
q (100-yr) = 0.10cfs

$D_{50} = 12(1.923qS^{1.5})^{0.529}$
$= D_{50} = 12(1.923(0.10)(0.02^{1.5})^{0.529}$
D_{50} =2" required
D_{50} =6" provided

$L= (1.8 (Q-5)/D^{1.5}+10) =10$ feet
W1=3D = 3(1')= 3 feet
W2= 3D+0.7L= 3(1)+0.7(10) = 10 feet

Inspection and Maintenance Log FOR: Stafford Street
AFTER CONSTRUCTION & After 3.0" Rain

Components	**Date**
UG Basin#1 **– twice a year**	
Comments during insp.	
Note corrective measures performed & Date	
Settling Basin **-twice a year**	
Comments during insp.	
Note corrective measures performed & date	
Rip Rap Swale **-twice a year**	
Comments during insp.	
Note corrective measures performed & date	
Stormceptor #1 **-twice a year**	
Comments during insp.	
Note corrective measures performed & date	
Catch Basins **– 8 inches of sediment or twice a year**	
Comments during insp.	
Note corrective measures performed & date _____. Inspector Title Date	
_____. Address Tel#	

Inspection and Maintenance Log FOR: Stafford Street
AFTER CONSTRUCTION & After 3.0" Rain

Components	**Date**
Stormceptor #2 **-8 inches of sediment or twice a year**	
Comments during insp.	
Note corrective measures performed & date	
Outlet Control Structure **Twice a year**	
Comments during insp.	
Note corrective measures performed & date	
Drain Manholes **–four times a year**	
Comments during insp.	
Note corrective measures performed & date	
Spillway at settling basin **-as-needed**	
Comments during insp.	
Note corrective measures performed & date	
Gutters on Building **-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 _____. Inspector Title Date	
Components	Date

Inspection and Maintenance Log FOR: Stafford Street
AFTER CONSTRUCTION & After 3.0" Rain

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

WEEKLY
Inspection and Maintenance Log FOR: Stafford St
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: Stafford St
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: Stafford St
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 1 **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: Stafford St
DURING CONSTRUCTION & After 0.5” Rain

5/19/2022

RATIONAL METHOD PIPE DESIGN WORKSHEET

	PIPE SEGMENT		INCREMENTAL AREA						FLOW TIME (min.)			25-Yr	25-Yr	DESIGN CONDITIONS					Design (25-Yr)		Inverts		Remarks
LOCATION	From	To	DESIGNATION	A (Acres)	Total A	C	C*A	Sum (C*A)	To Inlet	In Chan.	Tot.	I (in/hr)	Q (cfs)	Pipe Diam (in.)	Length (ft)	Slope (%)	Q-full (cfs)	V-Full (fps)	Depth Peak (in.)	V-Peak (fps)	Up	Down	
Site To Basin 1																							
	CB2	DMH2		0.280		0.71	**0.20**		5		5	6.0	**1.19**	12	63	0.005	**2.74**	3.48	5.2	1.52	783.35	783.07	CB-2 Rim =785.35
	DMH2	DMH3		0.280		0.71	**0.20**		5		5	6.0	**1.19**	12	85	0.005	**2.74**	3.48	5.2	1.52	783.07	782.64	DMH2 Rim-786.00
	DMH3	ST1		0.28	0.280	0.71	*0.20*		5		5	6.0	**1.19**	12	48	0.005	**2.74**	3.48	5.2	1.52	782.64	782.40	ST1 Rim=786.80
	CB1	DMH3		0.180		0.9	**0.16**		5		5	6.0	**0.97**	12	46	0.009	**3.65**	4.65	3.2	1.24	783.75	783.34	CB-1 Rim =786.75
	DMH3	ST1		0.180		0.9	**0.16**		5		5	6.0	**0.97**	12	30	0.010	**4.03**	5.14	2.9	1.24	783.34	782.4	DMH1 Rim=786.90
				0.180		0.9	**0.16**		5		5	6.0	**0.97**	12	180	0.005	**2.74**	3.48	4.3	1.24	237.35	236.45	ST1 Rim=786.80
	ST1	BASIN1		0.560		0.80	**0.45**		10		5	6.0	**2.69**	12	15	0.027	**6.32**	8.05	5.1	3.42	782.40	782.00	ST1 Rim=786.50

Notes:

1) Runoff Coefficient C-Values used; Impervious(Pavement) C=0.90 Grass/OpenSpace C=0.20, Residential Suburban C=.25~.40, Mannings "n" HDPE n=0.012, RCP n=0.013
2) Rainfall Intensity I (in/hr) values taken from Figure 10-4 Intensity-Duration-Frequency Curve for Boston, Massachusetts, Mass Highway Design Manual.
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

RATIONAL METHOD PIPE DESIGN WORKSHEET

Hydrodynamic Separation Product Calculator

Warehouse/Ofiice Site

Stafford Street (ST#1)

CDS 2015-4

Project Information					
Project Name	**Warehouse/Office Site**			**Option #**	A
Country	UNITED_STATES	**State**	Massachusetts	**City**	**Leicester**

Contact Information			
First Name	Peter	**Last Name**	Lavoie
Company	Summit	**Phone #**	508-987-8713
Email	plavoie@summitesinc.com		

Design Criteria					
Site Designation	**Stafford Street** (ST#1)			**Sizing Method**	Net Annual
Screening Required?	Yes	**Drainage Area (ac)**	0.30	**Peak Flow (cfs)**	**1.95**
Groundwater Depth (ft)	0 - 5	**Pipe Invert Depth (ft)**	0 - 5	**Bedrock Depth (ft)**	0 - 5
Multiple Inlets?	Yes	**Grate Inlet Required?**	No	**Pipe Size (in)**	12.00
Required Particle Size Distribution?	No	**90° between two inlets?**	No	**180° between inlet and outlet?**	No
Runoff Coefficient	0.90	**Rainfall Station**	70 - East Brimfield Lake, MA	**TC (Min)**	10

Treatment Selection					
Treatment Unit	CDS	**System Model**	2015-4		
Target Removal	80%	**Particle Size Distribution (PSD)**	125	**Predicted Net Annual Removal**	96.72%

Hydrodynamic Separation Product Calculator

Warehouse/Office Site

Stafford Street (ST#1)

CDS 2015-4

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION BASED ON THE RATIONAL RAINFALL METHOD								
Rainfall Intensity[1] (in/hr)	**% Rainfall Volume[1]**	**Cumulative Rainfall Volume**	**Rainfall Volume Treated**	**Total Flowrate (cfs)**	**Treated Flowrate (cfs)**	**Operating Rate (%)**	**Removal Efficiency (%)**	**Incremental Removal (%)**
							Removal Efficiency Adjustment[2] =	
							Predicted % Annual Rainfall Treated =	
							Predicted Net Annual Load Removal Efficiency =	96.72%
1 - Based on 14 years of 15-minute rainfall data from NCDC Station 2107, East Brimfield Lake, Worcester County, MA								
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.								

SECTION (_____)
STORM WATER TREATMENT DEVICE

1.0 GENERAL

1.1 This item shall govern the furnishing and installation of the CDS® by Contech Engineered Solutions LLC, complete and operable as shown and as specified herein, in accordance with the requirements of the plans and contract documents.

1.2 The Contractor shall furnish all labor, equipment and materials necessary to install the storm water treatment device(s) (SWTD) and appurtenances specified in the Drawings and these specifications.

1.3 The manufacturer of the SWTD shall be one that is regularly engaged in the engineering design and production of systems deployed for the treatment of storm water runoff for at least five (5) years and which have a history of successful production, acceptable to the Engineer. In accordance with the Drawings, the SWTD(s) shall be a CDS® device manufactured by:

Contech Engineered Solutions LLC
9025 Centre Pointe Drive
West Chester, OH, 45069
Tel: 1 800 338 1122

1.4 Related Sections

1.4.1 Section 02240: Dewatering
1.4.2 Section 02260: Excavation Support and Protection
1.4.3 Section 02315: Excavation and Fill
1.4.4 Section 02340: Soil Stabilization

1.5 All components shall be subject to inspection by the engineer at the place of manufacture and/or installation. All components are subject to being rejected or identified for repair if the quality of materials and manufacturing do not comply with the requirements of this specification. Components which have been identified as defective may be subject for repair where final acceptance of the component is contingent on the discretion of the Engineer.

1.6 The manufacturer shall guarantee the SWTD components against all manufacturer originated defects in materials or workmanship for a period of twelve (12) months from the date the components are delivered to the owner for installation. The manufacturer shall upon its determination repair, correct or replace any manufacturer originated defects advised in writing to the manufacturer within the referenced warranty period. The use of SWTD components shall be limited to the application for which it was specifically designed.

1.7 The SWTD manufacturer shall submit to the Engineer of Record a “Manufacturer’s Performance Certification” certifying that each SWTD is capable of achieving the specified removal efficiencies listed in these specifications. The certification shall be supported by independent third-party research

1.8 No product substitutions shall be accepted unless submitted 10 days prior to project bid date, or as directed by the Engineer of Record. Submissions for substitutions require review and approval by the Engineer of Record, for hydraulic performance, impact to project designs, equivalent treatment performance, and any required project plan and report (hydrology/hydraulic, water quality, stormwater pollution) modifications that would be required by the approving jurisdictions/agencies. Contractor to coordinate with the Engineer of Record any applicable modifications to the project estimates of cost, bonding amount determinations, plan check fees for changes to approved documents, and/or any other regulatory requirements resulting from the product substitution.

2.0 MATERIALS

2.1 Housing unit of stormwater treatment device shall be constructed of pre-cast or cast-in-place concrete, no exceptions. Precast concrete components shall conform to applicable sections of ASTM C 478, ASTM C 857 and ASTM C 858 and the following:

2.1.1 Concrete shall achieve a minimum 28-day compressive strength of 4,000 pounds per square-inch (psi);

2.1.2 Unless otherwise noted, the precast concrete sections shall be designed to withstand lateral earth and AASHTO H-20 traffic loads;

2.1.3 Cement shall be Type III Portland Cement conforming to ASTM C 150;

2.1.4 Aggregates shall conform to ASTM C 33;

2.1.5 Reinforcing steel shall be deformed billet-steel bars, welded steel wire or deformed welded steel wire conforming to ASTM A 615, A 185, or A 497.

2.1.6 Joints shall be sealed with preformed joint sealing compound conforming to ASTM C 990.

2.1.7 Shipping of components shall not be initiated until a minimum compressive strength of 4,000 psi is attained or five (5) calendar days after fabrication has expired, whichever occurs first.

2.2 Internal Components and appurtenances shall conform to the following:

2.2.1 Screen and support structure shall be manufactured of Type 316 and 316L stainless steel conforming to ASTM F 1267-01;

2.2.2 Hardware shall be manufactured of Type 316 stainless steel conforming to ASTM A 320;

2.2.3 Fiberglass components shall conform to applicable sections of ASTM D-4097

2.2.4 Access system(s) conform to the following:

2.2.5 Manhole castings shall be designed to withstand AASHTO H-20 loadings and manufactured of cast-iron conforming to ASTM A 48 Class 30.

3.0 PERFORMANCE

3.1 The SWTD shall be sized to either achieve an 80 percent average annual reduction in the total suspended solid load with a particle size distribution having a mean particle size (d_{50}) of 125 microns unless otherwise stated.

3.2 The SWTD shall be capable of capturing and retaining 100 percent of pollutants greater than or equal to 2.4 millimeters (mm) regardless of the pollutant's specific gravity (i.e.: floatable and neutrally buoyant materials) for flows up to the device's rated-treatment capacity. The SWTD shall be designed to retain all previously captured pollutants addressed by this

subsection under all flow conditions. The SWTD shall be capable of capturing and retaining total petroleum hydrocarbons. The SWTD shall be capable of achieving a removal efficiency of 92 and 78 percent when the device is operating at 25 and 50 percent of its rated-treatment capacity. These removal efficiencies shall be based on independent third-party research for influent oil concentrations representative of storm water runoff (20 ± 5 mg/L). The SWTD shall be greater than 99 percent effective in controlling dry-weather accidental oil spills.

3.3 The SWTD shall be designed with a sump chamber for the storage of captured sediments and other negatively buoyant pollutants in between maintenance cycles. The minimum storage capacity provided by the sump chamber shall be in accordance with the volume listed in Table 1. The boundaries of the sump chamber shall be limited to that which do not degrade the SWTD's treatment efficiency as captured pollutants accumulate. The sump chamber shall be separate from the treatment processing portion(s) of the SWTD to minimize the probability of fine particle re-suspension. In order to not restrict the Owner's ability to maintain the SWTD, the minimum dimension providing access from the ground surface to the sump chamber shall be 16 inches in diameter.

3.4 The SWTD shall be designed to capture and retain Total Petroleum Hydrocarbons generated by wet-weather flow and dry-weather gross spills and have a capacity listed in Table 1 of the required unit.

3.5 The SWTD shall convey the flow from the peak storm event of the drainage network, in accordance with required hydraulic upstream conditions as defined by the Engineer. If a substitute SWTD is proposed, supporting documentation shall be submitted that demonstrates equal or better upstream hydraulic conditions compared to that specified herein. This documentation shall be signed and sealed by a Professional Engineer registered in the State of the work. All costs associated with preparing and certifying this documentation shall be born solely by the Contractor.

3.6 The SWTD shall have completed field tested following TARP Tier II protocol requirements

4.0 EXECUTION

4.1 The contractor shall exercise care in the storage and handling of the SWTD components prior to and during installation. Any repair or replacement costs associated with events occurring after delivery is accepted and unloading has commenced shall be borne by the contractor.

4.2 The SWTD shall be installed in accordance with the manufacturer's recommendations and related sections of the contract documents. The manufacturer shall provide the contractor installation instructions and offer on-site guidance during the important stages of the installation as identified by the manufacturer at no additional expense. A minimum of 72 hours notice shall be provided to the manufacturer prior to their performance of the services included under this subsection.

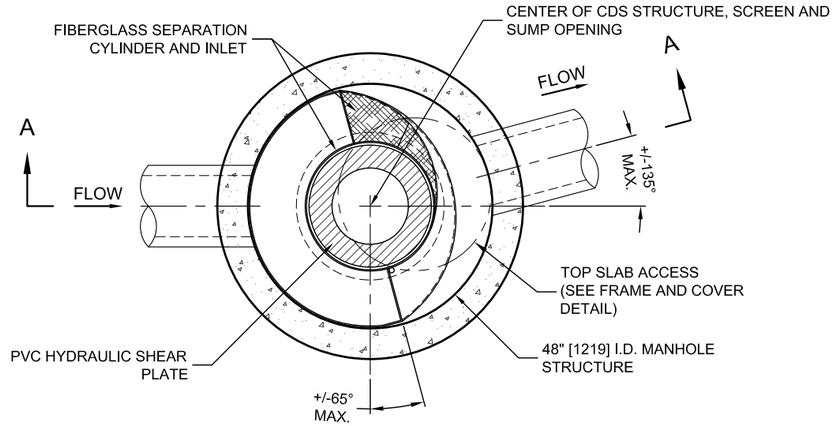
4.3 The contractor shall fill all voids associated with lifting provisions provided by the manufacturer. These voids shall be filled with non-shrinking grout providing a finished surface consistent with adjacent surfaces. The contractor shall trim all protruding lifting provisions flush with the adjacent concrete surface in a manner, which leaves no sharp points or edges.

4.4 The contractor shall removal all loose material and pooling water from the SWTD prior to the transfer of operational responsibility to the Owner.

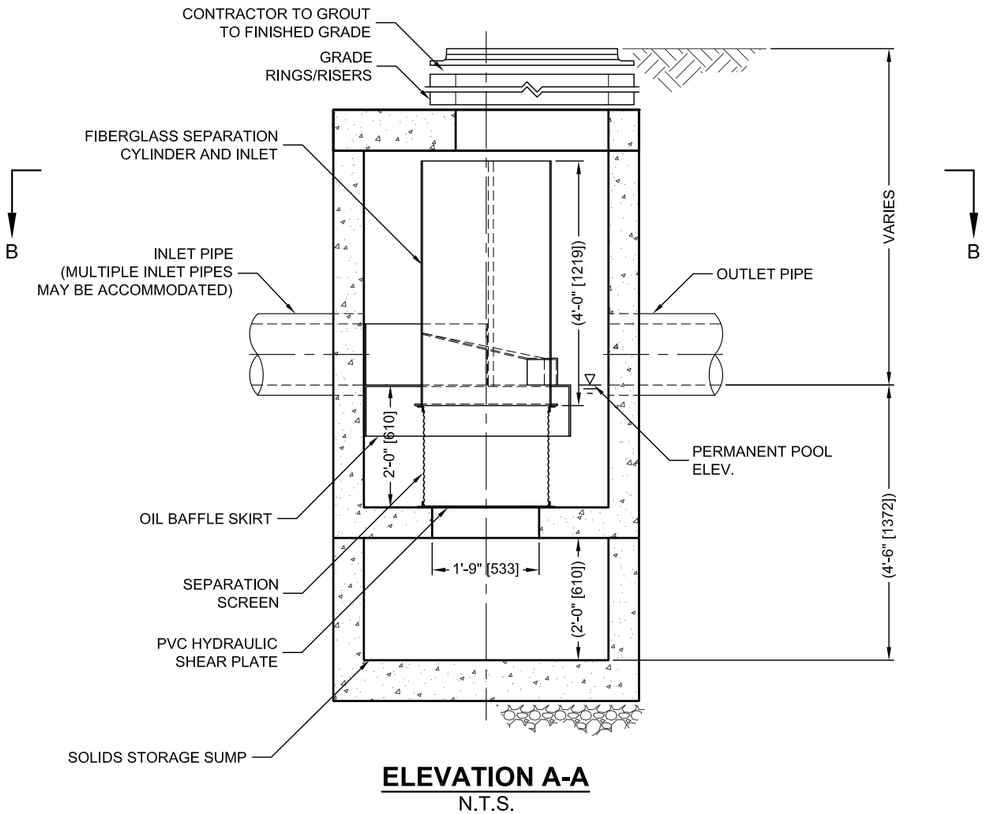
TABLE 1
Storm Water Treatment Device
Storage Capacities

CDS Model	Minimum Sump Storage Capacity $(yd^3)/(m^3)$	Minimum Oil Storage Capacity (gal)/(L)
CDS2015-4	0.9(0.7)	61(232)
CDS2015-5	1.5(1.1)	83(313)
CDS2020-5	1.5(1.1)	99(376)
CDS2025-5	1.5(1.1)	116(439)
CDS3020-6	2.1 (1.6)	184(696)
CDS3025-6	2.1(1.6)	210(795)
CDS3030-6	2.1 (1.6)	236(895)
CDS3035-6	2.1 (1.6)	263(994)
CDS3535-7	2.9(2.2)	377(1426)
CDS4030-8	5.6(4.3)	426(1612)
CDS4040-8	5.6 (4.3)	520(1970)
CDS4045-8	5.6 (4.3)	568(2149)
CDS5640-10	8.7(6.7)	758(2869)
CDS5653-10	8.7(6.7)	965(3652)
CDS5668-10	8.7(6.7)	1172(4435)
CDS5678-10	8.7(6.7)	1309(4956)
CDS7070-DV	3.6(2.8)	914 (3459)
CDS10060-DV	5.0 (3.8)	792 (2997)
CDS10080-DV	5.0 (3.8)	1057 (4000)
CDS100100-DV	5.0 (3.8)	1320 (4996)

END OF SECTION



PLAN VIEW B-B
N.T.S.



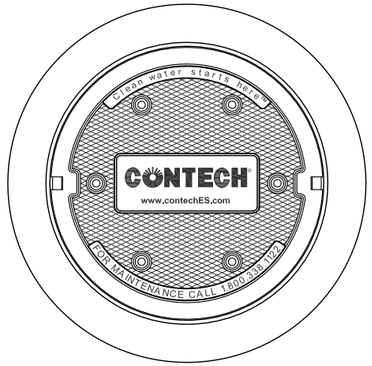
ELEVATION A-A
N.T.S.

THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING U.S. PATENTS: 5,788,848; 6,641,720; 6,511,595; 6,581,782; RELATED FOREIGN PATENTS, OR OTHER PATENTS PENDING.

CDS2015-4-C DESIGN NOTES

THE STANDARD CDS2015-4-C CONFIGURATION IS SHOWN. ALTERNATE CONFIGURATIONS ARE AVAILABLE AND ARE LISTED BELOW. SOME CONFIGURATIONS MAY BE COMBINED TO SUIT SITE REQUIREMENTS.

CONFIGURATION DESCRIPTION
GRATED INLET ONLY (NO INLET PIPE)
GRATED INLET WITH INLET PIPE OR PIPES
CURB INLET ONLY (NO INLET PIPE)
CURB INLET WITH INLET PIPE OR PIPES
SEPARATE OIL BAFFLE (SINGLE INLET PIPE REQUIRED FOR THIS CONFIGURATION)
SEDIMENT WEIR FOR NJDEP / NJCAT CONFORMING UNITS



FRAME AND COVER
(DIAMETER VARIES)
N.T.S.

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID	
WATER QUALITY FLOW RATE (CFS OR L/s)	*
PEAK FLOW RATE (CFS OR L/s)	*
RETURN PERIOD OF PEAK FLOW (YRS)	*
SCREEN APERTURE (2400 OR 4700)	*

PIPE DATA:	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	*	*	*
INLET PIPE 2	*	*	*
OUTLET PIPE	*	*	*

RIM ELEVATION	*

ANTI-FLOTATION BALLAST	WIDTH	HEIGHT
	*	*

NOTES/SPECIAL REQUIREMENTS:

* PER ENGINEER OF RECORD

GENERAL NOTES
1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH ( ) ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
3. FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.contechES.com
4. CDS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
5. STRUCTURE SHALL MEET AASHTO HS20 AND CASTINGS SHALL MEET HS20 (AASHTO M 306) LOAD RATING, ASSUMING GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION.
6. PVC HYDRAULIC SHEAR PLATE IS PLACED ON SHELF AT BOTTOM OF SCREEN CYLINDER. REMOVE AND REPLACE AS NECESSARY DURING MAINTENANCE CLEANING.

INSTALLATION NOTES
A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CDS MANHOLE STRUCTURE (LIFTING CLUTCHES PROVIDED).
C. CONTRACTOR TO ADD JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS, AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH PIPE INVERTS WITH ELEVATIONS SHOWN.
E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

CONTECH® ENGINEERED SOLUTIONS LLC
www.contechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CDS2015-4-C INLINE CDS STANDARD DETAIL

C:\USERS\SCHLACHTERH\DESKTOP\CDS DETAILS 180 MICRON SIZING\ACAD\CDS2015-4-C-DTL.DWG 5/19/2014 5:16 PM

Hydrodynamic Separation Product Calculator

Warehouse/Ofiice Site

Stafford Street (ST#2)

CDS 2015-4

Project Information					
Project Name	**Warehouse/Office Site**			**Option #**	A
Country	UNITED_STATES	**State**	Massachusetts	**City**	**Leicester**

Contact Information			
First Name	Peter	**Last Name**	Lavoie
Company	Summit	**Phone #**	508-987-8713
Email	plavoie@summitesinc.com		

Design Criteria					
Site Designation	**Stafford Street** (ST#2)			**Sizing Method**	Net Annual
Screening Required?	Yes	**Drainage Area (ac)**	0.28	**Peak Flow (cfs)**	**1.50**
Groundwater Depth (ft)	0 - 5	**Pipe Invert Depth (ft)**	0 - 5	**Bedrock Depth (ft)**	0 - 5
Multiple Inlets?	Yes	**Grate Inlet Required?**	No	**Pipe Size (in)**	12.00
Required Particle Size Distribution?	No	**90° between two inlets?**	No	**180° between inlet and outlet?**	No
Runoff Coefficient	0.90	**Rainfall Station**	70 - East Brimfield Lake, MA	**TC (Min)**	10

Treatment Selection					
Treatment Unit	CDS	**System Model**	2015-4		
Target Removal	80%	**Particle Size Distribution (PSD)**	125	**Predicted Net Annual Removal**	96.72%

Hydrodynamic Separation Product Calculator

Warehouse/Office Site

Stafford Street (ST#2)

CDS 2015-4

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION BASED ON THE RATIONAL RAINFALL METHOD								
Rainfall Intensity[1] (in/hr)	**% Rainfall Volume[1]**	**Cumulative Rainfall Volume**	**Rainfall Volume Treated**	**Total Flowrate (cfs)**	**Treated Flowrate (cfs)**	**Operating Rate (%)**	**Removal Efficiency (%)**	**Incremental Removal (%)**
							Removal Efficiency Adjustment[2] =	
							Predicted % Annual Rainfall Treated =	
							Predicted Net Annual Load Removal Efficiency =	96.72%
1 - Based on 14 years of 15-minute rainfall data from NCDC Station 2107, East Brimfield Lake, Worcester County, MA								
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.								

SECTION (_____)
STORM WATER TREATMENT DEVICE

1.0 GENERAL

1.1 This item shall govern the furnishing and installation of the CDS® by Contech Engineered Solutions LLC, complete and operable as shown and as specified herein, in accordance with the requirements of the plans and contract documents.

1.2 The Contractor shall furnish all labor, equipment and materials necessary to install the storm water treatment device(s) (SWTD) and appurtenances specified in the Drawings and these specifications.

1.3 The manufacturer of the SWTD shall be one that is regularly engaged in the engineering design and production of systems deployed for the treatment of storm water runoff for at least five (5) years and which have a history of successful production, acceptable to the Engineer. In accordance with the Drawings, the SWTD(s) shall be a CDS® device manufactured by:

Contech Engineered Solutions LLC
9025 Centre Pointe Drive
West Chester, OH, 45069
Tel: 1 800 338 1122

1.4 Related Sections

1.4.1 Section 02240: Dewatering
1.4.2 Section 02260: Excavation Support and Protection
1.4.3 Section 02315: Excavation and Fill
1.4.4 Section 02340: Soil Stabilization

1.5 All components shall be subject to inspection by the engineer at the place of manufacture and/or installation. All components are subject to being rejected or identified for repair if the quality of materials and manufacturing do not comply with the requirements of this specification. Components which have been identified as defective may be subject for repair where final acceptance of the component is contingent on the discretion of the Engineer.

1.6 The manufacturer shall guarantee the SWTD components against all manufacturer originated defects in materials or workmanship for a period of twelve (12) months from the date the components are delivered to the owner for installation. The manufacturer shall upon its determination repair, correct or replace any manufacturer originated defects advised in writing to the manufacturer within the referenced warranty period. The use of SWTD components shall be limited to the application for which it was specifically designed.

1.7 The SWTD manufacturer shall submit to the Engineer of Record a “Manufacturer’s Performance Certification” certifying that each SWTD is capable of achieving the specified removal efficiencies listed in these specifications. The certification shall be supported by independent third-party research

1.8 No product substitutions shall be accepted unless submitted 10 days prior to project bid date, or as directed by the Engineer of Record. Submissions for substitutions require review and approval by the Engineer of Record, for hydraulic performance, impact to project designs, equivalent treatment performance, and any required project plan and report (hydrology/hydraulic, water quality, stormwater pollution) modifications that would be required by the approving jurisdictions/agencies. Contractor to coordinate with the Engineer of Record any applicable modifications to the project estimates of cost, bonding amount determinations, plan check fees for changes to approved documents, and/or any other regulatory requirements resulting from the product substitution.

2.0 MATERIALS

2.1 Housing unit of stormwater treatment device shall be constructed of pre-cast or cast-in-place concrete, no exceptions. Precast concrete components shall conform to applicable sections of ASTM C 478, ASTM C 857 and ASTM C 858 and the following:

2.1.1 Concrete shall achieve a minimum 28-day compressive strength of 4,000 pounds per square-inch (psi);

2.1.2 Unless otherwise noted, the precast concrete sections shall be designed to withstand lateral earth and AASHTO H-20 traffic loads;

2.1.3 Cement shall be Type III Portland Cement conforming to ASTM C 150;

2.1.4 Aggregates shall conform to ASTM C 33;

2.1.5 Reinforcing steel shall be deformed billet-steel bars, welded steel wire or deformed welded steel wire conforming to ASTM A 615, A 185, or A 497.

2.1.6 Joints shall be sealed with preformed joint sealing compound conforming to ASTM C 990.

2.1.7 Shipping of components shall not be initiated until a minimum compressive strength of 4,000 psi is attained or five (5) calendar days after fabrication has expired, whichever occurs first.

2.2 Internal Components and appurtenances shall conform to the following:

2.2.1 Screen and support structure shall be manufactured of Type 316 and 316L stainless steel conforming to ASTM F 1267-01;

2.2.2 Hardware shall be manufactured of Type 316 stainless steel conforming to ASTM A 320;

2.2.3 Fiberglass components shall conform to applicable sections of ASTM D-4097

2.2.4 Access system(s) conform to the following:

2.2.5 Manhole castings shall be designed to withstand AASHTO H-20 loadings and manufactured of cast-iron conforming to ASTM A 48 Class 30.

3.0 PERFORMANCE

3.1 The SWTD shall be sized to either achieve an 80 percent average annual reduction in the total suspended solid load with a particle size distribution having a mean particle size (d_{50}) of 125 microns unless otherwise stated.

3.2 The SWTD shall be capable of capturing and retaining 100 percent of pollutants greater than or equal to 2.4 millimeters (mm) regardless of the pollutant's specific gravity (i.e.: floatable and neutrally buoyant materials) for flows up to the device's rated-treatment capacity. The SWTD shall be designed to retain all previously captured pollutants addressed by this

subsection under all flow conditions. The SWTD shall be capable of capturing and retaining total petroleum hydrocarbons. The SWTD shall be capable of achieving a removal efficiency of 92 and 78 percent when the device is operating at 25 and 50 percent of its rated-treatment capacity. These removal efficiencies shall be based on independent third-party research for influent oil concentrations representative of storm water runoff (20 ± 5 mg/L). The SWTD shall be greater than 99 percent effective in controlling dry-weather accidental oil spills.

3.3 The SWTD shall be designed with a sump chamber for the storage of captured sediments and other negatively buoyant pollutants in between maintenance cycles. The minimum storage capacity provided by the sump chamber shall be in accordance with the volume listed in Table 1. The boundaries of the sump chamber shall be limited to that which do not degrade the SWTD's treatment efficiency as captured pollutants accumulate. The sump chamber shall be separate from the treatment processing portion(s) of the SWTD to minimize the probability of fine particle re-suspension. In order to not restrict the Owner's ability to maintain the SWTD, the minimum dimension providing access from the ground surface to the sump chamber shall be 16 inches in diameter.

3.4 The SWTD shall be designed to capture and retain Total Petroleum Hydrocarbons generated by wet-weather flow and dry-weather gross spills and have a capacity listed in Table 1 of the required unit.

3.5 The SWTD shall convey the flow from the peak storm event of the drainage network, in accordance with required hydraulic upstream conditions as defined by the Engineer. If a substitute SWTD is proposed, supporting documentation shall be submitted that demonstrates equal or better upstream hydraulic conditions compared to that specified herein. This documentation shall be signed and sealed by a Professional Engineer registered in the State of the work. All costs associated with preparing and certifying this documentation shall be born solely by the Contractor.

3.6 The SWTD shall have completed field tested following TARP Tier II protocol requirements

4.0 EXECUTION

4.1 The contractor shall exercise care in the storage and handling of the SWTD components prior to and during installation. Any repair or replacement costs associated with events occurring after delivery is accepted and unloading has commenced shall be borne by the contractor.

4.2 The SWTD shall be installed in accordance with the manufacturer's recommendations and related sections of the contract documents. The manufacturer shall provide the contractor installation instructions and offer on-site guidance during the important stages of the installation as identified by the manufacturer at no additional expense. A minimum of 72 hours notice shall be provided to the manufacturer prior to their performance of the services included under this subsection.

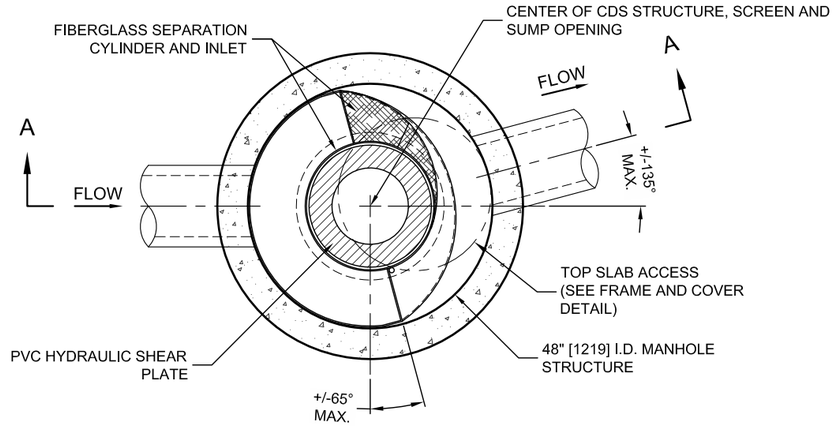
4.3 The contractor shall fill all voids associated with lifting provisions provided by the manufacturer. These voids shall be filled with non-shrinking grout providing a finished surface consistent with adjacent surfaces. The contractor shall trim all protruding lifting provisions flush with the adjacent concrete surface in a manner, which leaves no sharp points or edges.

4.4 The contractor shall removal all loose material and pooling water from the SWTD prior to the transfer of operational responsibility to the Owner.

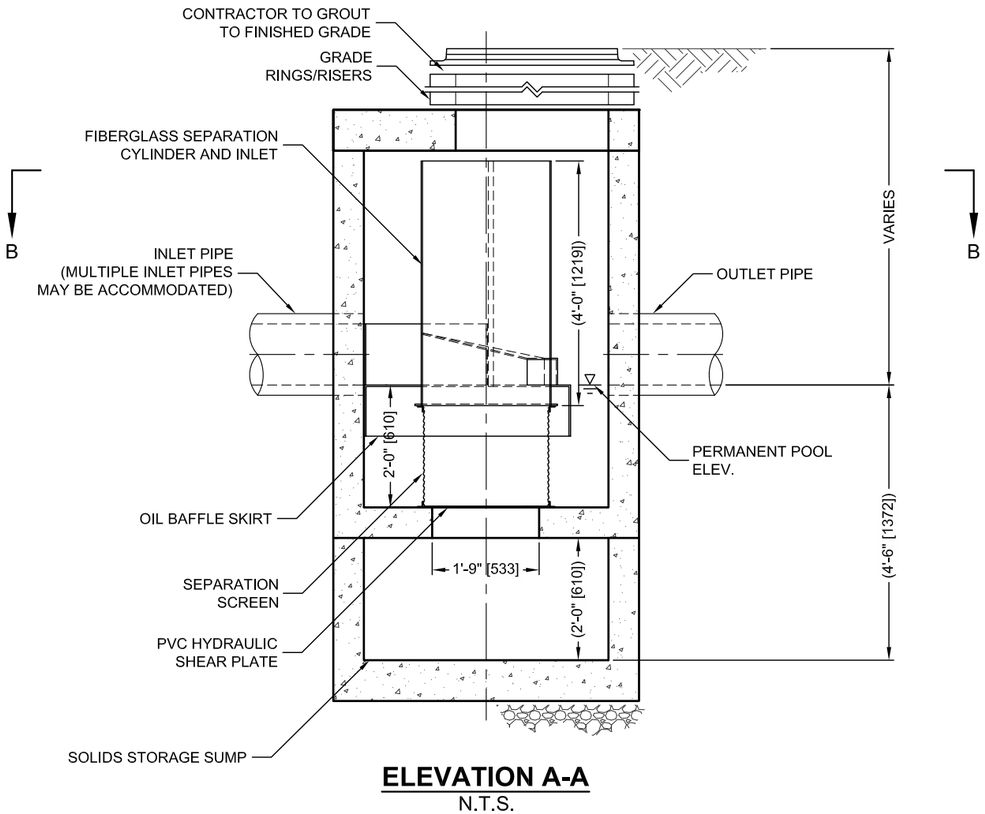
TABLE 1
Storm Water Treatment Device
Storage Capacities

CDS Model	Minimum Sump Storage Capacity $(yd^3)/(m^3)$	Minimum Oil Storage Capacity (gal)/(L)
CDS2015-4	0.9(0.7)	61(232)
CDS2015-5	1.5(1.1)	83(313)
CDS2020-5	1.5(1.1)	99(376)
CDS2025-5	1.5(1.1)	116(439)
CDS3020-6	2.1 (1.6)	184(696)
CDS3025-6	2.1(1.6)	210(795)
CDS3030-6	2.1 (1.6)	236(895)
CDS3035-6	2.1 (1.6)	263(994)
CDS3535-7	2.9(2.2)	377(1426)
CDS4030-8	5.6(4.3)	426(1612)
CDS4040-8	5.6 (4.3)	520(1970)
CDS4045-8	5.6 (4.3)	568(2149)
CDS5640-10	8.7(6.7)	758(2869)
CDS5653-10	8.7(6.7)	965(3652)
CDS5668-10	8.7(6.7)	1172(4435)
CDS5678-10	8.7(6.7)	1309(4956)
CDS7070-DV	3.6(2.8)	914 (3459)
CDS10060-DV	5.0 (3.8)	792 (2997)
CDS10080-DV	5.0 (3.8)	1057 (4000)
CDS100100-DV	5.0 (3.8)	1320 (4996)

END OF SECTION



PLAN VIEW B-B
N.T.S.



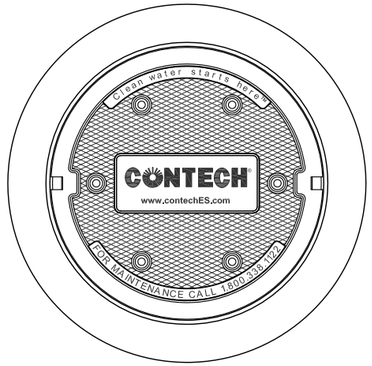
ELEVATION A-A
N.T.S.

THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING U.S. PATENTS: 5,788,848; 6,641,720; 6,511,595; 6,581,782; RELATED FOREIGN PATENTS, OR OTHER PATENTS PENDING.

CDS2015-4-C DESIGN NOTES

THE STANDARD CDS2015-4-C CONFIGURATION IS SHOWN. ALTERNATE CONFIGURATIONS ARE AVAILABLE AND ARE LISTED BELOW. SOME CONFIGURATIONS MAY BE COMBINED TO SUIT SITE REQUIREMENTS.

CONFIGURATION DESCRIPTION
GRATED INLET ONLY (NO INLET PIPE)
GRATED INLET WITH INLET PIPE OR PIPES
CURB INLET ONLY (NO INLET PIPE)
CURB INLET WITH INLET PIPE OR PIPES
SEPARATE OIL BAFFLE (SINGLE INLET PIPE REQUIRED FOR THIS CONFIGURATION)
SEDIMENT WEIR FOR NJDEP / NJCAT CONFORMING UNITS



FRAME AND COVER
(DIAMETER VARIES)
N.T.S.

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID	
WATER QUALITY FLOW RATE (CFS OR L/s)	*
PEAK FLOW RATE (CFS OR L/s)	*
RETURN PERIOD OF PEAK FLOW (YRS)	*
SCREEN APERTURE (2400 OR 4700)	*

PIPE DATA:	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	*	*	*
INLET PIPE 2	*	*	*
OUTLET PIPE	*	*	*

RIM ELEVATION	*

ANTI-FLOTATION BALLAST	WIDTH	HEIGHT
	*	*

NOTES/SPECIAL REQUIREMENTS:

* PER ENGINEER OF RECORD

GENERAL NOTES
1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH ( ) ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
3. FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.contechES.com
4. CDS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
5. STRUCTURE SHALL MEET AASHTO HS20 AND CASTINGS SHALL MEET HS20 (AASHTO M 306) LOAD RATING, ASSUMING GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION.
6. PVC HYDRAULIC SHEAR PLATE IS PLACED ON SHELF AT BOTTOM OF SCREEN CYLINDER. REMOVE AND REPLACE AS NECESSARY DURING MAINTENANCE CLEANING.

INSTALLATION NOTES
A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CDS MANHOLE STRUCTURE (LIFTING CLUTCHES PROVIDED).
C. CONTRACTOR TO ADD JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS, AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH PIPE INVERTS WITH ELEVATIONS SHOWN.
E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

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CDS2015-4-C INLINE CDS STANDARD DETAIL

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