Stormwater Management Report

For the:
Proposed Retail Development

Located at:
146 Washington Avenue
Town of North Haven Connecticut

Prepared for Submission to:
Town of North Haven, Connecticut

April 8th, 2021

Prepared for:
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Executive Summary

This report has been prepared in support of a Permit Application submission to the Town of North Haven by 146 Washington Ave, LLC for a proposed commercial redevelopment at 146 Washington Avenue. The design and analysis as presented within this report complies with the Town of North Haven Inland Wetlands and Watercourse Regulations, Town of North Haven Zoning Regulations, the *2002 Connecticut Guidelines for Soil Erosion,* and the *2004 Connecticut Stormwater Quality Manual.*

The proposed development will not result in any adverse impacts to the nearby wetlands nor sensitive areas downstream of the proposed development.

Location

The proposed development is situated on seven existing tax parcels, totaling approximately 1.59 acres. The property is bordered to the north by a fast-food restaurant and Blakeslee Avenue, to east by residential lots, to the south by Monroe Street and to the west by Route 5 (Washington Avenue). Per the Town of North Haven's Zoning Map, the property is located within the CB-20 zone, abutting parcels on the east are located within the R-12 Zone and abutting parcels on the west are located within the IL-30 zone. A project location map has been provided in Appendix A of this Report.

Property Description

The existing parcels impacted by the proposed redevelopment includes commercial and residential uses. The site consists of a 9,184 square foot commercial building, a parking lot and two single family homes. The existing topography, ranging from elevation 45 to 43, generally slopes towards Washington Avenue, Monroe Street, and Blakeslee Avenue and ultimately flowing to the existing drainage network in Washington Avenue. Runoff within the site is routed to one of three existing catch basins/drywells. All three catch basins/drywell onsite are in the rear parking lot. Based on the existing drainage patterns, the Site hydrology can be divided into two drainage areas; the existing commercial lot and the existing residential lot along Monroe Street; and the residential lot along Blakeslee Avenue. Runoff from the existing commercial lot is routed to the existing drainage network onsite and ultimately discharged to the drainage system in Washington Avenue. Runoff from the existing residential lots flows to Monroe Street or Blakeslee Avenue and ultimately discharges to the existing drainage system in Washington Avenue.

Project Description

The proposed site improvements include the construction of a +/- 7,050 SF mixed-use building, parking areas, landscaped areas, site utilities, lighting, and a stormwater management system. To improve the existing, stormwater quality conditions for the site and support the overall proposed development, additional water quality devises have been incorporated into the overall stormwater design. These measures include the use of subsurface infiltration systems with an insolator row, a water quality structure, sumps and hooded outlets within each catch basins. A complete summary of the supporting analysis and sizing is provided in subsequent sections of this report.

FEMA Flood Insurance Rate Map

Per the FEMA Flood Insurance Rate Map Number 09009C0313K for New Haven County, Connecticut revised May 16, 2017, the parcel resides entirely within the Other Areas of Flood Hazard Zone X. Zone X (unshaded) is defined as areas of minimal flooding and is determined to be outside the 0.2% annual chance floodplain. A copy of the FEMA Flood Insurance Rate Map is included in Appendix A for reference.

Stormwater Analysis Summary

A HydroCAD model, using TR-55 and SCS methodology, was developed to evaluate the site's existing and proposed drainage conditions for 2-, 10-, 25-, 50- and 100-year storm events. Water quality treatment has been provided for this project and consists of two hydrodynamic separators located upstream of each discharge point. The proposed Best Management Practices (BMPs) for this project will provide additional water quality treatment and include hooded sump catch basins as well as a subsurface infiltration system with isolator row. These proposed improvements will provide the minimum required TSS removal rate of 80% per the *2004 Connecticut Stormwater Quality Manual.*

The software program Bentley StormCAD V8i, which uses the Rational Method and Structural Loss Mode of Energy Grade, was used to evaluate and properly size the proposed storm sewer conveyance system up to the 25-year design storm. All supporting calculations are included within Appendix D.

Hydrologic Modeling Methodology

Hydrologic Modeling

The SCS Runoff Curve Number and TR-55 Methods were utilized to determine the peak runoff for each watershed impacted by the proposed development. All supporting calculations have been completed using the stormwater computer modeling program known as HydroCAD, version 10.00, developed by HydroCAD Software Solutions, LLC. Hydrographs for each watershed were developed using the SCS Synthetic Unit Hydrograph Method and rainfall depths per the NOAA Atlas 14 for North Haven, CT as shown in Table 1. The drainage areas, or sub catchments as labeled by the program, are depicted by hexagons on the attached drainage diagrams. Pre-development HydroCAD results can be found in Appendix B and Post-development HydroCAD results can be found in Appendix C.

Table 1 – 24-HR Rainfall Depths per NOAA Atlas 14 (North Haven, CT)

Return Period	24-hour Rainfall Depth
2-year	3.49
10-year	5.40
25-year	6.59
50-year	7.47
100-year	8.42

Existing Site Conditions and Hydrology Conditions

General Site Information

As previously noted, generally slopes towards Washington Avenue, Monroe Street, and Blakeslee Avenue and ultimately flowing to the existing drainage network in Washington Avenue. Runoff within the site is routed to one of three existing catch basins/drywells. All three catch basins/drywell onsite are in the rear parking lot. Based on the existing drainage patterns, the Ste hydrology can be divided into two drainage areas; the existing commercial lot and the existing residential lot along Monroe Street; and the residential lot along Blakeslee Avenue. Runoff from the existing commercial lot is routed to the existing drainage network onsite and ultimately discharged to the drainage system in Washington Avenue. Runoff from the existing residential lots flows to Monroe Street or Blakeslee Avenue and ultimately discharges to the existing drainage system in Washington Avenue.

Soil Description

The soils included within this stormwater analysis were identified using available online resources created by the United States Department of Agriculture (USDA) Natural Resource Conservation Services (NRCS). They are as follows:

- Urban Land – Type D Soil
- Penwood Loamy Sand – Type A Soil
- Penwood-Urban Land – Type A Soil

A copy of the USDA NRCS Hydrologic Soil Group map is located within Appendix A of this report.

Existing Hydrologic Conditions

The existing site drainage area analyzed within this study totals 1.84 acres and is approximately 75.3% impervious. The majority of the existing commercial lot's site's runoff is captured, detained, and infiltrated via three catch basins located onsite. The runoff from the existing residential lots flows via sheet flow to Monroe Street and Blakeslee Avenue. All of the site's runoff ultimately flows to the existing drainage network within Washington Avenue. The existing discharge point has been identified as Point of Interest 1 (POI-1) for the analysis included within this report. All collected runoff tributary to the discharge point flows offsite undetained.

The following is a brief summary of the existing drainage areas as shown on the enclosed Existing Drainage Map (ED-1), in Appendix F.

Existing Drainage Area 100 (EDA-100): This area consists of the existing commercial lot and the existing residential lot on the southern side (Map 73, Lot 35). EDA-100 is approximately 1.58 acres. The approximate imperviousness of this drainage area and CN number are 83.4% and 91, respectively. Stormwater runoff from EDA-100 flows overland and through the existing drainage system onsite and ultimately discharge to Washington Avenue (Point of Interest 1).

Existing Drainage Area 200 (EDA-200): This area consists primarily on the northern existing residential lot (Map 73, Lot 32) and is approximately 0.26 acres. The approximate imperviousness of this drainage area and CN number are 26.3% and 56, respectively. Stormwater runoff from EDA-200 flows overland and ultimately discharges to the Washington Avenue drainages System (Point of Interest 1).

Table 2 – Pre-Development (Existing Conditions) Drainage Characteristics

Drainage Area	Area (square feet)	Composite Curve Number	Imperviousness Cover (%)	Time of Concentration (minutes)
EDA-100	68,696	91	83.4%	5.00
EDA-200	11,284	56	26.3%	5.00

Note: Minimum Time of Concentration (T_C) used for this analysis is 5 minutes.

Table 3 – Pre-Development Conditions Peak Flows

Analysis Point	Description	Peak Flows (CFS)				
		1-YR	10-YR	25-YR	50-YR	100-YR
Point of Interest 1	Washington Avenue Drainage System	4.79	8.31	10.53	12.18	13.97

Developed Site Conditions and Hydrology Conditions

General Site Information

The proposed development includes converting the existing building into a 7,050 square foot mixed-use development. Additional improvement includes driveways, parking areas, storm sewer infrastructure, utilities, and landscaping. The existing drainage patterns have been maintained throughout the site. To improve the overall water quality for this site and support the proposed development, water quality treatment devices have been strategically located at each outfall to treat the captured stormwater prior to discharging offsite.

All existing infrastructure outside of the project's limits shall remain in place without interruption in service or overall functionality.

The proposed project will disturb approximately 1.84 acres.

Proposed Hydrologic Conditions

The proposed hydrologic analysis for this project maintains the methodologies, design points, and supporting assumptions described above. The intent of the proposed stormwater design is to mimic the existing drainage patterns, runoff flowrates, and runoff volumes to the greatest extend practical while improving the stormwater quality for the site.

The proposed site drainage area analyzed within this study maintains the original 1.84 acres described above. The proposed redevelopment is consistent with the previous commercial use and is approximately 75% impervious. This includes all paved surfaces such as sidewalk and driveways as well as the proposed building's roof.

The intent of the proposed stormwater design is to mimic the existing drainage patterns for the drainage areas as described within the Existing Hydrology Conditions Section of this report. All calculations were based on the 2- 10- 25-, 50- and 100-year stormfall events in order to accurately depict the proposed conditions. To mitigate any impact and improve the overall water quality for this site, stormwater treatment will be provided with the installation of a hydrodynamic separators to treat the stormwater runoff. Design calculations for the overall treatment effectiveness of the proposed system and water quality calculations are included in Appendix E. All stormwater quality treatment measures have been designed per *2004 Connecticut Stormwater Quality Manual*.

Proposed Drainage Areas

The following section briefly describes each drainage area as shown on the enclosed Proposed Drainage Map (PD-1), located in Append F of this report.

Proposed Drainage Area 100A (PDA-100A): Located within the existing residential property off of Monroe Street, drainage area PDA-100A consists of approximately 0.18 acres and is 76.6% impervious. Runoff within this area flows across the proposed parking lot to proposed catch basin 8. Catch basin 8 flows to the proposed water quality structure and ultimately discharged to the existing drainage network in Washington Avenue (Route 5). PDA-100A consists mainly of impervious pavement and pervious landscaped areas associated with the proposed parking lot.

Proposed Drainage Area 100B (PDA-100B): Located within the southern portion of the existing commercial development, drainage area PDA-100B consists of approximately 0.55 acres and is 84.8% impervious. Runoff within this area flows across the parking lot to proposed catch basins 7, 9, and 10. Additional runoff is capture through roof drains and is discharged to catch basin 7, 9, and 10. Catch basins 7, 9, and 10 flow to the proposed water quality structure and ultimately discharge to the existing drainage network in Washington Avenue (Route 5).

Proposed Drainage Area 100C (PDA-100C): Located in the northeast corner of the existing commercial development, drainage area PDA-100C consists of approximately 0.35 acres and is 79.5% impervious. Runoff within this area flows across the parking lot to proposed catch basins 1 and 2. Catch basins 1 and 2 flow to the proposed water quality structure and ultimately discharge to the existing drainage network in Washington Avenue (Route 5).

Proposed Drainage Area 100D (PDA-100D): Located in the northwest corner of the existing commercial development, drainage area PDA-100D consists of approximately 0.41 acres and is 72.4% impervious. Runoff within this area flows across the parking lot to proposed catch basins 5 and 6. Catch basins 5 and 6 flow to the proposed water quality structure and ultimately discharge to the existing drainage network in Washington Avenue (Route 5).

Proposed Drainage Area 200 (PDA-200): Located within the existing residential property off of Blakeslee Avenue, drainage area PDA-200 consists of approximately 0.34 acres and is 59.4% impervious. Runoff within this area flows to catch basin 11 which discharges to the subsurface infiltration system with an isolator row. Flow from the

subsurface infiltration system discharges to the proposed the water quality structure and ultimately empties into the existing drainage network in Washington Avenue (Route 5).

Post-Development Hydrologic Analysis Results

The results of the post-development hydrologic analysis are as follows and summarized in Table 4 and Table 5 below:

Table 4 – Post Development Drainage Characteristics

Drainage Area	Total Area SF	Composite Curve Number	Imperviousness Cover %	Time of Concentration Minutes
PDA-10A	7,841	84	76.6%	5.0
PDA-100B	24,140	95	84.8%	5.0
PDA-100C	15,220	94	72.4%	5.0
PDA-100D	18,001	93	68.6%	5.0
PDA-200	14,777	78	59.4%	5.0

Table 5 – Post-Development Conditions Peak Flows

Analysis Point	Description	Peak Flows (CFS)				
		2-YR	10-YR	25-YR	50-YR	100-YR
Point of Interest 1	Washington Avenue Drainage System	4.73	7.76	10.24	12.03	13.75

For a complete comparison of pre- and post-development runoff rates for each design storm, refer to Table 6, shown below.

Table 6 – Existing vs Proposed Peak Rates of Runoff

	Peak Flow (cfs)				
Drainage Area	**2-YR**	**10-YR**	**25-YR**	**50-YR**	**100-YR**
Point of Interest 1					
Existing	4.79	8.31	10.53	12.18	13.91
Proposed	4.73	7.76	10.24	12.03	13.75
Change in Runoff	-0.06	-0.55	-0.29	-0.15	-0.16

Hydraulic Criteria and Design for Proposed Storm Sewer Conveyance System

Hydraulic Modeling for Proposed Conveyance Systems

The proposed storm sewer conveyance systems are sized to safely convey all stormwater runoff up to the 10-year storm event. All supporting calculations modeled using Bentley StormCAD V8i are included in Appendix D.

Permanent BMP's and Water Quality

Permanent Water Quality Best Management Practices (BMPs) have been incorporated into the project design to include a water quality structure and a subsurface infiltration system with an isolator row to treat the required runoff flow rates for the proposed development. Additional permanent BMP's include hooded sump catch basins. For location of each permanent BMP, refer to the drainage maps included in Appendix F of this report.

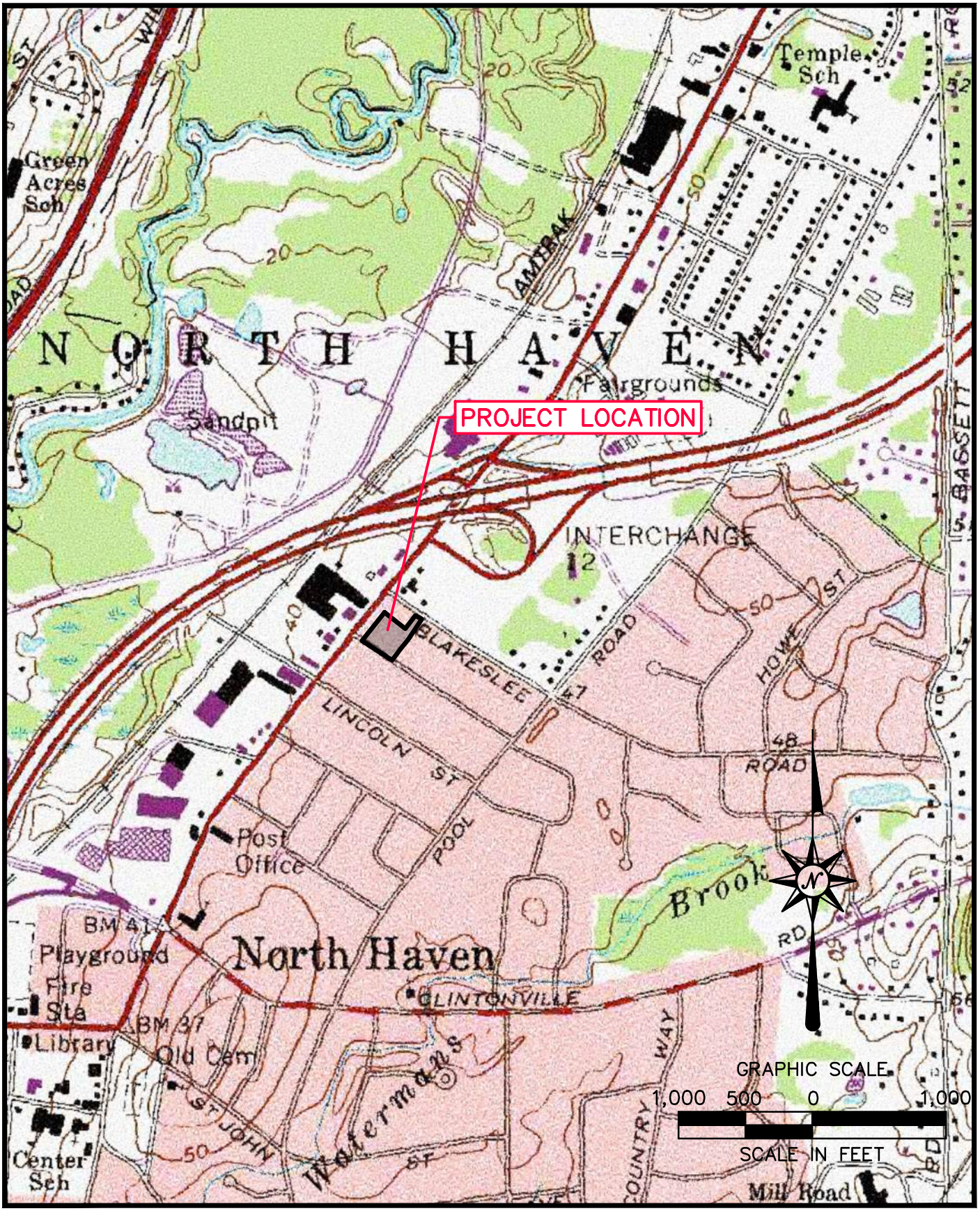
Summary

This stormwater analysis and report has been prepared to comply the *Town of North Haven Zoning Regulations,* the *2002 Connecticut Guidelines for Soil Erosion,* and the *2004 Connecticut Stormwater Quality Manual.* The proposed development and proposed drainage infrastructure have been designed to convey and treat the stormwater runoff up to the 10-year design storm and will not result in any adverse impacts to adjacent waterways or wetlands that are to remain. All post-development stormwater drainage patterns have been maintained to match the pre-development conditions. Stormwater quality is provided with the installation of proposed BMPs such as the water quality structure, a subsurface infiltration system with an isolator row, deep hooded sump catch basins, and the implementation of a street sediment sweeping program. These features will provide the minimum required 80% TSS removal.

APPENDIX A

LOCATION MAPS

Figure 1: USGS Location Map
Figure 2: Aerial Location Map
Figure 3: NRCS Soil Survey Map with Hydrologic Soil Group Data
Figure 4.0 FEMA Federal Insurance Rate Map
Figure 5: NOAA Atlas 14 Storm Data (Depth, Inches)
Figure 6: NOAA Atlas 14 Storm Data (Intensity, Inches per Hour)
Figure 7: Water Quality Classifications North Haven, CT
Figure 8: Natural Diversity Data Base Areas North Haven, CT



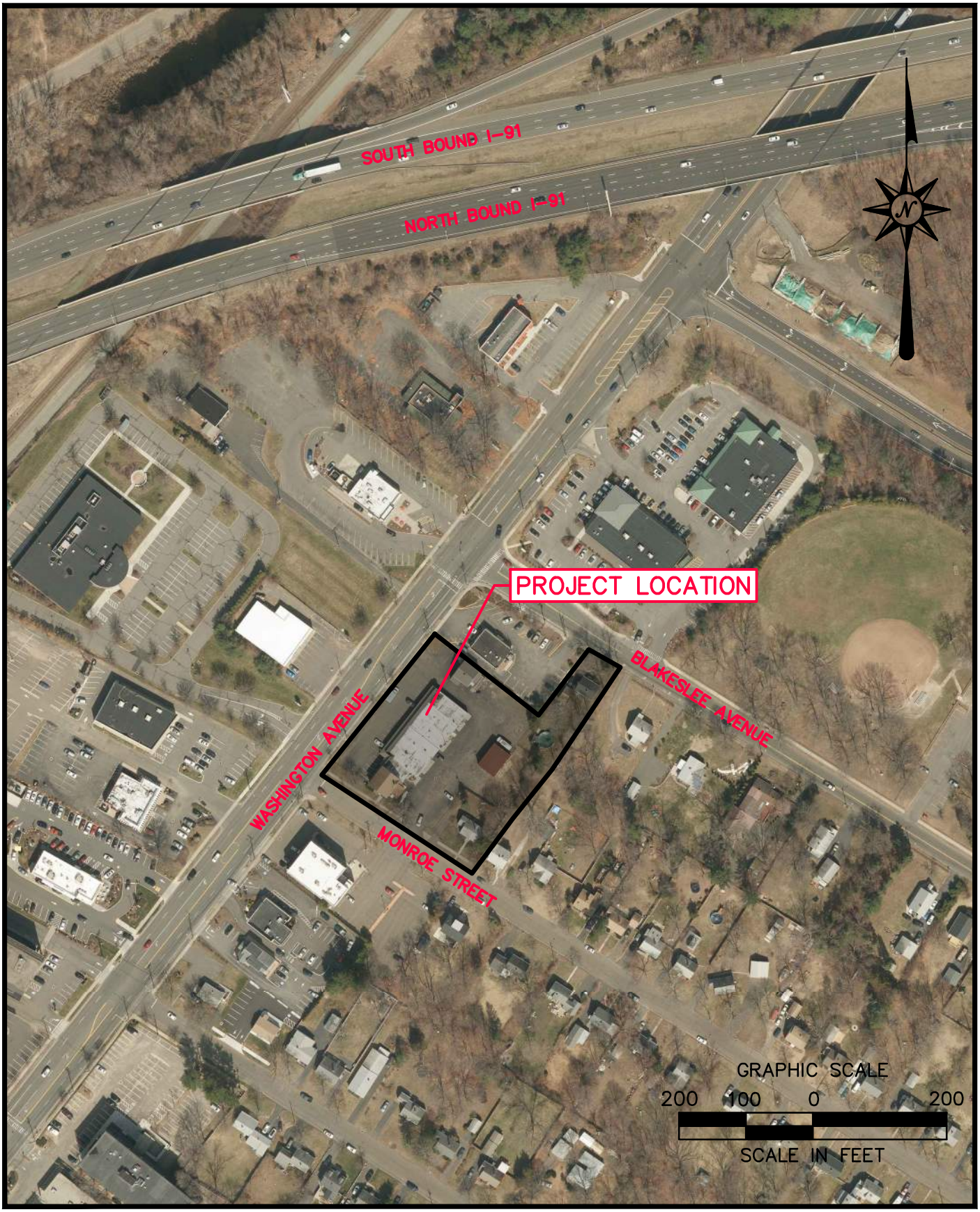
BL Companies

ARCHITECTURE
ENGINEERING
ENVIRONMENTAL
LAND SURVEYING

PROPOSED
RETAIL DEVELOPMENT
146 WASHINGTON AVENUE
NORTH HAVEN, CONNECTICUT

Designed	E.A.E.
Drawn	E.A.E.
Checked	X.X.X.
Approved	X.X.X.
Scale	1"=1,000'
Project No.	19901997
Date	3/30/2021
CAD File	EXH190199701

FIGURE 1
USGS LOCATION MAP



BL Companies

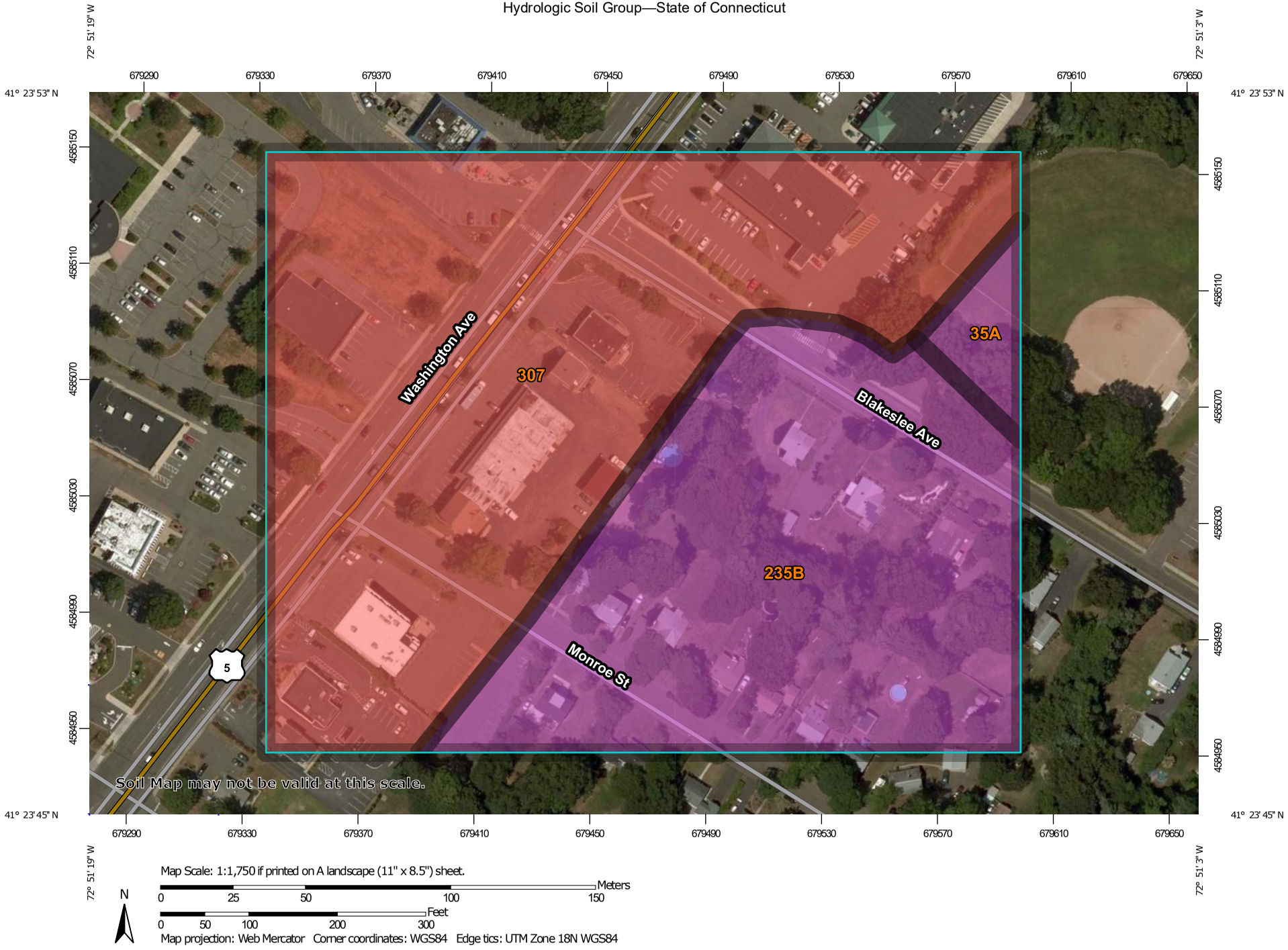
ARCHITECTURE
ENGINEERING
ENVIRONMENTAL
LAND SURVEYING

PROPOSED
RETAIL DEVELOPMENT
146 WASHINGTON AVENUE
NORTH HAVEN, CONNECTICUT

Designed	E.A.E.
Drawn	E.A.E.
Checked	X.X.X.
Approved	X.X.X.
Scale	1"=200'
Project No.	1909997
Date	3/30/2021
CAD File	EXH190199701

FIGURE 2
AERIAL LOCATION MAP

Hydrologic Soil Group—State of Connecticut



Map Scale: 1:1,750 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 25 50 100 150

Feet: 0 50 100 200 300

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

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

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

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

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

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

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

Soil Survey Area: State of Connecticut
Survey Area Data: Version 20, Jun 9, 2020

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

Date(s) aerial images were photographed: Jun 27, 2014—Jul 22, 2014

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
35A	Penwood loamy sand, 0 to 3 percent slopes	A	0.3	2.5%
235B	Penwood-Urban land complex, 0 to 8 percent slopes	A	5.3	39.7%
307	Urban land	D	7.7	57.8%
Totals for Area of Interest			**13.3**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

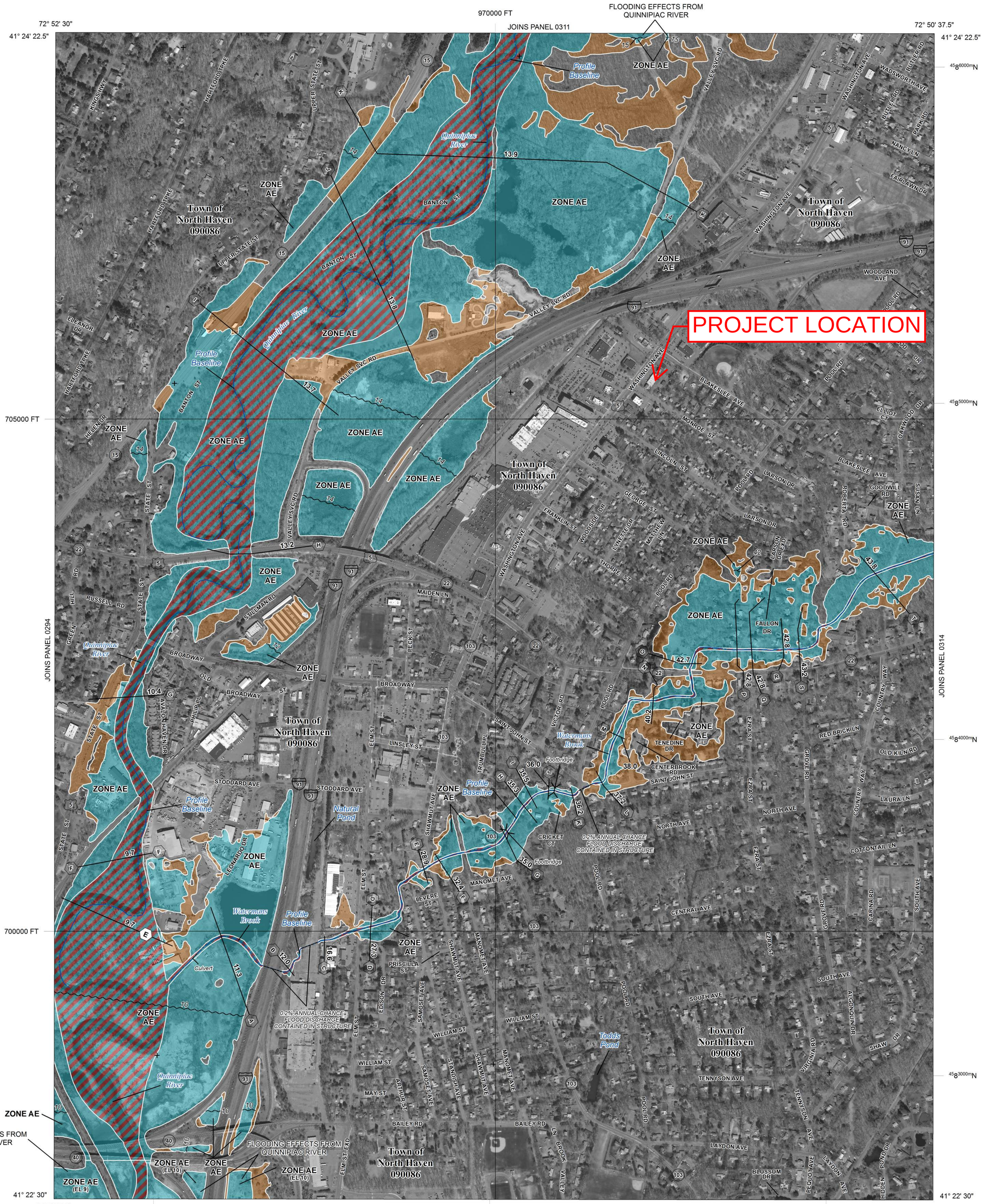
If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher



FLOOD HAZARD INFORMATION

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

THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT

HTTP://MSC.FEMA.GOV

SPECIAL FLOOD HAZARD AREAS	Without Base Flood Elevation (BFE) *Zone A, V, A99* With BFE or Depth *Zone AE, AO, AH, VE, AR* Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD	0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X* Future Conditions 1% Annual Chance Flood Hazard *Zone X* Area with Reduced Flood Risk due to Levee See Notes. *Zone X*
OTHER AREAS	NO SCREEN Areas Determined to be Outside the 0.2% Annual Chance Floodplain *Zone X* Area of Undetermined Flood Hazard *Zone D*
GENERAL STRUCTURES	Channel, Culvert, or Storm Sewer Levee, Dike, or Floodwall
OTHER FEATURES	E 18.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation (BFE) 8 Coastal Transect Coastal Transect Baseline Profile Baseline Hydrographic Feature 513 Base Flood Elevation Line (BFE) Limit of Study Jurisdiction Boundary

NOTES TO USERS

For information and questions about this Flood Insurance Rate Map (FIRM), available products associated with this FIRM, including historic versions, the current map date for each FIRM panel, how to order products, or the National Flood Insurance Program (NFIP) in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Flood Map Service Center website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Flood Map Service Center at the number listed above.

For community and countywide map dates refer to the Flood Insurance Study report for this jurisdiction.

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

Base map information shown on the FIRM was provided by the U.S. Geological Survey at a GSD of 0.30 meter.

SCALE

N

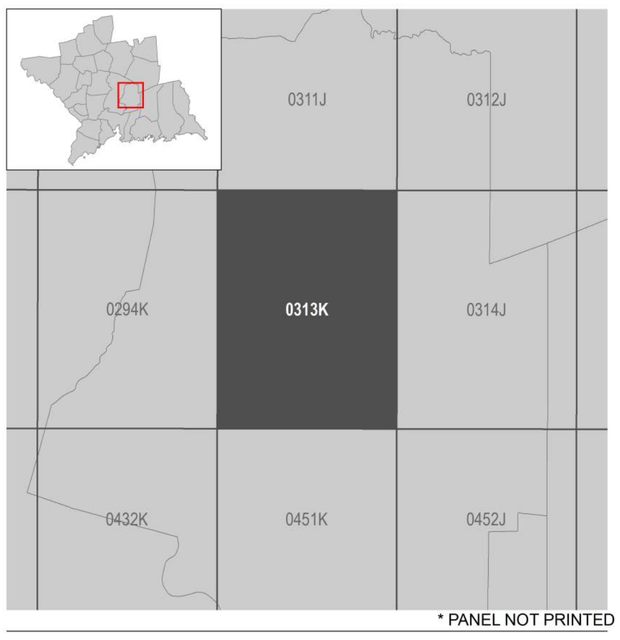
Map Projection:
State Plane Connecticut FIPS 0600 Feet; North American Datum 1983
Western Hemisphere; Vertical Datum: NAVD 88

1 inch = 500 feet 1:6,000

0 500 1,000 2,000 Feet

0 125 250 500 Meters

PANEL LOCATOR



* PANEL NOT PRINTED

FEMA

National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM
FLOOD INSURANCE RATE MAP

New Haven County, CT
(ALL JURISDICTIONS)
PANEL **0313** OF **0635**

FEMA

Panel Contains:

COMMUNITY	NUMBER	PANEL	SUFFIX
NORTH HAVEN, TOWN OF	090086	0313	K

VERSION NUMBER
2.3.3.2

MAP NUMBER
09009C0313K

MAP REVISED
May 16, 2017

NOAA Atlas 14, Volume 10, Version 3
Location name: North Haven, Connecticut, USA*
Latitude: 41.3968°, Longitude: -72.8554°
Elevation: 40.05 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.342 (0.266-0.427)	0.414 (0.321-0.518)	0.532 (0.412-0.668)	0.630 (0.485-0.796)	0.765 (0.570-1.01)	0.866 (0.633-1.18)	0.973 (0.691-1.38)	1.09 (0.736-1.58)	1.27 (0.823-1.91)	1.41 (0.895-2.17)
10-min	0.485 (0.376-0.605)	0.587 (0.455-0.734)	0.754 (0.583-0.946)	0.893 (0.686-1.13)	1.08 (0.808-1.44)	1.23 (0.896-1.67)	1.38 (0.980-1.95)	1.55 (1.04-2.24)	1.80 (1.17-2.70)	2.00 (1.27-3.07)
15-min	0.570 (0.443-0.712)	0.691 (0.536-0.863)	0.888 (0.687-1.11)	1.05 (0.808-1.33)	1.27 (0.950-1.69)	1.44 (1.05-1.96)	1.62 (1.15-2.29)	1.82 (1.23-2.64)	2.12 (1.37-3.18)	2.36 (1.49-3.62)
30-min	0.791 (0.614-0.988)	0.957 (0.742-1.20)	1.23 (0.948-1.54)	1.45 (1.12-1.83)	1.76 (1.31-2.33)	1.99 (1.46-2.70)	2.24 (1.59-3.16)	2.51 (1.69-3.64)	2.92 (1.89-4.38)	3.25 (2.06-4.99)
60-min	1.01 (0.786-1.26)	1.22 (0.948-1.53)	1.57 (1.21-1.97)	1.85 (1.42-2.34)	2.25 (1.67-2.98)	2.54 (1.86-3.45)	2.85 (2.03-4.03)	3.20 (2.15-4.63)	3.72 (2.41-5.58)	4.14 (2.62-6.36)
2-hr	1.33 (1.04-1.65)	1.59 (1.25-1.98)	2.03 (1.58-2.53)	2.38 (1.85-2.99)	2.88 (2.16-3.79)	3.25 (2.39-4.38)	3.64 (2.61-5.12)	4.10 (2.77-5.88)	4.76 (3.10-7.11)	5.32 (3.38-8.11)
3-hr	1.55 (1.21-1.91)	1.85 (1.45-2.29)	2.34 (1.83-2.91)	2.76 (2.14-3.44)	3.32 (2.50-4.36)	3.75 (2.77-5.04)	4.20 (3.02-5.89)	4.72 (3.20-6.76)	5.50 (3.58-8.18)	6.16 (3.92-9.35)
6-hr	1.96 (1.55-2.41)	2.35 (1.86-2.89)	2.99 (2.35-3.68)	3.52 (2.75-4.36)	4.24 (3.22-5.53)	4.78 (3.56-6.40)	5.36 (3.88-7.48)	6.05 (4.11-8.60)	7.07 (4.62-10.4)	7.93 (5.06-12.0)
12-hr	2.43 (1.93-2.96)	2.93 (2.33-3.57)	3.75 (2.97-4.59)	4.43 (3.49-5.46)	5.37 (4.10-6.96)	6.07 (4.54-8.07)	6.82 (4.96-9.47)	7.71 (5.26-10.9)	9.06 (5.94-13.3)	10.2 (6.53-15.3)
24-hr	2.85 (2.29-3.45)	3.49 (2.80-4.22)	4.53 (3.62-5.51)	5.40 (4.28-6.60)	6.59 (5.07-8.50)	7.47 (5.63-9.89)	8.42 (6.19-11.7)	9.60 (6.57-13.5)	11.4 (7.50-16.6)	13.0 (8.32-19.3)
2-day	3.20 (2.59-3.85)	3.99 (3.22-4.79)	5.27 (4.24-6.36)	6.33 (5.06-7.69)	7.79 (6.04-10.0)	8.86 (6.75-11.7)	10.0 (7.47-13.9)	11.6 (7.94-16.1)	14.0 (9.20-20.2)	16.1 (10.3-23.7)
3-day	3.47 (2.82-4.16)	4.34 (3.52-5.20)	5.75 (4.64-6.91)	6.92 (5.55-8.37)	8.53 (6.64-10.9)	9.71 (7.42-12.8)	11.0 (8.22-15.3)	12.7 (8.74-17.6)	15.4 (10.2-22.2)	17.7 (11.4-26.1)
4-day	3.73 (3.04-4.45)	4.64 (3.78-5.55)	6.14 (4.98-7.36)	7.38 (5.95-8.91)	9.09 (7.10-11.6)	10.3 (7.93-13.6)	11.7 (8.77-16.2)	13.5 (9.32-18.7)	16.3 (10.8-23.5)	18.8 (12.2-27.7)
7-day	4.44 (3.64-5.27)	5.46 (4.47-6.48)	7.11 (5.80-8.47)	8.48 (6.87-10.2)	10.4 (8.14-13.2)	11.8 (9.04-15.3)	13.3 (9.94-18.1)	15.2 (10.5-20.9)	18.2 (12.1-26.0)	20.8 (13.5-30.4)
10-day	5.16 (4.24-6.09)	6.22 (5.11-7.36)	7.96 (6.52-9.45)	9.41 (7.65-11.2)	11.4 (8.96-14.4)	12.9 (9.90-16.6)	14.5 (10.8-19.6)	16.4 (11.4-22.5)	19.4 (12.9-27.7)	22.0 (14.3-32.0)
20-day	7.35 (6.10-8.63)	8.50 (7.04-9.98)	10.4 (8.55-12.2)	11.9 (9.77-14.2)	14.1 (11.1-17.5)	15.7 (12.1-19.9)	17.4 (12.9-23.0)	19.3 (13.5-26.2)	22.1 (14.8-31.2)	24.4 (15.9-35.2)
30-day	9.20 (7.66-10.7)	10.4 (8.63-12.1)	12.3 (10.2-14.5)	13.9 (11.5-16.5)	16.1 (12.8-19.9)	17.8 (13.7-22.5)	19.6 (14.5-25.6)	21.4 (15.0-28.9)	24.0 (16.1-33.7)	26.0 (16.9-37.4)
45-day	11.5 (9.61-13.4)	12.7 (10.6-14.8)	14.7 (12.2-17.2)	16.4 (13.5-19.3)	18.7 (14.8-22.8)	20.4 (15.8-25.5)	22.2 (16.4-28.7)	23.9 (16.9-32.2)	26.2 (17.7-36.7)	28.0 (18.2-40.0)
60-day	13.4 (11.2-15.5)	14.7 (12.3-17.0)	16.7 (13.9-19.5)	18.4 (15.3-21.6)	20.8 (16.5-25.2)	22.6 (17.5-28.1)	24.4 (18.0-31.2)	26.0 (18.4-34.9)	28.1 (19.0-39.2)	29.6 (19.3-42.3)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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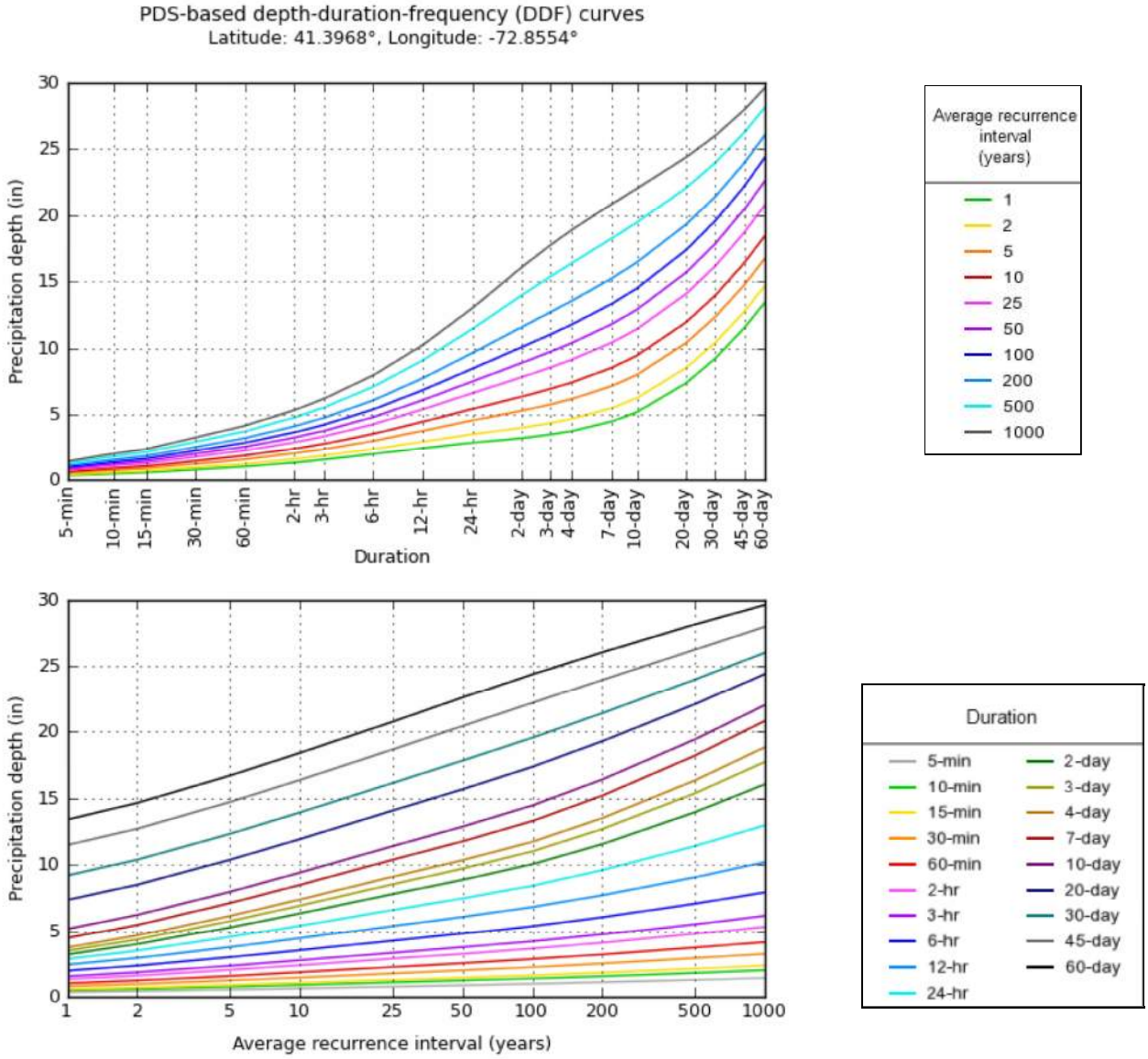
PF graphical



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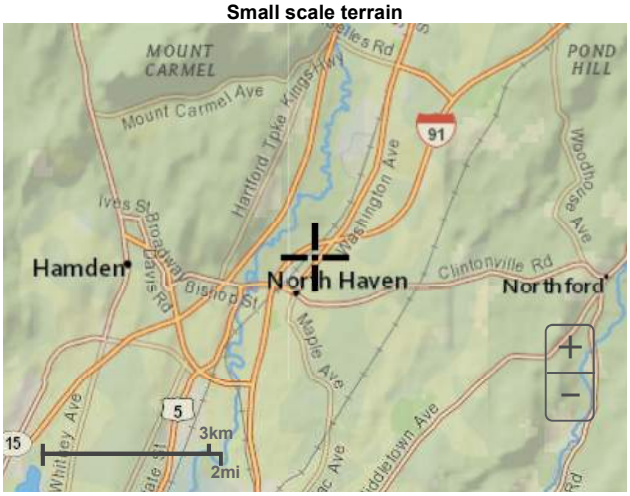
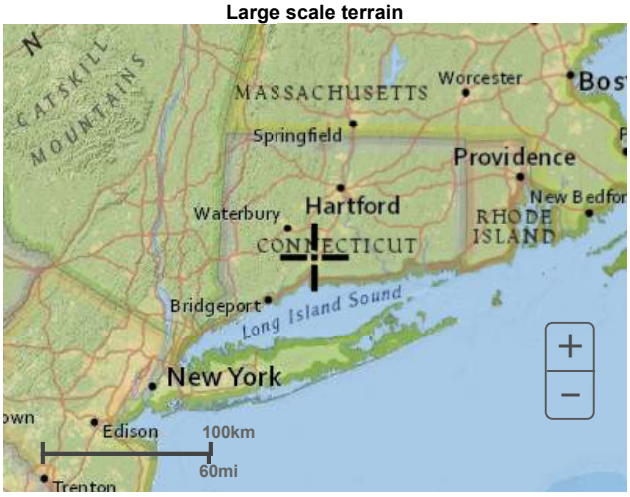
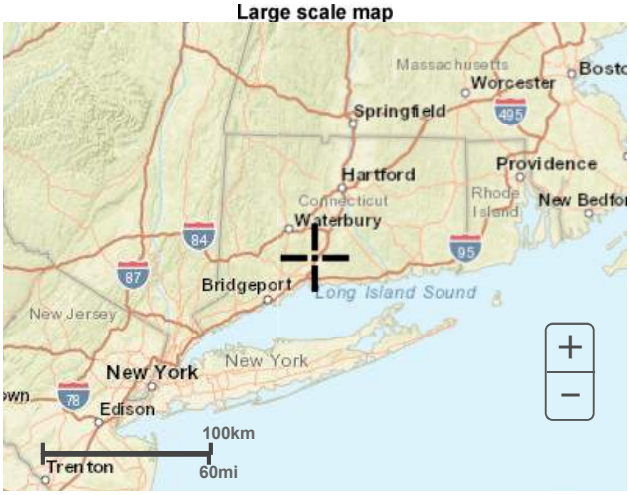
Small scale terrain



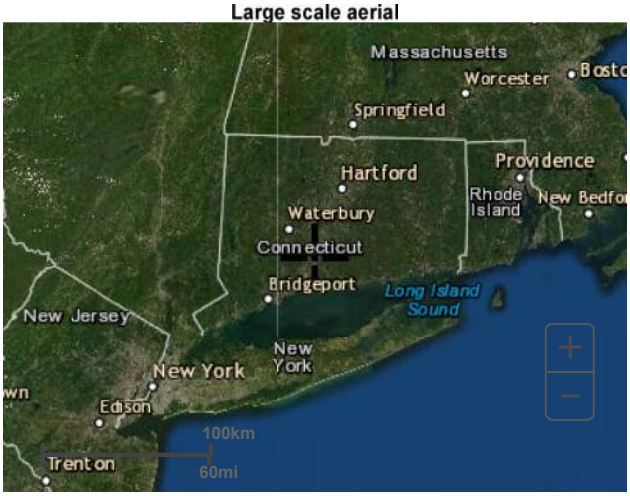
Large scale terrain



Large scale map



Large scale aerial



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NOAA Atlas 14, Volume 10, Version 3
Location name: North Haven, Connecticut, USA*
Latitude: 41.3968°, Longitude: -72.8554°
Elevation: 40.05 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**4.10** (3.19-5.12)	**4.97** (3.85-6.22)	**6.38** (4.94-8.02)	**7.56** (5.82-9.55)	**9.18** (6.84-12.2)	**10.4** (7.60-14.1)	**11.7** (8.29-16.5)	**13.1** (8.83-19.0)	**15.2** (9.88-22.9)	**17.0** (10.7-26.0)
10-min	**2.91** (2.26-3.63)	**3.52** (2.73-4.40)	**4.52** (3.50-5.68)	**5.36** (4.12-6.77)	**6.50** (4.85-8.62)	**7.36** (5.38-9.99)	**8.27** (5.88-11.7)	**9.30** (6.25-13.4)	**10.8** (6.99-16.2)	**12.0** (7.61-18.4)
15-min	**2.28** (1.77-2.85)	**2.76** (2.14-3.45)	**3.55** (2.75-4.46)	**4.20** (3.23-5.31)	**5.10** (3.80-6.76)	**5.78** (4.22-7.83)	**6.49** (4.61-9.16)	**7.30** (4.91-10.6)	**8.46** (5.48-12.7)	**9.43** (5.97-14.5)
30-min	**1.58** (1.23-1.98)	**1.91** (1.48-2.39)	**2.46** (1.90-3.08)	**2.90** (2.23-3.67)	**3.52** (2.62-4.67)	**3.98** (2.91-5.40)	**4.47** (3.18-6.32)	**5.03** (3.38-7.27)	**5.83** (3.78-8.76)	**6.50** (4.11-9.97)
60-min	**1.01** (0.786-1.26)	**1.22** (0.948-1.53)	**1.57** (1.21-1.97)	**1.85** (1.42-2.34)	**2.25** (1.67-2.98)	**2.54** (1.86-3.45)	**2.85** (2.03-4.03)	**3.20** (2.15-4.63)	**3.72** (2.41-5.58)	**4.14** (2.62-6.36)
2-hr	**0.665** (0.520-0.824)	**0.797** (0.622-0.990)	**1.01** (0.788-1.26)	**1.19** (0.923-1.50)	**1.44** (1.08-1.90)	**1.62** (1.20-2.19)	**1.82** (1.30-2.56)	**2.05** (1.38-2.94)	**2.38** (1.55-3.55)	**2.66** (1.69-4.05)
3-hr	**0.514** (0.404-0.635)	**0.615** (0.483-0.761)	**0.781** (0.610-0.969)	**0.918** (0.713-1.15)	**1.11** (0.834-1.45)	**1.25** (0.922-1.68)	**1.40** (1.00-1.96)	**1.57** (1.07-2.25)	**1.83** (1.19-2.72)	**2.05** (1.30-3.11)
6-hr	**0.328** (0.259-0.402)	**0.393** (0.310-0.482)	**0.499** (0.393-0.615)	**0.587** (0.460-0.728)	**0.708** (0.537-0.924)	**0.799** (0.594-1.07)	**0.895** (0.648-1.25)	**1.01** (0.686-1.44)	**1.18** (0.771-1.74)	**1.32** (0.845-2.00)
12-hr	**0.202** (0.161-0.245)	**0.243** (0.193-0.297)	**0.311** (0.247-0.381)	**0.368** (0.290-0.453)	**0.446** (0.340-0.578)	**0.503** (0.377-0.669)	**0.566** (0.412-0.786)	**0.640** (0.437-0.904)	**0.752** (0.493-1.10)	**0.847** (0.542-1.27)
24-hr	**0.119** (0.095-0.144)	**0.145** (0.117-0.176)	**0.189** (0.151-0.230)	**0.225** (0.178-0.275)	**0.274** (0.211-0.354)	**0.311** (0.235-0.412)	**0.351** (0.258-0.487)	**0.400** (0.274-0.562)	**0.475** (0.313-0.693)	**0.540** (0.347-0.804)
2-day	**0.067** (0.054-0.080)	**0.083** (0.067-0.100)	**0.110** (0.088-0.132)	**0.132** (0.105-0.160)	**0.162** (0.126-0.209)	**0.185** (0.141-0.244)	**0.209** (0.155-0.291)	**0.241** (0.165-0.336)	**0.291** (0.192-0.421)	**0.334** (0.215-0.494)
3-day	**0.048** (0.039-0.058)	**0.060** (0.049-0.072)	**0.080** (0.065-0.096)	**0.096** (0.077-0.116)	**0.118** (0.092-0.152)	**0.135** (0.103-0.178)	**0.153** (0.114-0.212)	**0.176** (0.121-0.245)	**0.213** (0.141-0.308)	**0.246** (0.159-0.363)
4-day	**0.039** (0.032-0.046)	**0.048** (0.039-0.058)	**0.064** (0.052-0.077)	**0.077** (0.062-0.093)	**0.095** (0.074-0.121)	**0.108** (0.083-0.142)	**0.122** (0.091-0.169)	**0.141** (0.097-0.195)	**0.170** (0.113-0.245)	**0.196** (0.127-0.288)
7-day	**0.026** (0.022-0.031)	**0.032** (0.027-0.039)	**0.042** (0.035-0.050)	**0.050** (0.041-0.061)	**0.062** (0.048-0.078)	**0.070** (0.054-0.091)	**0.079** (0.059-0.108)	**0.090** (0.063-0.125)	**0.108** (0.072-0.155)	**0.124** (0.080-0.181)
10-day	**0.021** (0.018-0.025)	**0.026** (0.021-0.031)	**0.033** (0.027-0.039)	**0.039** (0.032-0.047)	**0.047** (0.037-0.060)	**0.054** (0.041-0.069)	**0.060** (0.045-0.082)	**0.068** (0.048-0.094)	**0.081** (0.054-0.115)	**0.092** (0.059-0.133)
20-day	**0.015** (0.013-0.018)	**0.018** (0.015-0.021)	**0.022** (0.018-0.025)	**0.025** (0.020-0.029)	**0.029** (0.023-0.036)	**0.033** (0.025-0.042)	**0.036** (0.027-0.048)	**0.040** (0.028-0.055)	**0.046** (0.031-0.065)	**0.051** (0.033-0.073)
30-day	**0.013** (0.011-0.015)	**0.014** (0.012-0.017)	**0.017** (0.014-0.020)	**0.019** (0.016-0.023)	**0.022** (0.018-0.028)	**0.025** (0.019-0.031)	**0.027** (0.020-0.036)	**0.030** (0.021-0.040)	**0.033** (0.022-0.047)	**0.036** (0.024-0.052)
45-day	**0.011** (0.009-0.012)	**0.012** (0.010-0.014)	**0.014** (0.011-0.016)	**0.015** (0.013-0.018)	**0.017** (0.014-0.021)	**0.019** (0.015-0.024)	**0.021** (0.015-0.027)	**0.022** (0.016-0.030)	**0.024** (0.016-0.034)	**0.026** (0.017-0.037)
60-day	**0.009** (0.008-0.011)	**0.010** (0.009-0.012)	**0.012** (0.010-0.014)	**0.013** (0.011-0.015)	**0.014** (0.011-0.018)	**0.016** (0.012-0.019)	**0.017** (0.013-0.022)	**0.018** (0.013-0.024)	**0.020** (0.013-0.027)	**0.021** (0.013-0.029)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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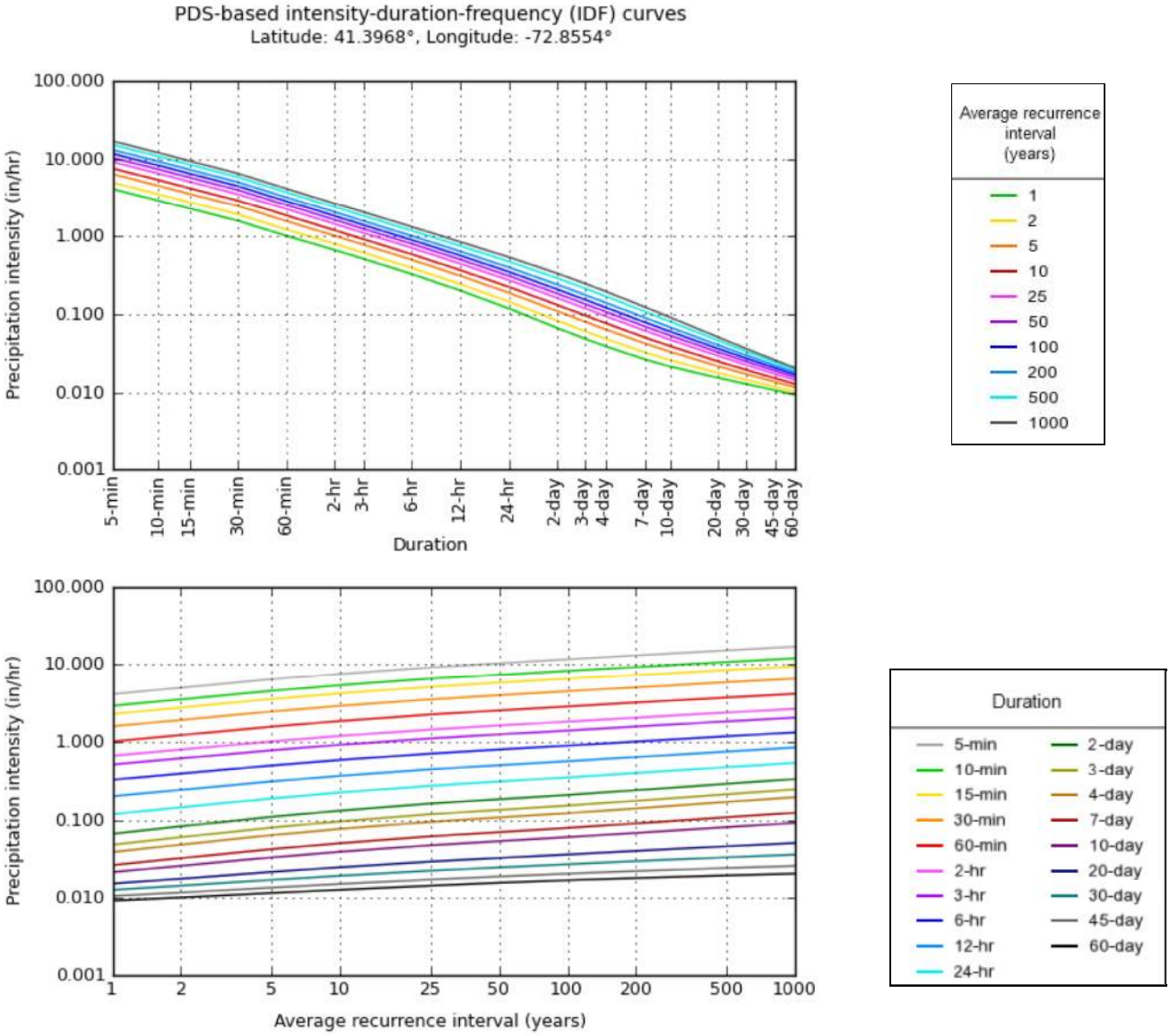
PF graphical



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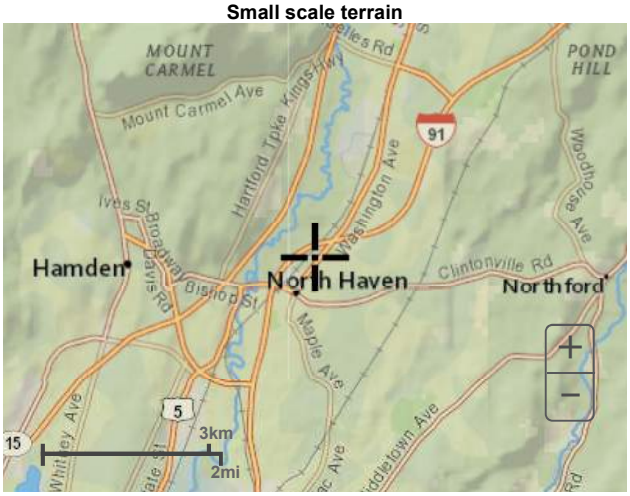

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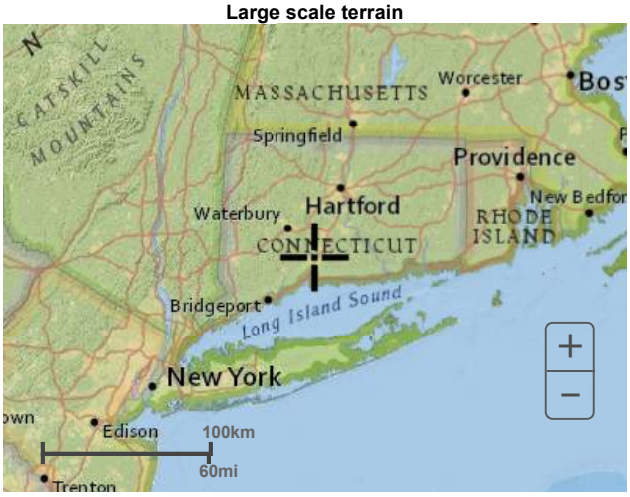
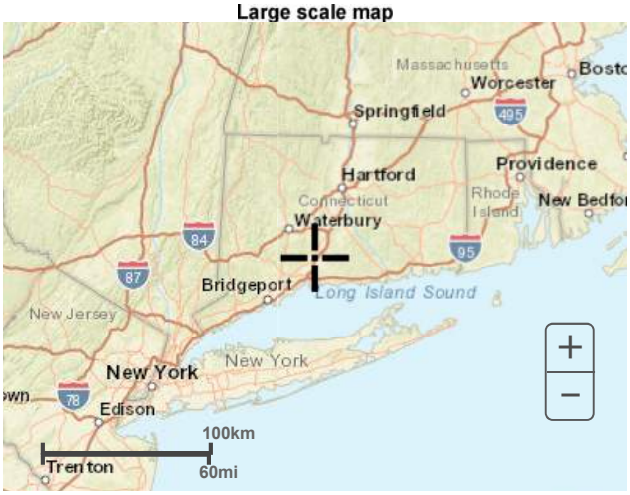
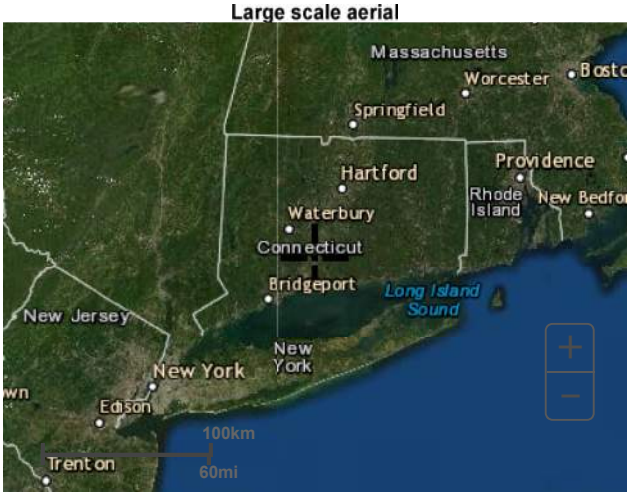


Large scale map



Large scale aerial



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Disclaimer

WATER QUALITY CLASSIFICATIONS
NORTH HAVEN, CT

SURFACE WATER QUALITY CLASSES

A	A
AA	AA
B, B*	B, B*
SA	SA
SB	SB

NOTES:
Surface Water Classifications beginning with S refer to Coastal and Marine Surface Water.
B* is a subset of Class B where no direct wastewater discharges are allowed other than those consistent with Class AA, A and SA surface waters.

GROUND WATER QUALITY CLASSES

- GA (white background)
- GAA, GAAs
- GA, GAA may not meet current standards
- GB
- GC
- Area of Contribution to Public Supply Well
- Final Aquifer Protection Area (Level A)
- Major Basin Boundary

EXPLANATION

WATER QUALITY CLASSIFICATIONS (WQC) MAPS are one of the elements of the Water Quality Standards (WQS) for the State of Connecticut. The WQS are a part of Connecticut's clean water program and are essential for protecting and improving water quality. The WQS follow the principles of Connecticut's Clean Water Act which is in Chapter 446K of the Connecticut General Statutes. The WQS provide policy guidance in many areas, for example decisions on acceptable discharges to water resources, siting of landfills, remediation or prioritization of municipal sewerage system projects. The first two elements of the WQS are the Standards, which set an overall policy for management of water quality, and the Criteria, which are descriptive and numerical standards that describe the allowable parameters and goals for various water quality classifications. A discussion of these two elements is found in the Water Quality Standards document available on the CT DEEP website. The third element is the Classifications and the Water Quality Classification Maps which show the Classification assigned to each surface and groundwater resource throughout the State. The WQS are adopted using a public participation process. The WQC maps are also adopted using a public participation process but go through hearings separately from the Standards and Criteria hearings. Revision and adoption of the WQC data occurs in accordance with the public participation procedures contained in Section 22a-426 of the Connecticut General Statutes. Ground WQC is subject to Connecticut regulation and changes must be reviewed and adopted. All changes to the Surface WQC require an adoption process which is subject to federal review and approval in addition to CT regulation. The adoption dates for the WQC by major drainage basin are: Housatonic River, Hudson River and Southwest Coastal Basins - March 1999; Connecticut River and South Central Coastal Basins - February 1993; Thames River, Pawcatuck River and Southeast Coastal Basins - December 1986. Surface Water Classifications do not change after the adoption date until the next major revision. Ground Water Classifications may change after the adoption date under specific circumstances. The map may have more than one WQC adoption date because a town may be in more than one major drainage basin.

SURFACE WATERS in Connecticut are divided into freshwater classified as AA, A, B or B* and saline waters classified as SA or SB. Class AA designated uses are existing or proposed drinking water supplies; habitat for fish and other aquatic life and wildlife; recreation; and water supply for industry and agriculture. Class A designated uses are habitat for fish and other aquatic life and wildlife; potential drinking water supplies; recreation; navigation; and water supply for industry and agriculture. Class SA designated uses are habitat for marine fish, other aquatic life and wildlife; shellfish harvesting for direct human consumption; recreation; industrial water supply; and navigation. Class B designated uses are habitat for fish and aquatic life and wildlife; recreation; navigation; and industrial and agricultural water supply. Class B*, applicable to Candlewood Lake, is a subset of Class B and is identical in all ways to the designated uses, criteria and standards for Class B waters except for the restriction on direct discharges. Class SB designated uses are habitat for marine fish and aquatic life and wildlife; commercial shellfish harvesting; recreation; industrial water supply; and navigation.

Surface waters which are not specifically classified shall be considered as Class A or Class AA. Surface waters in GA ground water areas are assumed Class A or Class SA unless otherwise indicated. Surface waters in GAA ground water areas are assumed Class AA unless otherwise indicated.

On the WQC map a surface water quality goal of A is represented by blue colored water bodies. Surface water quality goal of AA is represented by purple colored water bodies. Surface water quality goal of B is represented by gold colored water bodies.

GROUND WATERS in Connecticut are classified as GAA, GA, GB and GC. Class GAA designated uses are existing or potential public supply of water suitable for drinking without treatment and baseflow for hydraulically-connected surface water bodies. The Class GAAs is a subclass of GAA for ground water that is tributary to a public water supply reservoir. The area of contribution to a public water supply well is represented by a 500-foot radius around the well and is assumed to be Class GAA unless otherwise classified. Class GA designated uses are existing private and potential public or private supplies of water suitable for drinking without treatment and baseflow for hydraulically-connected surface water bodies. All ground waters not specifically classified are considered as Class GA. Class GB designated uses are industrial process water and cooling waters and baseflow for hydraulically-connected water bodies and is presumed not suitable for human consumption without treatment. Class GC designated uses are assimilation of discharges authorized by the Commissioner pursuant to Section 22a-430 of the General Statutes.

On the WQC map GA is represented by white colored land areas. Class GAA and class GAAs are represented by blue colored land areas. The area of contribution to a public water supply well is shown by a blue cross-hatch overprint. A notation of GAA followed by a state abbreviation indicates a watershed that contributes to the public water supply for a state other than Connecticut. Class GA or Class GAA areas that currently may not be meeting the GA or GAA standards are represented on the WQC maps by tan colored land areas. Class GB is represented by green colored land areas. Class GC is represented by magenta colored land areas.

FINAL AQUIFER PROTECTION AREAS (Level A) are included on the WQC maps for informational purposes. These areas are anticipated to be reclassified GAA during the next major basin updates, subject to public participation. The Aquifer Protection Program helps protect Connecticut's public drinking water resources by delineating aquifer protection areas (also called wellhead protection areas) for public supply wells and establishing land use regulations within these areas. These areas represent the land area contributing ground water to active public water supply wells or well fields that serve more than 1000 people and are set in sand and gravel aquifers (stratified drift deposits).

DATA SOURCES

WATER QUALITY CLASSIFICATIONS DATA – Water quality classifications shown on this map are based on information from the following digital spatial datasets that are typically shown together – Ground Water Quality Classifications Poly, Surface Water Quality Classifications Line, and Surface Water Quality Classifications Poly. The map legend above reflects the content of these three data sources. These WQC data were initially compiled on 1:24,000-scale 7.5 minute USGS topographic quadrangle maps and later digitized at 1:24,000 scale. For example, the Surface Water Quality Classifications Line and Surface Water Quality Classifications Poly digital data assigns surface water quality classifications to water bodies such as rivers, streams, reservoirs, lakes, ponds and coves found in 1:24,000-scale hydrography data available from CT DEEP. The hydrography may not include all the waterbodies in Connecticut. The Ground Water Quality Classifications Poly data assigns ground water quality classifications, at 1:24,000 scale, to the remaining land areas in Connecticut.

AQUIFER PROTECTION AREA DATA – Aquifer Protection Areas shown on this map are from the Aquifer Protection Area digital dataset which contains polygon data intended to be used at 1:24,000 scale. The dataset contains regulated areas classified as Level A Aquifer Protection Area (Final) and Level B Aquifer Protection Area (Preliminary). The Level B areas are not shown on the WQC maps. The data was collected from 1991 to the present and is actively updated as Final area mapping replaces earlier Preliminary areas. The Aquifer Protection Areas are delineated by the individual water companies owning the well fields and submitted to the CT DEEP for approval. Preliminary mapping provides a general estimate of the area contributing ground water to the well field. Final mapping is based on extensive, site-specific, detailed modeling of the ground water flow system. CT DEEP may adjust Final area boundaries to be consistent with 1:24,000 scale topography and base map data where appropriate during the approval process.

MAJOR DRAINAGE BASIN DATA – Major drainage basins shown on this map are from Major Basin Line data developed by CT DEEP and intended to be used at 1:24,000 scale.

BASE MAP DATA - Based on data originally from 1:24,000-scale USGS 7.5 minute topographic quadrangle maps published between 1969 and 1992. It includes political boundaries, railroads, airports, hydrography, geographic names and geographic places. Streets and street names are from Tele Atlas® copyrighted data. Base map information is neither current nor complete.

RELATED INFORMATION
This map is intended to be printed at its original dimensions in order to maintain the 1:24,000 scale (1 inch = 2000 feet).
WATER QUALITY STANDARDS - Go to the CT DEEP website for a summary and the full text of the "Water Quality Standards" and for other information on water quality.
AQUIFER PROTECTION AREAS - Go to the CT DEEP website for more information.

ADOPTED DATES

Water Quality Standards
February 25, 2011

Thames River, Pawcatuck River and Southeast Coastal Basins: December 1986

Connecticut River and South Central Coastal Basins: February 1993

Housatonic River, Hudson River and Southwest Coastal Basins: March 1999

MAP LOCATION

MAJOR BASINS
1 Pawcatuck
2 Southeast Coast
3 Thames
4 Connecticut
5 South Central Coast
6 Housatonic
7 Southwest Coast
8 Hudson

State Plane Coordinate System of 1983, Zone 3526
Lambert Conformal Conic Projection
North American Datum of 1983

SCALE 1:24,000 (1 inch = 2000 feet) when map is printed at original size

STATE OF CONNECTICUT
DEPARTMENT OF
ENERGY & ENVIRONMENTAL PROTECTION
79 Elm Street
Hartford, CT 06106-5127

Map created by CT DEEP
October 2018
Map is not colorfast
Protect from light and moisture

PROJECT LOCATION

PROSPECT
CHESHIRE
WALLINGFORD
DURHAM
BETHANY
HAMDEN
WOODBRIDGE
NORTH HAVEN
NORTH BRANFORD
GUILFORD
NEW HAVEN
EAST HAVEN
ORANGE
WEST HAVEN
BRANFORD

Natural Diversity Data Base Areas

NORTH HAVEN, CT

June 2020

State and Federal Listed Species

Critical Habitat

Town Boundary

NOTE: This map shows general locations of State and Federal Listed Species and Critical Habitats. Information on listed species is collected and compiled by the Natural Diversity Data Base (NDDB) from a variety of data sources . Exact locations of species have been buffered to produce the generalized locations.

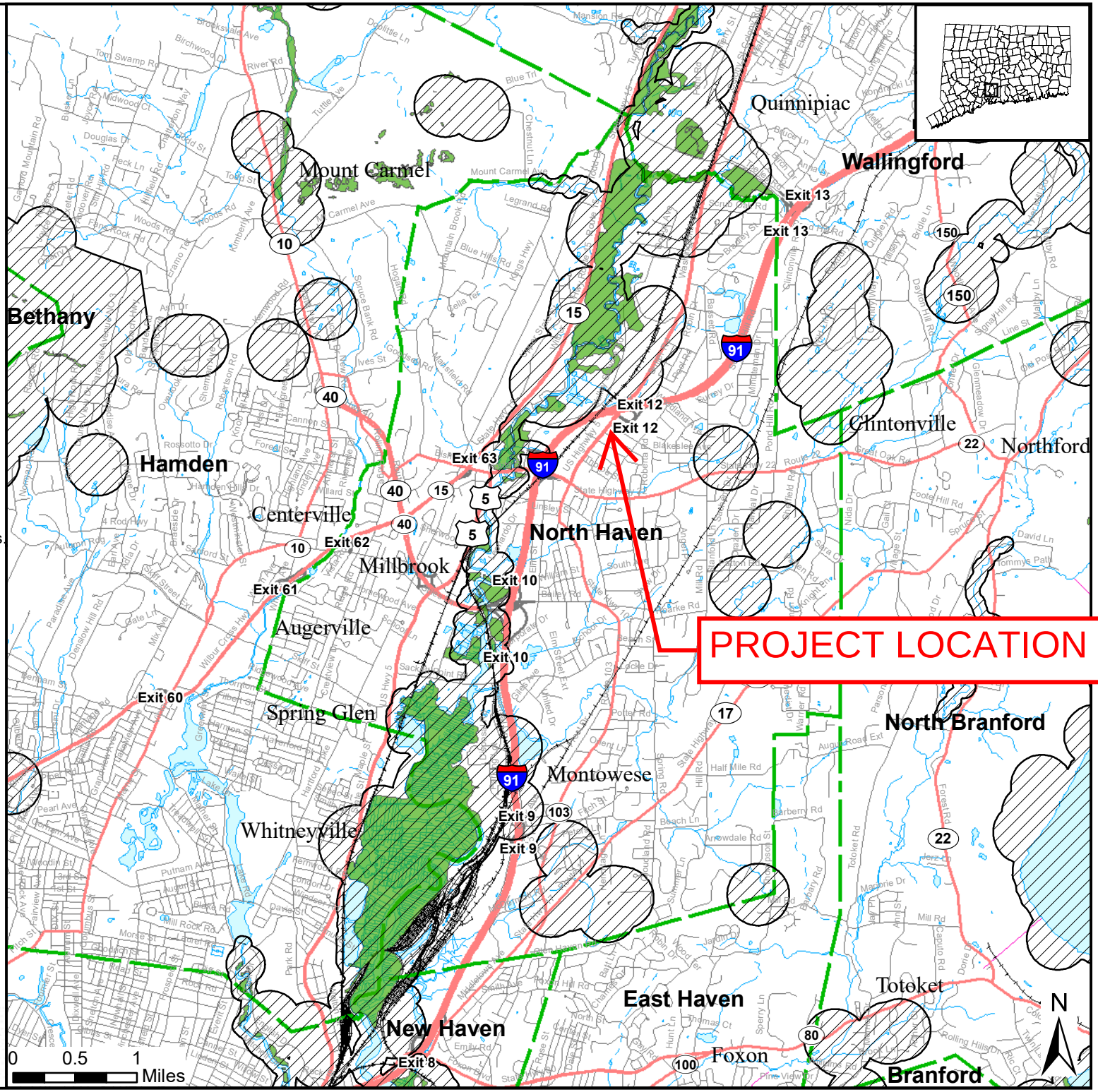
This map is intended for use as a preliminary screening tool for conducting a Natural Diversity Data Base Review Request. To use the map, locate the project boundaries and any additional affected areas. If the project is within a hatched area there may be a potential conflict with a listed species. For more information, complete a Request for Natural Diversity Data Base State Listed Species Review form (DEP-APP-007), and submit it to the NDDB along with the required maps and information. More detailed instructions are provided with the request form on our website.

www.ct.gov/deep/nddbrequest

Use the CTECO Interactive Map Viewers at http://cteco.uconn.edu to more precisely search for and locate a site and to view aerial imagery with NDDB Areas.

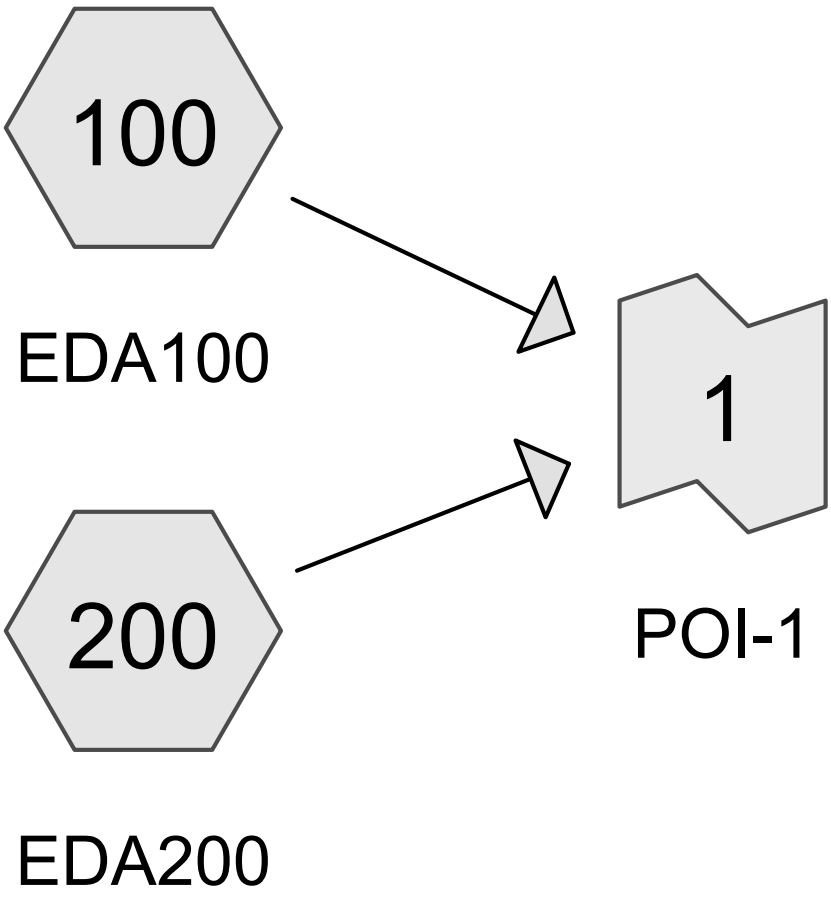
QUESTIONS: Department of Energy and Environmental Protection (DEEP)
79 Elm St, Hartford, CT 06106
email: deep.nddbrequest@ct.gov
Phone: (860) 424-3011

Connecticut Department of Energy & Environmental Protection
Bureau of Natural Resources
Wildlife Division



APPENDIX B

PRE-DEVELOPMENT HYDROLOGY
(2-, 10-,25-, 50-, and 100-year storms)



Subcat Reach Pond Link

Routing Diagram for C-DAT-1901997-PreConstruction
Prepared by {enter your company name here}, Printed 3/30/2021
HydroCAD® 10.00-24 s/n 01334 © 2018 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.324	39	>75% Grass cover, Good, HSG A (100, 200)
0.129	80	>75% Grass cover, Good, HSG D (100, 200)
0.145	98	Paved parking, HSG A (100, 200)
1.239	98	Paved parking, HSG D (100)
1.836	**86**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.468	HSG A	100, 200
0.000	HSG B	
0.000	HSG C	
1.368	HSG D	100, 200
0.000	Other	
1.836		**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
0.324	0.000	0.000	0.129	0.000	0.453	>75% Grass cover, Good	100, 200
0.145	0.000	0.000	1.239	0.000	1.383	Paved parking	100, 200
0.468	**0.000**	**0.000**	**1.368**	**0.000**	**1.836**	**TOTAL AREA**	

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment100: EDA100 Runoff Area=68,696 sf 83.39% Impervious Runoff Depth=2.53"
Tc=5.0 min CN=91 Runoff=4.75 cfs 0.333 af

Subcatchment200: EDA200 Runoff Area=11,284 sf 26.32% Impervious Runoff Depth=0.38"
Tc=5.0 min CN=56 Runoff=0.06 cfs 0.008 af

Link 1: POI-1 Inflow=4.79 cfs 0.341 af
Primary=4.79 cfs 0.341 af

Total Runoff Area = 1.836 ac Runoff Volume = 0.341 af Average Runoff Depth = 2.23"
24.66% Pervious = 0.453 ac 75.34% Impervious = 1.383 ac

Summary for Subcatchment 100: EDA100

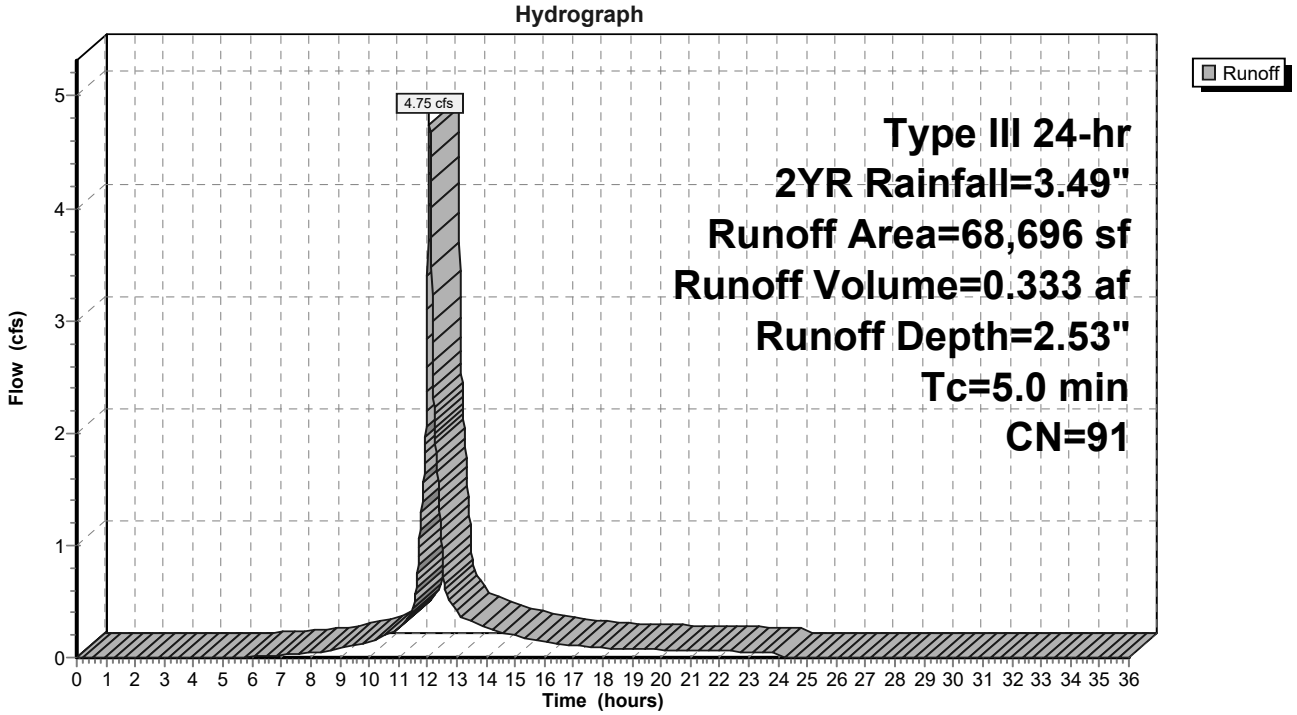
Runoff = 4.75 cfs @ 12.07 hrs, Volume= 0.333 af, Depth= 2.53"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2YR Rainfall=3.49"

Area (sf)	CN	Description
5,270	80	>75% Grass cover, Good, HSG D
53,964	98	Paved parking, HSG D
6,137	39	>75% Grass cover, Good, HSG A
3,325	98	Paved parking, HSG A
68,696	91	Weighted Average
11,407		16.61% Pervious Area
57,289		83.39% Impervious Area

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

Subcatchment 100: EDA100



Summary for Subcatchment 200: EDA200

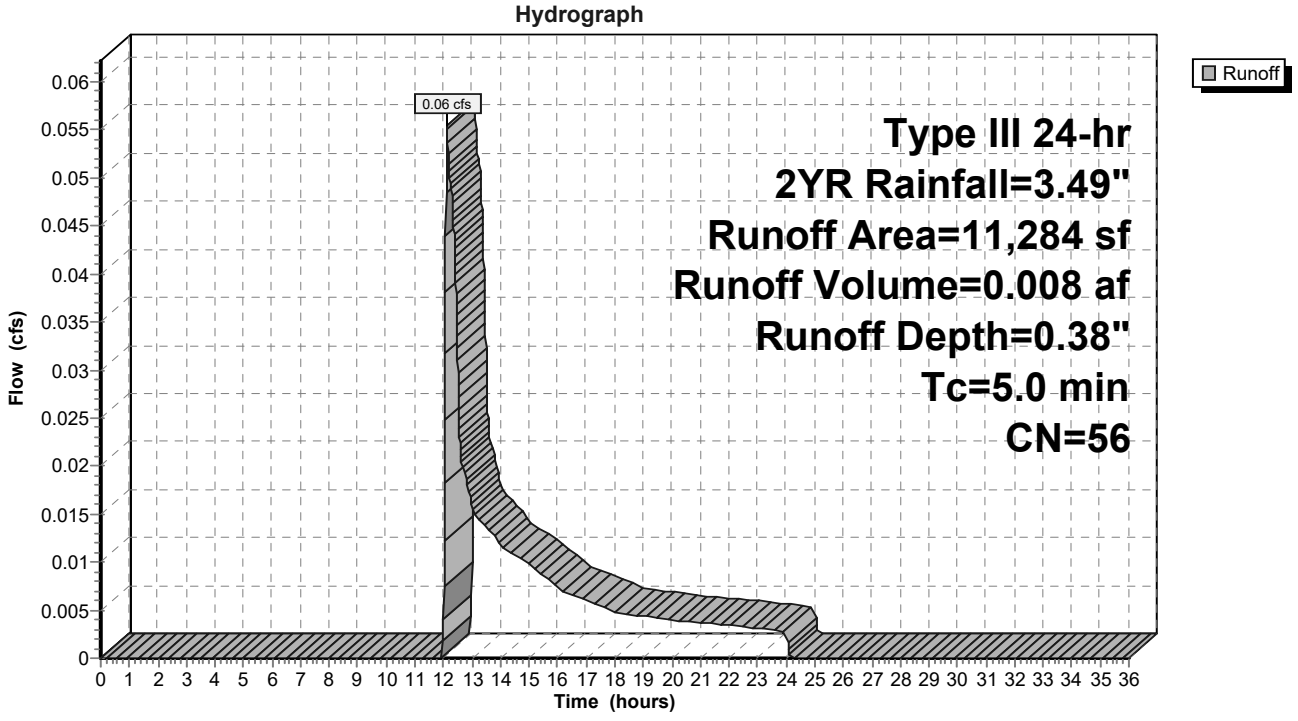
Runoff = 0.06 cfs @ 12.13 hrs, Volume= 0.008 af, Depth= 0.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2YR Rainfall=3.49"

Area (sf)	CN	Description
7,964	39	>75% Grass cover, Good, HSG A
350	80	>75% Grass cover, Good, HSG D
2,970	98	Paved parking, HSG A
11,284	56	Weighted Average
8,314		73.68% Pervious Area
2,970		26.32% Impervious Area

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

Subcatchment 200: EDA200

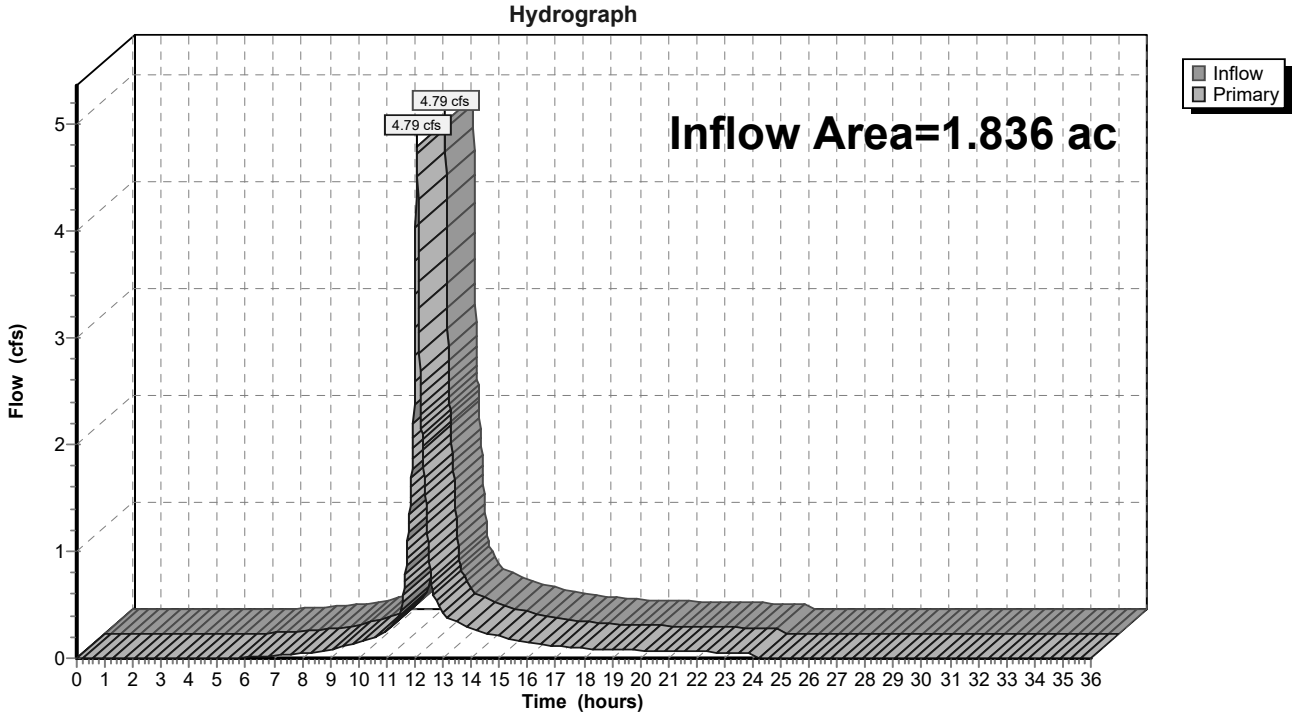


Summary for Link 1: POI-1

Inflow Area = 1.836 ac, 75.34% Impervious, Inflow Depth = 2.23" for 2YR event
Inflow = 4.79 cfs @ 12.07 hrs, Volume= 0.341 af
Primary = 4.79 cfs @ 12.07 hrs, Volume= 0.341 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 1: POI-1



Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment100: EDA100 Runoff Area=68,696 sf 83.39% Impervious Runoff Depth=4.37"
Tc=5.0 min CN=91 Runoff=7.98 cfs 0.574 af

Subcatchment200: EDA200 Runoff Area=11,284 sf 26.32% Impervious Runoff Depth=1.25"
Tc=5.0 min CN=56 Runoff=0.34 cfs 0.027 af

Link 1: POI-1 Inflow=8.31 cfs 0.602 af
Primary=8.31 cfs 0.602 af

Total Runoff Area = 1.836 ac Runoff Volume = 0.602 af Average Runoff Depth = 3.93"
24.66% Pervious = 0.453 ac 75.34% Impervious = 1.383 ac

Summary for Subcatchment 100: EDA100

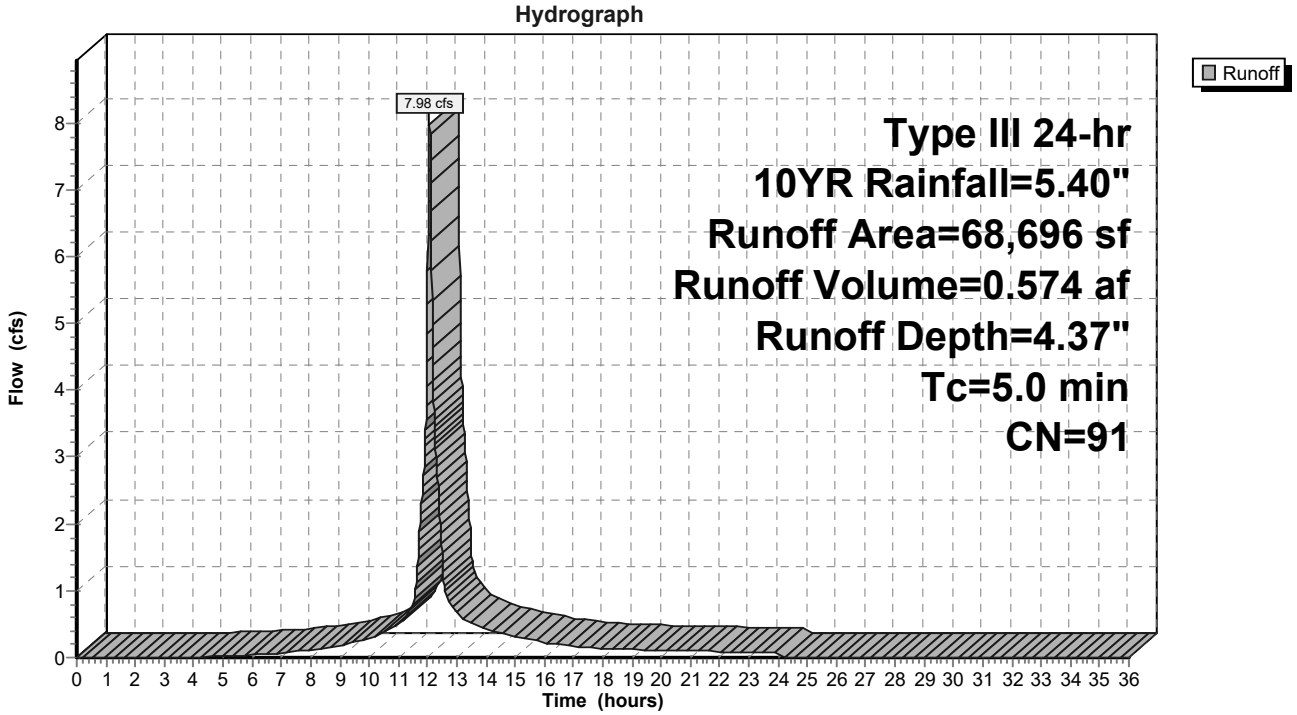
Runoff = 7.98 cfs @ 12.07 hrs, Volume= 0.574 af, Depth= 4.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10YR Rainfall=5.40"

Area (sf)	CN	Description
5,270	80	>75% Grass cover, Good, HSG D
53,964	98	Paved parking, HSG D
6,137	39	>75% Grass cover, Good, HSG A
3,325	98	Paved parking, HSG A
68,696	91	Weighted Average
11,407		16.61% Pervious Area
57,289		83.39% Impervious Area

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

Subcatchment 100: EDA100



Summary for Subcatchment 200: EDA200

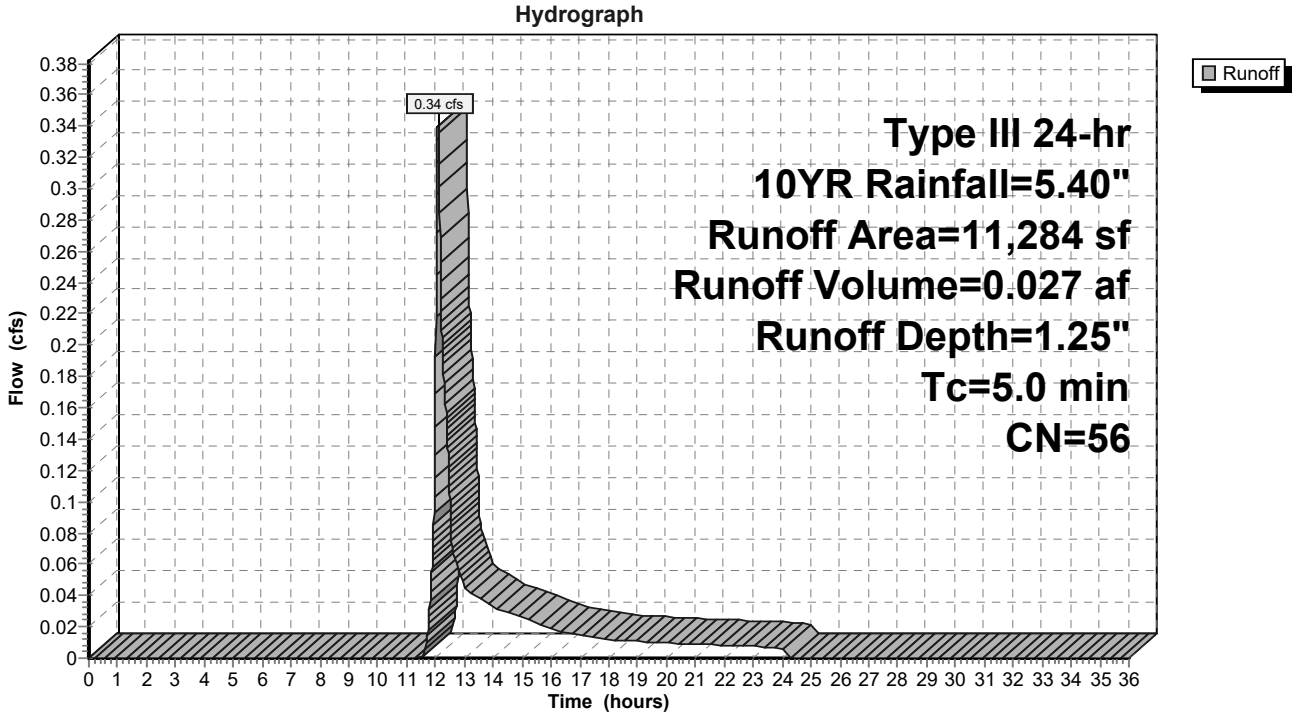
Runoff = 0.34 cfs @ 12.09 hrs, Volume= 0.027 af, Depth= 1.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10YR Rainfall=5.40"

Area (sf)	CN	Description
7,964	39	>75% Grass cover, Good, HSG A
350	80	>75% Grass cover, Good, HSG D
2,970	98	Paved parking, HSG A
11,284	56	Weighted Average
8,314		73.68% Pervious Area
2,970		26.32% Impervious Area

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

Subcatchment 200: EDA200

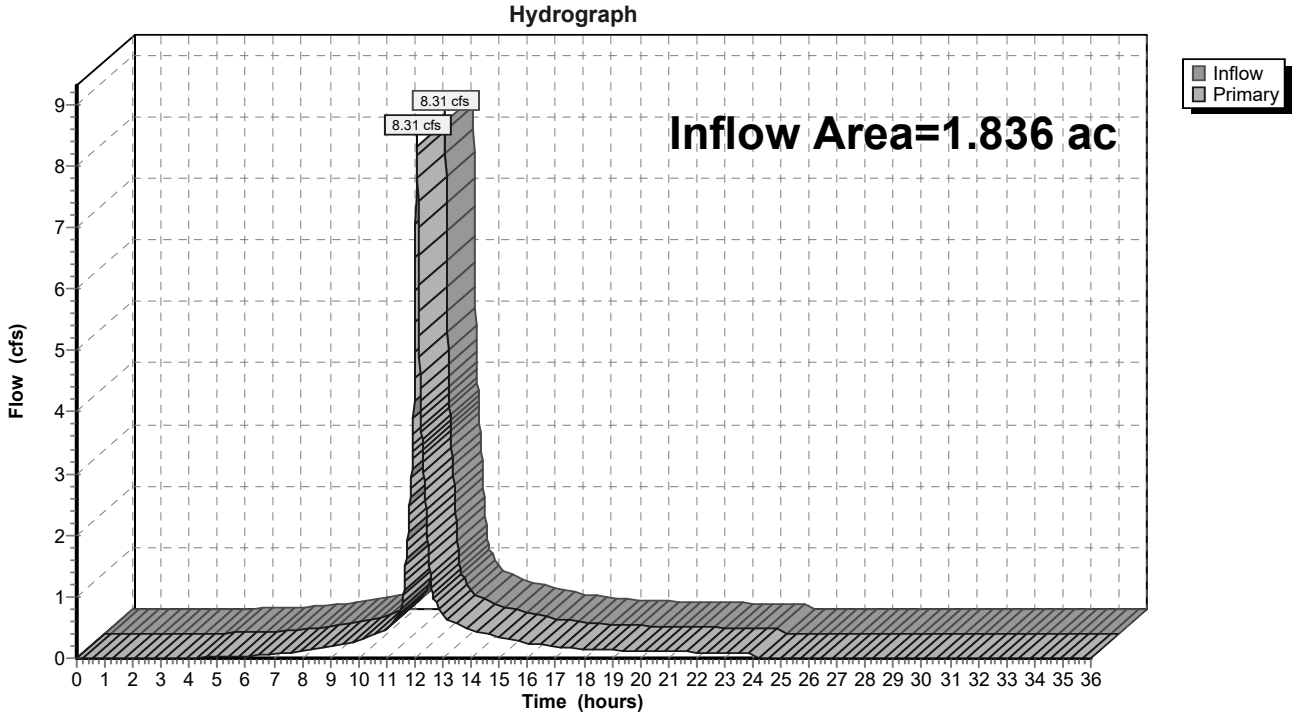


Summary for Link 1: POI-1

Inflow Area = 1.836 ac, 75.34% Impervious, Inflow Depth = 3.93" for 10YR event
Inflow = 8.31 cfs @ 12.07 hrs, Volume= 0.602 af
Primary = 8.31 cfs @ 12.07 hrs, Volume= 0.602 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 1: POI-1



Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment100: EDA100 Runoff Area=68,696 sf 83.39% Impervious Runoff Depth=5.54"
Tc=5.0 min CN=91 Runoff=9.97 cfs 0.728 af

Subcatchment200: EDA200 Runoff Area=11,284 sf 26.32% Impervious Runoff Depth=1.96"
Tc=5.0 min CN=56 Runoff=0.57 cfs 0.042 af

Link 1: POI-1 Inflow=10.53 cfs 0.770 af
Primary=10.53 cfs 0.770 af

Total Runoff Area = 1.836 ac Runoff Volume = 0.770 af Average Runoff Depth = 5.03"
24.66% Pervious = 0.453 ac 75.34% Impervious = 1.383 ac

Summary for Subcatchment 100: EDA100

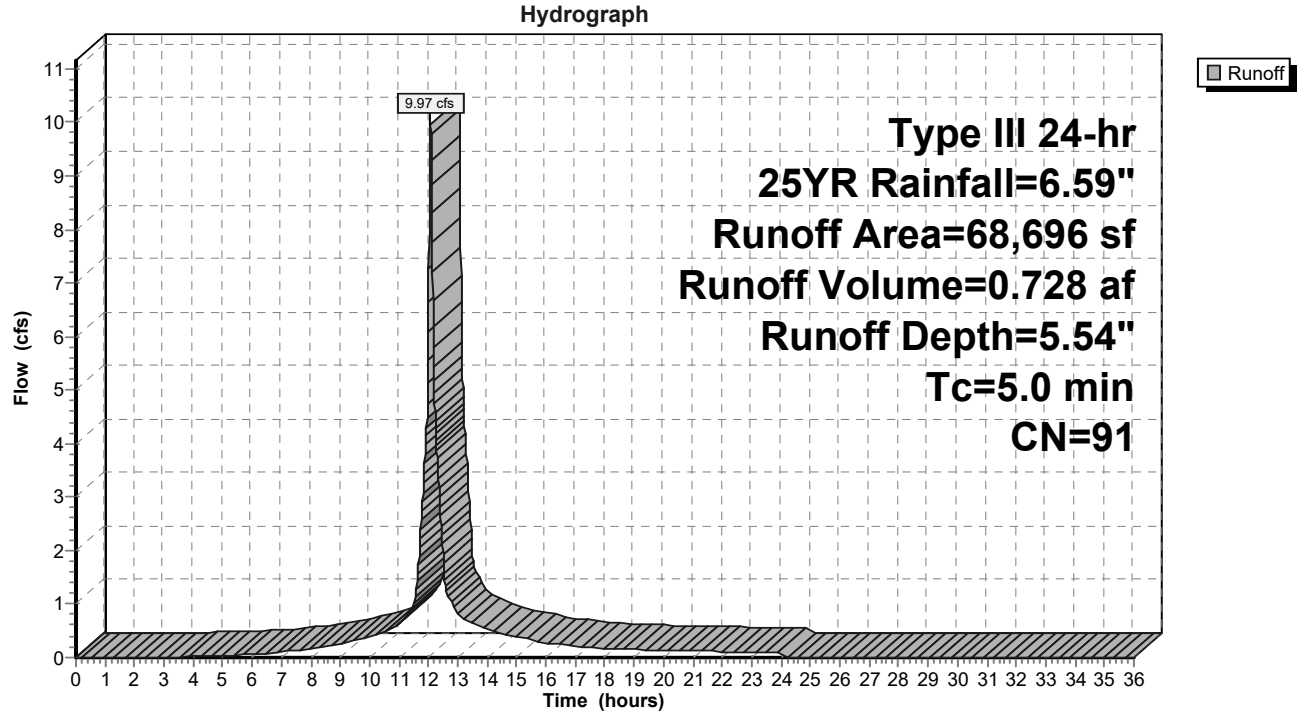
Runoff = 9.97 cfs @ 12.07 hrs, Volume= 0.728 af, Depth= 5.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25YR Rainfall=6.59"

Area (sf)	CN	Description
5,270	80	>75% Grass cover, Good, HSG D
53,964	98	Paved parking, HSG D
6,137	39	>75% Grass cover, Good, HSG A
3,325	98	Paved parking, HSG A
68,696	91	Weighted Average
11,407		16.61% Pervious Area
57,289		83.39% Impervious Area

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

Subcatchment 100: EDA100



Summary for Subcatchment 200: EDA200

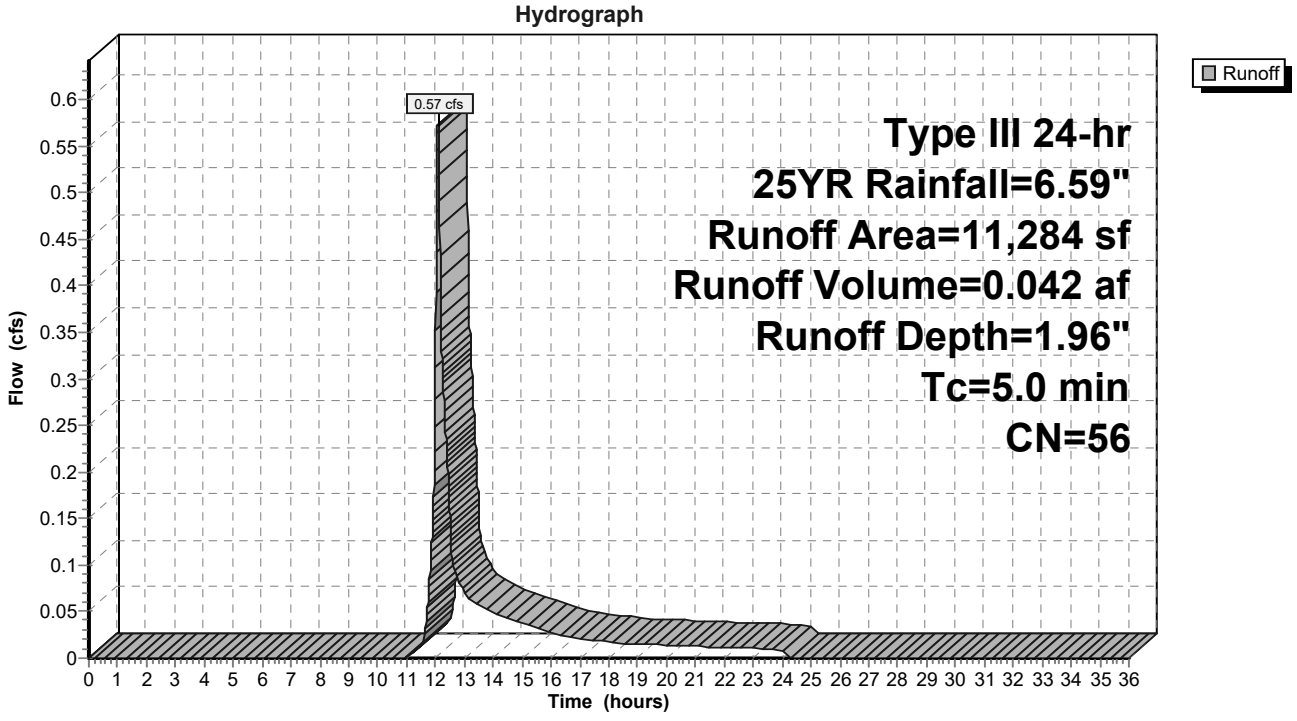
Runoff = 0.57 cfs @ 12.08 hrs, Volume= 0.042 af, Depth= 1.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25YR Rainfall=6.59"

Area (sf)	CN	Description
7,964	39	>75% Grass cover, Good, HSG A
350	80	>75% Grass cover, Good, HSG D
2,970	98	Paved parking, HSG A
11,284	56	Weighted Average
8,314		73.68% Pervious Area
2,970		26.32% Impervious Area

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

Subcatchment 200: EDA200

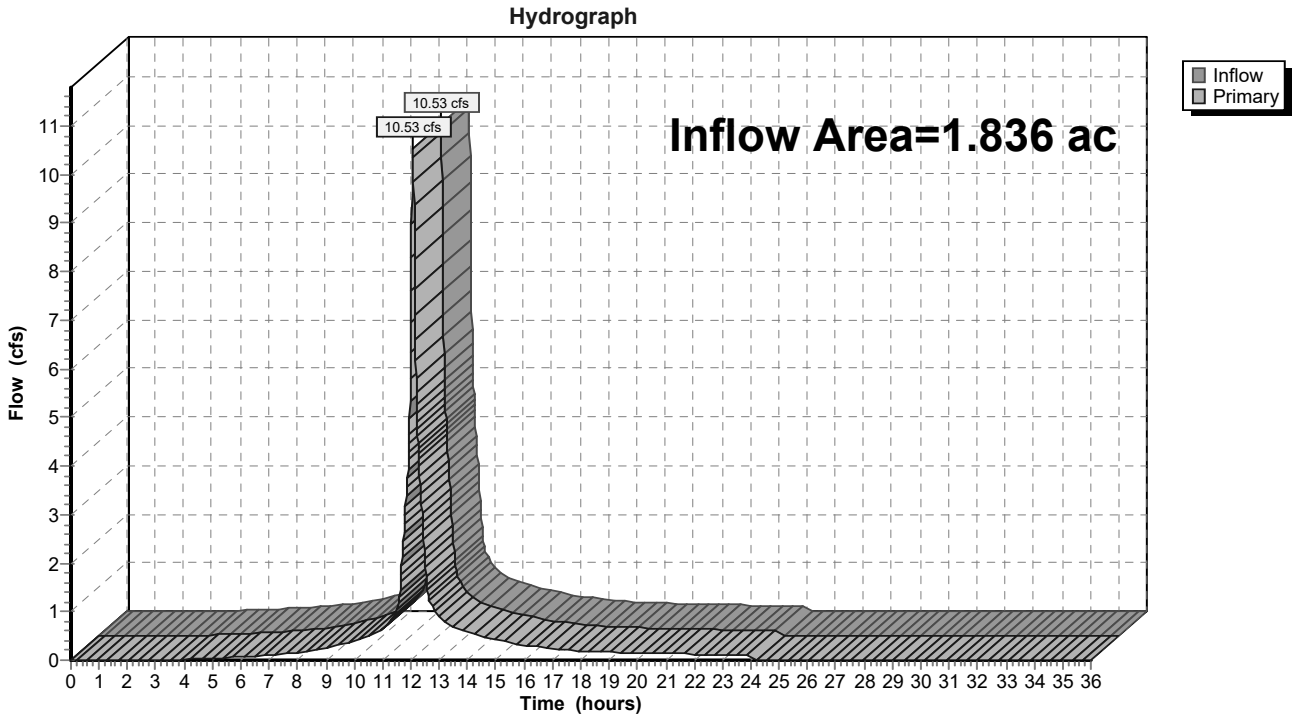


Summary for Link 1: POI-1

Inflow Area = 1.836 ac, 75.34% Impervious, Inflow Depth = 5.03" for 25YR event
Inflow = 10.53 cfs @ 12.07 hrs, Volume= 0.770 af
Primary = 10.53 cfs @ 12.07 hrs, Volume= 0.770 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 1: POI-1



Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment100: EDA100 Runoff Area=68,696 sf 83.39% Impervious Runoff Depth=6.40"
Tc=5.0 min CN=91 Runoff=11.43 cfs 0.841 af

Subcatchment200: EDA200 Runoff Area=11,284 sf 26.32% Impervious Runoff Depth=2.53"
Tc=5.0 min CN=56 Runoff=0.76 cfs 0.055 af

Link 1: POI-1 Inflow=12.18 cfs 0.896 af
Primary=12.18 cfs 0.896 af

Total Runoff Area = 1.836 ac Runoff Volume = 0.896 af Average Runoff Depth = 5.86"
24.66% Pervious = 0.453 ac 75.34% Impervious = 1.383 ac

Summary for Subcatchment 100: EDA100

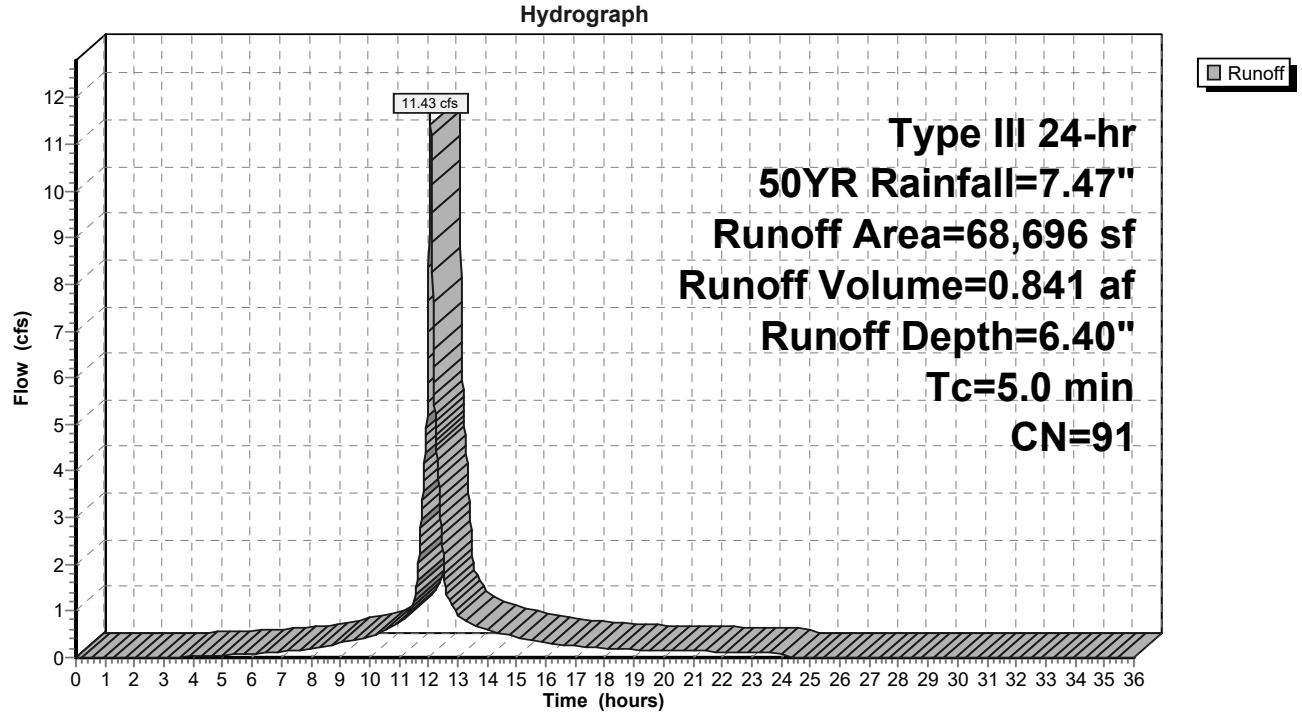
Runoff = 11.43 cfs @ 12.07 hrs, Volume= 0.841 af, Depth= 6.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 50YR Rainfall=7.47"

Area (sf)	CN	Description
5,270	80	>75% Grass cover, Good, HSG D
53,964	98	Paved parking, HSG D
6,137	39	>75% Grass cover, Good, HSG A
3,325	98	Paved parking, HSG A
68,696	91	Weighted Average
11,407		16.61% Pervious Area
57,289		83.39% Impervious Area

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

Subcatchment 100: EDA100



Summary for Subcatchment 200: EDA200

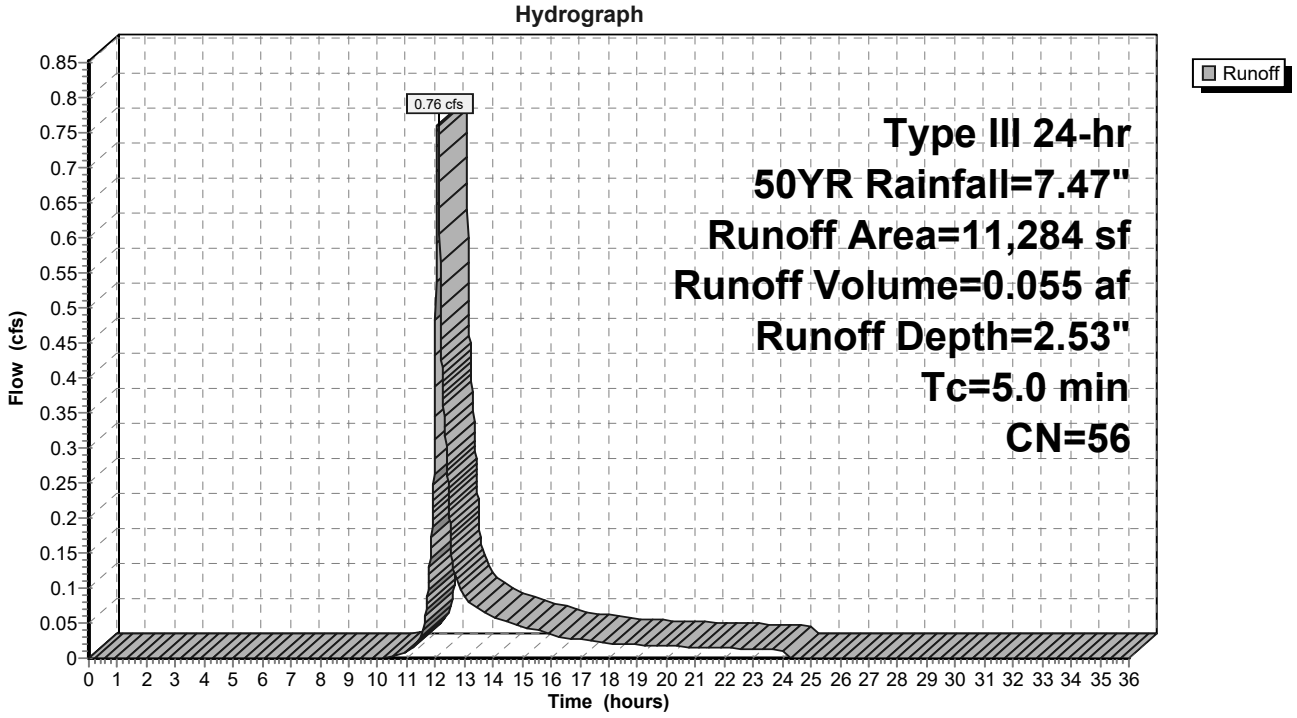
Runoff = 0.76 cfs @ 12.08 hrs, Volume= 0.055 af, Depth= 2.53"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 50YR Rainfall=7.47"

Area (sf)	CN	Description
7,964	39	>75% Grass cover, Good, HSG A
350	80	>75% Grass cover, Good, HSG D
2,970	98	Paved parking, HSG A
11,284	56	Weighted Average
8,314		73.68% Pervious Area
2,970		26.32% Impervious Area

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

Subcatchment 200: EDA200

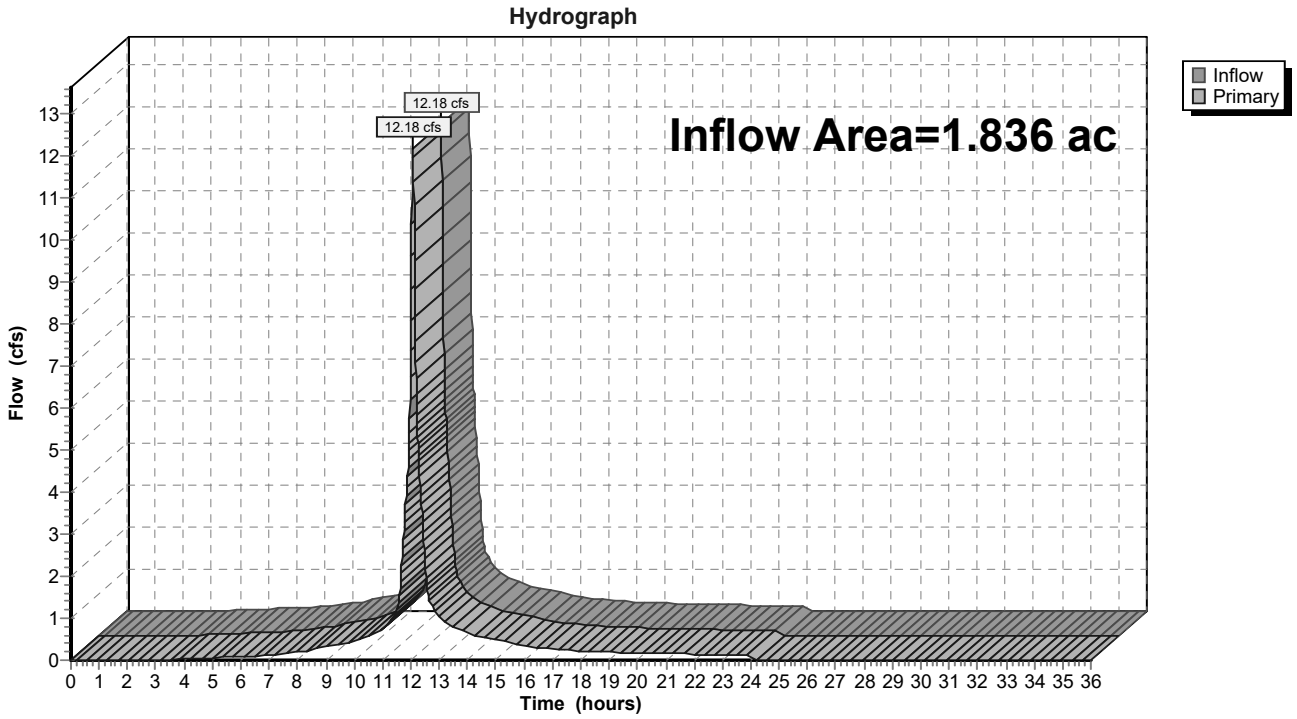


Summary for Link 1: POI-1

Inflow Area = 1.836 ac, 75.34% Impervious, Inflow Depth = 5.86" for 50YR event
Inflow = 12.18 cfs @ 12.07 hrs, Volume= 0.896 af
Primary = 12.18 cfs @ 12.07 hrs, Volume= 0.896 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 1: POI-1



Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment100: EDA100 Runoff Area=68,696 sf 83.39% Impervious Runoff Depth=7.34"
Tc=5.0 min CN=91 Runoff=13.00 cfs 0.965 af

Subcatchment200: EDA200 Runoff Area=11,284 sf 26.32% Impervious Runoff Depth=3.19"
Tc=5.0 min CN=56 Runoff=0.98 cfs 0.069 af

Link 1: POI-1 Inflow=13.97 cfs 1.033 af
Primary=13.97 cfs 1.033 af

Total Runoff Area = 1.836 ac Runoff Volume = 1.033 af Average Runoff Depth = 6.75"
24.66% Pervious = 0.453 ac 75.34% Impervious = 1.383 ac

Summary for Subcatchment 100: EDA100

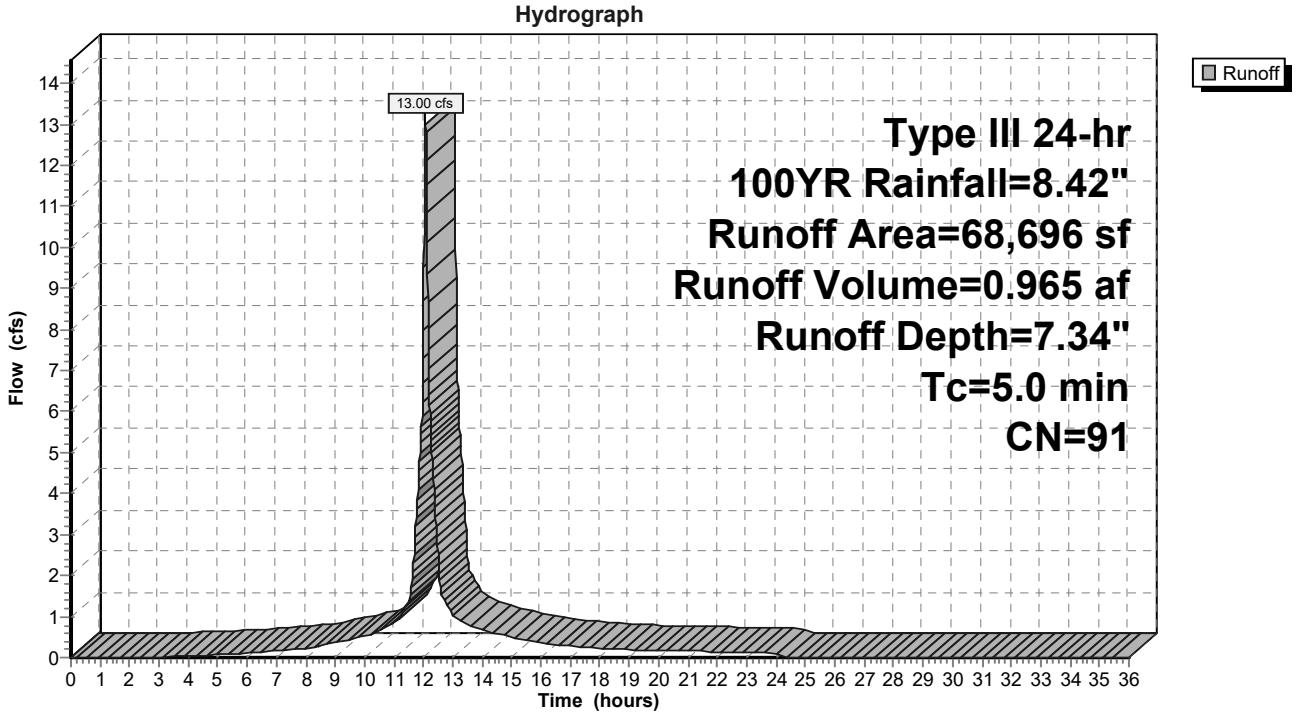
Runoff = 13.00 cfs @ 12.07 hrs, Volume= 0.965 af, Depth= 7.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YR Rainfall=8.42"

Area (sf)	CN	Description
5,270	80	>75% Grass cover, Good, HSG D
53,964	98	Paved parking, HSG D
6,137	39	>75% Grass cover, Good, HSG A
3,325	98	Paved parking, HSG A
68,696	91	Weighted Average
11,407		16.61% Pervious Area
57,289		83.39% Impervious Area

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

Subcatchment 100: EDA100



Summary for Subcatchment 200: EDA200

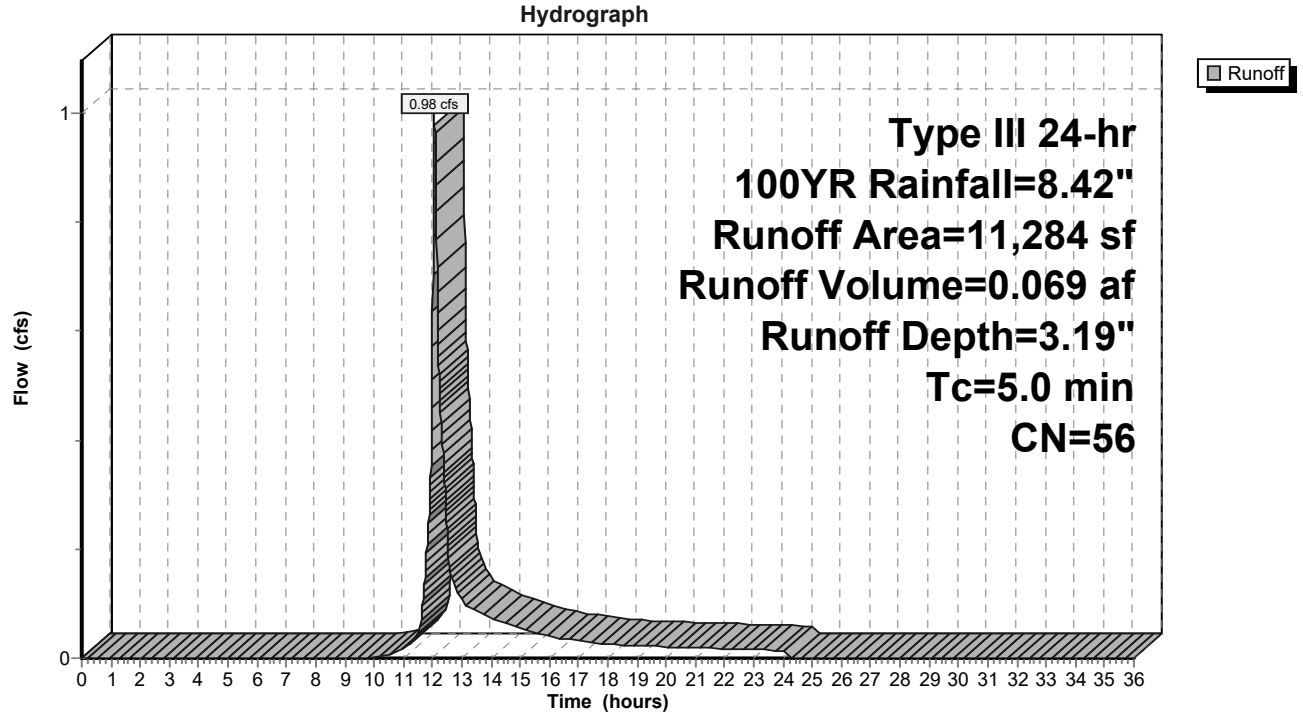
Runoff = 0.98 cfs @ 12.08 hrs, Volume= 0.069 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YR Rainfall=8.42"

Area (sf)	CN	Description
7,964	39	>75% Grass cover, Good, HSG A
350	80	>75% Grass cover, Good, HSG D
2,970	98	Paved parking, HSG A
11,284	56	Weighted Average
8,314		73.68% Pervious Area
2,970		26.32% Impervious Area

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

Subcatchment 200: EDA200

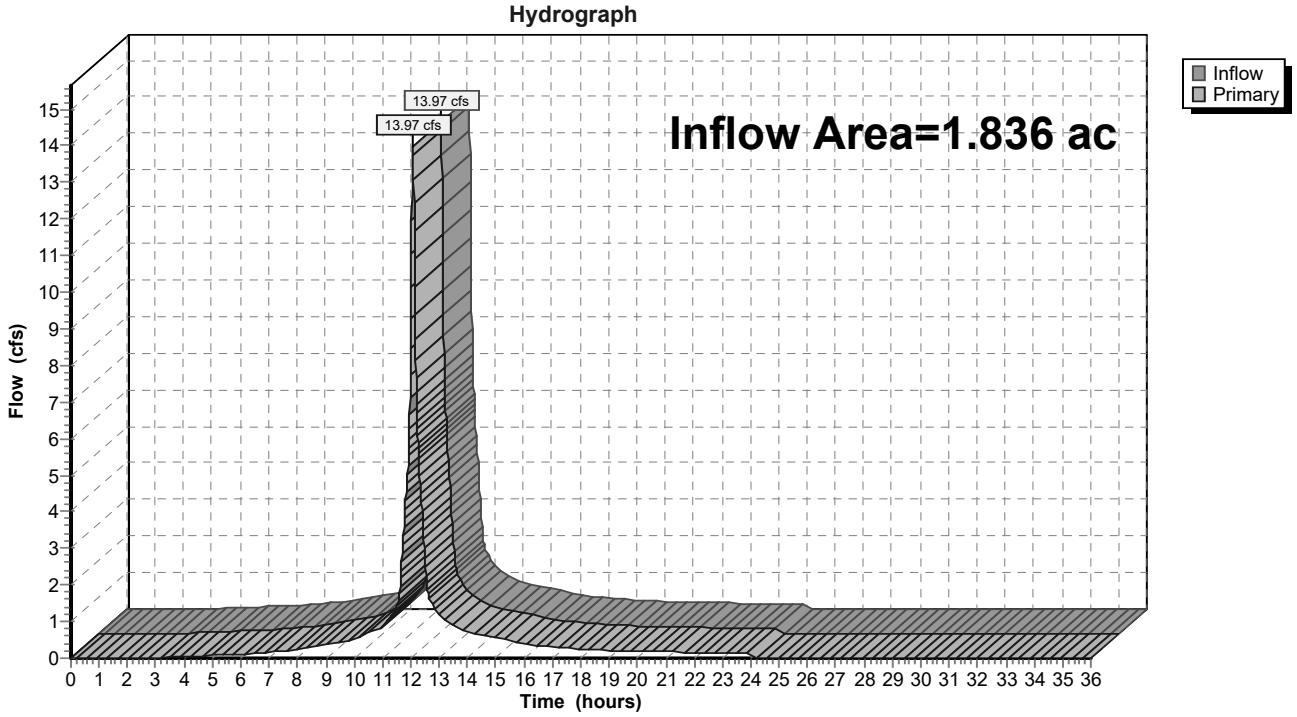


Summary for Link 1: POI-1

Inflow Area = 1.836 ac, 75.34% Impervious, Inflow Depth = 6.75" for 100YR event
Inflow = 13.97 cfs @ 12.07 hrs, Volume= 1.033 af
Primary = 13.97 cfs @ 12.07 hrs, Volume= 1.033 af, Atten= 0%, Lag= 0.0 min

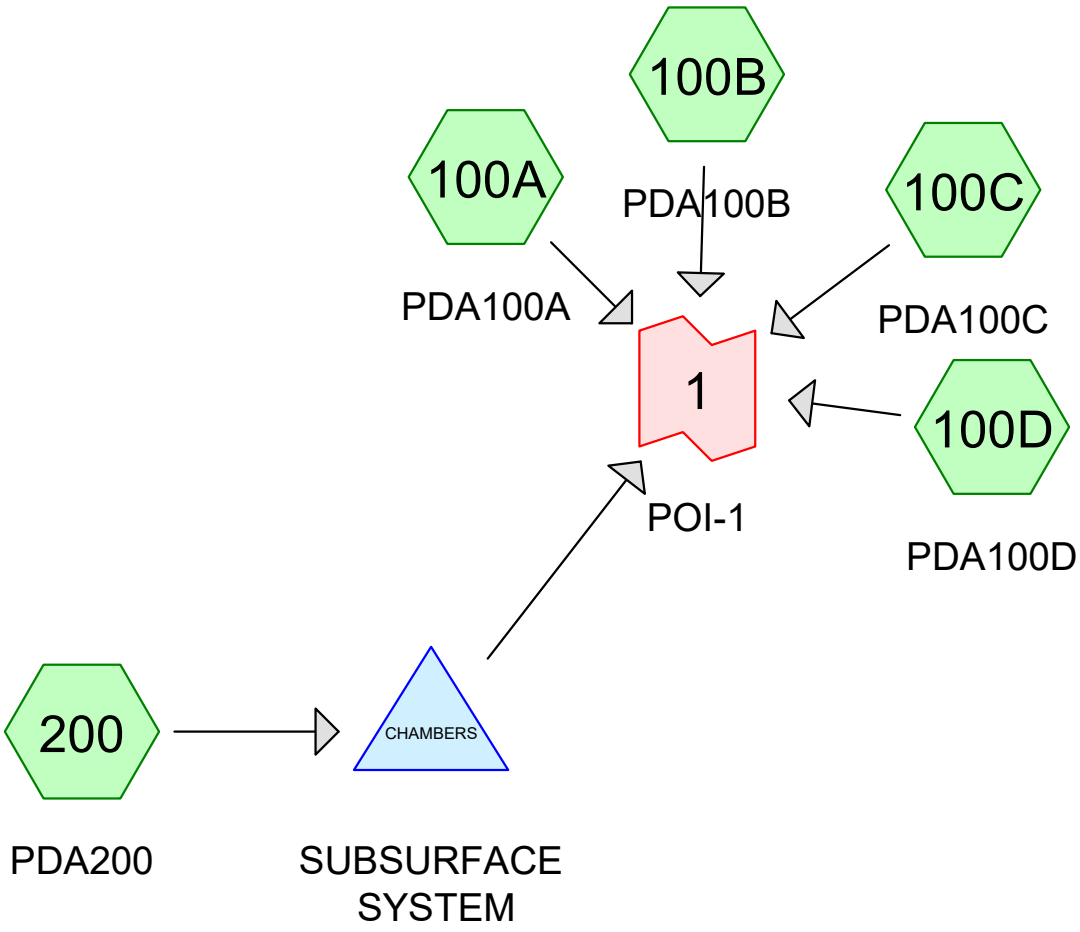
Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 1: POI-1



APPENDIX C

POST-DEVELOPMENT HYDROLOGY
(2-, 10-,25-, 50-, and 100-year storms)



Subcat Reach Pond Link

Routing Diagram for C-DAT-1901997-POSTConstruction
Prepared by {enter your company name here}, Printed 4/7/2021
HydroCAD® 10.00-24 s/n 01334 © 2018 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.151	39	>75% Grass cover, Good, HSG A (100A, 100B, 200)
0.299	80	>75% Grass cover, Good, HSG D (100B, 100C, 100D, 200)
0.317	98	Paved parking, HSG A (100A, 100B, 200)
1.069	98	Paved parking, HSG D (100A, 100B, 100C, 100D)
1.836	**90**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.468	HSG A	100A, 100B, 200
0.000	HSG B	
0.000	HSG C	
1.368	HSG D	100A, 100B, 100C, 100D, 200
0.000	Other	
1.836		**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
0.151	0.000	0.000	0.299	0.000	0.450	>75% Grass cover, Good	100A, 100B, 100C, 100D, 200
0.317	0.000	0.000	1.069	0.000	1.386	Paved parking	100A, 100B, 100C, 100D, 200
0.468	**0.000**	**0.000**	**1.368**	**0.000**	**1.836**	**TOTAL AREA**	

Summary for Subcatchment 100A: PDA100A

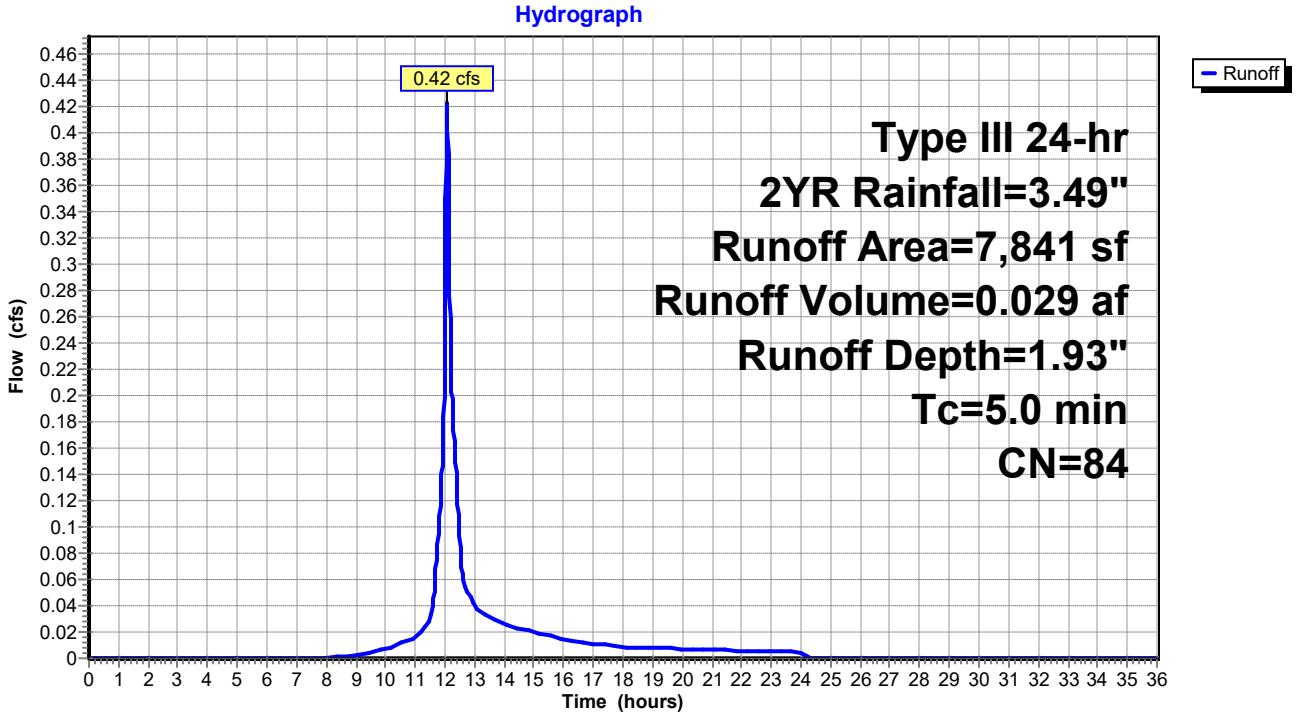
Runoff = 0.42 cfs @ 12.07 hrs, Volume= 0.029 af, Depth= 1.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2YR Rainfall=3.49"

Area (sf)	CN	Description
1,228	98	Paved parking, HSG D
1,836	39	>75% Grass cover, Good, HSG A
4,777	98	Paved parking, HSG A
7,841	84	Weighted Average
1,836		23.42% Pervious Area
6,005		76.58% Impervious Area

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

Subcatchment 100A: PDA100A



Summary for Subcatchment 100B: PDA100B

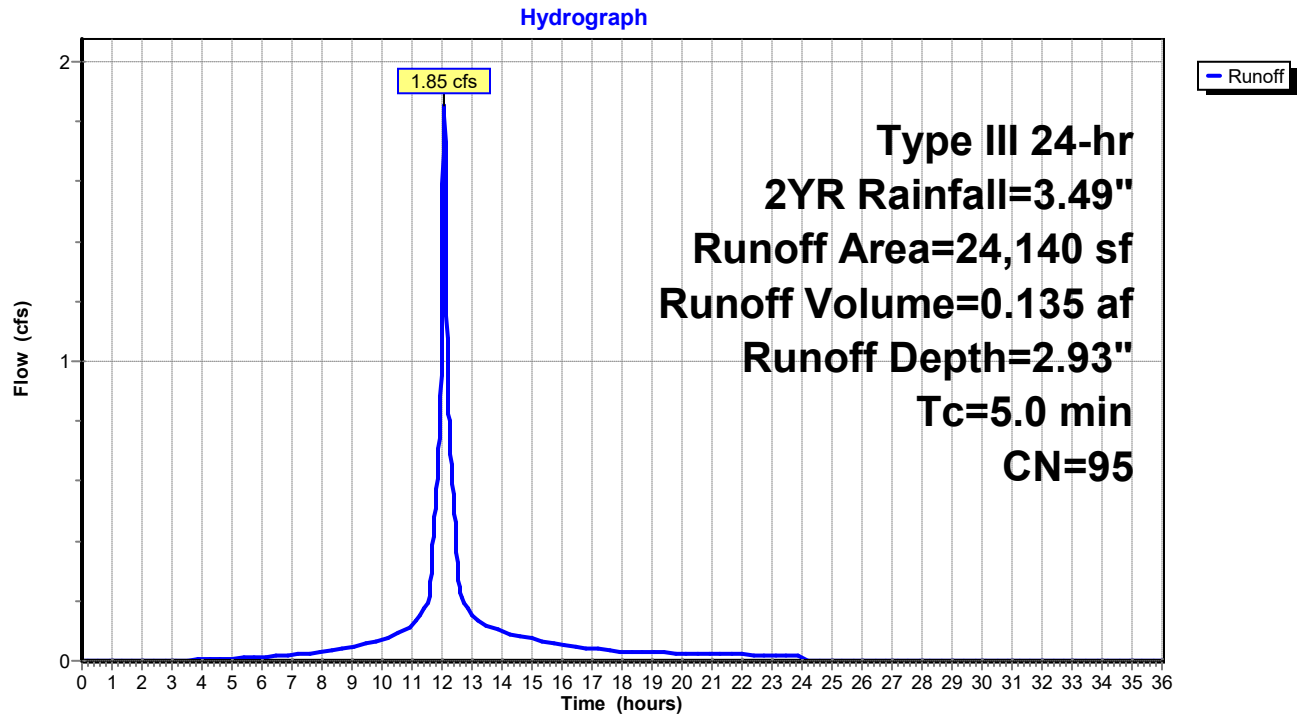
Runoff = 1.85 cfs @ 12.07 hrs, Volume= 0.135 af, Depth= 2.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2YR Rainfall=3.49"

Area (sf)	CN	Description
20,214	98	Paved parking, HSG D
99	39	>75% Grass cover, Good, HSG A
262	98	Paved parking, HSG A
3,565	80	>75% Grass cover, Good, HSG D
24,140	95	Weighted Average
3,664		15.18% Pervious Area
20,476		84.82% Impervious Area

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

Subcatchment 100B: PDA100B



Summary for Subcatchment 100C: PDA100C

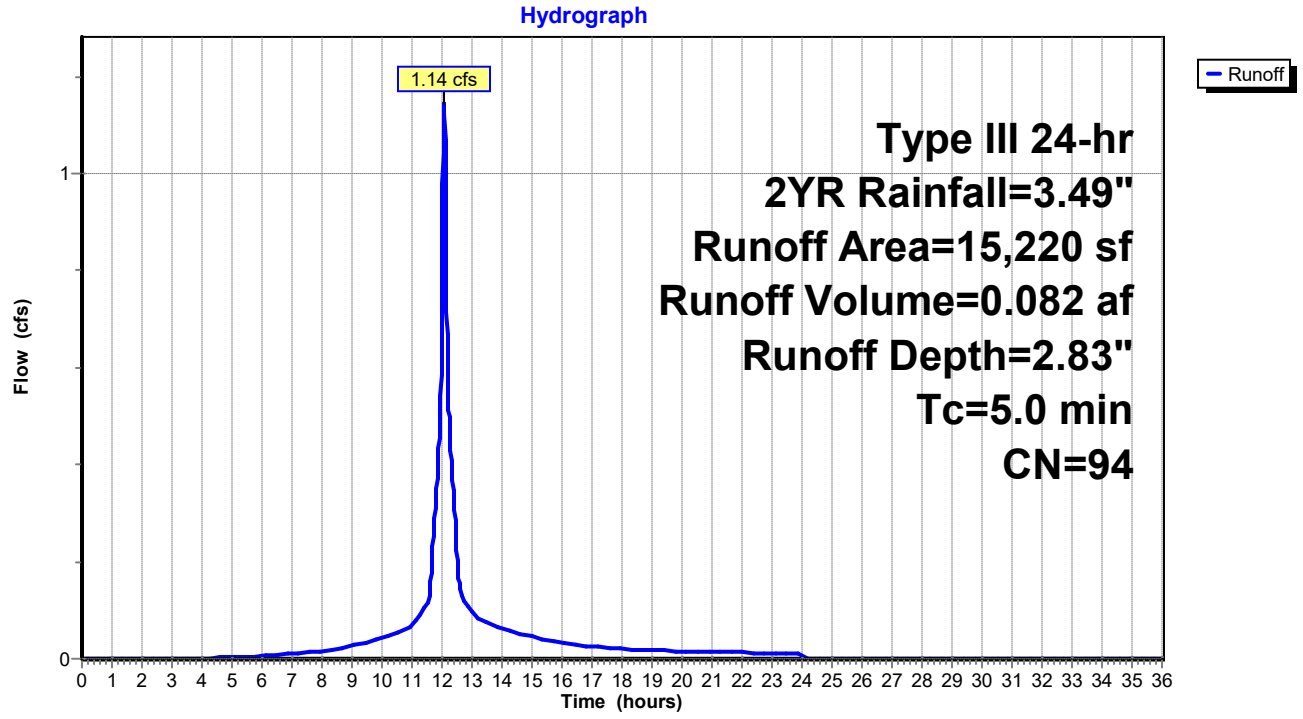
Runoff = 1.14 cfs @ 12.07 hrs, Volume= 0.082 af, Depth= 2.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2YR Rainfall=3.49"

Area (sf)	CN	Description
3,126	80	>75% Grass cover, Good, HSG D
12,094	98	Paved parking, HSG D
15,220	94	Weighted Average
3,126		20.54% Pervious Area
12,094		79.46% Impervious Area

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

Subcatchment 100C: PDA100C



Summary for Subcatchment 100D: PDA100D

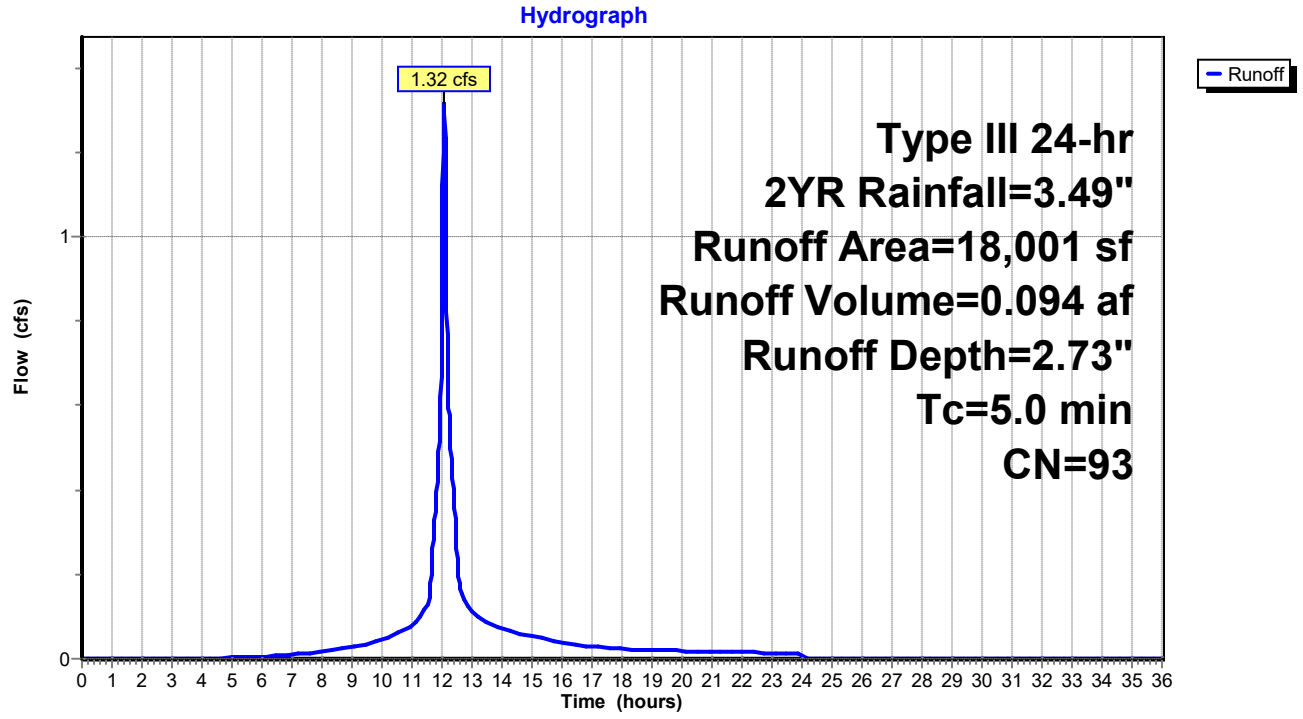
Runoff = 1.32 cfs @ 12.07 hrs, Volume= 0.094 af, Depth= 2.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2YR Rainfall=3.49"

Area (sf)	CN	Description
13,033	98	Paved parking, HSG D
4,968	80	>75% Grass cover, Good, HSG D
18,001	93	Weighted Average
4,968		27.60% Pervious Area
13,033		72.40% Impervious Area

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

Subcatchment 100D: PDA100D



Summary for Subcatchment 200: PDA200

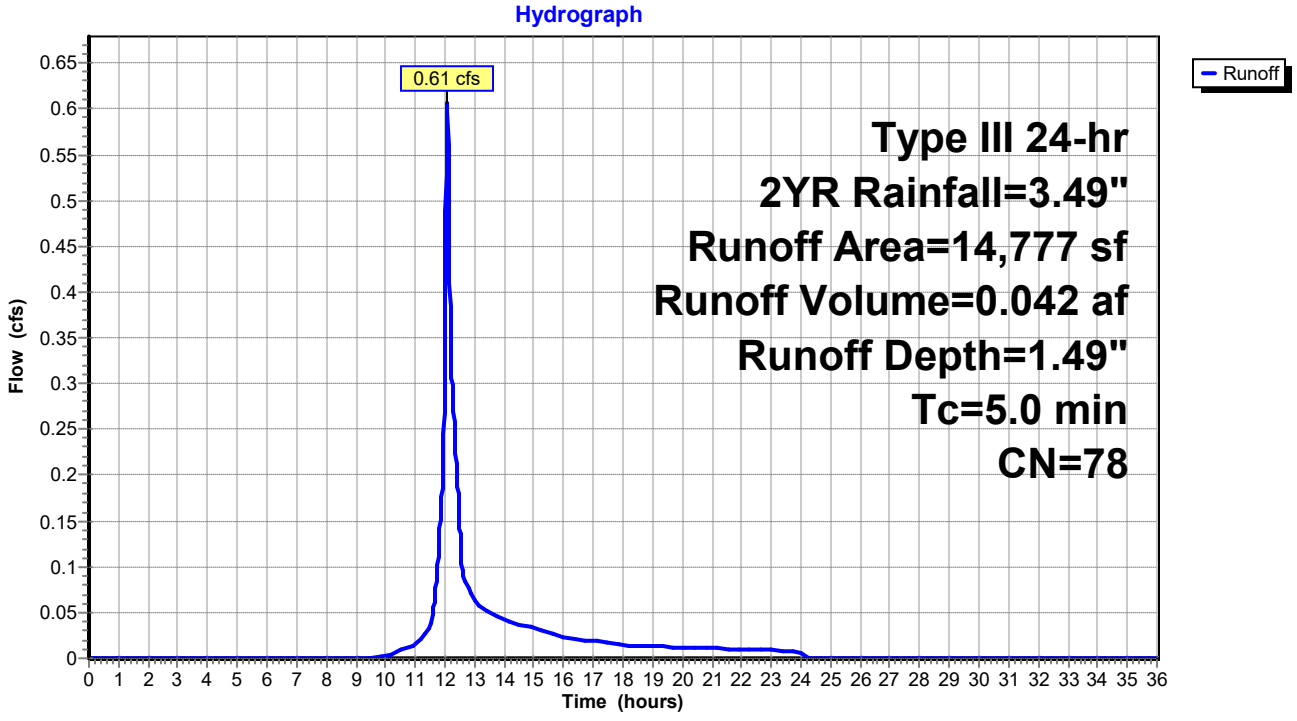
Runoff = 0.61 cfs @ 12.08 hrs, Volume= 0.042 af, Depth= 1.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2YR Rainfall=3.49"

Area (sf)	CN	Description
4,638	39	>75% Grass cover, Good, HSG A
1,356	80	>75% Grass cover, Good, HSG D
8,783	98	Paved parking, HSG A
14,777	78	Weighted Average
5,994		40.56% Pervious Area
8,783		59.44% Impervious Area

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

Subcatchment 200: PDA200



Summary for Pond CHAMBERS: SUBSURFACE SYSTEM

Inflow Area = 0.339 ac, 59.44% Impervious, Inflow Depth = 1.49" for 2YR event
Inflow = 0.61 cfs @ 12.08 hrs, Volume= 0.042 af
Outflow = 0.04 cfs @ 14.48 hrs, Volume= 0.017 af, Atten= 94%, Lag= 144.3 min
Discarded = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.04 cfs @ 14.48 hrs, Volume= 0.017 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 39.98' @ 14.48 hrs Surf.Area= 990 sf Storage= 1,186 cf

Plug-Flow detention time= 365.3 min calculated for 0.017 af (41% of inflow)
Center-of-Mass det. time= 237.9 min (1,081.5 - 843.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	38.07'	1,023 cf	**25.25'W x 39.22'L x 3.75'H Field A** 3,713 cf Overall - 1,156 cf Embedded = 2,557 cf x 40.0% Voids
#2A	38.82'	1,156 cf	**ADS_StormTech DC-780 +Cap** x 25 Inside #1 Effective Size= 45.4"W x 30.0"H => 6.49 sf x 7.12'L = 46.2 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 25 Chambers in 5 Rows
		2,179 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	38.07'	**2.410 in/hr Exfiltration over Horizontal area above 38.07'** Conductivity to Groundwater Elevation = 35.00' Excluded Horizontal area = 990 sf
#2	Primary	39.82'	**8.0" Round Culvert** L= 10.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 39.82' / 39.82' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=38.07' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.04 cfs @ 14.48 hrs HW=39.98' (Free Discharge)
↑—**2=Culvert** (Barrel Controls 0.04 cfs @ 0.86 fps)

Pond CHAMBERS: SUBSURFACE SYSTEM - Chamber Wizard Field A

Chamber Model = ADS_StormTech DC-780 +Cap (ADS StormTech® DC-780 with cap length)
Effective Size= 45.4"W x 30.0"H => 6.49 sf x 7.12'L = 46.2 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

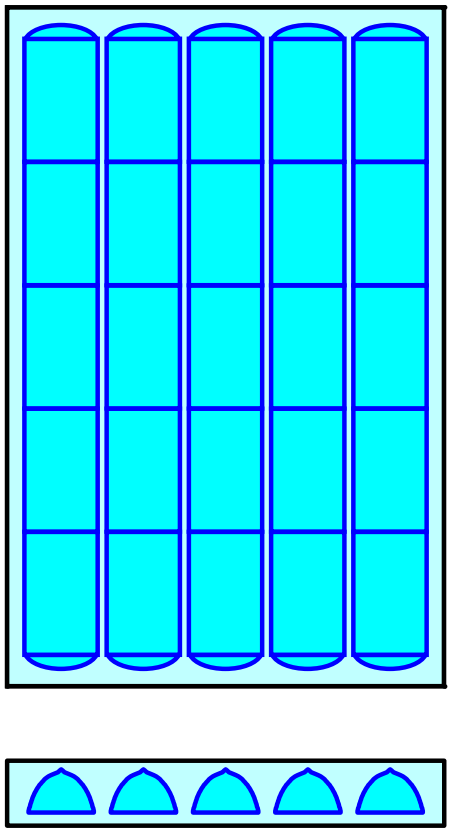
5 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 37.22' Row Length +12.0" End Stone x 2 = 39.22' Base Length
5 Rows x 51.0" Wide + 6.0" Spacing x 4 + 12.0" Side Stone x 2 = 25.25' Base Width
9.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.75' Field Height

25 Chambers x 46.2 cf = 1,156.0 cf Chamber Storage

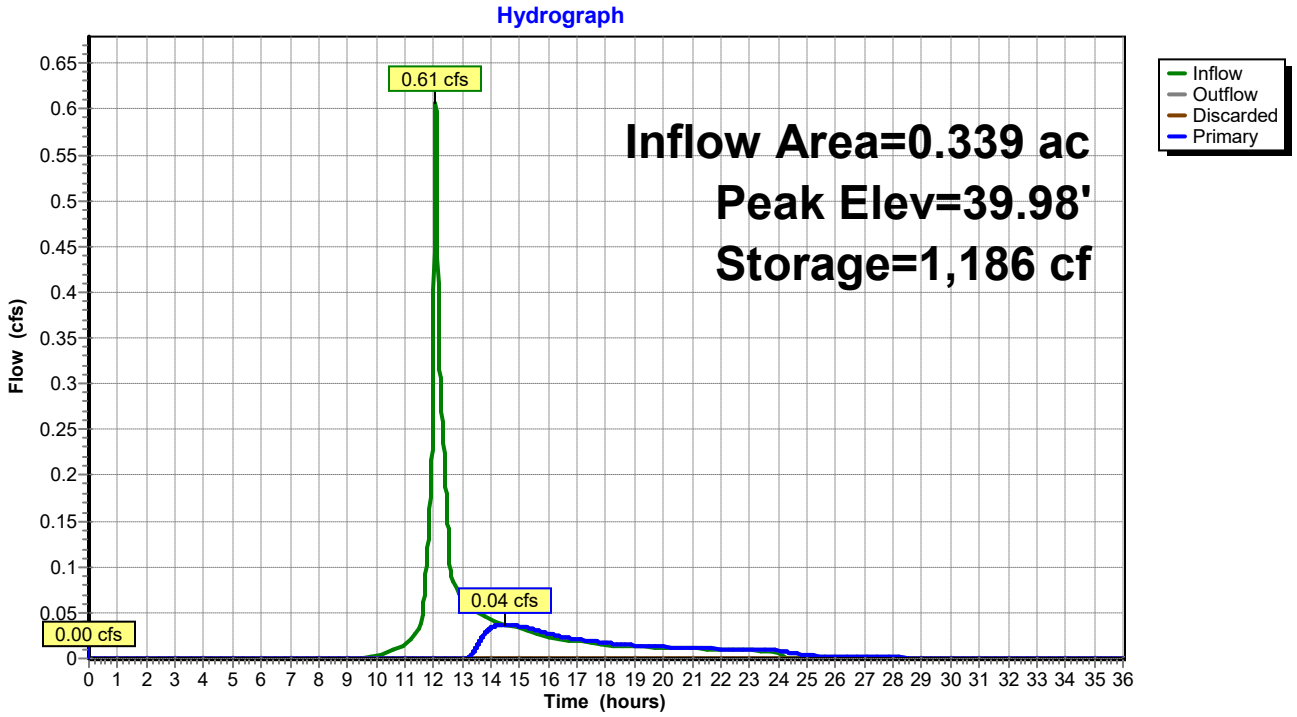
3,713.3 cf Field - 1,156.0 cf Chambers = 2,557.4 cf Stone x 40.0% Voids = 1,022.9 cf Stone Storage

Chamber Storage + Stone Storage = 2,178.9 cf = 0.050 af
Overall Storage Efficiency = 58.7%
Overall System Size = 39.22' x 25.25' x 3.75'

25 Chambers
137.5 cy Field
94.7 cy Stone



Pond CHAMBERS: SUBSURFACE SYSTEM

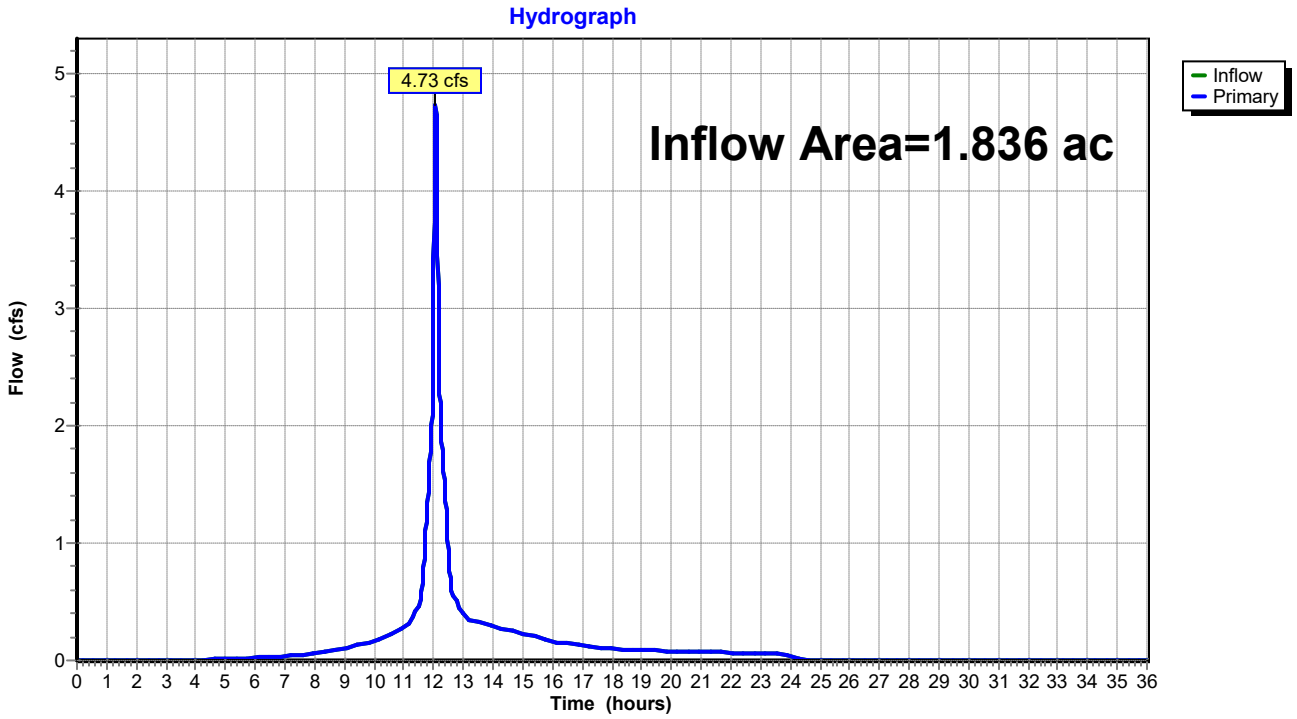


Summary for Link 1: POI-1

Inflow Area = 1.836 ac, 75.51% Impervious, Inflow Depth = 2.34" for 2YR event
Inflow = 4.73 cfs @ 12.07 hrs, Volume= 0.358 af
Primary = 4.73 cfs @ 12.07 hrs, Volume= 0.358 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 1: POI-1



Summary for Subcatchment 100A: PDA100A

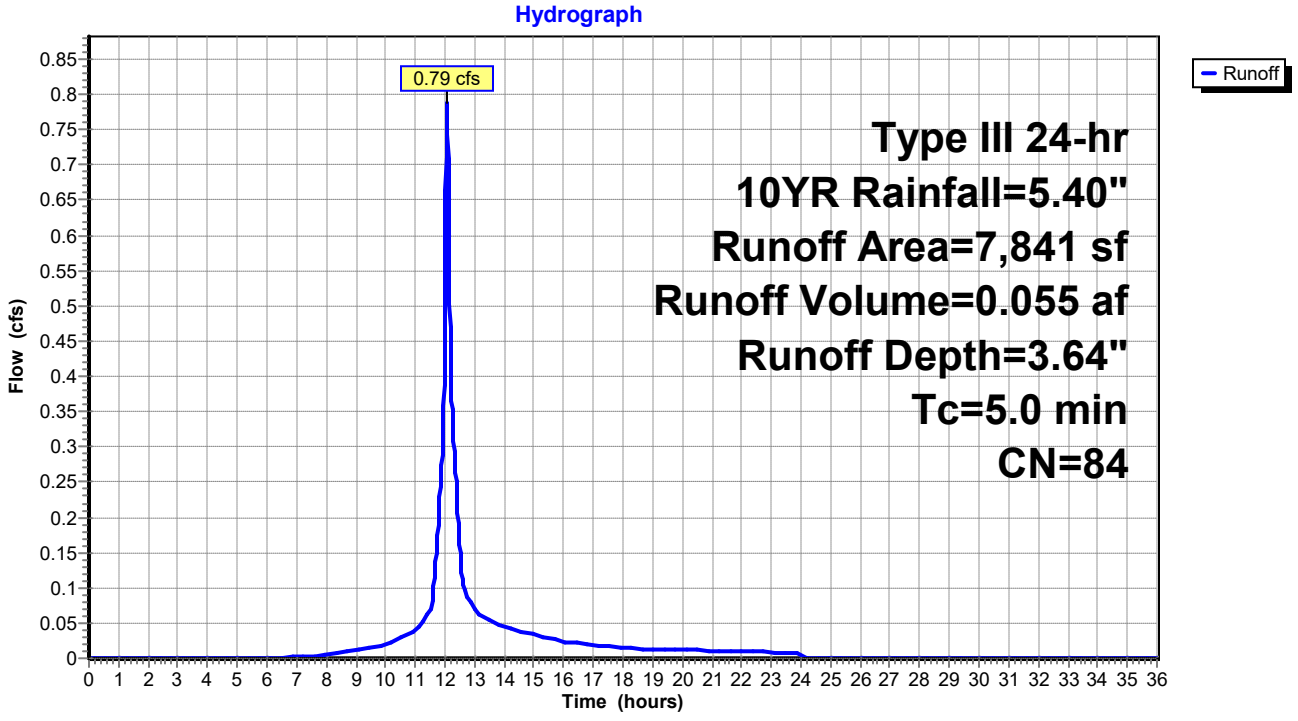
Runoff = 0.79 cfs @ 12.07 hrs, Volume= 0.055 af, Depth= 3.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10YR Rainfall=5.40"

Area (sf)	CN	Description
1,228	98	Paved parking, HSG D
1,836	39	>75% Grass cover, Good, HSG A
4,777	98	Paved parking, HSG A
7,841	84	Weighted Average
1,836		23.42% Pervious Area
6,005		76.58% Impervious Area

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

Subcatchment 100A: PDA100A



Summary for Subcatchment 100B: PDA100B

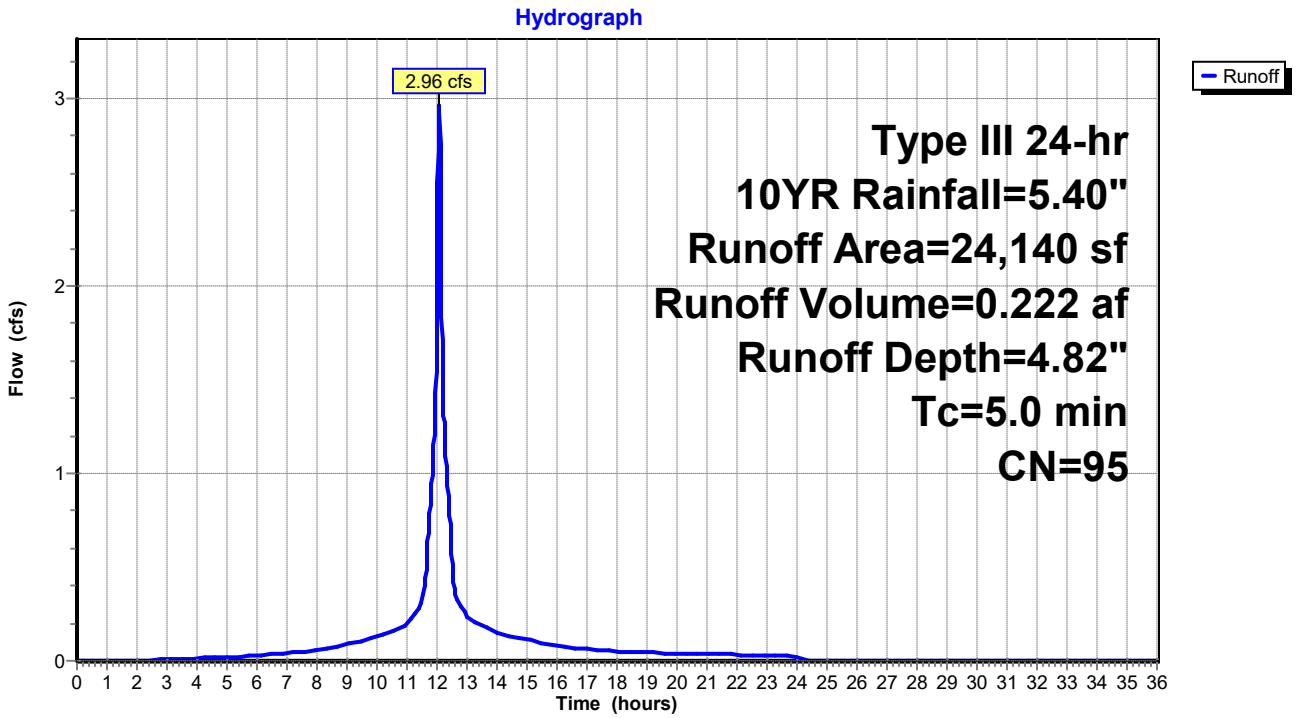
Runoff = 2.96 cfs @ 12.07 hrs, Volume= 0.222 af, Depth= 4.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10YR Rainfall=5.40"

Area (sf)	CN	Description
20,214	98	Paved parking, HSG D
99	39	>75% Grass cover, Good, HSG A
262	98	Paved parking, HSG A
3,565	80	>75% Grass cover, Good, HSG D
24,140	95	Weighted Average
3,664		15.18% Pervious Area
20,476		84.82% Impervious Area

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

Subcatchment 100B: PDA100B



Summary for Subcatchment 100C: PDA100C

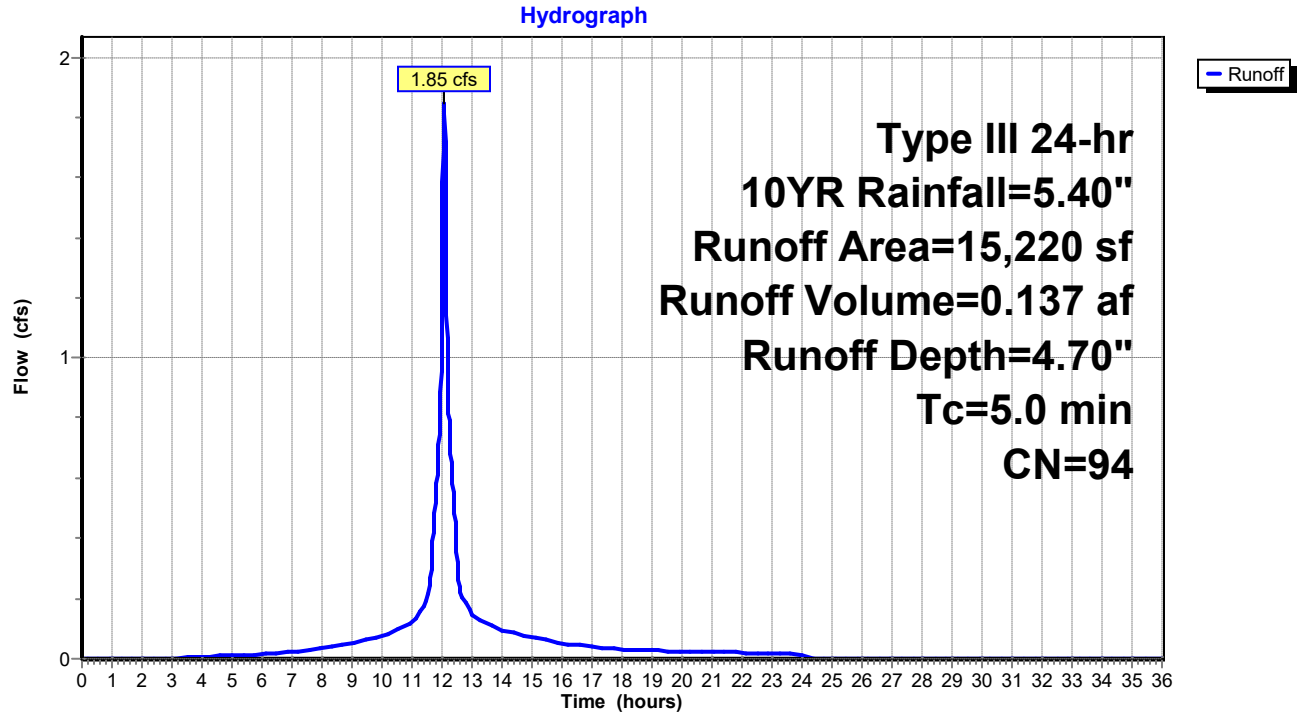
Runoff = 1.85 cfs @ 12.07 hrs, Volume= 0.137 af, Depth= 4.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10YR Rainfall=5.40"

Area (sf)	CN	Description
3,126	80	>75% Grass cover, Good, HSG D
12,094	98	Paved parking, HSG D
15,220	94	Weighted Average
3,126		20.54% Pervious Area
12,094		79.46% Impervious Area

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

Subcatchment 100C: PDA100C



Summary for Subcatchment 100D: PDA100D

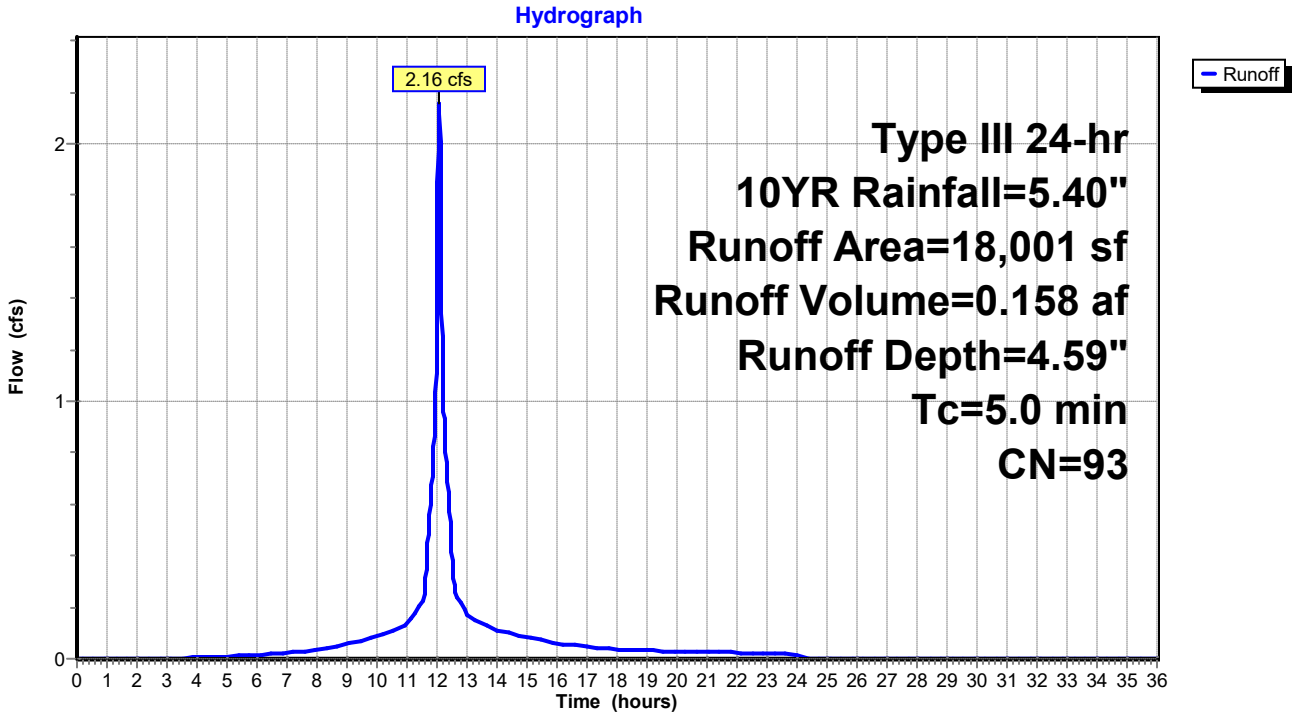
Runoff = 2.16 cfs @ 12.07 hrs, Volume= 0.158 af, Depth= 4.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10YR Rainfall=5.40"

Area (sf)	CN	Description
13,033	98	Paved parking, HSG D
4,968	80	>75% Grass cover, Good, HSG D
18,001	93	Weighted Average
4,968		27.60% Pervious Area
13,033		72.40% Impervious Area

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

Subcatchment 100D: PDA100D



Summary for Subcatchment 200: PDA200

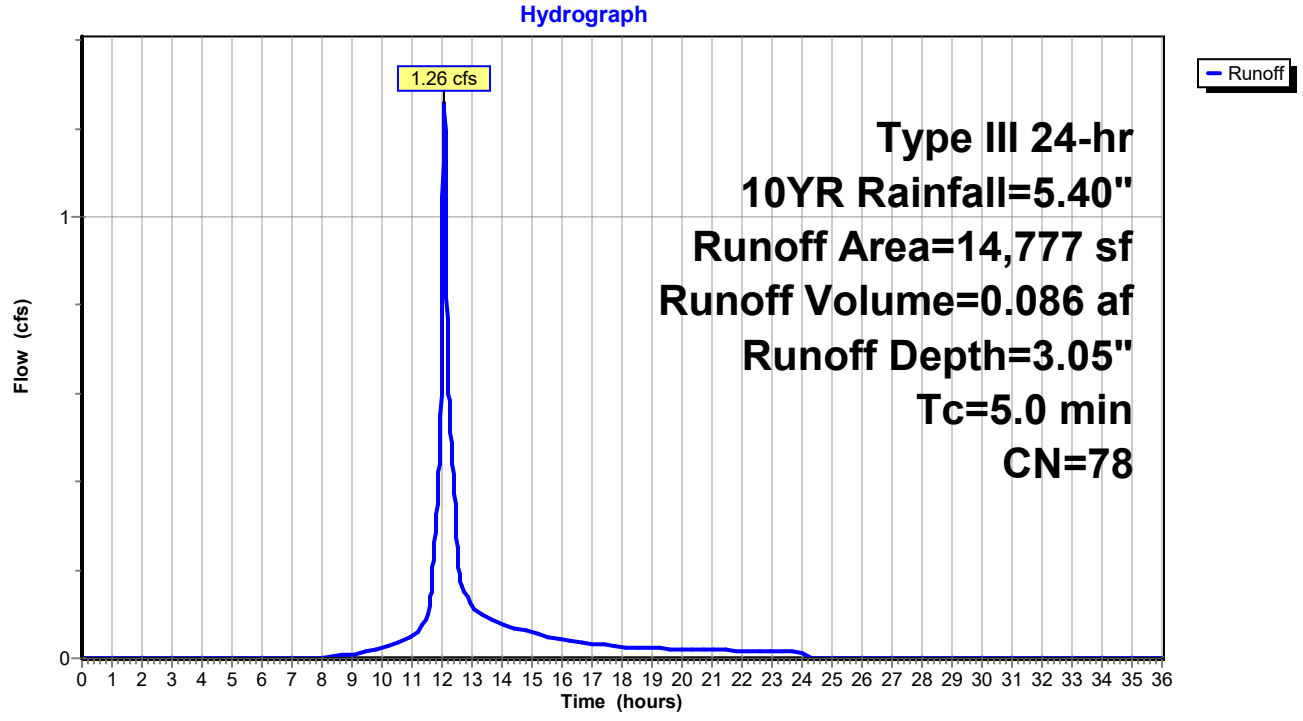
Runoff = 1.26 cfs @ 12.07 hrs, Volume= 0.086 af, Depth= 3.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10YR Rainfall=5.40"

Area (sf)	CN	Description
4,638	39	>75% Grass cover, Good, HSG A
1,356	80	>75% Grass cover, Good, HSG D
8,783	98	Paved parking, HSG A
14,777	78	Weighted Average
5,994		40.56% Pervious Area
8,783		59.44% Impervious Area

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

Subcatchment 200: PDA200



Summary for Pond CHAMBERS: SUBSURFACE SYSTEM

Inflow Area = 0.339 ac, 59.44% Impervious, Inflow Depth = 3.05" for 10YR event
Inflow = 1.26 cfs @ 12.07 hrs, Volume= 0.086 af
Outflow = 0.51 cfs @ 12.30 hrs, Volume= 0.062 af, Atten= 60%, Lag= 13.4 min
Discarded = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.51 cfs @ 12.30 hrs, Volume= 0.062 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 40.42' @ 12.30 hrs Surf.Area= 990 sf Storage= 1,490 cf

Plug-Flow detention time= 182.8 min calculated for 0.062 af (71% of inflow)
Center-of-Mass det. time= 89.1 min (911.8 - 822.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	38.07'	1,023 cf	**25.25'W x 39.22'L x 3.75'H Field A** 3,713 cf Overall - 1,156 cf Embedded = 2,557 cf x 40.0% Voids
#2A	38.82'	1,156 cf	**ADS_StormTech DC-780 +Cap** x 25 Inside #1 Effective Size= 45.4"W x 30.0"H => 6.49 sf x 7.12'L = 46.2 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 25 Chambers in 5 Rows
		2,179 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	38.07'	**2.410 in/hr Exfiltration over Horizontal area above 38.07'** Conductivity to Groundwater Elevation = 35.00' Excluded Horizontal area = 990 sf
#2	Primary	39.82'	**8.0" Round Culvert** L= 10.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 39.82' / 39.82' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=38.07' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.51 cfs @ 12.30 hrs HW=40.42' (Free Discharge)
↑—**2=Culvert** (Barrel Controls 0.51 cfs @ 2.03 fps)

Pond CHAMBERS: SUBSURFACE SYSTEM - Chamber Wizard Field A

Chamber Model = ADS_StormTech DC-780 +Cap (ADS StormTech® DC-780 with cap length)
Effective Size= 45.4"W x 30.0"H => 6.49 sf x 7.12'L = 46.2 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

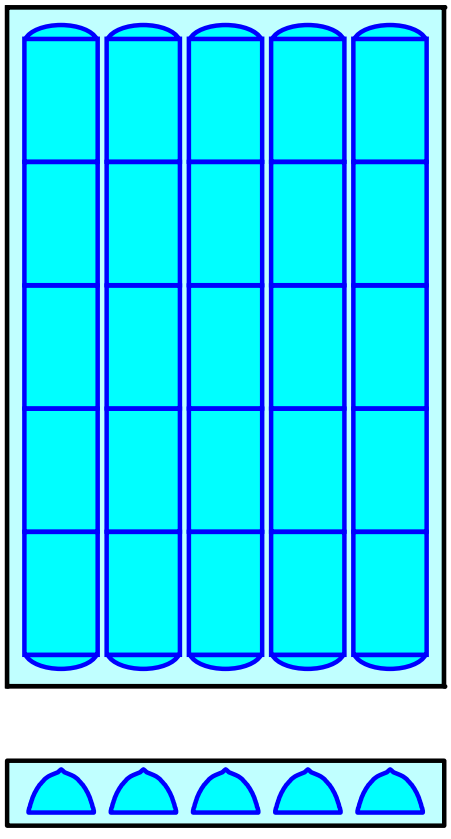
5 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 37.22' Row Length +12.0" End Stone x 2 = 39.22' Base Length
5 Rows x 51.0" Wide + 6.0" Spacing x 4 + 12.0" Side Stone x 2 = 25.25' Base Width
9.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.75' Field Height

25 Chambers x 46.2 cf = 1,156.0 cf Chamber Storage

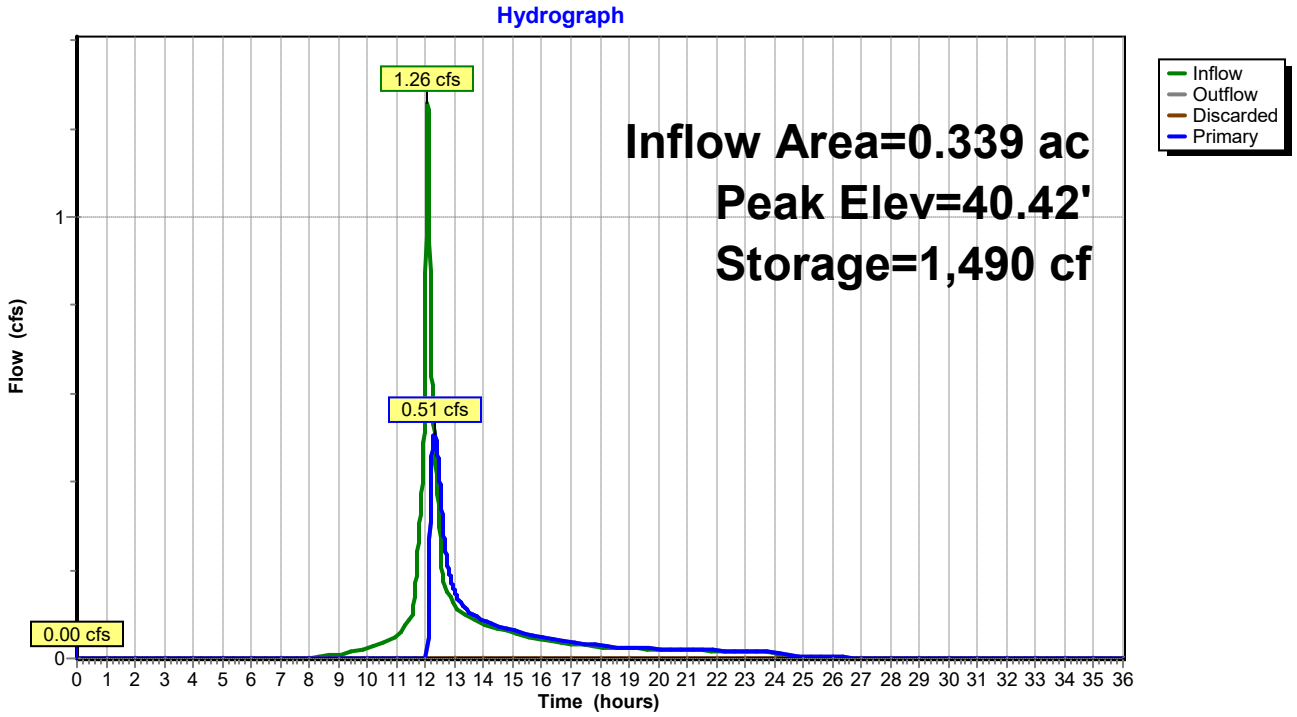
3,713.3 cf Field - 1,156.0 cf Chambers = 2,557.4 cf Stone x 40.0% Voids = 1,022.9 cf Stone Storage

Chamber Storage + Stone Storage = 2,178.9 cf = 0.050 af
Overall Storage Efficiency = 58.7%
Overall System Size = 39.22' x 25.25' x 3.75'

25 Chambers
137.5 cy Field
94.7 cy Stone



Pond CHAMBERS: SUBSURFACE SYSTEM

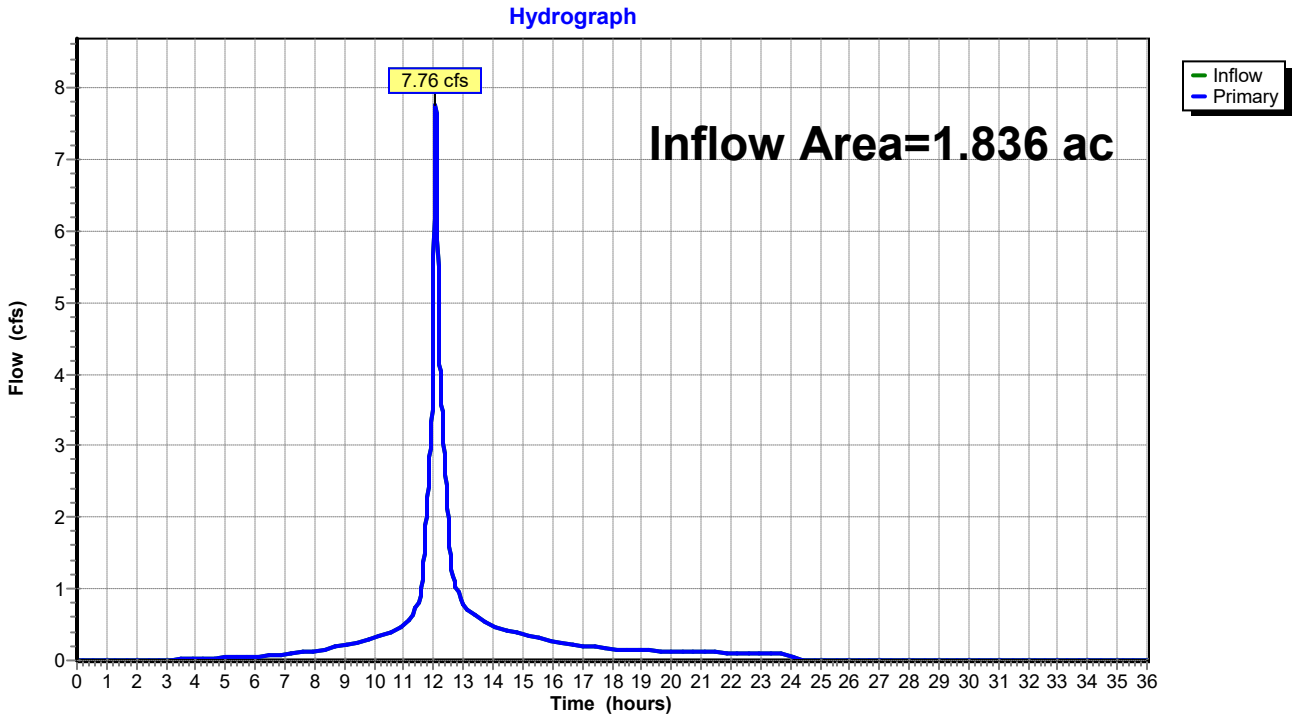


Summary for Link 1: POI-1

Inflow Area = 1.836 ac, 75.51% Impervious, Inflow Depth = 4.14" for 10YR event
Inflow = 7.76 cfs @ 12.07 hrs, Volume= 0.634 af
Primary = 7.76 cfs @ 12.07 hrs, Volume= 0.634 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 1: POI-1



Summary for Subcatchment 100A: PDA100A

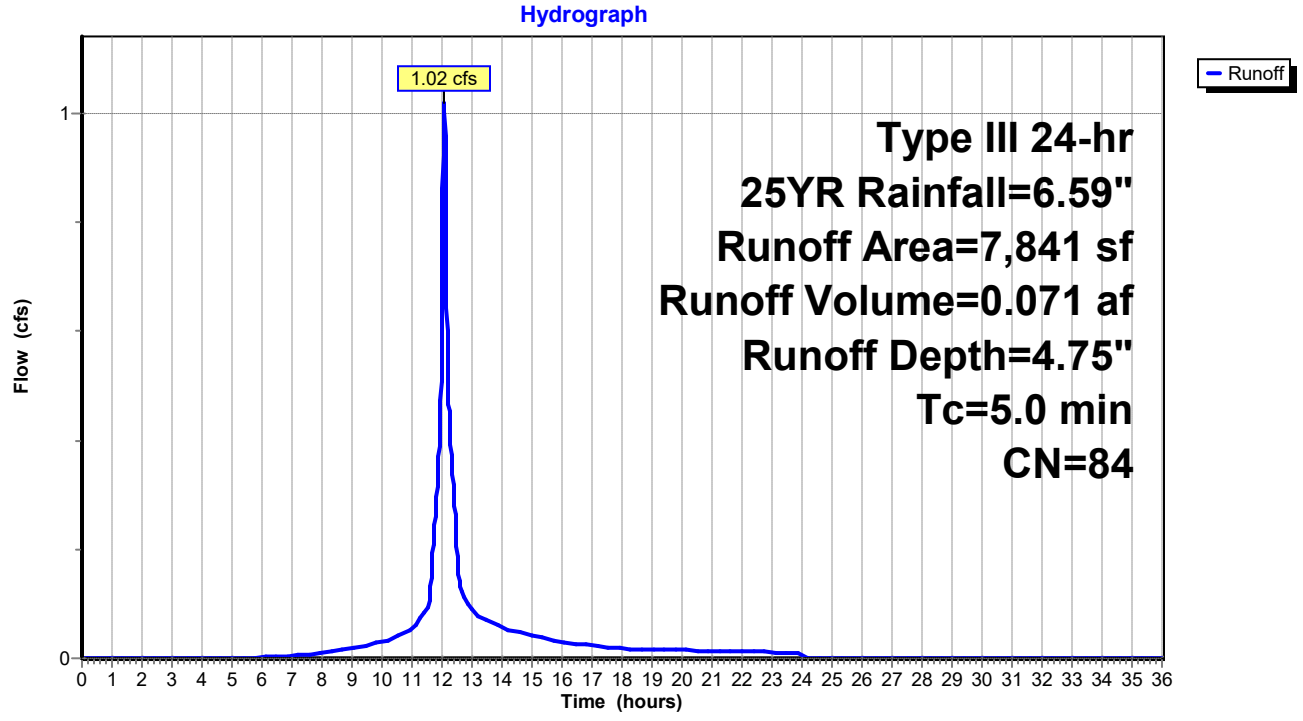
Runoff = 1.02 cfs @ 12.07 hrs, Volume= 0.071 af, Depth= 4.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25YR Rainfall=6.59"

Area (sf)	CN	Description
1,228	98	Paved parking, HSG D
1,836	39	>75% Grass cover, Good, HSG A
4,777	98	Paved parking, HSG A
7,841	84	Weighted Average
1,836		23.42% Pervious Area
6,005		76.58% Impervious Area

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

Subcatchment 100A: PDA100A



Summary for Subcatchment 100B: PDA100B

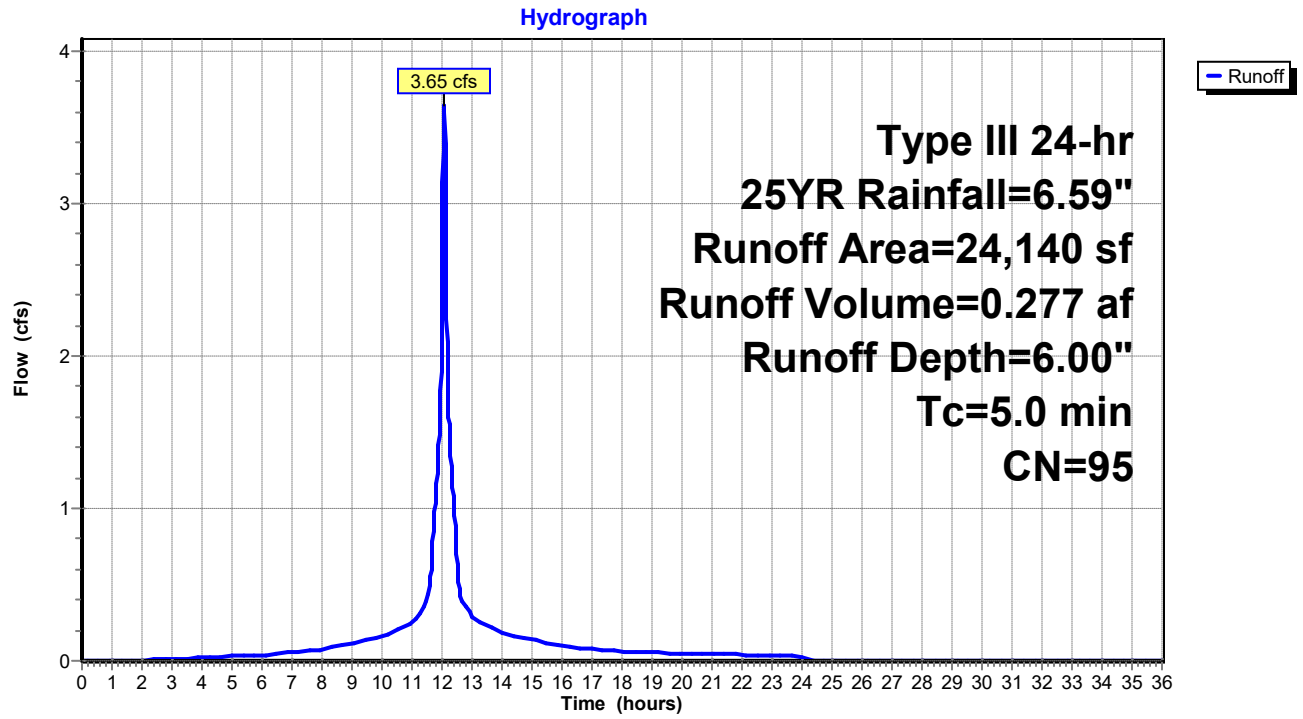
Runoff = 3.65 cfs @ 12.07 hrs, Volume= 0.277 af, Depth= 6.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25YR Rainfall=6.59"

Area (sf)	CN	Description
20,214	98	Paved parking, HSG D
99	39	>75% Grass cover, Good, HSG A
262	98	Paved parking, HSG A
3,565	80	>75% Grass cover, Good, HSG D
24,140	95	Weighted Average
3,664		15.18% Pervious Area
20,476		84.82% Impervious Area

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

Subcatchment 100B: PDA100B



Summary for Subcatchment 100C: PDA100C

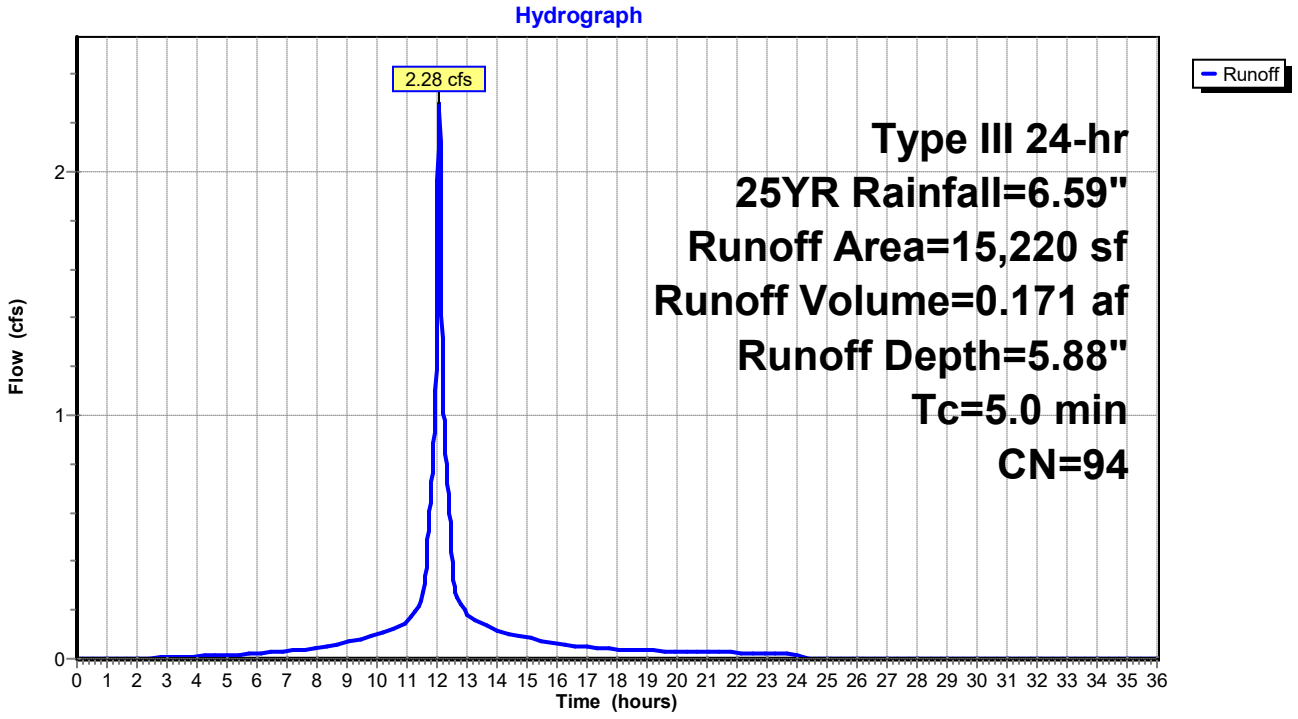
Runoff = 2.28 cfs @ 12.07 hrs, Volume= 0.171 af, Depth= 5.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25YR Rainfall=6.59"

Area (sf)	CN	Description
3,126	80	>75% Grass cover, Good, HSG D
12,094	98	Paved parking, HSG D
15,220	94	Weighted Average
3,126		20.54% Pervious Area
12,094		79.46% Impervious Area

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

Subcatchment 100C: PDA100C



Summary for Subcatchment 100D: PDA100D

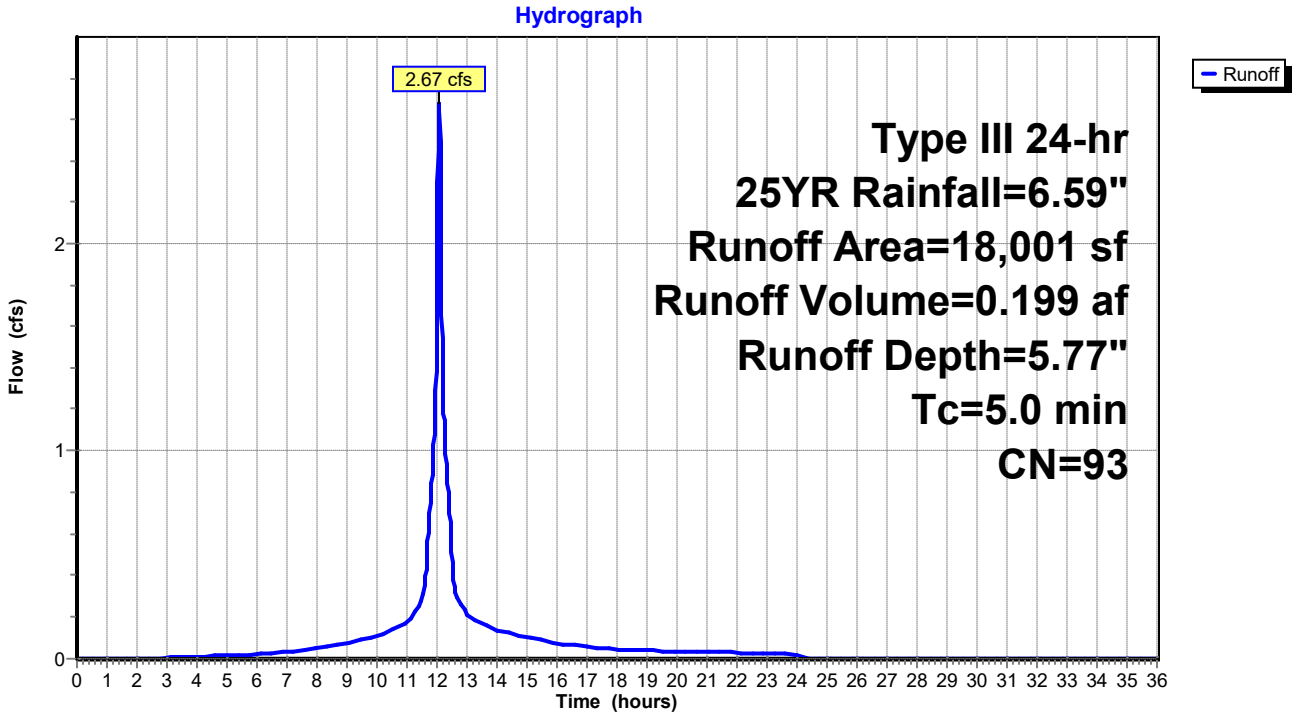
Runoff = 2.67 cfs @ 12.07 hrs, Volume= 0.199 af, Depth= 5.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25YR Rainfall=6.59"

Area (sf)	CN	Description
13,033	98	Paved parking, HSG D
4,968	80	>75% Grass cover, Good, HSG D
18,001	93	Weighted Average
4,968		27.60% Pervious Area
13,033		72.40% Impervious Area

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

Subcatchment 100D: PDA100D



Summary for Subcatchment 200: PDA200

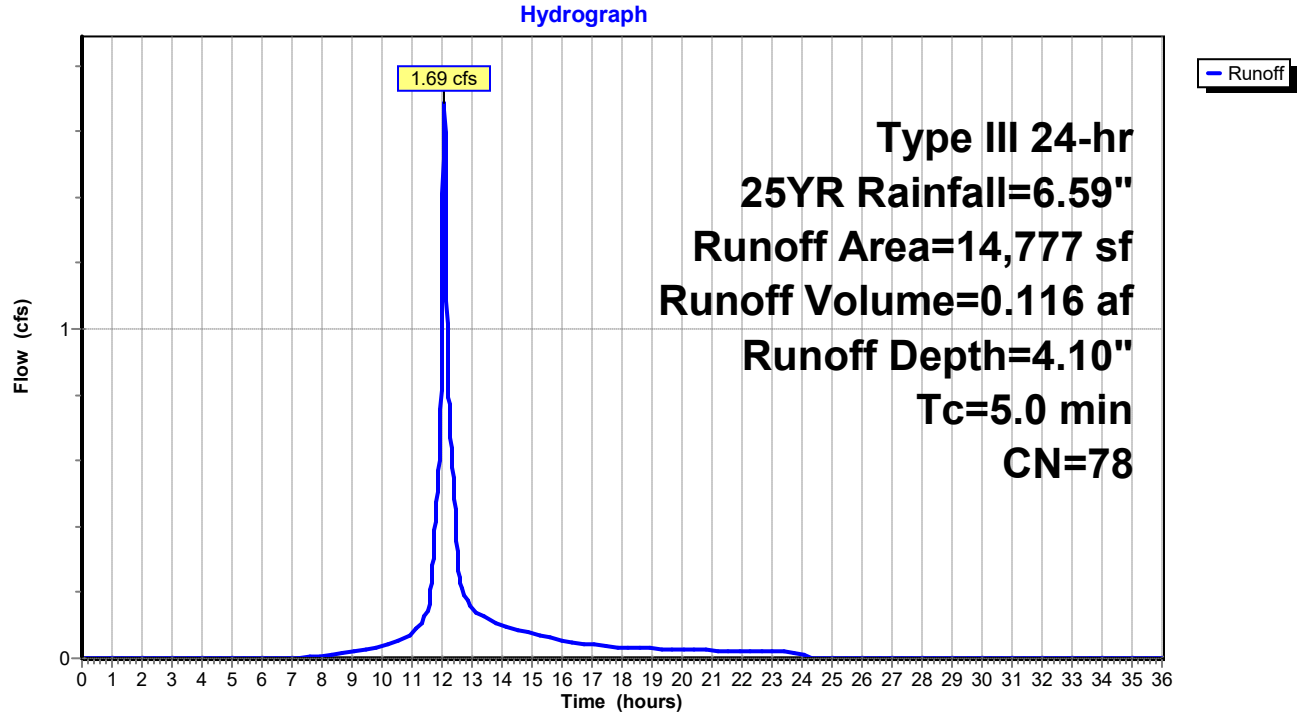
Runoff = 1.69 cfs @ 12.07 hrs, Volume= 0.116 af, Depth= 4.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25YR Rainfall=6.59"

Area (sf)	CN	Description
4,638	39	>75% Grass cover, Good, HSG A
1,356	80	>75% Grass cover, Good, HSG D
8,783	98	Paved parking, HSG A
14,777	78	Weighted Average
5,994		40.56% Pervious Area
8,783		59.44% Impervious Area

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

Subcatchment 200: PDA200



Summary for Pond CHAMBERS: SUBSURFACE SYSTEM

Inflow Area = 0.339 ac, 59.44% Impervious, Inflow Depth = 4.10" for 25YR event
Inflow = 1.69 cfs @ 12.07 hrs, Volume= 0.116 af
Outflow = 1.01 cfs @ 12.17 hrs, Volume= 0.091 af, Atten= 40%, Lag= 5.9 min
Discarded = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 1.01 cfs @ 12.17 hrs, Volume= 0.091 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 40.80' @ 12.17 hrs Surf.Area= 990 sf Storage= 1,729 cf

Plug-Flow detention time= 148.4 min calculated for 0.091 af (79% of inflow)
Center-of-Mass det. time= 68.7 min (883.0 - 814.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	38.07'	1,023 cf	**25.25'W x 39.22'L x 3.75'H Field A** 3,713 cf Overall - 1,156 cf Embedded = 2,557 cf x 40.0% Voids
#2A	38.82'	1,156 cf	**ADS_StormTech DC-780 +Cap** x 25 Inside #1 Effective Size= 45.4"W x 30.0"H => 6.49 sf x 7.12'L = 46.2 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 25 Chambers in 5 Rows
		2,179 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	38.07'	**2.410 in/hr Exfiltration over Horizontal area above 38.07'** Conductivity to Groundwater Elevation = 35.00' Excluded Horizontal area = 990 sf
#2	Primary	39.82'	**8.0" Round Culvert** L= 10.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 39.82' / 39.82' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=38.07' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=1.01 cfs @ 12.17 hrs HW=40.80' (Free Discharge)
↑—**2=Culvert** (Barrel Controls 1.01 cfs @ 2.89 fps)

Pond CHAMBERS: SUBSURFACE SYSTEM - Chamber Wizard Field A

Chamber Model = ADS_StormTech DC-780 +Cap (ADS StormTech® DC-780 with cap length)
Effective Size= 45.4"W x 30.0"H => 6.49 sf x 7.12'L = 46.2 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

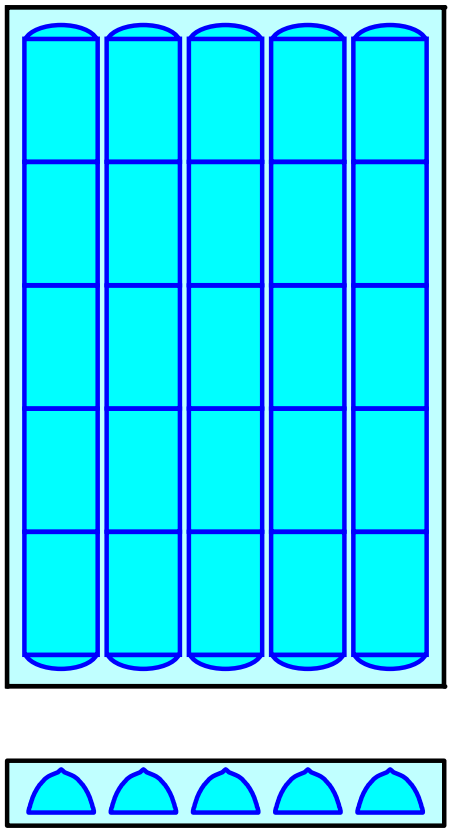
5 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 37.22' Row Length +12.0" End Stone x 2 = 39.22' Base Length
5 Rows x 51.0" Wide + 6.0" Spacing x 4 + 12.0" Side Stone x 2 = 25.25' Base Width
9.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.75' Field Height

25 Chambers x 46.2 cf = 1,156.0 cf Chamber Storage

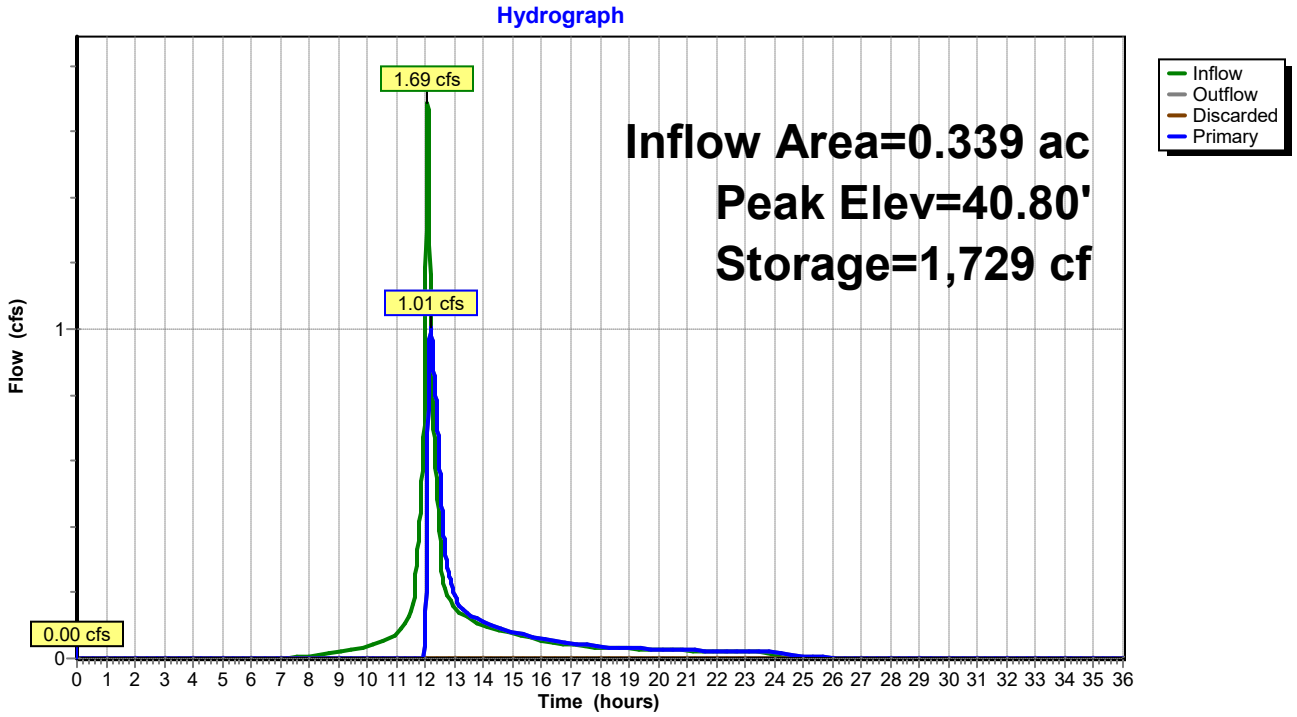
3,713.3 cf Field - 1,156.0 cf Chambers = 2,557.4 cf Stone x 40.0% Voids = 1,022.9 cf Stone Storage

Chamber Storage + Stone Storage = 2,178.9 cf = 0.050 af
Overall Storage Efficiency = 58.7%
Overall System Size = 39.22' x 25.25' x 3.75'

25 Chambers
137.5 cy Field
94.7 cy Stone



Pond CHAMBERS: SUBSURFACE SYSTEM

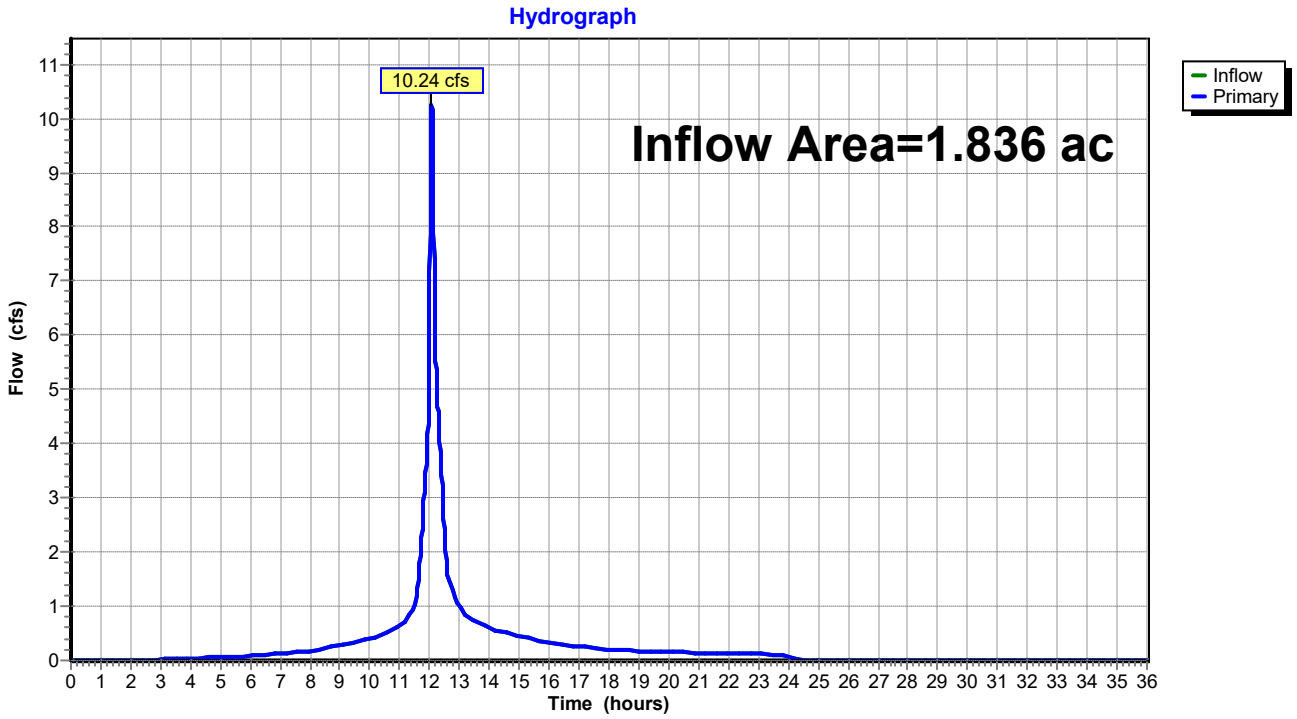


Summary for Link 1: POI-1

Inflow Area = 1.836 ac, 75.51% Impervious, Inflow Depth = 5.29" for 25YR event
Inflow = 10.24 cfs @ 12.08 hrs, Volume= 0.809 af
Primary = 10.24 cfs @ 12.08 hrs, Volume= 0.809 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 1: POI-1



Summary for Subcatchment 100A: PDA100A

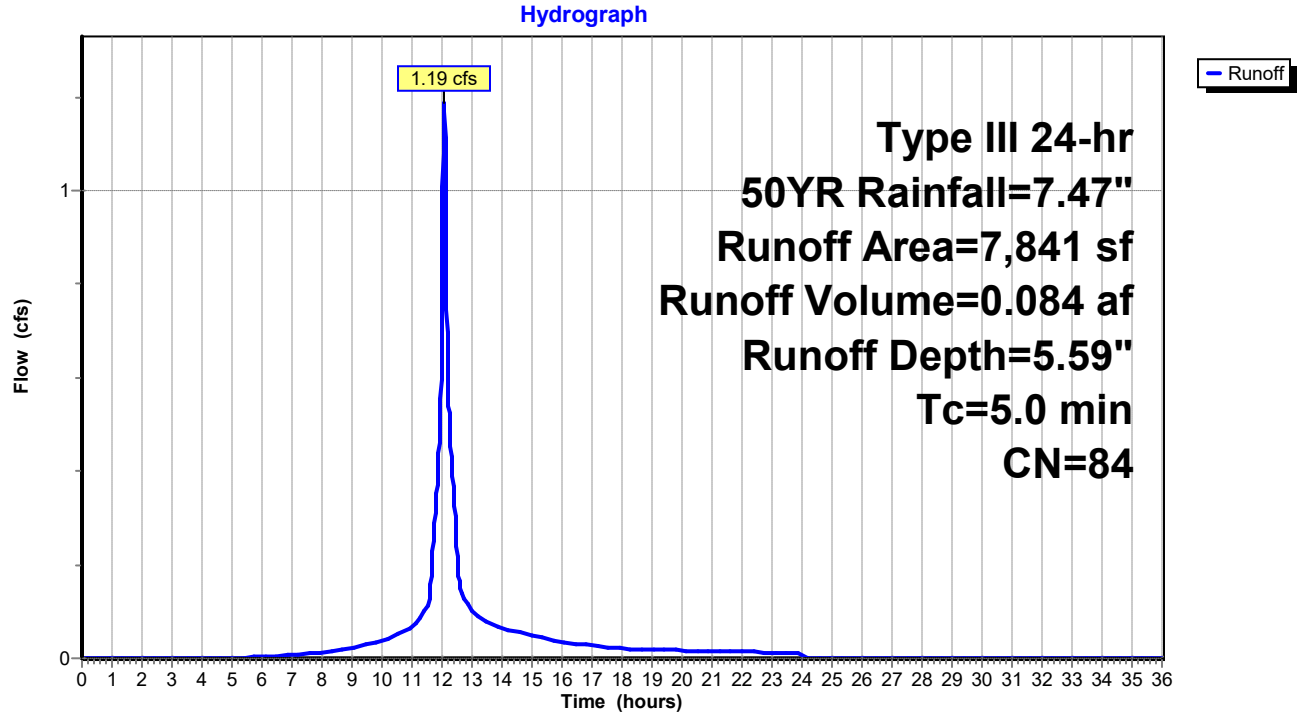
Runoff = 1.19 cfs @ 12.07 hrs, Volume= 0.084 af, Depth= 5.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 50YR Rainfall=7.47"

Area (sf)	CN	Description
1,228	98	Paved parking, HSG D
1,836	39	>75% Grass cover, Good, HSG A
4,777	98	Paved parking, HSG A
7,841	84	Weighted Average
1,836		23.42% Pervious Area
6,005		76.58% Impervious Area

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

Subcatchment 100A: PDA100A



Summary for Subcatchment 100B: PDA100B

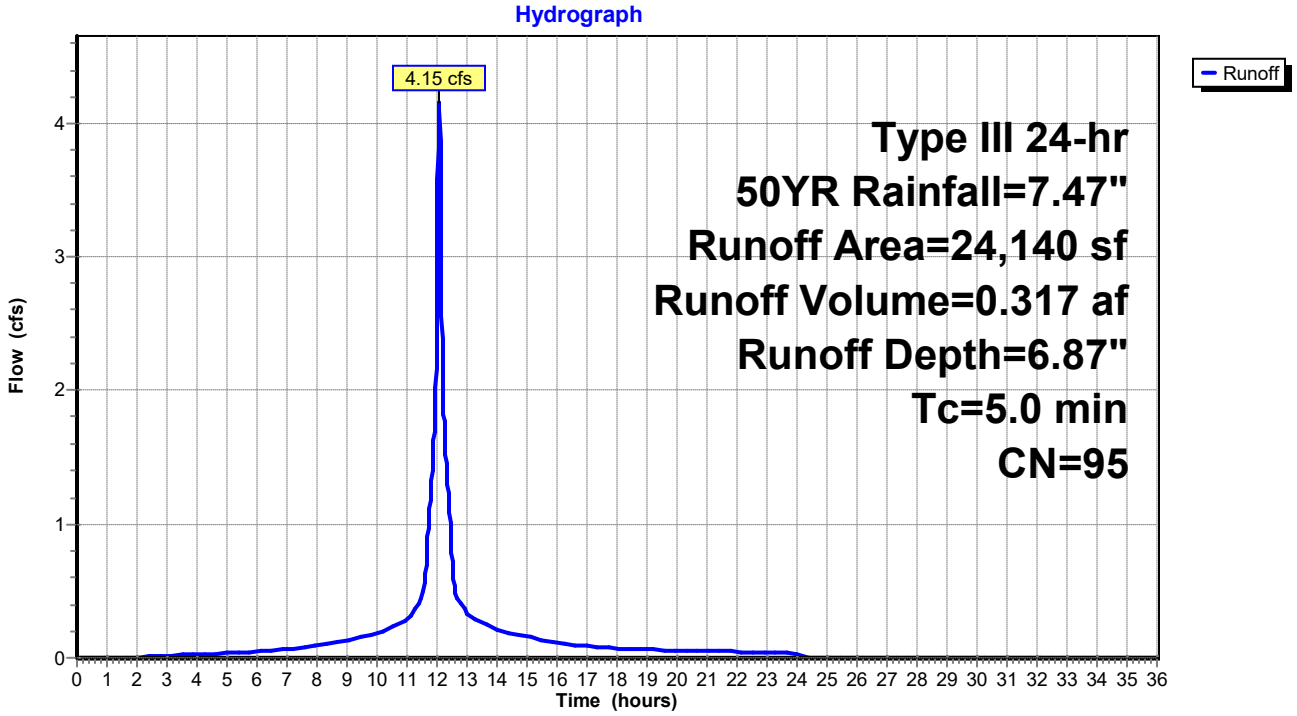
Runoff = 4.15 cfs @ 12.07 hrs, Volume= 0.317 af, Depth= 6.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 50YR Rainfall=7.47"

Area (sf)	CN	Description
20,214	98	Paved parking, HSG D
99	39	>75% Grass cover, Good, HSG A
262	98	Paved parking, HSG A
3,565	80	>75% Grass cover, Good, HSG D
24,140	95	Weighted Average
3,664		15.18% Pervious Area
20,476		84.82% Impervious Area

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

Subcatchment 100B: PDA100B



Summary for Subcatchment 100C: PDA100C

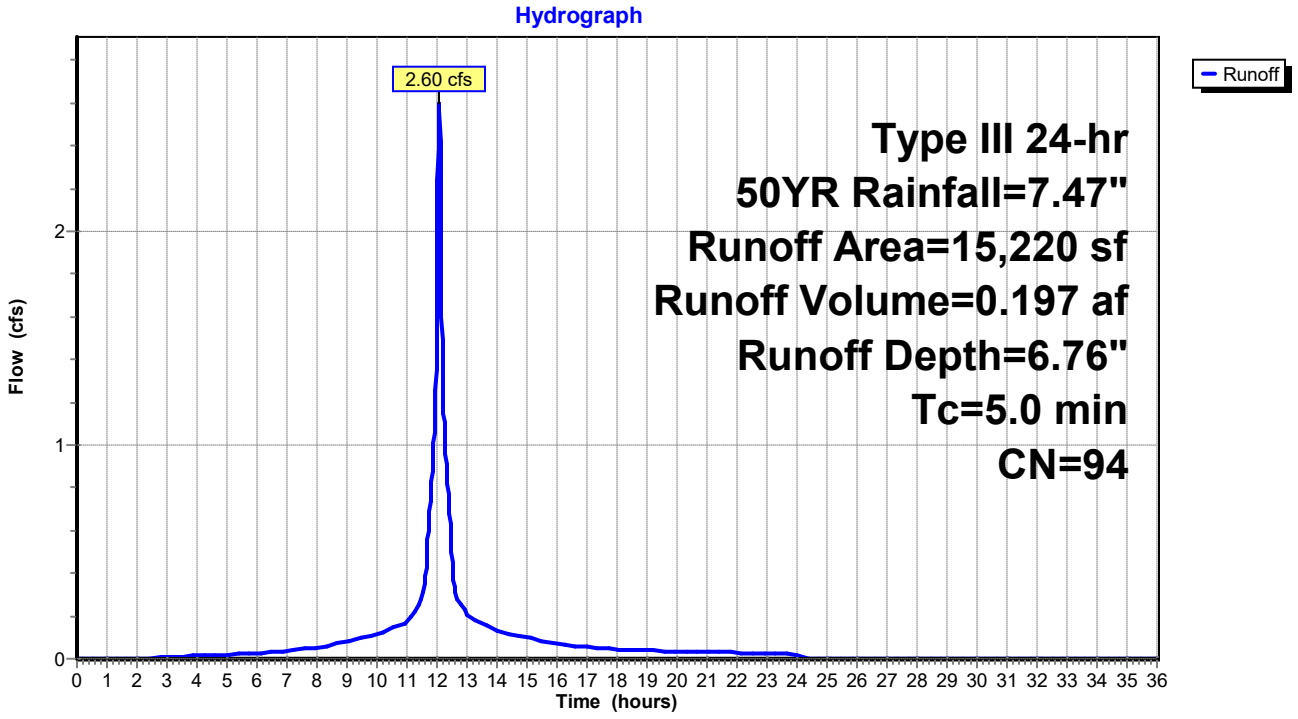
Runoff = 2.60 cfs @ 12.07 hrs, Volume= 0.197 af, Depth= 6.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 50YR Rainfall=7.47"

Area (sf)	CN	Description
3,126	80	>75% Grass cover, Good, HSG D
12,094	98	Paved parking, HSG D
15,220	94	Weighted Average
3,126		20.54% Pervious Area
12,094		79.46% Impervious Area

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

Subcatchment 100C: PDA100C



Summary for Subcatchment 100D: PDA100D

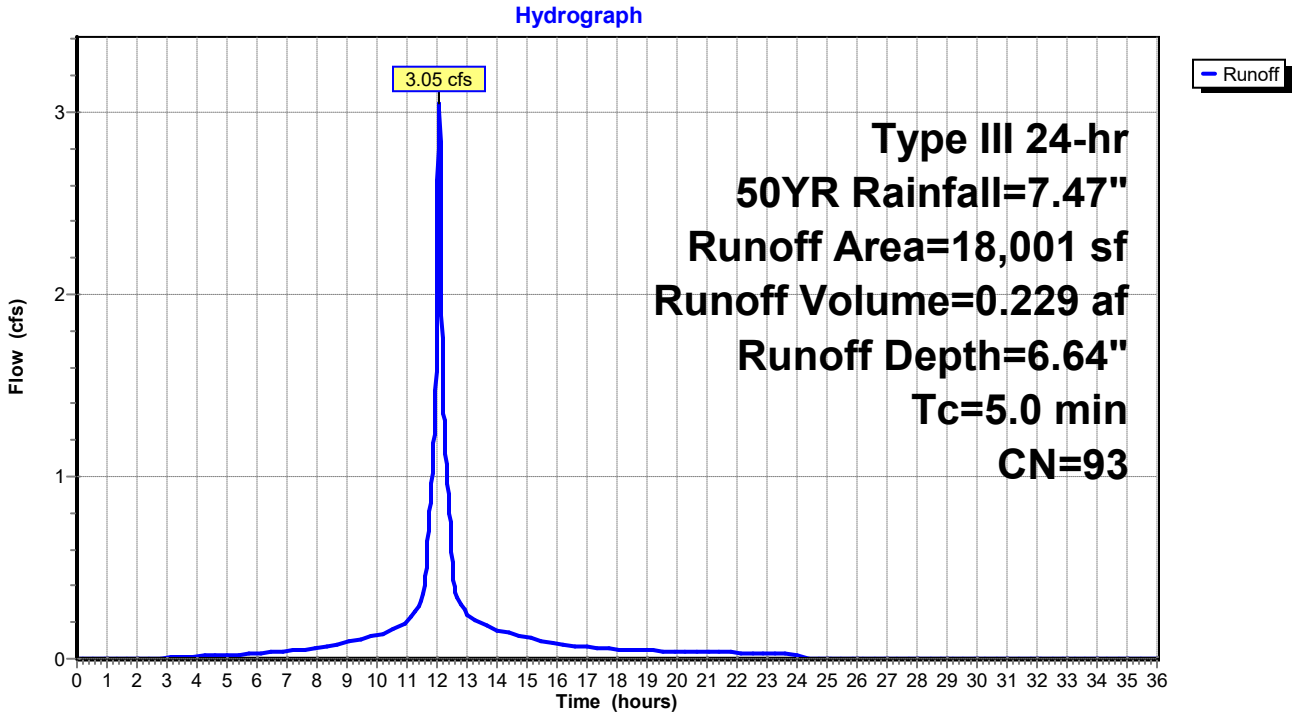
Runoff = 3.05 cfs @ 12.07 hrs, Volume= 0.229 af, Depth= 6.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 50YR Rainfall=7.47"

Area (sf)	CN	Description
13,033	98	Paved parking, HSG D
4,968	80	>75% Grass cover, Good, HSG D
18,001	93	Weighted Average
4,968		27.60% Pervious Area
13,033		72.40% Impervious Area

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

Subcatchment 100D: PDA100D



Summary for Subcatchment 200: PDA200

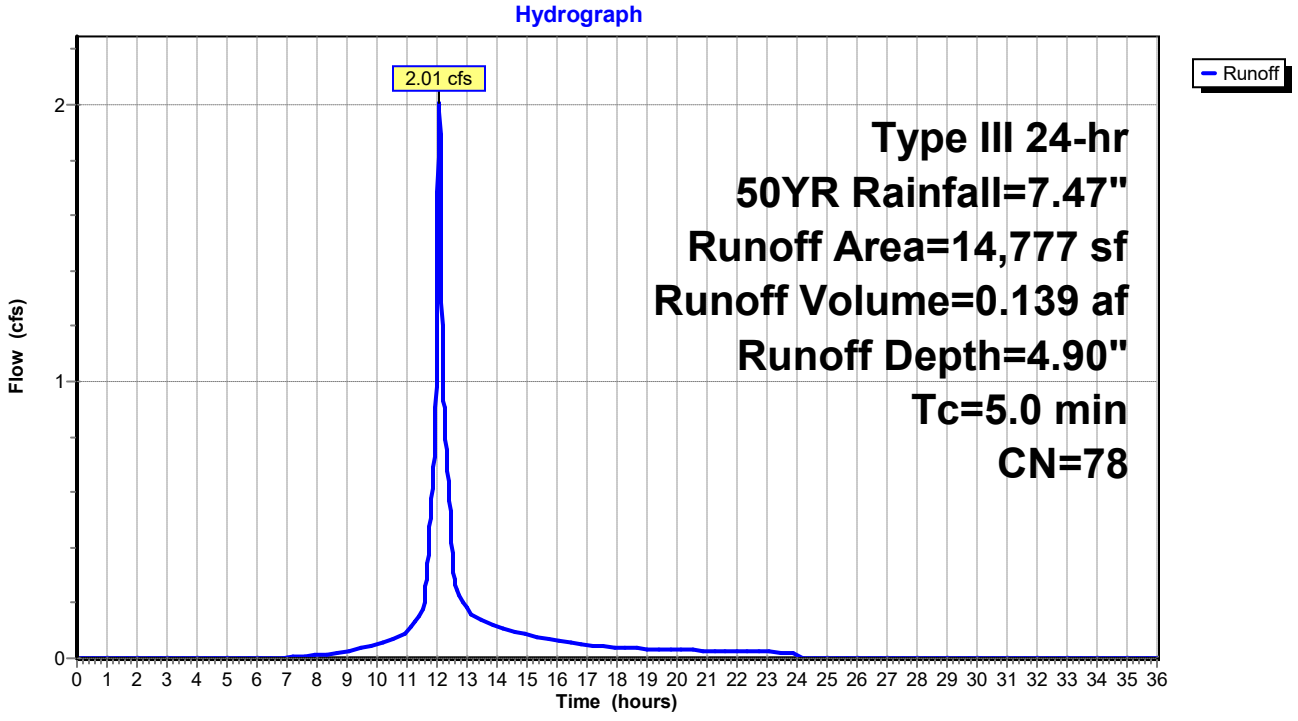
Runoff = 2.01 cfs @ 12.07 hrs, Volume= 0.139 af, Depth= 4.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 50YR Rainfall=7.47"

Area (sf)	CN	Description
4,638	39	>75% Grass cover, Good, HSG A
1,356	80	>75% Grass cover, Good, HSG D
8,783	98	Paved parking, HSG A
14,777	78	Weighted Average
5,994		40.56% Pervious Area
8,783		59.44% Impervious Area

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

Subcatchment 200: PDA200



Summary for Pond CHAMBERS: SUBSURFACE SYSTEM

Inflow Area = 0.339 ac, 59.44% Impervious, Inflow Depth = 4.90" for 50YR event
Inflow = 2.01 cfs @ 12.07 hrs, Volume= 0.139 af
Outflow = 1.30 cfs @ 12.16 hrs, Volume= 0.114 af, Atten= 35%, Lag= 5.1 min
Discarded = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 1.30 cfs @ 12.16 hrs, Volume= 0.114 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 41.11' @ 12.16 hrs Surf.Area= 990 sf Storage= 1,893 cf

Plug-Flow detention time= 132.4 min calculated for 0.114 af (82% of inflow)
Center-of-Mass det. time= 60.8 min (870.0 - 809.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	38.07'	1,023 cf	**25.25'W x 39.22'L x 3.75'H Field A** 3,713 cf Overall - 1,156 cf Embedded = 2,557 cf x 40.0% Voids
#2A	38.82'	1,156 cf	**ADS_StormTech DC-780 +Cap** x 25 Inside #1 Effective Size= 45.4"W x 30.0"H => 6.49 sf x 7.12'L = 46.2 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 25 Chambers in 5 Rows
		2,179 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	38.07'	**2.410 in/hr Exfiltration over Horizontal area above 38.07'** Conductivity to Groundwater Elevation = 35.00' Excluded Horizontal area = 990 sf
#2	Primary	39.82'	**8.0" Round Culvert** L= 10.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 39.82' / 39.82' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=38.07' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=1.30 cfs @ 12.16 hrs HW=41.11' (Free Discharge)
↑—**2=Culvert** (Inlet Controls 1.30 cfs @ 3.72 fps)

Pond CHAMBERS: SUBSURFACE SYSTEM - Chamber Wizard Field A

Chamber Model = ADS_StormTech DC-780 +Cap (ADS StormTech® DC-780 with cap length)
Effective Size= 45.4"W x 30.0"H => 6.49 sf x 7.12'L = 46.2 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

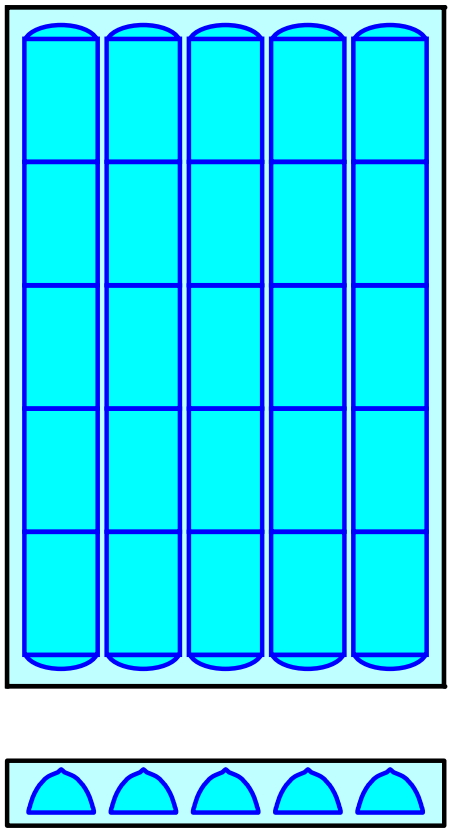
5 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 37.22' Row Length +12.0" End Stone x 2 = 39.22' Base Length
5 Rows x 51.0" Wide + 6.0" Spacing x 4 + 12.0" Side Stone x 2 = 25.25' Base Width
9.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.75' Field Height

25 Chambers x 46.2 cf = 1,156.0 cf Chamber Storage

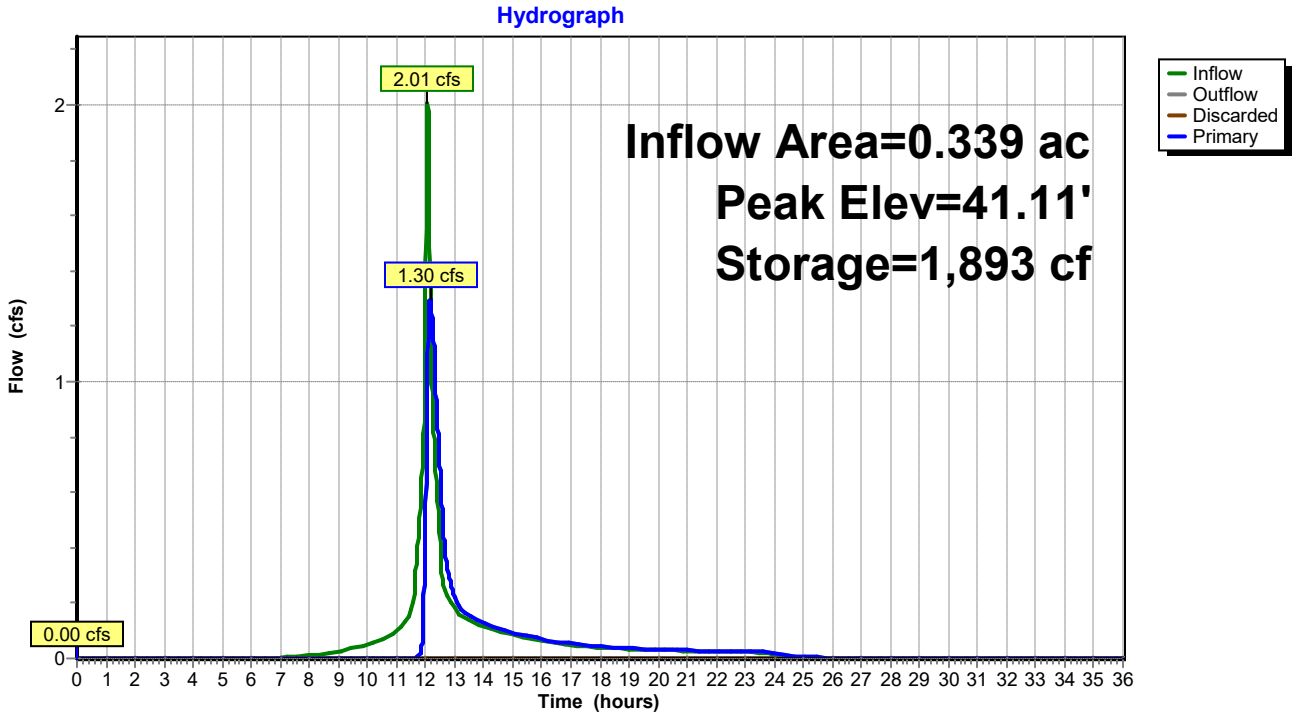
3,713.3 cf Field - 1,156.0 cf Chambers = 2,557.4 cf Stone x 40.0% Voids = 1,022.9 cf Stone Storage

Chamber Storage + Stone Storage = 2,178.9 cf = 0.050 af
Overall Storage Efficiency = 58.7%
Overall System Size = 39.22' x 25.25' x 3.75'

25 Chambers
137.5 cy Field
94.7 cy Stone



Pond CHAMBERS: SUBSURFACE SYSTEM

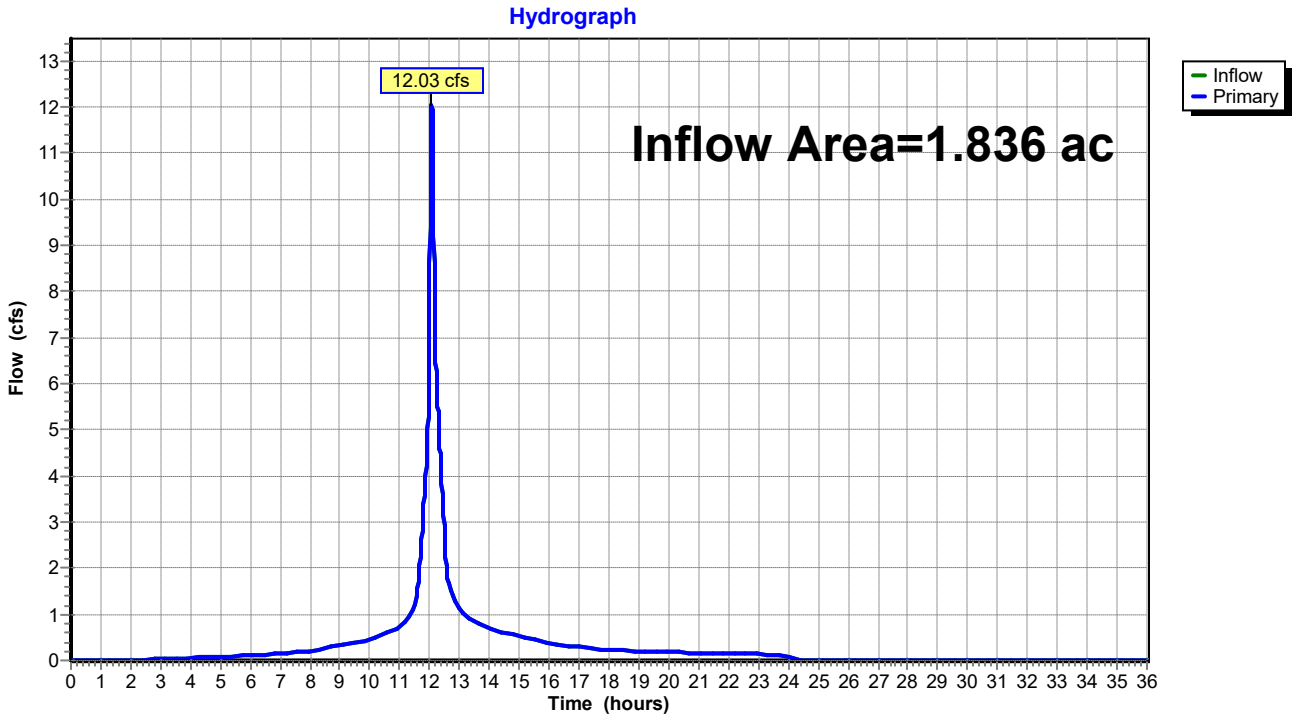


Summary for Link 1: POI-1

Inflow Area = 1.836 ac, 75.51% Impervious, Inflow Depth = 6.15" for 50YR event
Inflow = 12.03 cfs @ 12.07 hrs, Volume= 0.940 af
Primary = 12.03 cfs @ 12.07 hrs, Volume= 0.940 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 1: POI-1



Summary for Subcatchment 100A: PDA100A

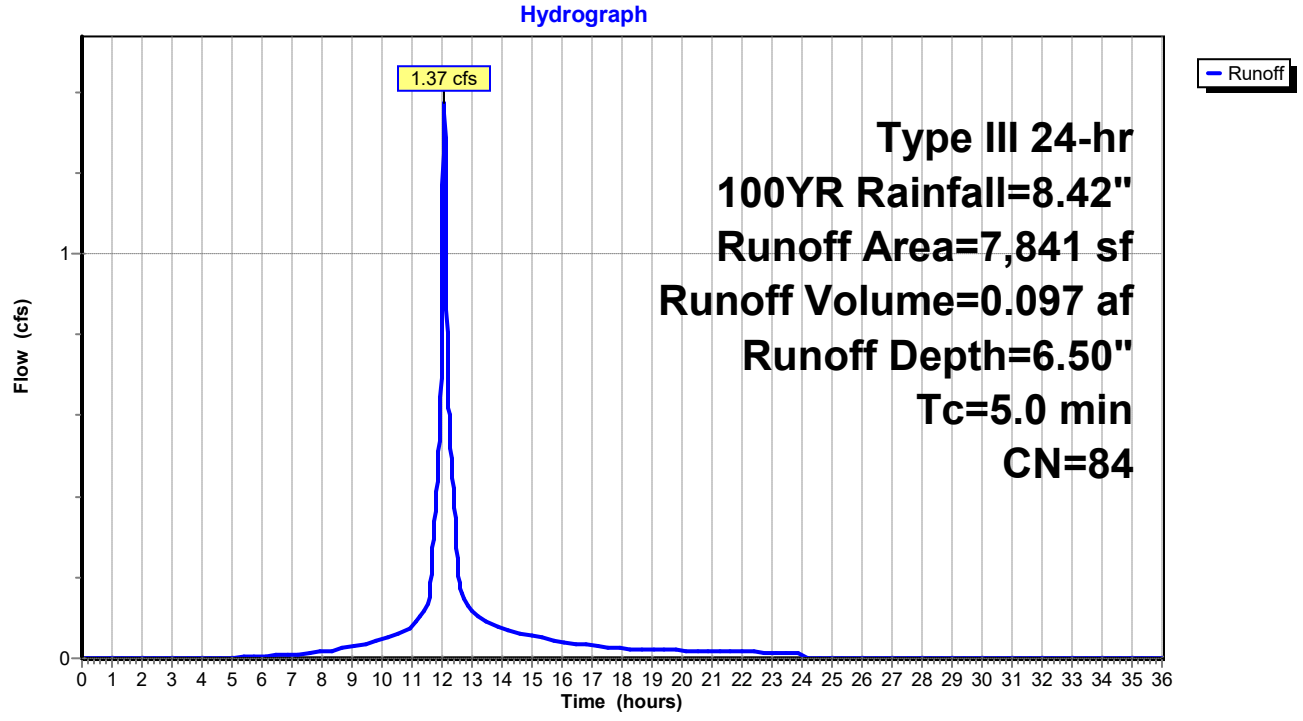
Runoff = 1.37 cfs @ 12.07 hrs, Volume= 0.097 af, Depth= 6.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YR Rainfall=8.42"

Area (sf)	CN	Description
1,228	98	Paved parking, HSG D
1,836	39	>75% Grass cover, Good, HSG A
4,777	98	Paved parking, HSG A
7,841	84	Weighted Average
1,836		23.42% Pervious Area
6,005		76.58% Impervious Area

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

Subcatchment 100A: PDA100A



Summary for Subcatchment 100B: PDA100B

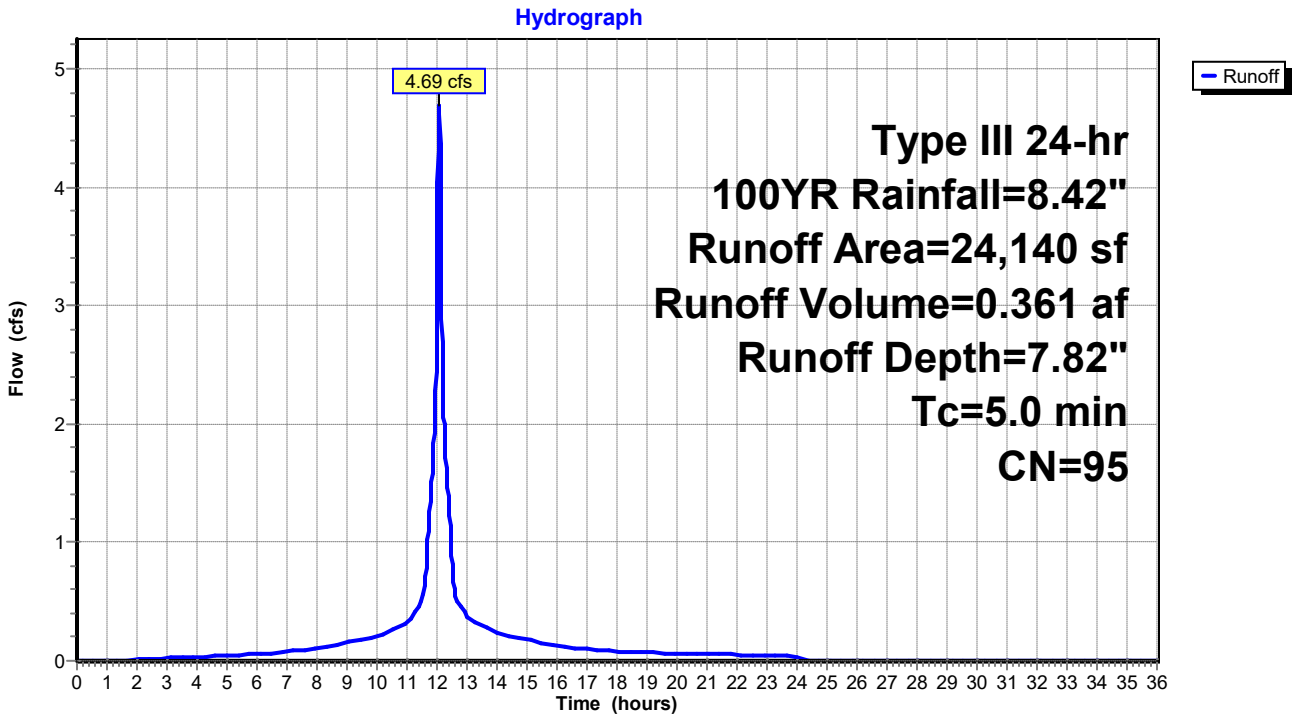
Runoff = 4.69 cfs @ 12.07 hrs, Volume= 0.361 af, Depth= 7.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YR Rainfall=8.42"

Area (sf)	CN	Description
20,214	98	Paved parking, HSG D
99	39	>75% Grass cover, Good, HSG A
262	98	Paved parking, HSG A
3,565	80	>75% Grass cover, Good, HSG D
24,140	95	Weighted Average
3,664		15.18% Pervious Area
20,476		84.82% Impervious Area

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

Subcatchment 100B: PDA100B



Summary for Subcatchment 100C: PDA100C

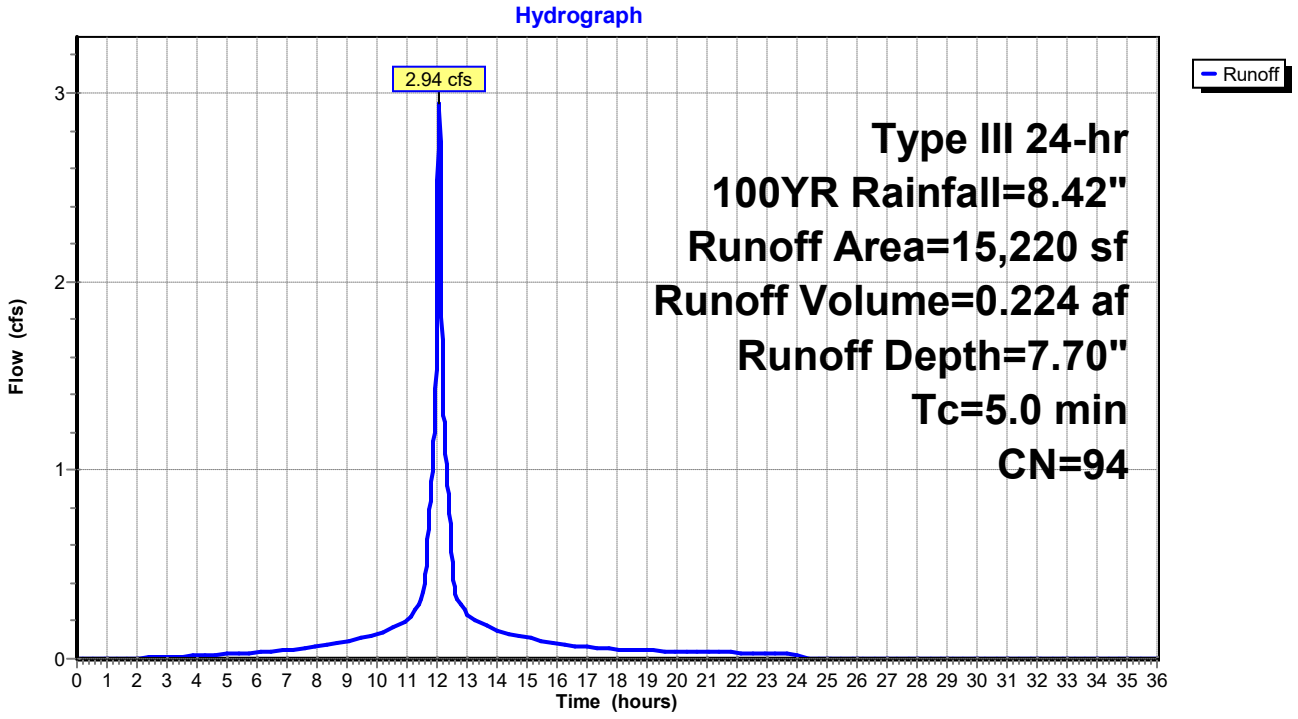
Runoff = 2.94 cfs @ 12.07 hrs, Volume= 0.224 af, Depth= 7.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YR Rainfall=8.42"

Area (sf)	CN	Description
3,126	80	>75% Grass cover, Good, HSG D
12,094	98	Paved parking, HSG D
15,220	94	Weighted Average
3,126		20.54% Pervious Area
12,094		79.46% Impervious Area

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

Subcatchment 100C: PDA100C



Summary for Subcatchment 100D: PDA100D

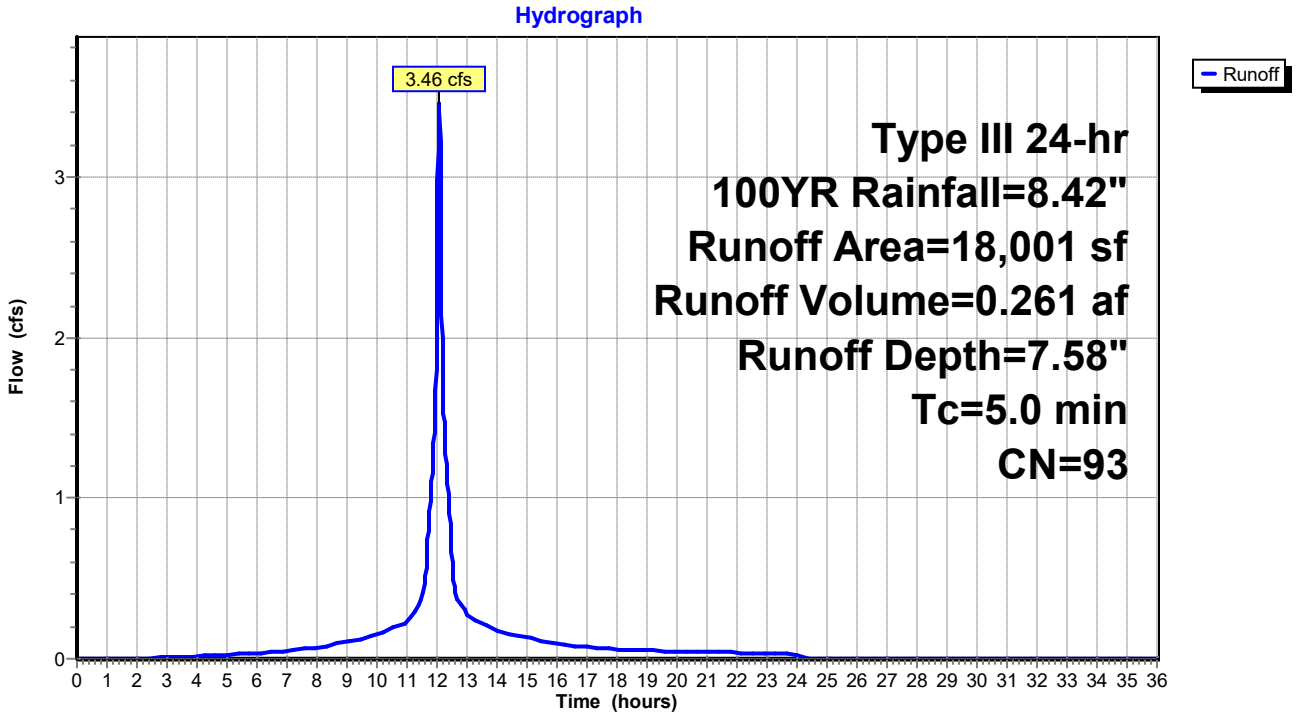
Runoff = 3.46 cfs @ 12.07 hrs, Volume= 0.261 af, Depth= 7.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YR Rainfall=8.42"

Area (sf)	CN	Description
13,033	98	Paved parking, HSG D
4,968	80	>75% Grass cover, Good, HSG D
18,001	93	Weighted Average
4,968		27.60% Pervious Area
13,033		72.40% Impervious Area

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

Subcatchment 100D: PDA100D



Summary for Subcatchment 200: PDA200

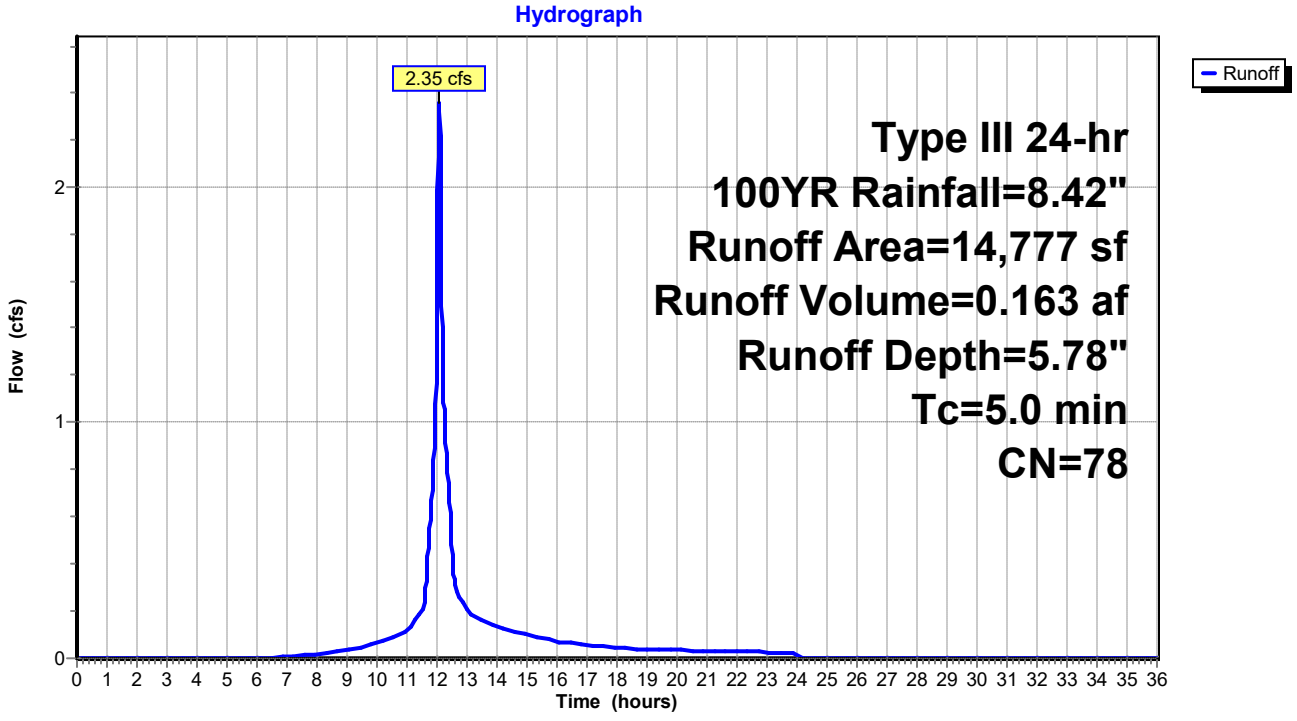
Runoff = 2.35 cfs @ 12.07 hrs, Volume= 0.163 af, Depth= 5.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YR Rainfall=8.42"

Area (sf)	CN	Description
4,638	39	>75% Grass cover, Good, HSG A
1,356	80	>75% Grass cover, Good, HSG D
8,783	98	Paved parking, HSG A
14,777	78	Weighted Average
5,994		40.56% Pervious Area
8,783		59.44% Impervious Area

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

Subcatchment 200: PDA200



Summary for Pond CHAMBERS: SUBSURFACE SYSTEM

Inflow Area = 0.339 ac, 59.44% Impervious, Inflow Depth = 5.78" for 100YR event
Inflow = 2.35 cfs @ 12.07 hrs, Volume= 0.163 af
Outflow = 1.54 cfs @ 12.16 hrs, Volume= 0.139 af, Atten= 34%, Lag= 5.0 min
Discarded = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 1.54 cfs @ 12.16 hrs, Volume= 0.139 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 41.51' @ 12.16 hrs Surf.Area= 990 sf Storage= 2,055 cf

Plug-Flow detention time= 119.9 min calculated for 0.139 af (85% of inflow)
Center-of-Mass det. time= 55.4 min (859.9 - 804.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	38.07'	1,023 cf	**25.25'W x 39.22'L x 3.75'H Field A** 3,713 cf Overall - 1,156 cf Embedded = 2,557 cf x 40.0% Voids
#2A	38.82'	1,156 cf	**ADS_StormTech DC-780 +Cap** x 25 Inside #1 Effective Size= 45.4"W x 30.0"H => 6.49 sf x 7.12'L = 46.2 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 25 Chambers in 5 Rows
		2,179 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	38.07'	**2.410 in/hr Exfiltration over Horizontal area above 38.07'** Conductivity to Groundwater Elevation = 35.00' Excluded Horizontal area = 990 sf
#2	Primary	39.82'	**8.0" Round Culvert** L= 10.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 39.82' / 39.82' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=38.07' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=1.54 cfs @ 12.16 hrs HW=41.51' (Free Discharge)
↑—**2=Culvert** (Inlet Controls 1.54 cfs @ 4.42 fps)

Pond CHAMBERS: SUBSURFACE SYSTEM - Chamber Wizard Field A

Chamber Model = ADS_StormTech DC-780 +Cap (ADS StormTech® DC-780 with cap length)
Effective Size= 45.4"W x 30.0"H => 6.49 sf x 7.12'L = 46.2 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

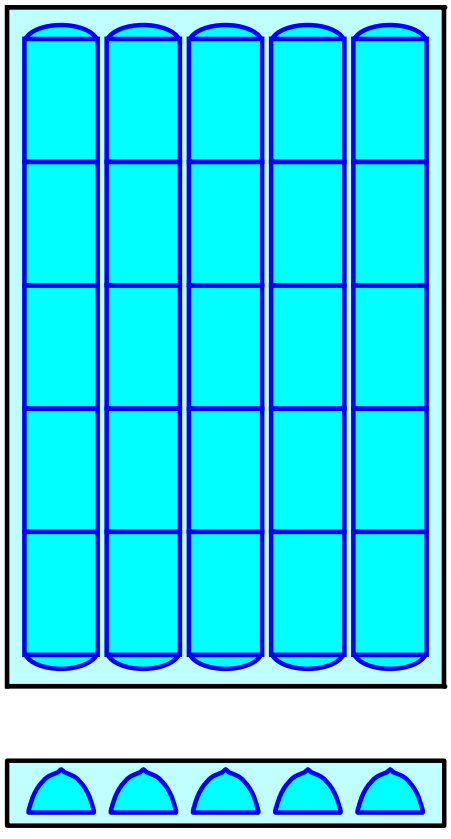
5 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 37.22' Row Length +12.0" End Stone x 2 = 39.22' Base Length
5 Rows x 51.0" Wide + 6.0" Spacing x 4 + 12.0" Side Stone x 2 = 25.25' Base Width
9.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.75' Field Height

25 Chambers x 46.2 cf = 1,156.0 cf Chamber Storage

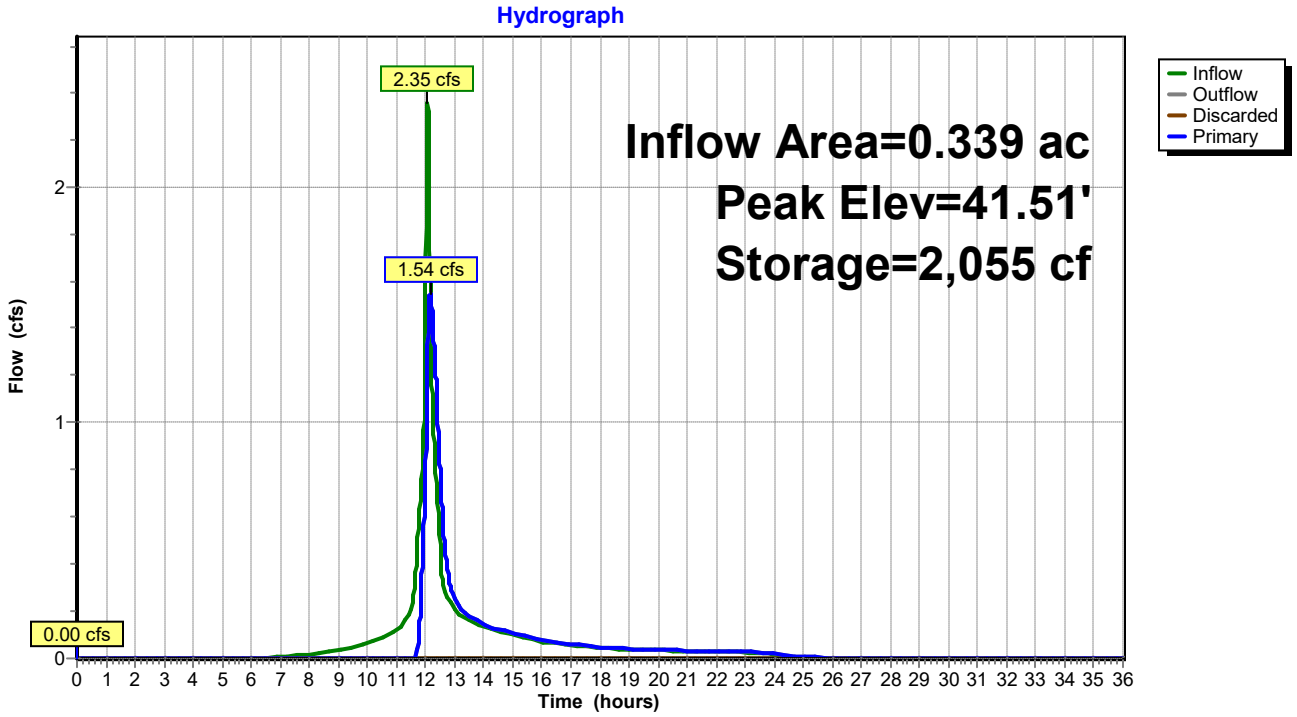
3,713.3 cf Field - 1,156.0 cf Chambers = 2,557.4 cf Stone x 40.0% Voids = 1,022.9 cf Stone Storage

Chamber Storage + Stone Storage = 2,178.9 cf = 0.050 af
Overall Storage Efficiency = 58.7%
Overall System Size = 39.22' x 25.25' x 3.75'

25 Chambers
137.5 cy Field
94.7 cy Stone



Pond CHAMBERS: SUBSURFACE SYSTEM

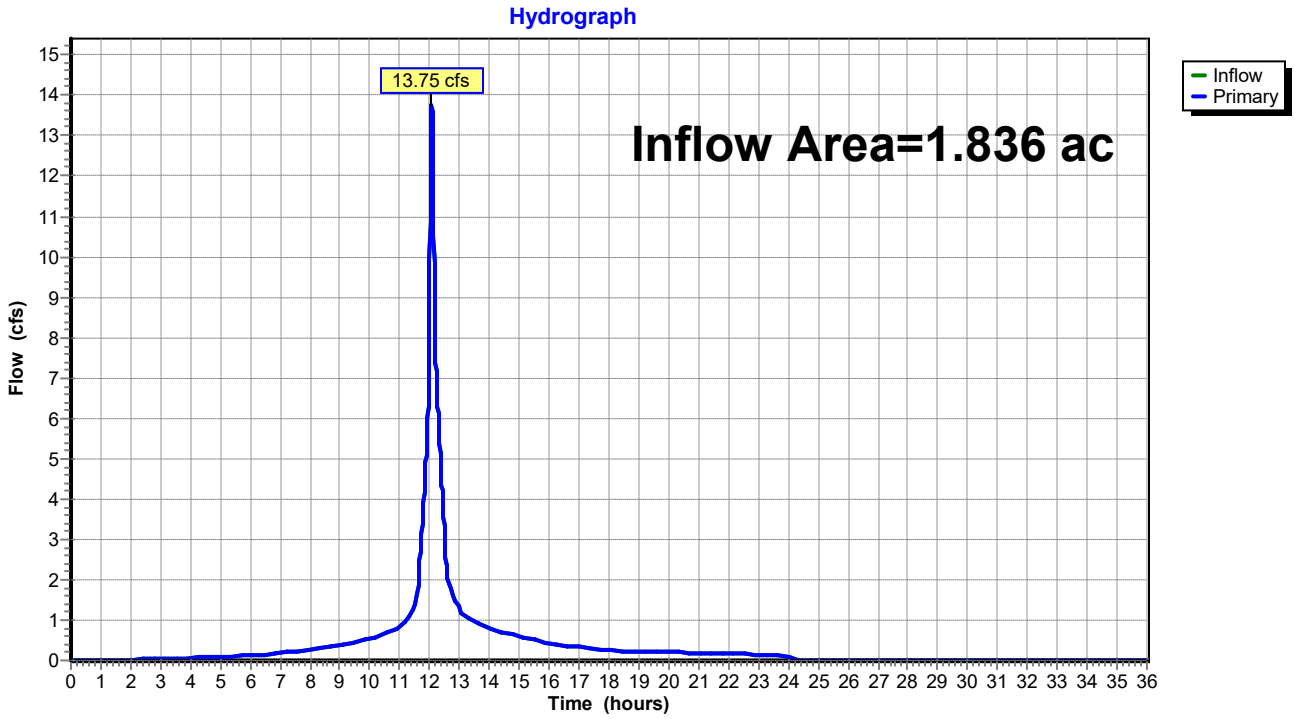


Summary for Link 1: POI-1

Inflow Area = 1.836 ac, 75.51% Impervious, Inflow Depth = 7.07" for 100YR event
Inflow = 13.75 cfs @ 12.07 hrs, Volume= 1.082 af
Primary = 13.75 cfs @ 12.07 hrs, Volume= 1.082 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 1: POI-1



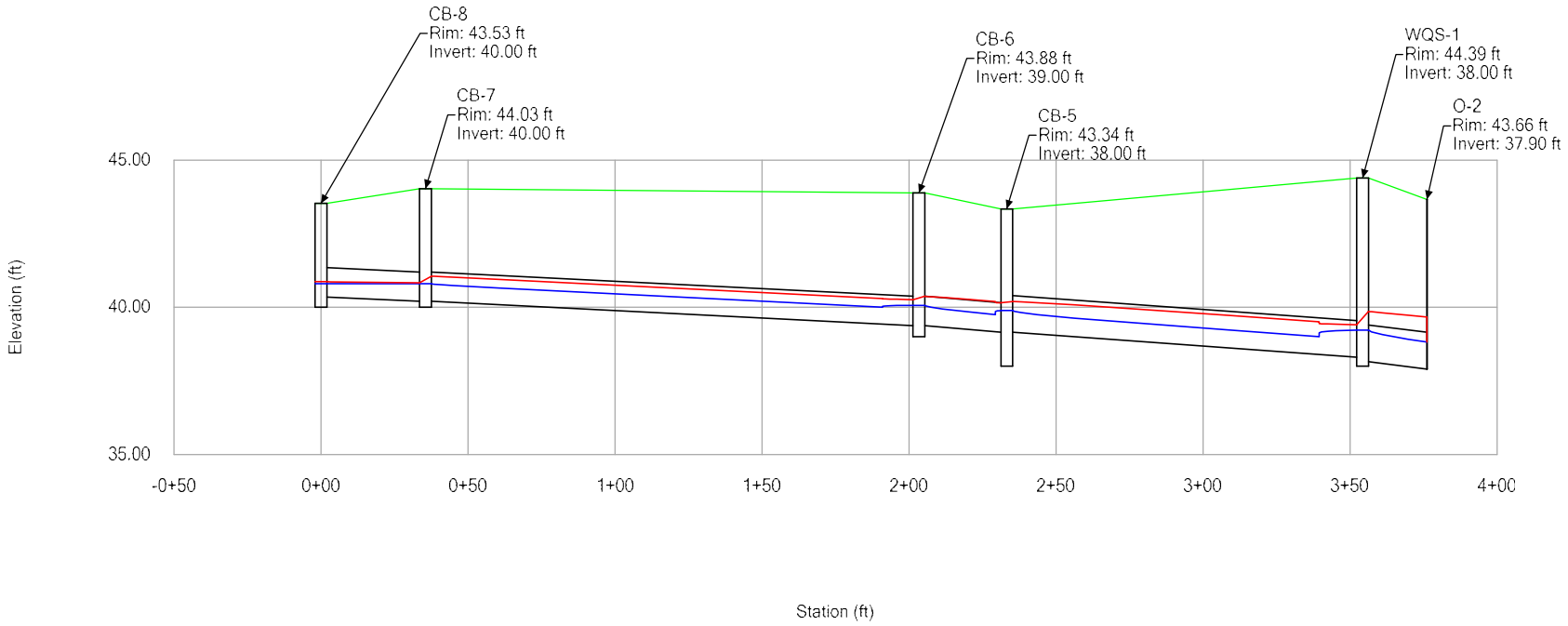
APPENDIX D

Collection and Conveyance Calculations

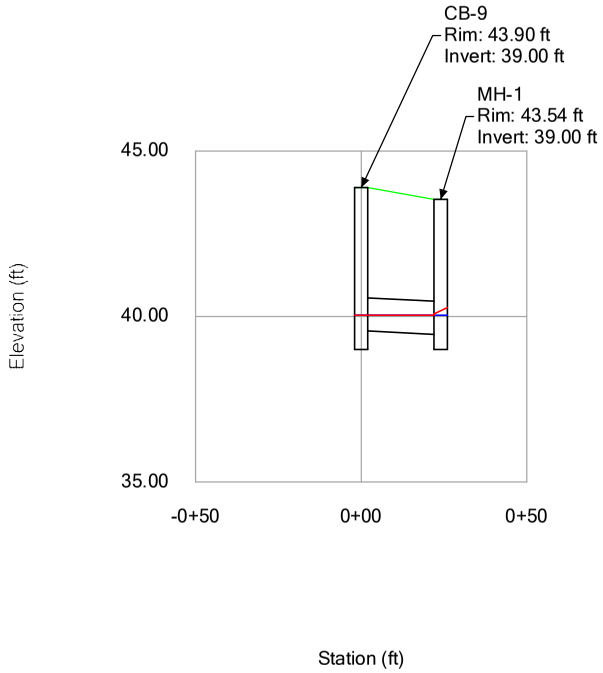
FlexTable: Conduit Table

Label	Start Node	Stop Node	Invert (Start) (ft)	Invert (Stop) (ft)	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Manning's n	Flow (cfs)	Velocity (ft/s)	Capacity (Full Flow) (cfs)	Flow / Capacity (Design) (%)	Cover (Start) (ft)	Cover (Stop) (ft)
CO-2	CB-9	MH-1	39.56	39.46	24.0	0.004	12.0	0.010	0.14	1.96	2.99	4.8	3.34	3.08
Pipe - (34) (STORM (3))	OCS-1	MH-1	39.70	39.44	63.0	0.004	12.0	0.010	0.74	3.14	2.98	24.9	3.04	3.10
Pipe - (16) (STORM (3))	CB-8	CB-7	40.35	40.20	35.5	0.004	12.0	0.010	0.72	3.15	3.01	24.0	2.18	2.83
Pipe - (17) (STORM (3))	MH-1	CB-1	39.44	38.89	132.0	0.004	15.0	0.010	2.25	4.21	5.42	41.5	2.85	3.07
Pipe - (15) (STORM (3))	CB-7	CB-6	40.20	39.38	167.8	0.005	12.0	0.010	2.00	4.34	3.24	61.7	2.83	3.50
Pipe - (9) (1) (STORM (3))	CB-2	WQS-1	38.55	38.15	102.0	0.004	15.0	0.010	3.94	4.70	5.26	75.0	3.43	4.99
Pipe - (14) (STORM (3))	CB-6	CB-5	39.38	39.15	29.9	0.008	12.0	0.010	2.55	5.46	4.06	62.9	3.50	3.19
CO-1	CB-5	WQS-1	39.15	38.30	121.0	0.007	15.0	0.010	3.37	5.68	7.04	47.9	2.94	4.84
Pipe - (10) (STORM (3))	CB-1	CB-2	38.89	38.55	26.5	0.013	12.0	0.010	2.93	6.86	5.24	55.9	3.32	3.68
Pipe - (17) (2) (STORM (3))	CB-10	MH-1	40.00	39.48		0.023	12.0	0.010	1.38	6.93	7.00	19.7	2.18	3.06
Pipe - (12) (STORM (3))	WQS-1	O-2	38.15	37.90		0.011	15.0	0.010	7.15	8.11	8.96	79.7	4.99	4.51
Pipe - (35) (STORM (3))	CB-11	O-1	39.50	39.00	17.0	0.029	12.0	0.010	1.75	8.11	7.94	22.0	2.55	4.00

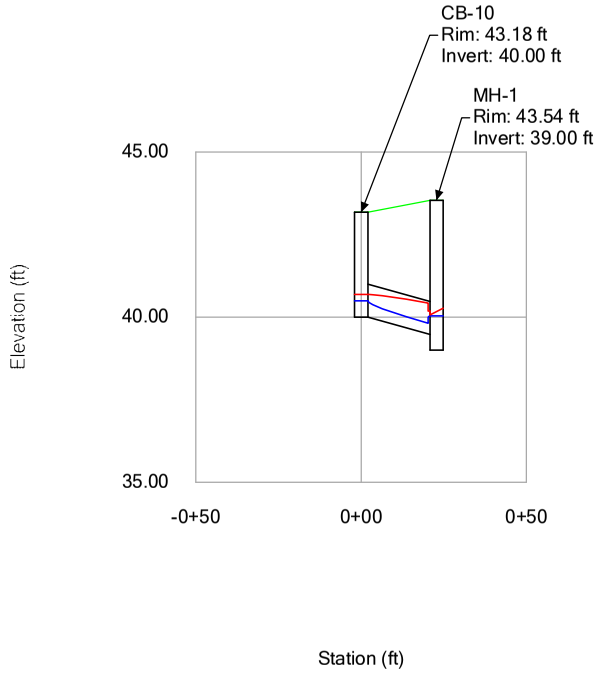
Profile Report
Engineering Profile - CB-8 to O-2 (PD1901997-04022021.stsw)



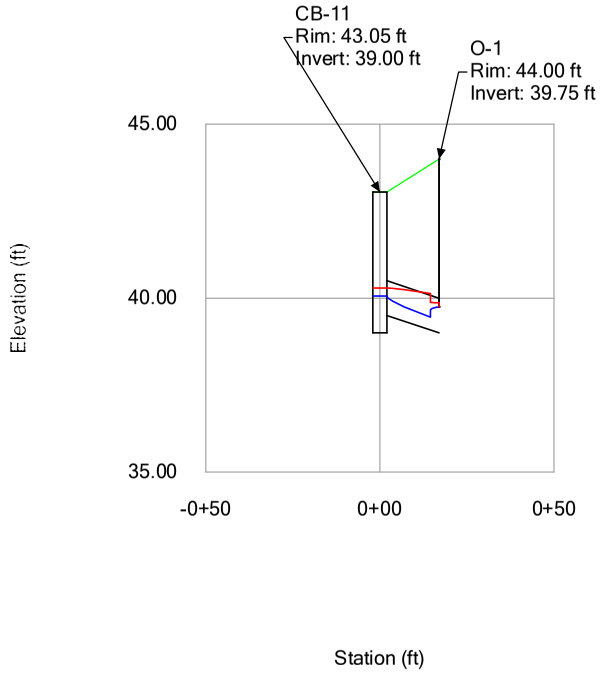
Profile Report
Engineering Profile - CB-9 to MH-1 (PD1901997-04022021.stsw)



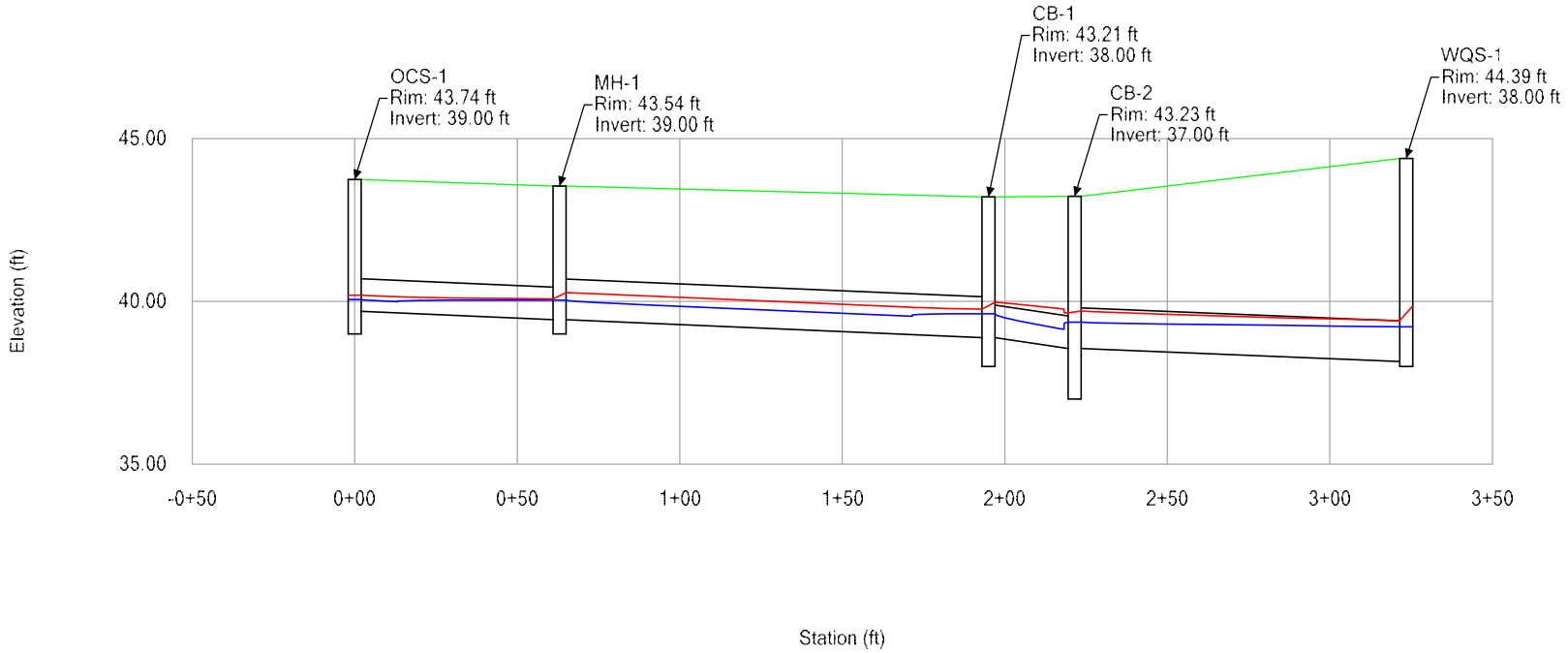
Profile Report
Engineering Profile - CB-10 to MH-1 (PD1901997-04022021.stsw)



Profile Report
Engineering Profile - CB-11 to O-1 (PD1901997-04022021.stsw)



Profile Report
Engineering Profile - OCS-1 to WQS-1 (PD1901997-04022021.stsw)



Appendix E

Water Quality Calculations
Best Management Practice (BMP) Treatment Train Efficiency Worksheet
Water Quality Calculations – Water Quality Volume (WQV)
Water Quality Calculations – Water Quality Flow (WQF)
Groundwater Recharge Calculations
Temporary Sediment Basin Calculations

Best Management Practice (BMP) Treatment Train Efficiency Worksheet

Prepared for:
North Haven Mixed Used Development
146 Washington Avenue
North Haven, Connecticut

Prepared by:
BL Companies
100 Constitution Plaza, 10th Floor
Hartford Connecticut

Date prepared:
April 7, 2021

Overall Site Treatment Train Efficiency

Et=[1-(1-E1)(1-E2)(1-E3)(1-E4)(1-E?)]*100

BMP	BMP Description	Type pf Treatment	Efficiency Rate %
E1	Deep Sump and Hooded Catch Basin	secondary (conventional)	25
E2	Water Quality Structure**	Secondary	85.2

Overall Treatment Train Efficiency (Et)= 89 % Total Suspended Solids (TSS) Removal

* 80% require per CT DEP
** Per manufacturers TSS removal rate
** University of New Hampshire

BMP	*Type pf Treatment*	*TSS Removal Rate*	*Starting TSS Load*	*Amount Removed*	*Remaining Load*
Deep Sump and Hooded Catch Basin	secondary (conventional)	0.25	1.00	0.25	0.75
Water Quality Structure	Secondary	0.852	0.75	0.64	0.11

Overall Treatment Train Efficiency (%) **89**

TSS Removal Rates (adapted from Schueler, 1996, & EPA, 1993)

BMP List	Design Rate	Range of Average TSS Removal Rates	Brief Design Requirements
Extended Detention Pond	70%	60-80%	Sediment forebay
Wet Pond (a)	70%	60-80%	Sediment forebay
Constructed Wetland (b)	80%	65-80%	Designed to infiltrate or retain
Water Quality Swale	70%	60-80%	Designed to infiltrate or retain
Infiltration Trench	80%	75-80%	Pretreatment critical
Infiltration Basin	80%	75-80% (predicted)	Pretreatment critical
Dry Well	80%	80% (predicted)	Rooftop runoff
			(uncontaminated only)
Sand Filter (c)	80%	80%	Pretreatment
Organic Filter (d)	80%	80%+	Pretreatment
Water Quality Inlet	25%	15-35% w/ cleanout	Off-line only; 0.1" minimum Water Quality Volume (WQV) storage
Sediment Trap (Forebay)	25%	25% w/ cleanout	Storm flows for 2-year event must not cause erosion; 0.1" minimum WQV storage
Drainage Channel	25%	25%	Check dams; non-erosive for 2-yr.
Deep Sump and Hooded Catch Basin	25%	25% w/ cleanout	Deep sump general rule = 4 x pipe diameter or 4.0' for pipes 18" or less
Street Sweeping	10%	10%	Discretionary non-structural credit, must be part of approved plan

CONTECH® ENGINEERED SOLUTIONS

CDS TECHNOLOGIES

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION BASED ON THE RATIONAL RAINFALL METHOD

146 WASHINGTON AVE NORTH HAVEN, CT

Area	1.57 ac	Unit Site Designation	WQU
Weighted C	0.78	Rainfall Station #	34
t_c	5 min		
CDS Model	2015-4	CDS Treatment Capacity	1.4 cfs

Rainfall Intensity[1] (in/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (cfs)	Treated Flowrate (cfs)	Incremental Removal (%)
0.02	9.7%	9.7%	0.02	0.02	9.7
0.04	9.7%	19.4%	0.05	0.05	9.7
0.06	9.8%	29.2%	0.07	0.07	9.7
0.08	7.7%	36.9%	0.10	0.10	7.5
0.10	8.0%	44.9%	0.12	0.12	7.8
0.12	5.4%	50.3%	0.15	0.15	5.2
0.14	4.7%	55.0%	0.17	0.17	4.4
0.16	5.5%	60.5%	0.20	0.20	5.2
0.18	3.5%	63.9%	0.22	0.22	3.2
0.20	4.1%	68.0%	0.24	0.24	3.8
0.25	6.5%	74.5%	0.30	0.30	5.9
0.30	5.5%	80.0%	0.37	0.37	4.9
0.35	4.0%	84.0%	0.43	0.43	3.5
0.40	2.0%	86.0%	0.49	0.49	1.7
0.45	2.1%	88.1%	0.55	0.55	1.8
0.50	2.0%	90.2%	0.61	0.61	1.6
0.75	5.1%	95.3%	0.91	0.91	3.6
1.00	2.5%	97.8%	1.22	1.22	1.5
1.50	1.8%	99.5%	1.83	1.40	0.7
2.00	0.5%	100.0%	2.44	1.40	0.1
					91.7
				Removal Efficiency Adjustment[2] =	6.5%
				Predicted % Annual Rainfall Treated =	92.9%
				Predicted Net Annual Load Removal Efficiency =	**85.2%**

1 - Based on 10 years of hourly precipitation data from NCDC station 806, Bridgeport WSO ARPT, Fairfield County, CT
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

Water Quality Calculations

Determine Water Quality Volume

From CT 2004 Stormwater Quality Manual:

$$WQV = \frac{(1")(R)(A)}{12}$$

$$R = 0.05 + 0.009(I)$$

WQV = water quality volume (ac-ft)
R = volumetric runoff coefficient
I = percent impervious cover
A = site area in acres

Area	Total Area		Impervious Area		Impervious Cover	Volumetric Runoff Coefficient	Water Quality Volume (WQV)		Water Quality Volume Provided
ID	ac	ft^2	ac	ft^2	%	R	acre-feet	ft^3	ft^3
SITE	1.836	79,976	1.386	60,374	75.49	0.729	0.112	4,879	4,879

Notes: The provided Water Quality Volume will be provided through the onsite CDS unit.

Water Quality Calculations

Determine Water Quality Flow

From CT 2004 Stormwater Quality Manual:

$$CN = \frac{1000}{\left[10 + 5P + 10Q - 10\left(Q^2 + 1.25QP\right)^{\frac{1}{2}}\right]}$$

$$Q = \frac{[WQV\,(acre - feet) \times [12(inches / foot)]]}{DrainageArea(acres)}$$

$$WQF = (q_u)(A)(Q)$$

CN = Runoff Curve Number
P = design preciptation, inches, (1" for water quality storm)
Q = runoff depth (in watershed inches)
T_c = time of concentration
I_a = Initial abstraction, inches, from Table 4-1, Chapter 4, TR-55
q_u = unit peak discharge,
WQF = water quality flow (cfs)

Hydrodynamic Separator	Total Area			Imp Area		Imp Cover	R	WQV	Q	P	CN	T_c		I_a	I_a/P	q_u *	WQF
	ft^2	ac	mi^2	ft^2	ac	%	-	acre-feet	in	in	-	mins	hours	in	-	$cfs/mi^2/in$	cfs
WQS-1	68,409	1.570	0.0025	54,349	1.248	79.49	0.765	0.1	0.76	1.00	98	5.0	0.08	0.041	0.041	650	1.21

Project: 146 Washington Ave
Location: North Haven, CT
Prepared For: BL Companies

Purpose: To calculate the first flush runoff flow rate (WQF) over a given site area. In this situation the WQV to be analyzed is the runoff produced by the first 1" of rainfall.

Reference: United States Department of Agriculture Natural Resources Conservation Service TR-55 Manual

Given:

Structure Name	A (acres)	A ($miles^2$)	Runoff Coefficient	Percent Imp. (%)*	t_c (min)	t_c (hr)
WQU	1.57	0.00245	0.78	79.40	5.0	0.083

* Assumes runoff coefficient of 0.3 for pervious areas and 0.9 for impervious areas.

Procedure: The Water Quality Flow (WQF) is calculated using the Water Quality Volume (WQV). This WQV, converted to watershed inches, is substituted for the runoff depth (Q) in the Natural Resources Conservation Service (formerly Soil Conservation Service), TR-55 Graphical Peak Discharge Method.

1. Compute WQV in watershed inches using the following equation:

$$WQV = P * R$$

where: WQV = water quality volume (watershed inches)
P = design precipitation (inches) = (1" for water quality storm)
R = volumetric runoff coefficient = 0.05 + 0.009(I)
I = percent impervious cover

Structure Name	Percent Imp. (%)	R	P (in)	WQV (in)	WQV (ac-ft)
WQU	79.40	0.765	1.0	0.765	0.1

2. Compute the NRCS Runoff Curve Number (CN) using the following equation, or graphically using Figure 2-1 from TR-55 (USDA, 1986):

$$CN = 1000 / [10+5P+10Q-10(Q^2+1.25QP)^{1/2}]$$

where: CN = Runoff Curve Number
P = design precipitation (inches) = (1" for water quality storm)
Q = runoff depth (watershed inches)

Structure Name	Q (in)	CN
WQU	0.765	97.71

3. Using computed CN, read initial abstraction (I_a) from Table 4-1 in Chapter 4 of TR-55; compute I_a/P, interpolating when appropriate.

Structure Name	I_a (in)	I_a/P
WQU	0.047	0.047

4. Compute the time of concentration (t_c) in hours and the drainage area in square miles.

Structure Name	t_c (hr)	A (miles^2)
WQU	0.083	0.00245

5. Read the unit peak discharge (q_u) from Exhibit 4-III in Chapter 4 of TR-55 for appropriate t_c for type III rainfall distribution.

Structure Name	t_c (hr)	I_a/P	q_u (csm/in)
WQU	0.083	0.046972645	650

6. Substituting WQV (watershed inches) for runoff depth (Q), compute the water quality flow (WQF) from the following equation:

$WQF = (q_u)*(A)*(Q)$

where: WQF = water quality flow (cfs)
q_u = unit peak discharge (cfs/mi^2/inch)
A = drainage area (mi^2)
Q = runoff depth (watershed inches)

Structure Name	q_u (csm/in)	A (miles^2)	Q (in)	WQF (cfs)
WQU	650	0.00245	0.765	1.22

Groundwater Recharge Volume Calculations

Groundwater Recharge Volume

From CT 2004 Stormwater Quality Manual:

$$GVR = \frac{(D)(A)(I)}{12}$$

GRV Groundwater Recharge Volume (ac-ft)
D = Depth of Runoff to be Recharged (table 7-4)
A = site area in acres
I = impervious cover (decimal)

	A	I														
	Total Site Area (AC)	Site Area by NRCS Hydrologic Soil Group				Impervious Cover by NRCS Hydrologic Soil Group				Site Imperviousness (Decimel) by NRCS Hydrologic Soil Group				GRV Required		Potential Recharge Pond Volumes Proposed	
		A	B	C	D	A	B	C	D	A	B	C	D	(ac-ft)	(cu ft)	(ac-ft)	(cu ft)
SITE	1.84	0.47	0.00	0.00	1.37	0.32	0.00	0.00	1.10	0.17	0.00	0.00	0.80	0.003	119	0.025	1,069

Table from 2004 Connecticut Stormwater Quality Manual

Table 7-4
Groundwater Recharge Depth

NRCS Hydrologic Soil Group	Average Annual Recharge	Groundwater Recharge Depth (D)
A	18 inches/year	0.4 inches
B	12 inches/year	0.25 inches
C	6 inches/year	0.10 inches
D	3 inches/year	0 inches (waived)

Source: MADEP, 1997.
NRCS – Natural Resources Conservation Service

NRCS Hydrologic Soil	Groundwater Recharge
A	0.40
B	0.25
C	0.10
D	0.00

Stage-Area-Storage for Pond CHAMBERS: SUBSURFACE SYSTEM

Elevation (feet)	Horizontal (sq-ft)	Storage (cubic-feet)
38.07	**990**	0
38.12	990	20
38.17	990	40
38.22	990	59
38.27	990	79
38.32	990	99
38.37	990	119
38.42	990	139
38.47	990	158
38.52	990	178
38.57	990	198
38.62	990	218
38.67	990	238
38.72	990	257
38.77	990	277
38.82	990	297
38.87	990	337
38.92	990	377
38.97	990	417
39.02	990	456
39.07	990	496
39.12	990	535
39.17	990	575
39.22	990	614
39.27	990	653
39.32	990	691
39.37	990	730
39.42	990	769
39.47	990	807
39.52	990	845
39.57	990	883
39.62	990	921
39.67	990	958
39.72	990	996
39.77	990	1,033
39.82	990	1,069
39.87	990	1,106
39.92	990	1,142
39.97	990	1,179
40.02	990	1,214
40.07	990	1,250
40.12	990	1,285
40.17	990	1,320
40.22	990	1,355
40.27	990	1,389
40.32	990	1,423
40.37	990	1,457
40.42	990	1,490
40.47	990	1,523
40.52	990	1,555
40.57	990	1,587
40.62	990	1,619
40.67	990	1,650
40.72	990	1,680
40.77	990	1,710
40.82	990	1,739
40.87	990	1,768
40.92	990	1,796
40.97	990	1,823
41.02	990	1,849
41.07	990	1,873
41.12	990	1,897
41.17	990	1,919
41.22	990	1,940
41.27	990	1,961
41.32	990	1,981
41.37	990	2,001
41.42	990	2,020
41.47	990	2,040
41.52	990	2,060
41.57	990	2,080
41.62	990	2,100
41.67	990	2,120
41.72	990	2,139
41.77	990	2,159
41.82	990	**2,179**

Temporary Sediment Basin Sizing - Minimum Dimensions

From the 2002 Connecticut Guidelines for Soil Erosion and Sediment Control:

W= Minimum width of bottom of temporay sediment basin (feet)

Q_{25}= Peak discharge from a 25-year frequency storm (cfs)

L= Minimum length of bottom of temporay sediment basin (feet)

$$W = 10\sqrt{Q_{25}}$$

$$L = 2W$$

Basin #	Q_{25}* cfs	Min. Width (W) Feet	Min Length (L) Feet	Proposed Width Feet	Proposed Length Feet	Bottom Elevation Feet	Bottom Elevation Area ft^2	Outlet Elevation Feet	Outlet Elevation Area ft^2	Wet Storage Provided ft^3	Wet Storage Required ft^3
1	11	34	68	35	70	38.00	2,312	40.00	2,312	4,624	4,161

* 25-year peak flow rates were determined using HydroCAD analysis of eah TSB drainage area.

APPENDIX F

DRAINAGE MAPS
ED-1 – Existing Drainage Plan
PD-1 – Proposed Drainage Plan
PD-2 – Proposed Catch Basin Areas

EXISTING HYDROLOGY

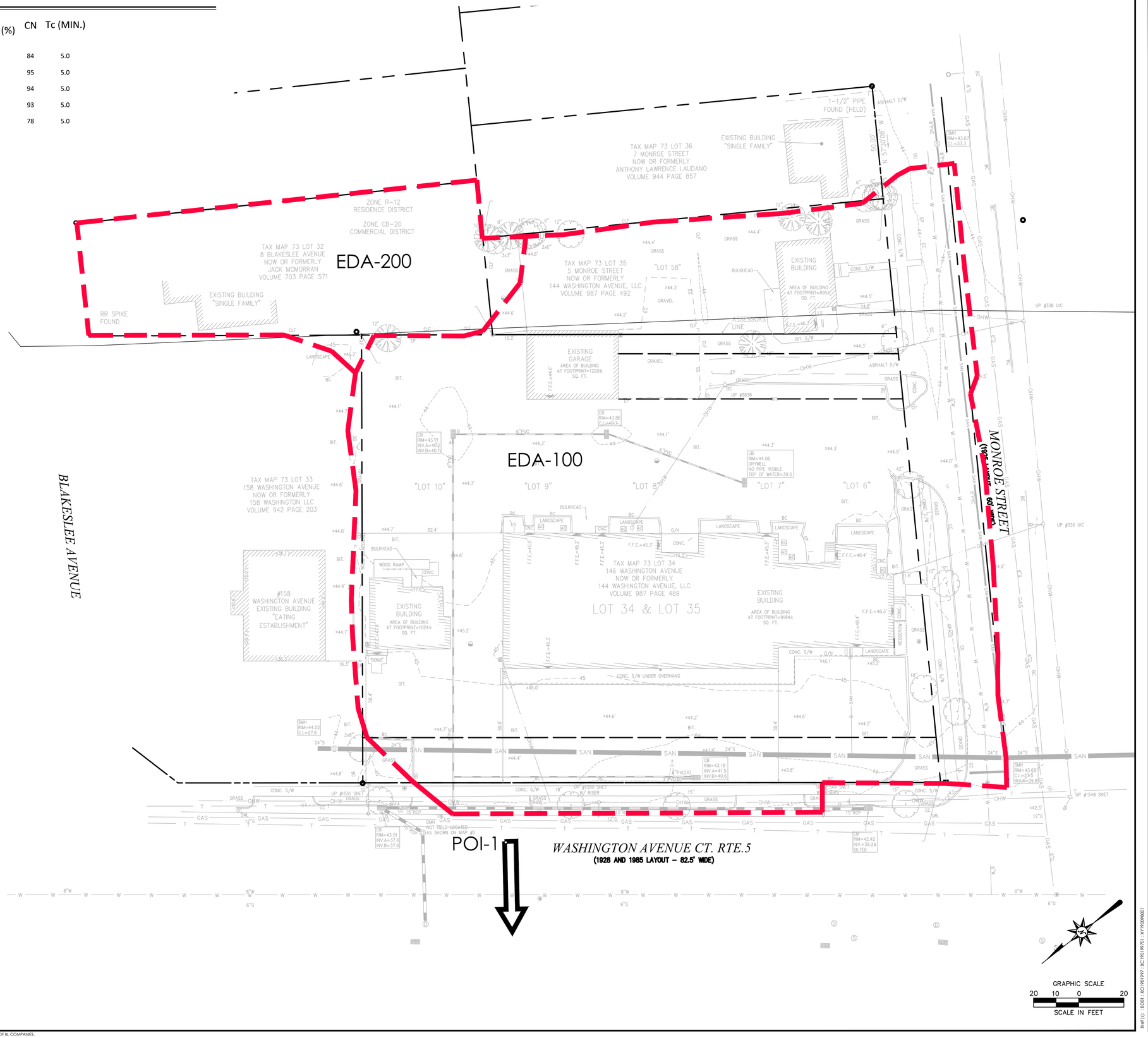
DRAINAGE AREA	TOTAL AREA (S.F.)	IMPERVIOUS AREA (S.F)	PERVIOUS AREA (S.F.)	PERCENT IMPERVIOUS (%)	CN	Tc (MIN.)
PDA100A	7,841	6,005	1,836	76.6%	84	5.0
PDA100B	24,140	20,476	3,664	84.8%	95	5.0
PDA100C	15,220	12,094	3,126	79.5%	94	5.0
PDA100D	18,001	13,033	4,968	72.4%	93	5.0
PDA200	14,777	10,139	4,638	68.6%	78	5.0

LEGEND

- PROPERTY LINE
- EXISTING DRAINAGE AREA BOUNDARY
- TIME OF CONCENTRATION FLOW PATH
- POI-1 — POINT OF INTEREST
- CN — CURVE NUMBER
- Tc — TIME OF CONCENTRATION

NOTES

1. THE FOLLOWING IS CONSIDERED "IMPERVIOUS AREA": BITUMINOUS DRIVEWAYS, BITUMINOUS WALKS, BITUMINOUS CURB, CONCRETE DRIVEWAYS, CONCRETE WALKS, CONCRETE PADS, CONCRETE CURB AND BUILDINGS.
2. TIME OF CONCENTRATION WAS ASSUMED TO BE 5 MINUTES FOR ALL CATCHMENTS



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PROPOSED DEVELOPMENT
146 WASHINGTON AVE (ROUTE 5)
NORTH HAVEN, CONNECTICUT

REVISIONS No.	Date	Desc.

Designed	L.A.E.
Drawn	L.A.E.
Reviewed	S.M.K.
Scale	1"=20'
Project No.	1901997
Date	XX/XX/XX

CAD File: ED190199701

Title

EXISTING DRAINAGE MAPPING

Sheet No.

ED-1

Xref (s) : BD01 : XO1901997-XC1901997701 : XY1902P8001

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PROPOSED HYDROLOGY

DRAINAGE AREA	TOTAL AREA (S.F.)	IMPERVIOUS AREA (S.F)	PERVIOUS AREA (S.F.)	PERCENT IMPERVIOUS (%)	CN	Tc (MIN.)
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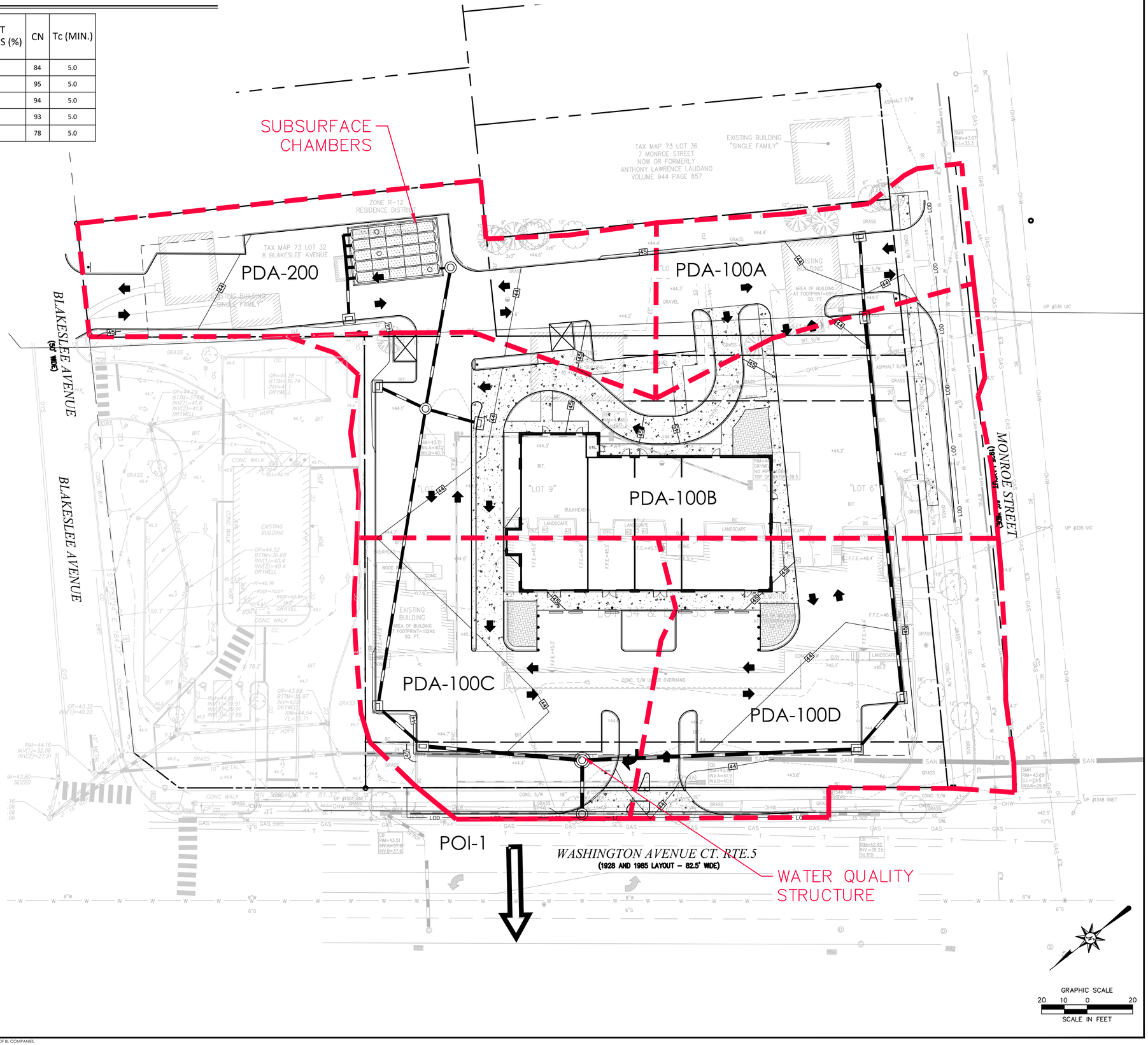
PDA100B	24,140	20,476	3,664	84.8%	95	5.0
PDA100C	15,220	12,094	3,126	79.5%	94	5.0
PDA100D	18,001	13,033	4,968	72.4%	93	5.0
PDA200	14,777	8,783	5,994	59.4%	78	5.0

LEGEND

- PROPERTY LINE
- PROPOSED DRAINAGE STUDY AREA BOUNDARY
- POI-1 — POINT OF INTEREST
- CN — CURVE NUMBER
- Tc — TIME OF CONCENTRATION

NOTES

1. THE FOLLOWING IS CONSIDERED "IMPERVIOUS AREA": BITUMINOUS DRIVEWAYS, BITUMINOUS WALKS, BITUMINOUS CURB, CONCRETE DRIVEWAYS, CONCRETE WALKS, CONCRETE PADS, CONCRETE CURB AND BUILDINGS.
2. TIME OF CONCENTRATION WAS ASSUMED TO BE 5 MINUTES FOR ALL CATCHMENTS



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PROPOSED DEVELOPMENT

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REVISIONS

No.	Date	Desc.

Designed	L.A.E.
Drawn	L.A.E.
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Project No.	1901997
Date	04/08/2021
CAD File: PD190199701	

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PROPOSED DRAINAGE AREA

Sheet No.

PD-1

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PROPOSED CATCH BASIN

Drainage Area	TOTAL AREA (S.F.)	IMPERVIOUS AREA (S.F.)	PERVIOUS AREA (S.F.)	PERCENT IMPERVIOUS (%)	Tc (MIN.)	Rational Method Coefficient
CB-1	5,570	4,801	769	86.2%	5.0	0.82
CB-2	8,553	6,459	2,094	75.5%	5.0	0.75
CB-5	7,054	5,269	1,785	74.7%	5.0	0.75
CB-6	5,372	3,982	1,390	74.1%	5.0	0.74
CB-7	9,496	8,168	1,328	86.0%	5.0	0.82
CB-8	5,210	4,588	622	88.1%	5.0	0.83
CB-9	973	973	0	100.0%	5.0	0.90
CB-10	9,968	8,807	1,161	88.4%	5.0	0.83
CB-11	14,777	10,140	4,637	68.6%	5.0	0.71
TOTAL	66,973	53,187	13,786	79.4%		

LEGEND

PROPERTY LINE

PROPOSED CATCH BASIN AREA BOUNDARY

CN — CURVE NUMBER

NOTES

1. THE FOLLOWING IS CONSIDERED "IMPERVIOUS AREA": BITUMINOUS DRIVEWAYS, BITUMINOUS WALKS, BITUMINOUS CURB, CONCRETE DRIVEWAYS, CONCRETE WALKS, CONCRETE PADS, CONCRETE CURB AND BUILDINGS.
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Reviewed	S.M.K.
Scale	1"=20'
Project No.	1901997
Date	04/08/2021
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Title

PROPOSED CATCH BASIN AREAS

Sheet No.

PD-2

Xref (s): ; BD01 ; XO1901997 ; XC190199701 ; XY190098001 ; XC190199703

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