RECEIVED
By Mattie VandenBoom at 2:19 pm, May 01, 2024

Drainage Analysis For
11 CLIFF STREET
WORCESTER, MA

Prepared for
LILI LLC
1127 GRAFTON STREET
WORCESTER, MA
April 10, 2024

Prepared by
ALPHA OMEGA ENGINEERING, INC.
25 Highland View Drive
Sutton, MA 01590

Roumany A. Wasef, P.E.

EXISTING CONDITIONS:

The site is located off Cliff Street. Presently, ground cover is wood. Existing site has one drainage catchment areas. Area A slopes about 13% easterly towards abutting property. The predominant soil on site from soil maps is Canton fine sandy loam, hydrologic soil type B and Ridgebury fine sandy loam, hydrologic soil type D. However, the soil testing shows all Canton fine sandy loam, hydrologic soil type B

DEVELOPED CONDITIONS:

Development of the site will result in the creation of a new Building and parking area The increase of storm water run-off will be sent to an underground detention/infiltration system to attenuate increased run-off rates as a result of development. The detention/infiltration system IS located in sub-catchment area A2.

ANALYSIS:

The goal of the stormwater management system proposed is to ensure that there is no increase in peak run-off rates downstream of the site. This goal is achieved using the proposed detention/infiltration system that has been carefully sized to attenuate flow rates for the 100 year storm event.

CALCULATIONS:

The storm modeling and routings were performed using HydroCAD.

SUMMARY:

A) Runoff Rate - cfs

	2 Year		*10 Year*		*25 Year*		*100 Year*	
Area	***Pre***	***Post***	***Pre***	***Post***	***Pre***	***Post***	***Pre***	***Post***
A	.11	.09	.76	.41	1.53	.73	3.45	1.91

Table 1

B) Runoff Volume - af

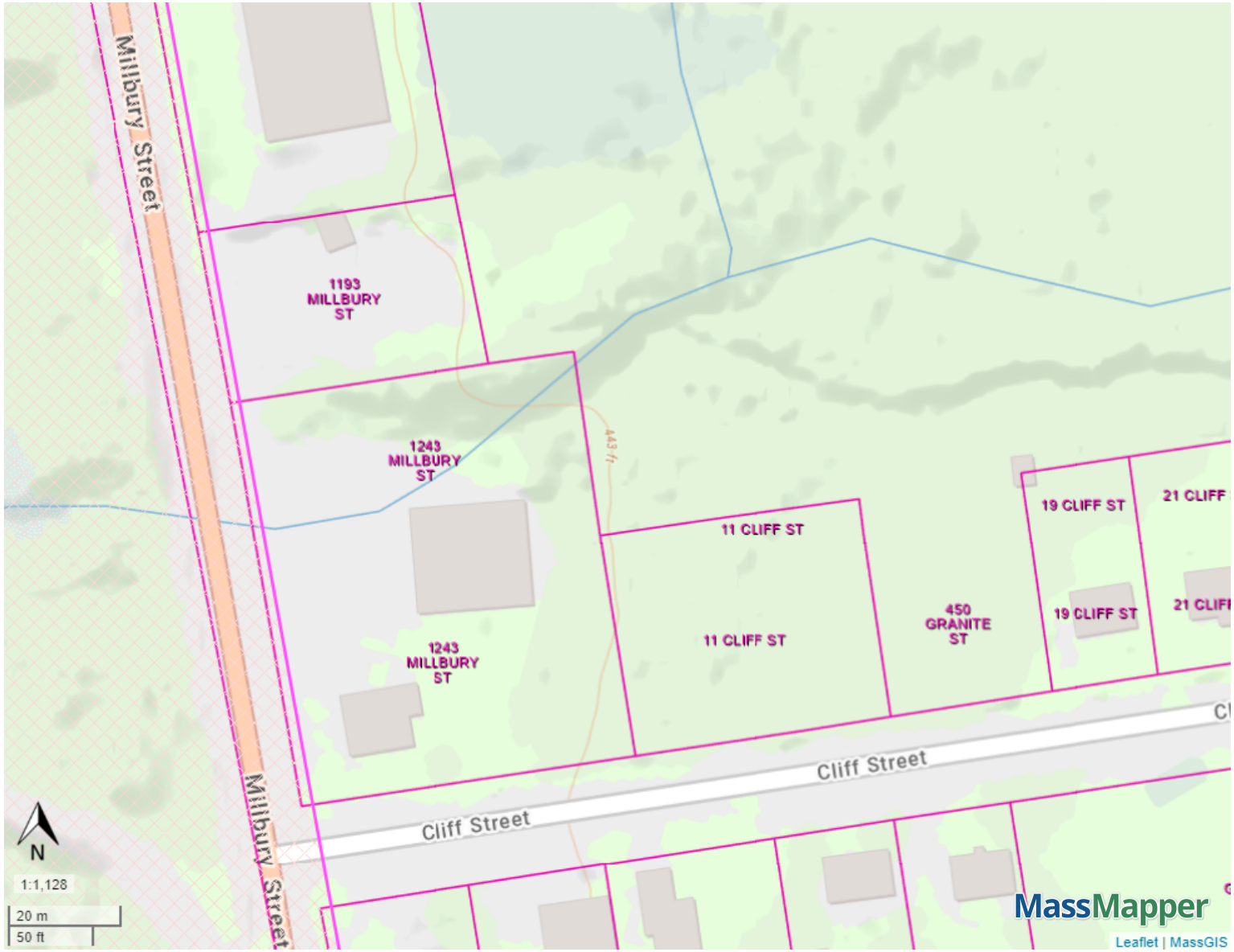
	2 Year		*10 Year*		*25 Year*		*100 Year*	
Area	***Pre***	***Post***	***Pre***	***Post***	***Pre***	***Post***	***Pre***	***Post***
A	.018	.010	.066	.031	.117	.063	.247	.210

Table 2

CONCLUSIONS:

From this analysis we conclude that no net increase in peak run-off rates and volumes will occur as a result of the development of this site. The total net peak run-off rates and volumes from this site will be reduced as a result of the development.

11 Cliff Street, Worcester



Zone IIs

Zone Is

IWPAs

NHESP Estimated Habitats of Rare Wildlife

NHESP Priority Habitats of Rare Species

Property Tax Parcels

NOTES TO USERS

is for use in administering the National Flood Insurance Program. It does sarily identify all areas subject to flooding, particularly from local drainage of small size. The **community map repository** should be consulted for pdated or additional flood hazard information.

more detailed information in areas where **Base Flood Elevations** (BFEs) **odways** have been determined, users are encouraged to consult the Flood nd Floodway Data and/or Summary of Stillwater Elevations tables contained Flood Insurance Study (FIS) Report that accompanies this FIRM. Users e aware that BFEs shown on the FIRM represent rounded whole-foot . These BFEs are intended for flood insurance rating purposes only and t be used as the sole source of flood elevation information. Accordingly, ation data presented in the FIS Report should be utilized in conjunction with ful purposes of construction and/or floodplain management.

Base Flood Elevations shown on this map apply only landward of 0.0' erican Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be at coastal flood elevations are also provided in the Summary of Stillwater s table in the Flood Insurance Study Report for this jurisdiction. Elevations the Summary of Stillwater Elevations table should be used for construction odplain management purposes when they are higher than the elevations this FIRM.

es of the **floodways** were computed at cross sections and interpolated cross sections. The floodways were based on hydraulic considerations with requirements of the National Flood Insurance Program. Floodway widths pertinent floodway data are provided in the Flood Insurance Study Report isdiction.

eas not in Special Flood Hazard Areas may be protected by **flood control s**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance port for information on flood control structures for this jurisdiction.

ection used in the preparation of this map was Massachusetts State Plane Zone (FIPS zone 2001). The **horizontal datum** was NAD 83, GRS 1980 . Differences in datum, spheroid, projection or UTM zones used in the n of FIRMs for adjacent jurisdictions may result in slight positional s in map features across jurisdiction boundaries. These differences do not accuracy of this FIRM.

vations on this map are referred to the North American Vertical Datum of ese flood elevations must be compared to structure and ground elevations d to the same **vertical datum**. For information regarding conversion the National Geodetic Vertical Datum of 1929 and the North American Datum of 1988, visit the National Geodetic Survey website at w.ngs.noaa.gov or contact the National Geodetic Survey at the following

rmation Services
NGS12
Geodetic Survey
#9202
t-West Highway
ng, Maryland 20910-3282
-3242

current elevation, description, and/or location information for **bench marks** this map, please contact the Information Services Branch of the National Survey at **(301) 713- 3242**, or visit its website at http://www.ngs.noaa.gov.

o information shown on this FIRM was derived from digital orthophotography files were provided in digital format by Massachusetts Geographic n Systems (MassGIS). Ortho imagery was produced at a scale of 1:5,000. otography is dated April 2005.

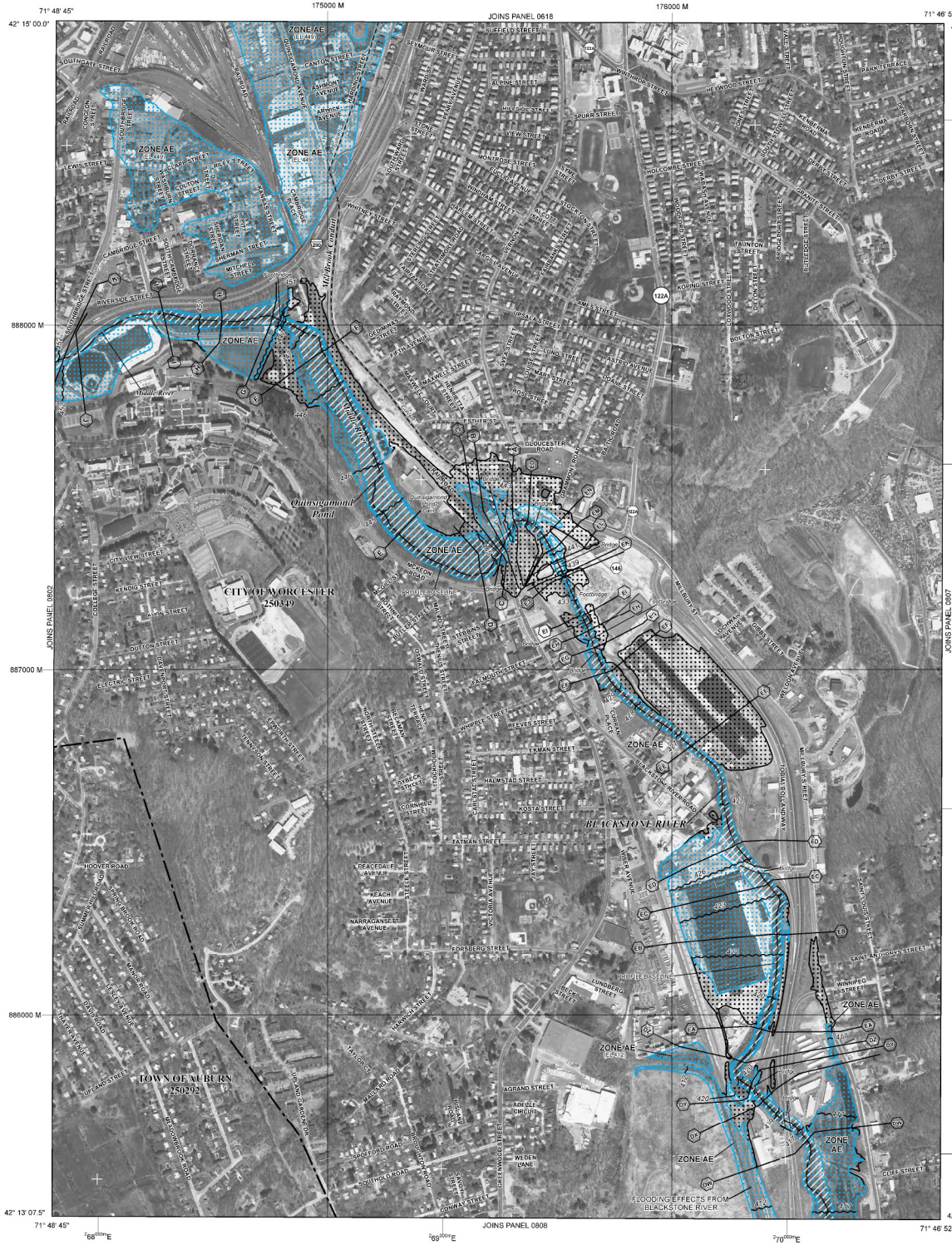
e baselines depicted on this map represent the hydraulic modeling baselines n the flood profiles in the FIS report. As a result of improved topographic data, **e baseline**, in some cases, may deviate significantly from the channel or appear outside the SFHA.

e limits shown on this map are based on the best data available at the time tion. Because changes due to annexations or de-annexations may have after this map was published, map users should contact appropriate y officials to verify current corporate limit locations.

fer to the separately printed **Map Index** for an overview map of the owing the layout of map panels; community map repository addresses; ting of Communities table containing National Flood Insurance Program each community as well as a listing of the panels on which each community .

mation on available products associated with this FIRM visit the **Map Center (MSC)** website at http://msc.fema.gov. Available products may reviously issued Letters of Map Change, a Flood Insurance Study Report, gital versions of this map. Many of these products can be ordered or directly from the MSC website.

ve **questions about this map,** how to order products, or the National surance Program in general, please call the **FEMA Map Information e (FMIX)** at **1-877-FEMA-MAP** (1-877-336-2627) or visit the FEMA t http://www.fema.gov/business/nfip.



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood a 1% chance of being equalled or exceeded in any given year. The Special Flood Hazard the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Haza include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water- elevation of the 1% annual chance flood.

ZONE A No Base Flood Elevations determined.

ZONE AE Base Flood Elevations determined.

ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood El determined.

ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); av depths determined. For areas of alluvial fan flooding, velocities also d

ZONE AR Special Flood Hazard Areas formerly protected from the 1% annual ch flood by a flood control system that was subsequently decertified. Zo AR indicates that the former flood control system is being restored to protection from the 1% annual chance or greater flood.

ZONE A99 Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations deter

ZONE V Coastal flood zone with velocity hazard (wave action); no Base Flood determined.

ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood El determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be k encroachment so that the 1% annual chance flood can be carried without substantial inc flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood wi average depths of less than 1 foot or with drainage areas less than 1 squ mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Are

- 1% Annual Chance Floodplain Boundary
- 0.2% Annual Chance Floodplain Boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Area Zones and bo dividing Special Flood Hazard Areas of different Base Flood flood depths, or flood velocities.
- 513 Base Flood Elevation line and value; elevation in feet*
- (EL 987) Base Flood Elevation value where uniform within zone; ele feet*

*Referenced to the North American Vertical Datum of 1988

- A—A Cross section line
- 23—23 Transect line
- Culvert
- Bridge
- 45° 02' 08", 93° 02' 12" Geographic coordinates referenced to the North American I 1983 (NAD 83) Western Hemisphere
- 4989000 M 1000-meter ticks: Massachusetts State Plane Mainland Zon (FIPS Zone 2001), Lambert Conformal Conic projection
- 4989000mN 1000-meter Universal Transverse Mercator grid values, zon
- DX5510 Bench mark (see explanation in Notes to Users section of t panel)
- M1.5 River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
July 4, 2011

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Commun Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance a or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET
150 0 150 300 METERS

NFIP NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0806E

FIRM

FLOOD INSURANCE RATE M

WORCESTER COUNT MASSACHUSETTS
(ALL JURISDICTIONS)

PANEL 806 OF 1075
(SEE MAP INDEX FOR FIRM PANEL LA

CONTAINS:

COMMUNITY	NUMBER	PANEL
AUBURN, TOWN OF	250292	0806
WORCESTER, CITY OF	250349	0806

Notice to User: The **Map Number** sho should be used when placing map or **Community Number** shown above s used on insurance applications for the community.

MAP NU 25027C

EFFECTIVE JULY 4

Federal Emergency Management

Extreme Precipitation Tables

Northeast Regional Climate Center

Data represents point estimates calculated from partial duration series. All precipitation amounts are displayed in inches.

Metadata for Point	
Smoothing	Yes
State	
Location	
Latitude	42.220 degrees North
Longitude	71.783 degrees West
Elevation	130 feet
Date/Time	Thu Oct 12 2023 15:55:20 GMT-0400 (Eastern Daylight Time)

Extreme Precipitation Estimates

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.28	0.42	0.53	0.69	0.86	1.09	**1yr**	0.74	1.07	1.27	1.62	2.07	2.67	2.90	**1yr**	2.36	2.79	3.20	3.88	4.47	**1yr**
2yr	0.35	0.54	0.67	0.88	1.11	1.40	**2yr**	0.96	1.27	1.62	2.04	2.58	3.26	3.52	**2yr**	2.89	3.38	3.88	4.60	5.24	**2yr**
5yr	0.41	0.64	0.80	1.07	1.37	1.75	**5yr**	1.18	1.58	2.04	2.58	3.26	4.12	4.47	**5yr**	3.65	4.30	4.93	5.76	6.48	**5yr**
10yr	0.46	0.72	0.91	1.24	1.61	2.08	**10yr**	1.39	1.86	2.43	3.09	3.90	4.92	5.36	**10yr**	4.35	5.16	5.90	6.84	7.62	**10yr**
25yr	0.54	0.86	1.10	1.51	2.00	2.60	**25yr**	1.73	2.31	3.06	3.90	4.94	6.22	6.82	**25yr**	5.51	6.56	7.49	8.58	9.45	**25yr**
50yr	0.60	0.97	1.25	1.75	2.36	3.10	**50yr**	2.03	2.72	3.66	4.68	5.92	7.43	8.20	**50yr**	6.58	7.88	8.98	10.18	11.12	**50yr**
100yr	0.69	1.12	1.44	2.04	2.78	3.68	**100yr**	2.40	3.21	4.36	5.58	7.07	8.89	9.85	**100yr**	7.87	9.47	10.77	12.10	13.09	**100yr**
200yr	0.78	1.28	1.66	2.38	3.28	4.38	**200yr**	2.83	3.79	5.20	6.68	8.46	10.63	11.84	**200yr**	9.40	11.39	12.91	14.37	15.41	**200yr**
500yr	0.94	1.54	2.01	2.92	4.09	5.51	**500yr**	3.53	4.71	6.56	8.45	10.73	13.47	15.12	**500yr**	11.92	14.54	16.43	18.06	19.14	**500yr**

Lower Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.21	0.32	0.39	0.53	0.65	0.96	**1yr**	0.56	0.94	1.11	1.46	1.90	2.36	2.54	**1yr**	2.09	2.44	2.90	3.53	4.15	**1yr**
2yr	0.34	0.53	0.65	0.88	1.08	1.26	**2yr**	0.93	1.23	1.44	1.90	2.44	3.14	3.40	**2yr**	2.78	3.27	3.73	4.43	5.05	**2yr**
5yr	0.38	0.59	0.73	1.01	1.28	1.50	**5yr**	1.11	1.47	1.71	2.25	2.87	3.80	4.14	**5yr**	3.36	3.98	4.55	5.28	5.92	**5yr**
10yr	0.42	0.65	0.81	1.13	1.46	1.71	**10yr**	1.26	1.67	1.94	2.54	3.23	4.36	4.77	**10yr**	3.86	4.59	5.25	6.01	6.65	**10yr**
25yr	0.49	0.75	0.93	1.33	1.75	2.04	**25yr**	1.51	1.99	2.30	3.02	3.81	5.23	5.78	**25yr**	4.63	5.55	6.33	7.12	7.77	**25yr**
50yr	0.55	0.83	1.04	1.49	2.01	2.32	**50yr**	1.73	2.27	2.62	3.43	4.30	6.01	6.69	**50yr**	5.32	6.43	7.30	8.10	8.75	**50yr**
100yr	0.61	0.93	1.16	1.68	2.31	2.65	**100yr**	1.99	2.59	2.98	3.89	4.88	6.89	7.75	**100yr**	6.10	7.45	8.44	9.21	9.83	**100yr**
200yr	0.69	1.04	1.31	1.90	2.65	3.03	**200yr**	2.29	2.96	3.39	4.45	5.54	7.91	8.98	**200yr**	7.00	8.63	9.75	10.45	11.02	**200yr**
500yr	0.81	1.20	1.54	2.24	3.19	3.62	**500yr**	2.75	3.54	4.03	5.31	6.57	9.51	10.92	**500yr**	8.42	10.50	11.80	12.35	12.82	**500yr**

Upper Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.31	0.48	0.58	0.78	0.96	1.19	**1yr**	0.83	1.16	1.38	1.76	2.31	2.98	3.21	**1yr**	2.64	3.08	3.58	4.19	4.82	**1yr**
2yr	0.36	0.56	0.69	0.93	1.15	1.35	**2yr**	0.99	1.32	1.55	2.01	2.58	3.42	3.67	**2yr**	3.02	3.53	4.07	4.81	5.47	**2yr**
5yr	0.44	0.67	0.84	1.15	1.46	1.75	**5yr**	1.26	1.71	2.01	2.58	3.25	4.44	4.84	**5yr**	3.93	4.66	5.32	6.28	7.16	**5yr**
10yr	0.51	0.79	0.98	1.36	1.76	2.13	**10yr**	1.52	2.09	2.45	3.11	3.87	5.46	6.01	**10yr**	4.83	5.78	6.58	7.73	8.77	**10yr**
25yr	0.64	0.97	1.20	1.72	2.26	2.78	**25yr**	1.95	2.72	3.17	3.95	4.89	7.19	8.00	**25yr**	6.36	7.70	8.71	10.17	11.50	**25yr**
50yr	0.75	1.13	1.41	2.03	2.73	3.39	**50yr**	2.36	3.32	3.88	4.76	5.83	8.86	9.94	**50yr**	7.84	9.56	10.78	12.53	14.13	**50yr**
100yr	0.88	1.33	1.67	2.41	3.31	4.15	**100yr**	2.85	4.05	4.74	5.74	6.95	10.91	12.36	**100yr**	9.65	11.88	13.35	15.45	17.38	**100yr**
200yr	1.04	1.56	1.98	2.87	4.00	5.08	**200yr**	3.45	4.96	5.80	6.89	8.28	13.45	15.37	**200yr**	11.90	14.78	16.52	19.06	21.39	**200yr**
500yr	1.30	1.93	2.49	3.61	5.14	6.63	**500yr**	4.44	6.48	7.56	8.81	10.44	17.72	20.53	**500yr**	15.68	19.74	21.89	25.19	28.17	**500yr**

Powered by ACIS
Northeast Regional Climate Center

Alpha Omega Engineering Inc.
25 Highland View Dr
Sutton, MA 01590
Ph: 508-865-9551
Fax: 508-499-6213
info@alphaomegaeng.net
www.alphaomegaeng.net

STORMWATER MANAGEMENT SYSTEM
OPERATION AND MAINTENANCE PLAN

For

11 Cliff Street
Worcester, MA

April 10, 2024

The owner and party responsible for the operation and maintenance of the Stormwater Management System within the parking, and driveway areas is the Contractor and owner of the site.

The Stormwater Management System shall be inspected and maintained annually. 11 Cliff Street, Worcester MA has been designed using the best Stormwater Management practices currently recommended by the Massachusetts DEP. The following components have been used in the design with the recommended maintenance criteria for each one.

1) Stormceptor maintenance recommendations

a. Units should be inspected post-construction, prior to being put into service.

b. Inspect every six months for the first year of operation to determine the oil and sediment accumulation rate.

c. In subsequent years, inspections can be based on first-year observations or local requirements.

d. Cleaning is required once the sediment depth reaches 15% of storage capacity, (generally taking one year or longer).

e. Inspect the unit immediately after an oil, fuel or chemical spill.

f. A licensed waste management company should remove captured petroleum waste products from any oil, chemical or fuel spills and dispose responsibly.

2) Stormceptor® Maintenance Procedures

Maintenance of the **Storm***ceptor*® is performed using vacuum trucks. No entry into the unit is required for maintenance. The Vacuum Service Industry is a well established sector of the service industry which cleans underground tanks, sewers and catch-basins. Costs to clean the **Storm***ceptor*® vary based on the size of unit and transportation distances.

The Stormceptor unit must be cleaned by the contractor after the site is stabilized.

2.1 Maintenance Frequency

Annual maintenance is recommended. Approximately 15% of the **Storm***ceptor*® total sediment capacity will be reduced each year based on the maximum impervious drainage.

Although it is recommended that annual maintenance be performed initially, the frequency of maintenance may need to be increased or reduced based on local conditions (i.e. if the unit is filling up with sediment more quickly than projected, maintenance may be required semi-annually; conversely once the site has stabilized maintenance may only be required once every two or three years).

2.2 Spills

The **Storm***ceptor*® is often implemented in areas where the potential for spills is great. The **Storm***ceptor*® should be cleaned immediately after a spill occurs by a licensed liquid waste hauler.

2.3 Disposal

Disposal options for the sediment will probably range from disposal in a works yard to disposal in a sanitary landfill site. It is not anticipated that the sediment would be classified as hazardous waste. Petroleum waste products collected in the **Storm***ceptor*® (oil/chemical/fuel spills) should be removed by a licensed waste management company.

2.4 Inspection

The **Storm***ceptor*® can be easily inspected from the surface by removing the maintenance cover. The presence of oil in the interceptor can be determined by inserting a tube dipstick in the 6" (150 mm) vent tube.

Similarly, the depth of sediment can be measured from the surface without entry into the **Storm***ceptor*® via a dipstick tube equipped with a ball valve (Sludge Judge). Maintenance

should be performed once the sediment depth exceeds the guideline values provided in Table 6.

Table 6. Sediment Depths Indicating Required Maintenance*	
Model	Sediment Depth (feet)
450I	0.50

* based on 15% of the interceptor's sediment storage

- Any potential obstructions at the inlet can be observed from the surface. The insert has been designed as a platform for maintenance personnel in the event that obstructions need to be removed, sewer flushing needs to be performed, or camera surveys are required.

3) Parking lot Maintenance

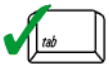
Parking lot must be swept twice a year.

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

Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

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

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

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

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

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

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

Massachusetts Department of Environmental Protection
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.

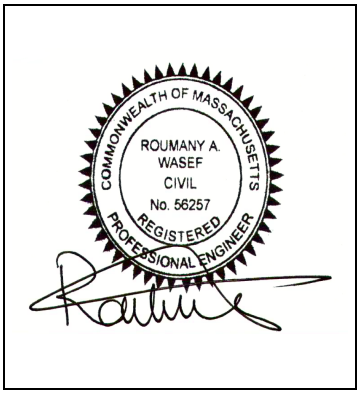
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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



04/10/2024
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 RainGardens)

☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)

☐ Treebox Filter

☐ Water Quality Swale

☐ Grass Channel

☐ Green Roof

☒ Other (describe): Hydrodynamic Separators and Infiltration Chambers

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.

Soil Map—Worcester County, Massachusetts, Northeastern Part
(11 Cliff St, Worcester)

Map Scale: 1:573 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 5 10 20 30

Feet
0 25 50 100 150

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 1:20,000.

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, Northeastern Part
Survey Area Data: Version 17, Sep 9, 2022

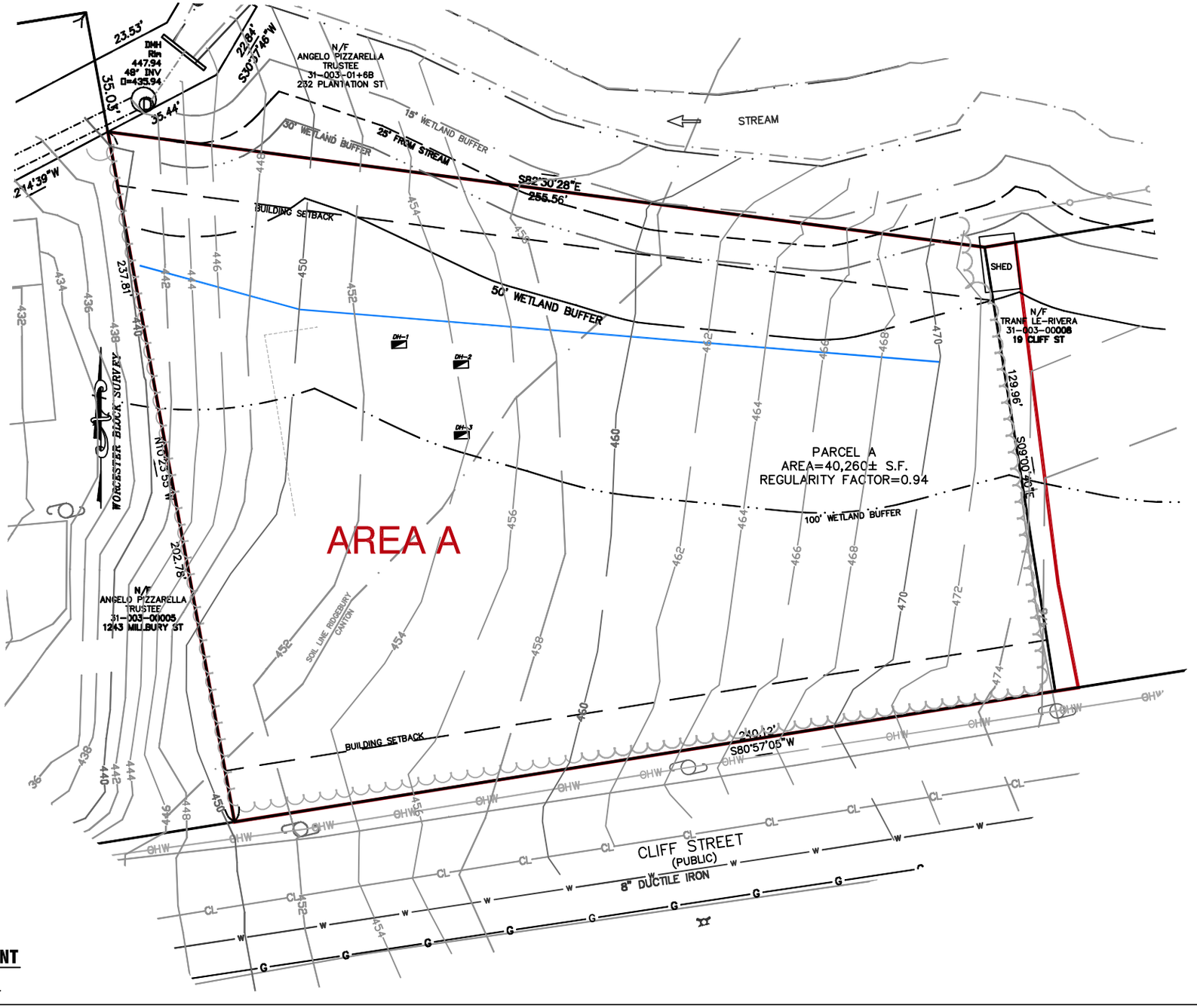
Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

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

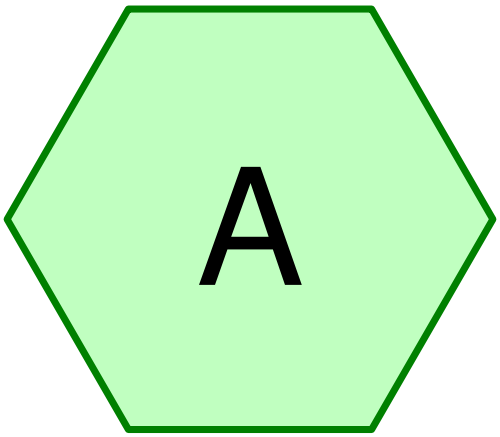
The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
71B	Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony	0.5	44.0%
422B	Canton fine sandy loam, 0 to 8 percent slopes, extremely stony	0.1	9.5%
422C	Canton fine sandy loam, 8 to 15 percent slopes, extremely stony	0.5	46.4%
Totals for Area of Interest		**1.1**	**100.0%**



PRE DEVELOPMENT
SCALE 1"=40'



Area A

Subcat Reach Pond Link

Drainage Diagram for 22-0654 Pre
Prepared by Alpha Omega Engineering Inc, Printed 4/10/2024

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.945	55	Woods, Good, HSG B (A)
0.945		**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.945	HSG B	A
0.000	HSG C	
0.000	HSG D	
0.000	Other	
0.945		**TOTAL AREA**

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

Subcatchment A: Area A Runoff Area=41,184 sf 0.00% Impervious Runoff Depth>0.23"
Flow Length=234' Slope=0.1300 '/' Tc=7.5 min CN=55 Runoff=0.11 cfs 0.018 af

Total Runoff Area = 0.945 ac Runoff Volume = 0.018 af Average Runoff Depth = 0.23"
100.00% Pervious = 0.945 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment A: Area A

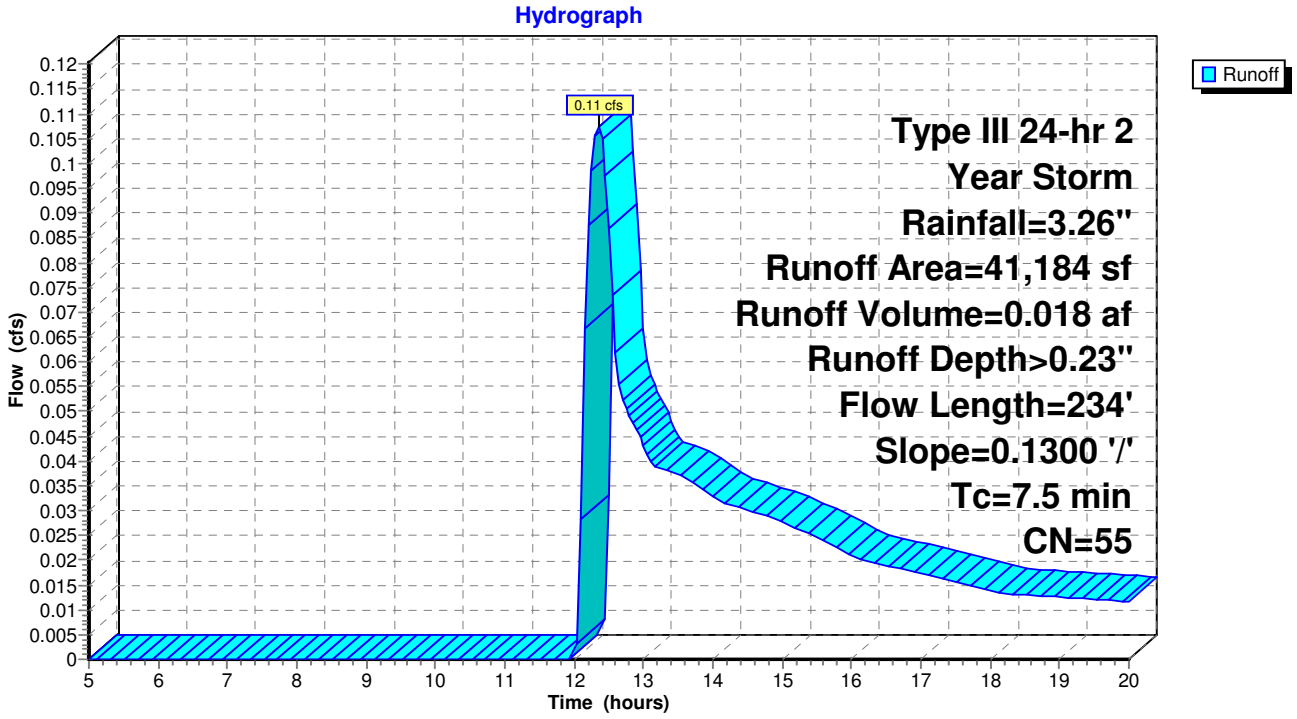
Runoff = 0.11 cfs @ 12.35 hrs, Volume= 0.018 af, Depth> 0.23"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.26"

Area (sf)	CN	Description
41,184	55	Woods, Good, HSG B
41,184		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	50	0.1300	0.14		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
1.7	184	0.1300	1.80		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
7.5	234	Total			

Subcatchment A: Area A



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

Subcatchment A: Area A Runoff Area=41,184 sf 0.00% Impervious Runoff Depth>0.84"
Flow Length=234' Slope=0.1300 '/' Tc=7.5 min CN=55 Runoff=0.76 cfs 0.066 af

Total Runoff Area = 0.945 ac Runoff Volume = 0.066 af Average Runoff Depth = 0.84"
100.00% Pervious = 0.945 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment A: Area A

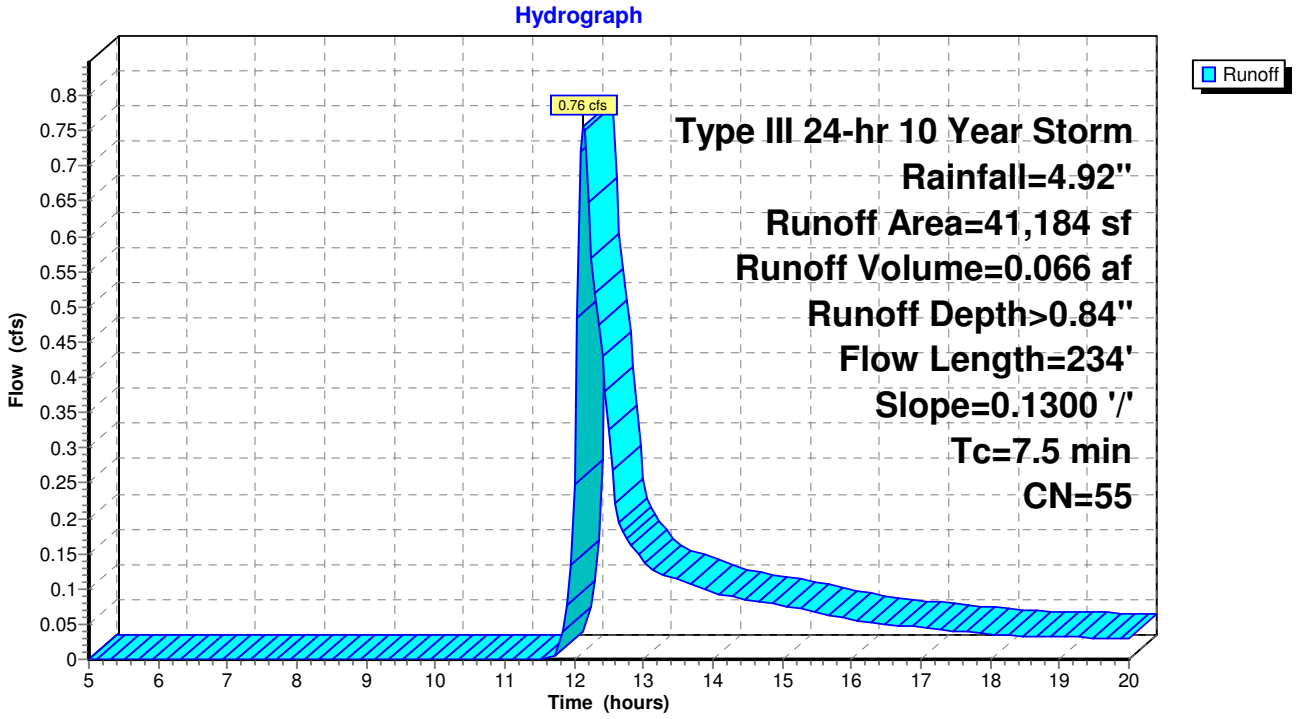
Runoff = 0.76 cfs @ 12.14 hrs, Volume= 0.066 af, Depth> 0.84"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=4.92"

Area (sf)	CN	Description
41,184	55	Woods, Good, HSG B
41,184		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	50	0.1300	0.14		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
1.7	184	0.1300	1.80		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
7.5	234	Total			

Subcatchment A: Area A



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

Subcatchment A: Area A Runoff Area=41,184 sf 0.00% Impervious Runoff Depth>1.49"
Flow Length=234' Slope=0.1300 '/' Tc=7.5 min CN=55 Runoff=1.53 cfs 0.117 af

Total Runoff Area = 0.945 ac Runoff Volume = 0.117 af Average Runoff Depth = 1.49"
100.00% Pervious = 0.945 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment A: Area A

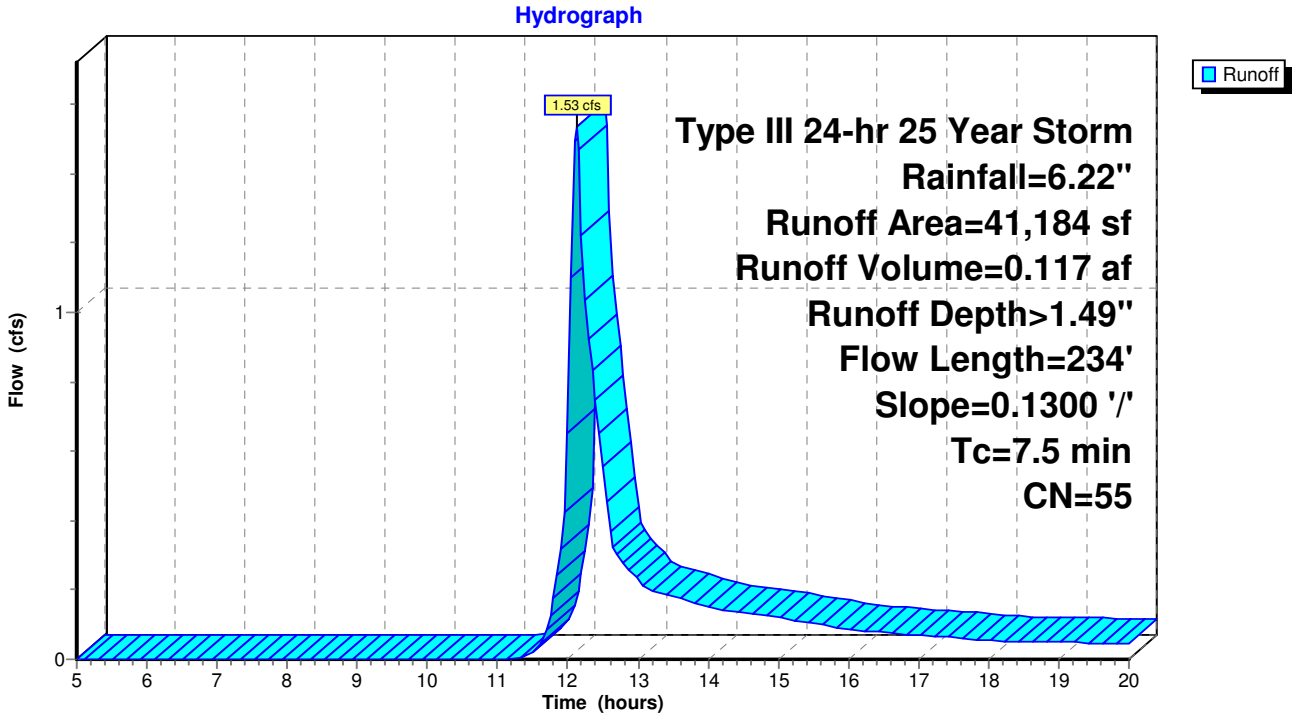
Runoff = 1.53 cfs @ 12.12 hrs, Volume= 0.117 af, Depth> 1.49"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Storm Rainfall=6.22"

Area (sf)	CN	Description
41,184	55	Woods, Good, HSG B
41,184		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	50	0.1300	0.14		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
1.7	184	0.1300	1.80		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
7.5	234	Total			

Subcatchment A: Area A



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

Subcatchment A: Area A Runoff Area=41,184 sf 0.00% Impervious Runoff Depth>3.13"
Flow Length=234' Slope=0.1300 '/' Tc=7.5 min CN=55 Runoff=3.45 cfs 0.247 af

Total Runoff Area = 0.945 ac Runoff Volume = 0.247 af Average Runoff Depth = 3.13"
100.00% Pervious = 0.945 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment A: Area A

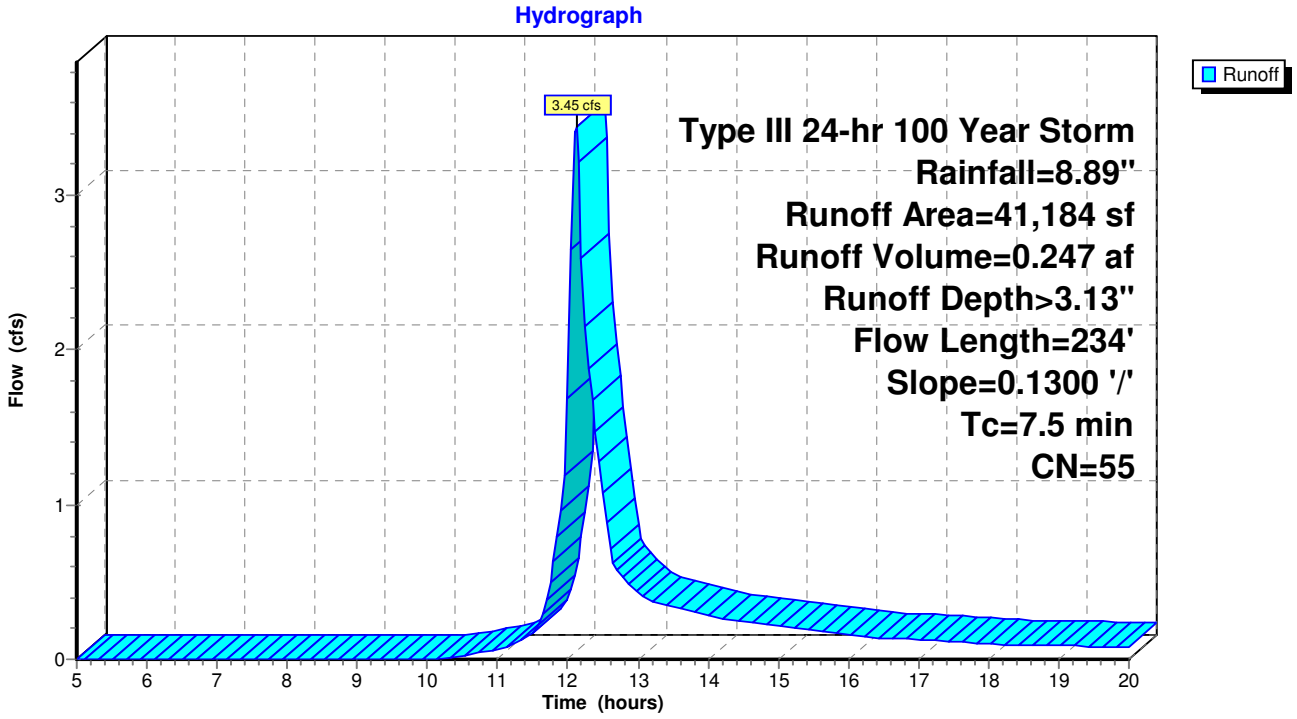
Runoff = 3.45 cfs @ 12.12 hrs, Volume= 0.247 af, Depth> 3.13"

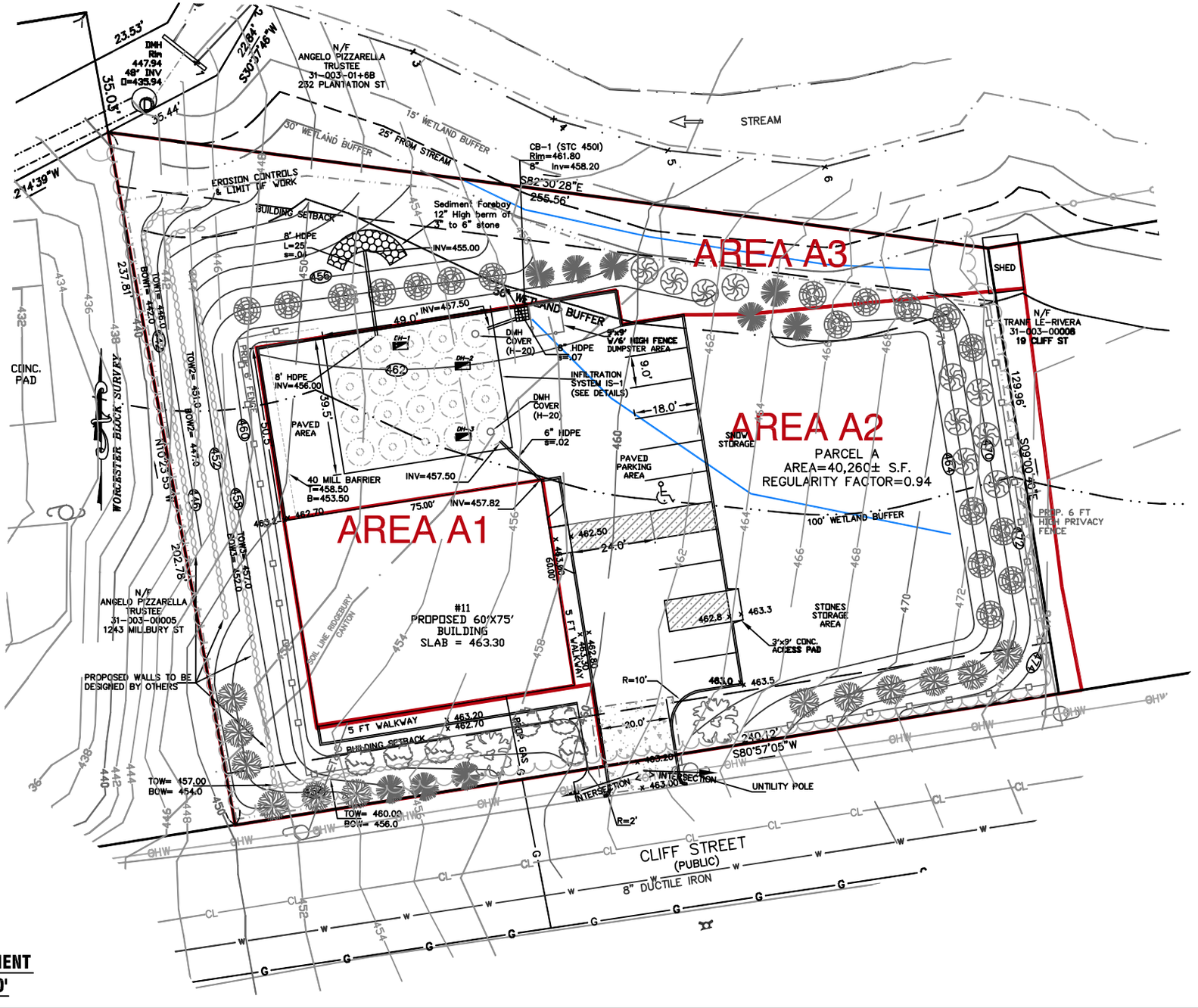
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.89"

Area (sf)	CN	Description
41,184	55	Woods, Good, HSG B
41,184		100.00% Pervious Area

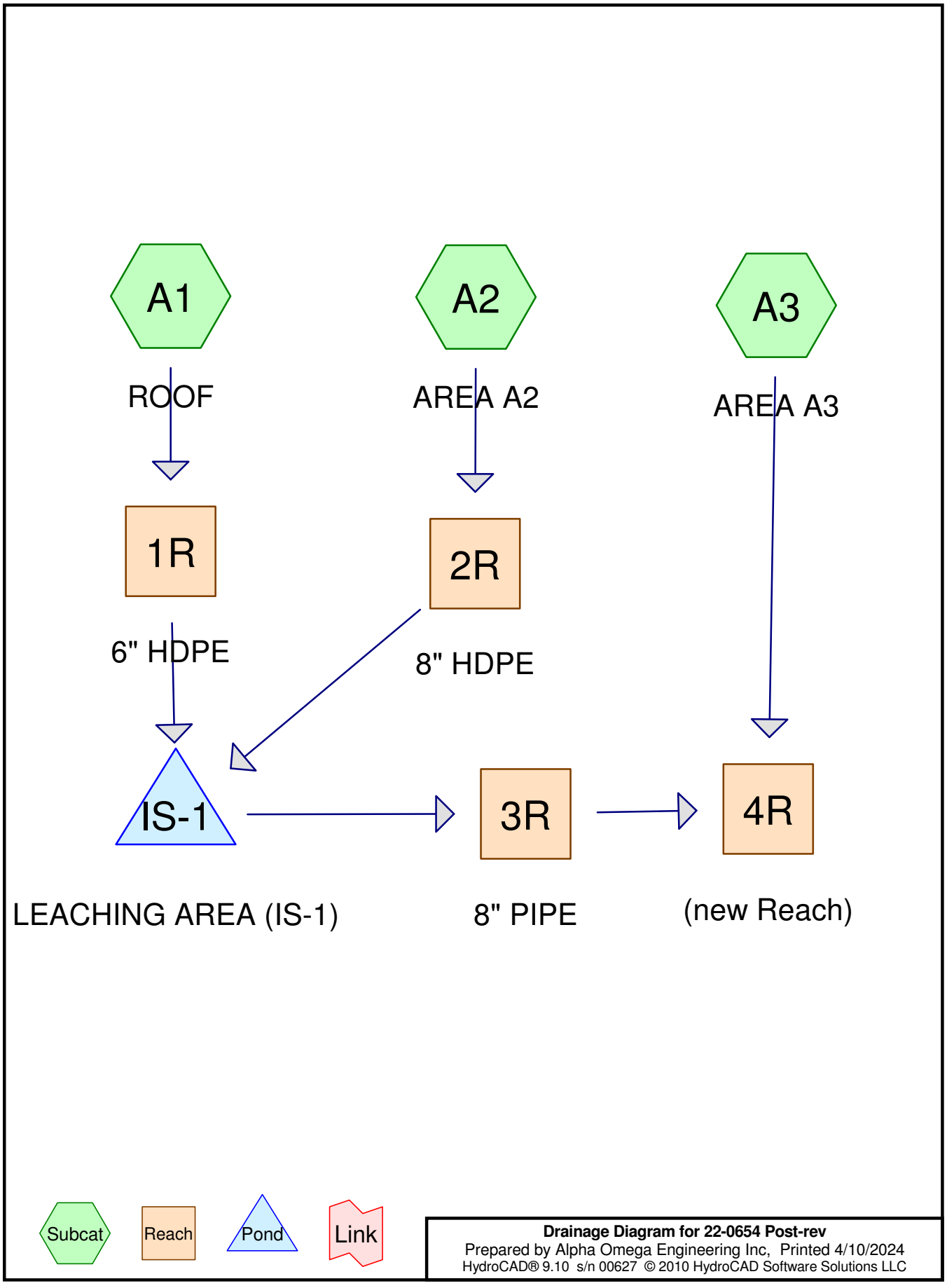
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	50	0.1300	0.14		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
1.7	184	0.1300	1.80		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
7.5	234	Total			

Subcatchment A: Area A





POST DEVELOPMENT
SCALE 1"=40'



Drainage Diagram for 22-0654 Post-rev

Prepared by Alpha Omega Engineering Inc, Printed 4/10/2024

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.071	55	Woods, Good, HSG B (A3)
0.539	61	>75% Grass cover, Good, HSG B (A2, A3)
0.215	98	Parking (A2)
0.005	98	Paved parking, HSG B (A3)
0.103	98	Roof (A1)
0.933		**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.614	HSG B	A2, A3
0.000	HSG C	
0.000	HSG D	
0.319	Other	A1, A2
0.933		**TOTAL AREA**

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Fill (inches)
1	1R	457.82	457.50	16.0	0.0200	0.012	6.0	0.0	0.0
2	2R	458.20	457.50	10.0	0.0700	0.012	8.0	0.0	0.0
3	3R	456.00	455.00	25.0	0.0400	0.013	8.0	0.0	0.0

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

Subcatchment A1: ROOF Runoff Area=4,500 sf 100.00% Impervious Runoff Depth>2.83"
Tc=5.0 min CN=98 Runoff=0.33 cfs 0.024 af

Subcatchment A2: AREA A2 Runoff Area=21,800 sf 43.03% Impervious Runoff Depth>1.15"
Flow Length=152' Tc=8.6 min CN=77 Runoff=0.64 cfs 0.048 af

Subcatchment A3: AREA A3 Runoff Area=14,329 sf 1.40% Impervious Runoff Depth>0.38"
Flow Length=148' Slope=0.1300 '/' Tc=6.7 min CN=60 Runoff=0.09 cfs 0.010 af

Reach 1R: 6" HDPE Avg. Flow Depth=0.21' Max Vel=4.06 fps Inflow=0.33 cfs 0.024 af
6.0" Round Pipe n=0.012 L=16.0' S=0.0200 '/' Capacity=0.86 cfs Outflow=0.33 cfs 0.024 af

Reach 2R: 8" HDPE Avg. Flow Depth=0.19' Max Vel=7.55 fps Inflow=0.64 cfs 0.048 af
8.0" Round Pipe n=0.012 L=10.0' S=0.0700 '/' Capacity=3.46 cfs Outflow=0.64 cfs 0.048 af

Reach 3R: 8" PIPE Avg. Flow Depth=0.00' Max Vel=0.00 fps Inflow=0.00 cfs 0.000 af
8.0" Round Pipe n=0.013 L=25.0' S=0.0400 '/' Capacity=2.42 cfs Outflow=0.00 cfs 0.000 af

Reach 4R: (new Reach) Inflow=0.09 cfs 0.010 af
Outflow=0.09 cfs 0.010 af

Pond IS-1: LEACHING AREA (IS-1) Peak Elev=455.05' Storage=1,437 cf Inflow=0.94 cfs 0.072 af
Discarded=0.11 cfs 0.067 af Primary=0.00 cfs 0.000 af Outflow=0.11 cfs 0.067 af

Total Runoff Area = 0.933 ac Runoff Volume = 0.083 af Average Runoff Depth = 1.06"
65.34% Pervious = 0.609 ac 34.66% Impervious = 0.323 ac

Summary for Subcatchment A1: ROOF

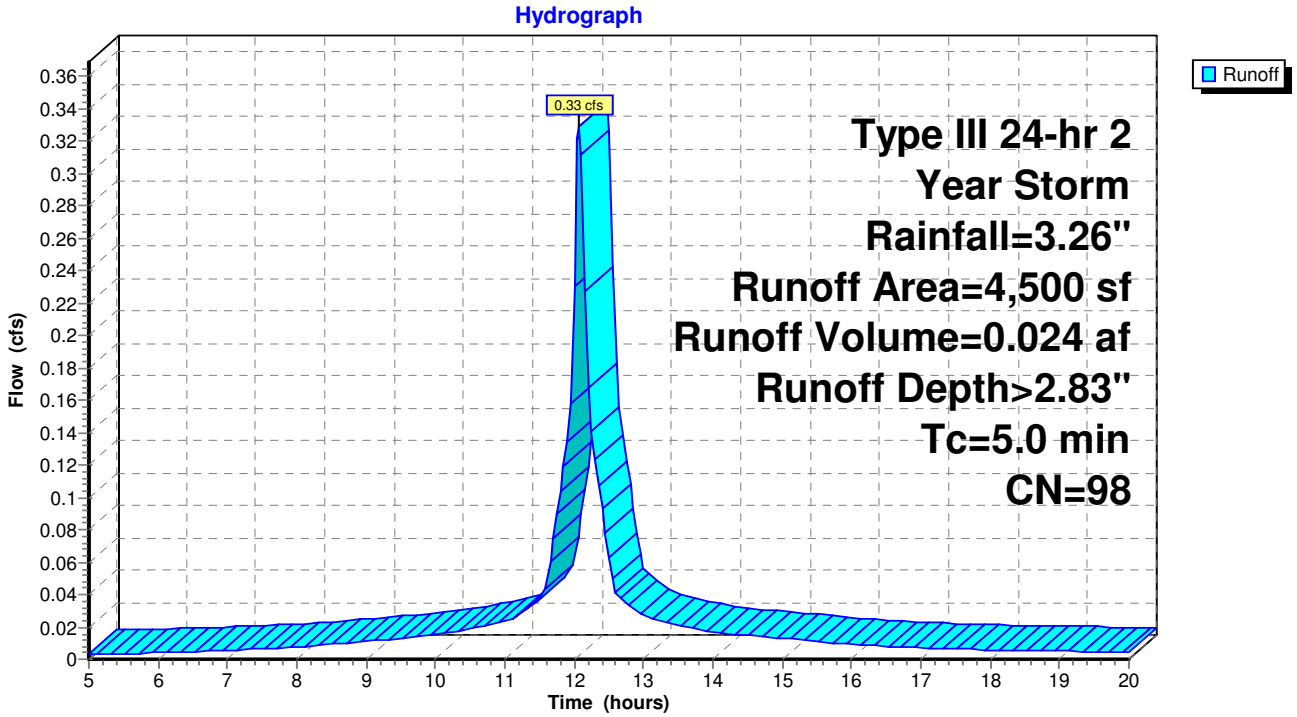
Runoff = 0.33 cfs @ 12.07 hrs, Volume= 0.024 af, Depth> 2.83"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.26"

	Area (sf)	CN	Description
*	4,500	98	Roof
	4,500		100.00% Impervious Area

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

Subcatchment A1: ROOF



Summary for Subcatchment A2: AREA A2

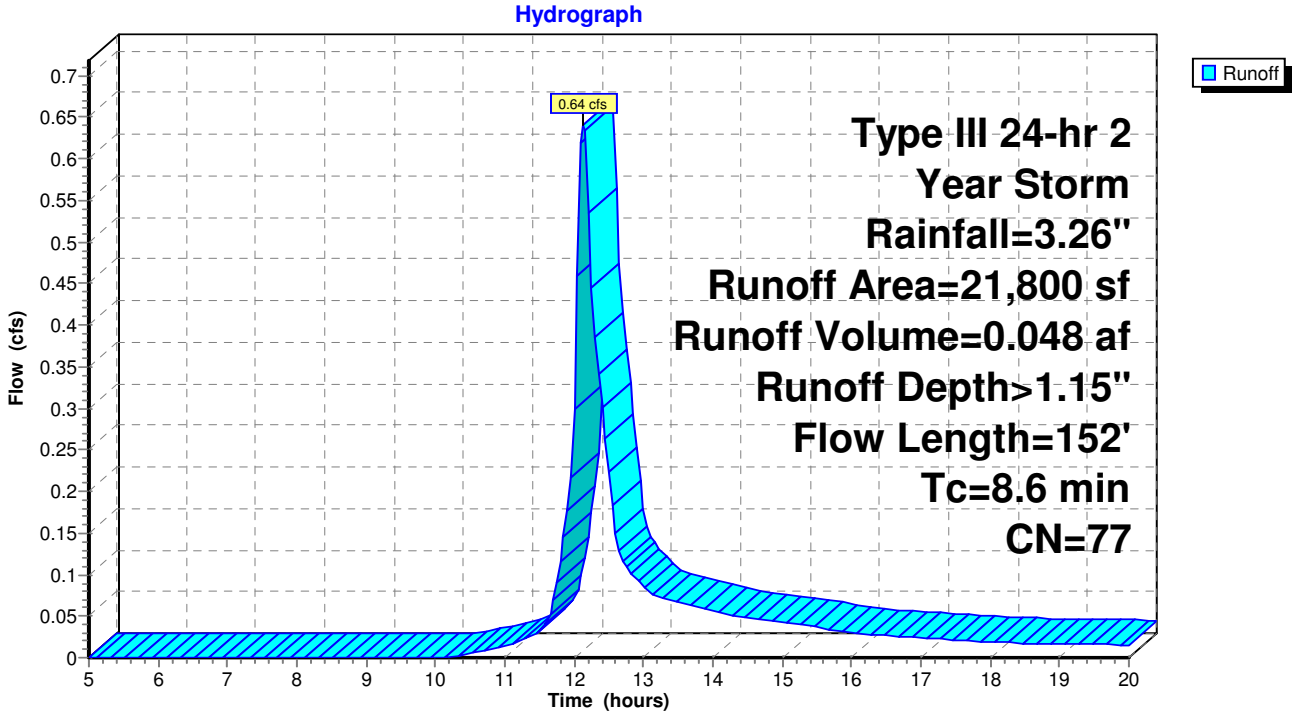
Runoff = 0.64 cfs @ 12.13 hrs, Volume= 0.048 af, Depth> 1.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.26"

	Area (sf)	CN	Description
*	9,380	98	Parking
	12,420	61	>75% Grass cover, Good, HSG B
	21,800	77	Weighted Average
	12,420		56.97% Pervious Area
	9,380		43.03% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	50	0.0100	0.11		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.5	22	0.0100	0.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.7	80	0.0080	1.82		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
8.6	152	Total			

Subcatchment A2: AREA A2



Summary for Subcatchment A3: AREA A3

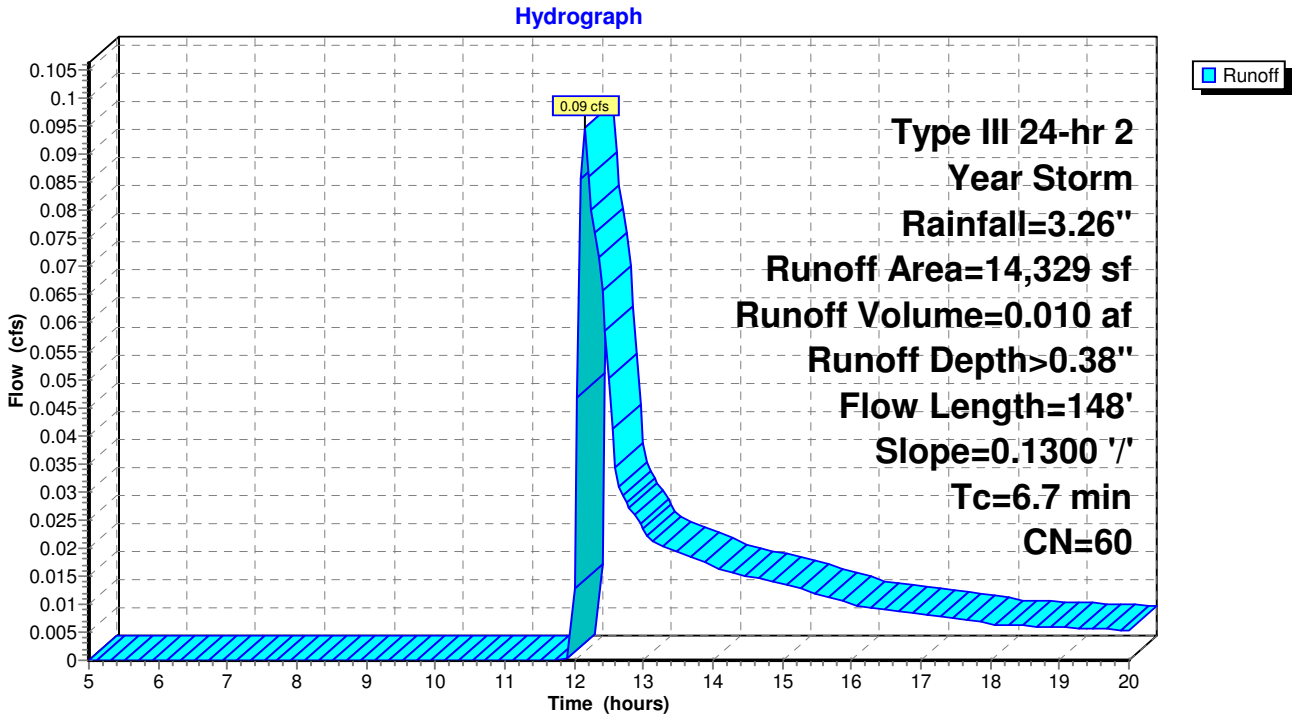
Runoff = 0.09 cfs @ 12.15 hrs, Volume= 0.010 af, Depth> 0.38"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.26"

Area (sf)	CN	Description
11,049	61	>75% Grass cover, Good, HSG B
3,080	55	Woods, Good, HSG B
200	98	Paved parking, HSG B
14,329	60	Weighted Average
14,129		98.60% Pervious Area
200		1.40% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	50	0.1300	0.14		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
0.9	98	0.1300	1.80		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
6.7	148	Total			

Subcatchment A3: AREA A3



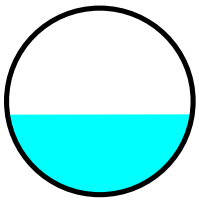
Summary for Reach 1R: 6" HDPE

Inflow Area = 0.103 ac,100.00% Impervious, Inflow Depth > 2.83" for 2 Year Storm event
Inflow = 0.33 cfs @ 12.07 hrs, Volume= 0.024 af
Outflow = 0.33 cfs @ 12.07 hrs, Volume= 0.024 af, Atten= 0%, Lag= 0.1 min

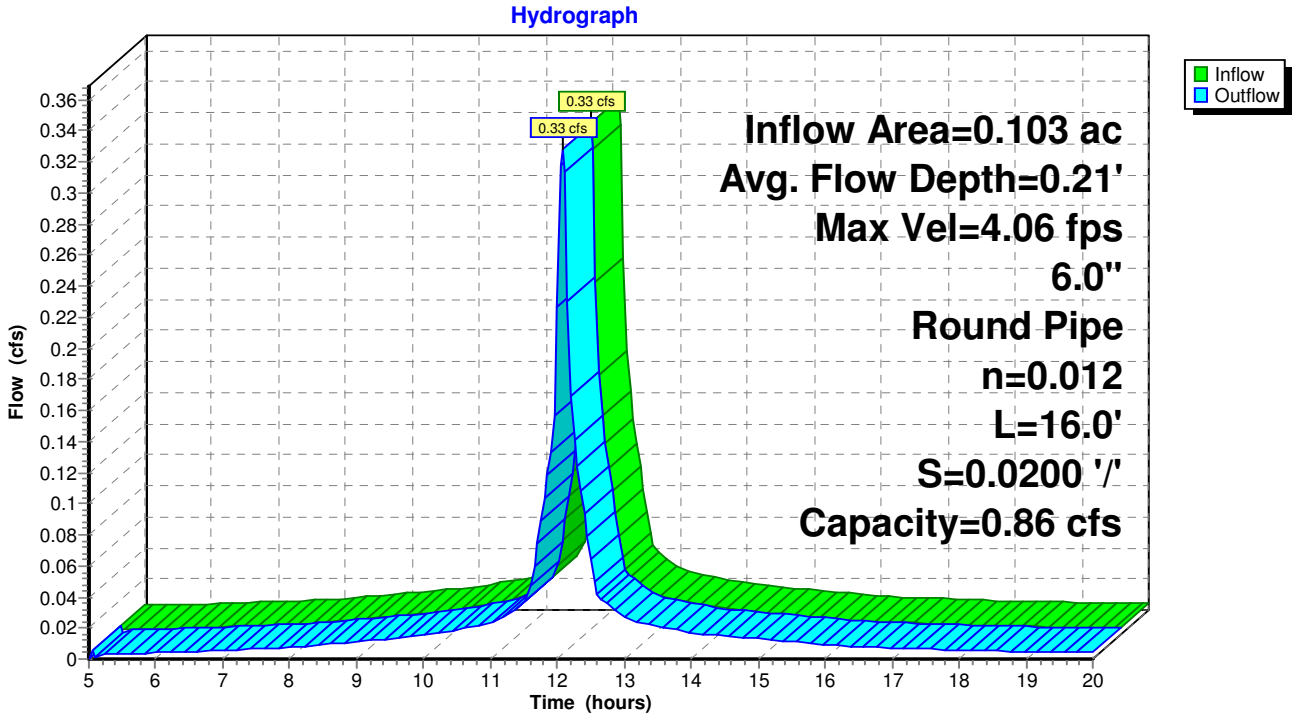
Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.06 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 1.57 fps, Avg. Travel Time= 0.2 min

Peak Storage= 1 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.21'
Bank-Full Depth= 0.50', Capacity at Bank-Full= 0.86 cfs

6.0" Round Pipe
n= 0.012
Length= 16.0' Slope= 0.0200 '/'
Inlet Invert= 457.82', Outlet Invert= 457.50'



Reach 1R: 6" HDPE



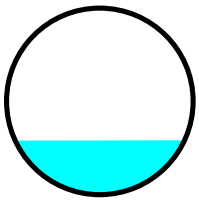
Summary for Reach 2R: 8" HDPE

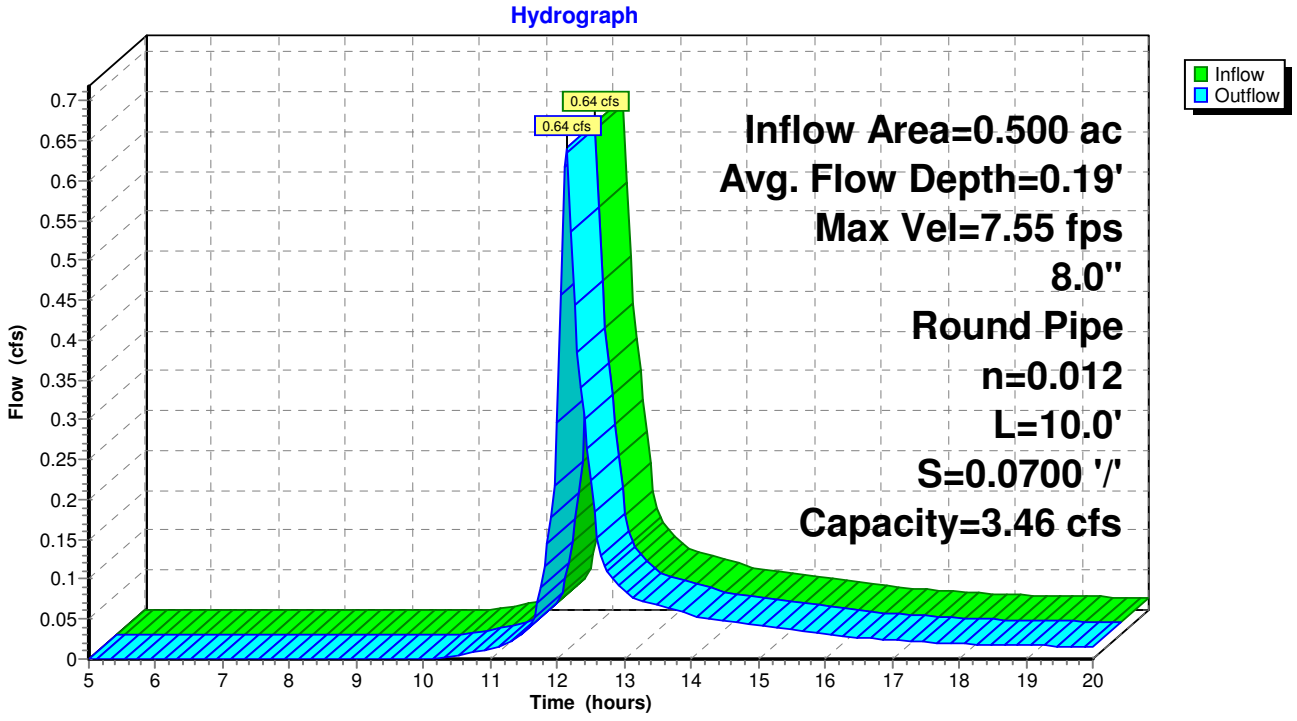
Inflow Area = 0.500 ac, 43.03% Impervious, Inflow Depth > 1.15" for 2 Year Storm event
Inflow = 0.64 cfs @ 12.13 hrs, Volume= 0.048 af
Outflow = 0.64 cfs @ 12.13 hrs, Volume= 0.048 af, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.55 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 3.24 fps, Avg. Travel Time= 0.1 min

Peak Storage= 1 cf @ 12.13 hrs
Average Depth at Peak Storage= 0.19'
Bank-Full Depth= 0.67', Capacity at Bank-Full= 3.46 cfs

8.0" Round Pipe
n= 0.012
Length= 10.0' Slope= 0.0700 '/'
Inlet Invert= 458.20', Outlet Invert= 457.50'





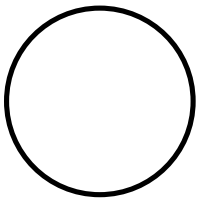
Summary for Reach 3R: 8" PIPE

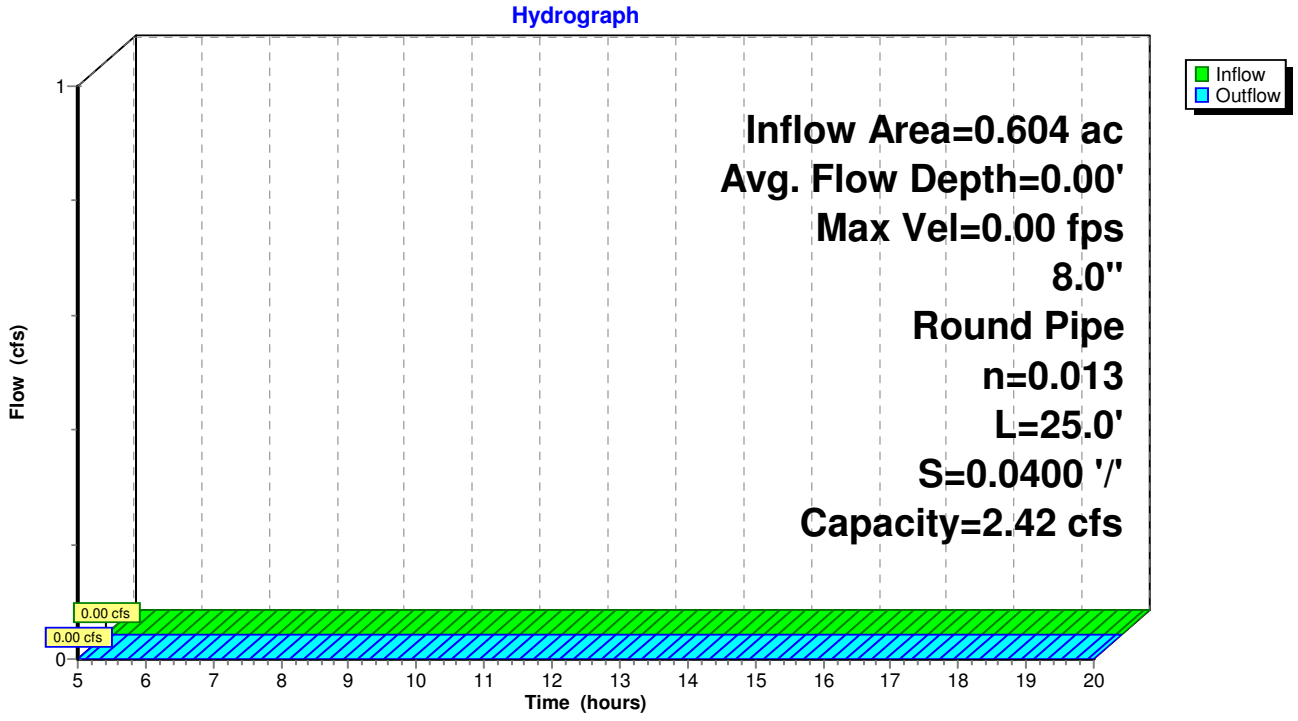
Inflow Area = 0.604 ac, 52.78% Impervious, Inflow Depth = 0.00" for 2 Year Storm event
Inflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 5.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 0.67', Capacity at Bank-Full= 2.42 cfs

8.0" Round Pipe
n= 0.013
Length= 25.0' Slope= 0.0400 '/'
Inlet Invert= 456.00', Outlet Invert= 455.00'



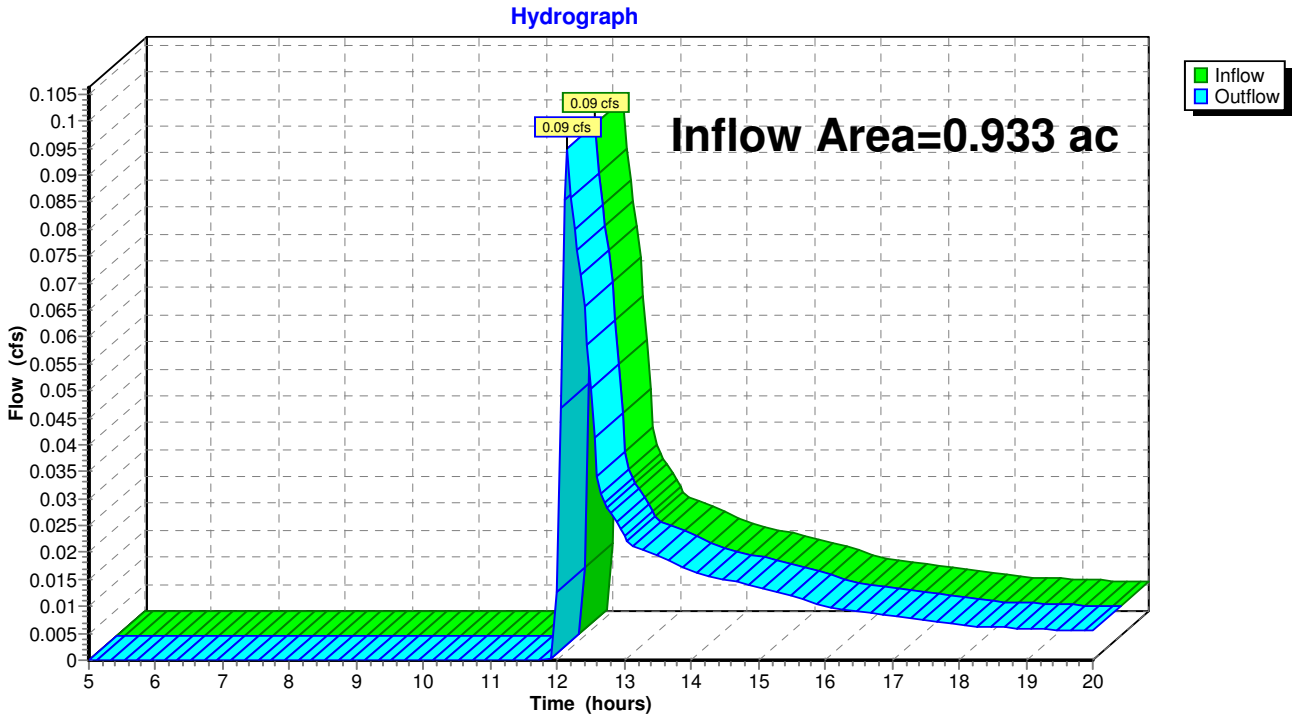


Summary for Reach 4R: (new Reach)

Inflow Area = 0.933 ac, 34.66% Impervious, Inflow Depth > 0.13" for 2 Year Storm event
Inflow = 0.09 cfs @ 12.15 hrs, Volume= 0.010 af
Outflow = 0.09 cfs @ 12.15 hrs, Volume= 0.010 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 4R: (new Reach)



Summary for Pond IS-1: LEACHING AREA (IS-1)

Inflow Area = 0.604 ac, 52.78% Impervious, Inflow Depth > 1.44" for 2 Year Storm event
Inflow = 0.94 cfs @ 12.11 hrs, Volume= 0.072 af
Outflow = 0.11 cfs @ 12.15 hrs, Volume= 0.067 af, Atten= 88%, Lag= 2.4 min
Discarded = 0.11 cfs @ 12.15 hrs, Volume= 0.067 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 455.05' @ 13.03 hrs Surf.Area= 0 sf Storage= 1,437 cf

Plug-Flow detention time= 147.0 min calculated for 0.066 af (92% of inflow)
Center-of-Mass det. time= 119.1 min (906.4 - 787.3)

Volume	Invert	Avail.Storage	Storage Description
#1	453.50'	5,915 cf	**Custom Stage Data** Listed below

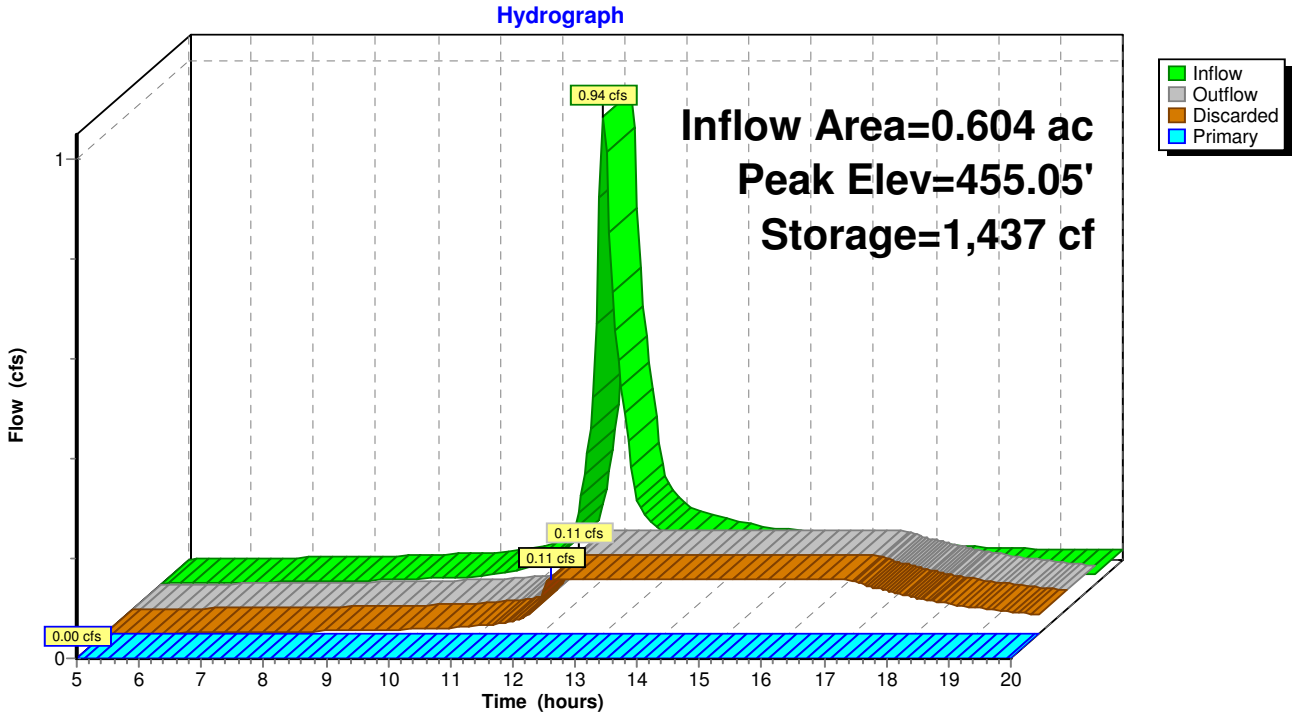
Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
453.50	0	0
454.50	727	727
455.50	1,297	2,024
456.50	1,297	3,321
457.50	1,297	4,618
458.50	1,297	5,915

Device	Routing	Invert	Outlet Devices
#1	Discarded	453.50'	**Exfiltration**
			Head (feet) 0.00 1.00 2.00 3.00 4.00 5.00
			Disch. (cfs) 0.000 0.110 0.110 0.110 0.110 0.110
#2	Primary	457.50'	**8.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.11 cfs @ 12.15 hrs HW=454.59' (Free Discharge)
↑—**1=Exfiltration** (Custom Controls 0.11 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=453.50' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Pond IS-1: LEACHING AREA (IS-1)



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

Subcatchment A1: ROOF Runoff Area=4,500 sf 100.00% Impervious Runoff Depth>4.35"
Tc=5.0 min CN=98 Runoff=0.50 cfs 0.037 af

Subcatchment A2: AREA A2 Runoff Area=21,800 sf 43.03% Impervious Runoff Depth>2.38"
Flow Length=152' Tc=8.6 min CN=77 Runoff=1.35 cfs 0.099 af

Subcatchment A3: AREA A3 Runoff Area=14,329 sf 1.40% Impervious Runoff Depth>1.13"
Flow Length=148' Slope=0.1300 '/' Tc=6.7 min CN=60 Runoff=0.41 cfs 0.031 af

Reach 1R: 6" HDPE Avg. Flow Depth=0.27' Max Vel=4.51 fps Inflow=0.50 cfs 0.037 af
6.0" Round Pipe n=0.012 L=16.0' S=0.0200 '/' Capacity=0.86 cfs Outflow=0.50 cfs 0.037 af

Reach 2R: 8" HDPE Avg. Flow Depth=0.29' Max Vel=9.24 fps Inflow=1.35 cfs 0.099 af
8.0" Round Pipe n=0.012 L=10.0' S=0.0700 '/' Capacity=3.46 cfs Outflow=1.34 cfs 0.099 af

Reach 3R: 8" PIPE Avg. Flow Depth=0.00' Max Vel=0.00 fps Inflow=0.00 cfs 0.000 af
8.0" Round Pipe n=0.013 L=25.0' S=0.0400 '/' Capacity=2.42 cfs Outflow=0.00 cfs 0.000 af

Reach 4R: (new Reach) Inflow=0.41 cfs 0.031 af
Outflow=0.41 cfs 0.031 af

Pond IS-1: LEACHING AREA (IS-1) Peak Elev=456.51' Storage=3,332 cf Inflow=1.79 cfs 0.136 af
Discarded=0.11 cfs 0.084 af Primary=0.00 cfs 0.000 af Outflow=0.11 cfs 0.084 af

Total Runoff Area = 0.933 ac Runoff Volume = 0.167 af Average Runoff Depth = 2.15"
65.34% Pervious = 0.609 ac 34.66% Impervious = 0.323 ac

Summary for Subcatchment A1: ROOF

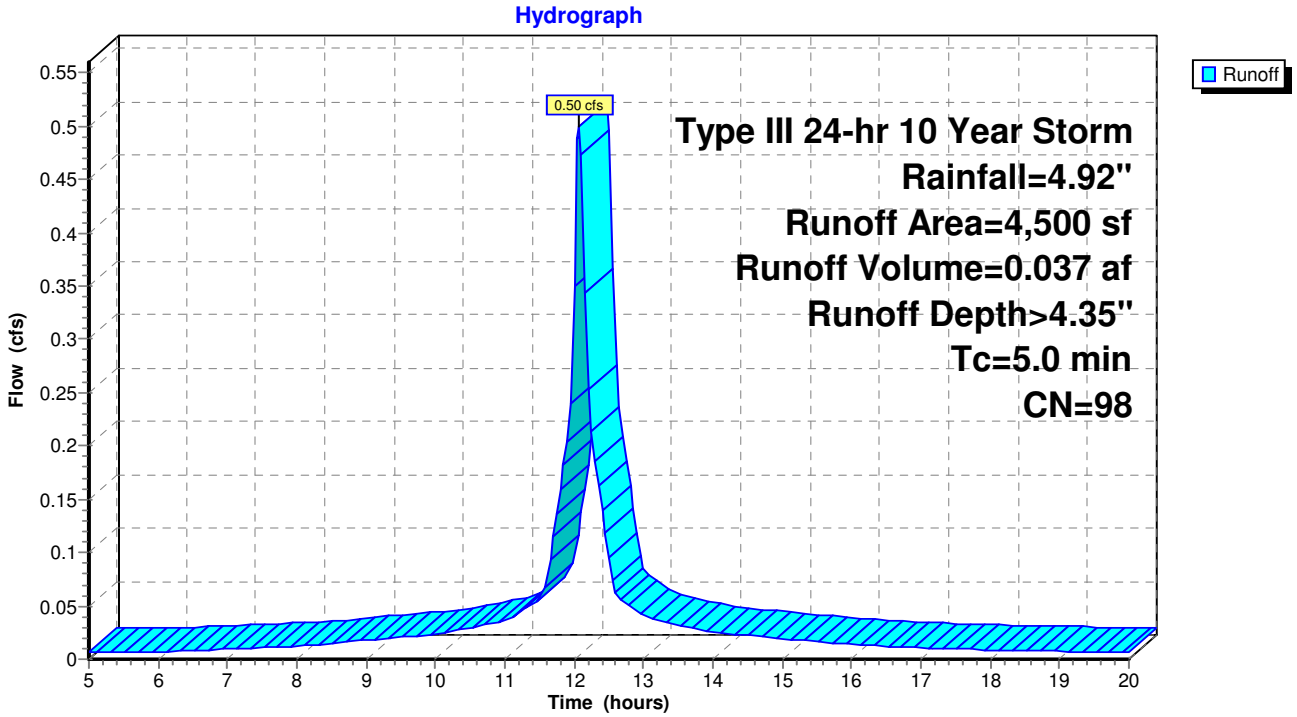
Runoff = 0.50 cfs @ 12.07 hrs, Volume= 0.037 af, Depth> 4.35"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=4.92"

	Area (sf)	CN	Description
*	4,500	98	Roof
	4,500		100.00% Impervious Area

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

Subcatchment A1: ROOF



Summary for Subcatchment A2: AREA A2

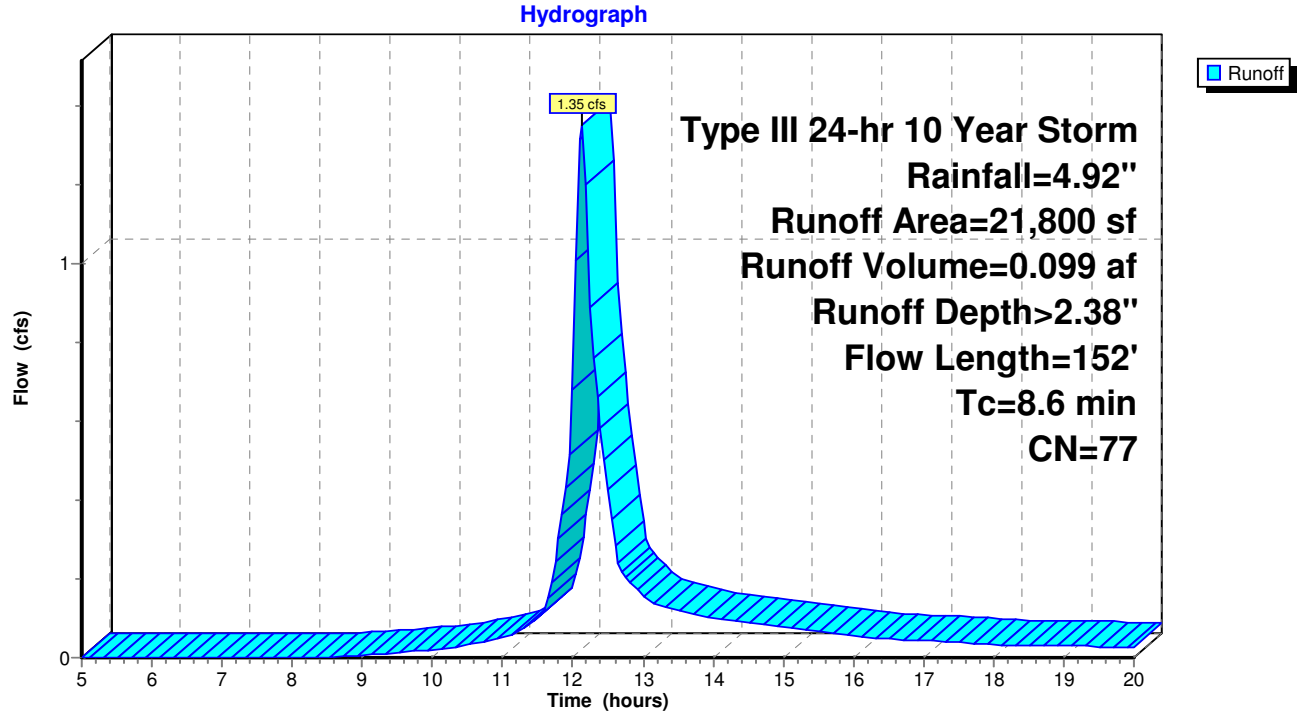
Runoff = 1.35 cfs @ 12.12 hrs, Volume= 0.099 af, Depth> 2.38"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=4.92"

	Area (sf)	CN	Description
*	9,380	98	Parking
	12,420	61	>75% Grass cover, Good, HSG B
	21,800	77	Weighted Average
	12,420		56.97% Pervious Area
	9,380		43.03% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	50	0.0100	0.11		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.5	22	0.0100	0.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.7	80	0.0080	1.82		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
8.6	152	Total			

Subcatchment A2: AREA A2



Summary for Subcatchment A3: AREA A3

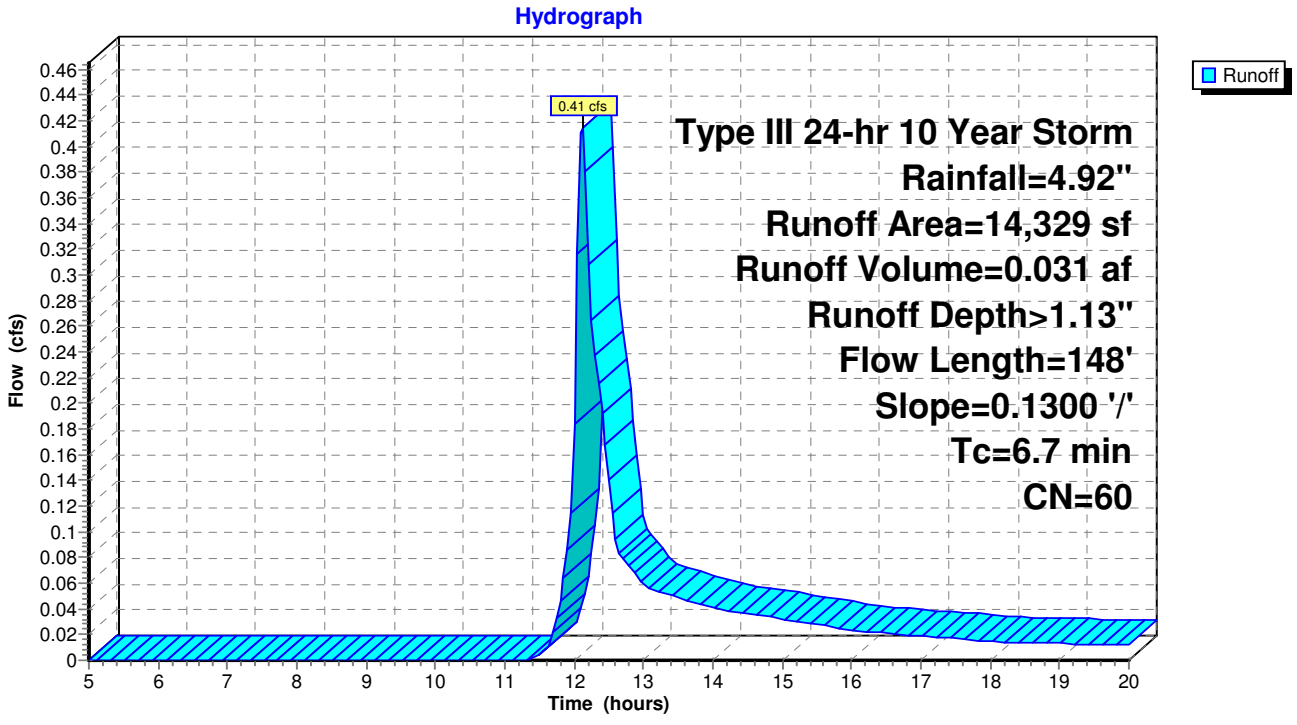
Runoff = 0.41 cfs @ 12.11 hrs, Volume= 0.031 af, Depth> 1.13"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=4.92"

Area (sf)	CN	Description
11,049	61	>75% Grass cover, Good, HSG B
3,080	55	Woods, Good, HSG B
200	98	Paved parking, HSG B
14,329	60	Weighted Average
14,129		98.60% Pervious Area
200		1.40% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	50	0.1300	0.14		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
0.9	98	0.1300	1.80		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
6.7	148	Total			

Subcatchment A3: AREA A3



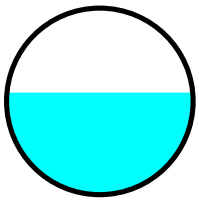
Summary for Reach 1R: 6" HDPE

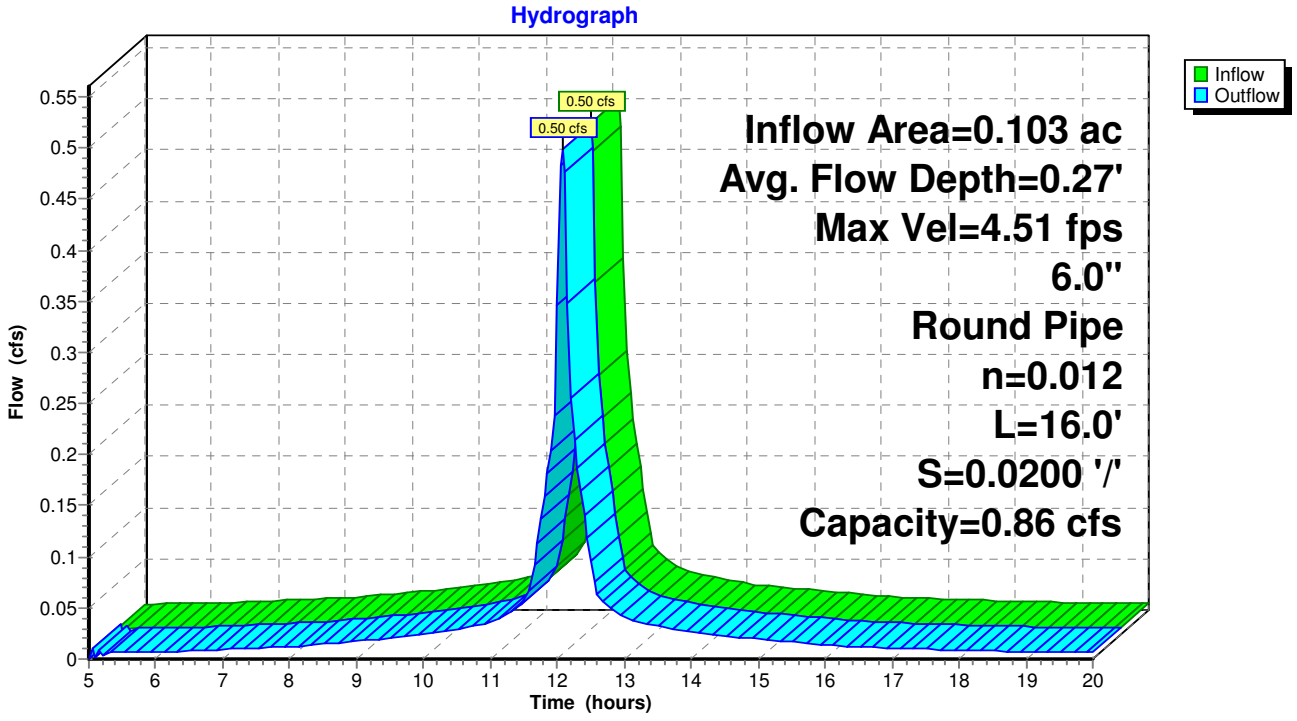
Inflow Area = 0.103 ac,100.00% Impervious, Inflow Depth > 4.35" for 10 Year Storm event
Inflow = 0.50 cfs @ 12.07 hrs, Volume= 0.037 af
Outflow = 0.50 cfs @ 12.07 hrs, Volume= 0.037 af, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.51 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 1.80 fps, Avg. Travel Time= 0.1 min

Peak Storage= 2 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.27'
Bank-Full Depth= 0.50', Capacity at Bank-Full= 0.86 cfs

6.0" Round Pipe
n= 0.012
Length= 16.0' Slope= 0.0200 '/'
Inlet Invert= 457.82', Outlet Invert= 457.50'





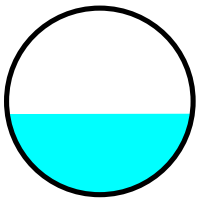
Summary for Reach 2R: 8" HDPE

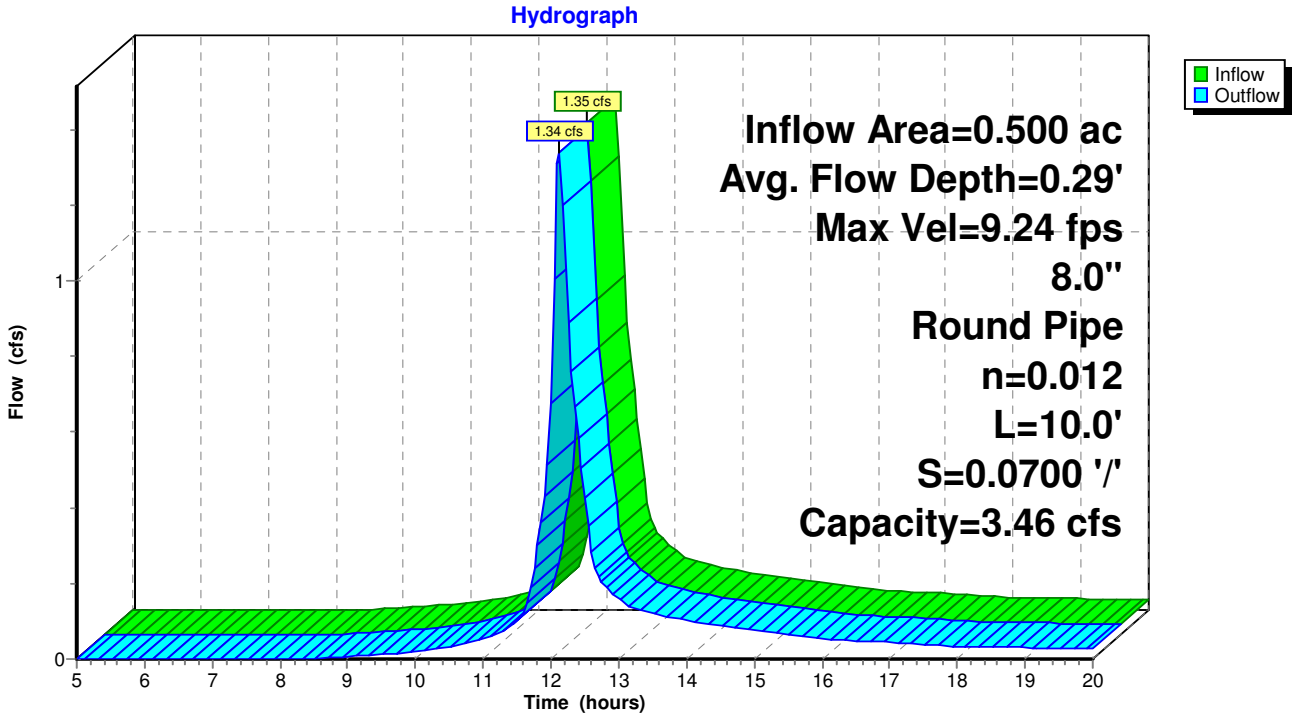
Inflow Area = 0.500 ac, 43.03% Impervious, Inflow Depth > 2.38" for 10 Year Storm event
Inflow = 1.35 cfs @ 12.12 hrs, Volume= 0.099 af
Outflow = 1.34 cfs @ 12.13 hrs, Volume= 0.099 af, Atten= 1%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 9.24 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 3.76 fps, Avg. Travel Time= 0.0 min

Peak Storage= 1 cf @ 12.12 hrs
Average Depth at Peak Storage= 0.29'
Bank-Full Depth= 0.67', Capacity at Bank-Full= 3.46 cfs

8.0" Round Pipe
n= 0.012
Length= 10.0' Slope= 0.0700 '/'
Inlet Invert= 458.20', Outlet Invert= 457.50'





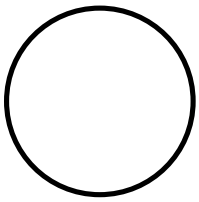
Summary for Reach 3R: 8" PIPE

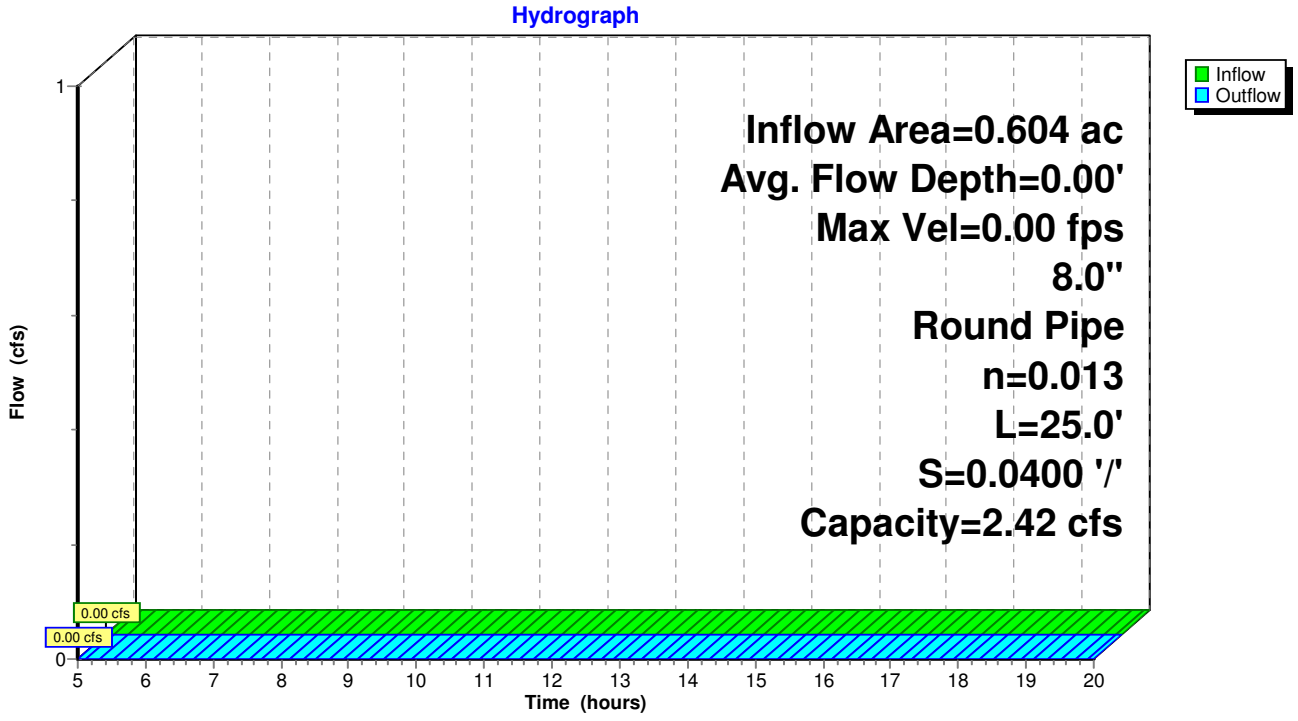
Inflow Area = 0.604 ac, 52.78% Impervious, Inflow Depth = 0.00" for 10 Year Storm event
Inflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 5.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 0.67', Capacity at Bank-Full= 2.42 cfs

8.0" Round Pipe
n= 0.013
Length= 25.0' Slope= 0.0400 '/'
Inlet Invert= 456.00', Outlet Invert= 455.00'



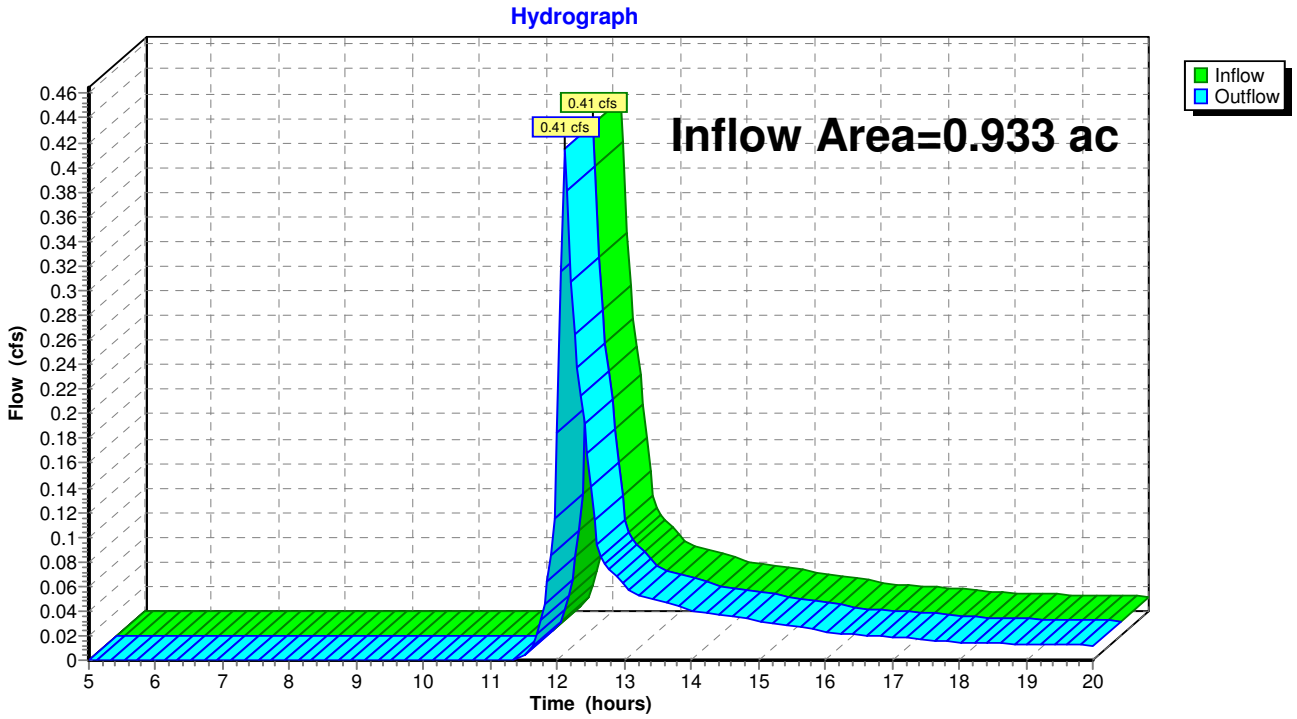


Summary for Reach 4R: (new Reach)

Inflow Area = 0.933 ac, 34.66% Impervious, Inflow Depth > 0.40" for 10 Year Storm event
Inflow = 0.41 cfs @ 12.11 hrs, Volume= 0.031 af
Outflow = 0.41 cfs @ 12.11 hrs, Volume= 0.031 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 4R: (new Reach)



Summary for Pond IS-1: LEACHING AREA (IS-1)

Inflow Area = 0.604 ac, 52.78% Impervious, Inflow Depth > 2.71" for 10 Year Storm event
Inflow = 1.79 cfs @ 12.11 hrs, Volume= 0.136 af
Outflow = 0.11 cfs @ 11.90 hrs, Volume= 0.084 af, Atten= 94%, Lag= 0.0 min
Discarded = 0.11 cfs @ 11.90 hrs, Volume= 0.084 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 456.51' @ 14.50 hrs Surf.Area= 0 sf Storage= 3,332 cf

Plug-Flow detention time= 215.8 min calculated for 0.084 af (61% of inflow)
Center-of-Mass det. time= 138.6 min (917.9 - 779.3)

Volume	Invert	Avail.Storage	Storage Description
#1	453.50'	5,915 cf	**Custom Stage Data** Listed below

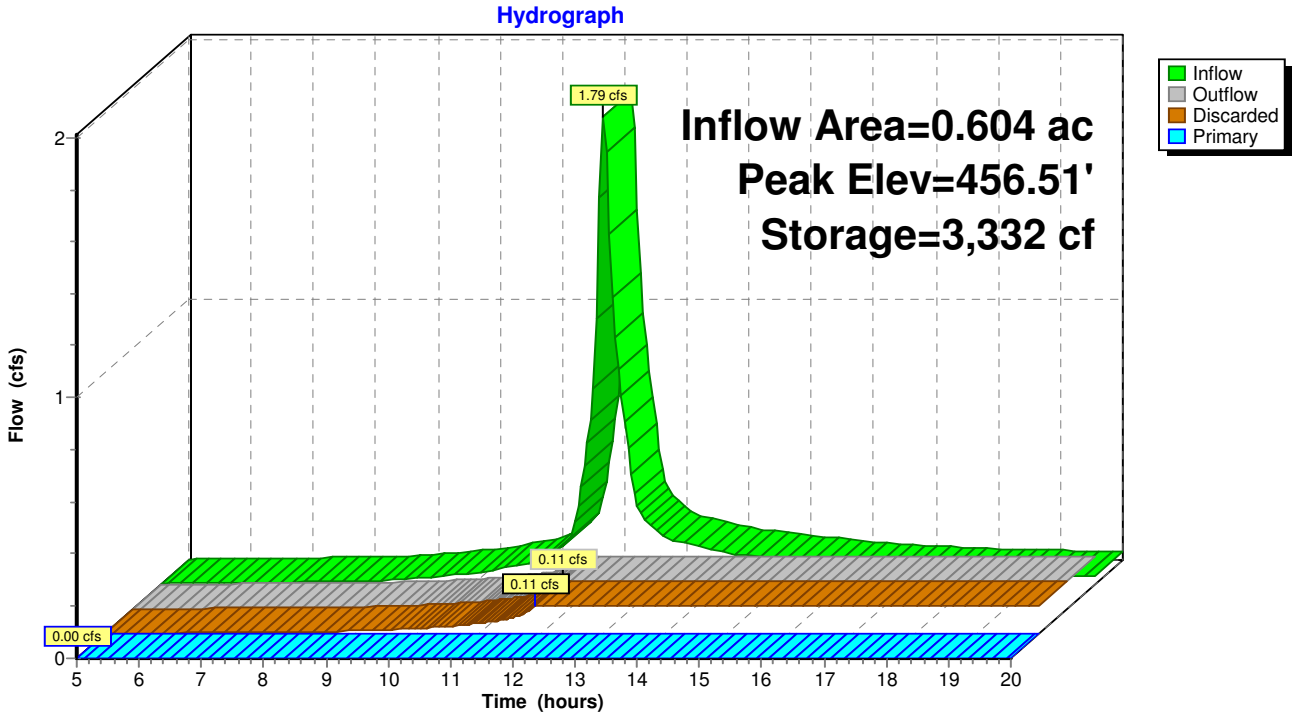
Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
453.50	0	0
454.50	727	727
455.50	1,297	2,024
456.50	1,297	3,321
457.50	1,297	4,618
458.50	1,297	5,915

Device	Routing	Invert	Outlet Devices
#1	Discarded	453.50'	**Exfiltration**
			Head (feet) 0.00 1.00 2.00 3.00 4.00 5.00
			Disch. (cfs) 0.000 0.110 0.110 0.110 0.110 0.110
#2	Primary	457.50'	**8.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.11 cfs @ 11.90 hrs HW=454.52' (Free Discharge)
↑—**1=Exfiltration** (Custom Controls 0.11 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=453.50' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Pond IS-1: LEACHING AREA (IS-1)



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

Subcatchment A1: ROOF Runoff Area=4,500 sf 100.00% Impervious Runoff Depth>5.53"
Tc=5.0 min CN=98 Runoff=0.63 cfs 0.048 af

Subcatchment A2: AREA A2 Runoff Area=21,800 sf 43.03% Impervious Runoff Depth>3.43"
Flow Length=152' Tc=8.6 min CN=77 Runoff=1.94 cfs 0.143 af

Subcatchment A3: AREA A3 Runoff Area=14,329 sf 1.40% Impervious Runoff Depth>1.89"
Flow Length=148' Slope=0.1300 '/' Tc=6.7 min CN=60 Runoff=0.73 cfs 0.052 af

Reach 1R: 6" HDPE Avg. Flow Depth=0.32' Max Vel=4.76 fps Inflow=0.63 cfs 0.048 af
6.0" Round Pipe n=0.012 L=16.0' S=0.0200 '/' Capacity=0.86 cfs Outflow=0.63 cfs 0.048 af

Reach 2R: 8" HDPE Avg. Flow Depth=0.36' Max Vel=10.15 fps Inflow=1.94 cfs 0.143 af
8.0" Round Pipe n=0.012 L=10.0' S=0.0700 '/' Capacity=3.46 cfs Outflow=1.94 cfs 0.143 af

Reach 3R: 8" PIPE Avg. Flow Depth=0.08' Max Vel=3.14 fps Inflow=0.08 cfs 0.011 af
8.0" Round Pipe n=0.013 L=25.0' S=0.0400 '/' Capacity=2.42 cfs Outflow=0.08 cfs 0.011 af

Reach 4R: (new Reach) Inflow=0.73 cfs 0.063 af
Outflow=0.73 cfs 0.063 af

Pond IS-1: LEACHING AREA (IS-1) Peak Elev=457.65' Storage=4,810 cf Inflow=2.51 cfs 0.191 af
Discarded=0.11 cfs 0.089 af Primary=0.08 cfs 0.011 af Outflow=0.19 cfs 0.100 af

Total Runoff Area = 0.933 ac Runoff Volume = 0.242 af Average Runoff Depth = 3.12"
65.34% Pervious = 0.609 ac 34.66% Impervious = 0.323 ac

Summary for Subcatchment A1: ROOF

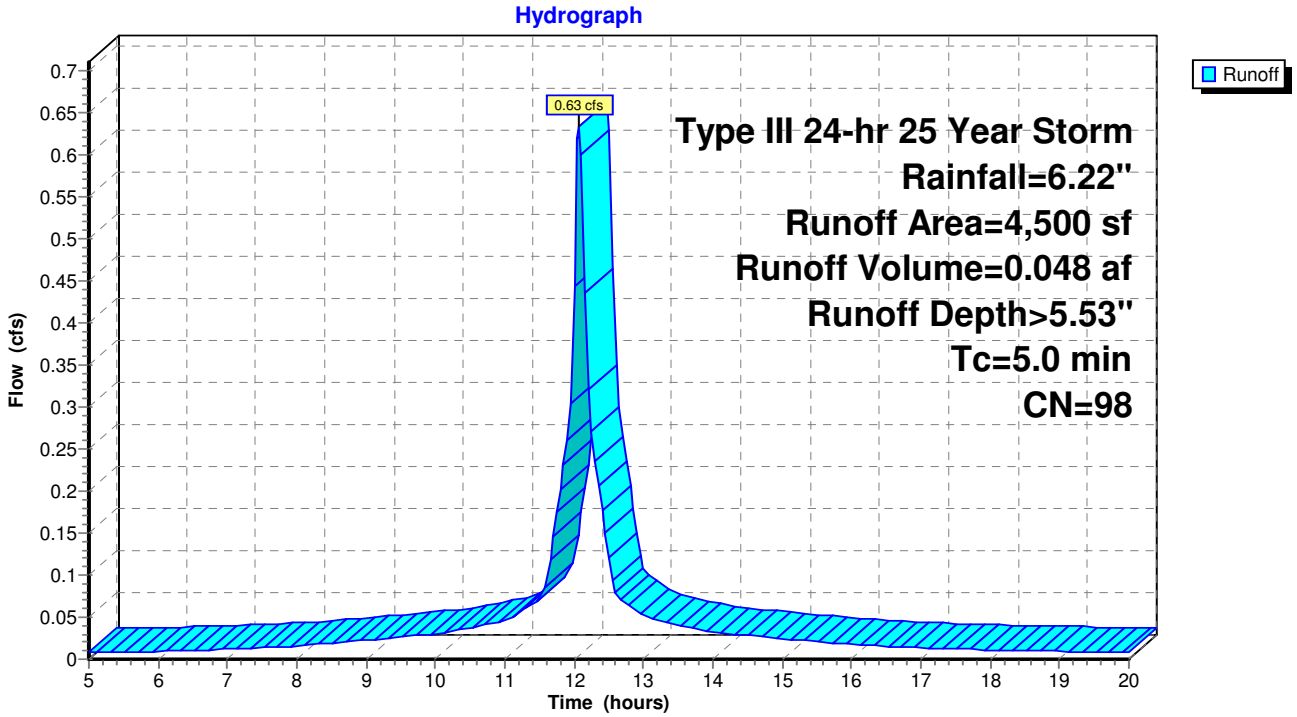
Runoff = 0.63 cfs @ 12.07 hrs, Volume= 0.048 af, Depth> 5.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Storm Rainfall=6.22"

	Area (sf)	CN	Description
*	4,500	98	Roof
	4,500		100.00% Impervious Area

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

Subcatchment A1: ROOF



Summary for Subcatchment A2: AREA A2

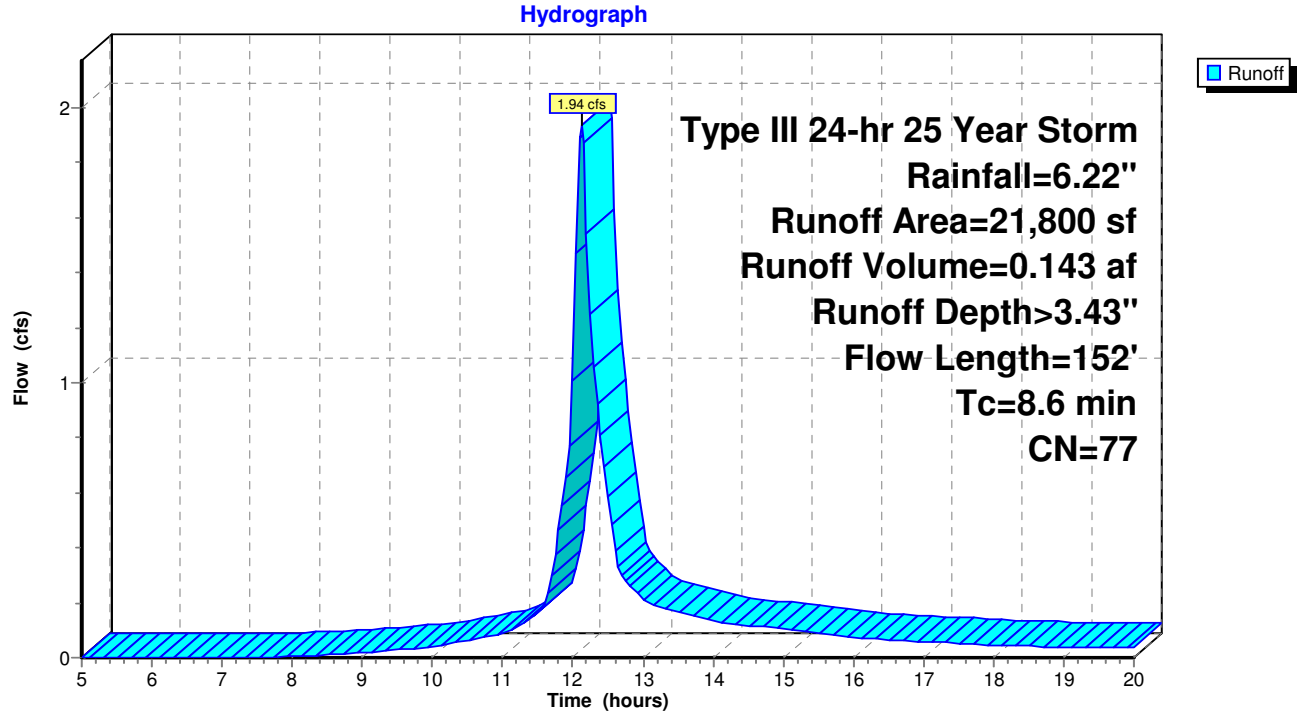
Runoff = 1.94 cfs @ 12.12 hrs, Volume= 0.143 af, Depth> 3.43"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Storm Rainfall=6.22"

	Area (sf)	CN	Description
*	9,380	98	Parking
	12,420	61	>75% Grass cover, Good, HSG B
	21,800	77	Weighted Average
	12,420		56.97% Pervious Area
	9,380		43.03% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	50	0.0100	0.11		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.5	22	0.0100	0.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.7	80	0.0080	1.82		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
8.6	152	Total			

Subcatchment A2: AREA A2



Summary for Subcatchment A3: AREA A3

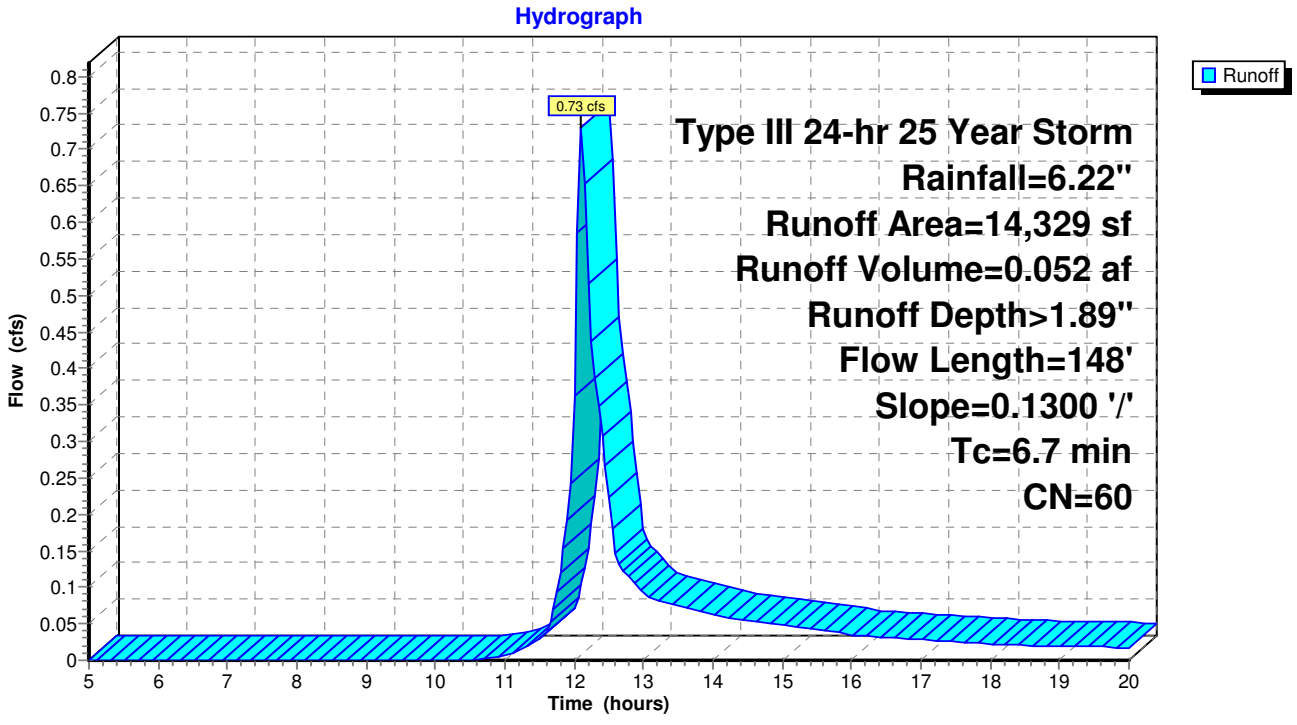
Runoff = 0.73 cfs @ 12.11 hrs, Volume= 0.052 af, Depth> 1.89"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Storm Rainfall=6.22"

Area (sf)	CN	Description
11,049	61	>75% Grass cover, Good, HSG B
3,080	55	Woods, Good, HSG B
200	98	Paved parking, HSG B
14,329	60	Weighted Average
14,129		98.60% Pervious Area
200		1.40% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	50	0.1300	0.14		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
0.9	98	0.1300	1.80		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
6.7	148	Total			

Subcatchment A3: AREA A3



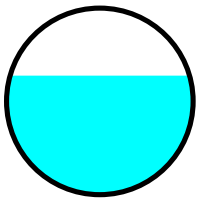
Summary for Reach 1R: 6" HDPE

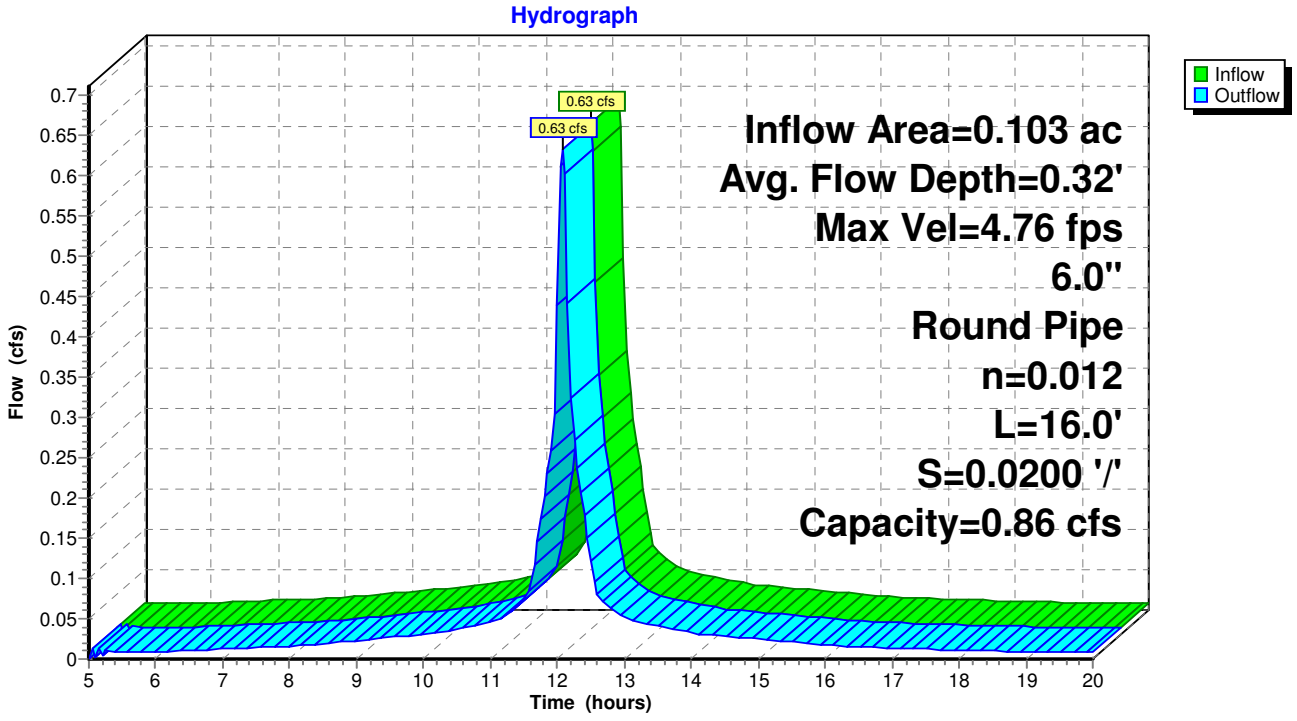
Inflow Area = 0.103 ac,100.00% Impervious, Inflow Depth > 5.53" for 25 Year Storm event
Inflow = 0.63 cfs @ 12.07 hrs, Volume= 0.048 af
Outflow = 0.63 cfs @ 12.07 hrs, Volume= 0.048 af, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.76 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 1.93 fps, Avg. Travel Time= 0.1 min

Peak Storage= 2 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.32'
Bank-Full Depth= 0.50', Capacity at Bank-Full= 0.86 cfs

6.0" Round Pipe
n= 0.012
Length= 16.0' Slope= 0.0200 '/'
Inlet Invert= 457.82', Outlet Invert= 457.50'





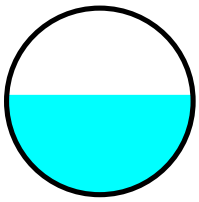
Summary for Reach 2R: 8" HDPE

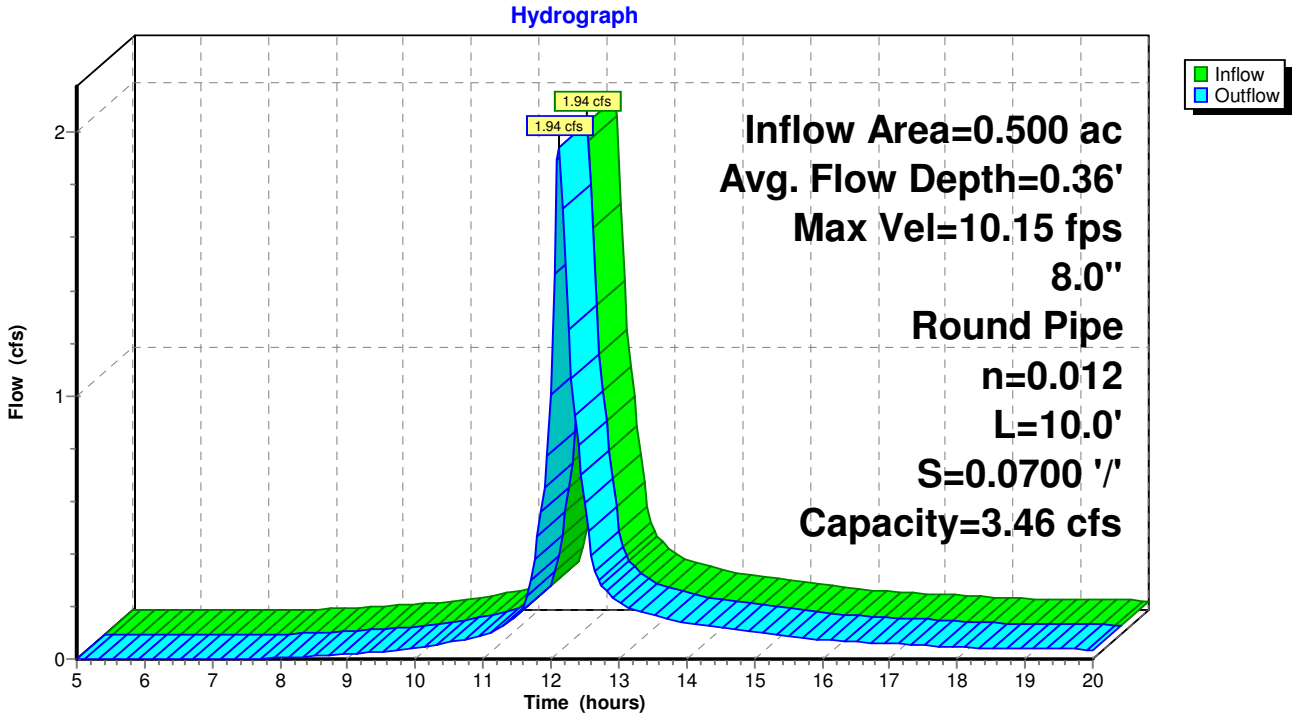
Inflow Area = 0.500 ac, 43.03% Impervious, Inflow Depth > 3.43" for 25 Year Storm event
Inflow = 1.94 cfs @ 12.12 hrs, Volume= 0.143 af
Outflow = 1.94 cfs @ 12.12 hrs, Volume= 0.143 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 10.15 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 4.05 fps, Avg. Travel Time= 0.0 min

Peak Storage= 2 cf @ 12.12 hrs
Average Depth at Peak Storage= 0.36'
Bank-Full Depth= 0.67', Capacity at Bank-Full= 3.46 cfs

8.0" Round Pipe
n= 0.012
Length= 10.0' Slope= 0.0700 '/'
Inlet Invert= 458.20', Outlet Invert= 457.50'





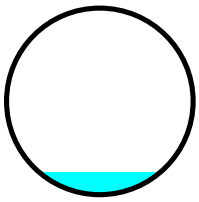
Summary for Reach 3R: 8" PIPE

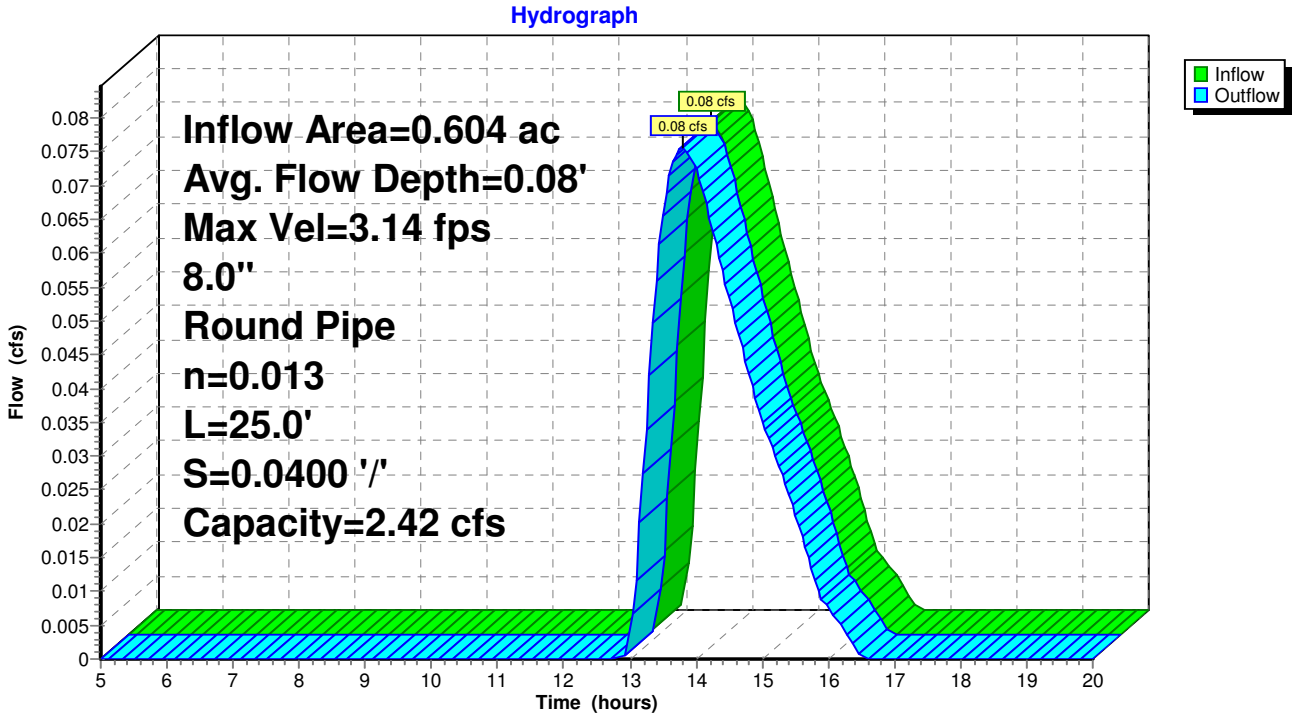
Inflow Area = 0.604 ac, 52.78% Impervious, Inflow Depth = 0.21" for 25 Year Storm event
Inflow = 0.08 cfs @ 13.80 hrs, Volume= 0.011 af
Outflow = 0.08 cfs @ 13.80 hrs, Volume= 0.011 af, Atten= 0%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.14 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.34 fps, Avg. Travel Time= 0.2 min

Peak Storage= 1 cf @ 13.80 hrs
Average Depth at Peak Storage= 0.08'
Bank-Full Depth= 0.67', Capacity at Bank-Full= 2.42 cfs

8.0" Round Pipe
n= 0.013
Length= 25.0' Slope= 0.0400 '/'
Inlet Invert= 456.00', Outlet Invert= 455.00'



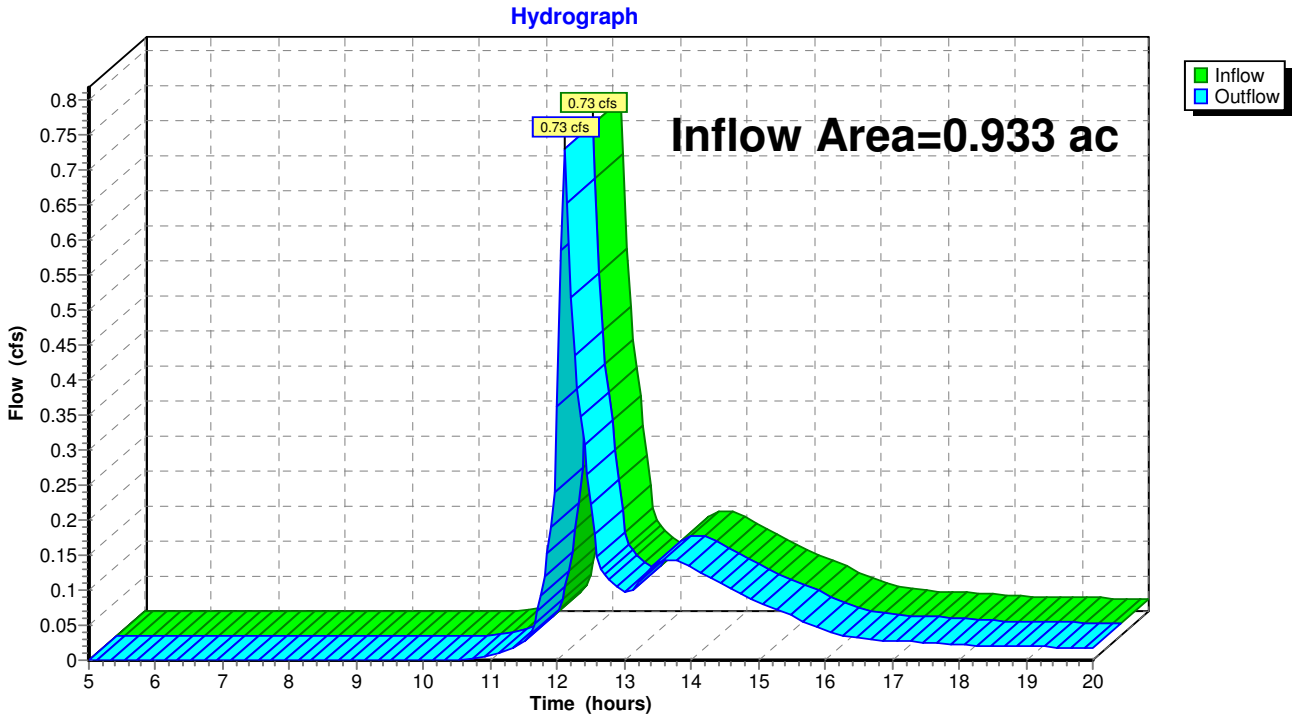


Summary for Reach 4R: (new Reach)

Inflow Area = 0.933 ac, 34.66% Impervious, Inflow Depth > 0.80" for 25 Year Storm event
Inflow = 0.73 cfs @ 12.11 hrs, Volume= 0.063 af
Outflow = 0.73 cfs @ 12.11 hrs, Volume= 0.063 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 4R: (new Reach)



Summary for Pond IS-1: LEACHING AREA (IS-1)

Inflow Area = 0.604 ac, 52.78% Impervious, Inflow Depth > 3.79" for 25 Year Storm event
Inflow = 2.51 cfs @ 12.11 hrs, Volume= 0.191 af
Outflow = 0.19 cfs @ 13.80 hrs, Volume= 0.100 af, Atten= 93%, Lag= 101.2 min
Discarded = 0.11 cfs @ 11.70 hrs, Volume= 0.089 af
Primary = 0.08 cfs @ 13.80 hrs, Volume= 0.011 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 457.65' @ 13.80 hrs Surf.Area= 0 sf Storage= 4,810 cf

Plug-Flow detention time= 205.5 min calculated for 0.100 af (52% of inflow)
Center-of-Mass det. time= 121.6 min (895.8 - 774.2)

Volume	Invert	Avail.Storage	Storage Description
#1	453.50'	5,915 cf	**Custom Stage Data** Listed below

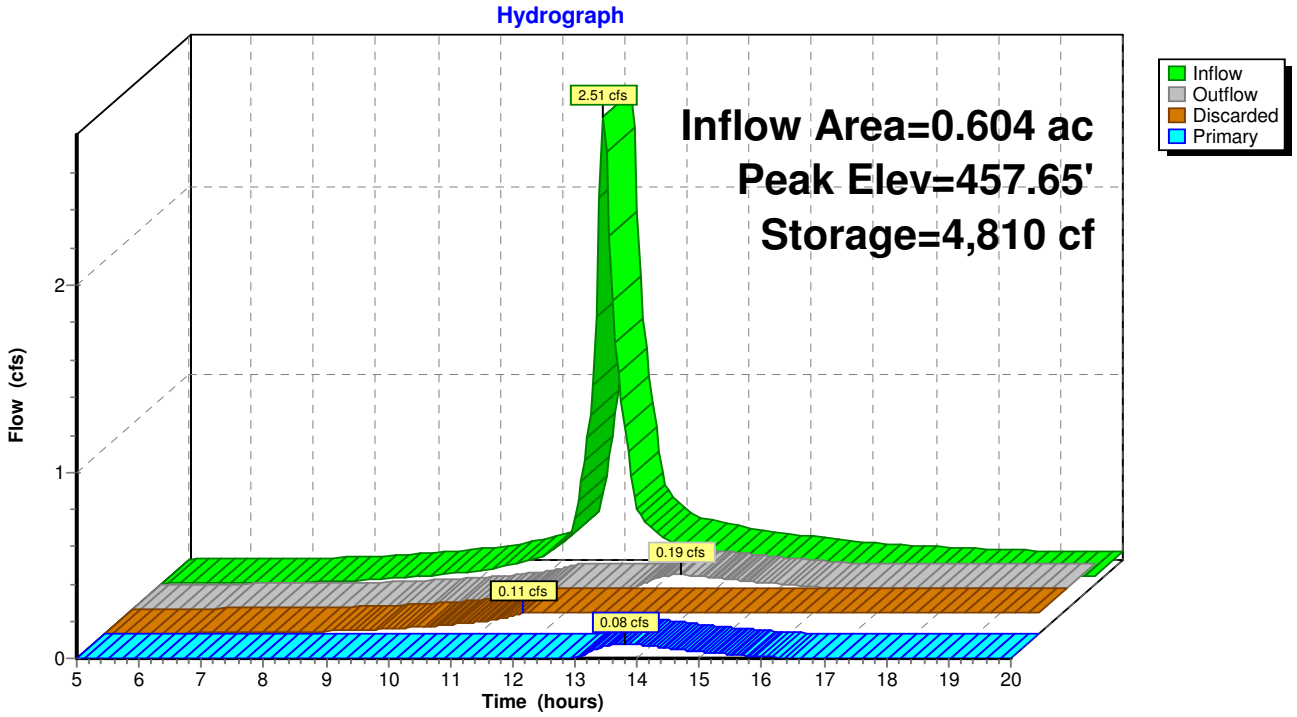
Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
453.50	0	0
454.50	727	727
455.50	1,297	2,024
456.50	1,297	3,321
457.50	1,297	4,618
458.50	1,297	5,915

Device	Routing	Invert	Outlet Devices
#1	Discarded	453.50'	**Exfiltration**
			Head (feet) 0.00 1.00 2.00 3.00 4.00 5.00
			Disch. (cfs) 0.000 0.110 0.110 0.110 0.110 0.110
#2	Primary	457.50'	**8.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.11 cfs @ 11.70 hrs HW=454.52' (Free Discharge)
↑—**1=Exfiltration** (Custom Controls 0.11 cfs)

Primary OutFlow Max=0.08 cfs @ 13.80 hrs HW=457.65' (Free Discharge)
↑—**2=Orifice/Grate** (Orifice Controls 0.08 cfs @ 1.31 fps)

Pond IS-1: LEACHING AREA (IS-1)



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

Subcatchment A1: ROOF Runoff Area=4,500 sf 100.00% Impervious Runoff Depth>7.95"
Tc=5.0 min CN=98 Runoff=0.91 cfs 0.068 af

Subcatchment A2: AREA A2 Runoff Area=21,800 sf 43.03% Impervious Runoff Depth>5.73"
Flow Length=152' Tc=8.6 min CN=77 Runoff=3.19 cfs 0.239 af

Subcatchment A3: AREA A3 Runoff Area=14,329 sf 1.40% Impervious Runoff Depth>3.71"
Flow Length=148' Slope=0.1300 '/' Tc=6.7 min CN=60 Runoff=1.48 cfs 0.102 af

Reach 1R: 6" HDPE Avg. Flow Depth=0.43' Max Vel=4.99 fps Inflow=0.91 cfs 0.068 af
6.0" Round Pipe n=0.012 L=16.0' S=0.0200 '/' Capacity=0.86 cfs Outflow=0.90 cfs 0.068 af

Reach 2R: 8" HDPE Avg. Flow Depth=0.50' Max Vel=11.23 fps Inflow=3.19 cfs 0.239 af
8.0" Round Pipe n=0.012 L=10.0' S=0.0700 '/' Capacity=3.46 cfs Outflow=3.19 cfs 0.239 af

Reach 3R: 8" PIPE Avg. Flow Depth=0.35' Max Vel=7.06 fps Inflow=1.30 cfs 0.108 af
8.0" Round Pipe n=0.013 L=25.0' S=0.0400 '/' Capacity=2.42 cfs Outflow=1.31 cfs 0.108 af

Reach 4R: (new Reach) Inflow=1.91 cfs 0.210 af
Outflow=1.91 cfs 0.210 af

Pond IS-1: LEACHING AREA (IS-1) Peak Elev=458.44' Storage=5,832 cf Inflow=4.00 cfs 0.307 af
Discarded=0.11 cfs 0.099 af Primary=1.30 cfs 0.108 af Outflow=1.41 cfs 0.207 af

Total Runoff Area = 0.933 ac Runoff Volume = 0.409 af Average Runoff Depth = 5.26"
65.34% Pervious = 0.609 ac 34.66% Impervious = 0.323 ac

Summary for Subcatchment A1: ROOF

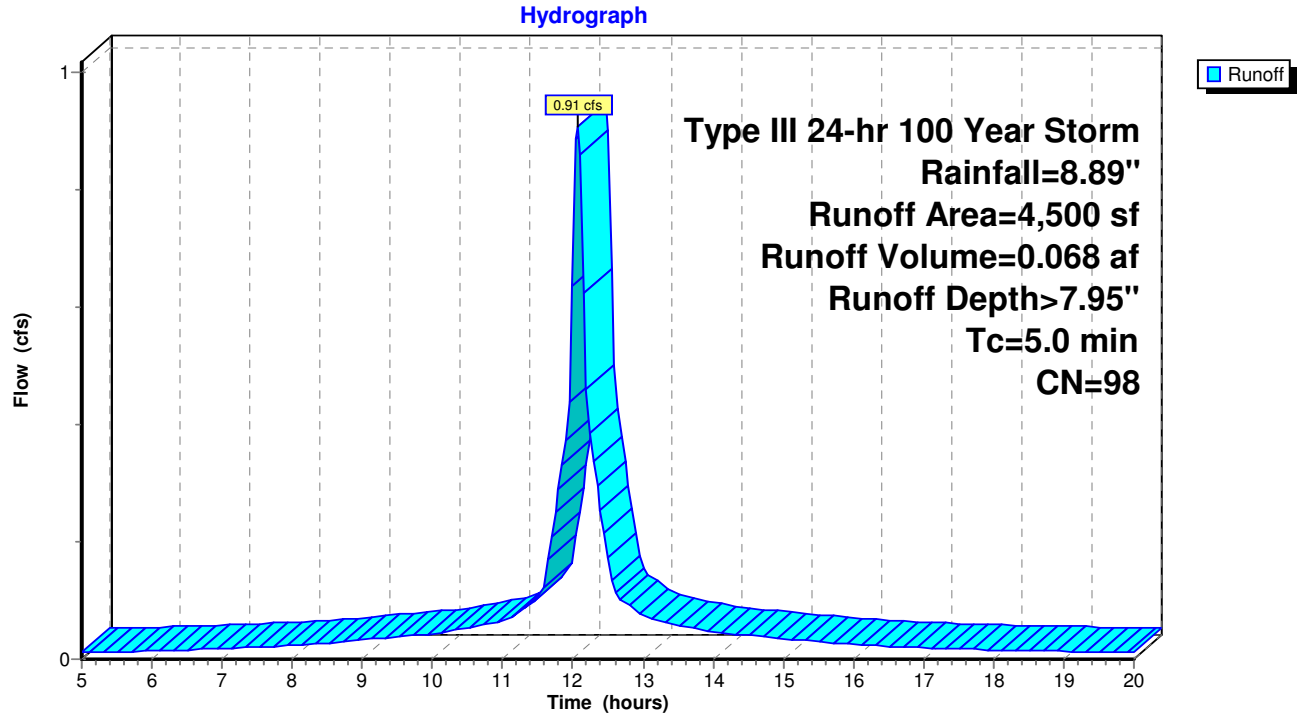
Runoff = 0.91 cfs @ 12.07 hrs, Volume= 0.068 af, Depth> 7.95"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.89"

	Area (sf)	CN	Description
*	4,500	98	Roof
	4,500		100.00% Impervious Area

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

Subcatchment A1: ROOF



Summary for Subcatchment A2: AREA A2

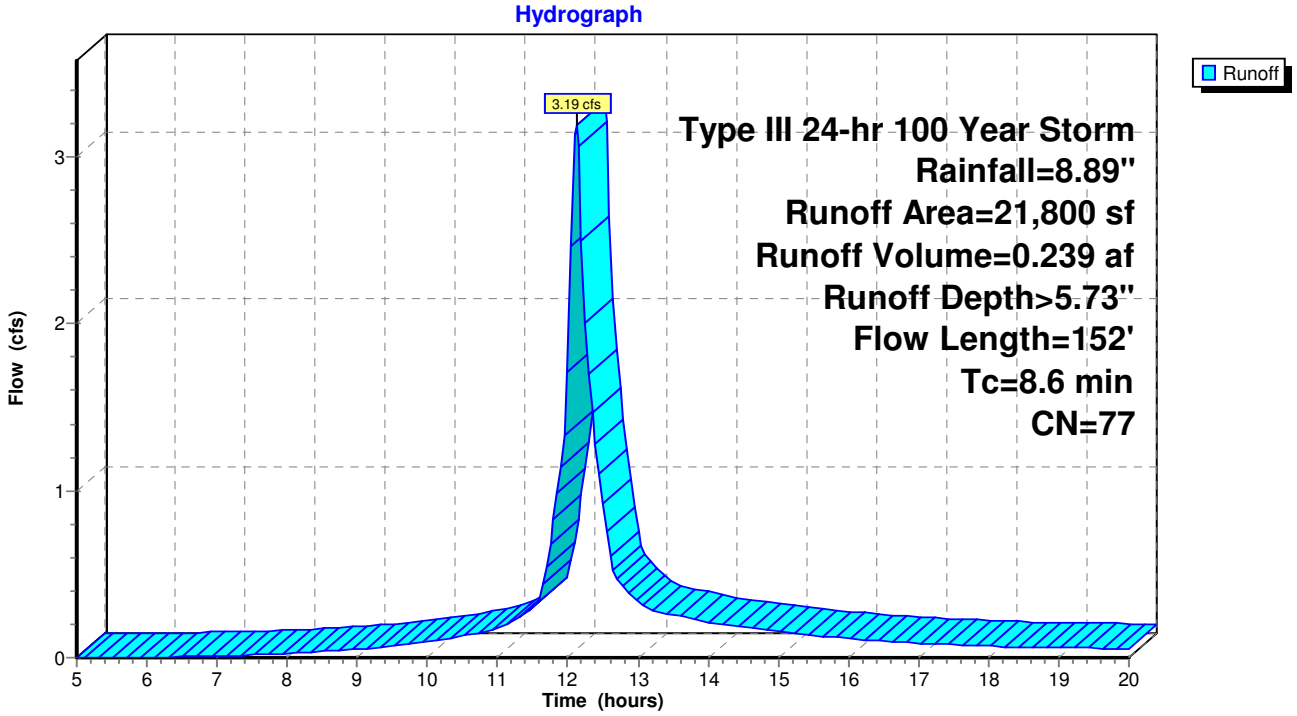
Runoff = 3.19 cfs @ 12.12 hrs, Volume= 0.239 af, Depth> 5.73"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.89"

	Area (sf)	CN	Description
*	9,380	98	Parking
	12,420	61	>75% Grass cover, Good, HSG B
	21,800	77	Weighted Average
	12,420		56.97% Pervious Area
	9,380		43.03% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	50	0.0100	0.11		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.5	22	0.0100	0.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.7	80	0.0080	1.82		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
8.6	152	Total			

Subcatchment A2: AREA A2



Summary for Subcatchment A3: AREA A3

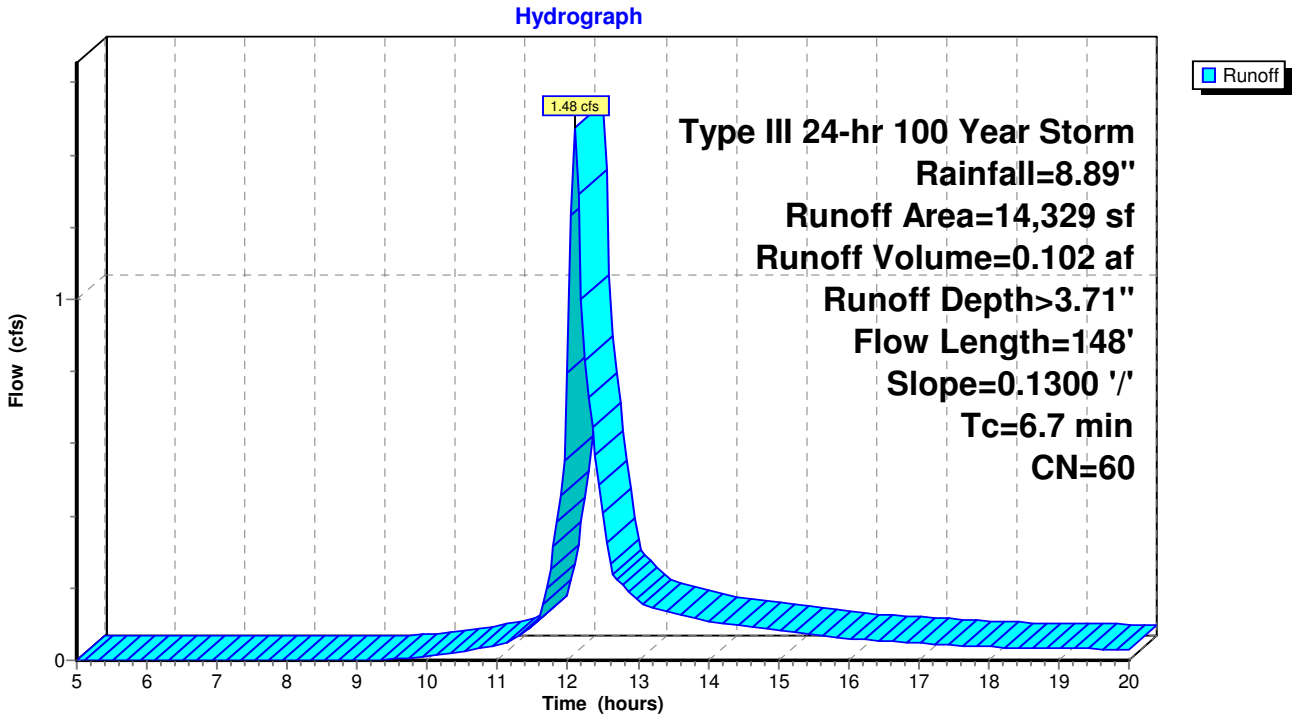
Runoff = 1.48 cfs @ 12.10 hrs, Volume= 0.102 af, Depth> 3.71"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.89"

Area (sf)	CN	Description
11,049	61	>75% Grass cover, Good, HSG B
3,080	55	Woods, Good, HSG B
200	98	Paved parking, HSG B
14,329	60	Weighted Average
14,129		98.60% Pervious Area
200		1.40% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	50	0.1300	0.14		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
0.9	98	0.1300	1.80		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
6.7	148	Total			

Subcatchment A3: AREA A3



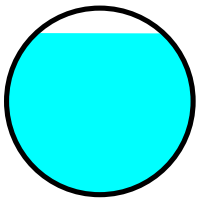
Summary for Reach 1R: 6" HDPE

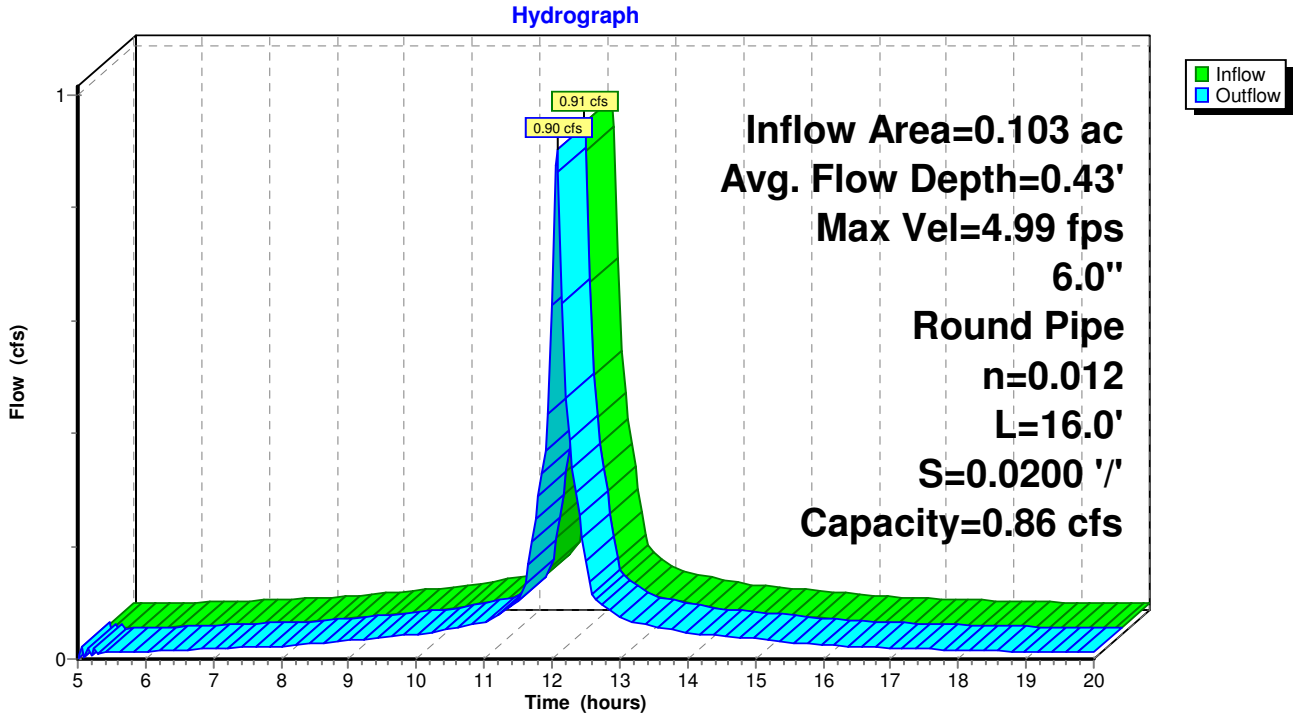
Inflow Area = 0.103 ac,100.00% Impervious, Inflow Depth > 7.95" for 100 Year Storm event
Inflow = 0.91 cfs @ 12.07 hrs, Volume= 0.068 af
Outflow = 0.90 cfs @ 12.07 hrs, Volume= 0.068 af, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.99 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.15 fps, Avg. Travel Time= 0.1 min

Peak Storage= 3 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.43'
Bank-Full Depth= 0.50', Capacity at Bank-Full= 0.86 cfs

6.0" Round Pipe
n= 0.012
Length= 16.0' Slope= 0.0200 '/'
Inlet Invert= 457.82', Outlet Invert= 457.50'





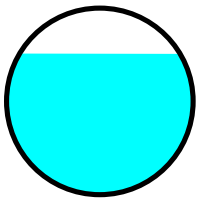
Summary for Reach 2R: 8" HDPE

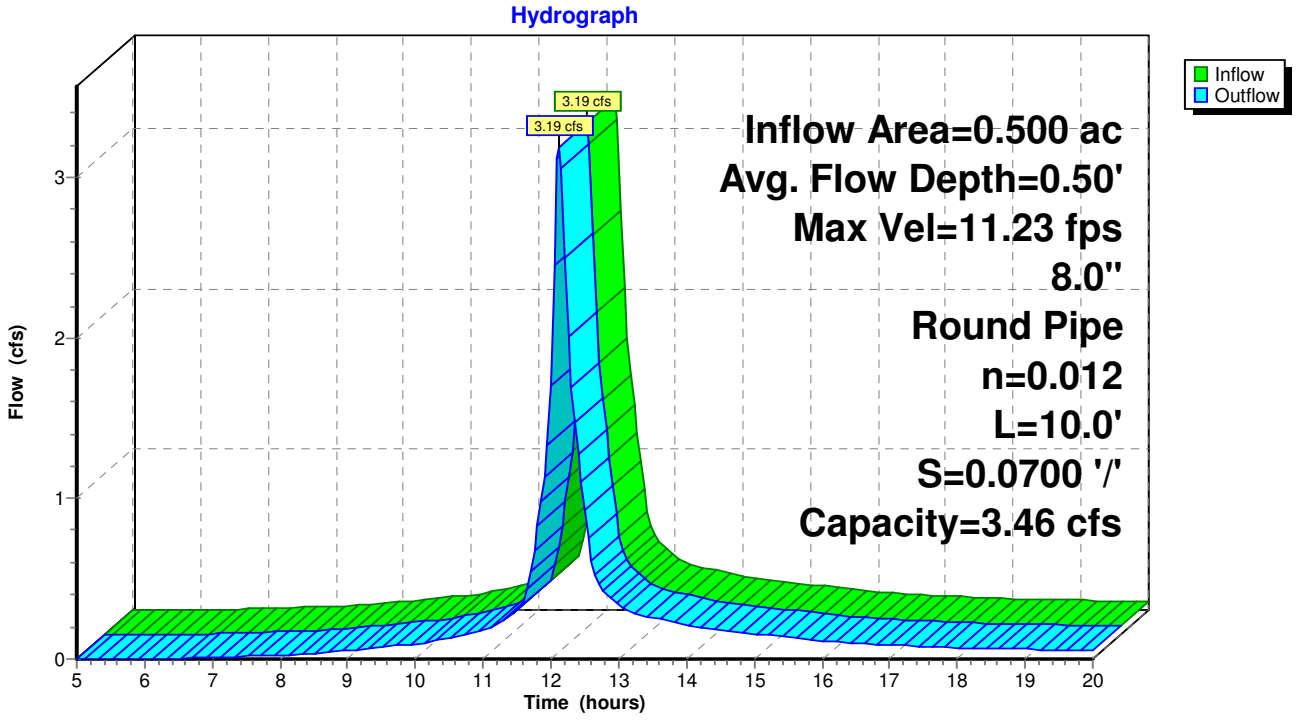
Inflow Area = 0.500 ac, 43.03% Impervious, Inflow Depth > 5.73" for 100 Year Storm event
Inflow = 3.19 cfs @ 12.12 hrs, Volume= 0.239 af
Outflow = 3.19 cfs @ 12.12 hrs, Volume= 0.239 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 11.23 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 4.48 fps, Avg. Travel Time= 0.0 min

Peak Storage= 3 cf @ 12.12 hrs
Average Depth at Peak Storage= 0.50'
Bank-Full Depth= 0.67', Capacity at Bank-Full= 3.46 cfs

8.0" Round Pipe
n= 0.012
Length= 10.0' Slope= 0.0700 '/'
Inlet Invert= 458.20', Outlet Invert= 457.50'





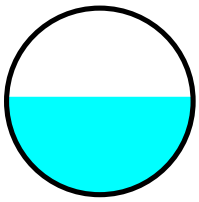
Summary for Reach 3R: 8" PIPE

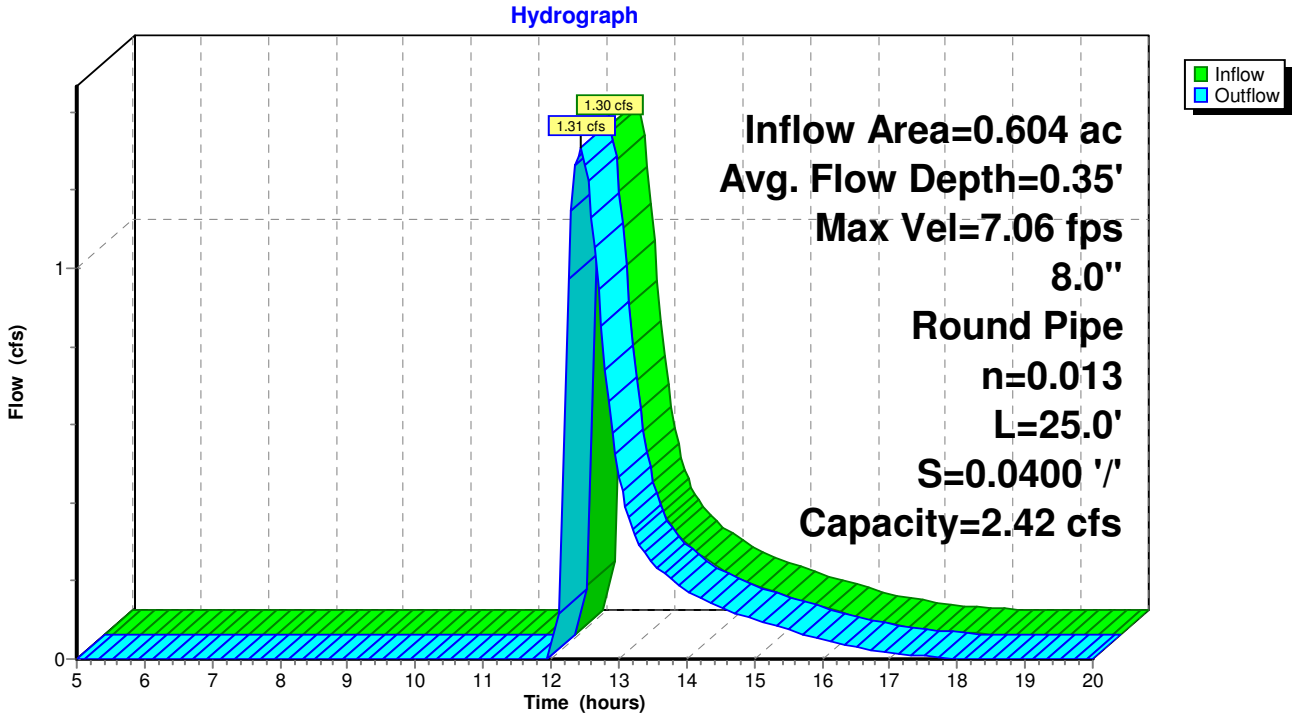
Inflow Area = 0.604 ac, 52.78% Impervious, Inflow Depth = 2.14" for 100 Year Storm event
Inflow = 1.30 cfs @ 12.43 hrs, Volume= 0.108 af
Outflow = 1.31 cfs @ 12.44 hrs, Volume= 0.108 af, Atten= 0%, Lag= 0.7 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.06 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 3.45 fps, Avg. Travel Time= 0.1 min

Peak Storage= 5 cf @ 12.44 hrs
Average Depth at Peak Storage= 0.35'
Bank-Full Depth= 0.67', Capacity at Bank-Full= 2.42 cfs

8.0" Round Pipe
n= 0.013
Length= 25.0' Slope= 0.0400 '/'
Inlet Invert= 456.00', Outlet Invert= 455.00'



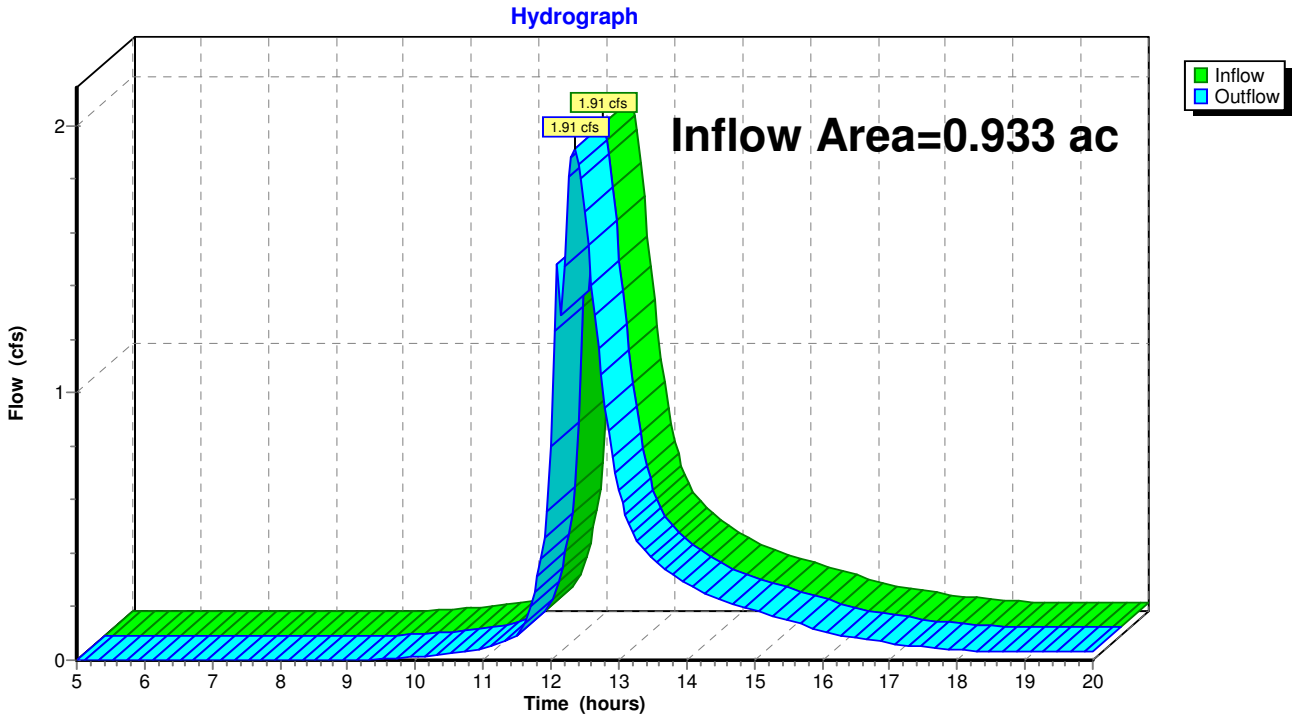


Summary for Reach 4R: (new Reach)

Inflow Area = 0.933 ac, 34.66% Impervious, Inflow Depth > 2.70" for 100 Year Storm event
Inflow = 1.91 cfs @ 12.34 hrs, Volume= 0.210 af
Outflow = 1.91 cfs @ 12.34 hrs, Volume= 0.210 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 4R: (new Reach)



Summary for Pond IS-1: LEACHING AREA (IS-1)

Inflow Area = 0.604 ac, 52.78% Impervious, Inflow Depth > 6.11" for 100 Year Storm event
Inflow = 4.00 cfs @ 12.11 hrs, Volume= 0.307 af
Outflow = 1.41 cfs @ 12.43 hrs, Volume= 0.207 af, Atten= 65%, Lag= 19.2 min
Discarded = 0.11 cfs @ 10.85 hrs, Volume= 0.099 af
Primary = 1.30 cfs @ 12.43 hrs, Volume= 0.108 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 458.44' @ 12.43 hrs Surf.Area= 0 sf Storage= 5,832 cf

Plug-Flow detention time= 132.5 min calculated for 0.207 af (67% of inflow)
Center-of-Mass det. time= 62.9 min (828.9 - 766.0)

Volume	Invert	Avail.Storage	Storage Description
#1	453.50'	5,915 cf	**Custom Stage Data** Listed below

Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
453.50	0	0
454.50	727	727
455.50	1,297	2,024
456.50	1,297	3,321
457.50	1,297	4,618
458.50	1,297	5,915

Device	Routing	Invert	Outlet Devices
#1	Discarded	453.50'	**Exfiltration**
			Head (feet) 0.00 1.00 2.00 3.00 4.00 5.00
			Disch. (cfs) 0.000 0.110 0.110 0.110 0.110 0.110
#2	Primary	457.50'	**8.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.11 cfs @ 10.85 hrs HW=454.51' (Free Discharge)
↑—**1=Exfiltration** (Custom Controls 0.11 cfs)

Primary OutFlow Max=1.30 cfs @ 12.43 hrs HW=458.43' (Free Discharge)
↑—**2=Orifice/Grate** (Orifice Controls 1.30 cfs @ 3.73 fps)

Pond IS-1: LEACHING AREA (IS-1)